

APRIL,
1920
25 cts.

ELECTRICAL EXPERIMENTER

SCIENCE AND INVENTION

OVER
200
ILLUST.

WATCHING PLANTS GROW
SEE PAGE 1246



THE LARGEST CIRCULATION OF ANY ELECTRICAL PUBLICATION

ELECTRICITY— as experts know it

*"Your spare
time is your
capital."*

YOU do not have to take time off from work and spend several hundred dollars in tuition in order to master the practical side of electricity. The whole subject is now covered in a low-priced set of books, flexibly-bound and handy pocket-sized. Just a few minutes of your spare time spent with the Croft Library of Practical Electricity each day will give you a knowledge which could otherwise be gained only in years of practice.

Earn a big salary

The salaries of electrical workers are high and constantly going up. And the demand for properly trained men is more insistent than ever before in the history of electricity.

Don't be content with \$38 to \$50 per week

Don't be content with just a fair knowledge of electricity. Don't be satisfied with the average electrical worker's salary of \$38 to \$50 per week. Know electricity as experts know it. Terrell Croft will tell you how.

The only library of its kind--

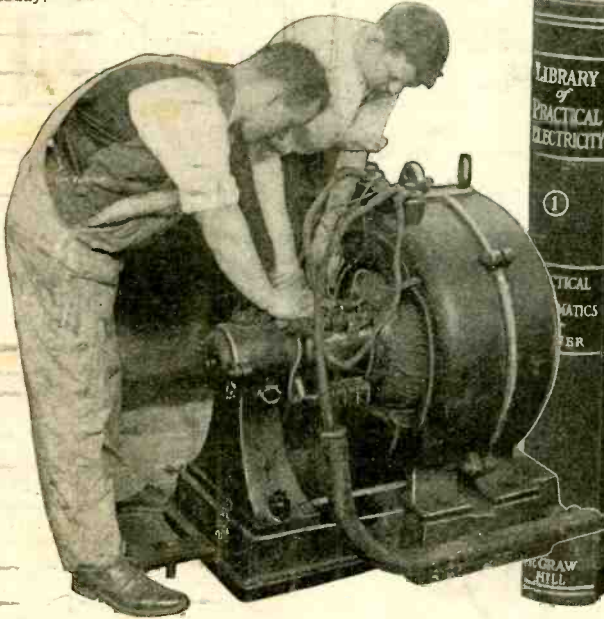
There never has been a set of books or a course on electricity that adhered so closely to actual electrical practice. The author, Terrell Croft, procured his knowledge with his sleeves rolled up. He was trouble shooter, draftsman, wireman, central station operator—then electrical engineer for the Westinghouse Company. He is a practical man and knows the exact wants of his fellow workers. He tells of the short cuts to bigger pay, of the why and how of everything in electrical practice of today.



**NOT ONE CENT
IN ADVANCE**

*Learn while
you earn*

Merely fill out the coupon below and return to us for ten days' absolutely free examination of the CROFT LIBRARY OF PRACTICAL ELECTRICITY. Use the books in connection with your work for ten full days. See how the hundreds of problems in electrical practice are cleared up in simple language and illustration. If thoroughly convinced that the books will enable you to know electricity as experts know it, send us only \$2 in ten days, and \$3 per month for six months. You pay only \$20 for a complete electrical education. Return the books at our expense if not entirely pleased.



**8 Volumes
Flexibly bound
Pocket Size
3000 pages
2100
illustrations
Everything
you must know
about
electricity at
the finger's end**

A letter that means something to YOU—

McGraw-Hill Book Company, Inc., 239 W. 39th St., New York, N. Y.

Gentlemen:—In an attempt to express myself about CROFT'S NEW LIBRARY OF PRACTICAL ELECTRICITY, I have never seen, and do not believe there was ever printed in the English language, a more comprehensive set of books. It is a library that is just as valuable to the novice as to the expert, because it is all practice.

Respectfully,

GUY H. PEIFER,
Chief, Doplank Silk Corporation,
Hazleton, Pa.

FREE EXAMINATION COUPON

McGraw-Hill Book Co., Inc.
239 W. 39th St., New York

Gentlemen:—Please send me the Library of Practical Electricity (shipping charges prepaid), for 10 days' free examination. If satisfactory I will send \$2 in ten days and \$3 per month until \$20 has been paid. If not wanted, I will write you for return shipping instructions.

Name
Home Address
City and State
Where Employed
Occupation (Ex. 4-20)

McGraw-Hill Book Co., Inc.
239 West 39th Street New York

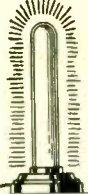
Electrical Experimenter

233 FULTON STREET, NEW YORK

Publishes by Experimenter Publishing Company, Inc. (H. Gernsback, President; S. Gernsback, Treasurer; R. W. DeMott, Sec'y), 233 Fulton Street, New York.



EDITORIAL



The Earth's Interior Molten?



ANY things that we take for granted sometimes turn out to be very much different than we first thought them to be. Take for instance the earth's interior. Our physics instructors and scientists taught us for years that the earth was once a huge molten sphere, just beginning to cool down. The interior and center is supposed to be entirely fluid—a huge molten mass where all the known elements "including rocks" are in a liquid state, at a tremendously high temperature running up into thousands of degrees Fahrenheit. Our physics instructors by way of impressing us were wont to tell us that the hard crust of the earth is just about as thick in proportion to the rest of the earth as the peel is to an orange.

And in order that we could not doubt their words our instructors give us "proofs" to back up their contentions.

First, we are pointed out that the volcanoes—the ventholes of the liquid earth's interior—prove that the earth is fluid inside. Witness the many volcanic eruptions belching forth molten rock, lava and brimstone. And to further disarm our suspicions we are shown that as we descend into the earth's interior, the temperature rises one degree Fahrenheit for every 40 to 50 feet. It matters not where we bore a hole or sink a shaft into the earth's interior; the rise of temperature as we descend is pretty uniform the world over, even in high latitudes. These are both facts, well authenticated and are not doubted by any sane person.

But recently scientists began wondering if these facts really proved that the earth's interior was in a molten state. And the more they wondered the more they learned. For one thing they said: If the earth's interior is really in a molten state, liquid in other words, why does not this molten mass rise and fall with the tides which undoubtedly it would do were it liquid or even plastic. Accurate measurements, however, show

that there is no such tide in the interior of the earth. If there were, the crust of the earth, due to the tidal effects of the moon and the sun, would constantly rise and fall, for one thing, and we would have extensive daily earthquakes. But, you will say, the earth's crust is so solid that there may well exist a tide inside of the earth that we cannot perceive. This is hardly even probable, however, because in that case the gigantic tidal effects created—a million times greater than any ocean tide—would burst thru the earth's crust in short order. Do not forget that if the orange peel analogy holds good, there will be a liquid mass some 7,000 miles deep! Contrast that with the average depth of the ocean of less than one mile and then figure out the gigantic tides a liquid interior would produce!

But our modern scientist does not stop there. He goes and counts the very few active volcanoes and finds that as ventholes for a molten globe 7,000 miles in diameter, they appear preposterous. These few holes could no more serve as vents for this big globe than you could vent an armory with a soda straw.

On top of this our astronomers come along and prove mathematically, without a shade of doubt, that the earth is at least as rigid as steel.

But how explain the volcanoes and our deep hot shafts? Our scientists prefer to think—and they can prove it, too, that the earth's interior is not molten. The volcanoes are merely ventholes for local molten pockets. The earth's heat is produced by radium, or rather radioactivity. And while the earth's interior is hot—very hot—it is not fluid.

While boring the famous Simplon tunnel, many hundred feet above sea level, the heat became unbearable and artificial cooling became necessary. Recent tests showed that the radium contents of the rock could easily produce this great heat.

The solution of the earth's heat, then, doubtless is radium.
H. GERNSBACK.

Vol. VII. Whole No. 84

Contents for April, 1920

No. 12

WATCHING PLANTS GROW.....	Front Cover
ELECTRIC POWER FROM THE SUN.....	From a painting by Harold Brown
BATTLE TRACER.....	1241
HEAT OF BODY DETECTED 600 FEET AWAY.....	1242
ONE MAN SUBWAY TRAIN.....	1244
WATCHING PLANTS GROW.....	1245
HELLO MARS!.....	1246
ELECTRICITY FOILS GERMAN SEALS.....	By a remarkably sensitive instrument devised by Sir Jagadis Bose, of India
THE PHYSIOPHONE.....	1243
ELECTRO-MEDICAL FRAUDS.....	By H. Winfield Secor, Assoc. Member Amer. Inst. Electrical Engineers
THE EDUCATED HARPOON.....	1251
ELECTRIC BACHELOR MAID.....	By Fred C. Kelly
TELEGRAPH, CABLE AND RADIO DISPATCHES.....	1252
	By H. Gernsback
	1254
	By Joseph H. Kraus
	1256
	By Charles S. Wolfe
	1257
	By Edna Purdy
	1258
	By Pierre H. Boucheron, Ensign U. S. N. R. F.

WEIGHING THE EARTH.....	1260
ELECTRIFYING CANAL BOATS AND BARGES.....	By Louis E. Derr, Prof. of Physics, Mass. Inst. of Technology
TALKING OVER A SUNBEAM.....	1262
"AUTOMOBILE NEWS".....	By Robert G. Skerrett
POPULAR ASTRONOMY — OBSERVING THE HEAVENLY BODIES.....	1263
"RABBIT CONTEST" AWARDS.....	By Prof. A. O. Rankine. Written especially for the ELECTRICAL EXPERIMENTER
PRACTICAL CHEMICAL EXPERIMENTS.....	1265
HOME-MADE 110-VOLT, 60-CYCLE INDUCTION MOTOR.....	By Isabel M. Lewis, M. A., of the U. S. Naval Observatory
THE "FINER WORKINGS" OF STATIC ELECTRICITY.....	1266
STORAGE BATTERY REPAIRING.....	By H. H. Parker
ELECTRICAL MACHINIST—NO. 6, ERECTING MOTORS AND SHAFTING.....	1274
	Secor Paper. By Frederick von Lichtenow
	1277
	By Henry Klaus
	1278
	By H. Winfield Secor

The ELECTRICAL EXPERIMENTER is published on the 15th of each month at 233 Fulton Street, New York. There are 12 numbers per year. Subscription price is \$2.50 a year in U. S. and possessions. Canada and foreign countries, \$3.00 a year. U. S. coin as well as U. S. stamps accepted (no foreign coin or stamps). Single copies, 25 cents each. A sample copy will be sent gratis on request. Checks and money orders should be drawn to order of EXPERIMENTER PUBLISHING CO., Inc. If you change your address notify us promptly, in order that copies are not mis-carried or lost.

All communications and contributions to this journal should be addressed to: Editor, ELECTRICAL EXPERIMENTER, 233 Fulton Street, New York. Unaccepted contributions cannot be returned unless full postage has been included. ALL accepted contribu-

tions are paid for on publication. A special rate is paid for novel experiments; good photographs accompanying them are highly desirable.

ELECTRICAL EXPERIMENTER. Monthly. Entered as second-class matter at the New York Post Office under Act of Congress of March 3, 1879. Title registered at the Patent Office. Copyright, 1920 by E. P. Co., Inc., New York. The Contents of this magazine are copyrighted and must not be reproduced without giving full credit to the publication.

The ELECTRICAL EXPERIMENTER is for sale at all newsstands in the United States and Canada; also at Brentano's, 37 Avenue de l'Opera, Paris. Sole British Agents—Geoffrey Parker & Gregg, 62 and 8A The Mall, Ealing, London. Member of the Audit Bureau of Circulation.

THOUGHT

The Greatest Commercial Product in the World

By Charles F. Haanel

YOU are, because you think. When you cease to think, you cease to exist. You are therefore what you think.

Thought is a spiritual activity; in fact, it is the only activity which the spirit possesses. All spiritual activities are creative, because spirit is the one creative Principle in the Universe. Thought is mind in motion just as wind is air in motion. When a thought goes out into the world, it combines with other similar thoughts and forms an idea. The idea then exists independently of the thinker. This idea becomes a seed-thought in the spiritual world and as soon as it finds congenial soil, it begins to sprout and grow and bring forth fruit a thousand fold.

FOR this reason, we find that the men who hold the \$50,000.00 positions are always men who think, who know how to control their thought processes. A single idea is often of more value than all the lost mines of Mexico, all the argosies that ever sailed from the Indies and all the silver-laden ships of storied Spain. An idea has life, vitality; it is the essence of the creative spirit and can reproduce itself exactly the same as a germ or a cell, so that in an incredibly short time there may be millions of these ideas all clamoring for self-expression. As thought is creative, it is constantly trying to express itself in form. For this reason thought leads to action and actions bring about results and conditions.

CIRCUMSTANCES and environment are, therefore, the result of thought, but frequently of unconscious and destructive thought for thought will create disagreeable, discordant and destructive conditions, just as readily as it will create wealth, beauty, refinement and harmony. We may think what we will, but the result is governed by an immutable law. That we reap what we sow is scientifically exact.

THOUGHT was until recently the possession of the few, but it is now about to become the priceless possession of the many. Until recently, the few assumed the privilege of thinking for the many, but men are beginning to do their own thinking and this is multiplying results and bringing about a new era, an era containing limitless possibilities.

THE Master Key System is the only clear, concise, comprehensive, definite, distinctive, exhaustive, original and scientific presentation of the creative power of thought ever formulated by anyone at any time. It is copyrighted in every civilized country in the world, and is having an almost unbelievable influence upon the lives of the hundreds of thousands who are coming into an understanding of the most

important and far-reaching truths of which the human mind can conceive.

ONE reader says, "The Master Key is too modest a title for such a stupendous revelation"; another says, "It is the most wonderful teaching ever conceived"; another says,

"**ITS** teaching that Mind is the dominating force is precisely in line with the wonders of the most recent psychology. All persons having desks should have this book thereon, and it would be a fitting pocket companion."

"**YOU** have led a hungry world to the threshold and placed in their hands a key with which the understanding ones may unlock the door and enter the Secret Place of the most high and enjoy the abundance of all good to be found therein."

"**THE** Master Key is the answer to the demand, 'Knock and it shall be opened unto you.' All the world seeks this wonderful key."

"**I** HAVE found the Master Key and with it I am each day unlocking the storehouse of wealth and wisdom concerning which I was heretofore in utter ignorance."

"**THE** lash of circumstances and the logic of events are more than ever impelling men to think. A philosophy of life having its basis blind optimism, a religion that won't work seven days in a week, or a proposition that is not practical, appeals to the intelligent, not at all. It is results that we want, and the acid test is—will it work? The Master Key qualifies! Intelligence rules! Thought intelligently directed automatically causes its object to manifest on a material plane."

"**YOU** have synthesized the wisdom of the East and West and given it in a manner so logical and penetrating, that by its aid one is able to distinguish wisdom from sophistry, truth from delusion, spiritual expression from psychic vagaries, and the sublime operations of spiritual insight and intuition from deceptive visions and false revelations. You have successfully taken the mystery out of mysticism and placed all propositions in the clear light, so that 'He who runs may read.' I consider you a true benefactor to the world."

I WANT the privilege of sending you a Master Key. You will find it a priceless possession, a Key with which many are converting loss into gain, fear into courage, despair into joy, lack into plenty, hope into fruition, a Key which thrills, fascinates, carries conviction, perception, understanding, power, a Key by which you will be enabled to organize victory, realize your ideals and make your dreams come true. Send me your address for a copy, it is free, there is no cost or obligation of any kind.



"**I** AM able to extract from this System all that can be made known by the finite mind relative to origin, evolution, destiny and the much-mooted riddle of the Universe."

Charles F. Haanel, 203 Howard Building, St. Louis, Mo.

LEARN WIRELESS

By Mail - In Ten Weeks



Radio Telegraphy and Telephony Can Now Be Mastered At Home By Marvelous New Method

THROUGH our Famous Home Study Course and with the help of our wonderful Natrometer outfit you can quickly learn both Wireless Telegraphy and Telephony in a few short weeks in your spare time and at home—without inconvenience or loss of time from work. Students of this institute have finished the course and secured their official license after approximately only ten weeks' instruction.

This Fine Natrometer Set Furnished Every Student

of the National Radio Institute. It is a wonderful set designed and built especially for us and comes to you complete in neat carrying case. It embodies the same type of wireless instruments which are used by the United States Bureau of Navigation in testing applicants for first grade wireless operator's license, with the addition of many improvements developed through our years of experience in this field. The Natrometer automatically sends you wireless messages just as you would receive them from a station thousands of miles away. We do not merely loan you the Natrometer. We give it to you. It becomes your personal property upon your completion of the course.

Special Privileges to National Radio Institute Students

Students of the National Radio Institute receive the following:

Complete combination course in Wireless Telegraphy and Telephony—Special post-graduate course at our large Washington school, if desired—

Five text books, one hand book, forty-six special lessons and eighteen personal examinations—

Membership in the N. R. I. Radio Relay League and handsome blue and gold membership pin presented immediately upon enrollment—

Large handsome diploma suitable for framing—

Complete automatic Natrometer outfit and carrying case—

Personal help in securing wireless position and endorsement of Institute officials.

Send for Free Book

We have prepared a book telling all you want to know about wireless and the future it offers you. Startling facts you are interested in are freely discussed. It tells how, during the past six years we have helped hundreds of ambitious men and women and how we will help you. Send the coupon today or write to

THE NATIONAL RADIO INSTITUTE

America's First and Foremost—Established 1914

Dept. 185 14th and U Sts., N. W., Washington, D. C.

First Grade License Guaranteed

Our course is so thorough and our method of instruction so practical that we are able to guarantee that, after successfully completing our course, you will be able to pass the examinations and secure a first grade government operator's license.

Salaries Up to \$15,000 a Year

The pay of Wireless Operators, Radio Inspectors, Wireless Aids, Machinists, Electricians and Wireless Engineers varies from \$225 a month to start for operators to \$15,000 a year and salaries should advance steadily in line with the rapid developments in this profession. The demand for wireless operators and workers in all branches of wireless is enormous and positions are guaranteed to all graduates of this institute as soon as they secure their first grade government license.

Travel and See the World

or locate in one of the many Land Radio Offices now open. Radio provides a broad field of opportunity and activity. If you like to travel you can visit foreign countries—if life on the seas or lakes appeals to you there are positions in coast-wise and lake shipping service—if you are best fitted for indoor work and prefer to be near your home, there are the land radio stations, manufacturing plants and railroads—and for real adventure you have the aerial mail and commerce.

NATIONAL RADIO INSTITUTE (Write plainly)
 Dept. 185, 14th and U Sts., N. W., Washington, D. C.

Send me your free book, "Wireless, The Opportunity of Today", telling me about the opportunities in Wireless, your Famous Home Study Course in Wireless Telegraphy and Telephony, your post-graduate course, the N. R. I. Radio Relay League and your special wireless instrument offer.

Name

Address

City State

Learn To Talk Convincingly

—and the World is at Your Feet

WHY can one man sell where another fails? Why can one man literally carry an audience off its feet, while another speaking on the same subject, makes little or no impression? Why can one man get the sought-after job when another better qualified is turned down? Why does everyone "believe in" one man and have no con-

CAN YOU DO THIS?

<p>Can you talk as well in public as at home?</p> <p>Can you get financial backing when you want it?</p> <p>Can you win confidence, friendship, love through your speech?</p> <p>Can you make people listen when you talk?</p>	<p>Can you hold your hearers spellbound?</p> <p>Can you give humorous, extemporaneous talks?</p> <p>Can you address any size audience from one to thousands?</p> <p>Can you get up and talk any time, any place, without nervousness?</p>
--	---



The ability to talk convincingly will win over prominent men. It is one of the secrets of closing big deals.



An interesting and convincing talker is popular—the center of attraction at all social affairs.

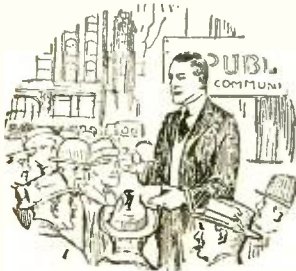
fidence in another who really has just as much ability? The thing that counts is

Not Only WHAT You Say, But HOW You Say It

The world is full of splendid merchandise that doesn't move—"order takers" who should be salesmen—political ideas that meet continual defeat—good men earning less, much less, than they're worth; all because so few know how to use that God-given faculty of speech which is one of man's greatest weapons.

Let Me Teach You

I can teach you how to carry conviction—how to make what you say have the effect



If your words carry conviction you can influence a crowd to think as you do.

you want it to, whether you talk to sell, to convince or to entertain. I can enable you to overcome timidity—give you confidence in yourself, develop your personality, improve your memory.

I can show you the art of brevity, the value of silence. Instead of being funny at the wrong time, I can suggest when and how to use humor with telling effect. Do you know the knack of making oral reports to superiors? Do you know the right and wrong way of presenting complaints, estimates, and to issue orders?

I can show you how to answer complaints, how to ask the bank for a loan, how to ask for an extension on your note. Another valuable lesson I teach is how—instead of antagonizing people when they disagree with you, you may swing them around to your way of thinking in a pleasant sort of way. You will learn the best way to get things done—the secrets of diplomacy.

Results in One Evening

Now one of the remarkable things about my method is that it requires little study and time.



Among strangers or at home people listen eagerly.

Nearly anyone can grasp the principles in an evening. Hundreds of letters pour in every day proving that my method brings almost immediate results.

Thousands Have Benefitted

Among the enthusiastic students of my Course are thousands of prominent men in all walks of life—they include business men, preachers, lawyers, teachers, physicians, bankers, etc., etc.

Frederick Houk Law.



At a committee or board of directors' meeting you will be able to hold attention when you talk.

The Independent Corporation, publishers of "Mastery of Speech," Dr. Law's Course in Business Talking and Public Speaking, are offering you an opportunity to learn in your own home how to improve your ability to Talk Convincingly. They are so con-

fident that you will see its possibilities that they are willing to send it to you for free examination.

Send No Money

You send no money. Just mail the coupon and, all charges prepaid, you will receive the Course—you are under no obligation whatever—and if you are not entirely satisfied send it back any time within five days after you get it—you will owe nothing.

But if you are pleased, as thousands of others have been who have used the Course, it will cost you only \$5.00 in full payment. You have everything to gain and nothing to lose. Act immediately before this unusual offer is withdrawn.

PERSONAL EXPERIENCES:

"... The very day after examining 'Mastery of Speech' I had the confidence to go up and ask my superintendent for a transfer on the planters. . . . And, to my surprise, he gave it to me. I had for months been wanting that change, but didn't have the confidence until your Course pointed out the easy way to talk to your 'Superior.' That is only one incident where your Course was of value."

RALPH L. LEONARD,
40 Bridge St., Beverly, Mass.

"After a careful perusal of the Course, I am convinced that correct speech is the largest contribution to a man's success, and that honest application to the study of this Course will produce the desired perfection in speech."

H. W. CROSS, 1802 W. Mansur St., Guthrie, Okla.

"I have had the Course only a few days, but have already noted considerable improvement in speech and in ability to please and entertain persons I'm associated with. I am much pleased with it."

OLAF A. BLOMGREN,
Utilities Q. M. C. Camp Lewis, Washington.

"I have read but one page—positively not another word—and I have found in that page the magical keynote which vibrates with my longing desire to be, and my belief that, with their help, I will become a good public speaker, despite an agonizing diffidence inherited from my mother."

CHAS. COURTLAND SMITH, 802 Hartford Bldg., Chicago, Ill.

Independent Corporation

Dept. L-1104, 319 Sixth Ave., New York City

Independent Corporation

Publishers of The Independent Weekly
Dept. L-1104, 319 Sixth Ave., New York City

You may send me the Course or Courses checked below. Within five days after receipt I will either remail them or send you \$5 for each in full payment.

- Mastery of Speech
By Frederick Houk Law
- Roth Memory Course
By David M. Roth
- How to Read Character at Sight
By Dr. K. M. H. Blackford
- Super-Salesmanship (\$7)
By Arthur Newcomb
- Purinton Course in Personal Efficiency
By Edward Earle Purinton
- Ferrin Home-Account System (\$3)
By Wesley W. Ferrin

Name.....

Address.....

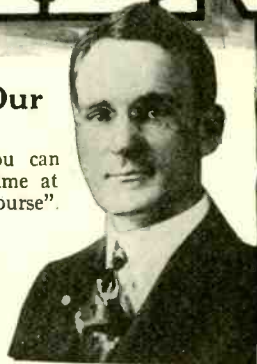
Elect. Exp. 4-20

The World of Industry Needs DRAFTSMEN

You Can Learn Quickly by Our Practical Method

IF you are a person of even average ability, you can master this profitable profession in your spare time at your own home through our famous "Home Study Course".

You can in a short time become a first class Draftsman because of the fact that our training is most thorough and practical, and because you will be personally instructed and coached by the President of the school, Roy C. Clafin, whose long experience as a draftsman and a teacher especially qualifies him to give you the kind of training you need. We teach you to work from actual models just as you would in a drafting room, instead of merely copying from books.



Roy C. Clafin, President, The Columbia School of Drafting

Draftsmen Get \$35.00 to \$100.00 a Week

Every mechanical idea must be drawn out by the Draftsman before it can become a reality. On account of the importance of his work, he is therefore paid a good salary and is always in line for advancement. Drafting is not only one of the best paying professions, but is the stepping stone to bigger opportunities. Many men, receiving up to \$40,000 a year and over, in technical positions, owe their success to their knowledge of Drafting as the starting point.

General construction companies, manufacturers of machinery, locomotives, and automobiles, designers of tools and special equipment, makers of aeroplanes, large engineering companies; in fact, all branches of industry need DRAFTSMEN today in greater numbers and at better salaries than ever before.

"Columbia" Graduates Are the Kind of Draftsmen That Are Needed

The properly trained draftsmen, such as those graduated by the COLUMBIA SCHOOL OF DRAFTING, are the ones who get the preferred positions and best salaries, and are the ones who are most greatly in demand. The success of our students demonstrates this fact. Columbia graduates are filling important positions in big concerns throughout the country.

We would like to send you a book of testimonials from many of our hundreds of students and graduates whose present highly paid positions as Draftsmen are the result of their practical training with us. A few of these letters are here reprinted.

No Previous Training Required

As our students are given practical Drafting work from the beginning of our course, they grasp the essentials quickly, so that no previous training or drafting experience of any kind is required to take up this work with us. You do not even need a high school education to learn Professional Drafting as taught by this school and the training we give you is all that is needed to secure a position as Draftsman (Read Lawrence P. Johnston's letter).

How Columbia Students Succeed

(More letters on request)

"I have accepted a position as draftsman, paying \$2,640.00 a year to start. I had no previous drafting experience aside from my training with you, which has proven all that was needed for me to become a professional draftsman." Lawrence P. Johnston.

"Several firms have offered me \$40 and \$45 a week to start. As I am doing nicely as draftsman up here and about to receive my second increase in salary have decided to stay. I find there are hundreds of openings for draftsmen and if I quit where I am I could secure another position in three hours' time. There will be a still greater demand for Draftsmen." Geo. Murray, Jr.

"I wish to express my appreciation for your courteous treatment and sincere interest in the progress of my studies and for aiding me, upon completion of your course, to secure a very desirable position at \$140 a month to start. I am getting on well and the chances for advancement are excellent." A. L. Gash.

"I have accepted a good position with a large manufacturing concern in Chicago and wish to thank you for the training your school has given me." Emil B. Johnson.

A few of our many other successful graduates are:
G. Tangorra, \$2,800 a year; T. R. Brown, \$2,860 a year; R. Fowkes, \$3,700 a year.

Drawing Outfit Furnished Students

We furnish, without extra charge, an individual drawing outfit to all our students for use throughout the course. This becomes your property as soon as the course has been paid for.

Mail This Coupon Today

Your future success depends upon what you do, TODAY. If you are interested in learning this interesting and big paying profession, send the following coupon WITHOUT DELAY for our Free catalog of particulars.

COLUMBIA SCHOOL OF DRAFTING
Dept. 1100

14th & T Sts. N.W.,
Washington, D. C.

Columbia School of Drafting Dept. 1100 14th and T Sts., N. W., Washington, D. C.

Without obligation to me, please send me FREE your illustrated book of particulars, testimonials from students, rates and liberal terms.

Name
Street & No.....
City State

Be an Automotive Electrical Expert

A Great New Field of Highly Paid Specialists

BIG paying positions are open throughout the country to men who are experts in electrical starting, lighting, ignition and storage battery work for automobiles, motor trucks, tractors, motorcycles, motor boats, aircraft, farm lighting plants and gas engines of all types. Here is a great new field of highly paid specialists where there are not enough trained men to supply the demand. Automotive electrical experts are needed by automobile and gas engine manufacturers, service stations and garages. No less than 75% of all automobile troubles are electrical and require the services of the expert who understands every detail of automotive electrical equipment; its construction, principles of operation, methods of testing, its care and repair.

Earn \$150 to \$400 a month

You can qualify for the big opportunities in this clean, interesting work. You can quickly become a master of electric starting, lighting, ignition and storage batteries and step into a big paying position as a trained specialist in the highest branch of auto mechanics. You can go into business for yourself, if you choose, for there is a big demand everywhere for expert electrical repair service.

In Three Months You Can Be A Master Of All Starting, Lighting and Ignition Systems and Storage Batteries

Our method of intensive, highly specialized training under practical experts in our big, fully equipped laboratories makes you a master of every phase of automotive and gas engine electrical equipment. You learn by actual work on models of every type of system in use. You are taught

everything, from the fundamental principles of electricity to the most intricate problems in construction, operation, testing and repair. In three short months, by devoting full time to your training, you can be an expert.

Come to American's Greatest Institution of Electrical Education

Train for your future as an automotive electrical expert in the largest and most completely equipped institution of its kind in the country. Nowhere else can you get the tremendous special advantages offered you by School of

Engineering of Milwaukee with its fifteen year record of training men for success in all branches of electricity. Four big buildings—1500 students—over 75 instructors. Dormitory and other special privileges. Students' athletics.

Earn While You Learn

We secure part-time employment for you with Milwaukee industrial concerns to defray your expenses if you wish. You can devote half time to earning money and half to your training in automotive electricity, completing the course in six months. Most of our students are earning their own way. You can take advantage of the same wonderful plan while you are training for a splendid future as a highly paid expert. As soon as your course is completed our Free Employment Bureau helps you to a good position. We have hundreds of requests from employers for men trained by School of Engineering of Milwaukee.

Write for Big FREE BOOK

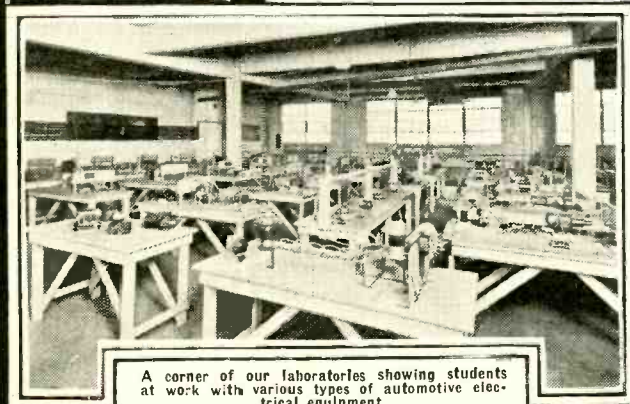
Just mail the coupon or write for our handsome illustrated Book telling about the great opportunities for you as an Automotive Electrical Expert, explaining our practical method of training and our Earn While You Learn Plan. Read about the great School of Engineering, its up-to-date electrical laboratories and its unparalleled layout of electrical equipment for you to work with. Do not pass by this opportunity to learn of the big future that will be opened to you by only a few short weeks of intensive, specialized training in automotive electricity. New classes forming now. Tear off the coupon and mail it today—your request involves no cost or obligation.



SCHOOL OF ENGINEERING OF MILWAUKEE
Dept. 14, 373 Broadway,
Milwaukee, Wis.

Please send me, without cost or obligation on my part, your Free Book on Automotive Electricity, telling about the opportunities open and your method of practical training. Also particulars of your Earn While You Learn Plan.

Name.....
Address.....
Town.....State.....



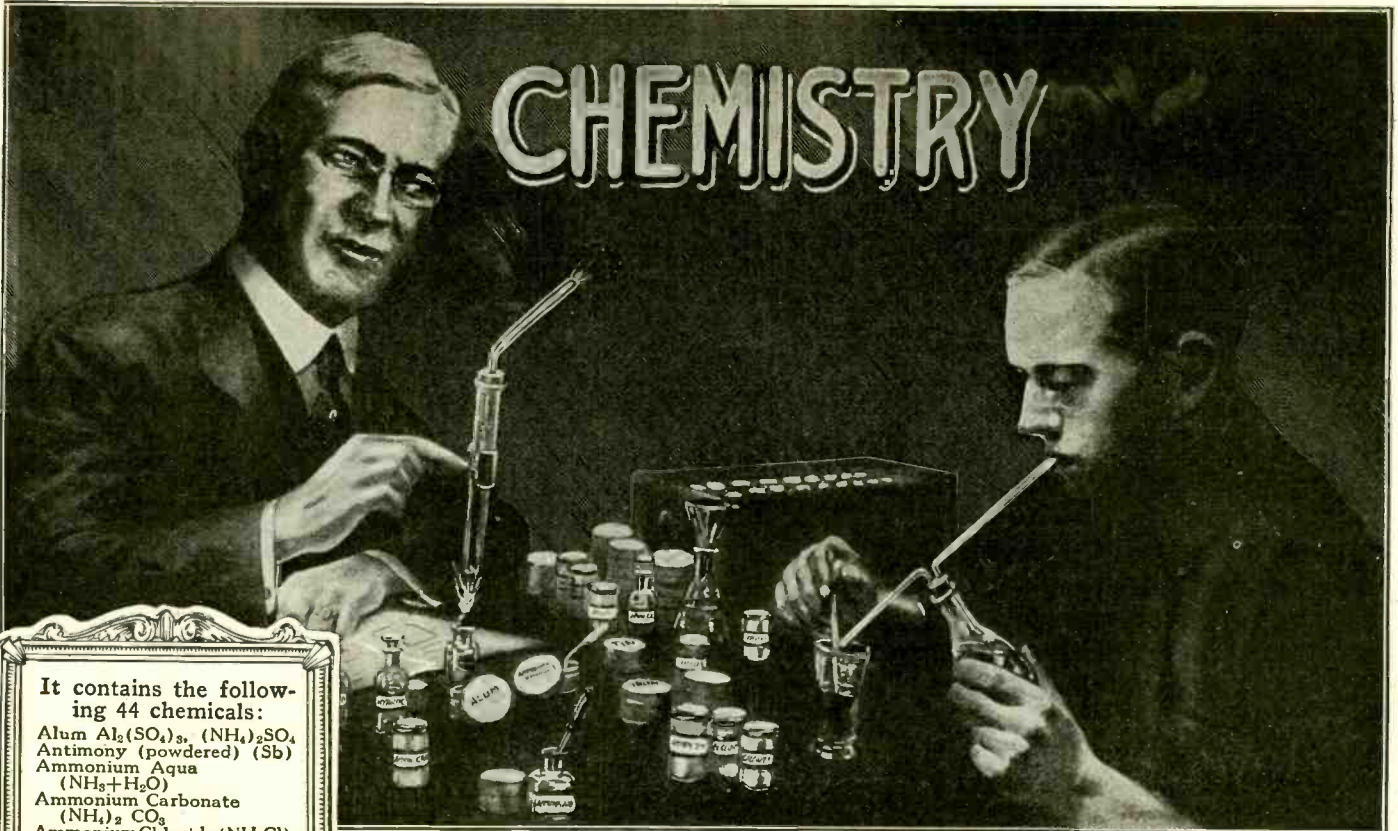
A corner of our laboratories showing students at work with various types of automotive electrical equipment.

SCHOOL OF ENGINEERING OF MILWAUKEE

Dept. 14, 373 Broadway, Milwaukee, Wis.

You benefit by mentioning the "Electrical Experimenter" when writing to advertisers.

CHEMISTRY



"The Joy of Father and Boy."

It contains the following 44 chemicals:

Alum $Al_2(SO_4)_3 \cdot (NH_4)_2SO_4$
 Antimony (powdered) (Sb)
 Ammonium Aqua
 $(NH_3 + H_2O)$
 Ammonium Carbonate
 $(NH_4)_2CO_3$
 Ammonium Chloride (NH_4Cl)
 Ammonium Sulphate
 $(NH_4)_2SO_4$
 Barium Chloride $(BaCl_2)$
 Boric Acid (H_3BO_3)
 Brimstone (Sulphur) (S)
 Calcium Chloride $(CaCl_2)$
 Calcium Oxide (CaO)
 Calcium Sulphate
 $(CaSO_4 \cdot 2H_2O)$
 Charcoal (Carbon) (C)
 Chloride of Zinc $(ZnCl_2)$
 Copper Sulphate $(CuSO_4)$
 Ferrous Sulphate $(FeSO_4)$
 Ferrous Sulphide (FeS)
 Glycerol (Glycerine)
 $C_3H_5(OH)_3$
 Hydrochloric Acid (HCl)
 Iodine (I)
 Iron Chloride $(FeCl_2)$
 Iron Oxide (Fe_2O_3)
 Lead Acetate Pb $(C_2H_3O_2)_2$
 Litmus Paper
 Magnesium Carbonate
 $(MgCO_3)$
 Manganese Dioxide (MnO_2)
 Mercury (Quicksilver) (Hg)
 Nickel Chloride $(NiCl_2)$
 Oxalic Acid $(H_2C_2O_4)$
 Sodium Bicarbonate
 $(NaHCO_3)$
 Sodium Borate $(NaBO_2)$
 Sodium Carbonate (Na_2CO_3)
 Sodium Chloride (NaCl)
 Sodium Nitrate $(NaNO_3)$
 Sodium Phosphate
 (Na_2HPO_4)
 Sodium Sulphate (Na_2SO_4)
 Sodium Sulphite (Na_2SO_3)
 Stannous Chloride $(SnCl_2)$
 Sulphate of Nickel $(NiSO_4)$
 Sulphate of Zinc $(ZnSO_4)$
 Sulphuric Acid (H_2SO_4)
 Tin (Granulated) (Sn)
 Zinc (Metal) (Zn)
 Zinc Carbonate $(ZnCO_3)$

The following apparatus are furnished:

One Standard Washbottle
 One Alcohol Lamp
 One Conical Glass Measure
 One Erlenmeyer Flask
 One Glass Funnel
 One Delivery Tube
 Six Assorted Test-Tubes
 One Test-Tube Holder
 Ten Sheets of Filter Paper
 One Glass Dropper
 One Spoon Measure
 Glass Tubing
 One book containing Treatise on Elementary Chemistry and 100 Chemical Experiments to be performed with this outfit.

Chemical Laboratory

We present herewith to our friends our new E. I. Co. Chemical Laboratory which contains real chemicals and apparatus to perform real chemical experiments. This outfit is not a toy, put up merely to amuse, but a practical laboratory set, with all the chemicals, apparatus and reagents necessary to perform real work and to teach the beginner all the secrets of inorganic chemistry. With this outfit we give free a book containing a Treatise in Elementary Chemistry, useful data and recipes, and 100 instructive and amusing experiments.

DESCRIPTION OF THE OUTFIT:

The outfit consists of forty-four (44) Chemicals all C. P. (chemical pure) put up in appropriate wooden boxes, glass bottles, and hermetically closed jars. The acids are put up in glass bottles, with ground-in glass stoppers and there is a sufficient quantity of chemicals supplied (mostly one to two ounces) enough to make dozens of experiments with each. See list of Chemicals herewith.

The apparatus furnished are all of the best obtainable make and of standard laboratory size and shape. A list of the 17 pieces of apparatus furnished with this outfit is printed also herewith.

The Instruction book is a real Chemistry Course for the Beginner. Some of the Contents are: Division of Matter: This is a Treatise on Elementary Chemistry and deals with the theory of the Elements, Molecules and Atoms, etc. Chemical Nomenclature: This explains in simple language the derivation of the chemical names of the Elements and their compounds. There is a chapter on Laboratory Operations; Glass Working; First Aid; Fire Extinguishers; Experimenters' Aphorisms, etc.

A good part of the book is devoted to Weights and Measures. The Metric System, the English system and the U. S. System are fully explained.

The following tables are furnished: Symbols and Atomic weights of the Elements; Measures of Weights, Volume, Capacity and Length; Per Cent solutions; Conversion of Measure expressed in parts; Poisons and their antidotes; Technical and common name of chemical substances; Formulas for Cleaning various substances, etc., etc.

Among the 100 Experiments are:

How to make chemical tricks; How to make invisible and magic inks; How to test flour; How to test soil; How to Make Chlorine Gas and smoke (German War Gas); How to bleach cloth and flowers. How to produce Oxygen and Hydrogen; How to make chemical colors; How to test Acids and Alkalies and hundreds of interesting hints and formulas.

The price is still \$5.00. Shipping Weight 10 lbs. (Can be shipped by Express only.)



TRADE MARK

THE ELECTRO IMPORTING CO., Mfrs.
 231 FULTON STREET NEW YORK CITY



TRADE MARK

"THE LIVELIEST CATALOG IN AMERICA"

Our big, new electrical cyclopedia No. 21 is waiting for you. Positively the most complete Wireless and electrical catalog in print today. 176 Big Pages, 400 illustrations. 300 instruments and apparatus, etc. Big "Treatise on Wireless Telegraphy." 21 FREE coupons for our 160-page FREE Wireless Course in 20 lessons. FREE Cyclopedia No. 21 measures 7x5 1/4". Weight 1/2 lb. Beautiful stiff covers.

ELECTRO IMPORTING COMPANY
 231 Fulton St., New York City

I enclose herewith 6 cents in stamps or coin, to cover postage, for which please send me your latest Cyclopedia Catalog No. 21 as described.

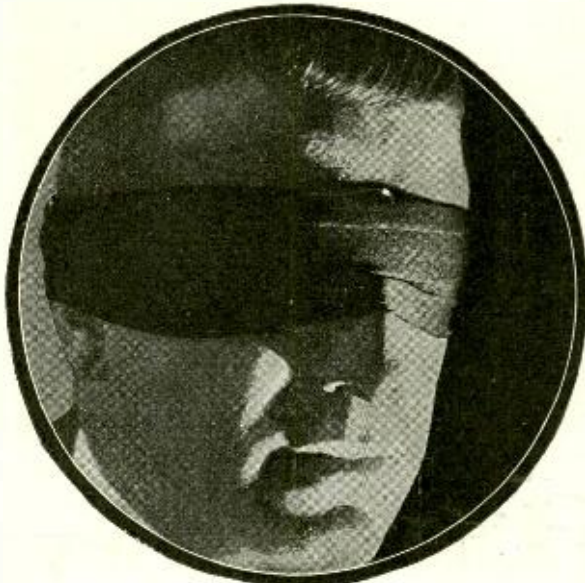
NAME

ADDRESS

STATE E. E. 4-20

A Startling Memory Feat That You Can Do

How I learned the secret in one evening. It has helped me every day



WHEN my old friend Faulkner invited me to a dinner party at his house, I little thought it would be the direct means of getting me a one-hundred-and-fifty per cent. increase in salary. Yet it was, and here is the way it all came about.

Toward the close of the evening things began to drag a bit, as they often do at parties. Finally some one suggested the old idea of having everyone do a "stunt." Some sang, others forced weird sounds out of the piano, recited, told stories, and so on.

Then it came to Macdonald's turn. He was a quiet sort of chap, with an air about him that reminded me of the old saying that "still waters run deep." He said he had a simple "stunt" which he hoped we would like. He selected me to assist him. First he asked to be blindfolded securely to prove there was no trickery in it. Those present were to call out twenty-five numbers of three figures each, such as 161, 249, and so on. He asked me to write down the numbers as they were called.

This was done. Macdonald then astounded everyone by repeating the entire list of twenty-five numbers backwards and forwards. Then he asked people to request numbers by positions, such as the eighth number called, the fourth number, and so on. Instantly he repeated back the exact number in the position called. He did this with the entire list—over and over again, without making a single mistake.

Then Macdonald asked that a deck of cards be shuffled and called out to him in their order. This was done. Still blindfolded, he instantly named the cards in their order backwards and forwards. And then to further amaze us, he gave us the number of any card counting from the top, or the card for any number.

You may well imagine our amazement at Macdonald's remarkable feat. You naturally expect to see a thing of this sort on the stage, and even then you look upon it as a trick. But to see it done by an everyday business man, in plain view of everyone, blindfolded and under conditions which make trickery impossible, is astonishing, to say the least.

ON THE way home that night I asked Macdonald how it was done. He said there was really nothing to it—simply a memory feat, the key to which anyone could easily learn in one evening. Then he told me that the reason most people have bad memories is because they leave memory development to chance. Anyone could do what he had done, and develop a good memory, he said, by following a few simple rules. And then he told me exactly how to do it. At the time I little thought that evening would prove to be one of the most eventful in my life, but such it proved to be.

What Macdonald told me I took to heart. In one evening I made remarkable strides toward improving my memory and it was but a question of days before I learned to do exactly what he had done. At first I amused myself with my new-found ability by amazing people at parties.

My "memory feat," as my friends called it, surely made a hit. Every one was talking about it, and I was showered with invitations for all sorts of affairs. If anyone were to ask me how quickly to develop social popularity, I would tell him to learn my memory "feat"—but that is apart from what I want to tell you.

The most gratifying thing about the improvement of my memory was the remarkable way it helped me in business. Much to my surprise I discovered that my memory training had literally put a razor edge on my brain. My brain had become clearer, quicker, keener. I felt that I was fast acquiring that mental grasp and alertness I had so often admired in men who were spoken of as "wonders" and "geniuses."

The next thing I noticed was a marked improvement in my conversational powers. Formerly my talk was halting and disconnected. I never could think of things to say until the conversation was over. And then, when it was too late, I would always think of apt and striking things I "might have said." But now I can think like a flash. When I am talking I never have to hesitate for the right word, the right expression or the right thing to say. It seems that all I have to do is to start to talk and instantly I find myself saying the very thing I want to say to make the greatest impression on people.

It wasn't long before my new-found ability to remember things and to say the right thing at the right time attracted the attention of our president. He got in the habit of calling me in whenever he wanted facts about the business. As he expressed himself to me, "You can always tell me instantly what I want to know, while the other fellows annoy me by dodging out of the office and saying 'I'll look it up.'"

* * * * *

I FOUND that my ability to remember helped me wonderfully in dealing with other people, particularly in committee meetings. When a discussion opens up the man who can back up his statements quickly with a string of definite facts and figures usually dominates the

others. Time and time again I have won people to my way of thinking simply because I could instantly recall facts and figures. While I'm proud of my triumphs in this respect, I often feel sorry for the ill-at-ease look of the other men who cannot hold up their end in the argument because they cannot recall facts instantly. It seems as though I never forget anything. Every fact I now put in my mind is as clear and as easy to recall instantly as though it were written before me in plain black and white. We all hear a lot about the importance of sound judgment. People who ought to know say that a man cannot begin to exercise sound judgment until he is forty to fifty years of age. But I have disproved all that. I have found that sound judgment is nothing more than the ability to weigh and judge facts in their relation to each other. Memory is the basis of sound judgment. I am only thirty-two, but many times I have been complimented on having the judgment of a man of forty-five. I take no personal credit for this—it is all due to the way I trained my memory.

* * * * *

THESE are only a few of the hundreds of ways I have profited by my trained memory. No longer do I suffer the humiliation of meeting men I know and not being able to recall their names. The moment I see a man his name flashes to my mind, together with a string of facts about him. I always liked to read but usually forgot most of it. Now I find it easy to recall what I have read. Another surprising thing is that I can now master a subject in considerably less time than before. Price lists, market quotations, data of all kinds, I can recall in detail almost at will. I rarely make a mistake.

My vocabulary, too, has increased wonderfully. Whenever I see a striking word or expression, I memorize it and use it in my dictation or conversation. This has put a remarkable sparkle and pulling power into my conversation and business letters. And the remarkable part of it all is that I can now do my day's work quicker and with much less effort, simply because my mind works like a flash and I do not have to keep stopping to look things up.

All this is extremely satisfying to me, of course. But the best part of it all is that since my memory power first attracted the attention of our president, my salary has steadily been increased. Today it is many times greater than it was the day Macdonald got me interested in improving my memory.

* * * * *

WHAT Macdonald told me that eventful evening was this: "Get the Roth Memory Course." I did. That is how I learned to do all the remarkable things I have told you about. The publishers of the Roth Memory Course—The Independent Corporation—are so confident that it will also show you how to develop a remarkable memory that they will gladly send the Course to you on approval.

You need not pay a single penny until you have examined the Course and found that it fully lives up to all the claims made for it. Send no money. Merely mail the coupon or write a letter, and the complete Course will be sent to you instantly, all charges prepaid. If after examination you decide that you do not want to keep the Course, then return it and you will owe nothing. On the other hand, if you find, as thousands of others have found, that the Roth Memory Course will do wonders for you, then merely send five dollars in full payment.

You have always wanted a good memory. Now you can have it. Remember, you pay no money until you have proved that the Course will benefit you. You have everything to gain and nothing to lose by taking immediate action. So mail the coupon NOW before this liberal offer is withdrawn.

INDEPENDENT CORPORATION,
Dept. R-1104, 319 Sixth Ave.
FREE EXAMINATION COUPON

INDEPENDENT CORPORATION

- Publishers of The Independent Weekly*
Dept. R-1104, 319 Sixth Avenue, New York
- You may send me the Course or Courses checked below. Within five days after receipt I will either return them or send you \$5 for each in full payment.
 - Roth Memory Course
 - By David M. Roth
 - How to Read Character at Sight
 - By Dr. K. M. H. Blackford
 - Mastery of Speech
 - By Frederick Houk Law
 - Super-Salesmanship (\$7)
 - By Arthur Newcomb
 - Purinton Course in Personal Efficiency
 - By Edward Earle Purinton
 - Ferrin Home-Account System (\$3)
 - By Wesley W. Ferrin

Name

Address



FOR SALE AT ALL NEWS STANDS

ARTISTIC TWO COLOR COVER

"THE 100% WIRELESS MAGAZINE"

What "Radio Amateur News" Is:

RADIO AMATEUR NEWS holds the field undisputedly as the greatest radio magazine in print today. In point of circulation, number of articles, illustrations, RADIO AMATEUR NEWS now leads all other wireless magazines. Take for instance the March issue with its 72 pages; there are fifty-four separate purely radio articles and 128 illustrations. *Over thirty-five thousand copies were printed and circulated.*

Each issue of the RADIO AMATEUR NEWS now contains 72 pages (or more) and an artistic cover in two colors. The illustrations average 120 every month and there are from 40 to 50 up-to-date articles, some by our greatest radio scientists, in every issue.

RADIO AMATEUR NEWS is the greatest and biggest radio magazine in print today.

RADIO AMATEUR NEWS is the only INDEPENDENT monthly wireless magazine in existence. It caters to no commercial interests—it has no boss save its readers. It is "different"—it has the latest radio news. It is a scientific magazine but it caters largely to the RADIO AMATEUR—it is by and for the Amateur. It is published by the publishers of the ELECTRICAL EXPERIMENTER, but there is no duplication of articles in the two magazines. Both are entirely different—but both together will give you ALL the radio news of all the world. Whether you are a professor or an Amateur, get a sample copy or order it from your Newsdealer today.

\$100.00 RADIOPHONE PRIZE CONTEST

The future of Radio lies in the Radio telephone, there is no doubt about that. With the Radiophone there is practically no interference; you need learn no code; a radiophone message takes but a fraction of the time of a radiotelegraph message.

The Editor of RADIO AMATEUR NEWS is so enthusiastic about the Radiophone, and he is such a staunch believer in its great future, that he has offered \$100.00 IN GOLD for the best photographs and description of a good amateur Radiophone. Here is your chance for some easy money.

For full particulars see this month's issue of RADIO AMATEUR NEWS.

20c
The Copy
\$2.00
A Year

Canada and Foreign
\$2.50 A Year

SEND
20c FOR
SAMPLE
COPY
TODAY

72 PAGES
128 ILLUSTRATIONS
SPECIAL OFFER

Gentlemen:
Please enter my subscription for RADIO AMATEUR NEWS for the term for one year for which I enclose herewith \$2.00. As a special offer you will also send me for 25c extra your great Wireless Course containing 160 pages, 350 illustrations, size 6 1/4 x 10" with fine flexible cloth cover. I have written my name and address in margin below.

Partial CONTENTS OF APRIL ISSUE:

- A Modern Radiophone
By Robert F. Gowen
- The Resonant Converter Transmitter
- New Facts About Nauen Station
By Dr. Alfred Gradenwitz
- Wireless in Modern Aircraft
By Alexis J. Hall
- New Reactance Transmitter
By E. T. Jones
- The Priess Loop Set—Part 4
By Walter J. Henry
- Aladdin's Lamp
By Charles S. Wolfe
- With the Amateurs

EXPERIMENTER PUB. CO., 231 Fulton St., New York City

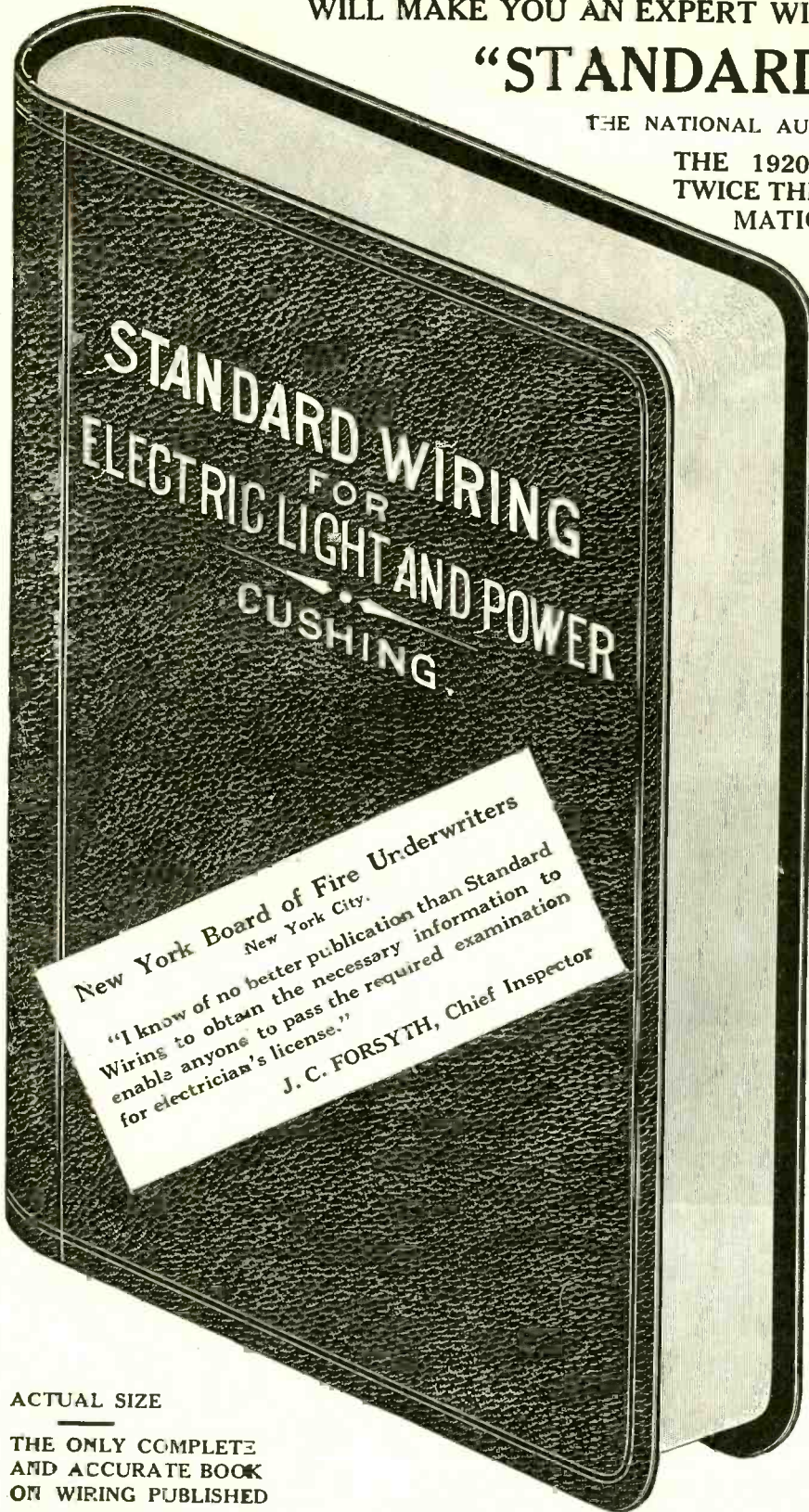
LEARN WIRING AND EARN \$75 A WEEK

THE 1920 EDITION, COMPLETELY REVISED TO DATE,
WILL MAKE YOU AN EXPERT WIREMAN

“STANDARD WIRING”

THE NATIONAL AUTHORITY FOR TWENTY-SIX YEARS

THE 1920 EDITION CONTAINS OVER
TWICE THE AMOUNT OF USEFUL INFORMATION EVER PUBLISHED BEFORE



CONTENTS

The National Electrical Code, with all its new rules, is explained and illustrated. 52 of the latest and simplest tables which show, at a glance, just what size of wire is needed for any kind and size of lighting, motor or heating installation, for any voltage, current and drop desired for any system, Direct Current, Alternating Current, single, two or three-phase. The latest Code Rules on grounding required on all work.

SPECIAL CHAPTERS

How to install and operate generators, motors, storage batteries and every kind of wiring device with diagrams of connections. Illumination, House Wiring, Garage Wiring, Theatre Wiring, Moving Picture House Wiring, Sign Wiring, Marine Wiring, Electric Range and Heater Wiring, Watt-Hour Meter Wiring and complete chapters on inside and outside wiring for every system from a central station to the smallest cottage. Electrical Units and their Equivalents. The latest lamp data. Proper symbols to use to indicate outlets, etc., etc. Also a complete directory of the leading manufacturers of officially approved apparatus and supplies necessary for any kind of installation.

ACTUAL SIZE

THE ONLY COMPLETE
AND ACCURATE BOOK
ON WIRING PUBLISHED

LEATHER COVER—POCKET SIZE
440 PAGES—FULLY ILLUSTRATED
GILT EDGES—PRICE \$3.00

Sent Post-paid to Any Address on Receipt of Price by

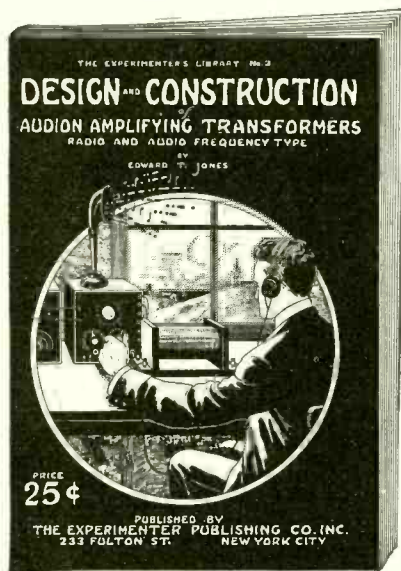
H. C. CUSHING, JR., 8 WEST 40TH STREET, NEW YORK CITY

Every Electrical Inspector in the United States will approve your work if done in accordance with the simple rules given in "Standard Wiring"

SPECIAL TO YOU!

Read this Remarkable Offer!

Here Are 3 Books You Should Have



For a limited time we will send all three for only 50c when included with a one-year subscription for the **ELECTRICAL EXPERIMENTER**. This offer is limited—it may be withdrawn at any time. Don't wait, get these books **NOW** and guarantee yourself twelve wonderful numbers of the **ELECTRICAL EXPERIMENTER**.

Design and Construction of Audion Amplifying Transformers Radio and Audio Frequency Type

by E. T. Jones, late Associate Editor of **RADIO AMATEUR NEWS**, a wonderful book—the only one of its kind in print—

should be on the shelf within easy reach of every amateur. Every line of this book is written so that you can understand it. Every detail in the manufacture and construction of Audion Amplifying Transformers is described at great length. The book contains many illustrations and diagrams that make it a simple matter to build the Transformers described. Never before have these instruments been described in print. They have always been considered strictly a "trade secret."



How To Make Wireless Receiving Apparatus

A wonderful book for the man who would construct his own apparatus. Size 5 1/4 x 7 1/2 inches. Containing 100 pages and 90 illustrations. Compiled of the writings of twenty-five Radio experts. Every amateur should have this book in his wireless room.

Any amateur in the "wireless game" can easily construct a complete sending and receiving station, and will have his choice of many varieties after reading these wonderful books.

Remember, all three will be sent you postpaid just as soon as we receive your subscription and 50 cents toward the cost of the books. You really get the books free, because the magazine alone would cost you \$3.00 if you bought the single copies each month.

How To Make Wireless Sending Apparatus

In every detail equal to "How To Make Wireless Receiving Apparatus." Size 5 1/4 x 7 1/2 inches. Containing 100 pages and 88 illustrations. Dealing at length on Quenched Spark Gaps, Rotary Gaps and Oscillation Transformers.

EXPERIMENTER PUBLISHING CO., Inc.
233 Fulton Street, New York City, N. Y.

Experimenter Publishing Co.,
233 Fulton St.,
New York, N. Y.

Gentlemen:—You may send me the three books described in the "Experimenter" and enter my name for a year's subscription to the **ELECTRICAL EXPERIMENTER MAGAZINE** for which I enclose \$3.00.

Name

Address

An Amazingly Simple Method of Writing Shorthand!

Only 7 Lessons—Easily Learned in 7 Evenings

You don't need to go to an expensive school to learn shorthand. You don't need to spend hours and hours in mental grind trying to master a lot of lines, shadings and hooks. You can gratify your wish to learn shorthand—to be able to take short notes or long speeches speedily and correctly by learning only 7 easy, fascinating Paragon Shorthand lessons. It's the ideal course for busy executives, reporters, advertising writers, secretaries, authors, clerks, ambitious boys and girls—anyone and everyone who realizes the tremendous advantage one has in ability to make quick and correct notes for later reference. Anyone who knows the alphabet can quickly master the principles of the Paragon Course. There are twenty-six letters in the alphabet and

Only 26 Word Signs

in the Paragon Shorthand method—six prefix abbreviations—and one general rule for contractions. You grasp the principles the first evening—within the first hour. Practice daily what you learn in each lesson and you very quickly gain great speed. Each sign is so easy to remember that you don't need to consult the book for the correct word sign—each one just pops into your mind as you require it. It's just like playing an interesting game. But you can make the knowledge pay you big dividends by using it in your daily work or stepping up to a position that requires a knowledge of shorthand.

Paragon writers are all over the world: in England, Continental Europe, Australia, New Zealand, Canada, South America, Canal Zone, China, Philippine Islands and in all other civilized places. Paragon Shorthand is used in the offices of Standard Oil Company, United States Steel Corporation, many of the great Railway Systems, the largest firms and corporations in the world.

Paragon Shorthand Only \$5.⁰⁰

For the price of a couple of theatre tickets you can get this knowledge and ability that will prove to be of inestimable value to you almost every day in your life.

Many of the big men in business got their start because they could write shorthand—Frank A. Vanderlip, George B. Cortelyou, William Loeb, Jr., Edward Bok and many other very successful men. The man or woman who can write shorthand has an advantage over those who can't write, every time.

Thousands of ambitious men and women who absolutely failed to learn the old, complicated forms of other systems of shorthand have learned Paragon with ease. They have since become court stenographers, reporters, assistants to business heads, executives of prominent concerns and institutions. Thousands of grateful letters have been written highly recommending the Paragon Course and the financial reward that the use of it has brought.

Large and small business houses are searching for efficient shorthand writers. They are willing to pay any salary within reason for the service which they must have. Salaries are steadily advancing—and yet the demand for shorthand writers cannot be supplied. This unfilled demand is your opportunity.

**Formerly \$25.⁰⁰
Now \$5.⁰⁰**

Paragon Shorthand, which we offer you for \$5.00, is exactly the same course that has been taught by the inventor, Mr. Alexander Lichtentag, charging a fee of \$25.00 for the Course with separate examinations after each lesson. This Paragon Course is Mr. Lichtentag's identical Course arranged into Seven Easily-Learned Lessons, and an ingenious self-examination method.

Try This Lesson Now

Take the ordinary longhand letter *d*. Eliminate everything but the long downstroke and there will remain *∩*. This is the Paragon symbol for D. It is always written downward.

From the longhand letter *e* rub out everything except the upper part—the circle—and you will have the Paragon E. *o*

Write this circle at the beginning of *∩* and you will have Ed. *∩*

By letting the circle remain open it will be a hook, and this hook stands for A. Thus *∩* will be Ad. Add another A at the end, thus *∩* and you will have a girl's name, Ada.

From *∩* eliminate the initial and final strokes and *o* will remain, which is the Paragon symbol for O.

For the longhand *m*, which is made of 7 strokes, you use this one horizontal stroke —. Therefore, *∩* would be Me.

Now continue the E across the M, so as to add D—thus *∩* and you will have Med. Now add the large circle for O, and you will have *∩* (medo), which is Meadow, with the silent A and W omitted.

Testimonials

Used in Government Service

"I learned Paragon Shorthand from the Home-study Course—the lessons alone—without any further aid whatever. At the end of a week I could write the system nicely. I am now using it in the Government service, Treasury Department, Washington, D. C., and am getting along O. K. On account of my efficiency as stenographer my salary has been increased. I owe my rapid advancement to Paragon Shorthand."—E. C. Alley, Room 426, Winder Building, Washington, D.C.

In Court Reporting

"I have been the official Court Reporter for the Ninth Judicial District of Louisiana for a number of years, using Paragon Shorthand exclusively. Some years ago I learned this system in seven lessons. With Paragon Shorthand I am able to do any kind of work with as great rapidity as the occasion may demand."—J. Martian Hamley, Lake Providence, La.

In Public Schools

"As a result of competitive tests, Paragon Shorthand was unanimously adopted as the exclusive system for the Atlanta High Schools. The classes we have already graduated in Paragon are by far the best we have turned out during my twelve years' connection with the schools."—W. C. Lowe, Head of the Shorthand Departments, 18 Avery Drive, Atlanta, Ga.

On Big Corporations

"I am getting along fine with Paragon Shorthand. It is all you claim for it. It is easy to write, and as fast for speed—there's no limit."—John Waller, Jr., Standard Oil Co., Sugar Creek, Mo.

You can quickly master the Course at home—in seven evenings—just as thousands of others have done.

Through this Paragon Course you can write without mental friction—you have no complicated rules to remember, no "lines" to watch, no heavy and light "shadings." Only 26 simple word-signs, with no tedious memorizing, no confusing of meanings through the old elimination of vowels. Paragon notes never get "cold"; they are just as easy to read after ten years as after ten minutes, and the complete price of the Course is only \$5.00.

Send No Money

Don't send one cent now. Simply fill in and mail the Coupon and the Paragon Shorthand Course will be mailed to you for your personal examination. Keep it for five days—test the lessons and see for yourself how quickly you can get the knack of writing Paragon Shorthand. Use your newly-found knowledge. Then, after the five days, send us five dollars as full and complete payment of the Course, or you may return the Course to us without owing us one cent. You can't lose by sending for the Course for the five days' free examination. You will gain by a complete knowledge of Paragon Shorthand. Send the Coupon.

Paragon Shorthand Institute

Home Study Dept. G-1104, 311-6th Ave., N. Y.

You may send Paragon Shorthand Course for my personal examination. After five days I will either send you \$5.00 in full payment of the Course or I will return it to you and I will not owe you any money or be obligated in any way.

Name.....
Address.....
Town.....



Elec. Exp. 4-20

NAME

ADDRESS

STATE

ELECTRO IMPORTING COMPANY,
231 Fulton St., New York City.

I enclose herewith 6 cents in stamps or coin for which please send me your latest Cyclopedia Catalog No. 21 containing 176 pages, 263 illustrations and diagrams, including Treatise on Wireless Telegraphy, and 20 coupons for your 160 page Free Wireless Course in 20 lessons.

ED-4-20

FILL IN THIS COUPON FOR YOUR COPY OF

**Our New 176 Page Cyclopedia No. 21
IT IS WAITING FOR YOU**

**Full size fac-simile of our catalog just as it looks when you get it
1-2 INCH THICK WEIGHT ALMOST 1-2 POUND
263 Illustrations**



The Electro Importing Co.
231 FULTON STREET NEW YORK
"EVERYTHING FOR THE EXPERIMENTER"

"THE LIVEST CATALOG IN AMERICA"

A Few Interesting Things from Catalog No. 21

Treatise on Wireless Telegraphy by H. Gernsback, Editor Electrical Experimenter and Radio Amateur News—13 big pages, 3 illustrations.

The Wireless Law of 1912—all about it, what you can do and what you can't.

How to receive and send Radio messages.

How far you can send messages.

Table of wave lengths, of principal U. S. & foreign Radio high power stations.

How to receive time signals by Radio.

How to construct an amateur aerial.

How to use the test buzzer.

How to join the "Radio League of America" FREE, including application blank.

How telephone receivers are wound and built, tested and magnetized, 3 pages, 2 illustrations.

Experiments with a pony telephone receiver, with 6 illustrations.

Wireless Codes: Morse, Continental, Navy.

Experiments with spark coils, 3 pages.

How to photograph electrical discharges (sparks).

All about storage batteries, how to test them, recharging, etc.

Tesla experiments, 2 pages.

How to make Selenium Cells (illustrated).

FREE with this wonderful cyclopedia—20 coupons for our 160 page Wireless Course in 20 lessons. 350 illustrations, 30 tables. Catalog explains how you can get this Course absolutely free.

IN this cyclopedia you will find 116 pages all about radio. One of the greatest catalogs of its kind in print.

You will find in it dozens of wireless instruments of the famous E. I. Co. make. Remember always that this company was the **FIRST** to make and sell wireless instruments, the first wireless outfit having been placed upon the market by them in 1904. The E. I. Co. *knows how*, because it has the experience. Others imitate but cannot equal

E. I. Co. for quality and workmanship.

Other things you will find listed in this catalog: Electrolytic Interrupters, Bulldog Spark Coils, Chemical Outfits, Omni-graphs, Code Practice Sets, Telegraph Instruments, Primary Batteries, Storage Batteries, Solenoids, Hydrometers, Volt and Ammeters, Batterymeters, Electrolytic Rectifiers, Rheostats, Tesla Coils, Nickel Plating Outfits, Lighting Plants, Dynamos and Motors, Microphones, Detectiphones, Loud

Talkers, High Frequency Apparatus and supplies, Heating Pads, Electro-magnets, X-ray tubes, Telephones, Magnetos, Low Tension Transformers, Books, etc., etc.

IN A WORD THE MOST COMPLETE CATALOG IN PRINT

ELECTRO IMPORTING CO.
231 FULTON STREET NEW YORK, N. Y.

"Everything for the Experimenter"

How Would You Like to Earn \$300 Next Week?

Col. S. W. Wilke did it one day, and in 4 years jumped to almost \$1,000,000 a year. S. E. Gibson jumped his earnings from \$150 to \$800 a month. Let me send you my secret of earning more money, to try 5 days Free. All you risk is a two cent stamp.

By A. L. Pelton



MY name is Pelton — Albert L. Pelton. Four years ago I was as poor as a church mouse. I was out of a job, \$300 in debt, and my wife and two children were living on starvation

rations. Yes, I've known the bitterest kind of want.

Today I have money and all that money will buy. I have my own home. I have no worries about high prices of food or clothing or rent.

Even if I never make another nickel, I don't think I will ever have to worry about money matters.

During the past three years I have been making on an average of over a thousand dollars a week.

That's quite a change from the time I was "on my uppers", isn't it?

Now let me tell you how I did it.

You will probably think I'm funny when I tell you that for twelve years I held in my hand the secret that at last won me riches.

But it's true.

For twelve years I struggled—with gold right in my hand.

It was this way.

I used to sell books—from door to door—eking out a poor man's living.

One of the books I sold was written by Dr. Frank Channing Haddock.

I never thought much about the book—although I sold a few from week to week.

For twelve years I never even took the trouble to read it.

It was called "Power of Will".

I didn't know anything about will power.

What's more, I didn't care.

I thought it might be a good book for fellows who had to read it.

But I was too busy earning a living to bother about will power.

Probably I thought then, as tens of thousands think today, who've heard and read about this great book—that will-power was some myth, or impractical thing for dreamers.

You see—I hadn't analyzed the lives of the world's greatest men then, and

discovered that will-power is the mightiest force men have ever known.

I was fooling myself—cheating myself fearfully, as I found out later.

One day I ran across a man who had purchased the book from me a few months back.

He stopped me on the street and said, "Hello, Pelton, say, I'd like to have another copy of that Haddock book,—can you send it up right away?"

I told him I would. Then I asked him casually if he liked it.

What he told me made me go home and read the book myself—for the first time since I began to sell it twelve years before.

That same evening I borrowed \$300. The next day I was in New York.

I secured the exclusive selling rights to the book.

Then I spent \$150 for a page "ad" in the Review of Reviews magazine.

It brought me about \$2000 in cash. As fast as the money came in I shot it back into advertising.

When I got \$2500 in cash I bought a half page "ad" in the Saturday Evening Post.

The first year I spent \$50,000 in advertising. The next year I spent nearly a hundred thousand.

I guess I've spent over half a million dollars since my first \$150 "ad", and already 450,000 men and women—including great executives, international diplomats, famous authors, etc., also have taken up this study.

At first some people said I was crazy to advertise that book.

When they found that the book was selling—and that I was spending as high as \$20,000 a month telling people about it, they said I had more nerve than sense.

But, my friends, all this time I was simply taking my own medicine.

I was telling people that the will was the motive power of the brain—that a strong will could batter down every obstacle to success—that weak will-power could be made strong, as easily as the muscles of the arm could be made strong—and that most people had weak wills made strong—and that simply because they didn't use their will power.

I had strengthened my own will and was using it when people were calling me "crazy". And it was my will power that people called "nerve".

Anyway, it was the secret of my success. Without it I might still be plodding—still canvassing.

Or even if I had gotten up enough courage to advertise I might have made only a piker's success.

It was my will power that got me the \$300 loan.

It was my will power that got me exclusive sale of Dr. Haddock's book.

It was my will power that made me plunge into advertising instead of going slowly.

And finally, it was my will power that made me say to the public—"Send No Money—Read Power of Will 5 days free. Pay me if you decide to keep it—Send it back if you don't want it."

That was a new sort of proposition to most people. They had nothing to lose—and a lot

to gain, if the book was worth while.

So the orders came in by the hundreds—then by the thousands.

At times I was 15,000 orders behind—just couldn't print books fast enough.

And letters from readers came pouring in so fast I simply couldn't read them all. Col. S. W. Wilkie of Roscoe, S. D., wrote that one day's study of "Power of Will" netted him \$300 cash, and that four years later, by using the methods Haddock formulated, his earnings had risen to nearly \$1,000,000 a year.

V. P. Coffin of Rochester, N. Y., wrote, about one month after getting the book—"Power of Will" already has produced an increase of \$5,000 a year in my income."

J. F. Gibson of San Diego, Cal., said that since reading "Power of Will" his salary jumped from \$150 to \$800 a month.

Men like Judge Ben Lindsey, Supreme Court Justice Parker, Asst. Postmaster-General Britt, Governor McKelvie of Nebraska, Senator Capper of Kansas, Secretary of Agriculture Meredith, Governor Ferris of Michigan—and a host of other big men, show the class of leaders who have studied Haddock's methods.

Surely there must be something in "Power of Will" for you, my reader.

It helped me. It has helped half a million others. I could send you a circular mailed with hundreds of letters from readers. But, better still, see the book and read it 5 days free.

All you lose, if you don't think "Power of Will" will increase your earnings, is a two cent stamp.

It may make \$300 for you next week—it might carry you upwards to \$50,000 or \$100,000 in a few years—I don't know. I do know it has made a lot of money for its readers.

I do know, too, that if you pass this offer by—if you are a scoffer and a doubter—I will lose only the small profit on the sale of a book—but you—you may lose the difference between peanut money and real money.

It costs only 2c stamp to mail the coupon.

Don't wait 12 years—as I did. You may have gold within your reach and not know it. Send for "Power of Will" now. You've seen my ads before—now answer this one and see if this masterful volume doesn't contain the one little push you may need to make your life rosy-red. Begin training your will by sending in the coupon *this very second*.

A. L. PELTON.

Pelton Publishing Co.
30-H Wilcox Block, Meriden, Conn.

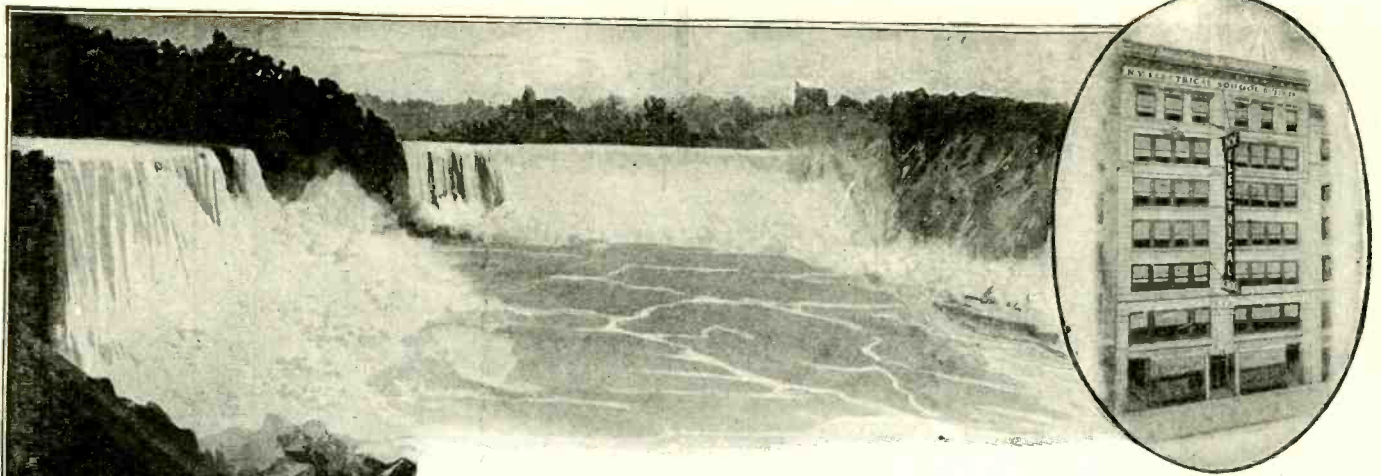
Pelton Publishing Company
30-H Wilcox Block, Meriden, Conn.

You may send me "Power of Will" at your risk. I agree to remit \$3.50 or remail the book to you in five days.

Name

Address

City



Master Electricity By Actual Practice

The only way you can become an expert is by doing the very work under competent instructors, which you will be called upon to do later on. In other words, *learn by doing*. That is the method of the New York Electrical School.

Five minutes of actual practice properly directed is worth more to a man than years and years of book study. Indeed, Actual Practice is the only training of value, and graduates of New York Electrical School have proved themselves to be the only men that are fully qualified to satisfy EVERY demand of the Electrical Profession.

The Only Institution of the Kind in America

At this "Learn by Doing" School a man acquires the art of Electrical Drafting; the best business method and experience in Electrical Contracting, together with the skill to install, operate and maintain all systems for producing, transmitting and using electricity. A school for Old and Young. Individual instruction.

Over 6,200 Graduates are Successful Men in the Electrical World

No previous knowledge of electricity, mechanics or mathematics is necessary to take this electrical course. You can begin the course now and by steady application prepare yourself in a short time. You will be taught by practical electrical experts with actual apparatus, under actual conditions.

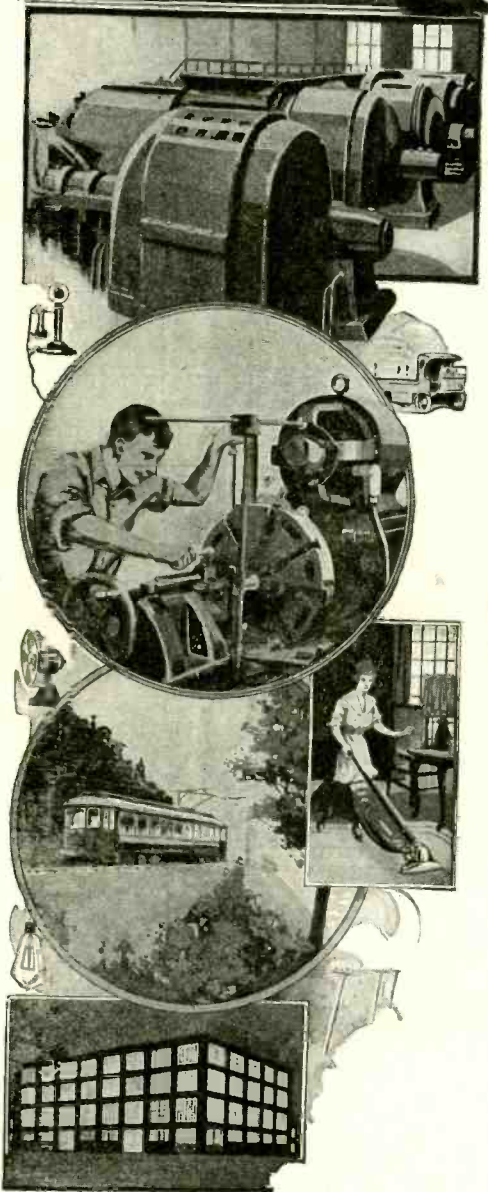
The N. Y. E. S. gives a special Automobile Ignition Course as an advanced training for Auto Mechanics, Garage Men and Car Owners. The course covers completely all Systems of Ignition, Starters, Lighting and other electrical equipment on automobiles, motor boats, airplanes, etc.

Let us explain our complete courses to you in person. If you can't call, send now for 64-page book—it's FREE to you.

New York Electrical School

29 West 17th Street, New York

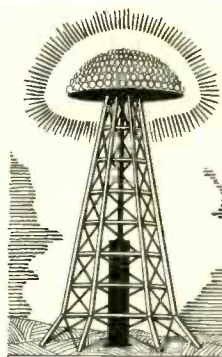
You benefit by mentioning the "Electrical Experimenter" when writing to advertisers.



New York Electrical School
29 W. 17th St., New York, N. Y.

Please send FREE and without obligation to me your 64-page book.

..... NAME
 STREET
 CITY STATE



ELECTRICAL EXPERIMENTER

H. GERNSBACK - EDITOR
H. W. SECOR - ASSOCIATE EDITOR



Vol. VII. Whole No. 84

April, 1920

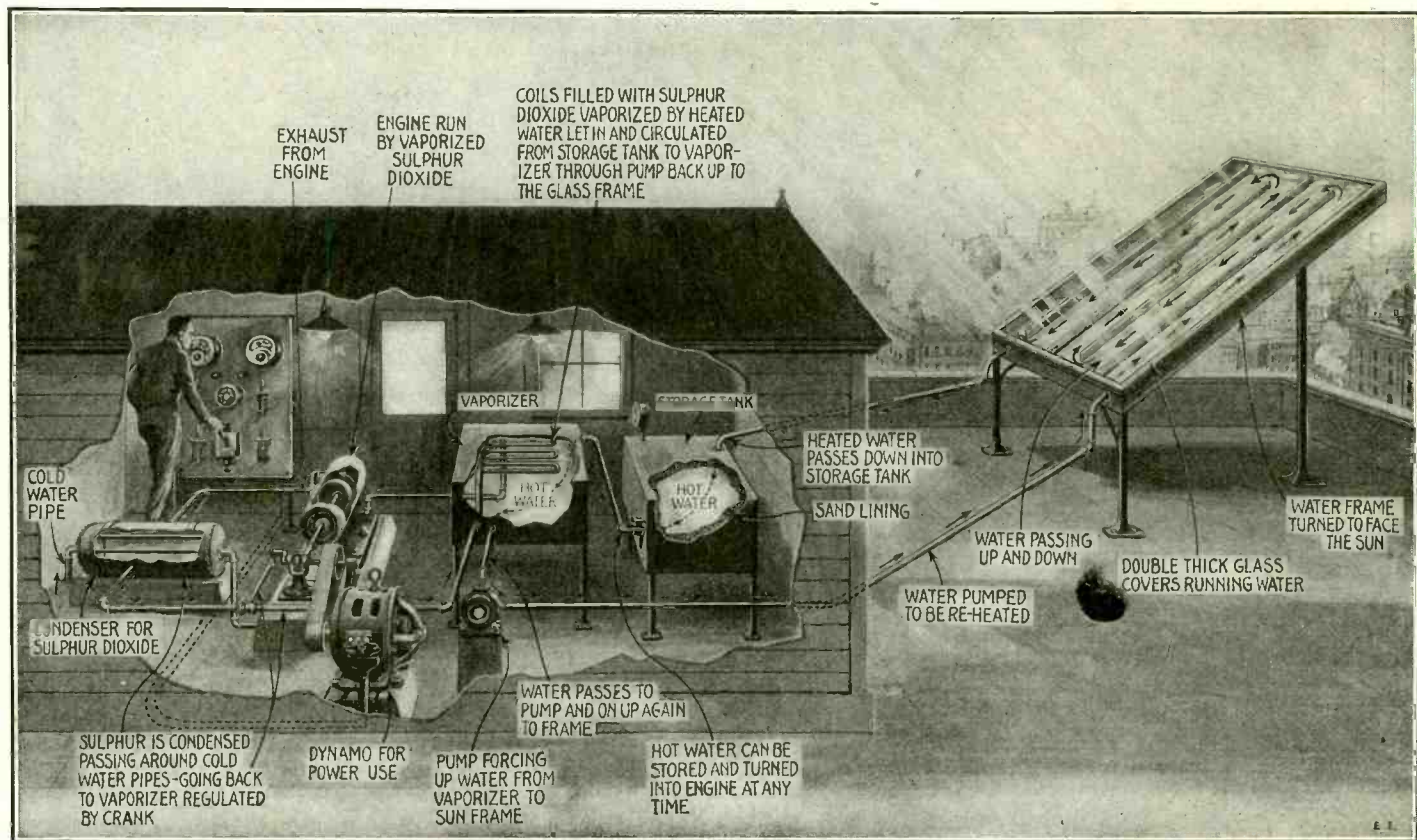
No. 12

Electric Power From The Sun

FROM time to time we hear of new schemes devised by inventors for harnessing the tremendous energy shot earthward every minute of our lives by "Old Sol." An American scientist, Mr. Henry E. Willsie, has re-

menting in the wilds and barrenness of an Arizona desert, where sandstorms, cloudbursts, thirst and poisonous reptiles all combined to threaten their very existence. All these experiences are interestingly told in an absorbing novel written by

power, particularly in the southern part of the United States and other more tropical parts of the world, experience has shown that the sun's heat will cause the temperature of the water to increase to about 150 degrees. The heated water passes into a



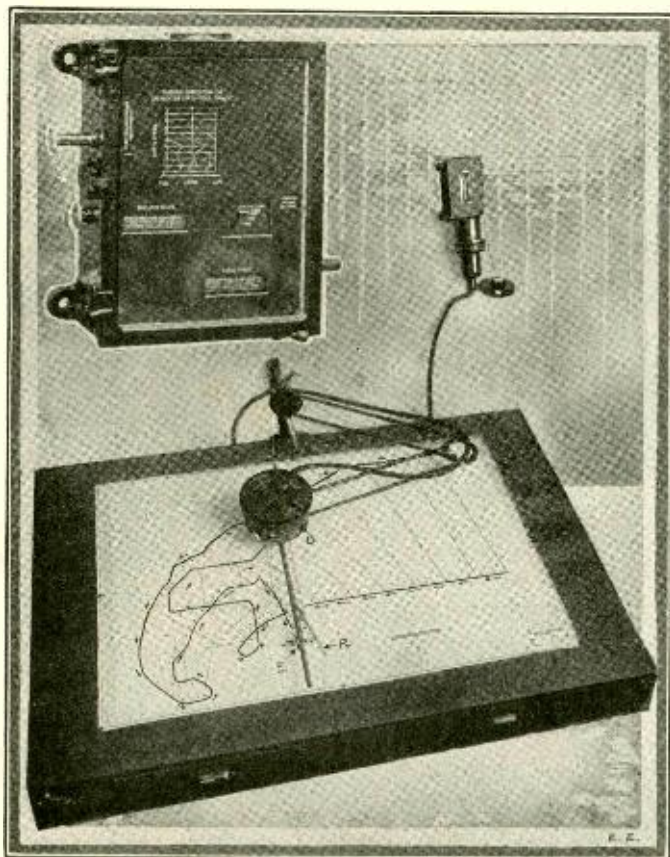
The Latest Sun-Power Electric Plant. By Following the Pipe Lines Conveying the Sun-Heated Water to the Sulfur Dioxide Boiler, and the Course Taken by the Sulfur Dioxide Steam Thru the Engine and Condenser, Thence Back to the Boiler Once More, a Clear Idea is Had of Just How This "Free Energy" Power Plant Works.

cently proposed a new form of Solar Power Plant, which comprises a number of very interesting and radical features which would seem to promise a successful future for it. Not only is Mr. Willsie a scientific theoretician, but also a man of practical deeds, and to this end he built, some years ago, a solar light and power plant on a small scale out in Arizona. The development of this plant nearly caused Mr. Willsie and his wife their lives during their many exciting adventures while experi-

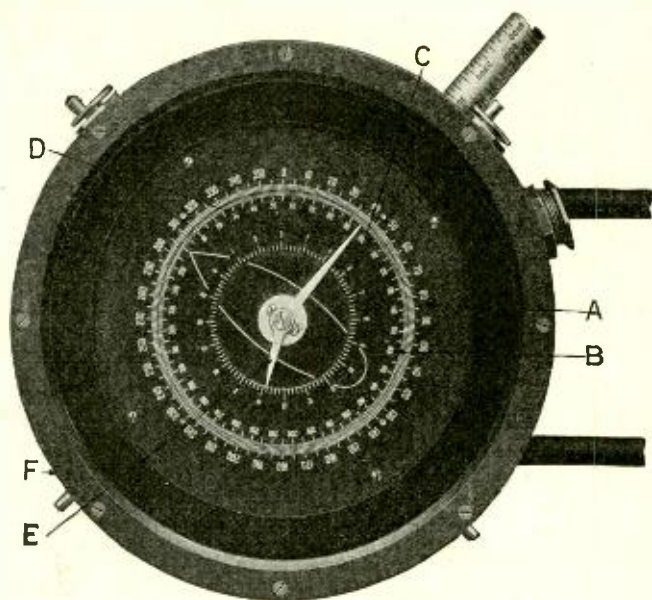
Mrs. Honoré Willsie, entitled "The Forbidden Trail." Coming back once more to the scientific side of Mr. Willsie's interesting invention, which is shown in the accompanying illustration in one of its applications, we learn that the underlying principle is the drawing of the heat from the sun's rays into a moving sheet of water, which passes up and down thru a series of zigzag passages, under a double thickness of glass. Where the sun has considerable thermal

sulfur dioxide boiler, and eventually this water returns to the glass heating tanks or planes exposed to the sun's rays. Where a large plant of this type is properly laid out, the mirrors or glass-covered tanks in which the water or liquid is heated by the sun's rays may be arranged in a fixed position, or also they may be designed so as to swing from east to west with the sun, so as to keep the rays perpendicular to the surface at all hours of the day. (Continued on page 1310)

The Battle Tracer

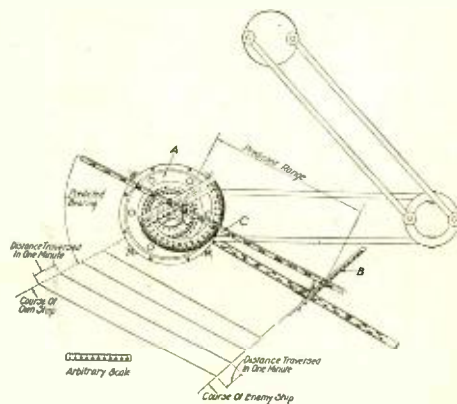


The Sperry "Battle Tracer" Complete, and Also Revolution Converter and Auxillary Range Transmitter. The "Battle Tracer" Records the Course Followed by their Own as Well as the Enemy Ship. E is the Enemy Arm Tracer and R, the Range Predictor.



Close-Up View of the Battle Tracer Motor Head, Thru Which the Graduated Enemy Arm Passes. This Connects With the Various Range Finding and Spotting Apparatus on the Vessel.

Diagram Showing How Range Is Computed Directly from "Battle Tracer" Plottings So That Guns Can Be Aimed Ahead of Time, to Hit the Enemy Ship, by "Prediction."



"YES, Captain, she was traveling at 18 knots; we were slowly closing in on her, and when 14 miles away we opened fire."

"The shells from the very first salvo struck her squarely amidship and blew her super-structure off—." Thus continued the gunnery officer's report of the Naval engagement just completed in which the very first shots found the enemy and silenced their guns before they had a chance to reply.

It is truly remarkable to think that not even a "finder" shot had been fired. In this case there was no need of firing the guns and wasting the big shells in order to get a "bead" on the fugitive vessel.

The vessel's range was computed to absolute accuracy and predetermined in time for the guns to be set and fired. All this computation with the aid of the device here mentioned required but 19 seconds, reducing thereby, past calculations several hundred per cent.

What is this remarkable equipment, you will ask. Essentially, it consists of a number of devices all working in conjunction with each other. The most important of which, perhaps, is the *Battle Tracer*, as it is called.

The object of the invention, which has proven itself to be of great practical use, is to provide a means whereby the course of our own ship is plotted automatically on a table similar to the table used for plotting navigation courses. In addition, an

arm extending from the instrument proper, called the *enemy arm*, keeps track at all times of the enemy's movements. In this way, regardless of what our own ship's speed may be or what the enemy's speed may be, prediction of its probable location, allowing sufficient time for the gunners to change their range, can be made with remarkable accuracy and the guns can be fired so that very few shots will miss the target for which they were intended.

"Suppose the enemy zig-zags," you will say. "Isn't the art of shelling more a matter of mere guess work than of accuracy?" No, dear reader, no! You must remember that a ship eight to nine hundred feet long traveling at 20 knots, or perhaps, even more, cannot steer and squirm away with the same ease as an automobile.

It is not a question of a few seconds, but *minutes elapse* before one of these large floating fortresses can be turned completely in their course, particularly in view of the terrific speeds at which they move. Hence, when a computation is made via the tracer, and guns can be elevated within nineteen seconds, taking the corrected findings as data to work from; it then gives the enemy very little opportunity to change a predicted and predetermined range or bearing.

Essentially, the apparatus consists of a cylindrical box about 7 inches in diameter and 5½ inches deep, containing four motors, and necessary gearing. It is mounted upon a tracer table and guided by a system of

parallel arms which allow free movement in any horizontal plane, at the same time, however, preventing the Tracer from turning on its axis. This allows the outer dial (A) of the Tracer to be kept in one position continually with reference to the table. (Accompanying letters refer to close-up view of Battle Tracer dials.)

This dial of which we have just spoken, is one of the three dials which perform varied functions. As will be noted, the outer dial is graduated to 360 degrees and is held on the table so that zero of the dial is north on the chart and is always at the upper edge of the table, altho capable of movement in any way except the turning movement.

Just inside of this dial and operating in juxtaposition with it, is another dial (B) similarly graduated but movable. This dial is controlled from the gyro-compass by one of the four motors inside the Battle Tracer head.

A pointer coming from the center of the Tracer head extends to the edge of this dial and the outline of a ship with its bow at zero is also engraved upon it. This pointer (D) which we have just spoken of is connected to the enemy arm and operates in conjunction with it, being moved by another motor connected to the Target Bearing Transmitters. Both the pointer and the enemy arm are capable of complete revolution. This movable dial (B) is mounted upon a movable post, to the bot-

(Continued on page 1332)

Heat of Body Detected 600 Feet Away

ALTHO you do not know perhaps, or at least may not have stopt to think about it, one of Uncle Sam's military experts can spot you in the dark, and tell in what direction you are moving—and at a distance of 600 feet—all due to the fact that your body radiates HEAT! Not very much, it is true—but still enough to affect a sensitive electric thermopile of the type shown in the accompanying illustration.

A recent issue of the *Physical Review* contains a summary of a paper read by Mr. S. O. Hofman at the Washington meeting of the *American Physical Society* on this extremely interesting subject. In trench warfare operations on the Western front, maneuvers took place mainly in the night time, as any movement during the day quickly attracted hostile rifle and artillery fire.

An attempt was made, therefore, to detect the presence of men moving in "No-Man's-Land" at night by recording or indicating the heat radiated from their bodies. The receiver utilized a delicate heat-actuated instrument or heat indicator for this purpose, comprising an electric thermopile placed or mounted on the focus of a 14-inch parabolic mirror. This thermopile, which generates a very minute yet measurable electric current whenever a heat ray, even tho ever so slight, impinges on it, is connected to an extremely sensitive

electric galvanometer or magnetic needle instrument of the D'Arsonval type.

Remarkable and uncanny as it may seem, it was actually found possible with this sensitive apparatus to detect the presence of a man at a distance of 600 feet or over one-eighth of a mile away, which gave plenty of time in most cases to organize a counter-attacking party, or extra guard.

This device proved very useful for detecting hostile raiding parties creeping towards the trenches in the darkness of night, and helped in many cases to capture some badly wanted enemy prisoners for the purpose of questioning by the intelligence officers, especially when an attack was about to be made by the Allied troops.

One of the accompanying illustrations shows an effective and sensitive form of thermopile. The minute electric current generated at the juncture of two dissimilar metals such as copper and iron, or antimony and bismuth, when heated by the impinging of a heat ray upon the juncture, will cause a deflection on a sensitive galvanometer connected to the opposite terminals of the thermopile.

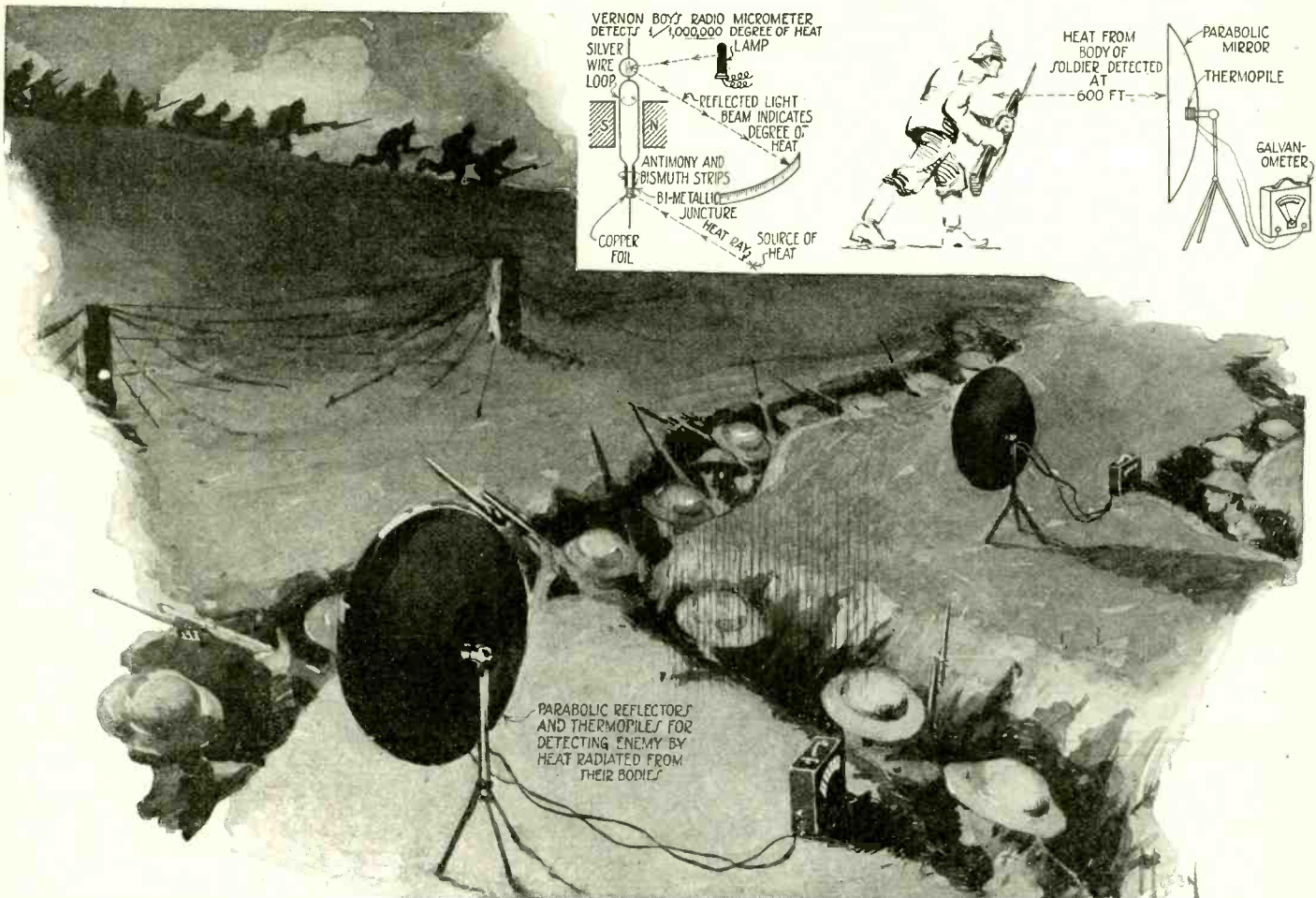
Altho it is but little known, thermopiles so sensitive that they will record the heat radiated by distant stars have been devised and regularly employed in astronomy work by those engaged in this work.

Dr. W. W. Coblentz, of the U. S. Bureau of Standards, has devised an extremely

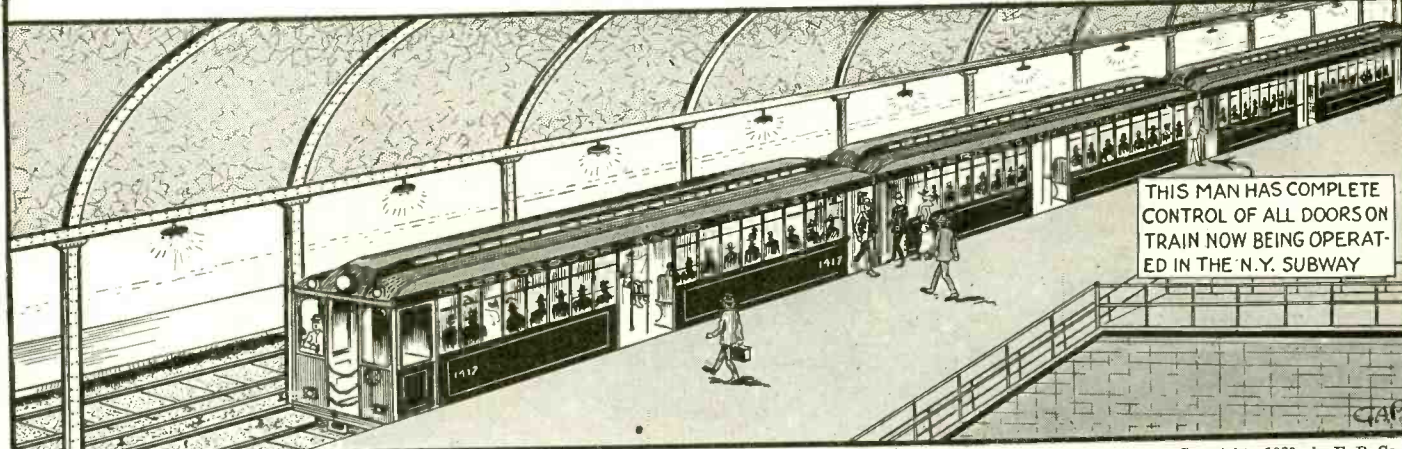
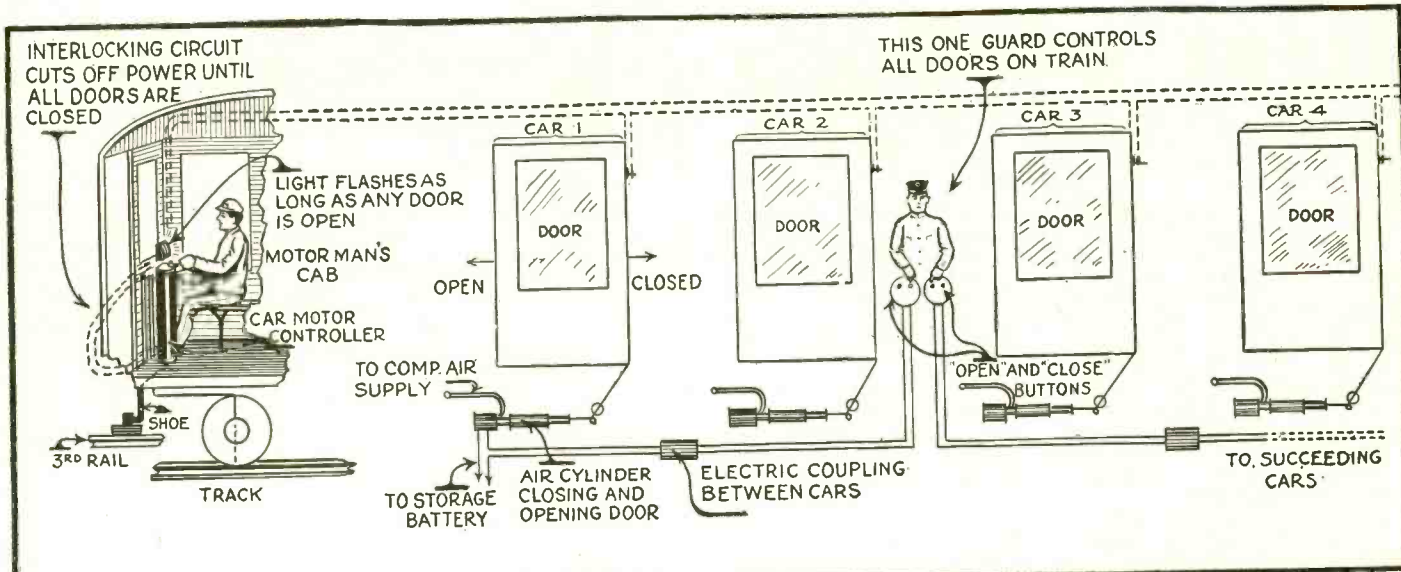
sensitive thermopile for this work, and this is built in an evacuated glass tube. On this measuring instrument are registered infinitesimal fluctuations of temperature.

A ray of light may have started ten years ago from some distant star, and may have spent all of these ten years hurtling earthward-bound thru space at a speed so astounding that it could girdle the globe in far less time than it takes to blink an eye—and yet when it falls upon the bolometers at the Bureau of Standards they will tell the observer how much heat that ray brought with it from the star to the earth!

As Silvanus Thompson points out, one of the most remarkable instruments of this type is the radio-micrometer devised by Vernon Boys. On this instrument a loop of fine silver wire is suspended by a quartz fiber between the poles of a magnet, and this loop of silver wire has its circuit closed at its lower end by a piece of antimony and a piece of bismuth (or alloys of these metals) soldered to a minute disc of copper foil. A rise of temperature in the copper foil, even so small as one-millionth of a heat degree, will generate an electric current in the loop and give a deflection over one division of the scale on the instrument. With a heat detecting instrument of this type the radiant heat of a candle can be detected at a distance of two miles, as Silvanus Thompson shows.



Imagine That You are a Soldier in the Dark At Night, and That You are Attempting to Raid the Enemy Trench. Likewise, Imagine That You are At a Distance of Nearly One-quarter of a Mile from Said Trench. If It is Pitch Dark, You Will Feel Very Confident in the Dark, That You Can Sneak Up On the Enemy Without Exciting the Least Suspicion On His Part,—But Foiled Again!—for It Now Develops, That the Electrical Experts of the Allied Military Engineers Had Developed and Utilized a Super-sensitive Electric Thermopile, Which Will Detect the Heat Radiated from the Human Body, At a Distance of from 600 to 1,000 Feet, and Many a Dead German Soldier Would Tell You the Answer, If He Could!



Copyright—1920—by E. P. Co.

One Man Controls All the Doors on This New Semi-Automatic Subway Train Now Being Tried Out in Actual Practice in the New York Subway. As the Diagram Shows, the Guard Stationed at the Center of the Train Can, by Pushing the Proper Electric Control Buttons, Cause Electro-Magnets to Control the Compress Air Mechanism Opening and Closing the Successive Car Doors. The Motorman Can Start the Train Only When All the Doors Are Closed.

One-Man Subway Train

A TRAIN comes dashing into a subway station, stops, discharges its passengers and allows others to enter. There is nothing unnatural in this "train" of events, as hundreds of trains come tearing in and out of the stations in New York's subways every day in the year. You go to ascertain from the guard where the nearest station to somewhere is, and travel to the end of the car,—but no guard in sight! With a shrug of your shoulders and the thought "Hmmm-m! Perhaps he is down the next car playing cards with his comrade," you travel thru another coach but still no guard, and so on down the 10 car train until you wonder whether you are paying for a ride or walking the distance, and then,—at last! a guard!!—right in the middle of the train.

After finding out that it takes exactly six blocks to the left and two to the north, with a couple of turns in the opposite direction thrown in, to get to the desired place, you stick around awhile, so to speak, in order to find out why but one guard is in the entire train. Cutting down expenses? Rather. Here in the middle car, his Imperial Majesty—"the Guard"—has control of the entire train and can aim the doors so that they will just miss you by a hair even tho he is two-hundred feet away from the door you enter.

In other words, by the press of a button, all doors on all cars either close or open at his volition. And months of experience has taught him exactly when to release the doors so that they will "clean up" everything in sight. The method of operation

is very ingenious. Everyone living in the greater metropolis knows that the terminals of the subway have constantly sufficient guards to successfully jam in all the people

Notice to Readers

In view of the fact that we are still handicapped due to the recent printers' strike, we have as yet not been able to catch up with our schedule. We would therefore ask our readers to be patient and not write us about the lateness of the issue for the next three months.

With the June issue we expect to catch up again with our regular schedule. In other words, the June issue will be out about May 25th. Several other publishers found it necessary to skip an issue in order to come up to date, but we prefer not to do this. We hope our readers will understand and bear with us until we are back to our former schedule again.

THE PUBLISHERS.

a train will hold and shut the doors after them, so that they won't fall out again! Hence there is no necessity of having as many guards on the train proper as the company is now employing.

For this reason, they have stationed a guard in the center of this new semi-auto-

matic train, so that he can command a view of both sides, by peeking out between the cars. At his right and left side are a series of push buttons for controlling electrically, all the compress air operated doors either to the fore or aft parts of the train. When he presses a button, a series of solenoids automatically actuate the valves, allowing for the escape of compress air from the cylinders operating the doors. The door is released and flies back, allowing the passengers of the train to be discharged. When other passengers have entered, he releases one button which shuts all the doors, from his position, up to the position of the motorman in the first car. He then actuates the button for performing the same function in the doors to the rear.

The instant all the doors are closed, an automatic control allows the motorman to throw his controller into the starting position which could not have been done before this. Likewise the signal light still lit while the door is open, is turned off automatically, and the light no longer flashes up toward the motorman, and interfering in this way, with his control.

Any of the doors may be instantly placed into an inoperative position, just the same as is being done at the present time, and very little change in the old cars, is necessary for adopting the new system.

Storage batteries are used to actuate all the electrical controls. Such apparatus, if put into universal use on all trains, would dispense with from 12 to 15 guards per train, who could do abler service perhaps, on the platforms of the subway stations.

Watching Plants Grow

IF you have ever planted flowers or vegetables and watched them grow from day to day, and from week to week, you have undoubtedly been strongly impressed with the remarkable changes which sometimes occur in a single night in plant growth. But—did you ever notice the change in growth of a plant or flower in the course of an hour, or a minute, or a *second*? Quite possibly not—but if you are interested in the close laboratory study of plant growth, then it is possible today to make readily visible the minute growth of plant life, even over such short periods of time as one one-hundredth of a second.

While there are a number of very inter-

Remarkably Sensitive Instrument Devised by Sir Jagadis Bose of India

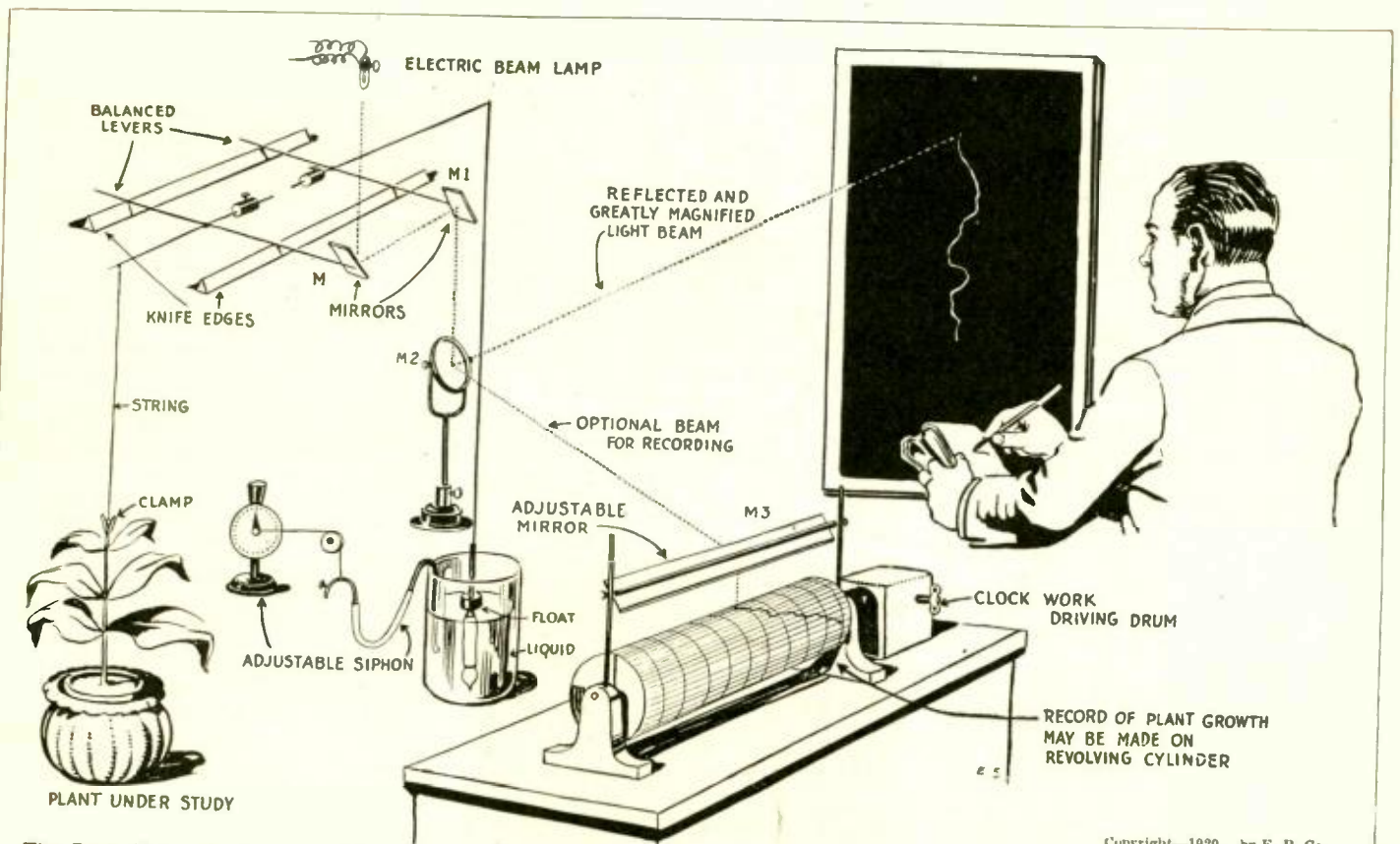
movements of the plant the crescograph actually gives.

Recently a large audience seated in the council chamber of the India Office, in London, England, watched the growth of a plant and the effects of various stimulants upon it, as recorded upon the large screen on the wall. This was at a lecture given by Prof. Bose. Either sunlight or else a beam

of such an instrument as this, as pointed out by Prof. Bose, is the much shorter time that it would now require to obtain a definite knowledge of the growth of a certain plant under specific soil and climatic conditions. Instead of watching a whole season to learn if a certain plant will grow well in a given soil, and in a given climate, this test can now be carried out in a few days or weeks. The accompanying graphic curves show some of the effects of electric shocks and poisons on plant growth.

HOW FAST DO PLANTS GROW?

Altho you probably think a plant grows at a fairly rapid rate, even tho you cannot



The Bosc "Balanced Crescograph" for Recording, Studying and Demonstrating the Growth of Plants. This Remarkably Sensitive Instrument Magnifies the Movement of a Plant While Growing, Up to 100 Million Times. In London, Recently, a Whole Audience Witnessed the Action of Plants as Reflected on a Large Lecture Screen.

Copyright—1920—by E. P. Co.

esting and useful devices available in college laboratories for the study of plant growth, as well as the action and reaction of plants, due to the application of heat and cold, as well as various chemicals and electric shocks administered at different time intervals, et cetera, one of the most accurate and remarkable instruments ever devised for this study is the one recently used by Sir Jagadis Chandra Bose, hailed as the most eminent man of science that modern India has produced, and which device is known as the *Crescograph*. This instrument is shown in the illustration on our front cover, as well as in one of the accompanying drawings by our artist.

HOW THE "CRESCOGRAPH" MAKES PLANT GROWTH VISIBLE.

Before going into the details of the *crescograph* or the *auxanometer*, both of which show the growth of plants in a vivid manner, it will be interesting to note what a really wonderful magnification of minute

of light from a small incandescent lamp may be used in the *crescograph*, and this light beam is reflected thru a series of mirrors in the manner evident from the accompanying illustration, so that by the time it reaches the screen the relative movement between the mirror and the focal spot of the impinging light beam is very markedly magnified.

In the case of the lecture just cited, a magnification of from 1,000,000 to 100,000,000 times was achieved. This is tantamount to magnifying the highest powers of the microscope 100,000 times. The room being darkened, a mysterious *hook of light* past swiftly over the screen. This showed the actual growth of the plant as projected from the mirror of the *crescograph*, magnified many hundred thousand times. The lecturer pointed out that this *hook of light* illustrated the effect of electricity upon the plant—too great power having the opposite effect to the stimulation afforded by a reasonable amount.

notice it in a period of, say, five minutes or even an hour, yet the plant really grows much more slowly than you perhaps imagine.

The little snail, whose slowness is proverbial, moves 6,000 times faster than the plant grows! Plants grow at an average rate of one one-hundred thousandth part of an inch per second, or, in other words, *plants add about one inch to their stature in eleven days*. A few years ago you would have thought it impossible to actually see the plant grow before your eyes, but now, thanks to Dr. Bose's remarkable researches, you can readily do this with the *crescograph*.

At a recent London lecture, Sir Jagadis Bose took a cyclamen leaf and attached it to the *crescograph*. The mirror at once reflected a spot of light on the wall screen, and this spot moved at the rate of ten feet in twelve seconds, notwithstanding the fact that the plant was growing only at the

actual rate of 1/100,000th part of an inch per second.

Plants resemble animals very much in their daily lives, and Dr. Bose's researches have shown the presence of heart beats, death spasms, definite and positive reactions to various forms of stimuli, to anesthetics, poisons, etc. All of this work shows, according to Prof. Bose, that plants, like human beings, do have a nervous system. It is reported that this great savant of Indian culture and science has actually shown that plants can and do feel the effect of an etheric wave message, or a Marconigram, as they pass over the earth. This proves that the plant is more sensitive in its nervous response than the human body, which we usually are wont to think of as the most marvelous structure ever created. People have never yet, so far as we know, been able to "feel"

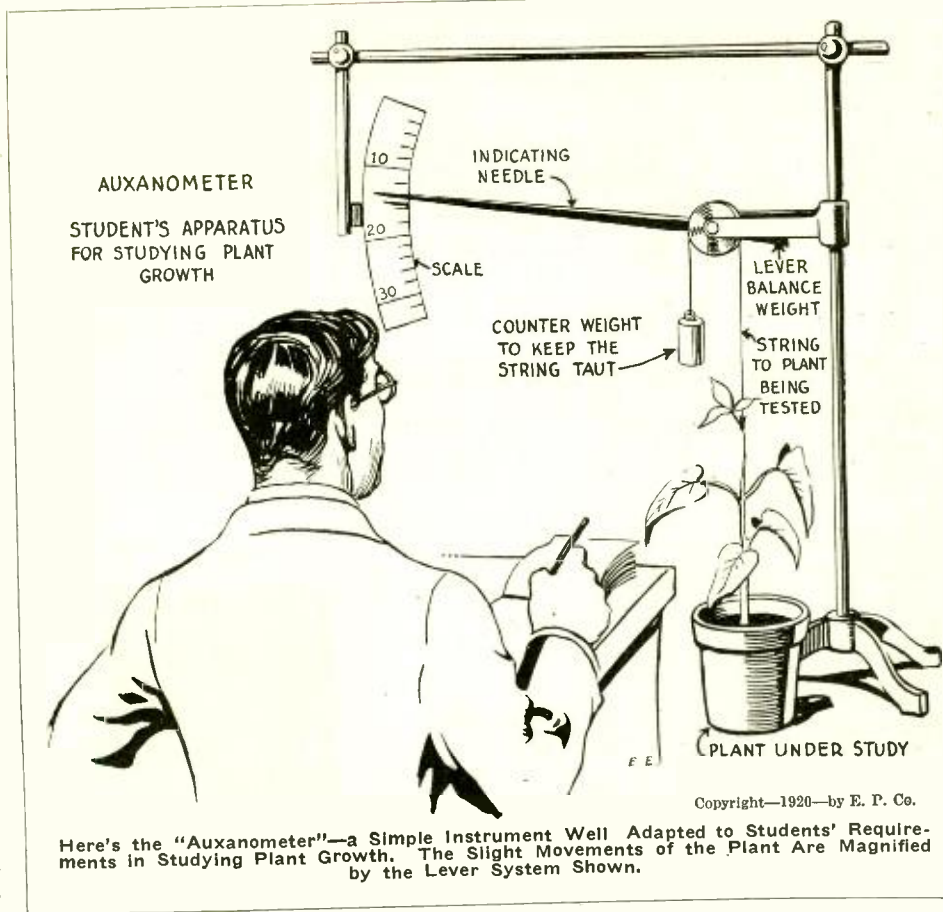
a wireless signal or wave passing thru them, but by means of specially sensitive apparatus connected to a plant Prof. Bose has shown that the plant really feels the effect of the radio wave and will interpret this effect under the proper conditions.

One of the interesting stories of Prof. Bose's interesting work relates how he studied a certain tree in India which had never been transplanted successfully. He reasoned that the tree died when transplanted because of the severe shock it received when it was dug from the ground, so he followed up this deduction by having a tree subjected to an anesthetic, in the same manner that the modern surgeon causes his patient to become unconscious in preparation for a surgical operation. Strange to relate, the tree manifested the same characteristics as a person under an anesthetic, and it was successfully transplanted while under the effect of the same. The tree continued to thrive.

HOW THE CRESCOGRAPH WORKS.

Several different forms of magnifying instruments for studying plant growth have been devised by Prof. Bose, and by other workers in this field of science. The standard form of Bose's crescograph is shown diagrammatically and in picture herewith. The student will find the simple form of plant growth measuring instrument, known as the *auxanometer*, illustrated herewith, quite within his mechanical possibilities, and it can be made up in many different ways. A smoked glass caused to travel slowly past the needle of such an instrument will record the changes taking place.

One principle, and in fact the underlying feature of all these instruments, appears to be the fact that a slight movement is magnified into a larger movement, by the well known law of levers—thus if you have a lever 100 inches long, and place a fulcrum at one inch from a given end, then any movement at the end of the shorter or one inch length of the lever will cause a corresponding and greatly magnified motion of this lever at the free end of the longer limb, which will be 99 times the initial movement.



Here's the "Auxanometer"—a Simple Instrument Well Adapted to Students' Requirements in Studying Plant Growth. The Slight Movements of the Plant Are Magnified by the Lever System Shown.

The reader can readily devise a simple form of magnifying apparatus constructed from some pieces of aluminum wire and possibly a balance wheel, with its supporting pivots cut from an old alarm clock frame, whereby he can obtain some inter-

times have risen above, and at other times fallen below, this average. If we now subject the spot of light to a uniform compensating movement, such as by itself would have made it move from right to left of the recording surface to the extent of 1,200 mm. by the end of the hour, we shall find that, being acted on by these two opposite movements of growth and compensation, the spot will remain approximately on a single base line of compensation. The fluctuations, or variations, which have occurred in this average rate of growth will, however, be recorded as deviations to one side or other of this mean neutral line. Thus it will be seen that the slightest deviation from a uniform rate of growth will be found displayed by the record of the moving spot of light.

We are further enabled from our knowledge of the speed of the recording drum and the balancing rate, and from an inspection of the curve itself, to determine not only the periodicities, but also the absolute value of the rate of variation of growth at any given moment.

The compensating movement referred to is effected by means of a simple hydraulic device. The spot of light from the optical level falls upon a mirror attached to a second lever, or to a rotating wheel. The arm of the lever, or a thread which is past around the wheel, is attached to a float on the surface of a cylinder of water. Water is escaping from this cylinder, by means of a syphon arrangement, at a rate which can be adjusted with the greatest nicety. The float can be thus made to descend at any speed that is desired, this descent producing a rotation of the second lever or of the wheel.

We have then two mirrors, of which one is rotated in one direction, by the *growth-movement* of the plant, and the second in the opposite direction, by the *descent of the float*. A spot of light reflected on the two mirrors will thus remain *stationary* when the precise balance is effected by proper regulation of the escape of water from the cylinder (see our figure herewith).

(Continued on page 1318)

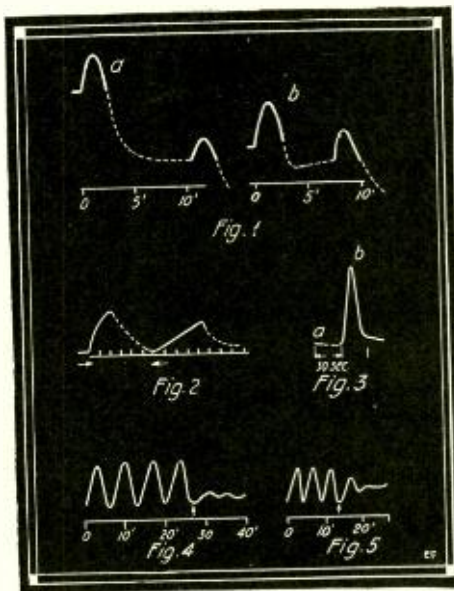


Fig. 1. Fatigue Under Long-Continued Stimulation in the Contracile Response of Plants. (a) Stimulation by Tetanizing Electric Shocks; (b) Stimulation by Rapidly Succeeding Thermal Shocks.

Fig. 2. Effect in Acceleration of Rate of Growth of Seedling of "Oryza Sativa" of Current Thru the Soil. The Continuous Line Shows Effect During Passage of Current Thru the Soil (1) from Left to Right (→), and (2) from Right to Left (←). Dotted Line Shows Effect of Cessation of Current.

Fig. 3. Additive Effect in Electrical Response of Plants. (a) A Single Stimulus of 3 Degrees Vibration Produced Little or No Effect, but the Same Stimulus When Rapidly Superposed Thirty Times Produced the Large Effect (b). Leaf Stalk of "Turnip."

Fig. 4. Death of Plant by Poison. Fig. 5. Death, and Arrest of Pulsation, in Leaflet of "Desmodium," by Electric Shock.

Hello Mars!

By H. WINFIELD SECOR

IN the past ten years, and particularly in the last twelvemonth, there has been evidenced a great deal of activity on the part of scientists in all parts of the world, on the subject of communicating with Mars, or possibly Venus. The present

Shall We Ever Be Able to Signal Mars Intelligently?

or other means, with a strange neighbor so distant as the Martians, Dr. Steinmetz should certainly be fully qualified.

Dr. Steinmetz, in a recent statement, said that wireless communication with Mars is not at all improbable, and he suggested that signals might be transmitted by radio from a gigantic wireless plant on the Earth, which would be charged with all the electric power generated in the United States. This could be accomplished for the tidy little sum of about one billion dollars, according to Dr. Steinmetz, and would require steel towers at least 1,000 feet in height, in order to transmit radio messages or signals to the planet Mars,—which never comes any nearer the Earth than 35,000,000 miles, and at certain periods is 230,000,000 miles away. After mentioning the fact that we might accomplish the interpretation, after several years' recording, of the stray wireless signals mentioned by Marconi and Tesla as being picked up in their powerful radio stations, he goes on to say,—“If Mars was trying to communicate with this world, it is doubtful if it would ever be possible to decipher the code, but it would be some satisfaction to know that one planet could send messages to the other, and that intelligent beings were inhabiting the planet from which these messages came. We know enough about Mars to assume that there are inhabitants there,” said Dr. Steinmetz, “and as it is a much older planet than ours, its inhabitants ought to be more advanced in scientific and educational investigations.”

But—“It is doubtful if it would ever be possible to decipher the code . . .”—read that line over!—for it means a whole bookful when you start to really think about it.

A SIMPLE EARTH-MARS CODE FOR NUMERICS.

There is, perhaps, no use of talking about communicating with Mars, or as we said before, with a people of whom we know absolutely nothing, but for the present we will consider that they are duly existing, and that they are, as some of our leading scientists and astronomers have argued,

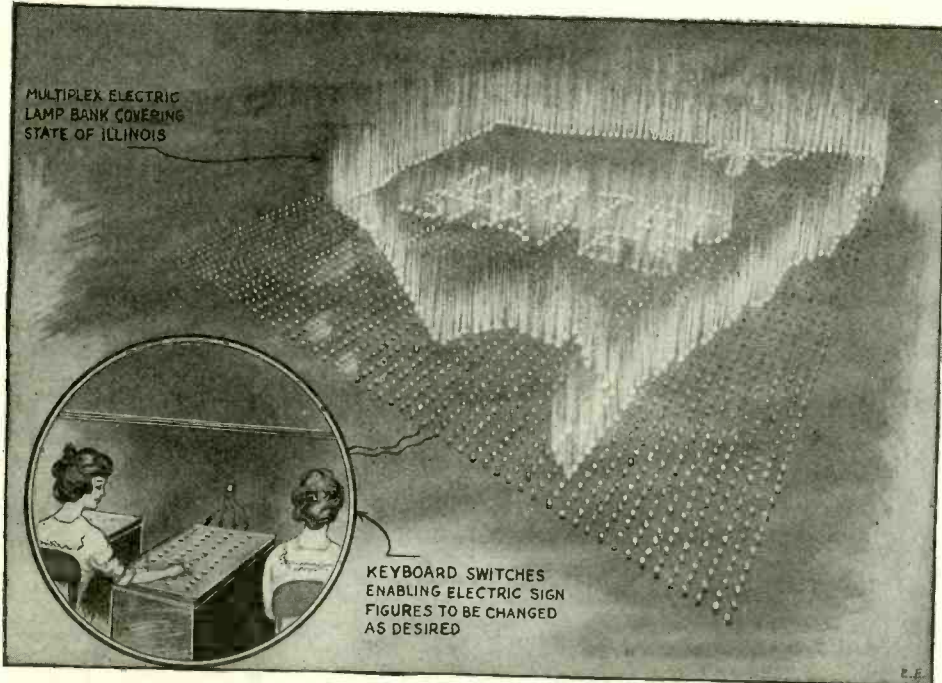


Fig. 7. One Writer on the Subject of Inter-Mars Communication Has Suggested That We Place Lamps, Thousands Upon Thousands of Them, Over a Large Territory—as Big as the State of Illinois—These Lamps To Be Fitted with Quick-Acting Shutters, Electrically Operated. The Lamps Are Also To Be Connected to Suitable Keyboards so That by Depressing a Given Pattern of Keys, Any Design Such as a “Map” of the United States, with the Letters “U-N-I-T-E-D S-T-A-T-E-S” Illuminated Can Be Flashed Out of the Entire Lamp Field as Here Shown, etc. Any Desired Letter or Picture Could Be Flashed on This Multiple Lamp Bank, as Becomes Evident.

discussion has nothing to do with the astronomical facts of the case, for these are already well known,—at least so far as the distance between the Earth and Mars is concerned, and other heavenly bodies.

The main thing that we do not know about Mars, is whether or not it is inhabited, but we will leave all of the vast and profound theories on the possibility of Mars' inhabitation, to the astronomers and others who are capable of investigating these facts.

So far as we are concerned in the present instance, we will assume that there is such a being as a “Martian”. Next, the all-important and preponderant phase of the Mars' inhabitation theory is—how, and in what way could we start picking up conversation or communication with our distant neighbors, intelligently.

It seems quite evident, that once we have outlined and developed the proper method of procedure to start transmitting and possibly interpreting the Martian signals, as well as making sure that our method is correct, that the Martian may, with his supposedly far greater intellectual development, (owing to the greater age of Mars as compared with the Earth,) understand what we are trying to say to him.

It is nothing short of startling to read some of the newspaper details that come from all parts of the world, suggesting the “simple schemes” whereby we can open up communication with a people of whom we know absolutely nothing about. Think of it! Aside from the fact that we have to doubt their very existence, we do not have the slightest conception of what they look like, nor what their language may be!

One of the latest Martian communication converts is Dr. Charles Proteus Steinmetz, probably the world's greatest electrical engineer today, and one of our foremost mathematicians. If anyone should be able to conceive of a scheme for opening up conversation by wireless telephone or telegraph,

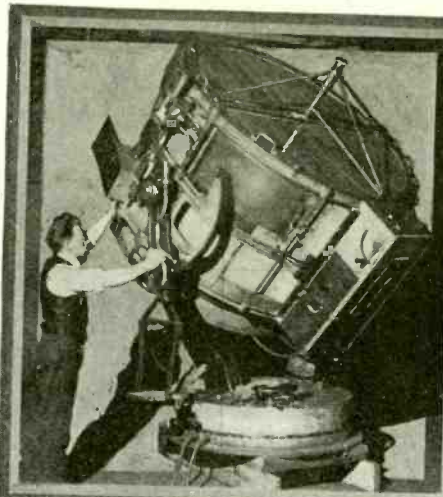


Fig. 1-A Shows the Gigantic Size Compared to a Man, of the New Sperry High-Power Searchlight, Giving a Beam Candle-Power of 1,250,000,000 C.P. The Fan Arrangement of Light Beams Was Formed by Placing Six Large Reflecting Mirrors in Front of the Searchlight, Each Divided Beam Being Far Stronger Than That Flashed from the Average High-Power Searchlight of the Ordinary Type.

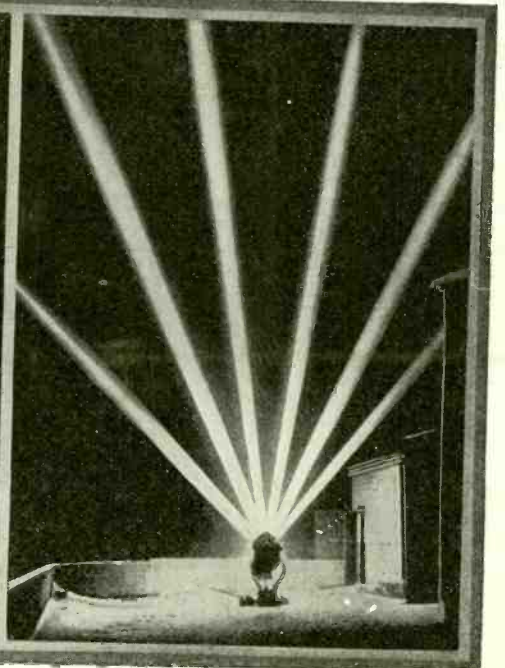


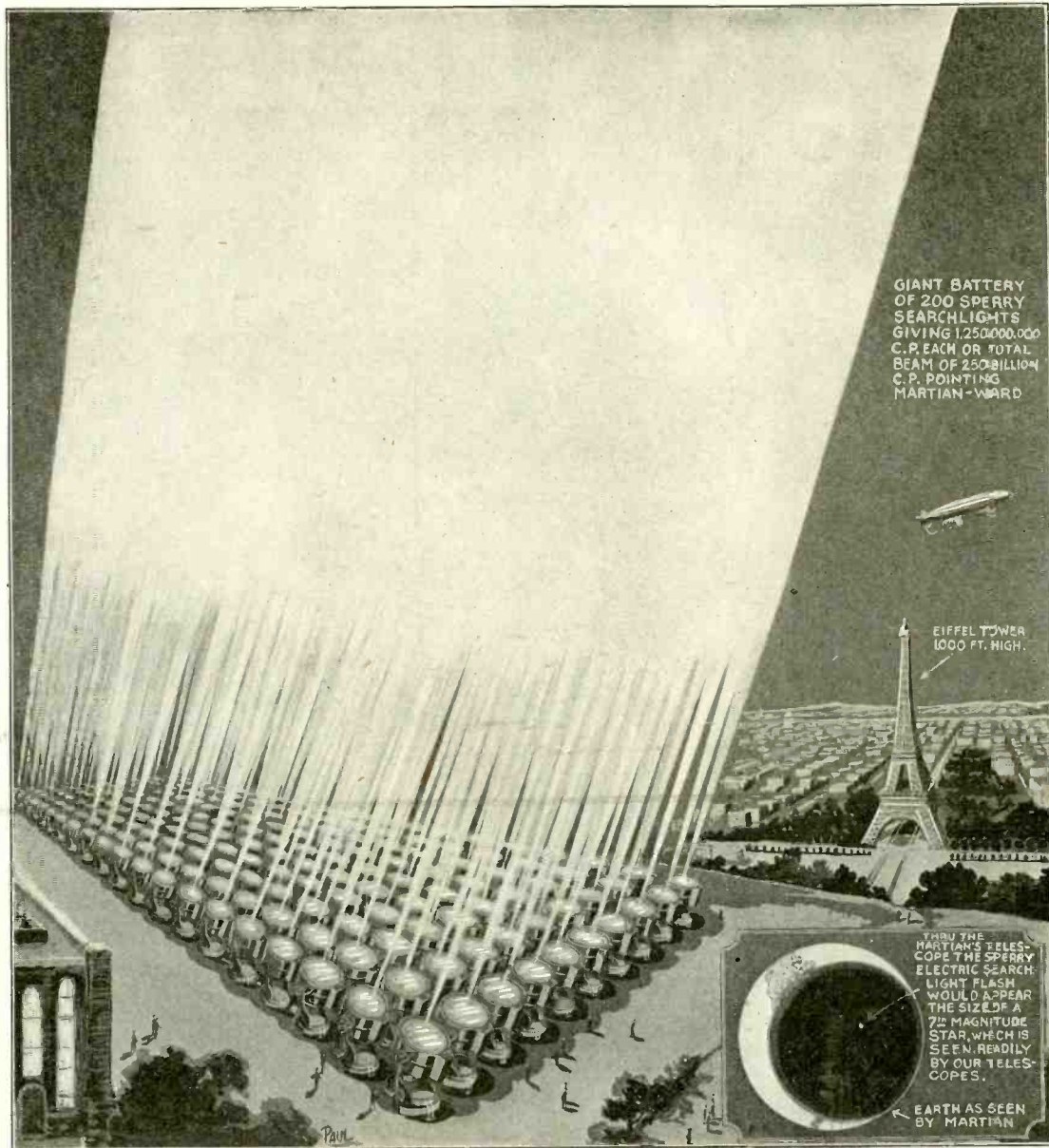
Fig. 1. The Latest Proposal as to How to Signal the Inhabitants of Mars is That of Mr. Elmer G. Sperry, Inventor of the World's Most Powerful Electric Searchlight, Shown at Fig. 1-A. Mr. Sperry Proposes That We Employ a Battery of 200 of His 1,250,000,000 C.P. Searchlights in One Gigantic Bank, so as to Concentrate Their Rays in One Powerful Beam of Light. It is Calculated That the Martians, if Such There Be, Cannot Miss This Blinding Flash of Light, Which Would Appear to Them as a Star of the 7th Magnitude, Which is Easily Picked Up by Our Earthly Telescopes. This Beam of Light, Totalling 250,000,000,000 Candle-Power, Would Rival the Sun Itself.

thousands of years in advance of us when it comes down to scientific matters including the languages. Probably they have but one language on the order of our rapidly growing universal language—*Esperanto*.

All well and good, but without wasting any more time conjecturing on the ways and means of interplanetary communication, let us start with the fundamentals of the understanding between any two Earthly human beings. To do this, as one professor of languages recently suggested to the writer, we certainly will have to step back to the period when we were little children. Go straight back to the days of the kindergarten, and then we are ready to start learning the real fundamentals of communication and understanding via the language route between humans. But before going further, we might take a glance at Fig. 2, which shows the simplest scheme for teaching or endeavoring to communicate to another person, the elements of numeric computation.

Fig. 2 shows that two dots, plus two dots, equal four dots. Little children are often taught in this way by several different schemes, how to count. Some of our ablest scientists and astronomers have suggested

times beyond number, that this is a very good and plausible way to start communicating with the Martians, and not only this, but they often carry this idea to the point where it is claimed that eventually languages or codes explaining the languages may be transmitted and interpreted either by us or by the Martians.



Copyright—1920—by E. P. Co.

It takes but a little reflection to see that, while presumably and with average intelligence no greater than ours, in a short time a person who doesn't know our language at all, should be able to perceive if shown a blackboard with this arrangement of dots, that we were trying to impress upon him the fact that two dots, plus two dots, equal four dots. Well and good, but when it comes to communicating letters or words of a language by this method, it would seem to be quite impossible, and altho the writer

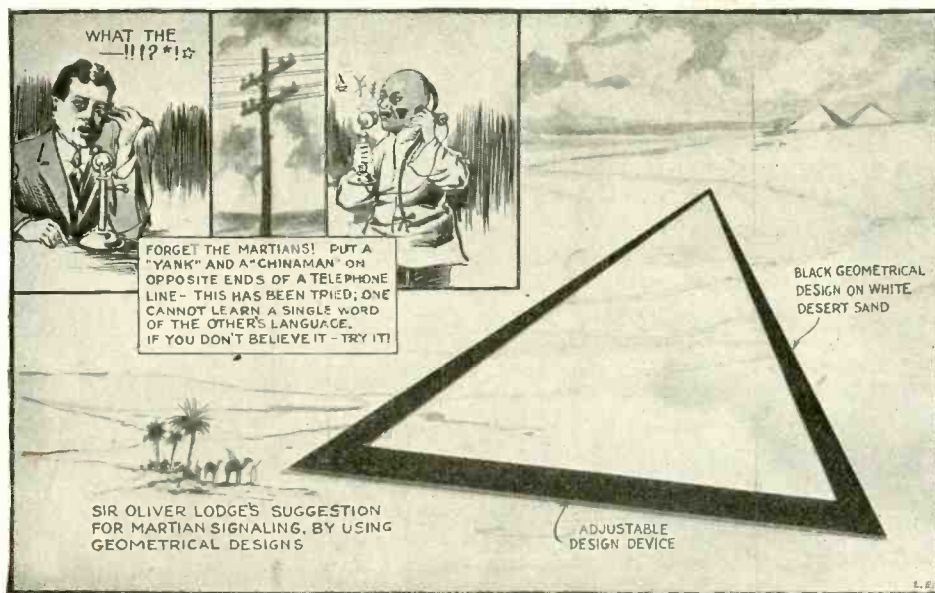
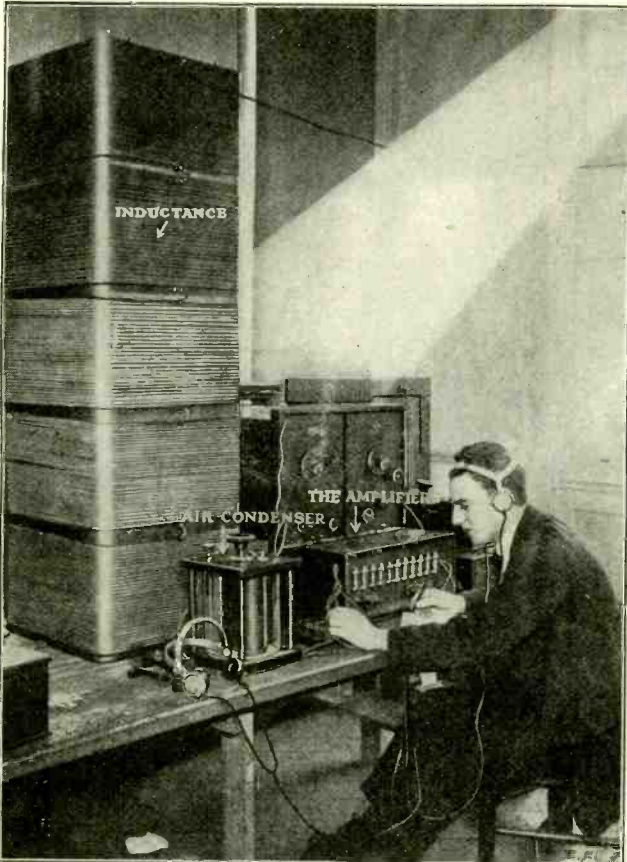


Fig. 5 (Inset). You Do Not Have to Endeavor to Open Up Wireless Telephone Communication with the "Martians" in Order to at Once Perceive That You Have "Started Something"—so Far as It is Possible to "Talk," or for That Matter If It Would Ever Be Possible for You to Learn Even One Word of Martian. The Experiment of Placing a Chinaman and a Yankee on Opposite Ends of a Telephone Line Has Been Tried for a Considerable Time Period, and Neither One Could Assimilate or Interpret One Word of Each Other's Language, Altho They Talked Long and Often, Over the Telephone. Fig. 6. Sir Oliver Lodge Suggests That We Build Large Geometrical Figures in Black on the White Sands of the Sahara Desert, and He Believes That the Martians Will Understand It, as Geometry is a Universal Study and Science.

has discuss this scheme with several experts on languages, they have not been able to think of a single method whereby it could be carried out.

So we go back once more to the little children in the kindergarten class. We will



or stands for than the wood tie-post to which you hitch Old Dobbin—except for one potent and all-important consideration, and that is—that in the books from which he studies or else by means of the blackboard and the skilled artistry of the

And Wonder of Wonders!—Here Is the Very High-Powered Marconi Radio Station at Which the Mysterious Dots and Dashes Filtered In from the Ether—and Furthermore These Signals Are Believed by the Great Marconi Himself to Quite Possibly Be "Signals of Inter-Communication" Hurled at Us Thru Millions and Millions of Miles of Interstellar Space, via Wireless, by the Martians. At Left We See the 100,000-Meter Wave Inductance. At Right the Wonderful Eleven-Stage Audion Amplifier, Magnifying the Signals 10,000,000 Fold.

sider for one moment—no matter how familiar you may be with secret codes and ciphers—and try to think how you would look this first Martian word squarely in the face and endeavor to understand what object it represents! Does it represent a sea? Does it represent a house?—or a Martian horse?—or does it mean a declaration of war between two Martian nations—and so on and so forth.

Consider that the writer is a Martian and that thru your powerful earthly telescope some dark night you are confronted by a burst of light from Mars and upon directing your telescope more minutely and accurately towards this illuminated spot on the distant planet you read in outlines of fire this word. There is no use of taking any other words, for this one serves its purpose (Continued on page 1302)

leave numbers out of the question, because we cannot carry on a conversation very well with a set of figures,—or at least we will presume that this is not the case with the Martians. How is a child taught the letters of the alphabet and their final correlation into words,—and again,—the meaning of these words?

When you have thoroly philosophized on this elemental detail of pedagogy, you at once become cognizant of the highly important fact that the little child who does not know anything about the language he is to be taught, cannot tell what such a simple word as "R-A-T" means. He can be taught the sounds of the letters of the alphabet so as to pronounce them—and also how to write them—but as soon as he has finished with this, think of asking him to

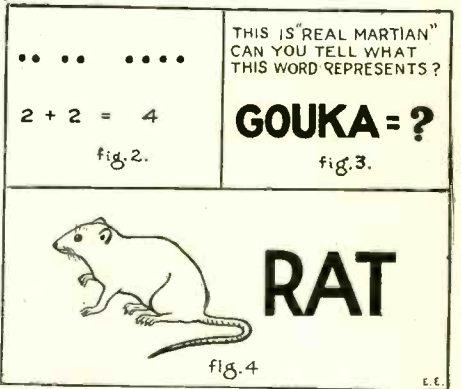
simultaneously in some form the object which the word represents.

Some one may object at this point and say it is not so in every case that an object representing the word is shown simultaneously with the mastery of the word, but the answer is that if this is not done, then the teacher or the governess will have to launch forth on a lengthy word-picture explaining about the rat, let us say, and what it looks like.

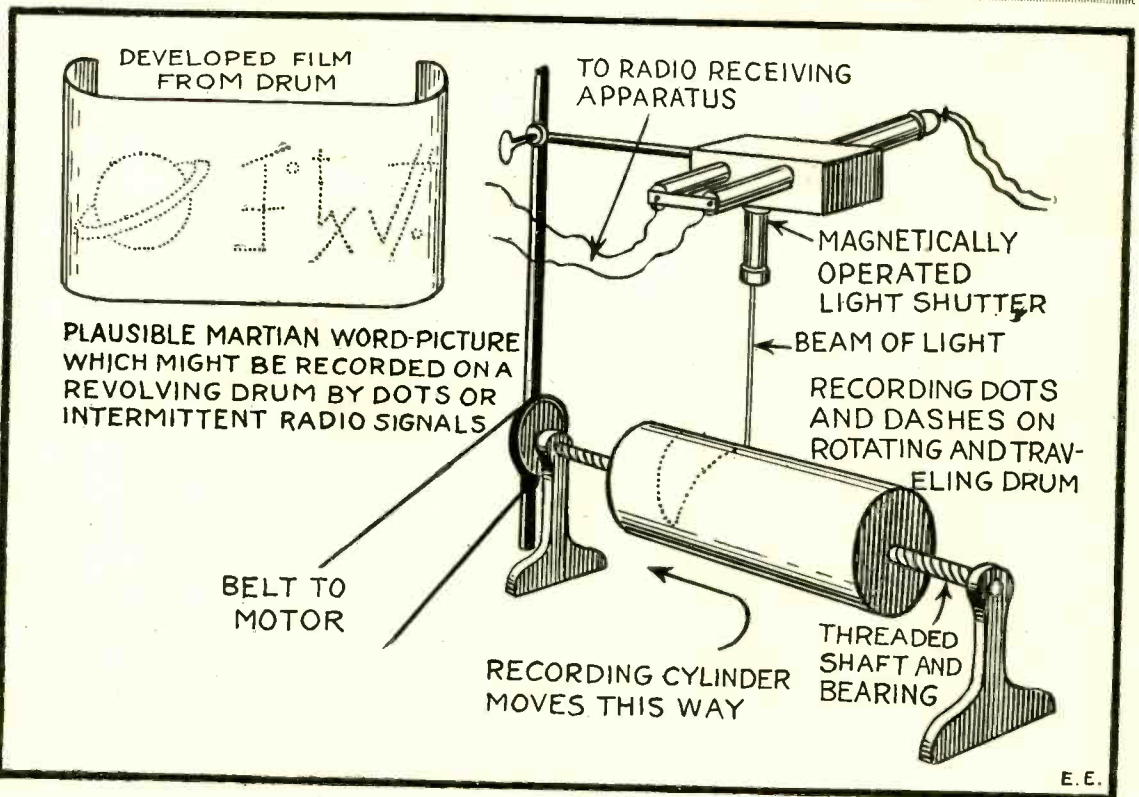
This basic element of learning any language is more forcefully shown at Fig. 3, where there is also shown what we shall call, for the sake of supposition, a real Martian word, G-O-U-K-A! Now just con-

The Mysterious Stray Wireless Signals Which Have Been Recorded by the Marconi Trans-Atlantic Station, May Have Some Meaning Which We Do Not Understand as Yet. It Has Been Suggested by One Authority That Possibly if We Have the Proper Apparatus or Scientific Means For Interpreting These Apparently Meaningless Jumbles of Dots and Dashes, That We May Cause Them to Produce a "Picture." Suppose, For Example, That You Had a Revolving Drum Which Was Moved on Its Axis and Covered with a Photographic Paper or Film. If the Incoming Radio Dots and Dashes Were Recorded on This Drum, They Might Possibly Form a "Picture" and a Word, Probably in Martian. If We Were Able to Obtain a Considerable Number of These Word Pictures We Could Eventually Figure Out What the Martian Alphabet Is. Fig. 8.

define the word "rat"—a simple three-letter combination. Now, it is at once evident that the child has no more idea of what R-A-T means



At Fig. 2 We Have the System—Commonly Advocated For Opening Up Communication Between the Earth and Mars by Means of Signals Sent by Light, Radio, etc. This Is to Give the Martian to Understand That We, Earthians Count Two Dots Plus Two Dots as Four Dots. It Is Conjectured That in a Short Time We Can Thus Inter-Communicate Very Nicely with Our Martian Neighbors. If You Think, However, That Such a System as This Will Eventually Lead to Inter-"Language" Communication and Understanding, Try and Dope Out What the (Assumed) Martian Word "G-O-U-K-A" Means. Fig. 3. In the Next Issue We Will Tell You. Fig. 4. The Most Logical Method of Establishing Any Inter-Language Communication with a Strange People, Such as the Martians, Surely Seems to Be by Means of "Word Pictures," Such as Shown Here, Flashed or Otherwise Transmitted Simultaneously, in Such a Manner That the Picture Can Be Built Up. Otherwise, If the Martian Received the Letters R-A-T by Radio and Could Understand Them, but Did not Know What Our Animal the "Rat" Looked Like—He Would Have Some Tall Difficulty in Trying to Find Out What R-A-T Meant, Granting, of Course, That He Knew Our Alphabet—For the Chances Are That Animal Life Is Different on Both Planets.



Electricity Foils German Seals

By FRED C. KELLY

HOW the Germans sealed up over a ton of official and secret papers in the safes of the Swiss Consulate at New York, only to be fooled by five American adventurers, who secretly opened the wax seals on the ropes and locks during the nights when the office was vacant proves highly interesting reading. The tale of these five doughty knights, whose names are unknown to the Government to this day, is told in this story. These unknown workers of Uncle Sam, who finally procured all the secret papers and handed them over to the

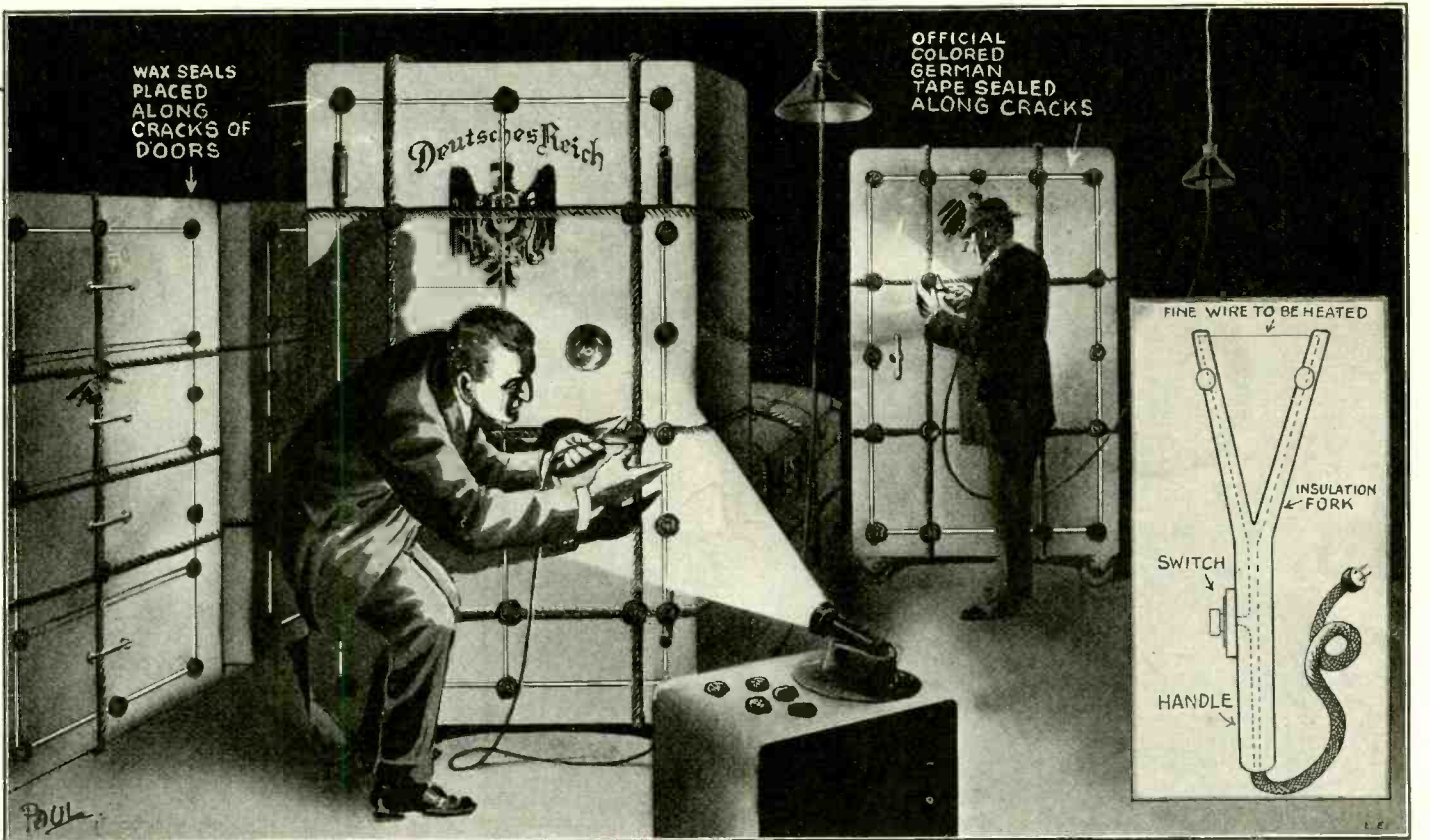
the safe, and the knots were sealed and stamped. The tape was also fastened against the flat surface of the safe doors with sealing wax and this, too, bore the official stamp.

Because the larger safe was the most carefully sealed up, the visitors assumed that it must contain the most valuable papers. They determined, therefore, to try to open that safe first of all. But even aside from the problem of working the combination, it looked like an impossibility to open the doors without disturbing the tape and seals.

In this way the seals could be removed one at a time, without disturbing the impression of the official stamp. Later the seals could be glued back to the same places from which they had been removed.

There was still the problem of getting the tape removed from the handles of the safe doors. But the callers hit on a plan for doing this that made the job simple.

Instead of trying to remove the seals and unwind the tape, they removed the little invisible cotter-pin which held the grip part of each handle in place. Then the whole mass of tape could be slipped right over the



Copyright—1920—by E. P. Co.

One of the Most Absorbing Chapters of "World War" History, Which Was Actually Enacted Not on the "Battle-Front"—But 4,000 Miles From It, in a Quiet Little Consulate Office Located in New York City, Is Here Told by the Author. The Germans, When They Left America, Placed Over a Ton of Valuable Papers in the Safes of the Swiss Consulate, and Plastered Up the Cracks of the Doors, and the Locks With Rope, Paper Tape, and Wax Seals Bearing the Imperial German Seal. Not to Excite Suspicion, Five Adventurous Americans Succeeded Finally, Thanks to the Clever Electric Heater Here Illustrated, in Removing the Seals Without Damaging Them—Procuring All the Secret and Valuable Papers—and Then Gluing the Seals Back Into Place.

Government, hired a suite of offices in the building where the papers were stored.

First they had their lock expert fashion a key to the outer door of the consular offices, and one night they went there to look the layout over. To all appearances the German papers were stored in two large safes, several sections of metal filing cases and a steel trunk.

Each safe and each filing case was bound around with rope and with red-white-and-black tape—in much the same manner that a shoe-box is tied with a piece of string at a store. The knots in the tape or rope were invariably covered with sealing wax of a special kind not easily imitated, and the wax was stamped with the official German seal.

Particular care had been given, apparently, to the sealing up of the larger safe. Pieces of sealing wax, bearing the official stamp, had been stuck at intervals all along the cracks at the edges of the safe doors. Official tape had been wound back and forth between the handles of the double doors of

HOW ELECTRICITY REMOVED GERMAN SEALS UNDAAGED.

If these seals were noticeably marred it soon would be discovered that the safe had been tampered with. This would prevent later visits, and furthermore, if it became known that the papers were gone, part of the value they might have in tracing German agents might be lost.

The visitors saw that if they were to open the safe and not have their work afterward discovered they would need several ingenious tools. When they returned a few nights later they were equipt with such tools and devices as were required. The most noteworthy of these was an *electrical contrivance* which could be attached to one of the electric light sockets near the safe. The working part of this consisted of a Y-shaped instrument between the two prongs of which was stretched a fine wire. This wire, when heated by the electrical current, could be past underneath the seals where they adhered to the flat surface of the safe.

knob of the handle. All very simple!

The handles showed slight blemishes where the pins had been removed, but this was quickly remedied simply by polishing the abrasion in the nickel-plating and applying a little nickel-plating solution.

The job of opening the safe, removing the contents and restoring the safe to its previous condition occupied the five men from about 11 o'clock at night until toward daylight. It was many days before they dared return to continue their search. While the nature of the papers in this safe was disappointing, the Germans, with typical German inefficiency, had left in the safe a great quantity of paper seals of exactly the same kind that they had used in sealing up the drawers of the metal filing cases. The possession of these seals greatly simplified the job of opening those drawers later on.

On a certain night while the Americans were at work on these files, a man, now supposed to have been the night watchman, came along and nearly stumbled upon them.

(Continued on page 1331)

THE PHYSIOPHONE

Music For The Deaf

By H. GERNSBACK

WHEN I was sixteen I secured an old-fashioned Pathé phonograph of the cylindrical record type. You know the kind that was in vogue years ago. Being much interested in electricity in those days, the thought occurred to me, the same as it occurred to thousands of others, namely, why not transmit the music electrically by putting a sensitive microphone somewhere on the phonograph and thus get the music at a distance.

No sooner said than done. An old-fashioned Hughes microphone was constructed by means of three little carbon rods, and this miniature microphone was attached to the sound box. The microphone was in series with a battery and the primary of an ordinary telephone induction coil. The music transmission was excellent and phonograph music was transmitted over a distance of three hundred yards on my father's estate. These experiments created quite a sensation in those days, and my friends, all electrical "bugs," were much elated and pleased with the stunt.

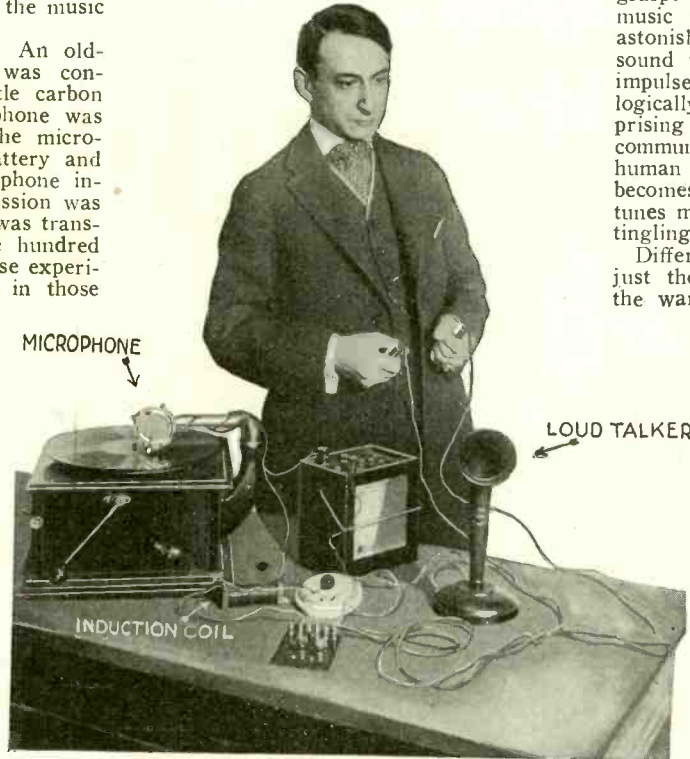
One evening I accidentally touched the two wires of the secondary terminals of the telephone coil and was quite surprised to get a smart and disagreeable shock. That was in 1900. The early experiments were soon forgotten, but in 1917, while editing an article in this magazine, where a young man had re-discovered the ancient experiment, I thought of that shock, and I understood immediately what that shock really was. I accordingly set to work and immediately built a new transmitter which was attached to a Victor phonograph sound box, and which is shown in Fig. 4. The connections are shown from which it will be seen that the microphone is in

series with the 6-volt storage battery and the primary of an induction coil such as is used in telephone work.

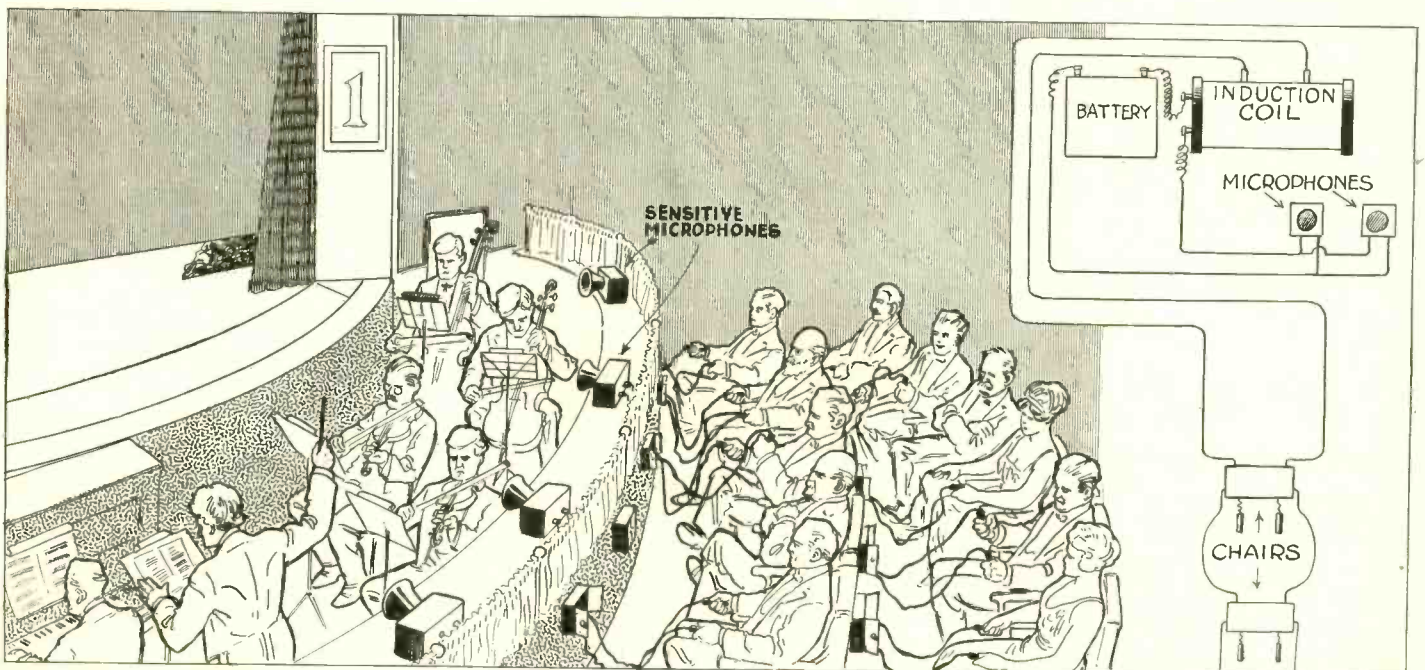
The writer used a regulation sound box merely by making a microphone out of it and substituting a carbon diafram for the mica diafram. The space between the back carbon and the carbon diafram is filled out with polisht carbon grains. The

mechanical suspension of the carbon diafram must be the same as the one for the mica-diafram. In other words, the vibrations of the phonograph needle must be faithfully past onto the carbon diafram, the same as is the case with the mica type. When the connections are correctly made and two handles are now attached to the secondary of the induction coil, and these graspt in your hands, the rhythm of the music will be felt faithfully and with astonishing fidelity. What we do feel is sound vibration translated into electrical impulses which in turn are felt physiologically by the human nerves. It is surprising how well this translated music is communicated to the nervous system of the human being, and with a little practise it becomes possible to recognize the different tunes merely by the variations of the little tingling shocks.

Different records were tried in 1917, but just then the United States entered into the war, and the experiments came to a sudden end. Recently, however, they were taken up again with the following results. Improvements were made on the microphone and a great many new types were tried out, because the original type was not entirely satisfactory. Later experiments, however, proved to me that the 1917 type in principle was probably the best that could be produced. From some ten or twelve types which were evolved by me then, a few are shown here. Many different records were tried, and it seemed to be readily establish that the different tunes, the different musical instruments, as well as voices, could be readily differentiated physiologically *without listening at all to the music*, or without hearing any sound whatsoever. Of course, it goes without saying that such experiments must



Mr. Gernsback Demonstrating the PhysioPhone. The Photograph Shows How the Instruments Are Connected. By Means of the Double Pole Switch, the Music Is Reproduced by a Loud Talker, Then the Switch Is Thrown, and Physiological Music Is Had.



Double Barreled Music. Showing How an Audience Can Enjoy the Music Orally As Well As Physiologically. In Other Words You Hear the Music and You Feel It As Well. A Brand New Source of Enjoyment.



During Tests With Totally Deaf People, They All Expressed a Great Desire to Dance by Means of Physiological Music. Due to the Rhythm a Deaf Person Can Now Dance Without Any Trouble by Means of Physiological Music.

be made with the phonograph in a different part of the building with the handles so far away that the music from the phonograph cannot be heard at all. When using the microphone type as shown in Fig. 4, the sound near the phonograph is still audible, altho not anywhere near as loud as if the original mica-diafram were used.

For this reason the handles must be located in another room so that whatever music leaves the phonograph cannot be heard. I used a double-throw switch and a loud talker of the type commercially sold, and invited visitors to first listen to the phonograph record by means of the loud talker. Then the switch was thrown, and of course no sound was heard at all. By grasping the handles, the visitors could readily follow the rhythm of the record, and right here a curious thing happens.

Some people, altho musically inclined, have trouble in following the music, while others immediately recognize the different strains and have no trouble to sing or whistle with this physiological music. There seems to be a difference in the nervous system of individuals, and some people can more readily translate the rhythm than others, altho not necessarily more musically inclined. Other tests were made paralleling the idea by using no phonograph at all, but simply a microphone into which a person spoke. By having the experimenter count from one to a hundred, the other party at the far end could feel the voice impulses and after a while managed to "understand" the voice by physiological impulses.

In Fig. 1 is shown another type of transmitter attach in front of the sound box in the phonograph. It consists simply of three transmitters connected in parallel, the connections being the same as usual. This,

however, did not work as well, and very little could be felt at the secondary end.

In Fig. 2 is shown two transmitters, because the writer at one time when working with a single transmitter on a disc type phonograph did not receive all the impulses, that is to say, only one side of the lateral cut vibrated the diafram.

The same idea is shown in Fig. 3 where

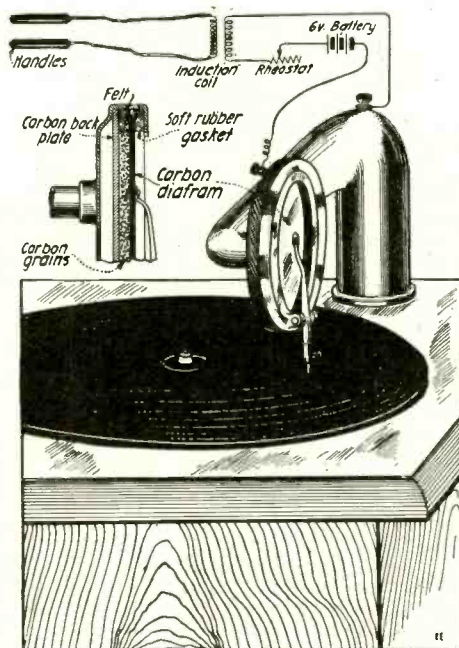


Fig. 4. Schematic Illustration of the Components of the Physiophone.

two transmitters were simply attached to the needle holder, the rubber band serving simply to feather the action, but the results in neither case were good, and the original 1917 type transmitter with certain refinements has been found to work best in all respects.

What purpose is accomplished by these experiments? Ordinary human beings certainly do not require the translation of musical impulses into their nervous system, but for the deaf a vast and important field has been opened. Here we have a means of translating music into the nervous system of a deaf person who has not the slightest conception of music. Of course, it should be understood right here that I do not mean to convey the idea that a deaf person will actually "hear" the music. What he does get, however, is the rhythm, and he certainly gets this very definitely as has been actually demonstrated by tests with deaf persons upon which the writer experimented. It has been found that a deaf person can readily understand the different musical pieces, and can even recognize different musical instruments with very little practise.

Of course, the deaf person must learn the same as any other human being, for it is a well-known fact that if a person totally deaf were restored his hearing, he would not be able to understand what you said to him for some time to come. He would have to learn and judge the sound just the same as a child. The same is the case with a totally blind person who has never seen daylight. Experiments made with such people invariably prove that as soon as the eyesight is restored, they do not see in the sense that the normal person

(Continued on page 1320)

Electro-Medical Frauds

By JOSEPH H. KRAUS

FROM time immemorial, people of this and foreign countries have allowed a class of humbugs and fakers to foist upon them innumerable cure-all devices and medicines. Not alone have these quack doctors been charging exorbitant prices for worthless trash, but they have also caused various injuries and hardships to those attempting to manipulate or apply these worthless humbugs "as per directions."

In medicines, even today, the market is full of glaring advertisements of remedies which formerly were claimed to cure anything from a corn to a malignant tumor.

Some of these fakers and quack doctors have been enjoined from ever again manufacturing or offering for sale, any medicines of any kind and the harvests of five hundred thousand to several million dollars annually, is lost forever to them. Like all schemes of this nature, these individuals produce testimonial upon testimonial to prove (?) that their goods are as wonderful as they claim them to be and with the boldest effrontery, produce advertisements such as "Five Hundred Dollars will be paid to any one who can prove that these letters are not genuine, or have been solicited." This seems to pave the way to the enormous financial profits recorded by them in income tax reports and demonstrates to what an extent they have hoodwinked the Public.

It is only necessary for us to watch the continuous panorama of advertisements which bunko medicine houses use and view the daily death column in the paper to note the marked similarity of names of persons who have died of the same disease, which, two days later, the cure-all concern announces it had cured. "Dead men tell no tales" as the old adage goes, and hence, we will not stop to even question whether or not the individuals concerned in the treatment, ever had used it, but if so, the remarkable results are clearly indicated by the "slow procession."

One of the greatest frauds of all time and finally declared by the Government to be simply a scheme for obtaining money thru the mails by means of pretexts and fraudulent promises, and to which further use of the mails was denied, was the "great" and "wonderful" ACTINA humbug. Perhaps many of our readers remember this Actina inhaler, having probably seen advertisements of it thruout the country. This device sold at about ten dollars and later on, if the correspondents did not answer, a 50 per cent discount on any goods was offered.

Essentially, it consists of an outer casing about three inches long with a wide opening at one end, and a narrow opening at the other. An inner tube of perforated zinc about ¼ inch wide and fitting inside the first tube or casing (this made of copper). The American product, however, was entirely of steel. The space between the two walls shown in illustration (1) was filled with oil of mustard and oil of sassafras. The former smells like a decayed onion and great caution must be exercised when smelling this oil, hence the Actina advertisements stating that it was perfectly harmless were not only fraudulent, but also of great injurious content. This swindle "cured" deafness, blindness, catarrh, and nervousness and a couple of other odds and ends thrown in.

The American Medical Association, in their exposé propaganda, speaking of its effect in curing any eye or ear disease, state that the sufferer might just as well

and with more safety, blow red pepper up his nose, and get his sneeze cheaper than by sniffing at a \$10.00 evil smell.

This fraud claimed, in addition, to be an ozone battery, the electric action of which was due to the copper and zinc involved in its construction. We would refer the reader to several past descriptions of real ozone generators and recall to his mind that even the smallest of these generators was comparatively bulky and

did they ever have even the slightest effect upon the individual. Such bunko devices as the magnetic hair brushes and combs, "cold feet" pads generating electricity due to the action between the copper and zinc plates, and electric belts, not only never cured, but also made themselves uncomfortable to the wearer.

Out of hundreds of claims for testimonials, not one cure could be authenticated by the use of the various devices here referred to.

In order to note the effect of magnetism on the human body, tests were made in France (see Fig. 2), which involved the use of gigantic electro-magnets capable of forming the most intense magnetic fields.

Persons placed under the effect of this ultra-powerful magnetic flux were carefully watched and every movement recorded with remarkable accuracy and precision. The pulse rate, heart beat, breathing, and reflex responses from the various nerve centers were noted and in no case was even the slightest change effected when the person was first under magnetic influence and again when the current was turned off.

This fact is well worth remembering. When once thoroly learned, people will not be bamboozled by any device which claims as its healing power, magnetism of any sort. Under this category, come also such ridiculous schemes and such flagrant misrepresentations as *Electro-magnetic Rings* which cure everything from nose bleed down to appendicitis, and varicose veins.

Another of the wonderful deafness cures which was perhaps more magical and mystical than the former was that of (Dr.) Branaman. This device would cure deafness or catarrh, head noises or asthma, so quickly that you would not even know it, regardless of what the deafness was due to. The poor afflicted victim was given a symptom blank which he filled out and whether he could add yes to every question or no to every question asked thereon, he was either pronounced deaf or suffering from catarrh.

The contrivance altho selling for \$8.00, cost about \$1.50 to make. Essentially, it is a leather belt strap securely around the head, made in the form of a pocket. This houses the "battery." The battery is the same as employed in the audacious commercial frauds even now being advertised and manufactured in the form of belts.

These consist of a number of copper and zinc elements, the zinc being placed inside the copper. Around the zinc element is a tiny bit of felt so that when the battery is immersed in a vinegar solution an electric current is set up! These electric currents buzz thru the ears and stimulate in that way, the nerves of hearing, according to Dr. Branaman, America's leading ear specialist (at least he calls himself that); he even went so far as to publish advertisements in the newspapers showing the photograph of a man as being cured of deafness and blindness. This man had been deaf for years and was still deaf; and this Dr. Branaman knew. Still he persisted and continued to use the victim's name in his advertising slogans. Strange to say, a testimonial purported to have been written by the man, was printed altho the victim was so unfortunate as to be unable to write.

Even today, in some of our newspapers and magazines perhaps we find advertisements that start off with a big flare "Don't shout, use the Morley ear phone." This

(Continued on page 1312)

For "May" E. E.

Peace Time Uses for the Searchlight—A new scheme for outlining airplane field with one searchlight, by Edwin F. Linder, M. E., Specialist in Searchlight Design and Inventor of Bullet-proof Mirror.

The Automatic Telephone—Simple explanation in picture and in diagram by an expert in Automatic Telephony.

Flashlighting Birds and Animals, by Howard Taylor Middleton.

The "Loadstone" or Natural Magnet—Specially written by an expert on loadstones, with special illustrations.

A Day With the Weatherman—The rôle of electro-mechanics in forecasting your daily weather report, by H. Winfield Secor.

"Odd Photo" Prize Contest.

"House-hold Electrics" page, by Edna Purdy.

The Why and Wherefore of Magnetism, by Edward A. Keever.

How Glass Is Made—All about glass, the everyday substance about which we know so little, by Prof. Floyd L. Darrow.

Popular Astronomy, by Isabel M. Lewis, M.A.

The Amateur Magician—The Mysterious "Rapping Hand" which foretells your fortune, by Joseph H. Kraus.

Long Waves and "Strays" on Rogers' Antennae, by Lieut.-Com. A. Hoyt Taylor, U.S.N.R.F.

Some Laboratory!—An interesting story with excellent photographs of an American model worker's shop de luxe—Written as only he can write it, by Thomas Reed.

More Light for Microscopes, by Merrill M. Hunting.

yet we find here, a company deciding that ozone can be generated by electric action (?) between the zinc and the copper, while held in the hand. Additional fakes made by the same concern were the Magneto Conservative Garment shown in Fig. 3. This garment, which was claimed to cure anything from indigestion to locomotor ataxia, looked like a suit of underwear with a large number of bar magnets, oodles and oodles of them, scattered thruout its interior.

Such magnetic devices never cured nor

ELECTRO-MEDICAL FRAUDS

FOR ASTHMA!!

ACTINA FRAUD FOR 'CURING' DEAFNESS

1

THE MAGNETIC EFFECT EXPERIMENT

2

MAGNETIC FIELD

ODDLES OF BAR MAGNETS

MAGNETO CONSERVATIVE GARMENT FOR CURING 'N' EVERYTHIN'

3

ELECTRO-MAGNETIC HEAD CAP FOR 'DEAFNESS' 'EAR-ACHES' AND 'ASTHMA'

ZINC

FELT

COPPER

CONNECTOR

4

MORLEY EAR PHONE 'CURES' DEAFNESS

5

MECHANICAL BLOOD CIRCULATOR

6

OXYDONOR

7

MAGNETIC BLANKET

S	N	S	N
N	S	N	S
S	N	S	N

8

VACUUM HEAD CAP TO MAKE HAIR GROW

9

"The Educated Harpoon"

By CHARLES S. WOLFE

THE Chief of Police gave me a hostile questioning stare. I'm not exceptionally quick witted, but I don't have to be hit with a club in order to grasp an idea. I rose instantly. "Something tells me I am *de trop*," I murmured.

My friend put out a protesting hand. "Sit down, you touchy ass," he said. "Chief, this man is a particular friend of mine. You can safely say anything in his presence. It will go no farther."

Undecided whether to go or stay, I hesitated. The Chief smiled sourly. "Oh, it's all right, Mister, if Joe here says so. But forget anything you hear, get me? We can't afford leaks."

whole clan had no terrorizing influence on Joe.

The Chief dropt wearily into the nearest chair. "You'll have to pardon me, friend," he growled at me, "I'm a little short on manners at the best of times, and this thing is getting on my nerves. Joe," turning to Fenner, "I want you to help us again."

I turned a mental summersault. The Chief of Police addressing my chum as Joe. Asking him to help them—again. Ye Gods! Was my seemingly commonplace chum a detective?

The Chief was speaking. "There was a man killed in the Atwood building an hour ago. I've just come from there."

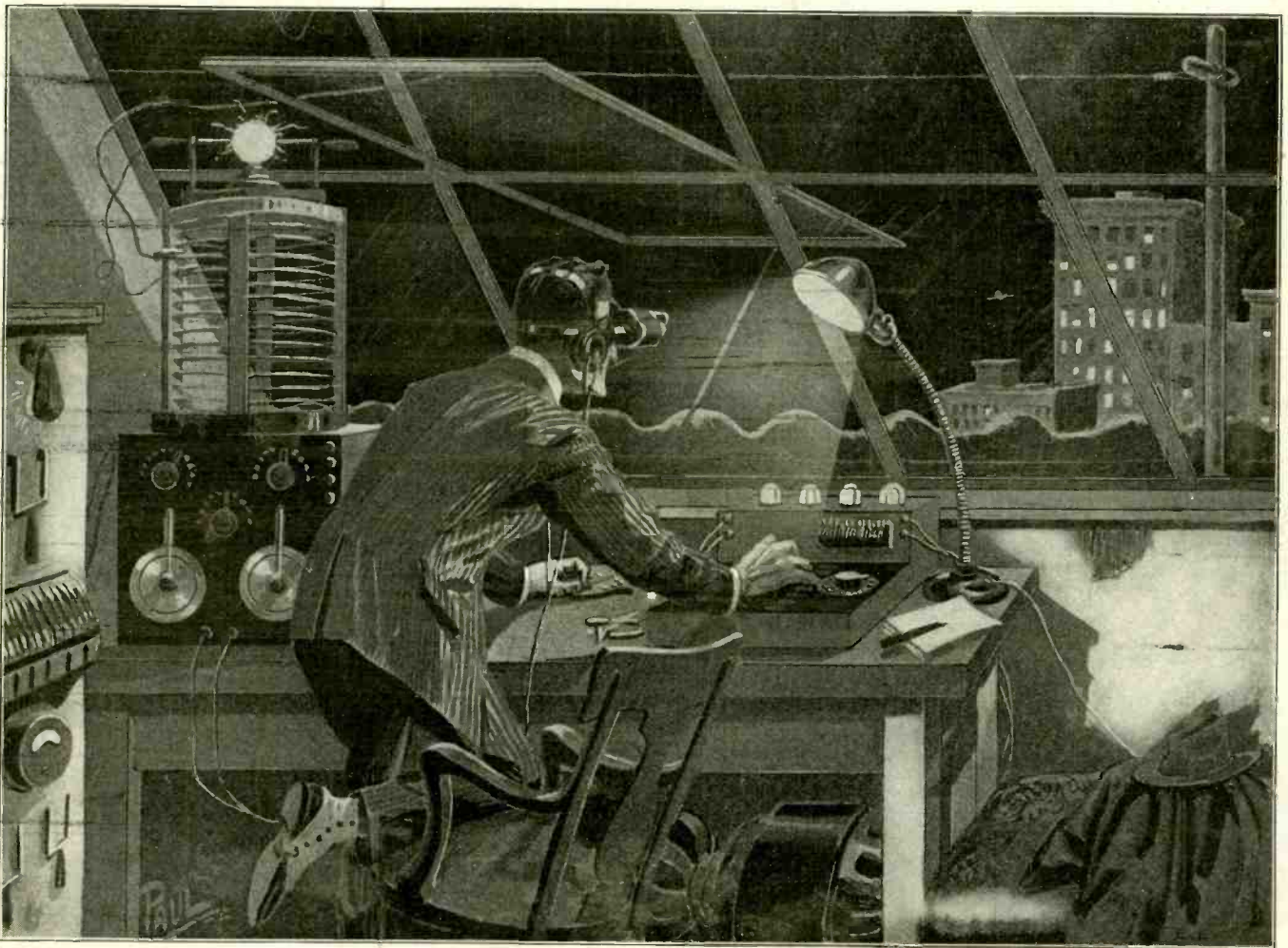
about them, anyway, Chief?" queried Joe.

"Well, for one thing, we can't find the knife, or whatever it was that he was stabbed with."

"Murderer took it away with him," suggested Fenner.

The Chief's face took on a pained look. "Maybe he did," he said, wearily, "only—there's no possible way he could get in to stab the man in the first place, and no way that he could get out after he had stabbed him in the second place. And in the third place the crime simply couldn't have been committed at all, but it was. And there you are."

"Chief, you're talking thru your hat," reproved the amazing Fenner with astound-



This is a Story of An "Educated Harpoon," and We Are Not Going to Tell You In a Few Words, Just What It Is or How It Came About That a Great Business Man Was Murdered In His Private Office, Without Anyone Having Entered the Office, As the Facts of the Case Have Clearly Proven. However, If You Have a Fair Education in Electrical and Radio Matters, You May Be Able to Guess How the Man Was Killed. If Not, You Will Find This One of the Most Interesting Scientific Narrations Ever Written.

Joe saw that I intended to go, and he crost and forced me back into my chair. "Don't mind the Chief, Bill," he said, laughingly. "He has an inherently suspicious disposition. Now then, Chief, what is troubling you?"

I gasped. I knew Joe Fenner as a fellow student, wireless telegraph enthusiast and scientific dabbler. A mighty likable, but not extraordinary, sort of a fellow. To find him on terms of intimacy—to say nothing of equality—with the Chief of our city's police force was astounding. Personally, I've always had a little fear of policemen, a relic of boyhood days and pranks. Apparently the king-bee of the

My face must have reflected the varying emotions that this statement produced within me, but Joe's countenance remained passive. "Murdered," he asked, quietly. "How?"

"Stabbed in the back." The Chief might have been saying "Please pass the potatoes," for all the feeling expressed in his tones.

Joe shrugged his shoulders. "I don't think you want me, then," he said. "It's out of my line."

"Yes, you'd think so," agreed the Chief, "if it wasn't for the peculiar circumstances surrounding the crime."

"Peculiar circumstances? What's peculiar

ing disregard of the deference due one in the Chief's position. "There must be a perfectly simple way in which some one got into the place and away again."

The Chief arose. "My car's outside," he said. "Come along down and have a look."

As Fenner hesitated I took my cue. "I'll ride along as far as my house if you don't mind," I said.

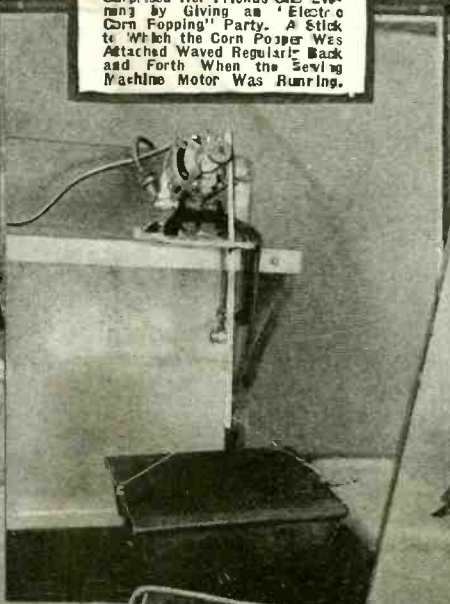
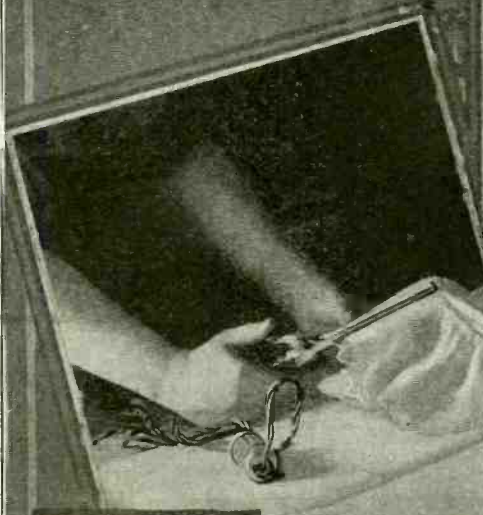
"You'll ride along and have a look with me," said Fenner, warmly. "I know you're just as curious as I am to get a look at the scene of this remarkable crime."

The Chief was almost friendly. "Yes,"

(Continued on page 1335)

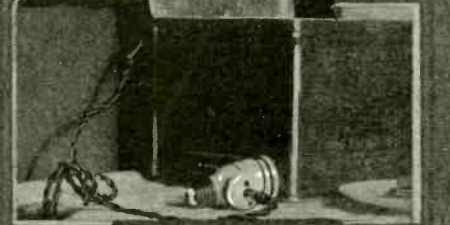
ELECTRIC BACHELOR MAID

The Electric Bachelor Maid Surprised Her Friends One Evening by Giving an 'Electric Corn Popping' Party. A Stick to Which the Corn Popper Was Attached Waved Regularly Back and Forth When the Sewing Machine Motor Was Running.



Every Young Woman Likes These Beautiful Elongated Ruffles, but She Often Foregoes Buying Them Because She Has No Crimper. An Electric Curling Iron Is Not to Be Despised As a Crimper or Ruffles When One Has No Crimper.

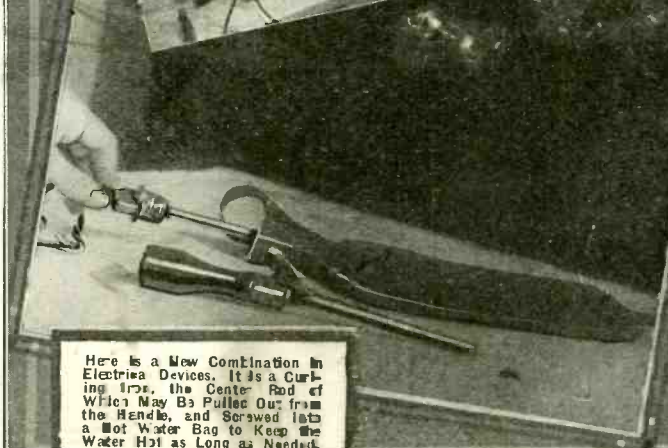
The Electric Bachelor Maid Does Not Confine the Motor to the Sewing Machine. She Cuts a Circular Felt Buffer and Fits it Onto the Shaft of the Motor for an Electric Manicure.



Making an Electric Cracker Jar. A Hydrogen Red Bulb is Inserted Thru the Top of the Cracker Tin, and the Heat is Just Right When the Light is On 1 Day a Week.

One of the Annoying Things About "Vacuuming" is a Tangled Cord. A Coiled Spring May Now Be Purchased, or Made by the Handy Mechanic.

Efficient Brushing by Motor. The Brush Connects to the Shaft of the Motor Revolves, and Its Speed is Regulated by the Foot Pedal of the Motor.



Here is a New Combination in Electric Devices. It is a Curling Iron, the Center Rod of Which May Be Pulled Out from the Handle, and Screwed into a Hot Water Bag to Keep the Water Hot as Long as Needed.

A Nitrogen Lamp Held or Clamped to a Tin Dipper for a Reflector, Gives a Surprising Amount of Heat, Which May Be Directed Over the Entire Head or Used to Dry a Section.

Telegraph, Cable and Radio Dispatches

By PIERRE H. BOUCHERON, Ensign U. S. N. R. F.



fifty words or less. This form of message is charged for at one and one-half the charge of a

The Accompanying Illustration Shows the Three Principal Forms of Business Messages as Commonly Transmitted by TELEGRAM, CABLEGRAM and WIRELESS or MARCONIGRAM. The Underlying Key-Note, in Writing Out These Messages for Transmission, is of Course Brevity, with a Capital "B." Many Useful and Practical Hints for the Correct Preparation of Such Messages Are Given by the Author in the Accompanying Text. Altho the Preferred Forms of These Messages Are Known Fairly Well to Everyone, Yet It Is a Fact That a Brief and Fully Complete Message Which Shall Not Be Misunderstood by the Recipient, is a Rarety.

regular ten-word daily telegram, additional words being charged for at the rate of one-fifth of

LARGE corporations of today do not waste and take up the valuable time of high-salaried executives by leaving it to them to prepare and properly route the dispatches of the firm in the most economical way. Instead a specially trained clerk, preferably one who has had experience in a telegraph or cable office, is assigned to this work; and all telegrams, cablegrams and radiograms must be routed thru him before forwarding. However, since it is not every organization whose business warrants the employment of such a clerk, nevertheless the smaller concerns may profit by some timely information on this subject. Particularly is this needed today, for in the mad scramble to "get the business" little details like economy in the use of words in telegrams and cablegrams are seldom taken seriously.

The writer, who during the war had an opportunity to study various systems of communications, both government and commercial, was surprised at the lack of common sense and knowledge displayed by some firms and individuals when sending dispatches. In some instances no efforts were made to economize in the use of words, and in a fifteen-word cablegram as many as five unnecessary words would be used, which in the case of messages destined to remote points, costing 42 cents per word, meant a loss of \$2.10. On the other hand, there were those who were seeking economy by the wrong methods, and thru lack of proper knowledge of rules would attempt to combine words in an illegitimate manner

in order to lower the cost of the message. In either case much money and time was lost in harangues and disputes between themselves and the cable clerks, which could have been avoided by securing the necessary information in very short order from competent telegraph clerks or from other experienced persons.

Besides the telephone there are three general means of rapid verbal communication with distant points as follows and in the order of their importance:

1. The telegraph.
2. The cables.
3. The wireless.

THE TELEGRAM.

The telegraph as a means of communication is usually resorted to in this country where the telephone is too expensive, or where the special delivery mail is too slow, and of the three mentioned above is the most commonly known and used.

CLASSES OF SERVICE.

There are four classes of messages which may be sent by telegraph:

- (1) The telegram, for which full rate is charged and which is given expedited transmission. It may contain ten or less words for the same charge, additional words being charged for according to rate per word.
- (2) The night message, which is handled during the night only when traffic is small and for which reduced rates are charged. This message is usually delivered in the morning of the following business day.
- (3) The day letter is transmitted during slack periods of the day and may contain

initial rates for each additional ten words or less.

(4) The night letter is handled in practi-

Code	Description	Code	Description
0211	Advertise	0211	Advertise
0212	Advertise	0212	Advertise
0213	Advertise	0213	Advertise
0214	Advertise	0214	Advertise
0215	Advertise	0215	Advertise
0216	Advertise	0216	Advertise
0217	Advertise	0217	Advertise
0218	Advertise	0218	Advertise
0219	Advertise	0219	Advertise
0220	Advertise	0220	Advertise
0221	Advertise	0221	Advertise
0222	Advertise	0222	Advertise
0223	Advertise	0223	Advertise
0224	Advertise	0224	Advertise
0225	Advertise	0225	Advertise
0226	Advertise	0226	Advertise
0227	Advertise	0227	Advertise
0228	Advertise	0228	Advertise
0229	Advertise	0229	Advertise
0230	Advertise	0230	Advertise
0231	Advertise	0231	Advertise
0232	Advertise	0232	Advertise
0233	Advertise	0233	Advertise
0234	Advertise	0234	Advertise
0235	Advertise	0235	Advertise
0236	Advertise	0236	Advertise
0237	Advertise	0237	Advertise
0238	Advertise	0238	Advertise
0239	Advertise	0239	Advertise
0240	Advertise	0240	Advertise
0241	Advertise	0241	Advertise
0242	Advertise	0242	Advertise
0243	Advertise	0243	Advertise
0244	Advertise	0244	Advertise
0245	Advertise	0245	Advertise
0246	Advertise	0246	Advertise
0247	Advertise	0247	Advertise
0248	Advertise	0248	Advertise
0249	Advertise	0249	Advertise
0250	Advertise	0250	Advertise
0251	Advertise	0251	Advertise
0252	Advertise	0252	Advertise
0253	Advertise	0253	Advertise
0254	Advertise	0254	Advertise
0255	Advertise	0255	Advertise
0256	Advertise	0256	Advertise
0257	Advertise	0257	Advertise
0258	Advertise	0258	Advertise
0259	Advertise	0259	Advertise
0260	Advertise	0260	Advertise
0261	Advertise	0261	Advertise
0262	Advertise	0262	Advertise
0263	Advertise	0263	Advertise
0264	Advertise	0264	Advertise
0265	Advertise	0265	Advertise
0266	Advertise	0266	Advertise
0267	Advertise	0267	Advertise
0268	Advertise	0268	Advertise
0269	Advertise	0269	Advertise
0270	Advertise	0270	Advertise
0271	Advertise	0271	Advertise
0272	Advertise	0272	Advertise
0273	Advertise	0273	Advertise
0274	Advertise	0274	Advertise
0275	Advertise	0275	Advertise
0276	Advertise	0276	Advertise
0277	Advertise	0277	Advertise
0278	Advertise	0278	Advertise
0279	Advertise	0279	Advertise
0280	Advertise	0280	Advertise
0281	Advertise	0281	Advertise
0282	Advertise	0282	Advertise
0283	Advertise	0283	Advertise
0284	Advertise	0284	Advertise
0285	Advertise	0285	Advertise
0286	Advertise	0286	Advertise
0287	Advertise	0287	Advertise
0288	Advertise	0288	Advertise
0289	Advertise	0289	Advertise
0290	Advertise	0290	Advertise
0291	Advertise	0291	Advertise
0292	Advertise	0292	Advertise
0293	Advertise	0293	Advertise
0294	Advertise	0294	Advertise
0295	Advertise	0295	Advertise
0296	Advertise	0296	Advertise
0297	Advertise	0297	Advertise
0298	Advertise	0298	Advertise
0299	Advertise	0299	Advertise
0300	Advertise	0300	Advertise

A Page from One of the Famous Telegraph and Cable "Code Books" (Lieber's Code). By the Use of a Single "Code Word" You Can Transmit a Whole Sentence, Thus Reducing the Cost Remarkably.

cally the same manner as the night message, but may contain fifty or less words, and is charged for at the same rate as a regular day telegram for fifty words. Additional words are charged for at the rate of one-fifth of the regular day message rate for every ten words or less.

Note: Day and night lettergrams must be written in plain English, foreign language, code or cipher not being accepted by telegraph companies.

The domestic telegraph message differs essentially from the cable and wireless in that the text is the only part charged for; the address and signature being sent free of cost to the sender. Some essential and general rules regarding the transmission of telegraph messages may be briefly described as follows:

- (1) The complete address as well as one signature are not counted nor charged for.
- (2) Any dictionary word of a recognized language, that is, the English, German, French, Italian, Dutch, Portuguese or Latin, may be used and will be counted as one word, no matter how many letters the word contains.
- (3) All numerals, decimal points, punctuation points, whether isolated or together, are counted and charged for as one word each.
- (4) Names of places, states or countries, such as New York City, Havre de Grace, Camp Dix, District of Columbia, East St. Louis, South Orange, may be combined and counted as one word each, and in order to simplify counting, should be written thus: Newyorkcity, Havredegrace, etc.
- (5) Mutilated dictionary words, written together contrary to accepted usage of the language, or combinations of several dictionary words will be counted and charged for according to the number of words they are composed of. For example, such words as "firstclass," "allright," "postoffice," etc., are counted as two words.
- (6) Such words as "parcelpost," "percent," "carload," "O.K.," "A.M.," "P.M.," "C. O. D.," "F. O. B.," are counted and charged for as one word each, because these are recognized by custom to be single words.
- (7) Code words and cipher words may be used. Code words not exceeding ten letters, and cipher words not exceeding five letters are counted and charged for as one word each.
- (8) Only one address and one signature are allowed in one message, two or more signatures being charged for as so many

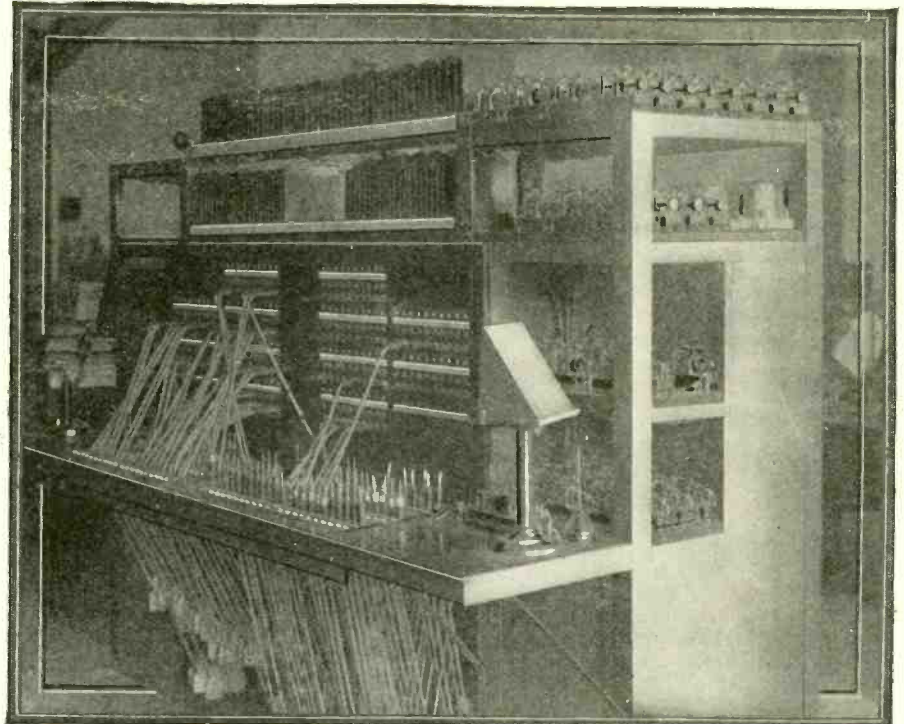


Photo Courtesy Donald McNeel.
 And Speaking of the Dispatch of Telegraph Messages—Here Is the "Distribution Board" Which Links Our Local Telegraph Office, Manned by Two or Three Operators, with the Large Staff of Telegraphers in the Main Telegraph Exchange in New York City. Each Operator's Position on the Long Dispatch Tables Is Connected with a "Tell-Tale" Signal Lamp on the Front of the Switchboard. The Operator, who Sits in Front of this Board, Can Thus See at Any Instant Just Which Operators Are Idle. A Branch Exchange, Desiring to Transmit a Message, Signals Thru a Lamp on the Table of the Board, and All the Operator Has Then to Do is to Take One of the Plugs Beside This Lamp and Connect It with a Jack Connecting with an Idle Operator. The Battery of Relays on the Right-Hand Side of the Frame Are Connected to the Various Branch Exchange Circuits and Cause the Signal Light in Each Case to Remain Lit Until Connection is Properly Made by the Distribution Operator.

extra words, whichever the case may be.
 (9) Numerals in the body of a domestic message are counted and charged for as one word for each individual numeral.

THE CABLEGRAM.

The cablegram is a more complex and detailed subject than the domestic telegram, and in order to avoid errors requires judgment and accuracy on the part of the sender. One reason for this is that it is usually sent to foreign lands, which entails handling by many hands, and the cost is considerably greater per word than the telegram. In the case of the cablegram, every part of the message is charged for with one exception—the name of the country to which it is

destined, such as France, Italy, etc. In preparing the message these names are usually bracketed to avoid counting and charging for them. The manner of counting words is known and usually referred to as the "cable count," which same is also employed in checking wireless messages or radiograms. Owing to the fact that cablegrams are expensive, commercial houses make extensive use of code and cipher in order to lessen the number of words and therefore reduce the cost.

Several well-known codes in commercial use today are:

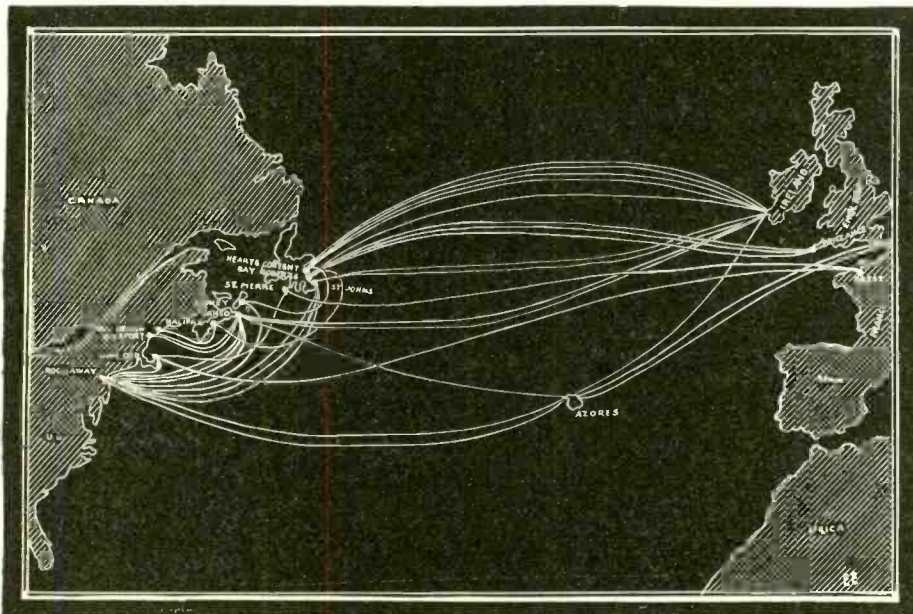
- ABC Codes, 4th and 5th Editions.
- Lieber's Improved Code.
- Western Union Code.
- A. I. Code.
- Bentley's Code.
- Century Code.
- Scott's Code, 10th Edition.
- Riverside Code.
- Imperial Code.
- Bromley's Code.
- Broomhall's Code.
- Typical code words: Codiac, Gopher, Staticallo, Nomadimice.

DIFFERENCE BETWEEN PLAIN LANGUAGE, CODE AND CIPHER.

Plain language, as referred to in cablegrams or radiograms, may be any language using the Latin alphabet and Arabic system of numerals. In using plain language in a cable or radiogram any legitimate word may be counted as one word up to and including fifteen letters; beyond that point and for each additional fifteen letters it is considered and charged for as two words, tho the word need not necessarily be disconnected. For instance, the word "unconstitutional," which contains sixteen letters, is counted as two words.

Code language consists of genuine or artificial words of a pronounceable nature, but which may have a different face meaning and are counted and charged for at the rate of ten letters to the word. When code words of an artificial nature exceed ten

(Continued on page 1298)



Many of Us No Doubt Entertain the Idea That There Are Two or Three Undersea Cables Spanning the Atlantic Ocean Between Europe and America, but a Glance at This Latest Cable Map of the Atlantic Ocean Tells a Different Story. There Are, in All, Seventeen Cables Linking the Old and the New Worlds.

Weighing The Earth

By LOUIS DERR

Professor of Physics, Massachusetts Institute of Technology.
Specially Written for the Electrical Experimenter

IF the earth could be weighed like a load of coal, how much would it weigh? Is it composed of light materials principally, or heavy ones? How can anything be learned about the matter? It is the purpose of this article to give a brief outline of some of the methods by which questions like these are answered.

Sir Isaac Newton's celebrated law of universal gravitation, published in 1687, states that every particle of matter attracts every other particle with a force proportional to the product of their masses, and inversely proportional to the square of the distance between them. As may readily be imagined, the law was deduced from astronomical facts, and finds its most important applications in astronomy, for by it the motions of the moon, the planets and other celestial bodies are determined.

There are, however, too many unknown factors in the formula to make it directly available for calculating the mass of the earth from astronomical data. Five quantities are involved, of which four must be known in order to calculate the fifth: the force between the two bodies, their respective masses, the distance separating them, and a numerical constant whose value depends on the units in which force, mass and distance are expressed. If we wish to know the mass of the earth in pounds or tons, we must take some selected body on the earth's surface and compare the earth's attraction for it with the attraction of some other known body for it, at a known distance. The working difficulty is that bodies of manageable size, separated by

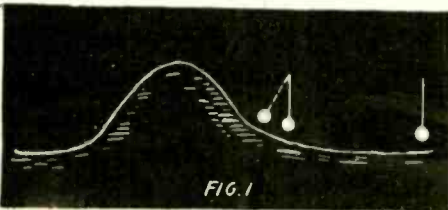


Fig. 1. Diagram Showing How the French Physicist, Bouguer, Attempted to Weigh the Earth by Noting the Pull of a Mountain Mass on a Suspended Bob, or Weight, in 1740. A Deflection of 16 Seconds of Arc Was Actually Observed, and From This Ratio, as Compared to the Pull of the Earth Upon the Bob, It Was Possible to Compute the Average Density of the Earth.

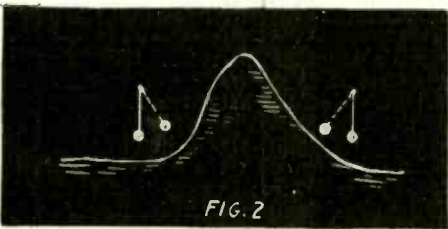


Fig. 2. This Shows the Arrangement Followed by Rev. Nevil Maskelyne in 1774, in Which Case He Chose a Mountain in Scotland for His Experiments. One Plumb Line Was Placed South of the Mountain, and Another North of It. The Ratio Between the Pull of the Earth and the Pull of the Mountain Was Readily Observed, and the Density of the Earth Then Computed.

controllable distances, exert so feeble a gravitational pull upon each other that the measurement is a problem of considerable magnitude.

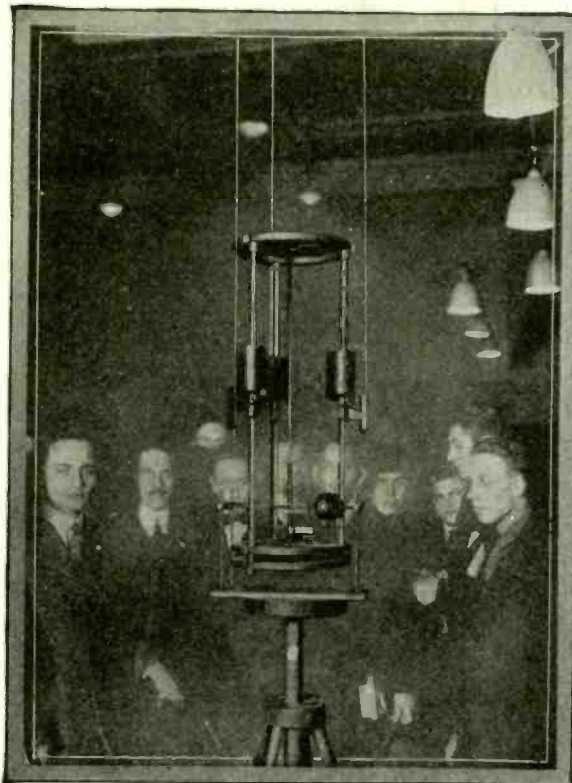


Fig. 8. This Shows the Remarkably Sensitive Cavendish Type Apparatus With the Small and Large Lead Balls, Reflecting Mirror, Etc., Actually Used in Determining the Weight and Density of the Earth, at the Present Date, by Professor Louis Derr and His Associates at the Massachusetts Institute of Technology, Cambridge, Mass.

The problem is an old one, and has been attacked many times and from many angles. The results obtained are usually given in figures representing the average density of the earth, a quantity of perhaps more scientific interest than the mere statement of its mass. Of course, if the mass and volume are known the average density is found simply by dividing one by the other.

Perhaps the earliest definite results are those obtained by the French physicist, Bouguer, about 1740. He hung up a plumb-line, ten miles east of the great mountain mass of the Cordilleras in Peru, and then moved it close to the mountain range. He reasoned that if the mountains exerted any attraction for the suspended bob, the line would no longer hang vertically, but would be tipped slightly. This is shown in Fig. 1.

The deflection was actually observed, and was found to be about sixteen seconds of arc. This gave a ratio between the pull of the mountain on the hanging bob and the pull of the earth upon it (its weight, of course) and from this ratio it was possible to compute the average density of the earth, which was figured out as about twelve times the density of water. The experiments were carried out with great difficulty, and the result is now known to be much too large, but Bouguer's work was of pioneer importance in that it showed that the earth is denser than water, that it could not be regarded as hollow, in view of the large average density, and that mountain masses do attract.

In 1774 the Rev. Nevil Maskelyne, Astronomer Royal of Great Britain, employed a somewhat different method, choosing a mountain in Scotland for his experiments. Fig. 2 shows his arrangements. One plumb-

line was placed just south of the mountain, another just north of it. Now, from the known circumference of the earth and the measured distance between the plumb-lines, the difference of longitude between the two stations could easily be calculated, and the angle between the vertically hanging plumb-lines would have been 41 seconds of arc if the mountain were not there. Actually the angle was 53 seconds, the mountain having pulled the plumb-line six seconds out of the vertical on each side. This is indicated in the figure.

From this, as before, the relative pull of the mountain and the earth on the suspended bob could be determined, and when geologists had studied the mountain and estimated its mass the mass of the earth could be easily computed. Its average density came out 4.71 times that of water. Other trials, near Edinburgh, gave 5.32.

The weak point of the method is the difficulty of accurately estimating the mass of the attracting hill or mountain, and therefore the results obtained by methods involving the measurement of earth masses cannot be accepted as accurate. It is obviously necessary to have everything under complete control, and this has been accomplished in several ways.

Poynting's method (1890) is as follows: Two metal balls were carefully counterpoised on a very delicate balance, and the position of the balance pointer noted by an observer looking through a telescope from another room. Then a huge ball of lead weighing 350 pounds was cautiously moved to a position just below one of the sus-

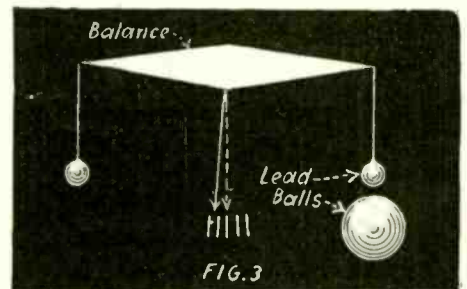


Fig. 3. This Shows Poynting's Method of Weighing the Earth. Two Metal Balls Were Carefully Counterpoised on a Delicate Balance or Scale. A Large Ball of Lead Was Then Moved to a Position Just Below One of the Suspended Balls and Its Direction Caused the Balance to Tip. The Pull of the Large Ball Could Thus Be Weighed Directly, Having Been About One Millionth of a Pound.

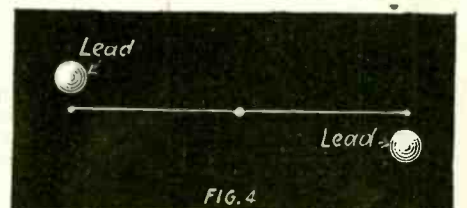


Fig. 4. This Illustrates a More Advanced Method of Weighing the Earth, Devised by Henry Cavendish, in London, in 1798. In This Case Two Small Metal Balls Are Suspended From a Fine Wire, and Two Larger Lead Balls Are Then Placed, One Behind and the Other in Front of the Suspended Balls. The Attraction of the Large Balls Thus Deflected the Rod Carrying the Small Masses, and This Deflection Could Be Recorded or Thrown on a Screen, by Means of a Mirror Mounted on the Suspension Wire and on Which a Beam of Light Was Focused.

pended balls, and its attraction caused the balance to tip slightly, as indicated in Fig. 3. The pull of the 350-pound ball was thus weighed directly; in the actual experiment it was about *one millionth of a pound*.

But the most accurate results of all have been obtained thru a method devised by Rev. John Mitchell. He did not live to carry out his project, and the experiments were first made by Henry Cavendish in London, in 1798. Cavendish took a slender rod seven feet long with a small metal ball at each end and suspended it horizontally by a very fine wire. A large ball of lead, twelve inches in diameter, was then brought up in front of one of the suspended balls, and a second lead ball of the same size placed behind the other suspended ball, as shown in plan in Fig. 4. The attraction of the large balls thus deflected the rod and the hanging balls, until the deflecting pull was just balanced by the twist in the wire. The force was then calculated from the deflection.

Within recent years the apparatus of Cavendish has been much improved and given vastly greater sensitiveness, especially by Prof. C. V. Boys, a noted British physicist. Fig. 5 shows one form of the apparatus.

The suspended balls weigh one-fortieth of an ounce each, and are about an inch and a half apart. The large attracting masses are of lead, about the size of a baseball, and weigh about six pounds each. The suspension is a fine thread of quartz, eighteen inches long and about one-twelfth the diameter of a human hair. Fig. 6 shows the quartz thread and a human hair equally magnified, and it must be admitted that the quartz thread is much the handsomer of the two. The fibers are made by melting the edges of two quartz crystals together and then quickly separating them, just as glass threads may be drawn by heating a glass rod in the middle and pulling the ends apart.

The deflection, which is very small, may be made visible to an audience in the following way. A tiny mirror is fastened to the little rod carrying the swinging balls, as shown in Fig. 7, and a narrow beam of light from an electric lamp is reflected from the mirror upon a scale on a distant wall. Any motion of the mirror is thus shown by a displacement of the spot of light on the wall, and the device practically amounts to putting a long pointer on the swinging arm, a pointer of any desired length, perfect stiffness and *no weight!*

The apparatus requires various accessories, an extremely steady support for the suspended balls being the most important. This steadiness is obtained by mounting the swinging system on a heavy iron frame or cage hung from a bracket on the wall of the room and provided with large adjustable weights at its extremities. These weights are set by trial at such points as to destroy accidental vibrations as completely as possible, and when properly adjusted they are very effective. Fig. 8 shows the arrangement worked out at the *Massachusetts Institute of Technology*.

The experiment, tho not spectacular, is nevertheless a striking one, and is occa-

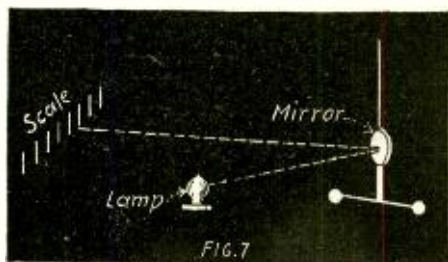


Fig. 7. This Diagram Shows How a Narrow Beam of Light Is Reflected From a Mirror on the Quartz Fiber, Suspending the Swinging Balls in the Cavendish Balance, Used in Determining the Density and Weight of the Earth.

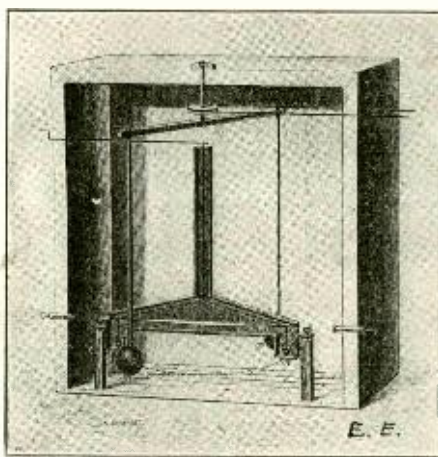


Fig. 5. The Early Cavendish Apparatus Is Shown at Left. A More Modern Type of Cavendish Balance Is Shown at the Right, and Which Was Much Improved and Gained Vastly Greater Sensitivity Under Development by Prof. C. V. Boys, a Noted British Physicist.

sionally shown at some of the larger colleges and technical schools. With the apparatus at rest, the spot of light on the wall is almost motionless, perhaps quivering a little when someone treads heavily on the floor above. But when the large lead balls are moved into position, altho nothing apparently happens for a minute or thereabouts, the spot of light then begins to creep slowly but surely increases until the displacement is a yard or more on a wall forty or fifty feet away. No haste can be expected, for with the apparatus illustrated the force on the little balls is

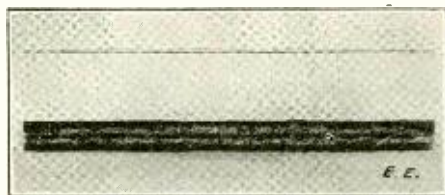
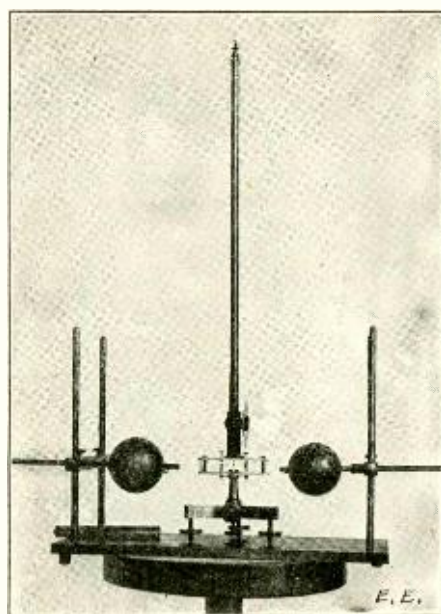


Fig. 6. This Photo Shows the Remarkable Smoothness and Even Diameter of a Quartz Thread Compared to a Human Hair, Both Equally Magnified. The Quartz Thread Is Used to Suspend the Two Small Balls in the Cavendish Balance.

no greater than the weight of about one one-hundred-thousandth of an inch of human hair!

The "conscientious objector" now rises to ask how it is possible to measure a force so absurdly small, and the answer is that the force is not measured directly, but obtained by calculation. By knowing the weights and the dimensions of the swinging parts of the apparatus, and the time required for a complete swing back and forth (just as the balance wheel of a watch swings), it is possible to calculate the force required to produce any given deflection, and in this way the pull of the lead balls on the suspended system may be figured. With the apparatus shown, one complete swing requires about three-quarters of an hour.

To sum up: The experiment determines the actual force between two known masses, at a known distance apart. If we consider a ten-pound ball lying on the ground we have a closely similar case. We know the pull of the earth on the ten-pound ball—obviously ten pounds' weight. We know the distance between the ball and the attracting center of the earth—four thousand miles. We know the mass of the ball—ten pounds. With the Cavendish apparatus we start by knowing the distance and both masses, and then determine the force; with the ten-pound ball on the ground we



start with a knowledge of the force, the distance and one of the masses, and compute the other mass—the mass of the earth. A simple proportion, derived from the experiment just described, then gives the mass of the earth directly.

The resulting figure is so stupendous that it is utterly meaningless: the mass of the earth is 6,000,000,000,000,000,000 (six sextillion) tons. It may be added that its average density is 5.52 times that of water.

THE "UNIVERSE" ON A SMALL SCALE.

"Mars always challenges interest," says William Joseph Showalter in a recent communication to the National Geographic Society.

"It is quite generally believed that Mars has ice-capt poles. The telescope reveals white spots at the poles that have every appearance of being like our ocean Polar region. They advance toward the equator in winter and retreat in summer. In the summer of 1916, Pickering, who, with Lowell, has led the school of astronomers who believe they can see canals on Mars, said that he found the white caps stretching farther down toward the equator than he had ever seen them before.

"He said that if there was any connection between the weather of Mars and that of the earth the winter of 1916-17 would be the coldest in many years. It was true. May it yet be possible to do long-range weather forecasting on the earth by studying the waxing and waning of the ice-cap on the South Pole of Mars?"

"Perhaps our most graphic picture of the solar system is given by Herschel. Imagine a circular field two and a half miles in diameter; place a library globe two feet in diameter in the very center; eighty-two feet away put a mustard seed. The globe will represent the sun and the mustard seed Mercury.

"At a distance of 142 feet place a pea, and another at 215 feet. These will represent Venus and the earth both as to size and distance. A rather large pinhead at a distance of 327 feet will speak for Mars, and a fair-sized tangerine a quarter of a mile distant will stand for Jupiter. A small lemon at two-fifths of a mile will play the rôle of Saturn, a large cherry three-fourths of a mile distant will answer for Uranus, and a fair-sized plum at the very edge of the field will proclaim Neptune.

"Eighty moons would be required to make one earth. A player there could throw a ball six times as far as it can be thrown on American diamonds. A man weighing 150 pounds there would weigh 900 on the earth."

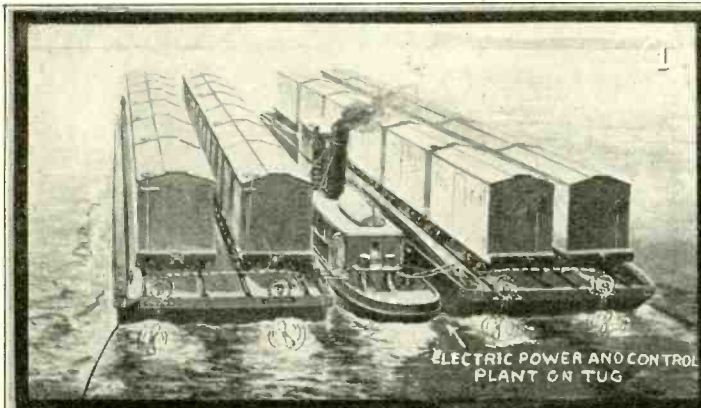
Electrifying Canal Boats and Barges

By ROBERT G. SKERRETT

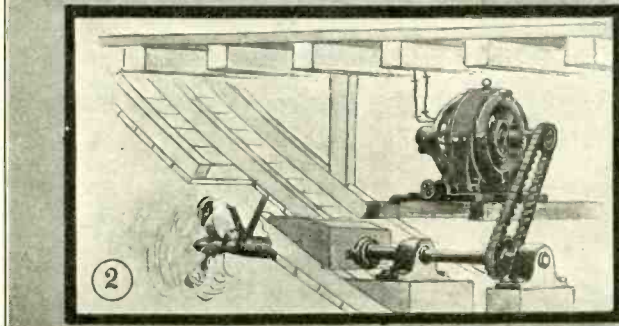
THE towboat of to-day does not make the most of its store of mechanical energy. It fails for a variety of reasons, but primarily because its screw or screws are incapable of getting a full grip upon the

Marine Transportation by Electrified Trailers

guidance and, within the limits imposed by the linking electrical conductor, enjoy considerable freedom of action. With each charge properly motored and fitted with a suitable screw for a given maximum speed, and the power boat similarly equipt for



ELECTRIC MOTORS DRIVING PROPELLERS ON CAR FLOATS



1—In This Case the Flanking Car Floats are Each Equipt with Twin Screws Electrically Operated, and the Control of the Entire Group is in the Hands of the Man in the Pilot House of the Central Vessel. By "Going Ahead" On One Barge and "Backing" with the Other, It Would Be Entirely Feasible to Turn the Whole Tow Within a Small Circle. 2—This Diagram Illustrates One-half of the Propelling Equipment, An Electric Motor, of a Car Float. 3—A Photograph of the "New Era" Preceding the "DAWN" from Which She Obtained Her Energizing Current. Nearby is Seen the Pulley Over Which the Electrical Conductor Passes and Immediately Below is Visible a Part of the Reel At the Bow of the "DAWN." 4—A Fleet of Electrically Propelled Barges Making Their Way Thru a Canal. It Will Be Observed That the Prime Mover, the Source of Energy, is a Freight-laden Craft At the Rear of the Line.

water when drawing one or more powerless craft. A propeller to be efficient must actually advance thru the water proportionately to its speed of revolution, and the force of its drive is dependent upon the number of times it turns in the course of a minute. If it revolves rapidly without moving on it churns up the water, pumps down air, and, to a more or less pronounced extent, whirls around in a mixed or agitated medium which is hard to get hold of effectively.

Now this is pretty much the state of affairs when a tug heads the line of a string of barges or canal boats. Should the convoy be laden, then the tug struggles with all of its power to make headway, but the rate of advance is not in keeping with the speed at which the steamer would move if free and developing the same measure of energy. In short, its task is something akin to a freight locomotive, attached to a train, trying to mount a gradient on wet tracks, but with this difference—the tug must take the water as it finds it, but the locomotive can "sand the rails."

But the towboat is further hampered by the conditions under which it has to work. For instance, its churning propeller drives rearward a veritable mill race—directly against the bows of the oncoming convoy. As a consequence, this disturbance virtually adds to the load to be drawn by turning the steam vessel's own efforts against

itself. In these days of high prices and general insistence upon operative efficiency there is a crying need for something better than the tug as a handy marine tractor. Fortunately, a line of improvement has been pointed out and convincingly demonstrated by Mr. William T. Donnelly of New York City.

Mr. Donnelly proposes to turn the erstwhile tug into a navigable power station, generating electricity for its own drive and for the unit propulsion of its string of tows. The several vessels that would thus draw upon the floating central station would be equipt with electric motors for driving their respective screws. Making due allowances for the power losses between the generator and the motors dependent upon it, taking into account wastage incidental to transmission, et cetera, Mr. Donnelly has established the fact that a given initial power development can be thus apportioned and yield distinctly superior results in the common speed of a nautical train, so to speak. Further, the central station can, with equally good effect, either head or follow its charges or, if desirable, the tows can be secured on one or both sides of the master craft.

To begin with, an arrangement of this nature reasonably promises to add tremendously to the ease with which a number of boats so energized can thread a tortuous channel or a busy waterway, for each unit will be susceptible of independent

efficient operation at towing speeds. The whole string would be able to maintain a pace much faster than that possible if the same propulsive effort were exerted by a tug, as is now the case.

Mr. Donnelly has planned that his system be adapted to coastwise and ocean transportation. In the latter case, while the electric cable would not be expected to exert a pull, still he is satisfied, by reason of technical developments, that the conductor can be built strong enough to permit it to serve as a tow line in an emergency, involving motor breakdown on any of the convoy. For this purpose his cable would be patterned with a copper core suitably insulated, then wrapt with hemp and finally armored with steel wire, the latter giving the needful strength and serving at the same time as a "ground" for the circuit. For deep-sea work, the object in making the distributing cable strong enough to bear a linking stress would be to hold the various units of the tow together during a storm, thus taking care of "lame ducks" and enabling the whole fleet to help one another for the time being, when heading up into the wind and waves.

As a substitute for river freight-and-passenger steamers and kindred craft plying our Great Lakes and semi-protected coastal waters upon daily schedules, Mr. Donnelly would have recourse to specially designed navigable centra stations, capa-

(Continued on page 1319)

Talking Over a Sunbeam

By PROF. A. O. RANKINE

Professor of Physics, Imperial College of Science and Technology, London, England.
Written Especially for the Electrical Experimenter.

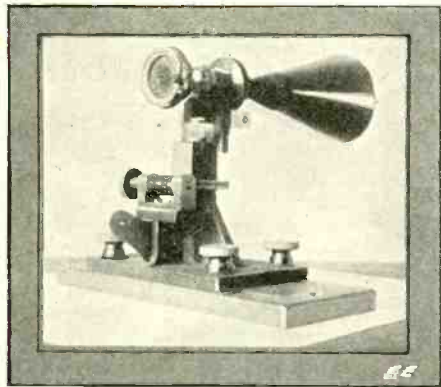


Fig. 3 Shows the Mount of the Vibrating Mirror On the Phonograph Sound Box. When the Voice Waves are Spoken Into the Trumpet They Cause the Diaphragm to Vibrate, and Also the Small Mirror Attached On An Arm, Secured to the Center of the Diaphragm.

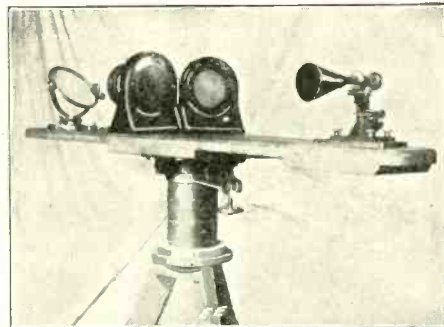


Fig. 4. This Shows the Latest Type Light-ray Transmitter Arranged for Use with Light from the Sun.

FORTY years ago ordinary telephony was a novelty. Today the telephone is part of the equipment of most modern houses, and we use it without often thinking of the ingenuity which resulted in its invention. It comes as a surprise to find that telephony by means of light, the *Photophone*—which is still a great novelty—was invented almost as soon as the ordinary telephone. Appropriately enough, the inventor of both was one and the same person—Alexander Graham Bell.

It was in 1880 that he succeeded in communicating speech, by means of a beam of sunlight, over a distance of about 200 yards. This was a very remarkable achievement, and it is difficult to understand why it has failed to develop to any great extent until recently. Various experimenters have worked intermittently on the subject, with a view to improving Graham Bell's methods, but the fact remains that development has been extraordinarily slow in comparison with that of telephony over wires. The subject is, however, a very fascinating one, and it is the purpose of this article to explain the principles and methods involved.

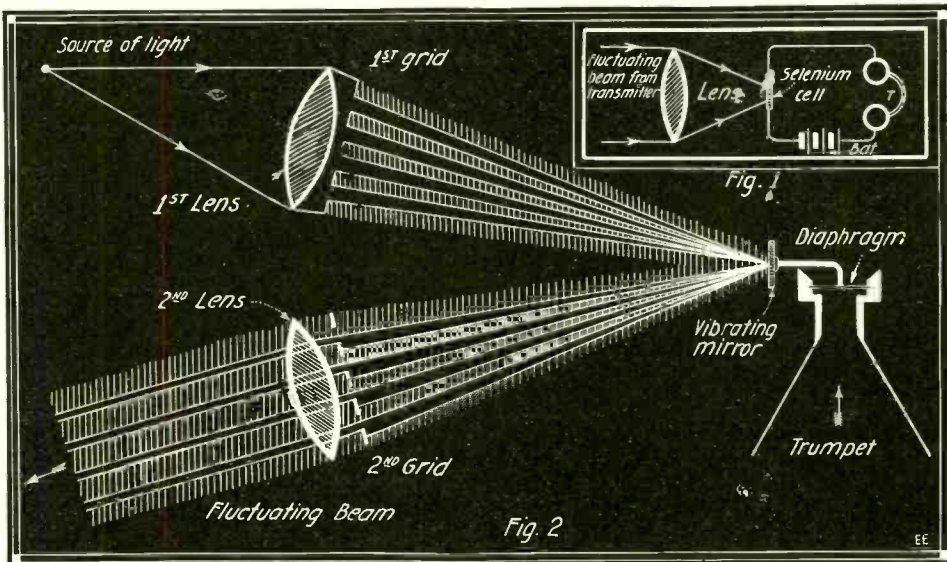
In ordinary telephony we speak into the transmitter and thereby cause a diaphragm to vibrate in accordance with the vibrations constituting the speech sounds. The diaphragm in moving to and fro compresses to a varying degree the carbon granules contained in the microphone. Compressed carbon is a better conductor of electricity than carbon loosely packed, and therefore, if we connect an electric battery to the microphone, we obtain a current of electricity which fluctuates in magnitude in accordance with the vibrations of the diaphragm. These fluctuations of current are conveyed

to a distance by means of wires, and, passing thru the electromagnet in the receiver, alter the amount of the attraction which the magnet exerts on an iron diaphragm, which is thus set in vibration, and the original sounds are reproduced.

Now, it will be clear that any means by which we can cause a current of electricity to fluctuate in accordance with the vibrations of speech will provide a method of telephony. And if this current can be operated by means of a beam of light projected from some distance away, it will be possible to dispense with the wires between sending and receiving stations. Graham Bell solved this problem by using the remarkable element called *selenium*. This substance is, ordinarily, a bad conductor of electricity, but if it is illuminated by a beam of light, its conductivity is increased. Thus if a thin layer of selenium is connected with an electric battery and kept in the dark, a small current flows thru it. If it is now placed near a bright light, the current is very much increased. Different colors have different effects. Red light is more effective than blue, but, generally speaking, the whole of the constituents of white light contribute to the increased conductivity. It is not within the scope of this article to describe the manufacture of a selenium cell. Suffice it to say that it has to be prepared in a thin layer, annealed at a special temperature, and mounted with two terminals

means of the lens on the selenium cell. What will happen? Every time the light gets bright the current in the receiver will increase. Every time it gets dim, there will be a reduction of current. Actually, of course, these fluctuations of light occur far too rapidly to be visible—perhaps 1,000 per second. But the selenium is affected by them, and the variations of light are copied by the variations of current, and one hears, as it were, the *light speaking*. Figure 1 then represents the arrangement of the receiver in "telephony by light."

We have now to consider the problem of the transmitter, that is, the means whereby the vibrations of speech can be impressed upon a beam of light, so as to make it fluctuate accordingly. There are two possible methods of procedure. One may either endeavor to make speech vibrations control the brightness of a source of light itself, or use the vibrations for the purpose of interrupting the light proceeding from a steady source. The latter procedure was adopted by Graham Bell, and he describes two devices in this connection. It is unlikely that the first of these ever proved successful, but it is mentioned



1—Simple Form of Receiving Circuit for Use in Photophone, Comprising Light-sensitive Device, Such as a Selenium Cell, Connected in Series with a Battery and Telephone. 2—This Diagram Shows How Rays from Source of Light are Past Thru a Lens and Grid On to a Vibrating Mirror Mounted On an Arm Attached to a Phonograph Sound-box Diaphragm at the Right, and How This Beam is Reflected Thru a Second Lens and Grid On Its Way to the Receiving Set.

for leading the electric current in and out. It then goes commonly by the name of a "selenium cell." It acts as a sort of electric valve, permitting a big current to pass when brightly illuminated, and only a small one when in the dark.

Look now at Figure 1. On the right hand side are shown a selenium cell, a battery and a telephone receiver in series. A current is flowing thru the receiver, but it is only when the current fluctuates that sounds will be heard. Now, later on, we shall describe how it is possible to make a beam of light fluctuate in intensity in accordance with the vibrations of speech sounds. For the moment let us suppose we have such a beam and that we focus it by

here because of its relation to the author's method, which will be described later. Bell proposed to construct two grids consisting of parallel strips alternately opaque and transparent. One of these grids was to be fixed, the other attached to a diaphragm at the end of a trumpet. The grids were to be placed parallel to one another, and originally so that the opaque strips of the one covered up the spaces of the other. A beam of light fell upon the grids, and the amount of light penetrating the pair would depend on their relative position. By speaking into the trumpet the diaphragm would be made to vibrate, and, consequently, the "shutter" formed by the grids

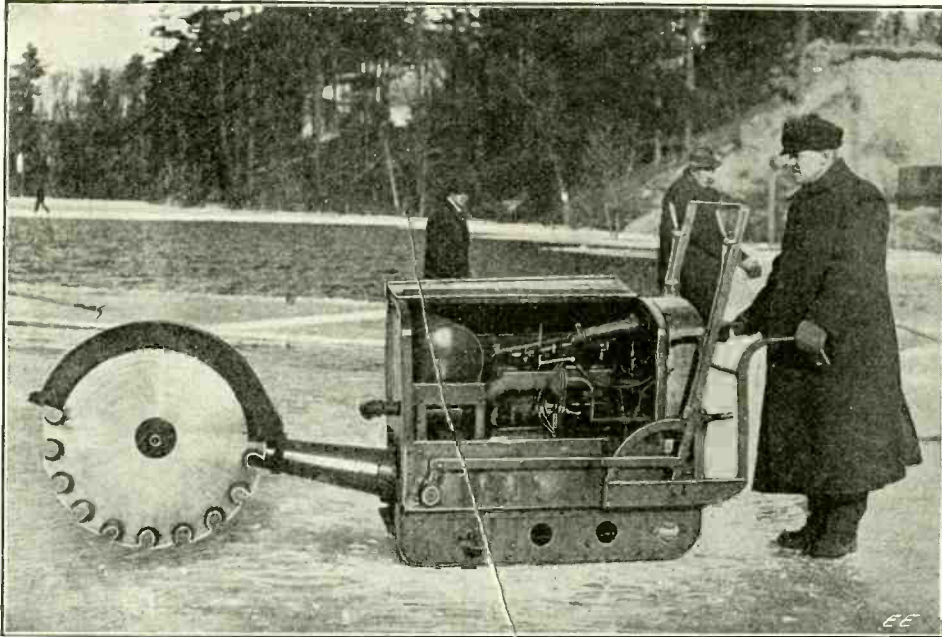
(Continued on page 1315)

Sawing Ice By "Motor"

It takes a thief to catch a thief, they say, and so it has finally come to pass that the electric current steps in to really cut ice with anything like efficiency,—or what was once a *current* of water. In other words, this is a case of when current meets current—to paraphrase the old adage "when Greek meets Greek."

The twentieth century way of cutting ice on ponds and rivers, is to utilize electric current to operate a powerful motor, which in turn is connected thru gearing or directly to a large saw which tears thru the ice at prodigious speed.

With the aid of this powerful elec-



The 20th Century Way of Cutting Ice on Ponds and Rivers, Is to Utilize Electric Current as Shown Herewith. The Current Is Transmitted to the Motor Within the Saw Machinery, Thru Flexible Rubber-Covered Cable Running to the Shore. Gasoline Driven Saws Are Also Used.

tric ice sawing machine, which obtains its current thru a flexible insulated cable, running to an electric power line near the pond, the work of putting 60,000 tons of ice in the ice-house of the Boston Ice Co., at Wellesley, Mass., was completed this winter in record-breaking time.

The ice reaches the machine in twenty-foot squares and the four cylinder saws cut them into the regulation size cakes.

Besides the electrically driven saws there are in use many gasoline engine driven saws for ice cutting. A Ford engine makes a good powerful prime mover for such a saw.

This Fire Alarm "Talks"

NOW that everything in the line of safety apparatus and fire announcers has been invented, a New York genius, a fireman, to be more specific, has perfected and patented a device which not only gives instant alarm in case of fire, but also notifies its precise and exact location, making the announcement when the heat in a room reaches about 130 degrees Fahrenheit, which is considerably lower than the temperature at which the sprinkler system would operate. In this way, announcement of the fire is made long before the automatic sprinklers flood the apartment or building with water, thus ruining by water a lot of material which

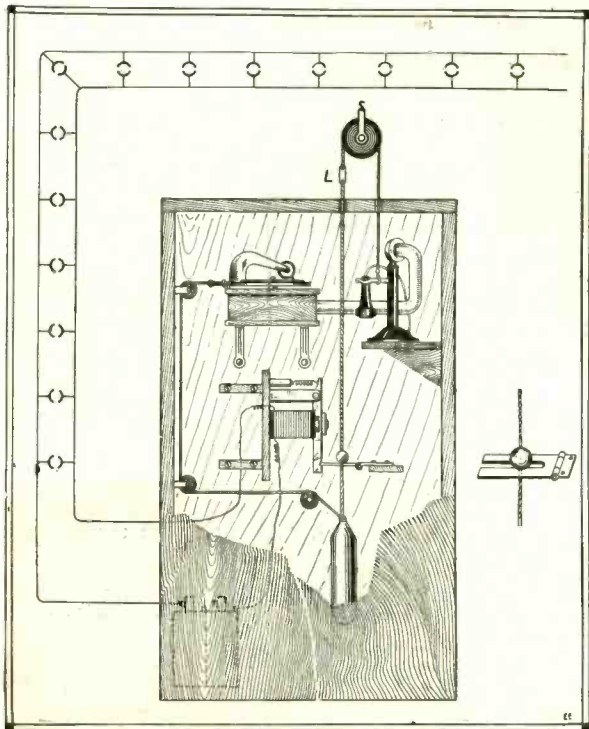
could have been saved if the sprinkler had been promptly shut off. Knowing the difficulties and the faults of the methods used to-day, the inventor has developed mechanisms which are actuated by weights in which electric current plays but a very small part, and as long as gravity exists the mechanism is absolute and positive in its action.

Fuse links are another feature of this invention. These join together lengths of cord or very thin wire. This taut wire running thru a series of pulleys finally terminates in the fireproof box containing the phonograph apparatus. A weight

is suspended to the cord which is also connected directly to the lever starting the phonographic mechanism. Another cord runs up thru the box and has another fuse link inserted in it, the latter outside of the box as illustrated. The cord now passes thru the box again and is connected to the Bell telephone receiver hook.

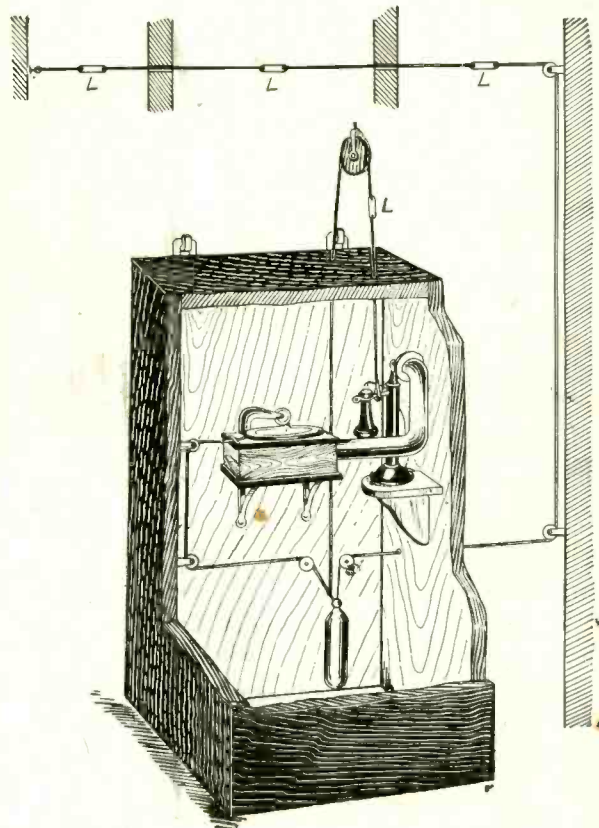
When a fire breaks out in any particular portion of the building, one of the fuses

(Continued on page 1317)



"Hello, Operator!— There is a Fire at 188 Blank Street, in the Warehouse on the Second Floor, Front. Notify Fire Headquarters at York 1,000. Central, there is Etc." This is a Fire Alarm Call SPOKEN Over the Telephone by This Latest Fire Alarm Device. Diagram at Right Shows Fusible Links "L" Inserted in Taut Cord Which Releases Phonograph, As Soon As the Links Are Melted.

Diagram at Left Shows Electric Thermostats Which May Be Placed on the Ceiling About 10 Feet Apart, and Electric Relay or Tripping Device for Starting Phonograph in Case of Fire. When the Fusible Link Just Above the Cabinet Melts, the Phonograph is Shut Off, and the Telephone Hook is Restored to Normal Condition.



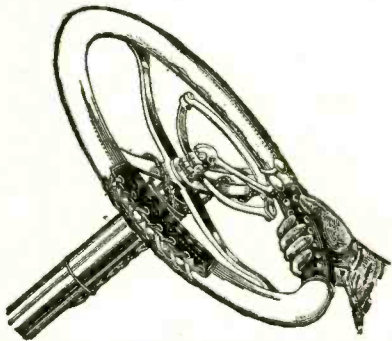
...Automobile News...

ELECTRIC STEERING WHEEL HEATER.

This newest electric winter driving comfort consists of two neat leather covered grips, one for each hand, which lace on to the steering wheel at any place convenient for driving. Special resistance wires are cleverly arranged between two copper plates in such a way that a very small current is sufficient to keep the grips warm. They operate on the same principle as an electric heating pad. After a certain heat is obtained the heaters will get no hotter, but retain an even temperature. They are simple, neat and efficient.

A type designed specially for the Ford car is heated by electricity from the magneto.

Safety demands a firm grip of the steering wheel which you cannot get with cold fingers. The new device keeps your fingers limber, with only a pair of light gauntlets on, which enables you to grip the wheel tight on the coldest winter days, giving you a safe feeling even while driving over pavements slippery with ice.

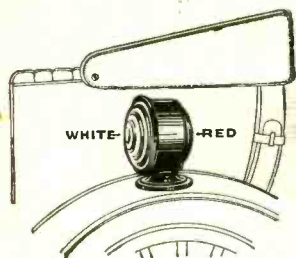


Electrically Heated Steering Wheel for Autos.

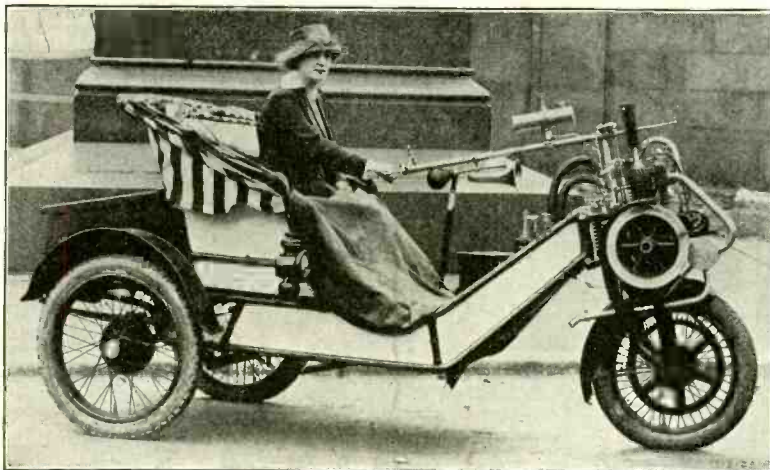
The heater coils use only half the current necessary for electric headlights. They are operated from the same storage battery or magneto that supplies the headlights and are easy to attach. They can be put on in ten minutes. There are no bolts or screws, or holes to bore; lace on—wire up—that's all.

AUTO PARKING LIGHT.

In order to save current while automobiles are standing idle on the streets, an enterprising concern has developed this auto parking light. This lamp is attached to the rear fender and takes the place of the regular head and tail lamps when the car is not being operated. The 2-candle-power bulb is said to consume only about a quarter of the current the regular lamps use. A 2½-inch white semaphore lens is furnished in front of the lamp and a red semaphore lens in the rear. An "off" and "on" switch is installed on the lamp itself.



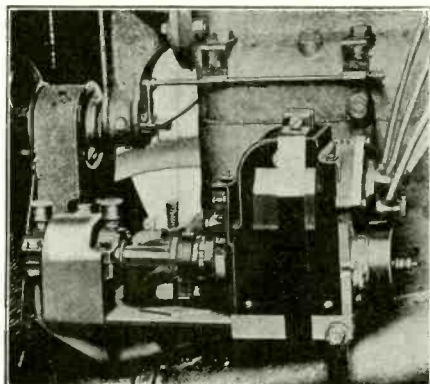
A Small Current-Saving Electric Parking Light for Autos. Lamp is Attached to Rear Fender. Flashes White Ahead and Red to Rear.



This is the "Ford" of Europe in the Central Sections. The Power Plant is Entirely Mounted on the Front Above the Wheel. Photo—Edna Purdy.

NEW MAGNETO FOR FORDSON TRACTOR.

One of the neatest and most effective easy-starting ignition appliances yet produced for the Fordson is the new model magneto fitted with an impulse starter coupling. One slow turn of the crank of the engine gives ignition results ordinarily had at 500 revolutions per minute, due to the impulse starter giving a quick spin to the magneto rotor shaft. The new outfit is chain driven from the front end of the crankshaft, the unit being located on the left side of the engine, where it is away from exhaust heat, a most important advantage when the destructive effect of the heat is considered. The heat quickly destroys distributor blocks and reduces the magnetic life of the magnets. In this magneto all this has been eliminated. All that is needed for installation is a wrench. No holes need be drilled, or any parts removed or discarded. As shown in the accompanying illustration, the magneto rests



Showing New Magneto for Fordson Tractor Installed on Engine. It Has an Impulse Starter, Giving Full Spark on One Revolution.

on a support which itself is braced by brackets attached to the crankcase. The instrument is driven by a short shaft at one end of which is an adjustable coupling and at the other two bronze bearings mounted on either side of a 16-tooth sprocket. This sprocket is driven by a silent chain from another sprocket at the forward end of the camshaft. The silent chain is protected by a guard which is provided with an oil hole so that the chain may be given an occasional oiling. The chain is easily adjusted.

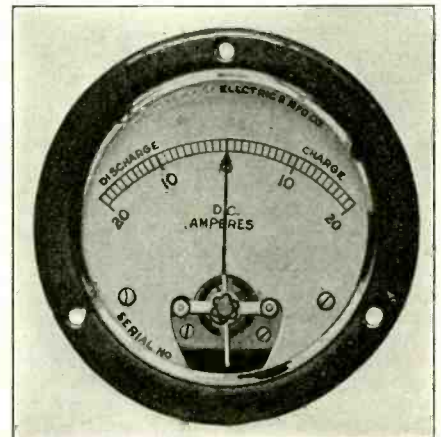
NEW AUTOMOTIVE AMMETERS.

Two new ammeters for automobiles, motor boats, airplanes and other automobiles have recently been added to a well-known line of instruments.

The type of ammeter shown is an inexpensive instrument, but is rugged, reliable and amply accurate for the service for which it is intended. It operates on the polarized-vane principle, without springs or moving coils, is dead beat and can withstand momentary overloads of 500 amperes without injury.

The dial is two inches in diameter, and the scale which indicates amperages of from 15 to 30, charge and discharge, is an inch and a half long. Either black dials with white figures and needles, or white dials with black figures and needles can be supplied. The meter is arranged for flush mounting in the dash or cowl.

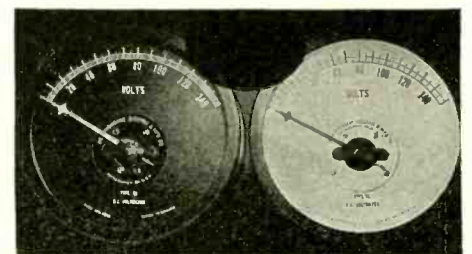
The second type of ammeter was originally designed for government radio serv-



Latest Type of Auto Ammeter. White or Black Dials Are Available on These Meters.

ice, and is the smallest d'Arsonval instrument made. Tho but two inches in body diameter, this instrument possesses all of the delicacy of action, high sensibility, great accuracy and ruggedness of the standard switch-board type. It is supplied for flush as well as projection mounting. Voltmeters with scales ranging from 3 volts upward are also supplied in this style of instrument.

Many electrical instruments can be furnished, when desired, with black dials, the figures, scale, and pointer being white. The comparative illumination on black and white dial instruments is vividly shown by the accompanying illustration, which shows a white and black dial instrument mounted side by side on a switchboard and illuminated by the same lamp.



Comparative Illumination on Black and White-Dial Instruments

Popular Astronomy

By ISABEL M. LEWIS, M. A.

Of the U. S. Naval Observatory

TO appreciate the beauties of a starlight night get as far away from the heart of the city as possible. No observations of the heavens can be made thru slit-like openings between rows of houses with the glare of street lights in one's face and the smoke, dust and haze of a busy city enveloping one on all sides. Even such celestial jewels as Sirius, Vega and Spica shine with a pale and sickly light for the city dwellers.

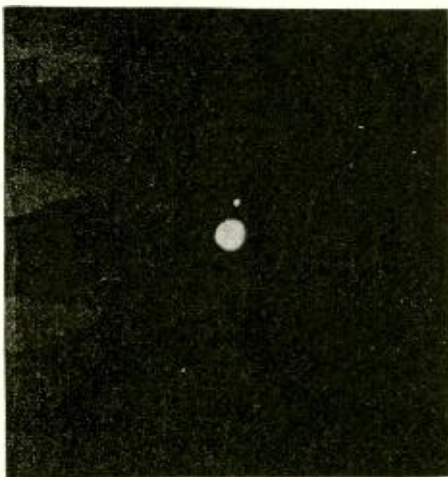
Get out in the open if you want to become acquainted with the stars and choose, moreover, a clear, moonless night, for bright moonlight blots out fully half of the stars that would otherwise be visible to the naked eye.

A good test of the "seeing" is the visibility of the Milky Way. If you always view the heavens from the outskirts of a great city the Milky Way really means nothing to you, but if you have the good fortune to be aboard ship on a clear, dark, moonless night or on the western prairies or near the summit of a mountain or at some farm or country home far removed from the city you will not fail to see at some hour of the night a portion of this magnificent girdle of the heavens, the groundwork of the universe, where suns are piled upon suns in riotous profusion and where the misty light of the luminous nebulae leads into the dark caves, rifts and lanes produced by the non-luminous nebulae, the whole giving us the impression of an elaborate and intricate structure that reveals the workings of a Master-mind and overwhelms us with feelings of awe.

In attempting to explore the wonders of the heavens with an opera-glass some amateurs have complained that they could not find Jupiter's four moons. This may be due either to poor observing conditions, as mentioned above, or to the use of a poor glass or to failure to recognize these minute points of light when visible. All four moons will probably not be visible at once, as one or more of the moons will usually be in transit across the planet or occulted behind the planet or eclipsed by its shadow.

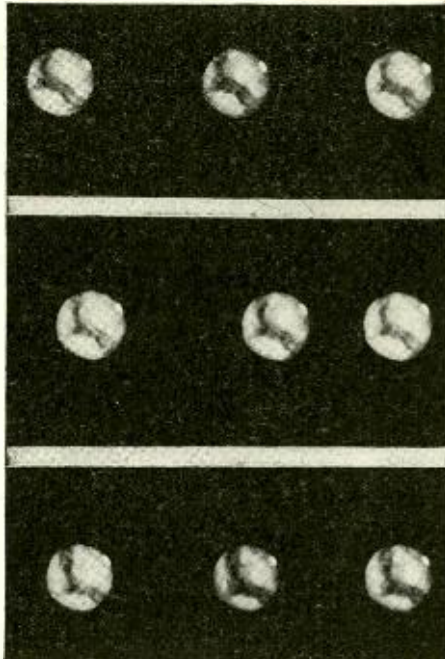
Continued observing from night to night will reveal the fact that these little bodies are actually revolving around the planet.

With a telescope that was in some respects inferior to a modern field glass Galileo determined the periods of revolution of all four satellites within a few nights of their discovery.



An Interesting Telescopic View of the Planet Neptune with Its Moon. The Little White Spot Near the Large One Is Neptune's Moon. An Unusual Photograph, as the Little Satellite is a Very Difficult Object to View, Even Thru a Large Telescope.

Observing The Heavenly Bodies



Mars: Region of Syrtis Major. Photos Taken at Yerkes, September 28, 1909, Showing Changes Due to Rotation. Exposure 3 to 4 Seconds.

Some have complained also of the "dancing" of the stars when viewed thru a spy-glass or small telescope of greater power than an ordinary field glass. It is useless to attempt to use any instrument more powerful than a field glass or opera glass without a tripod or rigid mounting of some form.

The more powerful the telescope the more carefully it must be mounted.

Buildings for housing powerful telescopes are built, if possible, far away from street-car lines and railroads for the trembling of the ground caused by the passage of trains and cars affects the instruments. Telescopes of four inches or more in aperture are of little value unless mounted on a stone or cement pier and housed in such a way as to be entirely free of the floor, as even walking across the floor would otherwise cause the instruments to tremble. Temperature and atmospheric effects must also be considered, and to equalize the inside and outside temperature and overcome the "boiling" of the atmosphere due to unequal temperature the astronomer throws open the dome of the observing room for some time before he expects to begin his observations.

At most large observatories "visitors' nights" are a regular feature. Visitors to Mt. Wilson Observatory observe the great 100-inch reflector from a glass encased observing room that they may introduce no temperature effects upon the sensitiveness of this powerful instrument.

There are certain celestial objects that nearly every one desires to see thru a telescope.

We all want to see the Moon and Saturn's rings and some of our near neighbors in the solar system, as well as some of the most interesting objects that lie many light years away, the great nebulae and the globular star clusters and the double stars

The best general view of the moon, as many are aware, is obtained a few days after the first quarter, but the best time to study any particular marking is when it lies near the terminator, the line separating the light from the dark portion of the moon's surface. The marking, crater or mountain or cleft, as the case may be, is then illuminated by a low sun and casts a long shadow, which indicates the height and form of the object. Lunar objects that stand forth beautifully when the sun is rising or setting upon them sometimes entirely disappear from view under a high sun. The poorest of all times to observe the moon is at the time of full moon, when there are no shadows and all detail of the lunar markings is lost in a flood of sunlight under vertical illumination.

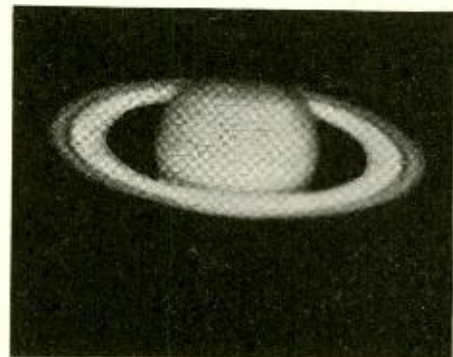
The most interesting views of the moon from a popular point of view are those obtained with a six- or eight-inch telescope showing the entire lunar disk in the field of view.

Highly magnified views taken with the great reflectors and refractors show the moon to us piece-meal, for, as the magnification increases, the angular width of the field decreases, and instead of a view of the entire lunar disk we get a "close-up" of a very limited portion of the surface showing great detail.

Venus in the telescope is a surprisingly beautiful little object if seen near its time of greatest brilliancy, halfway between inferior conjunction and elongation, when it appears as an exquisite little crescent moon. With a magnifying power of forty-five Venus appears exactly as the moon does to the unaided eye when it is four days old, tho, of course, it shows no distinctive markings such as appear on the lunar surface, for the surface of Venus is screened from our view by its dense atmosphere.

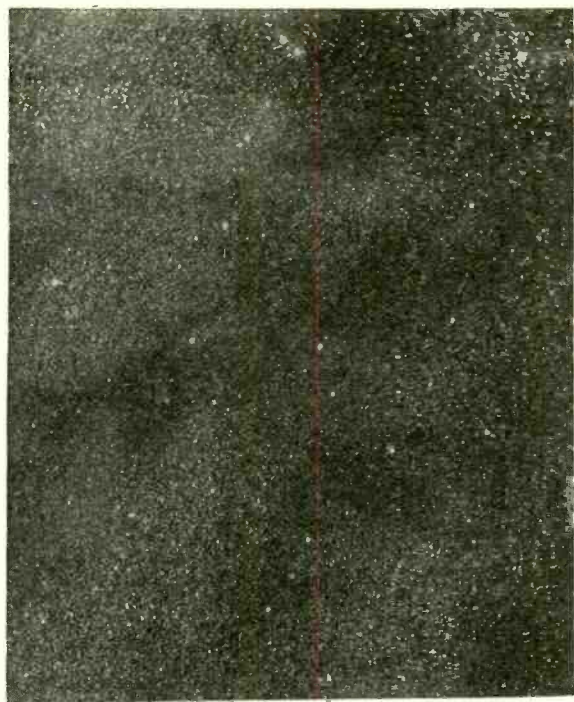
Astronomers prefer to make their observations of Venus and Mercury in the daytime, for they are then higher in the sky and the observations are not marred by the disturbing atmospheric effects of refraction, haze and "boiling" that are always greatest near the horizon.

Saturn is one celestial object that hardly ever disappoints us. His rings are a source of never-failing interest to everyone. To be sure, they disappear from view for a very brief period once every fifteen or seventeen years, when our line of vision



Remarkable Photograph of Saturn, Taken November 17, 1911, with the Sixty Inch Telescope of the Mt. Wilson Observatory. This Shows It as It Appears in a Powerful Reflecting Telescope.

lies directly in their plane, but such disappearances are comparatively rare and, even at such times, we cannot fail to be in-



At Left—Great Photographic Nebula Near Pi and Delta Scorpii. Photographed by Mr. Barnard with the Bruce Telescope. Exposure 8 Hours and 45 Minutes. One of the Most Beautiful Sights in the Heavens.



At Right—Encke's Comet, Taken at the Yerkes Observatory, October 29, 1914. Note the Great Lengths of the Star Trails, Which Indicate Rapid Motion of the Comet. This Comet is Noted for Having the Shortest Period of All Known Periodic Comets, Three and Three-Tenths Years. At Its Brightest, It Is a Faint Telescopic Object, Showing no Trail.

terested in his belts and his moons and the pronounced flattening at the poles, which is then particularly noticeable.

Jupiter also delights us all with his constantly changing belts and varied coloring, and the phenomena of his four historic moons that show up so beautifully even in the small telescopes.

Mars in the telescope is usually a disappointment to every one, and the astronomer never presents him as a show object; in fact, he prefers not to show him at all unless you are prepared beforehand. The Martian disk is small, for Mars is a tiny world after all. Its surface is less than a third that of the earth, it must be remembered. To glimpse the Martian canals one needs a trained eye and the skill in observing that only comes after long continued practise, as well as exceptionally fine atmospheric conditions, such as are not usually to be found on visitors' nights at the observatories of our large cities.

It must be remembered that the maps of the Martian canals that most of us have seen are the results of years of painstaking observations made under superlatively fine observing conditions, and that only a small proportion of the total number of canals have been seen at any one time. A canal may flash forth during a moment of exceptional seeing and then be dimmed by Martian mists or terrestrial haze. Even the chance observer will note the snow caps, however, and the most conspicuous surface markings.

The outer planets, Uranus and Neptune, are so far away that they are of little interest even in the large telescopes.

In delving into space beyond the solar system, of greatest interest to all are the star clusters and nebulae and the double and multiple star systems, as well as the many wonderful regions of the Milky Way.

Aside from the Great Nebula in Orion, which is, indeed, a wonderful object in the telescope, the nebulae are, on the whole, disappointing when observed directly. Here is one instance in which the photographic plate, on account of the cumulative effect of light, is vastly superior to

the human eye. All the wonderful detail brought out in the photographs of the nebulae and star-clusters is the result of several hours of photographic exposure.

The Great Spiral Nebula in Andromeda, the Trifid Nebula and many of the wonderful double armed spirals with which we are familiar thru their photographs show up quite disappointingly in the telescope because they appear so extremely faint to the human eye.

Star clusters, as well as nebulae, appear at their best photographically. A few of

the coarser globular clusters are wonderful objects in the larger telescopes. With small three-inch telescopes it is difficult to make out the stellar nature of even the coarsest of the star clusters.

Double and multiple star-systems can always be found even with as modest an instrument as an opera glass, for these systems abound in the heavens. At a conservative estimate at least one out of every four stars belongs to a physically connected system composed of two or more stars revolving around a common center of gravity.

One of the tests of the power of a telescope is its ability to separate close double stars. A six-inch telescope will separate a double star into its two components that appears as a single star in a three- or four-inch telescope, while it will in turn show as a single star a close double that can be separated by a telescope of greater aperture.

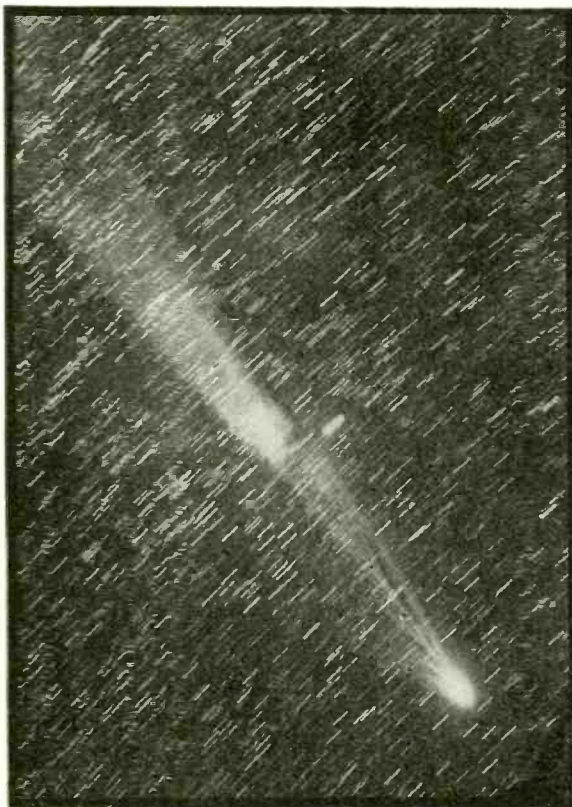
Some double stars are so close that no existing telescope is powerful enough to separate them, tho the shifting of spectral lines will reveal that a companion star is present. Such double star systems are called *spectroscopic binaries*.

The wider doubles are frequently of beautifully contrasting colors, such as green and red or blue and gold. Many of these gems are visible in the smallest telescopes and they are among the wonders of the heavens that every one will want to see.

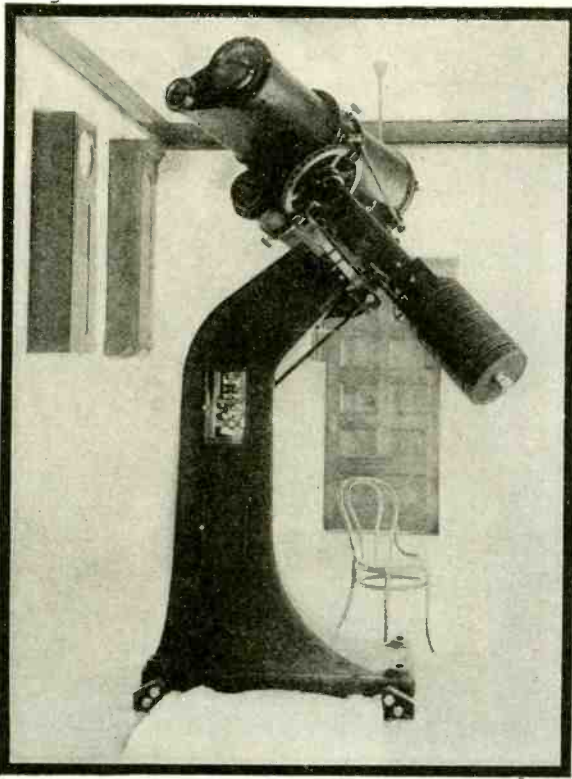
Often the faint companion of a brilliant star will be invisible in small telescopes because of the glare of light from its bright companion. Such is the case with the companions of Rigel and Antares.

Close satellites of the planets Jupiter, Saturn and Mars are also difficult to find, not only because they are small, but because they must always be so close to the planet that they are dimmed by its light. For the same reason our terrestrial planets are invisible at the distance of the outer planets.

Comets are not interesting objects to view telescopically, as they are extremely faint. No extended surface, such as the disk of a planet or a comet can appear brighter telescopically than it does to the naked



One of the Most Interesting of All Comets (Morehouse Comet) Because of the Sudden and Unexplainable Changes in Form and Brightness That Were Continually Taking Place. The Telescope Was Kept Pointed on the Comet While the Photograph Was Being Taken, Which Caused the Star Images to Trail Across the Plate. Taken at the Yerkes Observatory, October 15, 1908.



At Left—The Bruce Telescope of the Yerkes Observatory, Showing the Three Objectives by Means of Which Different Sized Photographs of the Same Regions May Be Photographed Simultaneously. Magnificent Photographs of the "Milky Way" Were Taken by Mr. Barnard with This Instrument, Temporarily Located on Mount Wilson, Cal. The Plate Holders Are Placed at the Eye-End of the Telescope.

At Right—A Universe of Suns: The Great Star Cluster in Hercules (Messier 13). Distance from the Earth Estimated To Be 37,000 Light Years. Photographed with the Sixty-foot Reflector of the Mt. Wilson Observatory. Exposure 11 Hours. This Is Visible to the Naked Eye as a Faint, Hazy Patch of Light. In a Three-Inch Telescope, Its Stellar Nature Can Hardly Be Distinguished.



eye, for altho the increase in light is proportional to the square of the diameter of the lens, the magnification of the object by the eyepiece spreads this light over a greater surface and the total amount of light received by the eye is less than when the object is gazed at directly.

The total amount of light received from the stars, however, is greatly increased as the diameter of the lens increases, because they appear as points of light. The bright stars can be seen in the daytime in the telescope and millions upon millions of stars invisible to the naked eye can be seen in the telescope. Many more millions that cannot be seen by the eye, even with telescopic aid, can be brought out by the cumulative action of light upon the photographic plate.

Photography is of little value in studying in detail surface markings of the planets on account of the rotation of the planets on their axes, which makes long photographic exposures impracticable.

The Martian canals have lately been photographed at the Lowell Observatory, and Dr. Slipher's wonderful photographs of Jupiter give unsurpassed general views of the Jovian markings, but all the more delicate changes in tint and shade of the markings of Jupiter, Saturn and Mars and, in fact, of the lunar markings as well, can be caught only by the human eye, which

excels the photographic plate in catching *fleeting glimpses of fine detail* and in utilizing the rare instants of *perfect seeing* which occur from time to time in all localities.

Photography is far more valuable for cometary work than in delineating planetary features.

In spite of the fact that a comet is moving rapidly thru the solar system, valuable photographic exposures of even several hours' duration can be obtained by stopping the clockwork of the telescope, which keeps the stars immovable in the field, and allowing the stars to trail across the field while an observer keeps the telescope pointed on the comet thruout the time of exposure by means of the cross-wires in the finder of the telescope or by some similar means.

Wonderful photographs of comets have been obtained by such methods and these are of great scientific value in that they afford indisputable evidence of the changes in the form and general appearance of a comet that often take place with startling suddenness.

The speed with which the comet is moving can be judged from the length of the star trails produced during the exposure.

Photographs of comets are of great value to any one interested in researches into the causes of the remarkable and unaccountable changes in the behavior of comets that are continually occurring.

One of the most interesting of all comets was Comet Morehouse (1908), which, tho never bright, exhibited some very striking phenomena. Its brightness changed from time to time in a most erratic manner, and the material that formed the tail at times appeared to be swept aside by unseen forces or driven from the head with unaccountable rapidity. It may be considered one of the most mysterious comets that has ever appeared. Many excellent photographs of this comet were taken which prove the peculiarity of its behavior.

Of special interest this spring will be the apposition of Mars, which will occur on April 21. Mars' nearest approach to the earth will take place a few days later, on April 27, when it will be about fifty-four million miles from the earth. In 1922 and 1924 the distance will be even less.

Any one may find the ruddy-hued planet at that time very readily, as it will be the brightest red star in view in the evening. At the time of apposition Mars will be almost as bright as Sirius, the brightest star in the sky, which will disappear below the western horizon very early in the evening by the last of April. At the same time Mars will appear in the eastern sky shortly after sunset and will be on the meridian at midnight. Jupiter will also be seen just west of the meridian at sunset and will not set until after midnight.

Sir Ernest Rutherford, On The Problems Of Radioactivity

In the first Silvanus Thompson Memorial Lecture, delivered before the Röntgen Society Sir Ernest Rutherford, F. R. S., reviewed the various lines of scientific investigation opened up as a result of the discovery of X-rays. In a tribute to the first president of the society, in whose honor the lectureship was instituted, he mentioned that on the morning that the late Silvanus Thompson read of Röntgen's discovery he set to work, and by nightfall had succeeded in producing what was probably the first X-ray photograph taken in England. The outbreak of war, Professor Rutherford said, had caused an almost complete stoppage in the great tide of advance in pure science, but the lull afforded a suitable opportunity for looking back with some degree of perspective over the ground covered during the last twenty years.

Undoubtedly the discovery of this new type of radiation marked the beginning of an epoch in physical science and had brought about a revolution in ideas of the nature of matter and electricity almost as marked as that produced in biology by the theory of evolution. The two decades from 1895 to 1915 had been a period of pioneer advance over a new and fertile territory, with the almost daily discovery of interesting facts and the gradual unfolding of fundamental ideas. The directions of advance which had been stimulated by the discovery of X-rays included investigation

on the ionization of gases, electrons, the diffraction of X-rays by crystals, and, most important of all, the phenomena of radioactivity, which was an even more direct consequence of the discovery of X-rays than the work on the electron. The sequence of changes in uranium, thorium, and actinium had now been followed out, not, indeed completely, but in the main part. No doubt there would still be in the future considerable developments as the result of investigations of the multiple transformations of the atom, but as a whole, apart from a few outstanding difficulties, like the origin of actinium, the transformation of radioactive bodies was fairly well understood.

on the ionization of gases, electrons, the diffraction of X-rays by crystals, and, most important of all, the phenomena of radioactivity, which was an even more direct consequence of the discovery of X-rays than the work on the electron. The sequence of changes in uranium, thorium, and actinium had now been followed out, not, indeed completely, but in the main part. No doubt there would still be in the future considerable developments as the result of investigations of the multiple transformations of the atom, but as a whole, apart from a few outstanding difficulties, like the origin of actinium, the transformation of radioactive bodies was fairly well understood.

"Rabbit Contest" Awards

(CONTINUED FROM THE MARCH NUMBER)

SECOND HONORABLE MENTION.

I wish to say that the peculiar effect reproduced on the sample piece of film published in the December issue of the *ELECTRICAL EXPERIMENTER* was probably caused by the distorted curve of the primary alternating current which was probably operating at commercial frequency.

A distorted curve is considered as a re-

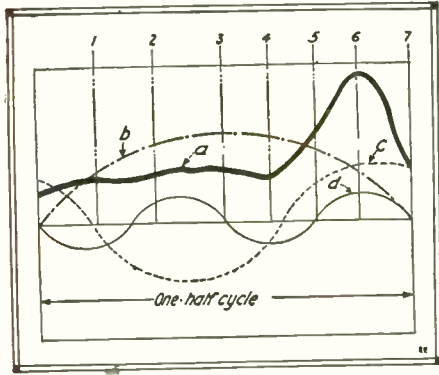


Diagram to Accompany Mr. Coffman's Explanation of the "Mysterious Rabbit."

sultant of a sine curve of the same frequency as the distorted curve, combined with a number of other sine curves of a higher frequency. The shape of the resultant curve depends on the features of design of the circuit. The sine wave of the same frequency as the distorted wave is called the *fundamental wave*, and the higher frequency components are called *harmonics*. Practically the resultant of the fundamental and a limited number of harmonics will represent any distorted wave with sufficient accuracy.

The actual shape of curves is determined by means of an oscillograph or by some other method. In practice the problem is usually that of splitting up a given distorted curve into the fundamental and harmonics, and the ability to distinguish at a glance the presence of prominent harmonics in any distorted curve can be attained only by practice in drawing different fundamental waves and harmonics and adding these algebraically. In making such drawings the maximum value of the harmonics should be taken at less than the maximum value of the fundamental.

By referring to the photo of the film, we may draw a resultant curve which will be distorted as can be seen. The resultant curve is shown in the illustration. By beginning at the top of the film and going down it can be seen that the power of the primary inducing current gradually increased, and then suddenly flashed up to maximum power when view six was taken. The numerals in the accompanying illustration represent the time at which the respective views were taken. By analysis of the resultant curves, it is proven that it consists of the fundamental wave *b* and the second and fourth harmonics *c* and *d*, respectively.

Altho the current in the high frequency secondary circuit was oscillating at an extremely high frequency, compared with that in the primary circuit, the power of the same at any instant was dependant upon the power of the current in the primary at that instant.

RAYMOND NOBLE COFFMAN.

105 Burt Ave.,
Newark, Ohio.

THIRD HONORABLE MENTION.

The effect obtained in making motion pictures of the rabbit undergoing the corona discharge from a high frequency apparatus is due to the fact that the exposures are made without reference to the intermittent appearance and disappearance of the corona discharge.

In a high frequency set the secondary voltage and current rises to maximum and drops to zero value in a rapidly succeeding train of high frequency waves for each discharge of the primary spark gap. That is, the frequency may be 200,000 cycles per second, but these wave trains are split into groups with a wave envelope of a shape determined by the frequency of sparking and the damping in the circuits.

A motion picture camera operating at a rate of sixteen exposures per second with each exposure lasting, say, .01 second, will snap the corona in the different stages of its changing values. The first five exposures on the length of film were made when the corona was at a value below its maximum, the sixth exposure occurring at the exact instant it had reached its maximum value in one of its recurring cycles. Were the rate of exposure and spark discharge kept at the same rate a perfect picture would be obtained at regular intervals.

THOS. W. BENSON.

3722 M St.,
Philadelphia, Pa.

FOURTH HONORABLE MENTION.

To explain this strange phenomenon, it is assumed that the spark-discharge used was of a highly damped order, also the speed of the camera at the time happened to be running at a speed, synchronous to one of the many harmonics of a wavelength developed by the frequency of the spark discharge.

If this be true, then each picture, beginning at the top would not necessarily be taken of the next wave of the train, but the next in their order of the harmonic.

It must be understood that the harmonic is moving constantly with the frequency of the wavelength developed by the spark discharge.

In this case the camera shutter opens only when the harmonic is in evidence; that is, there is no picture taken except when the harmonic covers some one point of the discharge wave-train.

To illustrate this, the full lines in the drawing show the oscillations of only one spark discharge, and the broken lines show the harmonic position relative to the opening of the camera shutter on a spark discharge, that is, the first picture in the illustration would be taken when the harmonic was in a position as shown at *C* in the drawing, the second taken when the harmonic again crossed a wave-train or at a point *D*, the third at a point *E*, the fourth at a point *F*, the fifth at a point *G*, the sixth picture would be taken from the first rush of current in discharging or at a point *A*, the seventh and eighth would be taken at a point *G* also or even later if the time-length of the wave-train was greater.

I have made many photographs of spark discharges, sometimes obtaining no picture at all, and never any two of the same strength or density.

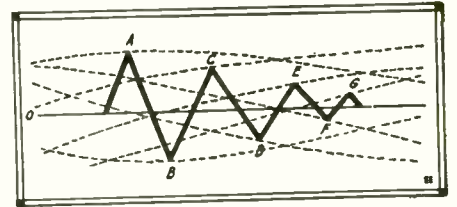
By using a speed camera with a shutter speed of one, three or four hundredths of

a second, pictures of this nature are easily obtained.

The movie camera gives the same effect, except that there are sixteen pictures per second in the standard machine, therefore the camera must have been running at a speed synchronous to a harmonic wavelength developed when the discharge took place.

HAROLD C. SIMONS,

Elec. (R. O.) U. S. N.,
Frankford, Mich.



Harmonics Enter Into the Solution of the "Rabbit Puzzle" by Mr. Simons.

FIFTH HONORABLE MENTION.

As everyone knows who is familiar with alternating current on open circuit (such as the poles and secondary windings of an high frequency induction coil constitute) the poles are electrified alternately with charges of positive and negative sign, one pole being positive while the other is negative. With a frequency of two hundred thousand the change in sign of the charge of either pole occurs so rapidly that the discharge seems to the unaided eye to be continuous.

The fact of the matter is that the discharge is not continuous, but approaches a maximum as the pole under observation is charged with electricity of one sign at its highest potential; dies down and disappears with the lowering of this potential, only to reappear when the pole is almost immediately charged with electricity of the opposite sign at a rising potential.

Thus it will be seen that if a camera with a fast working speed were trained upon the rabbit (in this case constituting part of one pole of the machine) and the film exposed at the time that the electric charge was changing signs (that is, when there is no discharge), the film when developed would be blank, while if exposed at the time of maximum discharge the result would be as shown in picture number six.

As the moving picture camera has a "frequency" of approximately sixteen, and the electrical discharge a frequency of two hundred thousand, the exposures would be made at times of different degrees of discharge.

Thus exposure number one was made when the discharge was approaching a minimum. Number two was made as the potential of the charge was still lower than the potential of the charge photographed in number one; numbers three and four are photographs of receding potential, while in number five the exposures of the camera and the frequency of the electrical machine again commence to be in synchronism, and the result is that the sixth exposure was made just as the discharge was at its maximum brilliancy, while numbers seven and eight again were made at times of discharge of lower potential.

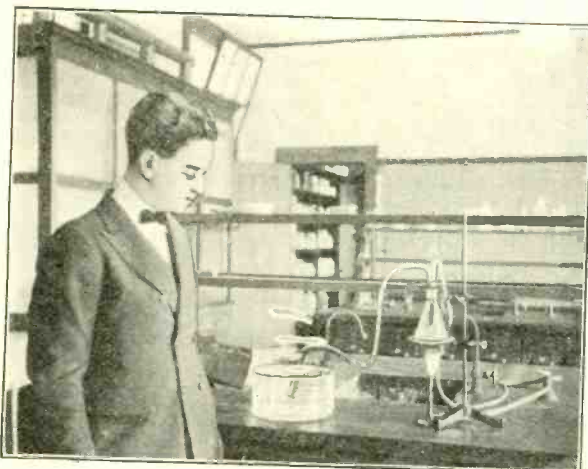
FRANK L. HEYDON.

Ponca, Neb.

(Continued on page 1317)

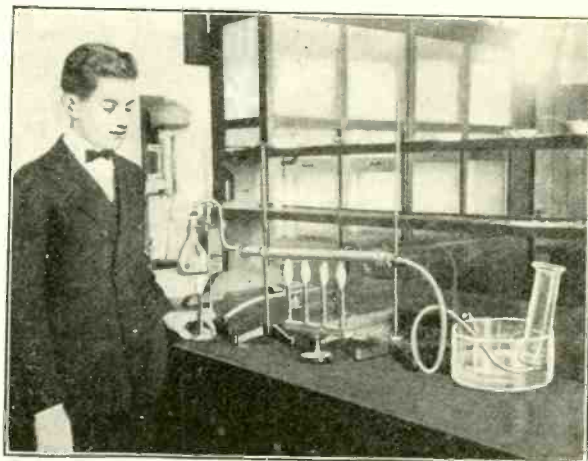
Practical Chemical Experiments

By PROF. FLOYD L. DARROW



Left — Making Phosphine Rings Is an Extremely Interesting "Chemical Stunt," Which Will Please All Those Who Have Even a Small Laboratory. The Gas Rings Arise in the Form of Beautiful Concentric Circles.

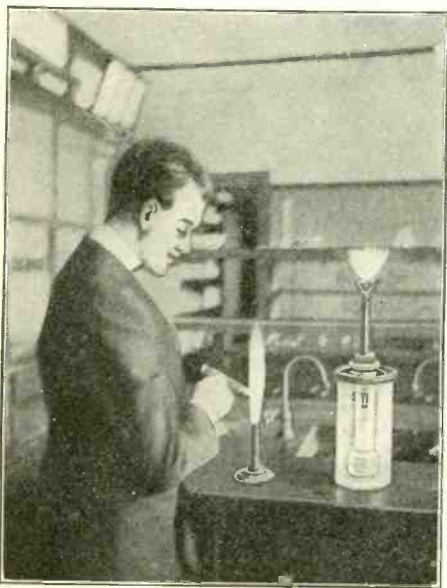
Right — Generation of Water Gas Is Here Readily Demonstrated, the Gas Being Collected by Downward Water Displacement. Note Bunsen Burner Quartet. The Set-Up of the Apparatus Is Clearly Depicted in Diagram, Figure 11.



FLAMES AND ILLUMINANTS.

THE object of experimentation in the home laboratory should not be amusement, merely. If that were the sole purpose, it would not be worth the time and effort required. But the skill in manipulation, the knowledge of chemistry, the training in observation and the interest in scientific work acquired in such practice are of inestimable value. It is well to remember, too, that a century and a half ago when chemistry was in its infancy most of the great chemical discoveries were made in *home laboratories*. Therefore, in all the work make it the best possible, be sure you understand the chemistry back of it and seek at every point to gain increased skill in manipulation.

In this article we shall consider the chemistry of *flames and illuminants*—a most important field of chemical investigation. Perhaps, we had better start off with the fact that to produce a flame requires the union of two gases or vapors. Red hot coals glow but there is no flame. Likewise the burning of iron in oxygen or the union of sulfur and zinc dust produces light but no flame.

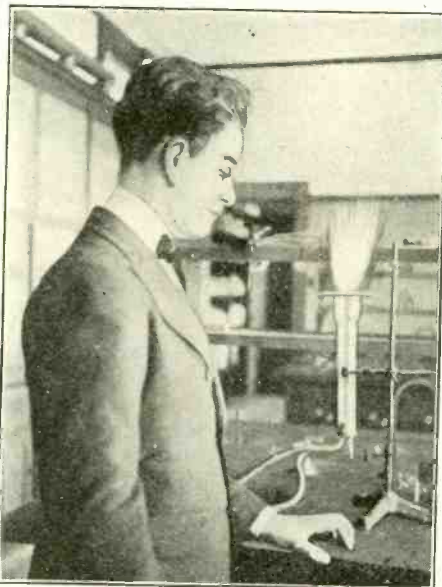


An Extremely Simple Acetylene Gas Lamp Whereby the Amateur Chemist Can Work at Night. The Light Emitted Is Very Constant and the Lamp May Be Turned Off by Simply Tightening the Pinch-Cock. The Embryo Chemist Is Here Seen Carrying on an Analysis Experiment by the Acetylene Lamp.

IGNITION OF GAS FROM AN EXTINGUISHED CANDLE.

Light a candle and when it is burning well blow out the flame. Immediately hold a lighted match in the rising smoke a half inch above the wick, when the vapor will catch fire and running back will communicate the flame to the wick.

To show this on a larger scale arrange a candle and Argand lamp chimney as shown in figure 1 allowing for good ventilation. On blowing out the flame and ap-



Here Is Something New to Try on the Gas Company. Instead of Burning Gas in Air—Do Both; Burn Air in Gas and Gas in Air Simultaneously, Thus Obtaining Two Lights at the Cost of One. The Trick Lies in the Lighting and Piping Arrangements of the Apparatus.

plying the lighted match to the top of the chimney, the candle will be relighted. The chimney may be 3 or 4 inches in height.

TO ILLUSTRATE THE TERM "SUPPORTER OF COMBUSTION."

A gas may be combustible and yet not a supporter of combustion. This is well illustrated with hydrogen. Generate a cylinder of the gas in the usual way by the action of dilute sulfuric on zinc and collect the gas over water.

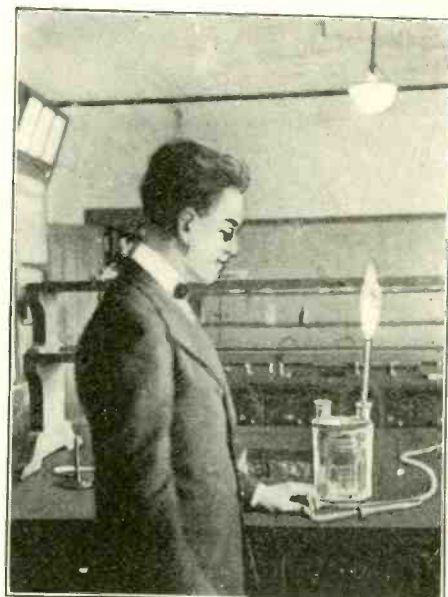
Now as shown in figure 2 hold the cylinder of hydrogen in the left hand, mouth

downward and thrust upward into it a lighted candle attached to a wire. The hydrogen lights at the mouth of the cylinder with a small explosion, burning with an almost colorless flame, but the candle immediately goes out. Upon withdrawing the candle it is relighted at the mouth, showing that the hydrogen itself is burning. The operation may be repeated a number of times before the gas is exhausted. This shows clearly that while the hydrogen is combustible it does not support combustion. This is also true of many other gases.

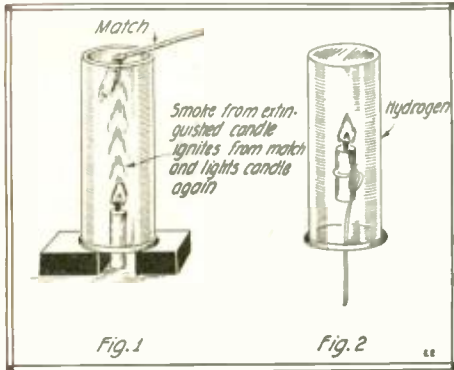
BURNING AIR.

That either illuminating gas or air may be regarded as the supporter of combustion is shown by the following experiment:

Fit a lamp chimney with a 2-holed rubber stopper carrying a glass elbow and a straight glass tube as shown in figure 3. The straight tube should be about 10 millimeters in diameter. On the top of the chimney place a piece of asbestos board with a small hole in the center. Now connect the glass elbow with the gas supply and closing the hole in the asbestos board with the palm of the hand turn on the



The Gas Flame Above Shown Coming From the Bottle Is Due to the Fact That Gas Had Been Introduced Primarily and Later Shut Off. Air Mixes With the Gas in the Bottle Until Finally the Mixture Therein Contained Is of a Sufficient Explosive Context to Go Off With a Loud Report.



Igniting the Gas From an Extinguished Candle, Thus Lighting the Candle Again.

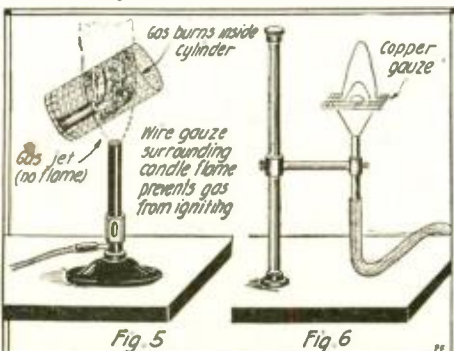
Above, Diagram Showing That Even Those Gases Which Burn Can Act as Supporters of Combustion in Which Case They Need Not Burn.

gas. Then light the gas at the lower end of the straight tube, immediately remove your hand from the cardboard and also light the gas at the top of the chimney. Two flames will result, one at the top of the chimney, which is the excess of gas burning in air and the other at the top of the straight tube, which is air burning in an atmosphere of illuminating gas. Thus air is the combustible gas here and the illuminating gas is the supporter of combustion.

AN EXPLOSIVE MIXTURE.

Secure a 2-holed Woolf bottle of two or three liters capacity and fit the necks with stoppers carrying glass tubes as shown in Figure 4. The straight tube should be about 10 or 12 millimeters in diameter. Connect the glass elbow with a gas cock, and turning on the gas drive out the air from the bottle. Light the gas at the top of the straight tube and then withdraw the elbow with its stopper, at the same time turning off the gas. The flame will continue to burn at the top of the straight tube for a few minutes and then seem to disappear entirely. But do not conclude that nothing will happen. Wait, and suddenly a sharp report will occur and the bottle will be filled with a sheet of flame. In a darkened room the effect is much more impressive.

As the burning gas escapes, air enters through the open neck until the bottle is full



The Plan of the Miners Safety Lamp Showing That an Explosive or Dangerous Gas Will Burn Inside the Wire Gauze Cage, Yet Not Ignite the Atmosphere of Gas Surrounding It.

Demonstrating That the Inner Cone of the Bunsen Flame is Cool.

of an explosive mixture of gas and air, when the feeble flame strikes down into the mixture and ignites it. The "striking back" of a gas stove or Bunsen burner is due to the same cause.

THE SAFETY LAMP.

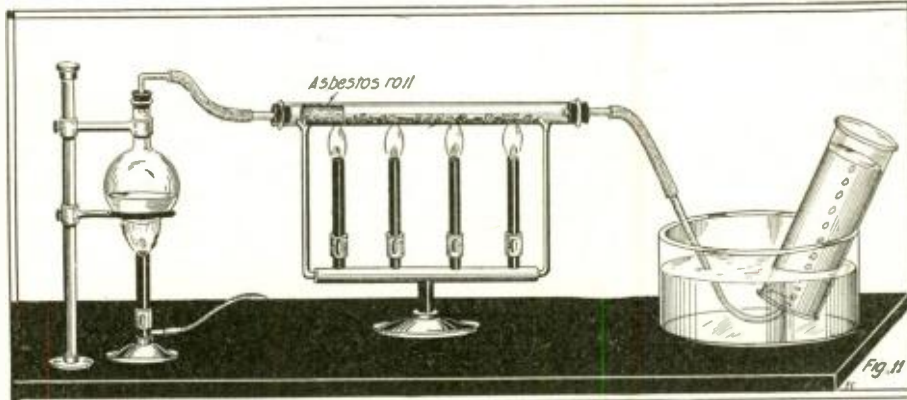
Multiply the above explosion a million times and you will have something like the effect produced by an explosion of "fire damp" in a coal mine. It will show you, too, the necessity for the miner's safety lamp invented by Sir Humphrey Davy a century ago.

The principle of this lamp is well shown by surrounding a candle with a cylinder of fine iron or copper gauze. Cut a sheet of gauze 6 by 8 inches and roll it into a cylinder and fasten it along the edges. At the bottom place a candle, securing it in position with wire supports.

Light the candle and hold the cylinder horizontally in jet of illuminating gas as shown in figure 5. The gas will be seen to burn inside the cylinder but the flame will not communicate outside and the burner will not light. This gauze may even become red hot without igniting the gas on the outside. So good a conductor of heat is the gauze that the gas does not reach its kindling temperature. A simple application of a physical principle, and yet it has saved thousands of lives.

A BUNSEN BURNER FLAME.

With the air holes open at the bottom of the tube a Bunsen burner flame shows two distinct cones—an outer cone of burning



Your Own Gas Generator; Making "Water Gas." You Can Bottle It and Use It to Your Heart's Content.

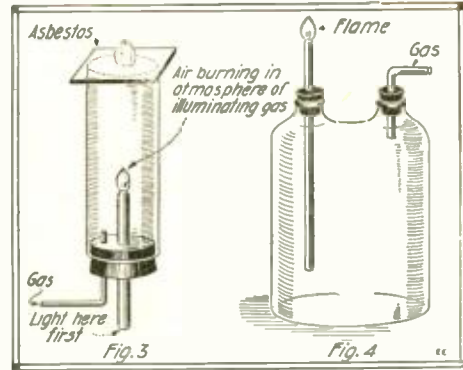
gas called the "oxidizing" flame and an inner cone of unburned gas called the "reducing" flame.

That the inner cone is not undergoing combustion is very strikingly shown in the following way: Thrust a pin thru a match stick about a half inch below the head. Mount this in the top of a Bunsen burner and turn on the gas. Now light the gas and observe that the match does not burn. To show that it has not burned turn off the gas and it will be found that the match is perfectly good and can be lighted in the usual way.

Another very striking experiment to demonstrate this fact is illustrated in figure 6. Make a burner of a small glass funnel and over the top place a piece of fine copper gauze. In the center of the gauze place a small heap of gunpowder or flashlight powder. Turn on the gas and light it by bringing a match down from above. The gas will burn but the powder will remain unignited. Slowly turn off the gas and as the flame diminishes in size the powder will ignite.

SPONTANEOUS IGNITION OF HYDROGEN.

Direct a stream of hydrogen from a generator on some platinized asbestos, when the asbestos will be seen to glow and presently the hydrogen will ignite.



Burning Air in an Atmosphere of Illuminating Gas. Two Lights are Noticed, One at the Top of the Cylinder Burning in Air, the Other Inside the Cylinder Burning in an Atmosphere of Gas.

The Layout for the Explosive Mixture Experiment. The Gas Supply Pipe and Cork is Removed; the Flame, However, Still Continues to Burn. Why?

The platinized asbestos may be prepared by moistening a small quantity of asbestos fibers with a few drops of platinum chlorid solution and igniting them in a Bunsen burner flame. The chlorid decomposes and finally divided platinum is left on the fibers.

PHOSPHINE SMOKE RINGS.

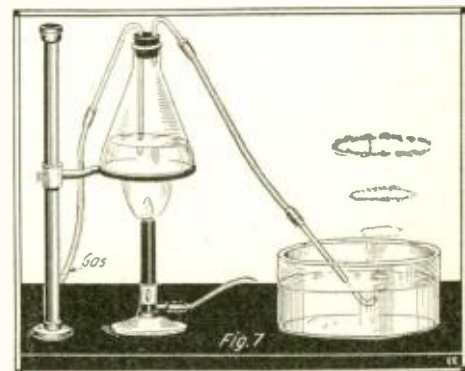
Arrange apparatus as shown in Figure 7. Fit a flask with a 2-holed stopper carrying two bent tubes, one of which reaches nearly to the bottom of the flask. In the flask place a strong solution of sodium or potassium hydroxid and a piece of yellow phosphorous, the size of a pea. Connect the tube leading to the bottom of the flask with a gas cock and drive out the air. To the other tube connect an 18-inch length of rubber tubing, in the end of which is inserted a glass delivery tube. Have the end of this tube bent up slightly and place it in a basin of water.

Now heat the contents of the flask and as the solution begins to boil a gas will be given off which spontaneously ignites on reaching the air.

AN ACETYLENE LAMP.

Obtain a large mouthed bottle of one or two quarts capacity, a large lamp chimney, small disc of coarse wire gauze, one-holed rubber stopper, 6-inch length of glass tubing, rubber connection, acetylene gas tip and 18 inches of heavy aluminum wire.

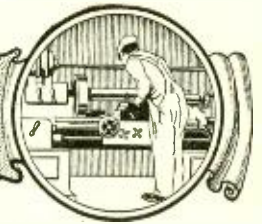
(Continued on page 1328)



The Very Pretty Phosphine Ring Trick. The Above Diagram Demonstrates a Stunt Which No Experimenter Should Refrain From Conducting.



THE CONSTRUCTOR



Home-made 110-Volt, 60-Cycle Induction Motor

By H. H. PARKER

MANY uses could be found for a small single-phase motor which would connect up to an ordinary 110-volt lamp socket, and while such motors are not high priced many Amateur Mechanics wish to build them themselves, but are deterred by the difficulty of making or obtaining field and rotor punchings, for, unlike the direct current variety, both the stator, or field magnet, and rotor cores must be built up of iron sheets or laminations.

No originality is claimed in the main design of the small motor to be described, but an attempt has been made to lay out a strong and substantial construction not too difficult to be built at home on a small screw-cutting lathe. The power of this little motor would depend to some extent upon the materials used and the workmanship and care in making the windings, but it should be serviceable for driving a fan, buffing wheel, rotary spark gap, or various types of light machinery. Having but one set of windings upon rotor and stator, it is not self-starting and will not start under a full load, this being characteristic of all such types of alternating current machinery. But by using a tight and loose pulley or a similar contrivance and giving the belt a sharp pull after throwing the switch, the motor will pick up speed without difficulty. Another crude but effective starting device is shown in the assembly drawing (Fig. 2); this consists of a spool shown on the left-hand end of the shaft around which a heavy cord is wound and the motor given a starting whirl by a quick pull of this cord.

In regard to the laminations: field and rotor are built up of sheets of "stove pipe" iron of about 22 gage, tho if regular transformer iron or silicon steel was obtainable a more efficient, as well as more expensive, machine could be produced. Even tho these sheets could be given a form simple enough to be cut out by hand, separately, with tinner's snips, this would be a formidable undertaking, and the method decided upon here is to cut out square sheets, pile them up, clamp together, drill out along the required outlines by means of a jig plate, then separate, break out the portions not needed and finish by filing and in the lathe. Even this means considerable work, when compared with the construction of a direct current machine, but to partly compensate for this the A.C. motor has no commutator, slip rings nor brush holders, the rotor windings being short-circuited. As seen in Figs. 1 and 2, the motor has four poles, with four stator coils, while the rotor has four wide slots and also four poles, with no electrical connection between stator and rotor. At a frequency of 60 cycles the speed will be a little under 1,800 r.p.m.

Fig. 3 shows the shape of the stator laminations and Fig. 4 of the rotor. By referring to Fig. 1 it will be seen that with the rotor in the position shown the spaces, or slots, in the rotor, lie opposite the stator pole faces, while the rotor faces lie next

to the stator slots. By using care and with an accurate drill press or lathe drill pad, it might be possible to cut both a rotor and stator lamination from one sheet of iron, by making narrow separations at the corners where the rotor faces meet the corners of the stator poles. Otherwise separate square sheets must be used for stator and rotor laminations, requiring, of course, considerable more material. A saving could be effected by making each stator sheet in two parts, as per the dotted lines in Fig. 3, and "breaking joints" when assembling the pile, but this would introduce a little more reluctance into the magnetic circuit. Figs. 6 and 7 illustrate the method of making the drilling jigs out of a scrap plate of half or three-eighths inch cast iron or steel. Care should be taken in laying out these jigs that enough material will be left around the edges of the sheets, after drilling, to allow of a smooth finish. To use the jigs, the square sheets are piled up to make a depth of two inches, for both stator and rotor, when compressed; this would take about 68 sheets of 22-gage iron. After clamping or bolting, by the corners, to a hardwood board, the center hole is drilled and two lines scribed exactly at right angles thru the center; then the four 11/32-inch holes in the stator and 5/32-inch holes in the rotor are drilled, rotating the jig so as to use the same hole thru it each time and taking care that the holes were exactly ninety degrees apart. Then a pin is driven thru the half-inch hole of the jig and one of these holds the jig furthermore clamped to the pile, and one-quarter of the holes drilled; the jig is then shifted thru a right angle and the process repeated, and so on until all the holes are thru. With an accurate drill press the whole pile could be drilled thru at once, but in other cases it might be best to drill half of the plates, or a pile one inch high, at a time. The plates are now separated, the pieces broken out, reassembled and the edges finish to size with a file. Previously to separating a shallow hacksaw cut should be made across the pile at some point, to insure getting them back in the same position, and before re-assembling the outside corners are cut off to make less work for the lathe.

The stator plates are then assembled and bolted to the lathe face-plate, with a hardwood packing piece in between, centered up and bored out and the outside turned down to the given diameter. They must then be taken apart again and all burrs cleaned off the edges to prevent making electric contact between the laminations; before the final assembly each plate is given a thin coat of shellac on one side and allowed to dry. 5/16" bolts are used and each is wrapt in shellacked paper so that when dry it may be just driven into the 11/32" hole without tearing the wrapping. This bolt and rivet insulation is necessary for the insulation of the laminations. Similarly, 3/8" rivets are insulated and put thru the 5/32" holes. The plates should be clamped

tightly together but not so tight as to spring them open where there are no bolts or rivets. The rotor core is similarly constructed, but the laminations are held on the shaft by two pairs of locknuts as well as 1/8" bolts, insulated with paper and fiber nuts, which also act as posts to hold the windings in place.

All the machine work must be completed before starting the winding. In regard to the bearings (Fig. 8-A), these are cast in brass or bronze; heavy bar brass with bearing bushings soldered or brazed in might also be used. The bearing yokes are separated from the stator core by cast iron, steel or brass posts, which also act as nuts to clamp the laminations together. There are several possible ways to drill out the bearings. One would be to put an 11/32" drill thru the bolt holes in the core, spot the bearing yokes and then drill and ream them 5/16". Then put in the 5/16" bolts (Fig. 7-A), insulated with shellacked paper and screw home the posts. Drill and ream to 3/8" a 2" length of steel shafting, drive it thru a hole in a 2" hardwood block, place between centers in the lathe and turn the block to a diameter that would just allow it to be pushed into the bore of the stator (3/16"). Then put in the short bearing studs (Fig. 8) and bolt one of the bearing yokes in place. Using the steel bush block as a jig, drill and ream the bearing yoke.

Two angle plates (Fig. 9) are cast in iron or brass for the motor base; these can be mounted on an angle plate on the face-plate and faced to take the stator core; one 5/16" bolt, also wrapt in paper, holds both in place.

The rotor laminations, as previously mentioned, are held to the shaft by two sets of locknuts, one set of which have 1" flanges. Or two 1" washers and four S. A. E. 1/2" nuts could be used. In any event, after screwing up these nuts and their lock nuts to clamp the laminations tightly, they are turned down to finish dimensions and the shaft also turned to finish size. If done previously to this, clamping the laminations might spring the shaft. Two grooves are turned, with sharp edges, to prevent oil working up into the rotor windings. A light cut is also taken to true up the surface of the rotor. Then the insulated 1/8" bolts are run thru and clamped by the fiber posts. Figs. 10, 11.)

THE WINDINGS.

Now for the windings. Procure a roll of "armature" tape, wrap some around the stator cores, tie it and cover with shellac. The construction of the stator precludes the use of form wound coils; so enough wire for one coil is wound on a spool small enough to pass thru the core, and the coil is wound by hand. A couple of split flanges of very thin fiber could be slipped on each end of the core and glued together, the splits opposite, to act as heads for the coil. No. 22 D.C.C. copper wire is used for the stator;

(Continued on page 1314)

Home-made A. C. Motor

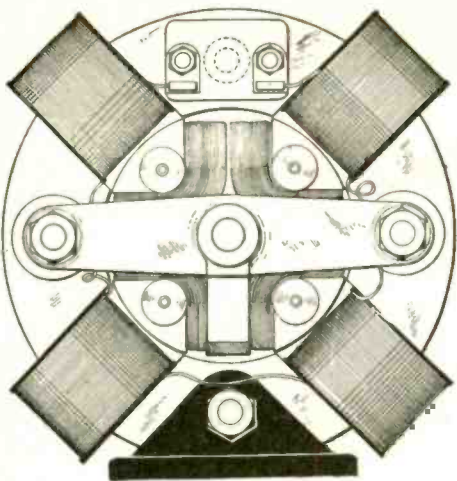


Fig. 1

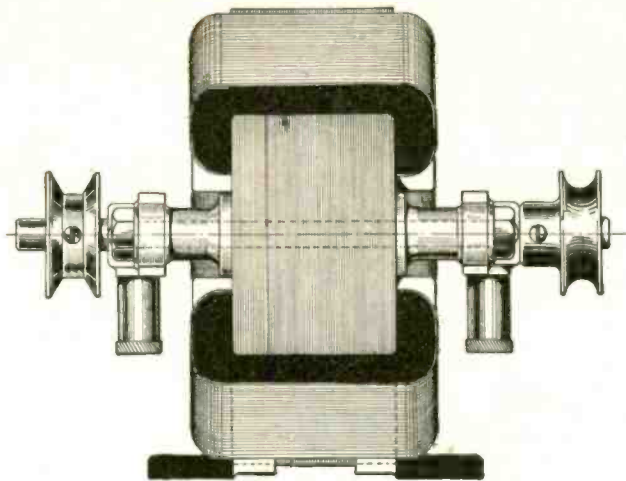
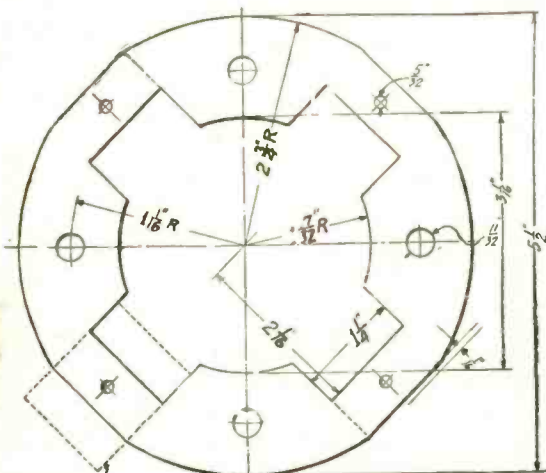


Fig. 2



Winding space Fig. 3
#22 sheet iron 68 reqd

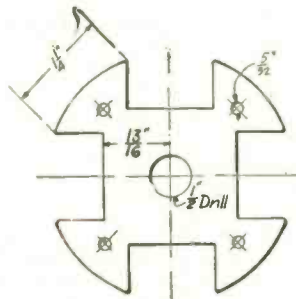


Fig. 4
#22 sheet iron 68 reqd

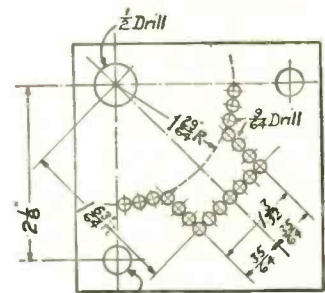
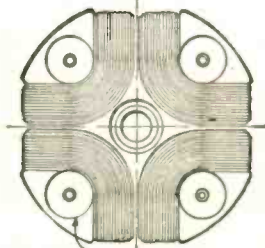


Fig. 6



Fibre post Fig. 5

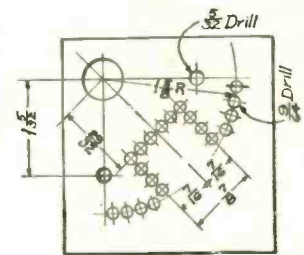


Fig. 7

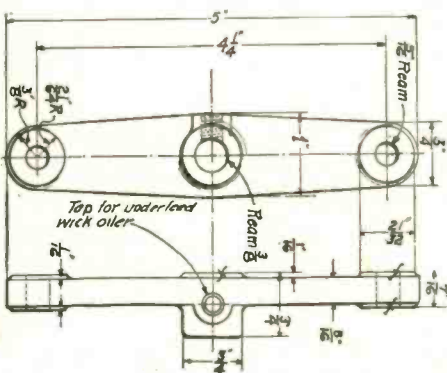


Fig. 8-A
2 reqd.

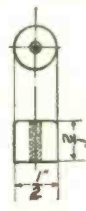


Fig. 11
8 reqd.
red fibre

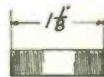
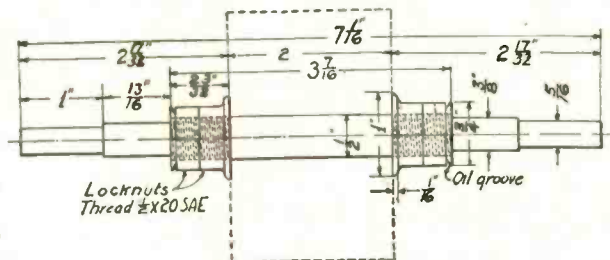


Fig. 8
C.R. steel 4 reqd.



Locknuts
Thread 2x20 SAE
Oil groove

Motor shaft
C.R. steel 1 reqd

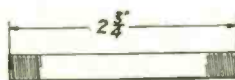


Fig. 7-A
C.R. steel 2 reqd

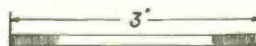


Fig. 10
C.R. steel 4 reqd

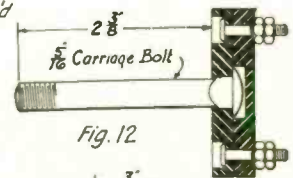


Fig. 12

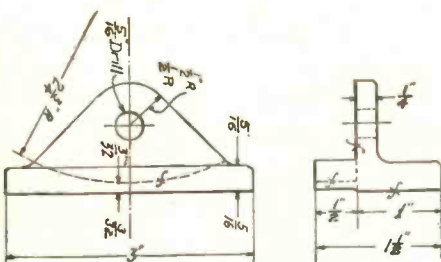


Fig. 9
2 reqd

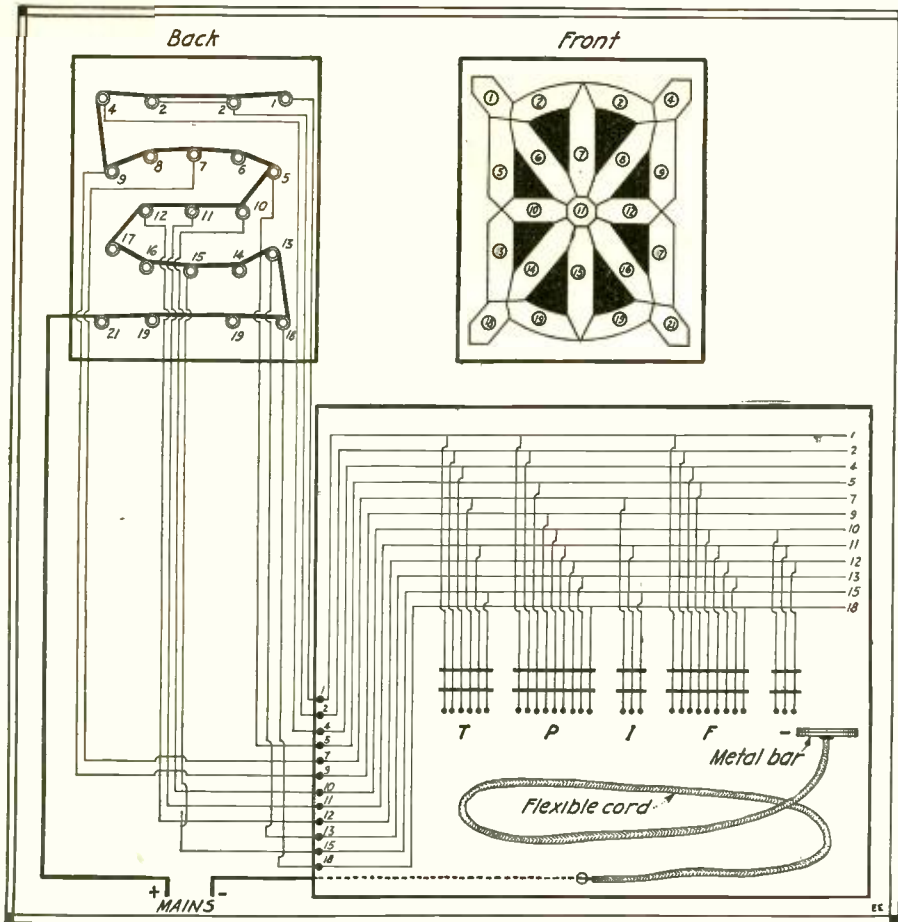


Drill 1/4 Top 1/8 x 18 USS.
Fig. 6A 4 reqd brass

(Full Description Covering the Construction of This Alternating Current Motor on Opposite Page.)

EE

Electro-Monogram Sign for the Boys



when lamp No. 8 is lighted, the whole trough indicated by No. 8 is lighted. When various combinations of these lamps are lighted, different letters may be formed. The entire alphabet and all of the numerals may be formed with this monogram.

The wiring diagram is shown on the back of the monogram. The heavy line is a continuous wire which is attached to one side of every lamp. This line goes to one side of the battery or power line.

Now one wire is run from the other side of each lamp to the switch-board terminals shown on the left of the board in the drawing. The lamps numbered 2 and those numbered 19 may be connected to one wire, as there is no letter that requires the use of one No. 2 lamp without the other. The same holds true in the No. 19 lamps. That means that we have nineteen wires to connect to the switch-board terminals. Only twelve wires are shown in the drawing for the sake of simplicity.

On the switch-board the nineteen wires are run across loosely until the letter groups such as T, P, I, F and the dash have been tapt. They may then be formed into a cable to give plenty of room on the board for the letter groups.

By tracing out the wires in the T group, it will be found that the lamps to which these wires are connected will form the letter T when lighted. The same is true of the P, I, F and dash groups. The wires forming the letter groups are stretched across bridges about a quarter of an inch high and fastened at the ends. The bridges should be made of wood or other non-conducting material. The portion of the wires between the bridges should be bared.

Now a wire is run from the source of current to the center of the bottom of the board and there a single-wire cord is attached. At the end of this cord a T-shaped metal bar is placed. The handle should be wrapt with tape or otherwise insulated if strong current is used. The bar must have contact with the wire cord. When the bar is placed across the bare wires in any letter group, the lamps to which those wires are connected will be lighted, illuminating the desired letter.

The letter groups may be arranged in rows in alphabetical order or after the manner of a typewriter keyboard. When the operator gets accustomed to the positions of the letter groups he will be able to spell out messages with great rapidity.

Contributed by ALTON D. SPENCER.

Something of Interest to Every Young Electrician—an Electro-Monogram Sign Which is Easily Constructed at Small Cost.

HERE, boys, is a signaling outfit that you may use at night, spelling out, one letter at a time, any message you desire to send to your "pal" across the street or over on the next avenue. No code is necessary. You merely place a metallic bar across groups of wires and the monogram, which contains electric lights, forms the desired letters.

You may construct the monogram any size you desire. A small one may be operated with batteries, or a large one may be connected with the 110-volt lighting circuit of your home.

A shallow box is used in the construc-

tion of the monogram. In case you make a small size, a cigar box of proper proportions is just right. It should be slightly longer than it is wide, but the proportions do not need to be exact.

The light portions of the monogram shown in the picture are troughs. Thin wood or metal may be used in making these troughs. They should be about as deep as the length of the lamps used in them, allowing a glass front to be placed on the monogram if desired. Each trough is furnished with a lamp, as indicated by the numbered circles. The troughs are painted white to form a reflector. Thus

Measuring Electric Current With the Eye

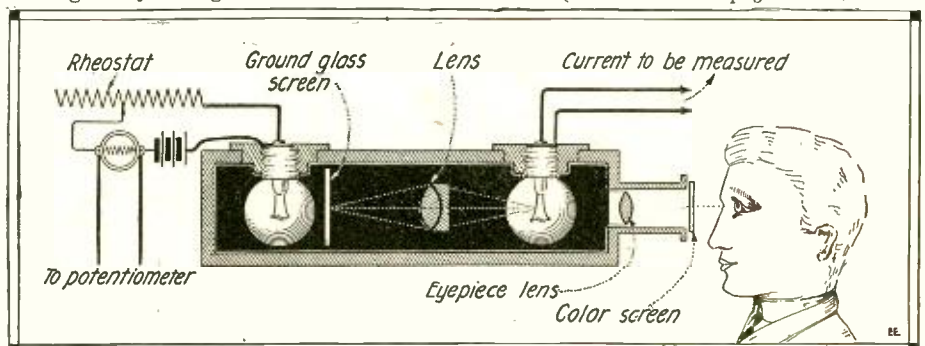
By C. A. BRIGGS

A WASHINGTON scientist at the Bureau of Standards has devised an ingenious arrangement whereby it is possible to measure the amperes of electric current by means of a sort of photometer. In his scheme the brightness of a hot filament is matched against a bright background. This may have an application to alternating current work, and particularly to wireless work where it has been always necessary to get some means whereby the value of an alternating or high-frequency current can be reduced to its equivalent direct current.

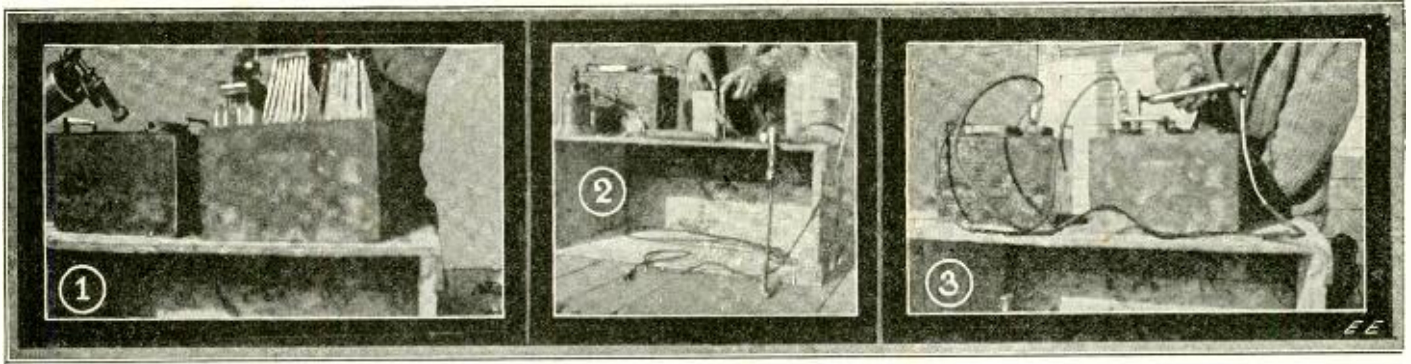
The method can be understood by reference to the accompanying diagram. The electric bulb at the closed end illuminates a ground glass screen the image of which is thrown, by means of an achromatic lens, on the filament of the second bulb. The filament of the second bulb is viewed

against the bright background thus formed by means of the eyepiece, which is provided with a color screen so that the observer is working always in light of one color. The

first bulb is heated by an electric current controlled by a rheostat. The value of this current can be determined, as indicated in (Continued on page 1324)



Arrangement of Electric Lamp Apparatus for Measuring the Current Strength By Matching the Brightness of a Hot Filament Against a Bright Background.



1—Great Care Must Be Taken In Removing the Plates from a Storage Battery, So As Not to Damage the Lead Paste Filling. 2—See to It That the Insulators Between the Lead Plates are Perfect and Not Cracked Or Broken. 3—The Terminal Connections May Be Soldered Or Fused By Current Obtained from Another Storage Battery, Using a Pointed Electrode As Shown.

Storage Battery Repairing

By HENRY KLAUS

SINCE automobiles have become so popular many profitable occupations and side lines are afforded for rebuilding and adjusting their various parts. This is especially true of storage battery repairing and recharging. Most garages in small towns are not in a position or have not time to take them apart and bother with them, so they send them away to some larger place to have it done. Any one with a little experience can do this and make a handsome profit besides. It is the object of this paper to explain briefly the main points to be observed in the application of this work.

The equipment needed comprises a syringe hydrometer, volt-ammeter, welder (electric home-made), saw, blow-torch, test clips lead covered, pincers, sulfuric acid, solder, distilled water (can be made in the still shown), generator or rectifier and lamps for charging.

While battery repairing could be done without a charging apparatus, it would be very inconvenient to carry them to a garage or service station to be charged every time after they were finished. Many experimenters are equipped with D.C., or, a rectifier can be purchased from any electrical house. It will pay well to install this because the money expended is soon made back on it.

When a battery is brought in the first thing to do is test the voltage. If the cells show from 1 to 2 V. each they probably need only charging. Next draw enough electrolyte from each cell separately into the hydrometer syringe to float the hydrometer, take reading, and put it back again in the same cell. The table below shows the relative strength of the battery at the various readings:

1250	80%	strength of battery
1225	60%	" " "
1200	40%	" " "
1175	20%	" " "
1150	exhausted.	

A fully charged battery should have a Sp. Gr. of 1.275, or 1275 on the hydrometer, but it sometimes occurs that one shows a density of 1300 or even 1325.

The charging rate will be found on the lead name plate tacked to the case. Here is an example:

Start 13½ Amp. Finish 4½ Amp.

In this case a current of 13½ amperes (about 14-100 Watt lights in the lamp bank

explained later) is allowed to flow until the cells gas freely, then continue the charge for 6 hours at the finish rate (in this case 4½ amperes with about 5 lamps connected). Never hold a match near the vent holes while charging as the products of electrolysis explode. If one of the cells has become short-circuited or for some other reason is below the rest, it should be charged separately until it is up with the

intervals of one or two months to keep the Sp. Gr. up as long as it is not in use. A repair station should make a specialty of storing batteries for auto owners. If the batteries are neglected and allowed to freeze the active material of the plates becomes spongy and will fall off. The table gives the freezing points of various densities.

1150	Freezes 20° above Zero Fahr.
1180	" 0°
1215	" 20° below "
1250	" 60° " "

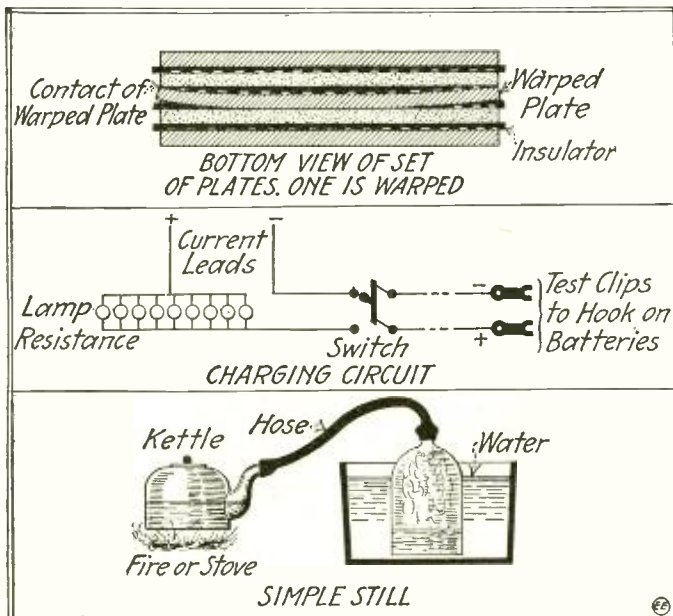
On a 110 Volt circuit a 100 Watt lamp draws nearly 1 Ampere and a 50 or 60 W. ½ Amp. When these size lamps are used for the charging resistance (110 V.) the current flow is easily calculated. The connections for this outfit are shown in the diagram. Don't forget to connect the positive side of the current supply to the positive terminal of the battery. Quite a number of batteries can be connected in series and charged at the same time. If you have test clips put them on the ends of the charging terminals, painting the positive red; also provide a few wires about a foot long with a test clip on each end. With these a connection is easily and instantly made.

Very commonly a battery comes in that has one or more cells which will not raise even after a day or two of continuous charging. This condition is usually caused by warped plates which have worn thru the insulators and touch each other. Such a cell, obviously, cannot be charged as the current goes thru the point of contact. The only remedy is to take out the plates and insulate

the places where they come together. A whole new insulator can be put in, or, a strip an inch wide can be put in from top to bottom where the pressure comes. These insulators may be obtained from any house selling storage batteries. (Diagram shows putting in separators.)

As they increase in age storage cells deteriorate. In a storage battery the active material falls from the grids. This is hastened where they are used on an automobile, because of the jolts they get. The more material they lose the less charge they will hold. It is the positive element that almost always falls out first and a new set of these plates will often make a good

(Continued on page 1313)



Useful Hints On Storage Battery Repairing. Top—How Plates Become Short-circuited By Sulfating, Over-discharge Or Over-charge. Center—Charging Circuit with Lamp Bank. The Lamps are of the Voltage Rating of the Line Potential. Positive Line Goes to Positive Terminal of Storage Battery. Bottom—Simple Still Made from Kettle and Large Bottle for Distilling Water for Storage Cells. Never Use Spigot Water—It Invariably Contains Sufficient Mineral Traces to Sulfate or Disintegrate Your Battery Plates.

others and then connect them all in. Some times a cell lags behind because the electrolyte leaks out of a cracked jar, and every time water is added the Sp. Gr. becomes less. This is taken up later. If the Sp. Gr. does not reach 1275 or over after 6 hours of charging at the finish rate continue at this rate until there is no increase. If a battery has been neglected for a long period it may take several days to bring it up to capacity. Never add acid to raise the density until the battery is fully charged. If it must be added it should have a Sp. Gr. of 1210.

A battery set away for the winter or standing idle for any length of time should first be fully charged and afterwards at

The Electrical Machinist

By H. WINFIELD SECOR

No. 6—ERECTING MOTORS AND SHAFTING

THE erection of dynamos and motors is always a matter requiring extreme care, particularly when it comes to properly and exactly aligning the pulleys on the motor and on the shaft which it is to drive. The leveling of the

face width. In this case the string is applied as shown at B, in the usual manner, and by means of a rule the difference between the two pulley widths is divided up proportionately. For instance, if the larger pulley has an 8-inch face and the small pulley a 6-inch face, then if the two are to be aligned, as is most always the case, then one inch space should be allowed on each side of the small pulley face when it is checked by a cord held on either side of the large pulley, as becomes clear upon examining the diagram.

If the method of lining up pulleys with the cord is not quite clear, a glance at Fig. 1-C will make it so. Here it is seen how a cord is past, as nearly as possible, across the two diameters of the respective pulleys. Where the shaft projects thru a pulley, then the cord is simply pulled taut a little to one side of it, which gives exactly as good results as if there were no shaft projection, and the string past exactly over the diameters. The length of the belt, which is to connect the pulleys is usually measured by means of a strong, non-stretchable cord, past over the two pulleys or else by means of a tape measure.

If the belt is to be a very exact fit, and of the endless variety, then the tape measure should be a steel one, so as to give a very exact reading. Most all motors, however, are fitted with belt-tightening screws on their base, so that quite a little variation is allowed for tightening up the belt, once it is put into place.

LEVELING SHAFTING.

The leveling of shafting, whether large or small, is an important affair, if the best efficiency and quietest running results are to be obtained. Figs. 2, A, B and C show some useful wrinkles in leveling shafts. The usual method for ordinary work is to employ a first-class steel level—preferably one having a V-shaped bottom—and the shafting should be turned into several different positions, so as to get a mean average on the level readings, and also the level should be placed on several points along the shaft while making the measurements, such as those indicated by X, X, X.

A unique suggestion to help in simplifying the leveling of long shafts, or, for that matter, short ones, is shown at Fig. 2-B. Two boiler gage glasses or other suitable glass tubes are hooked up with a length of rubber garden hose or rubber tubing; this is then filled with water, the water not quite reaching the tops of the gage glasses. The free ends of the gage glasses are fitted with hooks, which may pass over the shaft and hold it in position in the manner shown. This method is quite exact indeed, as it is well known that water or any other liquid will always seek its own level. In this case we at once perceive that the water level in the two gage glasses will be the true level, and if we then measure from these points indicated on the gage glasses to the surface of the shafting and keep changing the position of the shafting until these two distances, D and E, are equal, then we know that the shaft is perfectly level.

Where several shaft hangers have to be put in place before the shafting is available, the hangers are readily lined up and secured to the ceiling or side wall, whichever the case may be, by means of a center cord or string, as shown at Fig. 2-C. If more than two hangers are to be mounted by this method, then the two extreme end ones should be aligned and put into place first. Intermediate hangers can then be readily lined up by means of the center

string, which should be placed exactly thru the centers of the bearings in the end hangers, as becomes evident. Of course the string must be carefully checked up with a good spirit level, so that it is in a perfectly level plane. The shaft hangers are usually held on ceiling beams by means of lag bolts.

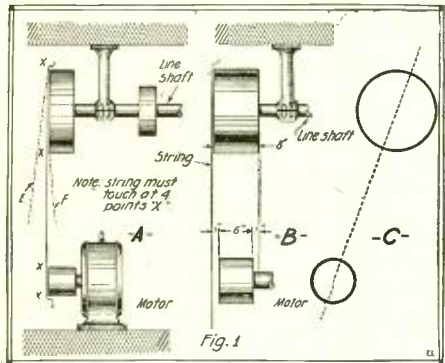


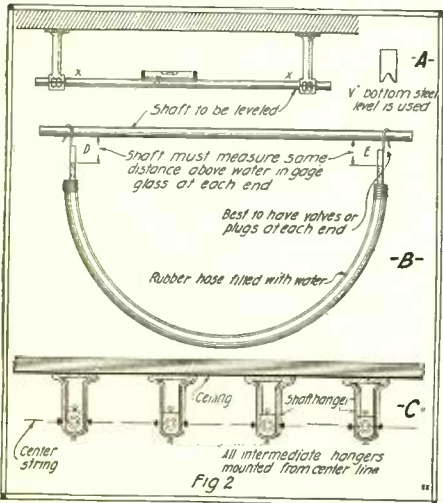
Diagram Showing How Motor and Shafting Pulleys Are Lined Up for Belt Drive by Means of a String or Chalk Line. If One Pulley is Narrower Than the Other, Then It is Centered as Shown at "B."

base of the machinery, as well as the leveling of the shaft are also very important matters which we shall here give our consideration.

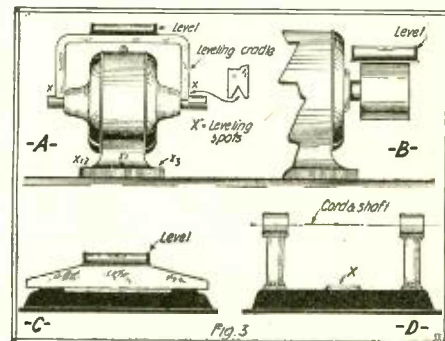
Referring to Fig. 1, A, B and C represent different phases of the art of aligning two pulleys, such as those on a motor and on a line shaft. At Fig. 1-A, the fundamental principle followed in lining up two pulleys of equal face width is illustrated. A strong cord or chalk line is held across the two faces of the pulleys so that the string shall touch at the four points marked "X." Usually two men do this, but if you have to do this alone, as will happen occasionally, then the string may be tightened around the pulley or otherwise secured at its highest point, when you can easily pull the string taut and bring it gradually into line with the lower base of the top pulley, and then move the motor to be mounted into position, so that its pulley face will be in perfect alignment with the cord.

Care must be taken to see that the cord is not allowed to assume an angular position such as shown, in a greatly exaggerated manner, by the dotted line E and F.

In some cases the two pulleys, that is the driver and the driven, are not of the same



Several Schemes Followed in Aligning Shafting. The Stunt Employing the Rubber Hose Filled With Water and Fitted With a Gage Glass on Either End Proves Very Successful and Useful.



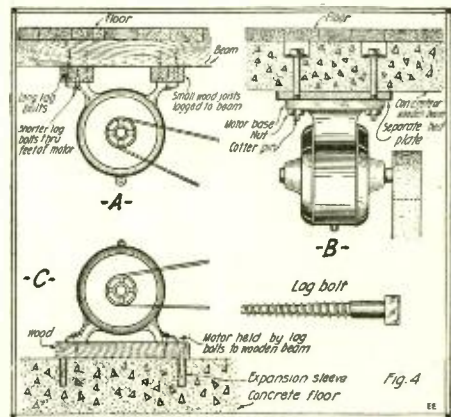
The Leveling of Motors and Dynamos Is Not Always the Easiest Proposition Imaginable. Several Ways of Leveling Up Electrical Machinery Are Here Shown.

LEVELING DYNAMOS AND MOTORS.

The leveling of dynamos and motor frames is not always the easiest task imaginable. This is particularly true in the case of small motors and dynamos having round or special housings, as shown at Fig. 3-A. An idea which can sometimes be brought into play, for such machines, is to have a leveling cradle of the form shown, and which may be adjustable for different sizes of machinery, which can be placed so as to rest on the shaft on both ends of the motor. The two lower feet of the leveling cradle should have V-shaped slots in them. The level is then placed on top of the cradle, as shown. In other cases there is often a sufficient amount of machined surface on the base of the motor so that it can be leveled in the necessary two directions, i.e., at right angles to one another at the points marked X1, X2 and X3, or on both sides, and front and back of the base.

In some instances it is possible and permissible on a small motor or dynamo to level it close enough by placing the level proper on the face of the pulley, as shown

(Continued on page 1323)



Small and Medium Size Dynamos and Motors Are Here Illustrated, Mounted on Both Ceiling and Floor. Motors, Even Small Ones, Should Not Be Held to the Ceiling Beams by Lag Bolts Alone for a First Class Job, as Belting Strains Are Liable to Pull It From Its Moorings.

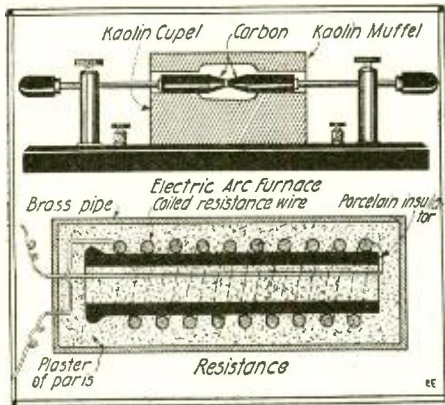
HOW-TO-MAKE-IT

This department will award the following monthly prizes: First Prize, \$3.00; Second Prize, \$2.00; Third Prize, \$1.00. The purpose of this department is to stimulate experimenters towards accomplishing new things with old apparatus or old material, and for the most useful, practical and original idea submitted to the Editors of this department, a monthly series of prizes will be awarded. For the best idea submitted a prize of \$3.00 is awarded; for the second best idea a \$2.00 prize, and for the third best prize of \$1.00. The article need not be very elaborate, and rough sketches are sufficient. We will make the mechanical drawings. Use only one side of sheet. Make sketches on separate sheets.

FIRST PRIZE, \$3.00

A "TESTED" ELECTRIC FURNACE.

I am a reader of your magazine and I have been interested in some of the experiments published in it, and am therefore taking the liberty of sending you the diagrams of an electric arc furnace which I



An Electric Furnace That Works! A Rheostat Is Used in Series With It.

have used in my laboratory for some time with good success.

I believe the diagram to be self explanatory of the method of construction, and can be made from odds and ends to be found in any shop. I have used the above furnace to fuse brass, copper, silver, gold and platinum very satisfactorily as a high degree of heat can be obtained.

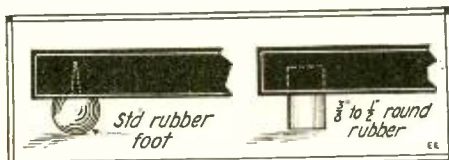
I also give a diagram of the resistance used in connection with the furnace. I used about thirty feet of No. 24 iron wire wound into a 3/16-inch coil which I then wound around a 4-inch porcelain tube. This was then suspended in a piece of brass pipe 6 inches long and poured full of plaster of Paris. It must be noted that before this can be used it must be placed over a very slow fire and thoroly dried out; else it would either burn out the coil or explode, due to the moisture being driven off too rapidly. I used this outfit on the regular 110-volt circuit.

Contributed by DR. A. T. FRIEDLINE.

UNIQUE RUBBER FEET FOR APPARATUS.

I had my wireless apparatus on a high polished table and as I did not wish to mar the table by fastening the apparatus to it, besides being bothered by having the instruments slide out of place and scratching the top, I cut up some rubber bands (about 1/4" x 1") and glued them around the edge of the base, 8" or 10" apart.

Contributed by HERBERT M. MAUS.



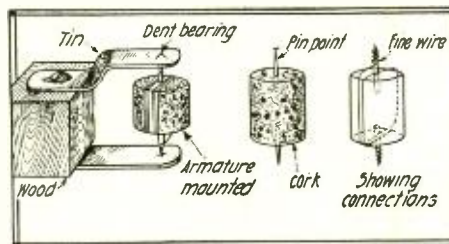
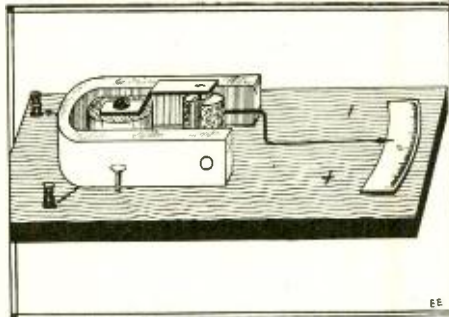
Rubber Feet Improve the Insulation of Any Electrical Instrument.

SECOND PRIZE, \$2.00

MAKING A PERMANENT MAGNET METER.

I have experimented quite a bit on making various kinds of meters and have found great satisfaction in the ammeter here described. Procure a horseshoe type permanent steel magnet, about the size of a telephone magnet; a cork, some fine magnet wire, tin, cardboard and pins, etc. Cut the heads off the pins and insert one in each end of the cork, but be careful that they do not touch—and wind the wire around the cork, as in illustration, and connect each end of the fine magnet wire to the two pins so the pins act as bearings and the cork as an armature. Mount the armature between two pieces of brass strip to act as bearings and place the armature between the poles of the horseshoe magnet. Next bend a piece of copper or aluminum wire and insert one end into the cork. Mount the meter on a planed wood base and fix a cardboard dial under the wire. Calibrate it by means of a standard ammeter and batteries.

Contributed by LEE HOLMES.



The Simplest Permanent Magnet—Moving Coil Meter. Nifty for Experimental Work.

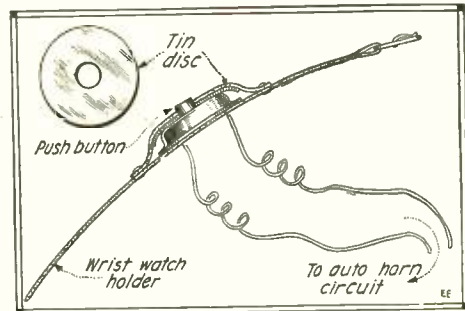
A SHORT-CIRCUIT EXPERIMENT.

Practically everybody knows that if a battery connected to a bulb is short-circuited, the bulb will go out. But look at Fig. 1. The short-circuiting element is an ordinary battery carbon. Close switch A and the bulbs light brightly. Close switch B, and no change in bulb. Why shouldn't it dim? Oh, you think, you only "shorted" one battery. But look at Fig. 2. Here after A is closed and then B, the bell still continues to ring, despite the fact that all the current is short-circuited. Oh, you say, current does not pass thru carbon. But connect as in Fig. 3 and the bell will ring, indicating that it will. The owner of a

THIRD PRIZE, \$1.00

A CONVENIENT HORN DEVICE FOR AUTOMOBILES.

Purchase a wrist-watch case for about 50 cents and cut out a piece of tin large enough to admit a push-button, but leave the outside rim large enough to fit the watch case snugly. Procure a flexible lamp cord of sufficient length to permit the



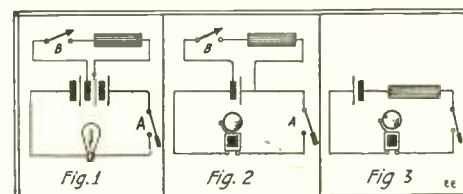
Mount Your Auto Horn Button on a Wrist Watch Band and See How Convenient It Proves.

driver to hold one end with his arm outside the car, as when turning a corner. Now connect the wires to the button and to the electric horn circuit. Our circuit being complete, let us pass on to the uses of the push-button. You may strap the button to your index and second finger, so that the button may be in place for the fingers to be prest against the wheel without removing the hand. Now again, to blow the horn while turning a corner. Simply extend the hand and press the button with the thumb, and continue to steer the car with the other. By this arrangement you may blow the horn, signal to turn the corner by extending the arm, and guide the car—all at the same time. If the driver should not wish to use the button all the time, he may wind the wire around the steering rod and strap the button anywhere on the steering wheel. But pessimists may argue—"They will be easily stolen." I maintain that you can place a separable connector costing 15 cents in the circuit, so that the apparatus may be disconnected and placed under the seat or elsewhere. I find this a decided improvement over the present method, and think it will be worth a trial by all motorists.

Contributed by LYLE CASHION.

Wheatstone bridge will easily ascertain the reason, however. It is a well-known fact that electricity will pass thru the conductor of least resistance.

Contributed by PHILIP A. WALL.

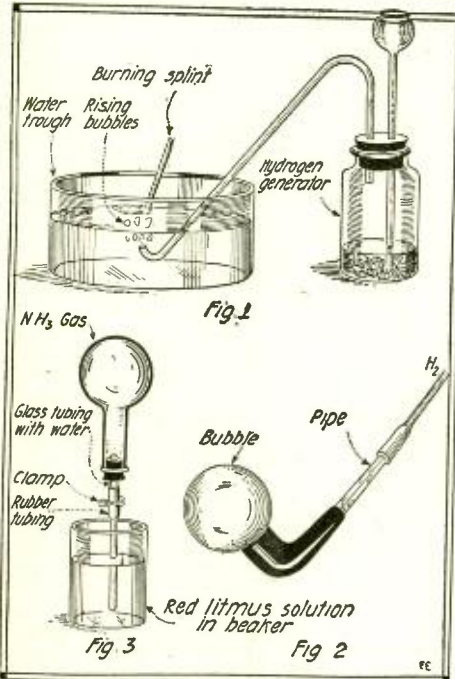


Conundrum: When is a "Short-Circuit" Not a Short-Circuit?



INTERESTING CHEMICAL EXPERIMENTS.

1. Heat a little sulfur with concentrated nitric acid until it has disappeared. Observe the red fumes. Insert a burning match into them and note that they support combustion. When the reaction is over,



Some Very Interesting Experiments in Chemistry are Here Illustrated and Described.

allow the tube and its contents to cool, then add barium chlorid solution and a white precipitate will be formed. This shows the presence of sulfuric acid. The sulfur has been oxidized by the nitric acid to sulfuric acid.

2. Burn a little sulfur in a bottle of oxygen and note the phenomenon. Do the same with phosphorous. This time if the room is dark, the reaction will be more brilliant. Burn some charcoal also in oxygen and note the scintillation. Slip a small piece of cotton into melted sulfur, then attach it to a piece of picture wire. Ignite this and lower into a bottle of oxygen. Note how readily the wire burns and the globule of red hot iron that forms on the end.

3. Generate hydrogen and allow it to escape from under water. Hold a lighted splint over the escaping bubbles. (Fig. 1). As each one escapes it is ignited and explodes. This sounds like a miniature battle. Another way is to blow hydrogen bubbles and as they rise, set fire to each. (Fig. 2).

4. Dissolve some yellow phosphorous in carbon disulfid and paint a sheet of paper with this solution. In a darkened room the phosphorous will glow after the carbon disulfid has evaporated. Do not leave the solution or brush around. The bottle should always be tightly corked.

5. Dissolve 15-20 grams of lead acetate (sugar of lead) in 500 c.c. of water and place in a wide mouth bottle. Suspend in this liquid a piece of sheet zinc by a string. Allow it to stand for a day or so. By

careful observation you will see the lead tree grow.

6. Alcohol from sugar. Dissolve 30 grams of table sugar (granulated) in 400 c.c. of water. Pour this into a flask provided with a stopper and delivery tube. Add $\frac{1}{4}$ cake of yeast and set aside in a warm place. It would be well to have the delivery tube dip into lime water, so as to show that carbon dioxide is given off. Allow this to stand for a few days. You can then distill off the dilute alcohol. This is done by distilling about half of the liquid and discarding the remainder. It may be necessary to distill off half again before the alcohol is strong enough to burn.

7. Boil 10 grams of powdered nutgals in 80 c.c. of water. Filter after standing. There is now tannin in the solution. Add to this a solution of iron sulfate. Some inks are made in this manner.

8. Place a small piece of phosphorous in a porcelain dish (free from water), and the same amount of iodine. The reaction proceeds by itself with the production of much light and heat.

9. Place a little powdered antimony into a jar of chlorin. It immediately catches fire and gives off a shower of sparks. Heat a piece of thin copper foil and plunge it into a jar of chlorin. Observe that it catches fire immediately, forming copper chlorid. Paint a piece of paper with turpentine and hold it in a flame until it begins to light. Quickly plunge it into a jar of chlorin. There will be a flash and great clouds of carbon are produced. Flowers, calico, etc., may be bleached by moistening and placing in a jar of chlorin.

10. Make an intimate mixture of equal parts of potassium chlorate and sugar. Set this in a pile and add a drop of sulfuric acid (concentrated). The mass catches fire at once and flares up.

11. A very striking experiment to illustrate the solubility of ammonia gas is to fill a flask completely with the gas and insert a stopper provided with a straight piece of tubing. (See Fig. 3). To this is added a piece of rubber tubing over which a clamp is placed. To this is attached another straight piece of glass tubing which dips into the bottom of a beaker of red litmus. When the clamp is opened, the water rises and the color changes to blue. This will take place sooner if water is put into the upper piece of tubing. (Fig. 3).

Contributed by

EDWARD MARENZANA.

LIQUEFYING A GAS.

The actual liquefying of a gas is an experiment of great interest, and in the case of sulfur dioxide easy to carry out. The apparatus is set up as shown in the diagram. A is an Erlenmeyer flask carrying a dropping funnel and containing in the bottom a layer of sodium sulfite powder. The funnel contains a solution of sulfuric acid made by pouring the concentrated acid very slowly into an equal volume of water and allowing to cool. B is a gas-washing bottle containing concentrated sulfuric acid. C is a battery jar containing a U-tube packed in a freezing mixture of salt and ice.

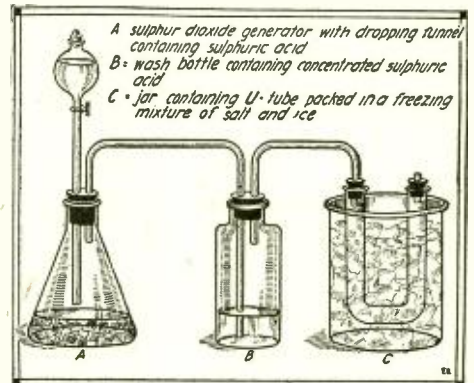
After the set-up has been made allow the acid from the funnel to drop slowly upon

the sulfite. A rapid evolution of sulfur dioxide gas will at once begin, and in passing thru the U-tube the gas will be condensed to a clear colorless liquid.

Freezing Action of the Gas—Pour a little of the liquid gas into 10 cc. of water in a small beaker. The mixture, upon stirring, will immediately crystallize to a solid mass.

Place a little water on a block of wood and upon it set a small beaker containing a little of the liquid gas. The rapid evaporation of the liquid will produce intense cold and freeze the beaker to the block.

Contributed by FLOYD L. DARROW.



Apparatus Set Up for Experiment in Liquefying a Gas.

TO GIVE PLASTER FIGURES APPEARANCE OF MARBLE.

Put one ounce of grated pure curd-soap into four pounds of clear water. Dissolve in a well-glazed earthen vessel. Then add one ounce of white bees-wax cut into thin slices. As soon as the whole is incorporated it is ready for use. Having well dried the plaster figure before the fire, suspend it by a piece of twine, and dip it once into the above varnish. Upon taking it out the moisture will appear to have been absorbed. In about two minutes stir the solution and give the figure another dip. Two dips are usually sufficient.

Allow the figure, carefully covered to protect it from all dust, to stand for a week, then with a soft muslin rag, or cotton wool, rub the figure gently, when a most brilliant gloss will be produced.

Contributed by

WALTER CHAS. MICHEL.

METHOD OF TESTING WOOLEN AND COTTON THREADS.

Take a few threads of the material to be tested and place in a test tube with enough nitric acid to cover them. Bring just to the boiling point over a flame and allow to cool. Pour a small quantity of ammonium hydroxide in the tube and note the change. If the liquid is not changed in color the material is cotton, but if the liquid assumes an amber color the material is woolen. In either case dense white fumes of ammonium nitrate will be evolved from the tube.

Wool contains much nitrogenous matter while cotton contains none. This accounts for the change. The above is a sure test. I have used it repeatedly.

Contributed by

JOHN ELIOT CHRYSAL.

RADIO DEPARTMENT

Some Long Distance Radio Telephone Tests

By ROBERT F. GOWEN*

A SERIES of radio telephone tests and experiments by the writer performed during the months of December and January have produced some results which may be interesting to the readers of the ELECTRICAL EXPERIMENTER. The results are interesting, not only because of the records made, but of the peculiar conditions under which the experiments were performed.

The transmitting equipment consisted of a standard one kilowatt deForest Oscillon panel transmitter which is designed to work on large ship type aerials on wave-lengths between 500 and 1000 meters. This transmitter uses two ½ kilowatt power tubes for the generation of the high frequency currents. The plate current of these tubes is supplied from a motor-generator set which delivers a voltage of 1500. The tubes are of a new type made of Pyrex glass and the plates are of Tungsten so that external cooling is not required. The tuning is done by means of a variable sectional series condenser and by varying contact clips on a helix in the rear of the panel. The circuit employed was of the standard deForest single tuned type with capacity coupling between the grid and plate circuits.

A special new type of modulating circuit developed by Mr. C. V. Logwood was installed, the novelty being in that both the grid and plate circuits of both tubes are modulated by the voice currents at the same time. Continuous wave telegraphy is accomplished by making and breaking the grid leak circuit and a modulated wave was added by substituting with a switch, a buzzer and key in place of the microphone.

The transmitter was installed at the home of the writer in Ossining, N. Y., and connected to a comparatively small aerial, four wires 170 ft. in length with a spacing of 30 inches and with an average height of 55 feet. A 60-foot lead-in was tapped off the end nearest the station and brought to the transmitter through a hole in a window pane. This aerial has a capacitance of approximately .0007 micro-farad and a fundamental wave-length of about 355 meters.

The ground system consisted of 84 square feet of copper sheet buried beneath the foundations of the operating room about 8 feet below the transmitting apparatus. There were also additional grounds to the water pipes, gas pipes, heating apparatus, etc., of the house.

Upon installation, no difficulty was experienced in making the transmitter operate successfully on 750 meters for tests and demonstrations with the deForest labora-

tories at High Bridge, but when later, experiments were made to cause the set to oscillate at 200 meters in order to work with the amateurs, it was found that the constants of the circuit were such as to make it decidedly unstable at this high frequency. After a good deal of experimentation and adjustment, however, fairly good results were obtained at a wave-length of 330 meters which, it will be noted, was below the fundamental of the aerial.

Using this wave-length during December the writer attempted to communicate with amateurs in the vicinity of New York and found great difficulty in making the telegraph signals heard because of the extremely sharp tuning of the emitted wave and also because very few amateurs listen on wave-lengths over 250 meters.

On the 330 meter wave-length the transmitter would put but 2.4 amperes into the aerial with an input of 300 watts, tho a maximum of 2.6 amperes could be obtained with an input of approximately ½ kilowatt. Owing to the unstable conditions caused by the circuit constants the oscillator had very poor efficiency and about January 1 the writer was surprised to have a report that the signals were being heard at Utica about 175 miles away. Mr. Benas at Utica reported by radio telegraph and by letter that the music sent out at the Ossining station could be heard 100 feet away from his telephone receivers when using a two step amplifier, so that in two instances, his friends there had used it as a dance orchestra.

It was apparent from this report that, altho it was difficult to get amateurs to listen and answer the calls on 330 meters, when the signals were once tuned in, they were very loud. This incentive prompted the idea of working later at night when the amateur interference was less, and shortly thereafter Radio Station 8ER answered a call and reported that they were at St. Mary's, Ohio, more than 600 miles away.

Continued efforts in adjustment of the circuit and methods of calling them brought in reports from many stations thruout Ohio, and Indiana. Reports of successful reception of the speech were received also from Wakefield, Massachusetts, Gaffney, South Carolina, Napanee, Ontario, about this time, increasing the distance to about 750 miles. Subsequently a letter was received from the operator on a yacht 300 miles south of Jacksonville, Florida. (Cont. on page 1326)



Photo Above Shows the Author, Mr. Robert F. Gowen, the Radio Engineer Who Talked 1,500 Miles on Less Than 300 Watts, or About One-Fifth of a Watt per Mile. He is Shown Holding a New De Forest 1 K.W. Transmitting Bulb or "Oscillon." Photo Below Shows Amateur Radio Station of Mr. Trump at Topeka, Kansas. He Received the 1,500 Mile Radlophone Speech Sent Out by Mr. Gowen at Ossining, New York

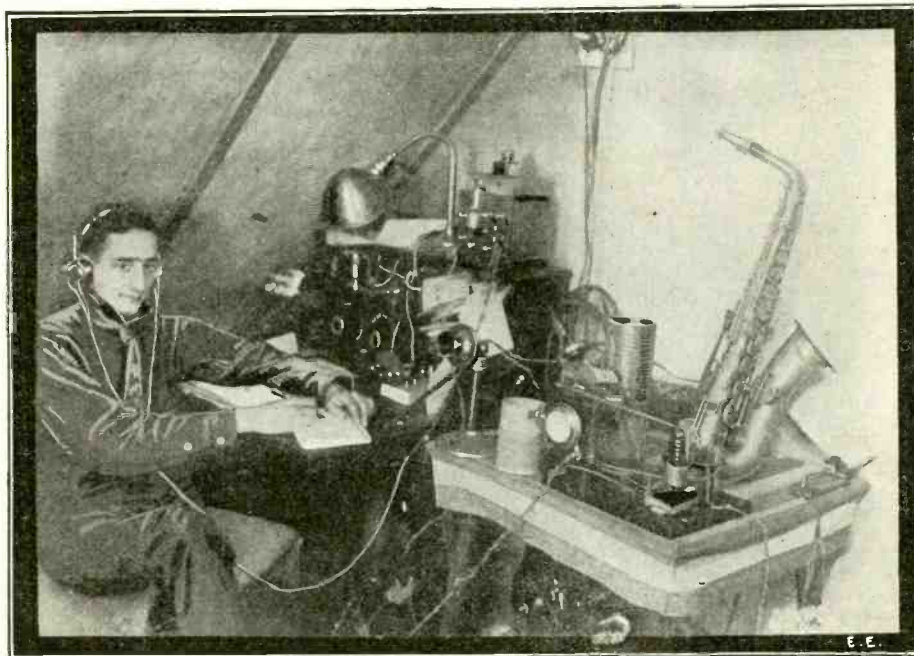
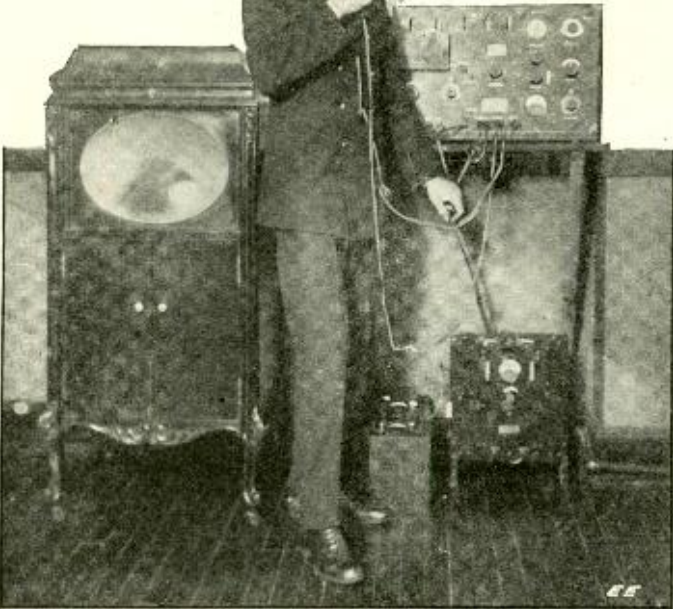


Photo from Underwood & Underwood
Robert K. Trump, 21, a Former Sailor Living in Topeka, Kansas, Overheard Phonograph Music and Conversation Between Robert F. Gowen, Engineer of the DeForest Radio Telephone and Telegraph Co. and R. H. G. Matthews of Chicago

* Engineer deForest Radio Tel. and Tel Co.

Music 400 Miles by Radio "Direct Current" Transmitter

If you haven't your favorite jazz melody and if there isn't one within 400 or 500 miles, don't let that worry you. Just send a radio to the nearest wireless station, and have them put the desired record on the instrument, put your receiver in operation, and you have it. Everyone knows the wireless has proven a successful invention, but very few know all the uses it may be



in all experimental work and the last rating was given 99.2 per cent. The photo shows L. W. Elias and the machine.

The wireless telephone is not so much of a novelty any more, altho of course, the apparatus is not to be had for a mere song. However, our radio experimenters, even the youngest, are rapidly becoming experts in the development and construction of simple apparatus, whereby it is possible to transmit articulately, the spoken word. In transmitting music or vocal records from a phonograph by means of the wireless telephone, there are several different ways in which

By Means of the Phonograph and Wireless Telephone Apparatus Here Shown, Dance Music Was Recently Transmitted 400 Miles by Radio to Some of Uncle Sam's Convalescent Soldiers. Photo (c) by U. & U.

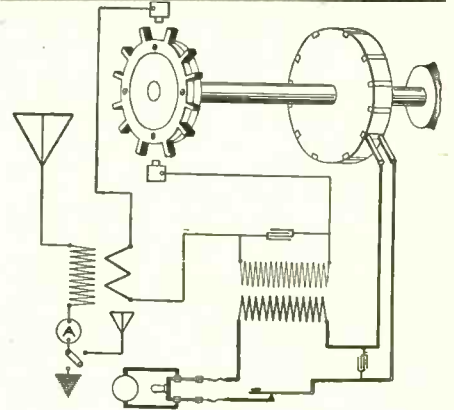
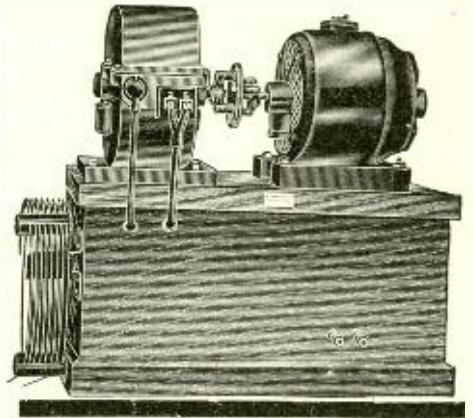
New Direct Current Wireless Transmitter Giving a Clear Note Equivalent to a 500-Cycle Synchronous Spark Set. Its Secret Lies in the Use of a Rotary Synchronous Spark Gap and Interrupter in Place of a Fixed or Stationary Spark Gap and Ordinary Interrupter.

the air waves set up in the phonograph sound chamber may be communicated or super-imposed upon,

the wireless telephone transmitting apparatus, and eventually to the antenna from which this is liberated into space, in the form of electro-magnetic waves in the ether. In some cases, the microphone of the modulating circuit of the wireless telephone outfit is placed in proximity to, or secured tightly to, the phonograph sound-box proper. In other instances, one or more microphones of the modulating circuit have been placed in the amplifying sound chamber of the phonograph, and this has been found to give very good results.

A microphone placed inside the doors or grill of the phonograph has many good points about it. This is so for one reason that the sounds created by the diaphragm of the phonographic sound-box have not their full vibrating timbre and sonority when they first proceed along the tone chamber, but receive their full sonority only after they have entered the larger amplifying chamber.

A new radio transmitter has been developed by L. M. Cockaday, of New York, which operates on a direct current source



of power, the system being such that it eliminates the motor-generator now used in connection with spark set transmitters.

In the primary circuit a rotary interrupter is used in series with the primary coil of a step-up transformer, in combination with a synchronous rotary spark-gap in the secondary circuit, as shown in the diagram.

The relative positions of these two wheels are so adjusted that as the interrupter closes the primary circuit, the condenser in the secondary circuit can discharge only at its maximum capacity; that is to say, the spark-gap comes into sparking position just as the interrupter opens the primary circuit, thereby obtaining its highest efficiency.

The interrupter successively opens and closes the power circuit a sufficient number of times to obtain a clear 500 cycle tone which is always steady.

Audions on Alternating Current Again!

As several readers have inquired about using audions on A.C., and how to get rid of the hum, etc., we referred these to Mr. Elliot A. White, author of the article "Operate Your Audion on A.C.," which appeared in the July issue. Here are some valuable pointers from Mr. White:

"In reply to your queries, I understand your first paragraph to mean that the queries concern the use of alternating current for the filament only.

"My experience has been that it is easier to use A.C. on the plate than on the filament, because in the former case the large condenser across the leads from the rectifier keeps the 60-cycle hum out of the circuit. It is more difficult to use the A.C. for the filament only, as it is sometimes hard to get rid of the hum. However, I have personally, as I said in the article, used the A.C. for both plate and filament,

both separately and together, and got rid of all noise. A friend of mine has also had success with it on the filament alone—"as silent as a church," he told me. I believe the Navy used toy transformers for filament-lighting at "Great Lakes" during the war, and I have also heard of its use by the Navy and by the Federal Telegraph Company on the 'Coast,' so you see it can be done all right. I suspect the trouble in the cases you mention is probably due to the Experimenters themselves, as I suggested in the article, for I by no means claim that the device is 'fool-proof.'

"However, you might call their attention to several important points, all of which were treated in the paper: 1. The connection to the balancing resistance across the filament must be properly adjusted. 2. Connections from the tuned circuit to the detector must be made exactly as in the

illustration ('ultraaudion' hook-up, the secondary being connected to grid and plate, not grid and filament). 3. The tuning adjustments of inductance and capacities must be properly made, this being delicate, as I said. 4. Any foreign sources of interference from A.C. must be eliminated.

"If your complaining readers are correct as to 1 and 2, then their trouble is with either 3 or 4. Concerning these, I would refer them again to the article, particularly to the second and third paragraphs from the end. It is, of course, also possible (I know of one such case) that the Experimenters are getting cross-talk from near-by power lines to antenna outside the house, or from house wiring to the set inside, either by capacity effect or by direct induction. I should think you would find it difficult to handle these problems without being on the ground."

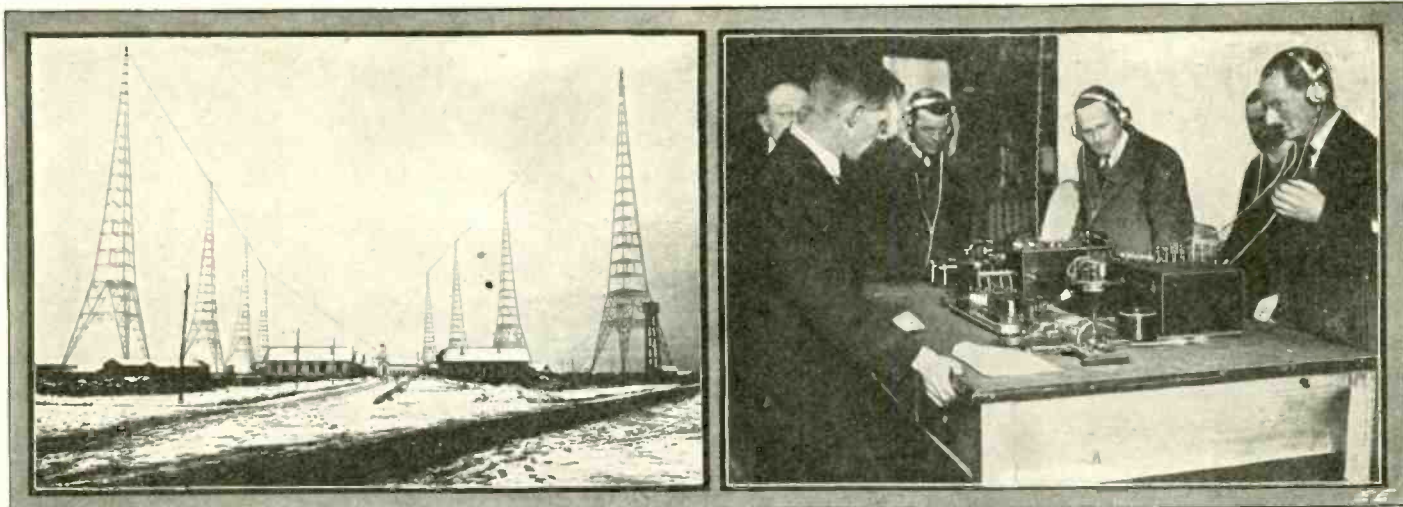


Photo at Left Shows the Famous New High-Powered Radio Station at Croix d'Hins, Which is Located Just Outside of Bordeaux, France. It Has a Total Power Rating of Some 1,000 Odd Kilowatts. Photo at Right Shows Remarkable New Radio Receiver Which Automatically Rings a Bell Signal on Ship, When Another Vessel Is Sending Out an "S.O.S." Call for Help. This Will Avoid Delays in Answering Distress Calls at Sea.

Latest Radio News

THE accompanying photograph at the left shows the gigantic steel towers of the powerful Lafayette radio station of Croix d'Hins, located 15 miles outside of Bordeaux, France.

This station, one of the most powerful if not the most powerful in the world, was started in 1918 by the U. S. Navy to enable radio communication to be carried on in a positive manner at all times with the American war vessels traversing the Atlantic Ocean and other waters.

This plant has since been turned over to the French government by special arrangement. There are eight giant masts, each rising 825 feet above "Mother Earth," which serve to support the antenna conductors.

When the armistice was signed the U. S. Navy Radio Department discontinued work on the stations, but the plant was completed by the Pittsburg-Des Moines Company for the French government.

This plant will have various types of radio transmitting equipment, including arc

and spark sets with a total rating of some 1,000 odd kilowatts.

AUTOMATIC S.O.S. BELL SIGNAL FOR SHIPS.

The photograph presented herewith at the right illustrates a remarkable new radio invention which is said to pick up and translate "S.O.S." calls from ship stations and to cause a bell to start ringing in the station receiving the call. In other words, when a ship in distress sounds the S.O.S. call (the International radio signal of distress, to which ships of all nations pay strict attention under the present regulations, in order to try and speed toward the disabled ship and render succor, if possible), the radio signals, flashed out from the vessel in distress is picked up on the antenna of other ships within a radius of several hundred miles and if fitted with this apparatus the message of distress will give an audible signal on the bell at once, without taking a chance of whether it will be picked up by a radio operator

"listening in." It has sometimes been the case that such signals have not been heard even by ships quite close to the vessel calling for assistance, owing to the fact that the operator may have been off duty at the time, or for some other reason.

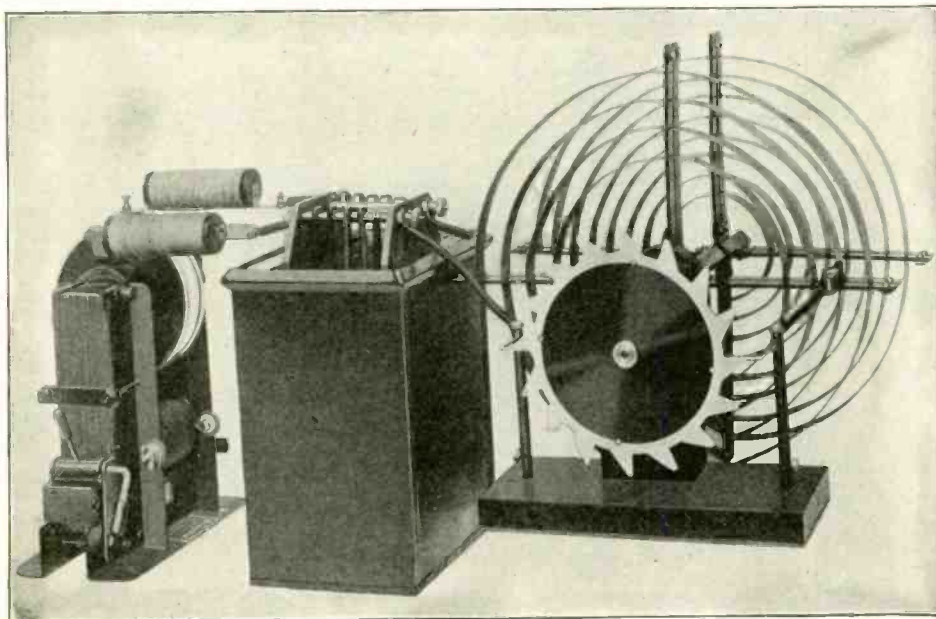
We have long advocated such an apparatus as this for receiving and interpreting "S.O.S." calls at sea, for many reasons. It is a simple matter now-a-days to rig up a positive working apparatus which, by means of sensitive relays and amplifiers, will serve to close a local circuit containing a sufficiently strong battery to actuate a call bell circuit.

The main purpose that the bell signal in this case serves is to call the attention of the radio operator in charge, and possibly the ship's commanding officer, to the fact that a distress signal is being received. When this has been done, the operator of course "listens in" in order to receive the further details of the distress ship's location, which is given out by wireless both as to latitude and longitude.

New Amateur Wireless Transmitting Set

General amateur wireless telegraph stations are restricted to a transmission wavelength of 200 meters, and a Chicago concern has developed and placed on the market a wireless telegraph transmitting set designed to give the best results on this short wavelength. This set includes a transformer, condenser and oscillation transformer and a rotary spark gap, all of which are shown in the accompanying illustration.

The transformer is of the closed-core, air-cooled type with a double magnetic circuit. A feature of the construction is its magnetic shunt control, which protects the



Complete Amateur Radio Transmitter Designed for 200 Meters Wave Length. Built In Sizes from 1/4 to 1 K.V.A.

transformer from all undue current surges. The transformers are designed to be connected directly to a source of alternating current, no choke coils being necessary. Capacities of 1, 1/4, 1/2 and 1/4 k.v.a. (kilo-volt-amperes) are made, but the 1/4 k.v.a. transformer does not have the magnetic shunt control. The center device in the illustration is the condenser. This is of the oil-immersed type. There are ten terminals arranged so that the capacity can be varied from .0018 to .009 microfarad in single steps of .0009 microfarad each. One k.v.a. = 1000 watts at 100 per cent power factor.

Selective Wireless Control

By EVERETT LEO DEETER

HUNT up all your old telegraph coils, your extra Audions (you who have fat pocketbooks), and prepare to settle down to business, for here's a new stunt to try, and you can become a great "profes-

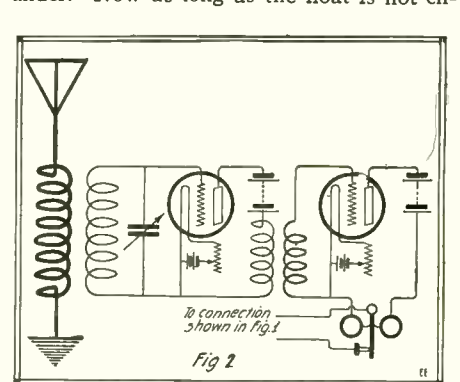
sor," or a "wizard," by amazing people in your own home town by the act of controlling numerous distant apparatus, simply by pushing a button on your radio-sending outfit.

Here we go—get your electrical dictionary and turn to diagrams—make sure you know what sign represents a relay, coherer, battery, etc., as you hardly ever see this one, and then after six or seven hours of real study we can almost realize the following facts:

If you focus your luminaries on diagram No. 1 and was just to imagine that some poor jay wireless amateur was to send out a right smart wireless wave, which was by decrement and other complicated mathematics of the same metric wavelength as that of our elaborate de-cohering outfit, why then our clumsy antenna would probably make a successful attempt and "down the thing." Now if the wave gets thru the coherer to the ground it causes the filings to get close enough together to lessen their resistance, and then things begin to hap-

pen. When the platinum (if you're rich) points close, of course the juice goes thru and makes the magnet pull down the arm which operates the sprocket wheel, in turn operating the commutator or the switch controlling the display apparatus. If you think you now understand all you've been over, proceed to diagram No. 4 also. If you don't proceed anyway—it'll do your think tank good. When the arm is down it makes contact to J, and this gives a little stingy juice to the bell, what there is of it, which hits the glass tube of the coherer and knocks the filings apart, ready for another "jazz." But this is not all the clumsy brass arm did—the string seen between C and M pulls the arm B, and out at the end where the plunger R is connected at O there is quite an emotion as the arm drops thru a long arc, which may be varied by sliding the arm at N.

The plunger R is connected to a small air-tight vessel partly filled with water, and this floats upon the water enclosed in the larger tin can P (see Fig. 5-A). Now when the arm comes down the "ship sinks," and



Amplifying Circuit Provided With Two Audions Connected to Sensitive Polarized Relay, Which in Turn Actuates the Special Selective Relay Here Described.

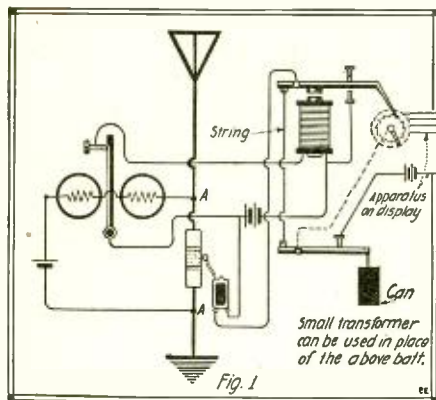


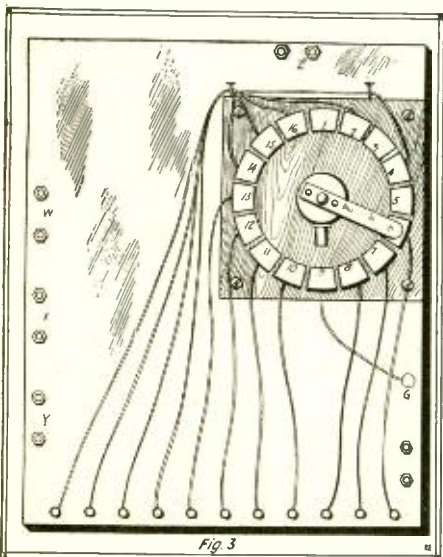
Diagram Showing Connection of Coherer and Decoherer With Polarized Relay, and Also Special Selective Relay Fitted With Dash-Pot.

By following the construction details given herewith a wireless control board which works very well can be easily constructed, and by its use the amateur can operate any certain apparatus connected to the board without first operating others, thus making it a true selective control.

Now if you are done with that message we'll go to work—yes, tell your neighbor to come over, too, for after he sees your's he'll want one, too. First we will see for ourselves how the thing works.

For simplicity we will consider the use of a coherer—the poor nut may be forced to use one in his actual model—and if he spent all his money for auto cable to try out the "underground trick"—but, anyhow, a coherer works quite well. But don't let anyone catch you when you file up a nickel and dime for filings. And don't break up the family thermometer for a tube, because

pen. When the platinum (if you're rich) points close, of course the juice goes thru and makes the magnet pull down the arm which operates the sprocket wheel, in turn operating the commutator or the switch controlling the display apparatus. If you think you now understand all you've been over, proceed to diagram No. 4 also. If you don't proceed anyway—it'll do your think tank good. When the arm is down it makes contact to J, and this gives a little stingy juice to the bell, what there is of it, which hits the glass tube of the coherer and knocks the filings apart, ready for another "jazz." But this is not all the clumsy brass arm did—the string seen between C and M pulls the arm B, and out at the end where the plunger R is connected at O there is quite an emotion as the arm drops thru a long arc, which may be varied by sliding the arm at N.



Rear View of Selective Relay Switch-board

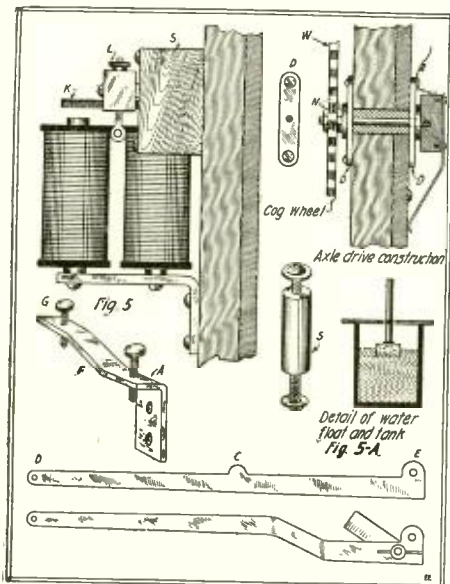


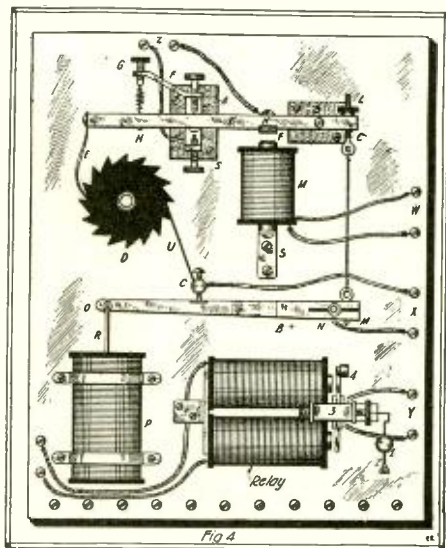
Illustration of Details to Be Followed in Constructing the Selective Radio Control Relay Here Described.

tirely up the main circuit for the display apparatus is open and therefore they do not operate. But when the arm is up then the circuit and the apparatus circuits operate on the point the switch is left on.

Now for the conclusive diagram, No. 3. This shows the back of the control board, and mainly the circular switch. Now supposing we had No. 1 of the switch connected to an electric train or street car, No. 3 to a little windmill, No. 4 to an electric light, No. 5 to an electric cannon, etc. We want to cause No. 1, the train, to operate. We push our transmitting button four times and toot-toot she goes. Now we are asked to shoot our cannon, No. 5, and all we have to do is to push the button four more times and bang! For No. 10 we would now push five times, etc.

Two and ten on the switch are stop blanks, while 16 can be a place where they all operate, making the segment of eleven narrow strips, not touching one another and connected to all other segments of the switch.

Retire for the night now, for you'll need all kinds of strength and ability, as well as (Continued on page 1334)



Front View of Selective Relay Switch-board.

War Versus Pre-War Apparatus

By "SPARKS"

C. E. Radio, U. S. N.

THESE seems to be a marked tendency among radio experimenters of the present to lay their hands on the new developments in radio apparatus, particularly as applied to various receiving instruments which have been brought out during the World War. From what I can gather from various publications and letters from the Amateurs, a great demand has arisen for the most modern of apparatus. This demand reflects a spirit of progressiveness in the Amateur, it is true, but there is a limit to all things, and the adoption of all the new and fancy frills which are being described from time to time will lead to a limit where the distressing facts are all too plain—that the little old stuff that we used to "gather in" the signals with, was far superior to seventy-five per cent of the war apparatus.

I have had considerable experience with the majority of apparatus which was brought out during the period of hostilities, having used practically all the latest developments under typical operating conditions, and for the benefit of those whose longings for "Navy VT's," "loop antennæ," etc., are getting the better of common sense, let me outline a few of the results I have obtained with new and marvelously efficient (?) war radio apparatus.

AERIALS.

Let us start at the top, this being the aerial, of course. Before 1917 we Amateurs used the good old inverted "L" or "T" type, flat-top antennæ of the four- or six-wire size, elevated from thirty to fifty feet, and we got GOOD results. A certain Portland (Ore.) Amateur, regularly communicated with a station in Los Angeles and with a Reno (Nev.) station also. Chicago Amateurs were heard up to one thousand miles, and the east coast stations were easily heard in the Middle West and South. *All this with one K.W. or less and on two hundred meters!* In my tests, I used an antenna of the typical flat-top "T" type, three hundred feet long and eighty feet high, four wires, and with a two-kilowatt, five hundred-cycle set, was able to cover twenty-two hundred (2,200) miles at night on six hundred meters, at sea. Substituting a loop antenna of four hundred ninety (490) meters natural period, I obtained a radiation of seventeen amperes, but my signals were only heard at a distance of two hundred seventy miles. The vessel with which I carried out these tests used an Amateur tubular audion bulb, with no amplification; with his Navy VT he could hear me very faintly at two hundred forty miles. I made several similar tests, elevating the loop, etc., but on no occasion was I able to do better. On the other hand, the loop antenna for receiving is not at all bad. I picked up signals from Lands End, England (GLD), at seventeen hundred miles, with one tubular bulb (eleven hundred miles on a Navy VT), and merely placing the loop on the bridge. The chief objection to the loop antenna for reception in Amateur Stations is its marked directive effects. In some cases this would be an advantage, in cutting out interferences, or receiving signals from but one general direction and its opposite, but very few Amateurs will care to limit their receiving possibilities to but one or two points of the compass. The loop invites experimentation, but don't be so all-fired het up about adopting it without trial in your proposed station. Stick to the flat-top, inverted "L" or "T" types—they aren't going to be back numbers at all.

AS TO APPARATUS.

Now as to the apparatus itself. A new form of layer wound inductance has made its début, in the form of pancake loading coils, and is also being embodied in several forms of loose-couplers. The coils have given good results, when used as loading inductances and coupler coils, and have the advantage of taking up much less space than the old type of cylindrical tube windings. It is also easily possible to incorporate these coils into panels, which are very popular, and make a neat job of it. The layer wound coil—*IF* wound with an offset winding (honeycomb coils) is a distinct step forward, and full credit should be given it. Experimenters, in buying, however, should demand this offset winding which makes the coils what they are—extremely neat, compact and efficient little units.

A word now about *capacity coupled* tuners. These were tried on various vessels, and in shore stations, but were found to be impractical for spark reception, due to their extreme sharpness of tuning, which made them poor "stand-bys." In certain cases the tone of the incoming signal was also distorted by them. For these reasons their

as is a motor-generator. We are mostly concerned with detectors, however. The war tubes were designed to combine ruggedness, reliable operation in inexperienced hands, with a fair degree of sensibility. In the last named requirement they did not exceed the specifications in the least. It is true that such bulbs require no variation of plate voltage and will operate over a moderate range of filament current fairly well, but the Navy VT's all require a plate voltage of from seventy to one hundred and fifty volts. I have used probably two hundred different Navy tubes at times, and have yet to find one which equals the little old "tubulars" for sensitiveness. A new bulb has recently come into prominence, which I have had no opportunity of trying out as yet, but which seems to be "the goods," as it is becoming popular with a great number of Amateurs. It requires but a low plate voltage not required to be varied and seems to promise much. Until I have had the opportunity of trying it out, however, I shall stick to the old "tubulars" for all around satisfactory work. I have tried the new bulbs as amplifiers, by doubling the plate voltage—sometimes even tripling it—and have found them to be excellent for that purpose, better in fact than the tubular bulbs, which are poor amplifier tubes.

All this crabbing would naturally lead up to the question of what I would consider a good Amateur Set for receiving. My idea is, after testing, planning, designing and trying all manner of sets for the past two years, to have a *short wave set*, with a range of one hundred and fifty to six hundred and fifty meters, to include both Amateur and Commercial marine waves, and get good efficiency on each. The circuits should by all means be *regenerative*, using one of the old tubular bulbs. If it is desired to amplify these sets, I would suggest a two-step amplifier using the new Amateur tubes. The transformers should perhaps be purchased until more data is published regarding their construction than is now available. The telephones should preferably be of the mica diafram type, or if the price is prohibitive a good two or three thousand ohm, double headset.

Besides the above set, all well equip Amateur Stations should have a long wave set, capable of receiving the undamp wave stations. While personally I do not care for the sustained wave system, it seems to be the coming thing, so we must all keep up with progress. An efficient *arc receiver* would comprise a long wave coupler, capable of receiving waves up to ten thousand meters at least, two or three variables, mica diafram phones, and a good oscillating bulb with a modern oscillating circuit. A very good undamp wave set can be made from the unit inductances now on the market, layer wound as before described. Several reliable concerns are putting out such inductances in neat individual cabinets of varying wavelengths, so that the inductances can be placed next to each other and used as primary and secondary coils, varying the coupling by changing the distance between the coils. If a receiver such as this is properly made, very good results will be had with an antenna of one single wire, several hundred feet long, which need not be more than *thirty feet high*.

A good ground connection is vitally important in every case. Solder your ground lead to a water pipe, and make it of heavy cable. In addition, ground to everything within reach—steam pipes, etc. It all helps.

If care is exercised in the construction and installation of equipment, and instru-

(Continued on page 1330)

In April

"Radio Amateur News"

Wireless in Modern Aircraft.

By A. J. Hall

The Priess Loop Set, Part IV.

By W. J. Henry

New Facts About the Nauau Station.

By Dr. A. Gradenwitz

Aladdin's Lamp.

By C. S. Wolfe

A Resonant Transmitter.

By W. S. Lemmon, E.E.

Easily Constructed Radio Mast.

By E. L. Deeter

adoption as spark receivers never became very popular, but in long wave undamp wave receivers they seem well adapted, for their sharpness is an advantage there, and it also seems that the more variables that can be crowded into an *arc set* the better it works. Capacity tuners, however, will never become popular in Amateur Stations.

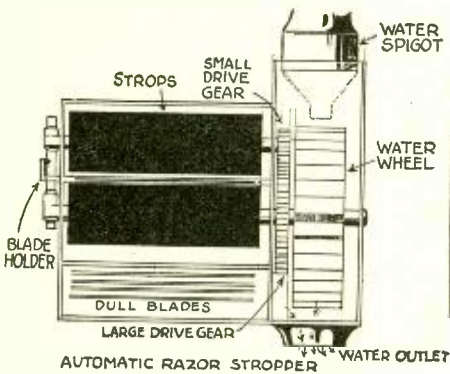
The heart of the receiving station draws our attention next. I have heard more Amateurs whine, sigh and express extravagant promises of reimbursement to anyone who would get them a Navy VT than desires for all the other new apparatus that has appeared. The prevailing opinion seems to be that for sensitiveness they are marvelous—unequaled! Where this idea ever found root is puzzling, in the face of the fact that the majority of tubes developed for war purposes were, and are, miserably poor bulbs in comparison with the tubular bulbs we had formerly used. This applies to their use as detectors—they make good amplifier bulbs when used with 150 to 300 volts, plate current—but where will the modern Amateur, even, get that voltage, D.C.? Batteries are out of the question,

What To Invent

By JAY G. HOBSON

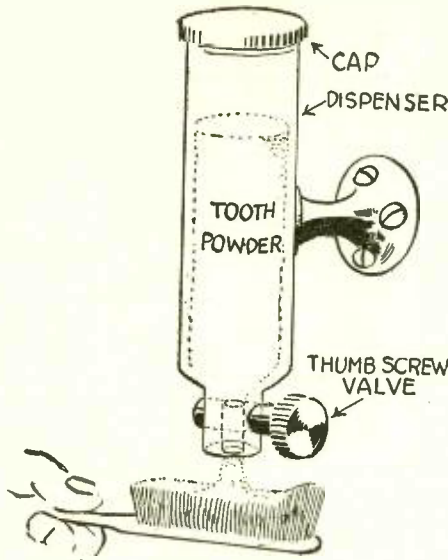
THERE are several kinds of razor blade sharpeners on the market. Few of them have met with considerable success because they really sharpened as claimed. However, all of the various designs require the user to turn a small crank to operate the stropping element. It consumes enough time preparing one's face for the trying ordeal without having to stand around cranking the sharpener until the razor blade is ready to shave.

Why not construct an automatic razor blade stropper to be fastened on the water faucet as illustrated, one that will run when the water is turned on so that your razor blade will be nice and sharp by the time you are ready to shave. An efficient sharpener of this kind could easily be made as shown, with a light metal case, two round stropers connected by small gears and operated by a little water wheel enclosed in part of the sharpener case. The blade can be arranged to strop on both of the revolving strops thru an eccentric connection with the blade holder. When you wish to shave fasten the sharpener to the water faucet, place the razor blade in the holder, turn on the water and by the time you are ready the blade will be in fine cutting condition to make shaving a pleasure. Every user of the modern safety razor would appreciate an improvement of this kind and gladly discard all other types for this design.



And Speaking of Shaving.—Why Cannot Someone Give Us a Low-Priced Automatic, Safety-Razor Blade Sharpener Which Could Be Connected to the Kitchen Spigot. A Small Cheap Water Motor, Specially Designed for the Purpose, Would Rotate the Strop Wheels in Apple-Pie Order. Mr. Hobson Guarantees to Sell One of These to Every User of a Safety Razor in the United States and Foreign Countries,—the Bolshevik Regions Not Included!

During the influenza epidemic eating in public restaurants and cafés was rather a risky thing to do because public eating places are not careful in cleaning dishes and cups before using them again. In drinking hot drinks from the common cup people place the rim of the cup between their lips and draw the liquid into their mouths. This is a very easy way to catch the "flu" or some other contagious disease, of which there are many. To avoid this possible exposure a small celluloid (or even paper) lip and mouth protector could be made like that shown. It should be made to fit the rim of the cup snugly so that the contents of same could not run under and out upon the user's clothes. A little sanitary invention of this kind would undoubtedly meet with approval by thousands of folks who are particular about their health and desirous of avoiding any exposure to others' carelessness.

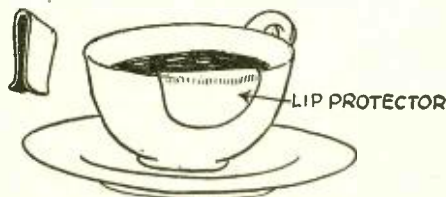


TOOTH POWDER DISPENSER

Instead of Losing About Six Tooth-Paste Tube Caps Every Month and Doing an Interminable Amount of Cussing About the Paste That Went to Waste or Soiled Your Clothes.—Why Not Invent a Neat and Cheap Tooth Powder Dispenser Like This? Zip—Turn the Thumb Valve and—Presto! You Get Just the Proper Quota of Tooth Powder on Your Tooth-Brush.

The average person becomes so adjusted to the present tooth brush and tube of paste or can of powder now in use that no thought of an improvement in this line seems to appear. However, on second consideration we can easily see that there is great inconvenience and waste in the seemingly efficient dentifrices of today. For example, remember the time you made a hurried trip to some distant point via Pullman, throwing necessities into your traveling bag as you ran out of the door. Recall how you had to stand on your head in the berth trying to find your tooth paste before retiring, and how very evasive it was. Finally you gave up hopes of finding it and went disgustedly to bed? On other occasions, at home when you were late for work and forgot to put the cover back on the tube of paste which was hard and useless when you returned home that evening? These experiences are a common kind to most of us. To overcome these difficulties and add to the pleasures of living I thought of what should prove to be a very welcome departure in every bathroom, every Pullman car, every public wash room and every place where dentifrices are used. As shown in the illustration my conception is in the form of a neat metal or porcelain bracket to which is secured a round tube or can embracing a removable

LIP MOUTH GUARD



First on the Program of Things to Invent,—We Have What Mr. Hobson Suggests for a "Lip and Mouth Protector." Afraid of Catching the "Flu" or Some One of 57 Odd Fevers? Carry a Little Lip Protector With You and Slip It Over the Edge of the Cup Where the Nasty Little Germs Are Wont to Sleep Until You Drink, and Then, Good Night! Yes, We SHOULD Have Them!

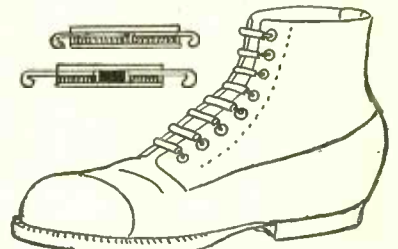
Copyright—1920—by Jay G. Hobson.

top to allow for refilling the same, and at the bottom end would be arranged a small measuring cup or valve operated by the thumb and forefinger of one hand while the other hand held the toothbrush under the spigot to receive an exact amount of powder or paste sufficient for one good cleaning of the teeth.

As will be seen a little device of this kind installed in each bathroom, or Pullman car, would not only economize in the use of the preparation, but it would always be handy and ready for use of each member of the family. Having it ever before them with this kind of a slogan printed thereon, "USE ME TWO TIMES A DAY AND I'LL KEEP THE DENTIST AWAY," would remind them of the importance of keeping their teeth clean. An attractive device of this description would sell to most every home and probably be used extensively by some large dentifrice manufacturer.

Watching a fat gentleman bending over three times trying to reach his shoes to tie a broken or loosened string, while somewhat amusing, suggested an idea for a needed improvement in shoe laces. The present kind in universal use is really unsatisfactory for many reasons.

To begin with it is forever coming untied, wears out quickly, breaks just when we don't want it to, and causes flat feet because there is practically no give in the string when we walk, run or jump. Raising up on the toes in walking causes the strings to force the arch of the foot downward instead of allowing it to follow the motion forward as is natural when walking barefoot.



METAL SHOE LACE

Ever Try to Lace Your Shoes in a Hurry? This Includes Ladies and Gentlemen, as Well as the Little Folks. Here's the Author's Suggestion: Do Away With the Everlasting String Laces Which Are Forever Losing Their Tips, and, Instead (When They Are Manufactured), Get a Dozen or So of These Spring Lacers,—and Besides, Your Foot Can Really Have Free Movement in This Expandable Shoe Top! Not Bad, Eh?

So an improvement in shoe laces is in order. One that seems practical to me could be made of a small, flat, adjustable bar or strip of metal with a stout coil spring concealed inside. This little bar is cut in the middle to allow for expansion and adjustment to shoe. At either end of this flat, hollow bar would be a blunt hook or catch "U" shaped and only large enough to fit into the eyes of both sides of the shoe as illustrated.

The small coil spring pulling on both ends of the flat bar would force the shoe sides together and hold them as securely as a shoe string, but, in addition, this improvement would allow for a free movement of the foot when walking, thereby preventing much of the present day foot troubles. A practical article of this kind should sell rapidly and be adopted by the large shoe manufacturers.

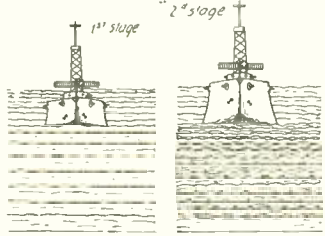
(This is the third article by Mr. Hobson. The next one will appear in the May issue.—EDITOR.)



LATEST PATENTS



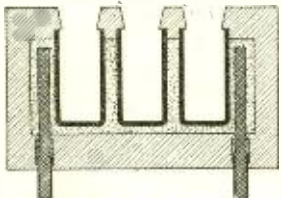
Theatrical Appliances.
(No. 1,324,680, issued to Langdon McCormick.)
This patent relates to a method of producing illusionary effects whereby ships and other objects are



made to rise and increase or decrease in size and move forward at the same time, to give the effect of the ship or other feature moving toward the front of the stage. A large number of moving platforms cause the illusion effect to be more pronounced, at the same time a wider sea area toward the rear of the ship is effected by gradually elevating the waves, causing the illusion effects to take on the aspects found in nature. In actuality, the ship moves forward for about 10 ft.

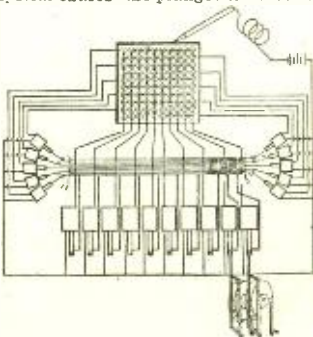
Electric Furnaces.
(No. 1,324,156, issued to Felice Javoviello.)

This latest invention is an electrical furnace wherein a series of graphite crucibles are imbedded in powdered coal or graphite, thus connecting them in series. The pipe or conduit communicates with the upper portion of every crucible. Molten metal can be poured from all of the crucibles at the same time. Great heat is produced in this furnace because of the relatively high and low conductivity of the alternate layers forming the graphite crucibles and the intermediate packing.



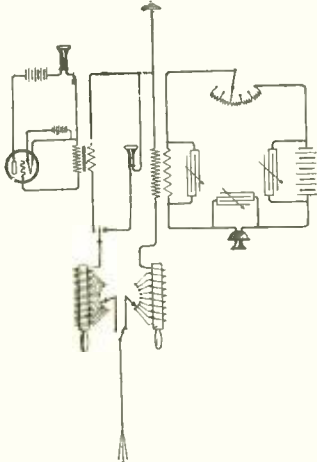
Electric Keyboard.
(No. 1,311,384, issued to William F. Drew.)

This does not relate to calculating machines only, but includes typewriters and the like. We shall describe the adding machine herewith. It consists essentially of ten solenoids which operate the adding machine levers. In addition, there are ten more solenoids connected to a tier of the same number of plates of slidable nature in the series. When, therefore, electrical contact is made by means of the stylus, two solenoids are immediately actuated. One draws the slidable plate of that series so that the plunger can only descend a definite distance, and the other system causes the plunger to descend.



Wireless Transmitter.
(No. 1,315,197, issued to Earl C. Hanson.)

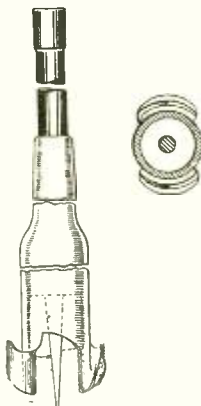
This patent is the latest for transmission of energy by means of electrostatic and electro-magnetic induction. It employs audio frequency radiation in contrast to the common radio frequency methods now used. It is extremely simple and can be controlled to such an extent that detection beyond the distance predetermined is impossible (according to the inventor). It consists of two reactances into which are placed iron cores; for sending a telephone coil is used, shunted by a variable condenser. The transmitter and battery are likewise shunted by variable condensers. Thus, the direct current, practically constant, induces no current in the high tension winding, but



when the operator speaks into the transmitter he varies the resistance, and a considerable potential is impressed between the antenna and the ground. For receiving, a similar iron core reactance is used and is either connected directly thru a receiver or thru a vacuum tube for the purpose of amplification.

Battery Connector Remover.
(No. 1,316,485, issued to Fremont S. Kay.)

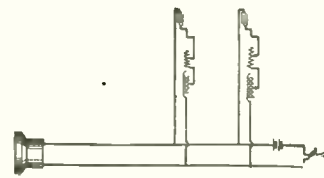
This patent is very clever and novel. Heretofore, in order to remove connectors from storage batteries and the like, it has been neces-



sary to destroy the posts by drilling them out. This device, however, leaves the center post intact, removing only the connector without injury to the original posts. It should meet with favor with all storage battery repair men. The tool when operated cuts two concentric zones. The inner cutter clears the solder from the periferal surface of the posts of the battery, while the outer cutter clears the solder from the wall of the eye on the connecting strip. In this way the post and connecting strip are completely saved.

Eliminating Undesired Vibrations.
(No. 1,319,521, issued to R. A. Fessenden and F. H. Leslie.)

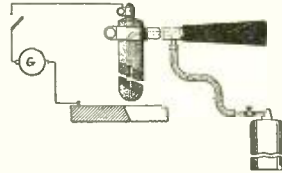
This patent is for sound producing bodies, such as diaframs, and its object is to suppress any desired ex-



tent of vibration frequencies which are not wanted. The presence of natural vibrations are very objectionable even in telephony, as a result of which the higher tones of the voice are unduly strengthened tho still permitting speech. If used in submarine signaling they would not transmit articulate speech, so by properly proportioning self-induction, resistance and capacity in the circuit, the amount of sound absorbed can be regulated and the diafram then made to vibrate substantially correctly over an entire range of frequencies, whereby clear, sharp, articulate speech can be heard for distances of five miles, via the absorption system, whereas, prior to this only indistinct sounds were heard.

Metal Cutting.
(No. 1,324,337, issued to R. E. Chapman and J. W. Kirk.)

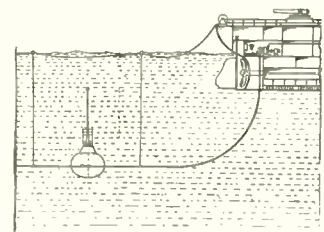
A very clever patent was recently granted to the above mentioned individuals on apparatus for cutting metals. It is of the simple arc-forming type in which a carbon connected to a generator creates an arc at its point of contact with the metal to be cut. The center of this carbon, however, has a hollow bore



running thru it, to which is connected an oxygen supply tank; thus when the arc is started and the metal commences to fuse, advantage is taken of the better cutting qualities under the oxygen stream. This arc, according to its inventor, will operate as efficiently under water as above.

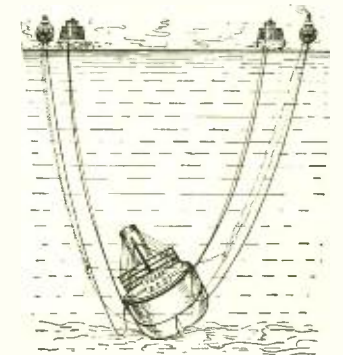
Submarine Boat Detector.
(No. 1,321,998, Issued to Giovanni Emanuele Elia.)

It consists of a long rubber hose about one-half inch in diameter suspended from a series of small buoys at a predetermined depth. This rubber hose may be quite long and as it is comparatively light, does not cause any great resistance upon the progress of the ship. Should the submarine now run into the hose and cut it, the sudden outflow of water which has been pumped into it under pressure, would be instantly noticeable on the vessel's indicating apparatus.



Ship Salvaging.
(No. 1,324,336, issued to J. T. Breneman.)

This is another of those patents which are planned to salvage sunken wealths and treasures. The patent, however, has the drawback in that the exact position of the ship must be known before further action can take place. Essentially, it consists of a method of dragging a cable over the bed of the river until it comes under the stern of the vessel. This cable is then replaced by a heavy chain. Immediately another chain is thrown across the top of the vessel so that it will lie perhaps 100 feet forward of the position of the first chain obtained. This second chain is connected with the first chain by a block which allows itself to slide downward only. When, therefore, the second chain is tightened, it forms a complete harness around

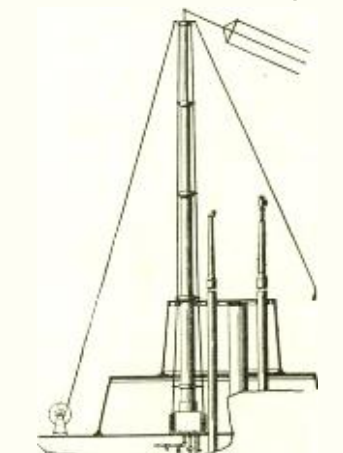


the vessel, gripping it firmly. As many of these chains are lowered as required in each case; the second chain only does the lifting, the first chain going under the bow and acting as the gripper.

A float actuated by hydraulic elevators then raises the vessel. As will be seen, the vessel for the successful operation should be in an upright position or nearly so.

Telescopic Tower.
(No. 1,325,053, issued to F. C. Steidle.)

This invention is the latest in telescopic towers for submarines and other uses. It is absolutely water-tight and air-tight and its telescopic means is accomplished by compress



air. Valves operating on a pressure principle cause the first and lowermost section to rise, carrying with it all the other sections. When this reaches its extreme height the increase in air pressure causes the valve to open and the second section rises, and so on until the last is completely elevated. It also carries with it guys so that there is no danger of it being damaged during the process of extension or when storms are encountered at sea.



WITH *The* AMATEURS



Our Amateur Laboratory Contest is open to all readers, whether subscribers or not. The photos are judged for best arrangement and efficiency of the apparatus. To increase the interest of this department we make it a rule not to publish photos of apparatus unaccompanied by that of the owner. Dark photos preferred to light-toned ones. We pay \$5.00 each month for the best photo or photos and \$2.00 to each "Honorable Mention." Address the Editor, "With the Amateurs" Dept.

"Amateur Electrical Laboratory" Contest

**THIS MONTH'S \$5.00 PRIZE WINNER—
PAUL WALTER**

I SUBMIT herewith, photos of my Electrical and Chemical Laboratory. I do my own photo work and produce many odd effects with my home made apparatus and am equip to enlarge, reduce and copy anything from an atom to a battleship. I manufacture a glue which will mend anything but a broken heart.

I have a motor-driven chuck upon which I turn up many things to be used in the making of coils, apparatus, instruments, etc. It will drill holes in any metal or wood and can be used to polish brass parts. This little tool is really necessary to any laboratory. A good asset for a well conducted shop, is to have everything arranged in some systematic order, so that when a fellow is working or has an idea, he will not be discouraged or tempted to be careless because the tool he wants is not handy, or the piece of material he needs is way down under some transformer iron. I have everything labeled and in plain view. Each screw and washer has its special place in my shop and I don't have to stop my work to look for an article. The result is that I get something done, because things are where they suggest their use.—Paul Walter, 2725 Main St., Ocean Park, Cal.

**HONORABLE MENTION, JOHN G. SPOTTON
\$2.00 PRIZE PAID EACH "HONORABLE MENTION"**

I WISH to show in this article what can be accomplish in a limited working space. I only have a small corner in a room. The apparatus that are permanently mounted, are either on the

table, the wall, or the switch-board. On the latter, I have a lamp, battery-fan, ignition coil, telegraph apparatus, "shocker" and a motor. These are controlled by a selective switch. The "juice" is obtained, at present, from dry cells. These are controlled by rheostats and by a switch, so that any number may be used.

A good feature, is the combination telephone-telegraph line. For telegraphy, I now use a key (mounted on the table) Radiotone, condenser, and Pony receiver, while at the other end, a friend has a regulation Morse telegraph outfit. For phoning, I use a microphone, designed from one shown in the December, 1916, EXPERIMENTER—a phone and bell. On a shelf is an arc light run by 110 volt A.C. current with a water resistance and fuses. I am now working on a detachable part, which can be fitted over the carbons, converting it into a furnace, when necessary. An eight point needle drop annunciator shown on the wall in the centre is very useful for connection with burglar and door mat alarms, thermostats, etc.

My workshop is equip with all the necessary wood and metal-working tools. I also have a foot-power lathe which is not shown. The chemicals of my Electro-Chemical department are kept on a shelf in my desk. I don't need a very big outfit as about all I do in this line, is to experiment with wet cells, accumulators, electro-plating, photography and occasionally I do some analysis. The upper shelf holds my library of about 30 technical books. What I value the most, tho, are my back numbers of the ELECTRICAL EXPERIMENTER, from November, 1913, to date. This indeed is a library in itself, and has been my "guiding star" since I first got to be an "Electrical Bug."—John G. Spotton, Harriston, Ontario, Canada.

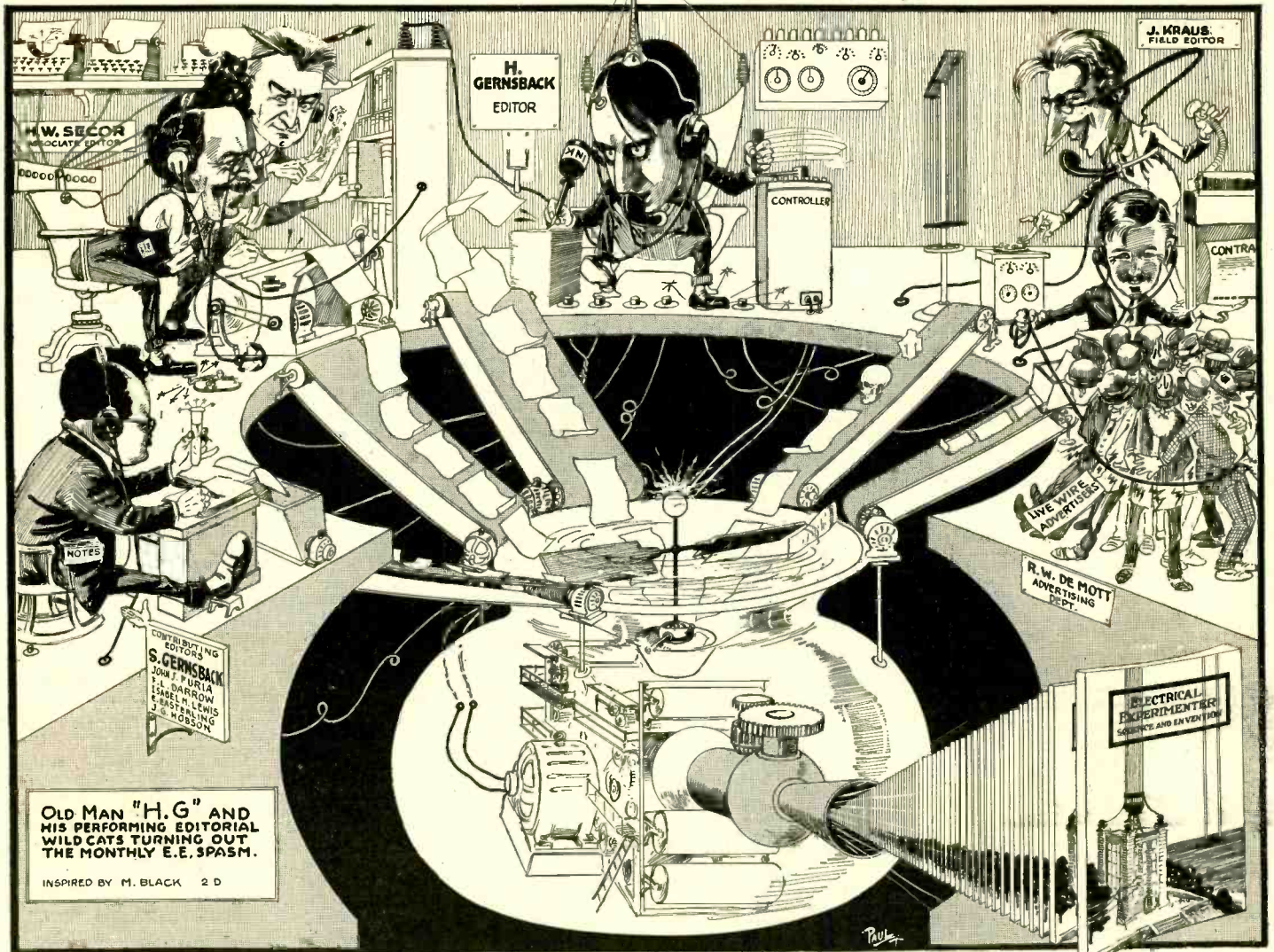


Science With A Bang

By EVERSON WESTERLING

FUTURE NEWS NOT AS YET INVENTED

RADIO NEWS FROM ALL OVER THE WORLD AND ELSEWHERE



OLD MAN "H.G." AND HIS PERFORMING EDITORIAL WILD CATS TURNING OUT THE MONTHLY E.E. SPASM.
INSPIRED BY M. BLACK 2 D

Formula: A Ton of Brains, 20 Barrels of Ink, 2 Carloads of Paper, Hundreds of Telegrams (Radio and Cablegrams), 10,000 Letters, Photographs and Manuscripts By the Barrel, Seasoned With a Dash of Electrical and Chemical Experiments, a Wild Night Ride or Two, Via Pullman, An Airplane Trip, Etcetra, Served With a Layer of Meringue Glace (Varnished Covers) and There You Have It—Your "Electrical Experimenter."

"I JUST can't get over wondering how that New York bunch keeps on turning out this sheet month after month," Bender queried while loafing—beg pardon—leafing over the latest issue of the EXPERIMENTER.

"And," he continued, "it beats old Dutch, how Gernsback and his editorial wild cats manage to make each issue better than the one ahead of it. Where do you think that bunch gets all those ideas from anyway?"

Jazz grew contemplative as he looked wistfully over the broad expanse of the Pacific as it lapt its way toward Frisco Bay. He pulled a few times at his cigar before he replied with a sigh:

"Tell you the truth, gents, I'd rather live in my quiet two by four in Oakland than publish that nerve-racking, man-eating shark that goes by the name of ELECTRICAL EXPERIMENTER, better known as Sperry in Australia. And if Gernsback had the slightest sense of humor he'd call it ELECTRICAL Exterminator, because it sure will exterminate him sooner or later. No man can live and remain a human fountain of ideas day in and day out like that bird, and not dry up in the end.

"But you boys want to know how it's

did every month—well, here goes, anyway:

"Last month when I went East I made it my business to call upon the E. E. outfit, and you may believe me or not, but I'm still dazed from what I saw, s'help me Caesar.

"Some fine Monday A. M. I trot down to Fulton St.—which is the dead line of the town—and pull up short at "Information," where I throw anchor.

"Want to see the Editor. Name's Jazz Stokes from Oakland, Cal., I mentions to the cutie behind the switchboard. A couple hours later when she finally finds time to give me the once over, she smiles expensively at me and asks what in blazes I want. I repeat the info.

"Oh, yes," she chirps languishly, man-icuring her nose with a powder-puff all the while, 'I remember you now, you are the Stoker from Coakland, Oklahoma. Excuse me for letting you wait a bit longer. Now what's your name?"

"I repeat it a few times over.

"Age?" she asks next.

"Uncertain," I murmur.

"Was your mother married?"

"Not yet, she's a widow!"

"Have you ever been in jail?"

"Sure thing, that's my profession."

"How come?"

"Well, you see, I am Warden of the jail of Berkeleigh, Cal.!"

"That's fine. Now then on what business would you like to see the Sultan?"

"Just a friendly visit."

"Just then the house bell clanged out the noon hour, and as I had no appointment with the All-Highest, I saw it would be useless to get into his Wigwam and next to his skin. So I invited the 'Info-Switchboarder' out for lunch, as a ruse. An invitation for lunch *always* works in New York. So while she got her hat and put on her outdoor complexion, I slipt by the gate, vaulted a couple of brass railings and made a home run for the sanctum labeled 'Editor.' I pussyfooted in cautiously—which, however, wasn't at all necessary. There were three or four people in his office and no one paid the slightest attention to me, so I sat down. The illustrious 'Idea-Incubator' was very, very busy with a couple of artists, his secretary, the phone, the radio-phone and his managers. During the half hour I was in that editorial bug-house, I

(Continued on page 1292)



THE ORACLE

The "Oracle" is for the sole benefit of all electrical experimenters. Questions will be answered here for the benefit of all, but only matter of sufficient interest will be published. Rules under which questions will be answered:

1. Only three questions can be submitted to be answered.
2. Only one side of sheet to be written on; matter must be typewritten or else written in ink, no penciled matter considered.
3. Sketches, diagrams, etc., must be on separate sheets. Questions address to this department cannot be answered by mail free of charge.

4. If a quick answer is desired by mail, a nominal charge of 25 cents is made for each question. If the questions entail considerable research work or intricate calculations a special rate will be charged. Correspondents will be informed as to the fee before such questions are answered.

LAMP BULB A LEYDEN JAR.

(1039) H. Edwards, Deseronto, Ont., writes:

A. 1. While experimenting with Geissler tubes, made from burnt-out lamp bulbs as described in a former issue of your magazine, I noticed an odd thing which I cannot account for. The bulb used was an ordinary Tungsten lamp. The glass rod in the center of the bulb had been shattered in some way, so I covered the glass tip with wax and made a Geissler tube out of it. The tube was attached to a static machine capable of giving a twelve-inch spark, by a wire which was wound around the brass end of the bulb and attached to the positive terminal of the machine. A short gap was left between the two terminals of the static machine and after operating for a few minutes I pushed the terminals of the machine together and disconnected the bulb. Then I picked up the bulb without touching the brass end. When I was about fifteen feet from the static machine I happened to drop my finger onto the brass end to the bulb and drew a spark about one inch long from it. Rather surprised I carried the bulb downstairs to the science teacher of the school and showed her the spark. This time it was less strong and after two or three attempts it became totally discharged. The bulb was certainly a Leyden jar, and my hand was one coating. What had formed a second coating to hold a charge on the inside of that exhausted bulb?

A. 1. Undoubtedly you are not aware that the charge is retained in the glass, and not in the coating of the Leyden jar. The highly ionized air in the electric bulb acted as an internal coat, and induced the glass to take on the charge inside, whereas the outside coat, viz., your hand, was connected to the earth thru your body.

To prove that the charge is retained in the glass and not in the coat is very easily demonstrated in a separable Leyden jar. The Leyden jar is charged, the coats carefully removed by an insulating rod, and these, when away from the glass, may be touched with impunity. Should the fingers be placed on both sides of the glass, a slight crackling is soon heard, showing that there is some charge, which escapes very slowly. However, if the coats are now replaced and a discharger brought in contact with the inside and outside coats, a sharp crack is heard and a spark flies across the discharge ball and the knob on top, the metal coatings acting as good conductors of the charge.

MAKING PERMANENT STEEL MAGNETS.

(1040) M. F. McCormick, Crown Point, Ind., asks the "Oracle":

Q. 1. Several questions regarding permanent steel magnets; these bar magnets measuring $\frac{1}{2} \times \frac{1}{2} \times 3$ inches.

A. 1. Regarding first question, would say that a compound steel magnet made up of two separate magnets, would be ap-

proximately twice as strong as either one of the single units, as you mention; presuming that both South and both North poles are placed together, i. e., both S.S. poles at one end, and the N.N. poles at the other.

Answering your second question as to the form of magnetizing coil required, would say in the first place alternating current cannot be used, and direct current

done by means of a telegraph key or switch operated by hand, or else a motor or slow speed vibrating relay may be rigged up to produce this effect.

In regard to the hardening of the steel, will say you will do well to look up some good machinists' handbook on this subject, but in brief, it has been found that the steel used should preferably be a tungsten steel, and that it should be glass-hard in order to have the greatest retentivity for magnetism. It is common practice for ordinary magnets to heat the steel to a cherry red and then to plunge the bar in water; thus quenching it quickly and producing a practically glass-hard temper. We take pleasure in recommending one of the best books on magnets, i. e., the work entitled "Experiments in Electricity and Magnetism," by Sylvanus Thompson, which our "Book Department" can supply for \$1.65 prepaid. A very good book covering tempering of steel, etc., is entitled "Rogers' Machinists' Guide," which can be supplied at \$2.15 prepaid.

DOLLARS FOR JOKES

A SCIENTIFIC magazine is supposedly notorious for its dry reading. Still we flatter ourselves that the ELECTRICAL EXPERIMENTER can hold your attention without your yawning too frequently.

Of course you like to laugh—we all do. Sometimes we make you smile while you peruse the EXPERIMENTER. Perhaps sometimes you laugh out loud—at some of our "preposterous ideas" which we print here. And then of course the joke's on us, because we were real serious!

Now it occurred to us that we would like to print a column of real, original jokes every month, but here's the hook: The joke must be a SCIENTIFIC JOKE. No, this is no joke, we mean it!

Anyone can print or re-print jokes, but we want them with a dose of science. So, till further notice we will pay \$3.00 as a monthly 1st prize for the best joke, and \$1.00 for each other one we print.

So you will know what we mean with a "Scientific Joke," we print one here, which we purloined from the "Baltimore American":

LOGICAL.—"I want some good current literature."

"Here are some books on electric lighting."

Now of course, our readers can do much better than this. So let's wait and see. One reader can submit as many jokes as he pleases. Even if it is old the joke is not necessarily barred or condemned. There is one rule however: The joke must not be too technical; in other words, it must be readily understood by anyone. Not more than 100 words can be used. Use only one side of the paper.

Address

SCIENTIFIC JOKE EDITOR,

Care of this publication.

either from a lighting circuit, or else from storage or dry cells must be utilized for the purpose. A very powerful magnetizing coil may be made as follows for service in conjunction with this battery current. A brass tube, $\frac{3}{8}$ inch inside diameter and measuring three inches in length, may be wound with 20 layers of No. 22 B. & S. gage, S.C.C. magnet wire. The magnet steel may be placed in the coil one after another and the current switched on, after each magnet is placed within the tube, the steel bars being magnetized from $\frac{1}{4}$ to $\frac{1}{2}$ minute. The strongest magnetization has been found to take place in such steel bars when the current thru the coil is interrupted at short intervals. This may be

ONE OR TWO TELEPHONE RECEIVERS BEST?

(1041) A. Jarrett, New York, N. Y., inquires:

Q. 1. Which is the best, the single Bell telephone receiver or this, together with an auxiliary watch case receiver.

A. 1. With respect to the efficiency of the watch-case telephone receiver, which is commonly used and supplied by telephone companies in different cities in order to hear long distance calls more plainly, etc., would advise:

There is no doubt about it that the addition of the watch-case receiver helps very considerably. As regards the electrical efficiency, you can rest assured that there is invariably sufficient current at the telephone terminals to operate at least two receivers connected on parallel. It is the same as connecting two lamps on parallel. Twice the current is required for two telephone receivers as would be required for one, but the editor of this department has never noticed any depreciation of the speech reproduction when the multiple phone is connected, when either receiver is tested separately. Secondly the hearing efficiency is increased by this arrangement of two receivers, as has been proven in wireless work, where two receivers are always used.

In the first place, as you state, there is more sound produced, but the main and most important thing is that you in this manner bring into operation the combined hearing forces of the two ears, which co-act in a very much better manner when they are both acted upon simultaneously by the same sound, as compared to the action when one ear is affected by the sound only. Besides, as you state, there is always trouble due to external noises affecting the open or unused ear.



Radiator Cement

In liquid form and easy to use. Will ordinarily seal leaks in from two to ten minutes.



Hastee Patch

A quick, permanent, inexpensive repair for tubes and casings. Can be applied in three minutes at a cost of 2 cents.



Valve Grinding Compound

Will remove pits and foreign substances from valves, giving a velvet seat. Will not cut grooves.



Carbon Remover

An occasional dose will stop that knock—quiet the motor—and save the batteries. You can do it yourself in ten minutes.

Keep Your Car Young

It isn't fair to yourself or to your car to run it without any attention and then sell it at a big loss. With but little effort you, yourself, can keep your car in such condition that the depreciation will be very slight. We offer for your use **Johnson's Car Savers**. No experience is necessary for their use. They can all be applied by the amateur with perfect satisfaction.

Johnson's Car Savers are of the very highest quality that can be produced. You will find cheap make-shifts on the market, but when you insist upon **Johnson's** you are taking no chance, for all of our preparations are fully guaranteed.

JOHNSON'S Car Savers

Start today to reduce the depreciation of your automobile. An hour or two every month and **Johnson's Car Savers** will prove their value in dollars and cents when you come to sell or turn in your car.

Johnson's Car Savers have been on the market for several years. Millions of cans have been used by motorists everywhere with entire satisfaction.

For years our employees have been our partners and share the profits. Because of this personal interest unusual care and skill enter into the manufacture of the Johnson products—overhead is reduced to the minimum and we are enabled to sell at a very slight increase over pre-war prices, notwithstanding the tremendous advances on all of our raw materials.

Representative dealers and jobbers all over the world handle **Johnson's Car Savers**. Don't accept or handle unknown substitutes. Write for our booklet "Keep Your Car Young"—it's free.

S. C. JOHNSON & SON

Dept. E. E. 4, RACINE, WISCONSIN



Top Dressing

Johnson's Black-Lac is the ideal top dressing. One coat imparts a rich, black surface just like new.



Auto-Lak

A splendid elastic varnish for bodies, hoods and fenders. A coat will increase the value of your car from 10% to 35%. Dries in 24 hrs.



Stop Squeak Oil

It seeps between the springs, thoroughly lubricating them. Makes your car ride easier, reduces the liability of spring breakage.

Know Your Man

- to sell to him
- to employ him
- to direct him

If you should seek for the one big qualification that has made for the success of Schwab, Carnegie, Morgan and others, you would find that they *knew men*; their ability to gather around them the right men for the right position more than any other factor contributed to their success.

Until you know how to judge men correctly, you cannot sell, direct or employ them to the full extent of your ability. You *can* know. It is easy. Mr. Wilson M. Taylor has given an infallible, correct and simple method in his new book

"The Science of Approach"

He classifies all types of men and shows you the best way to appraise quickly the minds of men of various types, to determine their inclinations, their process of thinking, their basis of judgment and decision.

Get This Key to Men's Minds

Stop guessing. Know why people like you and why they do not. Learn how to make them like you. Be able to recognize the type that thinks slowly and acts slowly, the type that thinks quickly and acts quickly, the emotional type, the mercenary type, the generous type and all other types. You can realize what an advantage this means to be able to do this. The largest firms in America are adopting Mr. Taylor's method. You, too, should have the knowledge this book contains.

Mr. Taylor Has Agreed to Send it on Five Days' Approval

Your opportunity is presented in the coupon below. Use it. All it requires is a little initiative to determine whether or not "The Science of Approach" will benefit you as greatly as it has benefited other men. You take no risk in determining this. Sign and mail the attached coupon *TODAY*.



WILSON M. TAYLOR, Inc.,
 35 West 39th Street, New York City

Please send me copy of your book, "The Science of Approach," on 5 days' approval—enclosed find \$2.00. If I decide not to keep the book, I will return same to you within 5 days and you are to return the \$2.00, without question.

Name

Address

E. E-4-20

P.S. If you prefer, we will send book and you can send us \$2.00 or return it in 5 days.

Science With A Bang

By EVERSON WESTERLING
 (Continued from page 1289)

never got the hang of it how he made himself understood with them, or they with him. I never knew if he talked to them, to the phones, or to himself.

"Howard Brown, the gink who smears the monthly canvas cover was discussing the next spasm with the Pasha. Brown wanted to know what the main color was to be.

"Weather Bureau,' yells the High-Chief into the phone. He gets it in a couple of seconds. 'What sort of weather will we have next month?' he bawls. 'Rain, all month, you say? O. K. Fine.'

"The cover will be *sky blue*,' as he turns to Brown. 'As it will rain all next month, people will be tickled to see a blue sky, even if it's only on a cover. We ought to sell a couple thousand copies on that argument alone!'

"Fine,' says the paint cuckoo. 'Now what's the subject?'

The Grand-Duke scratches his head thoughtfully while he toys with his telegraph instrument. Just then a nice ripe tomato comes sailing in thru the open window and lands squarely on the Mikado's bean. Quick like a flash he turns to Brown, and chuckling gleefully says, while blotting up the ketchup with a few blotters:

"That gave me the idea. Subject will be an artificial big steel man. Show him working in a field; paint him red—like this tomato sauce. Good combination—red steel monster with a skyblue background. People will be interested in him, now that help is scarce. Open his back to show the propelling machinery inside of him—ah yes—wireless aerial on his head and in foreground radio man with a lot of wireless junk, who directs the automaton's movements in the field.'

"Fine, wonderful," we all applauded. "That's going to be *some* cover," yelped the manager. "All our competitors will die of envy, but how on earth do you get all those ideas?"

"Simple," chuckles the Rajah, 'the tomato gave me the idea of course! Don't you see, tomato—auTOMATOn—and where does a tomato grow? In a field! There you have it, *automaton working in field*. Next!"

Just then Secor, the associate Editor comes in with a bang thru the loud talking telephone on the wall: X ! ? ! ! - . . . - ! x x Wow—R-rhrrrrr... what in thunder do you mean by adding 8 more pages to this infernal sheet, ain't we got enough now... r-r-r--R-R-R X ! ?**—can't possibly do MORE. Killing myself now. Absolutely Impossible to do more work—I quit right here—Wah—wow—wow—whizz—bang—"and he's gone!"

"But the High-Priest thru it all keeps on smiling; it seems he likes those gentle outbursts. No sooner has the enraged editorial bird ceased fluttering than the Grand-Turk presses a button and chirps into a mouthpiece:

"Great stuff, Secor. That talk of yours gave me a bunch of ideas to fill those eight pages: You spoke about *killing yourself*; why not send Kraus up to Sing-Sing and get some recent dope on how they electrocute the murderers up there—good for two pages with a full page washdrawing showing how it's did!

"And you said *What in thunder*," didn't you, darling? Well what's the matter with making a full page drawing showing all the different stages of a thunderstorm—good for two pages.

"Then you said *absolutely impossible*, yes, no? Well; two pages of good stuff showing historical instances how inventors made the impossible come true; ought

to make fine reading—full page drawing showing those inventions, what?

"Finally, you yelled so loud that my ears hurt. Seems as if the acoustics in my office are too good—how about two pages on acoustic freaks—echos—strange acoustic phenomena—full page illustrations how to do it—there are your 8 pages—no, don't thank me, call me up later if you need more ideas!"

"I had heard enough. I collapsed right then and there. After I came to a couple of hours later, I slunk out of this idea-monster's office. *He had never even seen me.*

After I had sufficiently recuperated I thought I'd waltz up to see this Secor bird. He looked—or rather sounded promising. As I had no appointment with the gink I bribed the elevator brigand who took me up, hidden in a big ashcan, which just went up after having emptied its load of rejected manuscripts on the paper dealer's wagon.

I was dumped onto the associate editor's floor and crept to the door labeled

HARRY WINFIELD SECOR,
 E. E. I. R. E. S. O. S. P. D. Q.
 ASSOCIATED EDITOR
 The guy who thinks he does all the work AND DOES

Thru the door came murderous sounds, and I had already turned back on second thought, but a tall young giant who wore a sign on his hat "Field Editor" rushed up in a monstrous haste. He collided with me and we both burst thru the door into the sanctum. However, he paid not the slightest attention to me, so I sat down and looked at the scenery.

Miscellaneous, gum chewing, powder-puffing dancels sat at various desks manipulating their keys.

On the floor lay a long-haired cuckoo, "artist" painted all over him. The associate editor was just then drumming an editorial point or two into the artist's anatomy. The Grand Vizier was waving a drawing hysterically at the unfortunate rat on the floor and lambasted him for some minutes soundly.

"What in X! ? X RRR do you mean by crabbing my illustration this way R! X? RRRRrrr Wow Bang Ziz.....look at this face—what will our readers think of me—I didn't want a pig's face—I want a MAN'S face—wow, bang, Rrrrrr ! X..... and look at this electric current—why, it looks like a bunch of spaghetti, you fish-faced, enaemic son of a rainworm. And then look at this thing—Lord have mercy on his brain that he hasn't got. Didn't I tell you to put a derrick here—and look what this poor idiot of an evaporated mollusk-brained flea puts in its place—a HER-RING, instead of a derrick. And here we're scheduled to go to press at 4:39 A. M. and the drawing must be made over again. Whizz, Bang, BANG, WOW X! ? X X! ? X

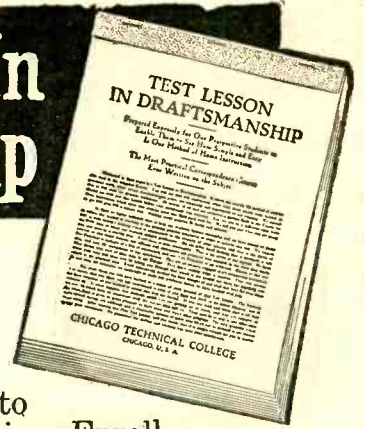
Just then the loud talker with the voice of the Editor-in-Chief's started:

"Listen Secor, I got a glorious idea, for you to work out. Best I've had since five minutes ago. Let's make a \$100 prize contest what to do with discarded mouse traps. Readers like these contests—besides these popular contests bring in from 6 to 9 tons of paper which we can sell to the paper deal—"

But the voice was cut dead by a large inkstand that the irate Secor threw at the loud talker.

(Continued on page 1294)

FREE Test Lesson In Draftsmanship



Send for this free lesson which explains the Chicago "Tech" method of teaching Draftsmanship by mail. Positions at big salaries are now waiting for competent men. Even draftsmen of limited training and experience are snapped up and paid good salaries. If you are dissatisfied with your opportunities, learn Draftsmanship. Chicago "Tech" will train you in the most practical way in the shortest time. Mail the coupon today and

let us tell you about the Chicago "Tech" method. The free lesson will show you how well equipped you are to follow Draftsmanship. Enroll in the course only if you decide that you can take it up to advantage. No cost, no obligation on you to make this investigation. Send the coupon.

\$25 to \$100 a Week

Draftsmen always command good salaries. And now when American industries are to be called upon to meet vast foreign and increased domestic demands, the opportunities are greater than ever. This is the time for you to prepare for a better position—a higher salary.

Come to the College or Learn At Home

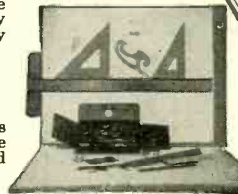
Hold your present position while training. Our experts will instruct you by mail. Only your spare time is required. You are directly under practical draftsmen and engineers. You are taught exactly the work required in the drafting rooms of big concerns. No time put in on unnecessary studies. This means thorough instruction and early graduation.

Easy Payments

The fees for Chicago "Tech" Courses are very moderate—and you can pay on easy terms. And also, you obtain in a few months what it would take several years to acquire by ordinary methods. You can get an early start. You are soon ready to take a paying position and to quickly get back the cost of your course. Then keep on earning more.

FREE Instruments

Every student of the Chicago "Tech" mail course in Draftsmanship receives this set of instruments, or a cash credit in case he already has a set. These instruments are of the same make and sizes as are used by high salaried experts in drafting rooms of factories, shops, railroads, etc. You use them while learning—then take them right into your practical work.



Auto and Gas Engine Course

All about automobile mechanism—its construction, operation and REPAIR—taught by mail. You train directly under the Chicago "Tech" automobile experts. Splendid opportunities open now. Send coupon and get all the facts.

Learn All This in Spare Time

Principles of the Automobile. Every point made clear about the basic principles of propulsion—steam, gas and electric cars. Power transmission systems in pleasure and commercial cars, etc., etc.

Gasoline Engines. All about the different types. A complete course in gas engine construction, operation and repair.

Power Plants and Transmissions. Application of power by 4-6-8-12 cylinder engines. Types of clutches, gears, drives, axles, etc.

Carburetors and Fuel Supply Systems. All methods demonstrated. Fuel values. How to test. Gasoline and air mixtures. Regulation, care and management, etc., etc.

Lubrication and Cooling. All

Know How to Find and Fix Troubles

Most complete instruction in auto repair work. Equips you for high pay or to start a business. Big demand for trained repair men and men who know how to inspect cars. This course makes you proficient. Prepares you to take a job as an expert. Not enough competent men now available.

WRITE Send the coupon and get catalog and all information about the Course, the small fee and the easy terms. All this sent on request. Mail coupon now.

about oils and how to test them. Splash and circulating systems. Operation in different cars explained. Diagrams and tables. Cooling systems completely illustrated, etc.

Batteries. Electrical principles explained. Instructive diagrams of wiring and connections. Coils, condensers, vibrators, etc., etc.

Magneto Ignition. Principles and practical operation of various types and systems with diagrams. Generation of current. Field, armature, high and low tension, all explained. Complete in every point.

Starting and Lighting Systems. All modern methods. Starters—spark, mechanical, air, acetylene, electric, battery—shown in detail with diagrams and full explanations. Charging. Motor and generator adjustments, etc., etc.

Send the Coupon—Now

The sooner you are prepared the sooner you will be holding a job that pays a large salary and opens the way to advancement. Many executives, general managers and superintendents began as draftsmen.

Other institutions ask you to pay first—and then to find out later how well qualified you are for this profession. We send you the free lesson first and place you under no obligation at all. Discover your qualifications before you pay anything.

The coupon will bring the Test Lesson, free. Also information about the profession of Draftsmanship and detailed facts about Chicago "Tech" methods, the fees, terms, etc. Mark with X the branch you are interested in—or if in doubt about which course to take, write a letter stating facts about yourself and asking our advice which will be freely given. Mail either the coupon or letter today.

CHICAGO TECHNICAL COLLEGE, 445 Chicago "Tech" Building, Chicago

Without obligation to me, please send me your FREE Test Lesson and other interesting literature covering the subject indicated below. Mark X opposite work in which you are especially interested.

- Architectural Drafting
- Machine Drafting
- Electrical Drafting
- Structural Drafting
- Sheet Metal Drafting
- Builders' Course
- Plan-Reading—Building
- Plan-Reading—Shop Men
- Estimating
- Surveying
- Map Drafting
- Autos and Gas Engines

Name.....

Address.....

City..... State.....

College or Home Study? State which.....

Chicago Technical College 445 Chicago "Tech" Bldg. Chicago, Ill.

Science With A Bang

(Continued from page 1292)

\$1.00 Postpaid SHAVES WITH GILLETTE BLADES

equal to any \$5.00 safety razor.



Rogers Bros. new safety razor is as nearly perfect as any safety razor can be made. No expense is spared to make it the very best offer to the users of high-grade safety razors.

Note the exclusive "Hexagon Handle" with a guaranteed double silver-nickel Electroplate throughout.

Mail this Coupon Now

D. A. R. Sales Company

2521 17th Ave. So.
MINNEAPOLIS, MINN.

Enclosed find one dollar for your special safety razor offer

Name

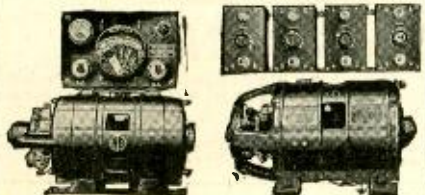
Address

BATTERY CHARGING PAYS BIG PROFITS

\$150 to \$300 Profit Every Month DO YOU WANT IT?

You can get it with an HB Charger. Sturdy, reliable, nothing to wear out or break. No burn-outs or expensive renewals. Charges batteries for 10c to 15c each—customer pays 75c to \$1.50. Figure those profits! This season brings biggest business. Start NOW!

WHICH ONE DO YOU NEED?



HB 500-Watt Charger—
Recharges 1 to 8 6-volt batteries at a time. Uses power from lines now in your garage. Should pay \$100 to \$200 profit a month. A big money-maker for a small battery business.

HB 32-Battery Charger—
Recharges 1 to 32 6-volt batteries or equivalent at a time. Four separate charging lines, each capable of charging up to 8 batteries. Ideal equipment for big garage or battery service station. Will clear as high as \$250 to \$350 a month.

Sold on Trial Under HB Absolute Money-Back Guarantee. All HB Equipment is sold under our absolute guarantee of complete satisfaction. You run no risks. If not satisfied after using any HB Equipment 10 days, you may return it and receive all you paid us. The HB monthly payment plan is an additional guarantee. Write today for full information about the HB Charger that fits your battery business.

HOBART BROS. CO. Box 48E, Troy, Ohio

STAMPS 50 all diff. British Gulana, Cuba, China, India, Jamaica, Japan, Portugal, Venezuela, etc., only 10c; 100 all diff. 15c; 1000 all diff. fine collection in itself, \$5.00; 100 diff. U. S. 3c; 1000 hinges, 10c. Agents wanted, 50% commission. List free. I BUY STAMPS.
L. B. DOVER OVERLAND, MO.

"That'll keep him quiet for a while," fumed the august Vice-Chancellor. Turning to one of the female inmates of his cell at his elbow he growled:

"See, there he goes again! Ideas, IDEAS, nothing but ideas all day and night long. Any idiot can have ideas, but does he work 'em out? Not on your lip-rouge! I'm the crab that does the dirty work, and then I have to wrestle with this scum—pointing to the prostrate form of the artist—so the readers will know what it's all about. And then, five minutes before going to press that Editor-in-Cheese countermands the order and sings out that he thinks a contest of discarded straw-hats would be preferable to old mouse traps—"

Just then there was a comparative lull while His Majesty came to blows with the Field Editor, because the latter hadn't fielded about something or other.

I took the occasion to approach the Lady in Waiting to his Highness.

"Enchanted inmate," I ventured, "could I speak for a few seconds with the Chief of the Harem? Name's Jazz Stokes from California. Tell the Señor I am here to talk on business, but if Monseigneur is too busy, I will wait awhile."

The Lady in Waiting gave no sign of approval, either negative or positive, so I took the occasion and made good my threat. I waited. I got even, however, because I pulled out my stopwatch and timed her gum chewing. She batted a high average. As a matter of fact she could chew faster than the rest of the ward inmates.

Just then a herd of draftsmen, photo engravers, boys with printer's proofs, professors with manuscripts in one hand and bills in the other, descended upon the unfortunate Secretary of Labor. He singled out one of the draftsmen who was twenty-four hours overdue with his drawings, and threw a bulky "Encyclopedia Germanica" at him. It caught the victim amidships, and as I stood behind him, he caught me well on my starboard side. We both had a pleasant sail thru the door and before landing, the draftsman introduced himself. "That's the second time he threw me out this week, but I don't mind it. I carry accident insurance—and he needs the exercise, poor boy—"

On my way down I stopt at a door labeled

S. GERNSBACK CIRCULATION DEPT. WRINKLES & FORMULAS

On entering softly I found this worthy flanked on all sides by many female assistants and keybangers all equipt with gas-masks. Unlike the other offices, a supreme quiet reigned here. It took me some minutes before I could make out the form of the Captain of the ship. Clad in an acid-stained duster, he was sitting behind a curious desk arrayed with every conceivable piece of junk, chemical glassware, magazines, bottles, shower bath, miscellaneous cats, minerals, one or two gross variegated ash trays, each with a legend: *No smoking*; files—letters, mail and cross cut—books, books, books, manicure set, test tubes, goggles, gold fish, auto tire, and too many other items impossible to encompass into the four ends of a compass.

The air reeked of the smell of putrefied codfish, but changed to the perfume of a dying rose the next, only to be transformed into the odor of fragrant frankfurters a second after. I then understood the gas-masks of his victims sitting about the office.

Just then by means of a dozen retorts

and test tubes he composed an odor sonata in B-sharp. I felt myself transported from the perfume of a vamp's boudoir, to the Chicago stock yards, thence to a sweet jasmine and rose field, only to be hurled immediately into the agonizing stench of a glue factory.

Before I had recovered there was a slight explosion of one of the formulas, and a large brick came sailing my way. It knocked me down flat, but the odor liberated by the explosion soon revived me. Coughing, puffing and sneezing, I galloped down the stairs forgetting entirely to introduce myself to the Wrinkle Professor. I went down six flights of stairs and cast anchor on a door mat resting before a door neatly smeared:

ROBERT W. DEMOTT
(accent on the Dee)
Advertising, etc.

This office was mostly desks. A whole forest of them. The inmates of the dormitory when they wanted to cross from one state to the other used an overhead trolley and a rope about the neck. This was by far the most elaborate Harem of the whole joint. The types varied from the opulent oriental to the Indian version of a Totem Pole. Being in the advertising office, they believed in advertising: bare arms, bare backs, and neat ankles were well advertised. By their flashing white teeth you saw at once that they were using a widely advertised brand of toothpowder. They all wore expensive smiles of the well-known and advertised brand: "The smile that won't come off."

The Chief was doing an elaborate War Dance, accompanied by the tam-tams of the typewriter keys.

Thomas A. Edison and Nikola Tesla, who had a story running in the next issue begged humbly to be allowed to have their articles run "next to pure advertising." Edison wanted to have most of his story sandwiched in between Correspondence Schools and Patents because he was cuckoo on them, while Tesla, having more aesthetic inclinations, wanted his story to run alongside the Wireless Ads and the High Frequency Machine Ads. These being his inventions, he thought it was no more than right that his story should be well garnished with them.

But the Chief of the Tribe was obdurate. He wouldn't listen. He said the other writers must have a show, too, and so on and so forth. Finally Edison hit upon a fine idea. *He would pay for the space alongside the ads and run his story in that space.* Before the Advertising Admiral had recovered from his surprise, both Edison and Tesla had planked down a thousand dollars on his desk and flown the coop.

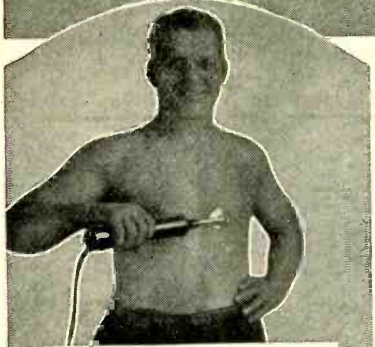
The only comment the General made was: "Chump that I was. If I had only thot of it myself, I could have played those birds against each other and gotten double the rates!"

Just then six or seven trembling men stalked in. I soon saw that they were big advertisers of the magazine. Their contracts had run out at 6 A. M. that morning, having been in force for four long days. By that time a new rate had gone into effect which threatened to ruin them. Would the Secretary of State not allow them to let the old contract run for two more days? Or if not, would he not be satisfied with a raise of 450%.

The Sheik pondered for a long time. Then he called over one of his Phoebe Snow's and asked for the latest time table, better known as *rate card*.

(Continued on page 1298)

Revitalize Your Tired Nerves!



Vitality

The Violet Rays send a spray of mild, tiny currents through every part and organ, vitalizing and invigorating every cell. It acts like the refreshing effects of a shower bath—and leaves you with a delightful feeling of bounding health and bouyant energy.



Beauty

Violet Rays purify the scalp and stimulate hair growth—a wonderful aid to beauty. Removes eczema, pimples, blackheads, obesity—giving the skin a smooth fine texture, free from blemishes and sallowness.

Magic-Like

Treatment For:

This is only a partial list of the many ailments that can be treated successfully with Violet Rays right in your own home.

- | | |
|---------------|---------------|
| Asthma | Goitre |
| Barbers' Itch | Insomnia |
| Boils | Lumbago |
| Blackheads | Nervousness |
| Bunions | Neuralgia |
| Callous | Neuritis |
| Catarrh | Obesity |
| Chilblains | Pains |
| Colds | Paralysis |
| Corns | Piles |
| Constipation | Pimples |
| Dandruff | Pyorrhoea |
| Deafness | Rheumatism |
| Earache | Skin Diseases |
| Eczema | Sore Throat |
| Eye Disease | Sprains |
| Falling Hair | Tonsillitis |
| Hay Fever | Whooping |
| Headache | Cough |

Simple, Delightful Treatments Right In Your Own Home

Enjoy wonderful, sparkling health! Feel the thrill of the bounding vitality of youth! Increase your store of energy, revitalize your worn out cells, make every fibre of your body tingle with a new vim and vigor! All this you can have through the magic of Vi-Rex Violet Rays right in your own home!

Violet Rays penetrate to every cell in the body, imparting that stimulating vigor which brings the glow of health, tones up the entire system, putting life into over-taxed and sluggish tissues. As a quick relief from pain Vi-Rex has no equal. Its soothing rays quickly find the source of distress and afford speedy comfort. Headaches, nervousness, skin blemishes and many other complaints vanish as if by magic through this marvelous treatment. You will be amazed at the splendid, quick results through the use of this wonderful new Vi-Rex Violet Ray Machine—right in your own home!

VIOLET RAYS

The Amazing New Source of Health, Energy and Beauty

Vi-Rex Violet Rays are effective for a host of disorders and ailments. Physicians in all parts of the country are adding this scientific outfit to their equipment and recommending its use to their patients. Beauty specialists have long realized its efficiency for inducing a clear and healthful skin. Until recently expense prohibited the use of this remarkable health-building force in private homes. Now the practical, inexpensive Vi-Rex Violet Ray Machine enables everyone to enjoy all the benefits of this marvelous treat-

ment at home.

The operation of the outfit is simplicity itself. Current from your electric light socket is transformed into an effective healing agent as pleasant to the senses as a ray of spring sunshine. It may be used on the very young and the very old without the slightest discomfort. No shocks or jolts—just a soft steady ray of violet light filled with an abundance of health and energy. (Special equipment is supplied to you at a trifling cost if electric current is not available.)

20 Home Self-Treatments FREE

You don't have to take any risk in giving Vi-Rex Violet Rays a trial. Take 20 treatments in your own home. Use this marvelous machine morning and night for ten days. If you do not find quick relief—if you do not feel better, sleep better, *look* better, send it back and you will not be out one penny. This special offer is now open but it may be withdrawn at any time so act quickly!

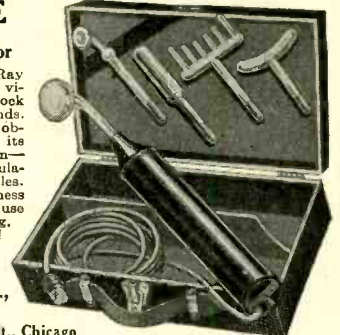
Write for Free Book and Trail Offer

Write to-day for our free booklet describing the wonderful Vi-Rex outfit in complete detail, and particulars of our liberal 10-day trial offer. Find out how Violet Rays will help you. Read what hundreds of users say about the Vi-Rex and astonishing results which have been obtained. Learn why it is the most economical and practical machine of its kind available. You may use it to gain health, vitality, beauty! There is no limit to its beneficial powers. Mail the Coupon or send a postal. Do it now.

Vi-Rex Electric Co., Dept. 44
326 W. Madison St., Chicago

Not a Viibrator

The Vi-Rex Violet Ray Machine is not a vibrator—does not shock or jar the nerve ends. Its effectiveness is obtained through its power of penetration—not through manipulation of surface muscles. No feeling of soreness or exhaustion after use—only a comforting, agreeable sense of relief.



Vi-Rex Electric Co.,
Dept. 44
326 W. Madison St., Chicago

Please send me without cost or obligation your free book describing your wonderful Violet Ray Machine.

Name.....
Address.....
City..... State.....



**RAILWAY
TRAFFIC
INSPECTORS
ASSOCIATE
WITH
BIG MEN**

That is what gives them chances for promotion. They start in at a good salary—\$110.00 a month and expenses.

The work is important, for the safety of thousands depends on their vigilance. And when they do their work as we teach them they attract the favorable attention of their superiors. Promotions then are rapid.

Learn This Profitable Profession

All you need is a common school education for entrance to our three-month's course, which is easy to learn at home during your spare time. Take the initiative now, while the demand for Railway Traffic Inspectors is so good. **THERE IS A BIG DEMAND IN THIS FIELD.**

We know of fine openings for our graduates. Many who started our course a few months ago now hold positions.

OUR BOOKLET tells of this ideal vocation—out in the big out-doors—how you associate with big men—how you can earn an excellent salary from the start—how you can climb to the very top. The opportunity **COUPON** (below) is your key to a better salary now and a much bigger future. Why not send it today? Remember you start at \$110 a month, and **WE SECURE YOUR POSITION.**



Standard Business Training Institute,
BUFFALO, N. Y.

Please send without obligation to me, your Booklet D119, explaining your Railway Traffic Inspector's Course.
Name
Address

**MARKO
STORAGE BATTERIES
ARE GOOD—TRY ONE**

Paul M. Marko & Co., Inc.
1402-1412 Atlantic Ave.
Brooklyn, N. Y.

ARE YOU BASHFUL, TIMID

Self Conscious, Embarrassed in Company. Let us tell you how you can overcome these troubles and acquire Poise, confidence, assurance and a magnetic personality. Address: The Veritas Science Institute, 1400 Broadway, New York, Desk 15.



Printing Cheap

Cards, circulars, labels, book, paper. Press \$8. Larger \$25 job press \$100. Save money. Print for others, big profit. All easy, rules sent. Write factory for press catalog, TYPE, cards, etc. **THE PRESS CO., D-47, Meriden, Conn.**

**Advertising
Talks**
NUMBER 6

AN OPEN LETTER TO MR.
THOMAS REED.

Dear Mr. Reed:—

A long time ago you wrote me this letter. I'll reproduce it here because it's so long ago you probably have forgotten it.

Mr. R. W. DeMott,
Advertising Manager,
The Electrical Experimenter,
New York City.

Dear Sir:—

I was interested in your address to the readers in this month's Experimenter, and will bring to your attention a little suggestion which I think you may be glad to have.

You will understand that the incident related in the enclosed letters was to me nothing more than an annoyance, but if the practice is a general one of this advertiser, it must be causing real disappointment among our readers, most of whom are boys with little money to spend. My suggestion is that you require all advertisers to state that their merchandise is "postage free" or else give the weight or something to indicate that postage is extra.

In the case referred to I assumed that the price of 50c on these ringers included postage. The advertiser sent me the ringers charging me the 30c postage as an extra to be collected C. O. D. As the cost of the merchandise was only \$1.00, the 30c extra charge was quite annoying. It also gives this advertiser an unfair advantage, because his prices look lower than they really are.

I have no doubt that the advertiser omitted the postage information thru oversight, but I don't want our boys to feel "stung" in the slightest degree when they answer our ads, which are not the least interesting part of the magazine. There is a chummy atmosphere about "E.E." which extends to the ads to quite a degree and which I should think the advertisers would find it to their interest to cultivate.

Very truly yours,
(Signed) Thomas Reed.

Now, Mr. Reed, I want to apologize first off for not having answered sooner. The point you bring up is so important to our readers that I thought the best way of answering your letter would be thru this column. But there has been such a rush of

other news these past few months—so many items of big interest to our readers—that my little sermons temporarily "got the gate". (Bet you never even noticed that they weren't in.) And so your letter remained filed away in a special folder and, frankly, it slipped my mind.

It wasn't until Friend Secor, Boss of the Ink Slingers from the Editorial Department, just because he happened to be in Cincinnati, 750 miles from home, with a hole in the magazine, and no news to fill it, stuck No. 5 of my little talks in the November issue. But lots of other things just as bad happened to that issue—that one we printed out in Cincinnati while the printers were on strike in New York.

Anyhow it did one good thing—it reminded me that I had a letter to answer. So I got busy and by exerting every pull I could spring got the loan of part of two columns in this issue.

Mr. Reed, your point is well taken from one standpoint. But here's the big rub in the mail order field. Suppose you buy some goods from New York. You live in Boston. Parcel Post rates are cheap between these points. Now suppose someone else living in San Francisco buys the same article. Do you want to pay part of his parcel post or express charges? That is what it would amount to if transportation charges were included in the price. The manufacturer or seller would have to add an item for shipping that would constitute the average shipping cost for all his sales. That means that the man nearest his plant would pay part of the shipping expense of the man far away and the one at a great distance would get his goods more cheaply than he should.

For this reason it is customary in the mail order field to quote prices net (without transportation charges).

And so it has become a recognized fact that most mail order concerns require the shipping charges added to the cost of the goods or else they ship "charges collect." It is pretty safe to assume that unless the price of an article is marked postpaid the price does not include the transportation charges.

It seems to me that it is more my duty to explain this to our readers rather than to try to change the advertisers' policy. Don't you agree? We certainly don't want any reader to feel "stung" when he buys from an advertiser and it is my aim to keep
(Continued on page 1326)

NEW MOTORS
FACTORY GUARANTEED - ALL SIZES - IN ORIGINAL BOXES
Your Opportunity To Buy New Guaranteed Electrical Apparatus of Standard Manufacture.

Single Phase Motors	Charging Generators	Polyphase Motors	Battery Charging Outfits
110-220 volts, A. C., 60 cycle, 1800 R. P. M. with pulley	Suitable for all lighting Battery Charging and Power Requirements.	2 and 3 phase, A.C., 220 v, 60 c. 1750 RPM, complete with base and pulley.	To operate on A. C., 60 cycle, single phase voltage as specified.
1/4 H. P., 110 volts, induction, full load start - -	8 volts, 10 amp. \$16.50	1/2 H. P. - \$42.50	110 volts, A. C., 100 watt, 24 volts, without switchboard \$40.00
1/2 H. P., 110-220 volts, induction, full load start - -	15 volts, 10 amp. \$21.00	1 H. P. - \$59.50	110 volts, A. C., 150 watts, 30 volts, with switchboard \$68.50
1/2 H. P., 110-220 volts, repulsion, for compressor \$46.50	40 volts, 6 amp. \$24.50	2 H. P. - \$72.50	110-220 volts, A. C., 250 watts, 24 volts, without switchboard - \$75.00
1 H. P., 110-220 volts, repulsion, with sliding base - - \$67.50	110 v, 2 1/2 amp. \$24.50	3 H. P. - \$84.50	220 volts, A. C., 300 watts, 30 volts, without switchboard \$85.00
2 H. P., 110-220 volts, repulsion, sliding base \$108.50	40 volts, 12 amp. \$38.50	5 H. P. - \$102.50	110 volts, A. C., 375 watts, 30 volts, without switchboard \$85.00
3 H. P., 110-220 volts, repulsion, sliding base \$124.50	110 volts, 5 amp. \$38.50	1 H. P., high speed, 3600 R.P.M., 220 v \$36.50	220 volts, A. C., 500 watts, 40 volts, with switchboard \$110.00
5 H. P., 110-220 volts, repulsion, sliding base \$164.50	40 volts, 25 amp. \$58.50	2 phase only - \$36.50	110 volts, A. C., 750 watts, 72 volts, without switchboard \$125.00
	Moving Picture Arc Generator \$85.00		

WRITE FOR CATALOG. BARGAIN IN MOTORS AND GENERATORS

1/4 SPECIAL 110 volts S.P., 1750 RPM. Complete, cord, plug & pulley **\$19.75 EACH**

WASHING MACHINE MOTORS Suitable for operating Small Corn presses, Coffee Grinders, Bottle Washers, Etc. Reg. Value \$22.50

SHIPPING TERMS: 25% deposit required on all orders. Balance C. O. D. by Express. Sight draft with Bill of Lading attached by freight.

MANUFACTURERS' DISTRIBUTOR
CHAS. H. JOHNSTON, Box 12, West End, Pittsburgh, Pa.

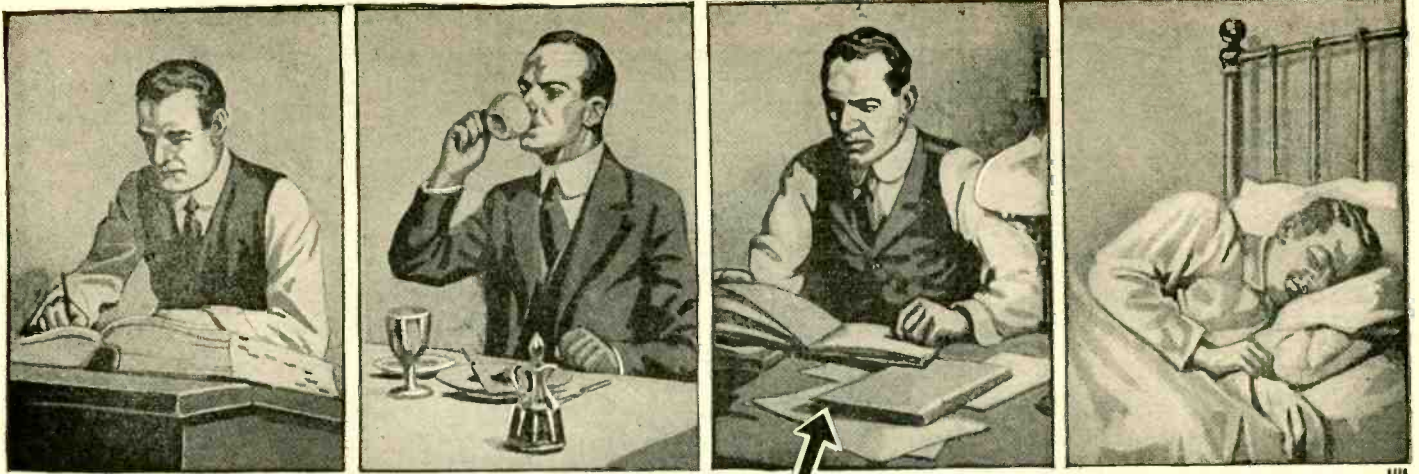
Sole English Agents
for
ELECTRICAL EXPERIMENTER
SCIENCE AND INDUSTRY

We are sole distributors for the **ELECTRICAL EXPERIMENTER** in Great Britain. If you reside anywhere in England, communicate with us and we will see that you are supplied each month.

1/6 the Issue

Specimen Copy sent post free upon receipt of a postal order or stamps for 6d. Address Dept. 7.

Messrs. Geoffrey Parker & Gregg
62, The Mall
Ealing. London, W. 5



These Are The Hours That Count

MOST of your time is mortgaged to work, meals and sleep. But the hours after supper are *yours*, and your whole future depends on how you spend them. You can fritter them away on profitless pleasure, or you can make those hours bring you position, money, power, *real success* in life. Thousands of splendid, good-paying positions are waiting in every field of work for men *trained to fill them*. There is a big job waiting for *you*—in your present work or any line you choose. Get ready for it! You can do it without losing a minute from work or a wink of sleep, without hurrying a single meal, and with plenty of time left for recreation. You can do it in one hour after supper each night, right at home, through the International Correspondence Schools.

Yes—You Can Win Success in an Hour a Day

Hundreds of thousands have proved it. The designer of the Packard "Twin Six," and hundreds of other Engineers, climbed to success through I.C.S. help. The builder of the great Equitable Building, and hundreds of Architects and Contractors, won their way to the top through I.C.S. spare-time study. Many of this country's foremost Advertising and Sales Managers prepared for their present positions in spare hours under I.C.S. instruction.

For 28 years men in offices, stores, shops, factories, mines, railroads—in every line of technical and commercial work—have been winning promotion and increased salaries through the I.C.S. Over 100,000 men are getting ready *right now* in the I.C.S. way for the bigger jobs ahead.

TEAR OUT HERE

INTERNATIONAL CORRESPONDENCE SCHOOLS

BOX 6226, SCRANTON, PA.

Explain, without obligating me, how I can qualify for the position, or in the subject, before which I mark X.

- | | | |
|--|--|---|
| <input type="checkbox"/> ADVERTISING | <input type="checkbox"/> ELECTRICAL ENGINEER | <input type="checkbox"/> MECHANICAL ENGINEER |
| <input type="checkbox"/> SALESMANSHIP | <input type="checkbox"/> Electrician | <input type="checkbox"/> Mechanical Draftsman |
| <input type="checkbox"/> Traffic Management | <input type="checkbox"/> Electric Wiring | <input type="checkbox"/> Machine Designer |
| <input type="checkbox"/> BUSINESS MANAGEMENT | <input type="checkbox"/> Electric Lighting | <input type="checkbox"/> Machine Shop Practice |
| <input type="checkbox"/> Private Secretary | <input type="checkbox"/> Electric Car Running | <input type="checkbox"/> Boilermaker or Designer |
| <input type="checkbox"/> Commercial Law | <input type="checkbox"/> Heavy Electric Traction | <input type="checkbox"/> Patternmaker |
| <input type="checkbox"/> Certified Public Accountant | <input type="checkbox"/> Electrical Draftsman | <input type="checkbox"/> Toolmaker |
| <input type="checkbox"/> Higher Accounting | <input type="checkbox"/> Electric Machine Designer | <input type="checkbox"/> Foundry Work |
| <input type="checkbox"/> Railway Accountant | <input type="checkbox"/> Telegraph Engineer | <input type="checkbox"/> Blacksmith |
| <input type="checkbox"/> BOOKKEEPER | <input type="checkbox"/> Telephone Work | <input type="checkbox"/> Sheet Metal Worker |
| <input type="checkbox"/> Stenographer and Typist | <input type="checkbox"/> ARCHITECT | <input type="checkbox"/> STEAM ENGINEER |
| <input type="checkbox"/> Good English | <input type="checkbox"/> Architectural Draftsman | <input type="checkbox"/> Stationary Fireman |
| <input type="checkbox"/> Window Trimmer | <input type="checkbox"/> Contractor and Builder | <input type="checkbox"/> MARINE ENGINEER |
| <input type="checkbox"/> Show-Card Writer | <input type="checkbox"/> Building Foreman | <input type="checkbox"/> GAS ENGINE OPERATING |
| <input type="checkbox"/> Sign Painter | <input type="checkbox"/> Carpenter | <input type="checkbox"/> Refrigeration Engineer |
| <input type="checkbox"/> CIVIL SERVICE | <input type="checkbox"/> Concrete Builder | <input type="checkbox"/> Metallurgist or Prospector |
| <input type="checkbox"/> Railway Mail Clerk | <input type="checkbox"/> PLUMBER & STEAM FITTER | <input type="checkbox"/> CIVIL ENGINEER |
| <input type="checkbox"/> Mail Carrier | <input type="checkbox"/> Heating & Ventilation | <input type="checkbox"/> Surveying and Mapping |
| <input type="checkbox"/> CARTOONIST | <input type="checkbox"/> Plumbing Inspector | <input type="checkbox"/> R. R. Constructing |
| <input type="checkbox"/> Illustrator | <input type="checkbox"/> Foreman Plumber | <input type="checkbox"/> Bridge Engineer |
| <input type="checkbox"/> Perspective Drawing | <input type="checkbox"/> CHEMIST | <input type="checkbox"/> SHIP DRAFTSMAN |
| <input type="checkbox"/> Carpet Designer | <input type="checkbox"/> Analytical Chemist | <input type="checkbox"/> Structural Draftsman |
| <input type="checkbox"/> Wallpaper Designer | <input type="checkbox"/> Locomotive Engineer | <input type="checkbox"/> Structural Engineer |
| <input type="checkbox"/> Bookcover Designer | <input type="checkbox"/> Roundhouse Foreman | <input type="checkbox"/> Municipal Engineer |
| <input type="checkbox"/> TEACHER | <input type="checkbox"/> WINE FOREMAN OR ENGINEER | <input type="checkbox"/> NAVIGATION |
| <input type="checkbox"/> Common School Subjects | <input type="checkbox"/> Coal Mining | <input type="checkbox"/> Motor Boat Bann'g |
| <input type="checkbox"/> High School Subjects | <input type="checkbox"/> Metal Mining | <input type="checkbox"/> AGRICULTURE |
| <input type="checkbox"/> Mathematics | <input type="checkbox"/> Assayer | <input type="checkbox"/> Fruit Growing |
| <input type="checkbox"/> AUTOMOBILE OPERATING | <input type="checkbox"/> TEXTILE OVERSEER OR SUPT. | <input type="checkbox"/> Vegetable Growing |
| <input type="checkbox"/> Automobile Repairing | <input type="checkbox"/> Cotton Manufacturing | <input type="checkbox"/> Live Stock & Dairying |
| <input type="checkbox"/> Auto. Electrical Work | <input type="checkbox"/> Woolen Manufacturing | <input type="checkbox"/> POULTRY RAISER |

Your Chance Is Here!

No matter where you live, the I.C.S. will come to you. No matter what your handicaps, or how small your means, we have a plan to meet your circumstances. No matter how limited your previous education, the simply written, wonderfully illustrated I.C.S. textbooks make it easy to learn. No matter what career you may choose, some one of the 280 I.C.S. Courses will surely suit your needs.

Make Your Start Now!

When everything has been made easy for you—when one hour a day spent with the I.C.S. in the quiet of your own home will bring you a bigger income, more comforts, more pleasures, all that success means, can you afford to let another single priceless hour of spare time go to waste? Make your start right now! This is all we ask: Without cost, without obligating yourself in any way, put it up to us to prove how we can help you.

**Just Mark
and Mail This Coupon**

Name _____

Occupation and Employer _____

Street and No. _____

City _____ State _____

You benefit by mentioning the "Electrical Experimenter" when writing to advertisers.



Be a Draftsman! Make \$30 to \$75 a Week

Your name and address on the coupon brings this great Cyclopedia of Drawing without a penny down. Pay only net shipping charges when books arrive. With these books and a low price "school set" of drawing instruments, obtainable at any store, a man can become master of drawing and earn \$30 to \$75 weekly. **LEARN AT HOME**—Good paying positions open everywhere. Intense activity in manufacturing, railroading, building, etc., calls for more draftsmen.

Shipped on 7 Days' FREE Trial CYCLOPEDIA OF DRAWING

4 Volumes. 1650 Pages. Thousands of Illustrations. Bound in genuine American morocco. Pages 5 1/4 x 8 1/4 inches. Covers all branches of Drafting—Architecture, Electrical, Structural Steel, Sheet Metal, etc. Teaches pen-and-ink rendering, lettering, free-hand, perspective, shades and shadows, working shop drawings, machine design, etc., etc.

50c a Week Only \$2 a month if you keep the books. Coupon explains offer, good only within borders of U. S. and Canada. **Free Membership in This Society.**—A Consulting Membership given free with each set—worth \$12.00.

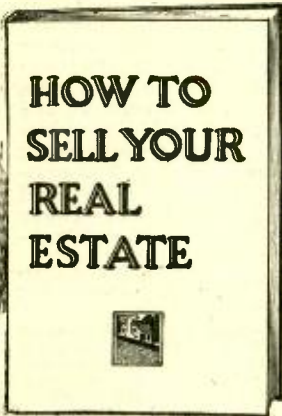
AMERICAN TECHNICAL SOCIETY
Dept. D-254 Chicago



AMERICAN TECHNICAL SOCIETY
Dept. D-254
Chicago, U. S. A.

Please send Cyclopedia of Drawing for 7 days' examination, shipping charges collect. I will send \$2.50 within 7 days and \$2 a month until \$14.80 is paid, or notify you and hold books subject to your order. Title not to pass until fully paid.

Name
Address
Reference



This FREE Book

tells how you can get cash for your property by using the *Simplex Plans for Selling Real Estate*, which have already sold more than 5,000 properties of all kinds in the U. S. and Canada. No matter where your property is located, these successful plans will show you how to sell it *yourself*, without employing agents, or paying commissions to any one. Don't spend a *minute's* time, an *ounce* of effort or a *cent* of money *trying* to sell without first reading this important book, and learning how to sell your property *quickly, economically* and at the *highest possible price*. The reading of this book has *saved property owners hundreds and thousands of dollars in commissions* and it can do the same for you. As the book is sent *absolutely free*, you have *everything to gain and nothing to lose*.

Quick Results!

"Sold my house within two weeks by following the Simplex Plans."—*F. Stark, Wis.*
"Sold for cash in 10 days."—*W. H. Carlisle, Mass.*
"Sold my property. Your plan quickest I ever saw."—*Johnson String, N. J.*
"Sold my home for cash within three weeks."—*M. E. Lounsberry, Okla.*
"Sold my lots for cash."—*R. P. Mondie, Ottawa, Can.*
"Sold for cash within a few weeks."—*M. P. Jones, Ind.*

THE SIMPLEX CO.

Dept. 241
1123 Broadway
New York

Telegraph, Cable and Radio Dispatches

(Continued from page 1298)

one word each in the address of cable or radio messages, irrespective of their length or the number of separate words they contain; for instance, Havre de Grace, New York, East St. Louis are counted as one word each. In the body or text of a message, however, such names are counted and charged for at the rate of fifteen letters to the word in plain language messages; at the rate of ten letters to the word in code messages, and at the rate of five letters to the word in cipher messages.

In dispatches written in a mixture of plain and code language the maximum length of a chargeable word is set at ten letters or characters.

In dispatches written in a mixture of plain, code and cipher languages, the passages in both plain and code language are charged as code language, and the passages in cipher language are charged at cipher rate.

In dispatches written in plain language and cipher language, the passages in plain language are counted as plain language, and the passages in cipher language are counted as cipher language.

A sender may prepay a reply. To do so he must write before the address of the message the indication of prepayment, as well as the number of words prepaid for the answer; thus R.P. 10 (to) Lathrop, Paris, etc., the expression "R.P. 10" being counted and charged for as one word.

RADIOGRAMS.

Radiograms are messages which must be transmitted thru the medium of the ether by means of radiated electro-magnetic waves and may originate on board a vessel at sea to a distant inland point or vice versa. There has also been recently inaugurated a radio service between the United States and various European points, whereby radiograms may be sent to and from England, Norway and other nations in the same manner as cablegrams.

In general, the system of counting the words in a radiogram is identically the same as that employed in cablegrams; in other words, the "cable count." Names of ships are counted as one word each, irrespective of the number of letters in the address. In the case of two or more ships of the same name (which is not an uncommon occurrence) the line controlling the vessel should be included in the address, as in the following manner: "Smith, Ward-line Steamer *New York*, via Cape May Radio."

Radiograms originating on land and destined for vessels at sea are sent by land wire to the coastal radio station nearest to the point or zone within sending and receiving radius of the vessel, after which the coastal radio station holds the message until it has established communication with the incoming or outgoing ship, as the case may be.

Before sending a radiogram to a vessel at sea the sender should first ascertain from the local ship news office or marine department of a newspaper as to the latest radio report received from the ship, giving her position or probable date of arrival or departure, as the case may be, so that the message may be properly timed. In some of the large seaports, such as New York, Boston, Baltimore, New Orleans, San Francisco, etc., it is well to first secure the above information from the local office of the radio system, as the latter is in a position to inform the sender as to the proper coastal station to route the radiogram, as well as rates and other necessary information. Ordinarily, however, any telegraph office will accept radiograms to and from ships and properly route and deliver them.

Make Your Own ELECTRICAL APPARATUS



SAVE 1/2

It is easy to make your own at home with the aid of these 4 up-to-date books that you can understand. Each has over 72 pages and over 60 illustrations, 3 color cover, size 5 x 7 inches. **HOME MADE ELECTRICAL APPARATUS**

- VOL. 1**—Contains working drawings and directions for making all sorts of Dynamos, Motors, Electric Apparatus, Home-made Batteries, Storage Cells, Transformers, Rectifiers, etc.
- VOL. 2**—Contains working drawings and directions for all sorts of Voltmeters, Ammeters, Galvanometers, Switches, Rheostats, Telegraph Keys, Sounders, Telephones, Shocking Coils, Spark Coils, Experiments, etc.
- VOL. 3**—Contains working drawings and directions for making all sorts of Dynamos, Motors, Electric Engines, Miniature Lighting Plants, Wireless Telegraph Apparatus, Tesla Coils, Wireless Telephone, Electroplating, Experiments, etc.
- HOME-MADE TOY MOTORS**—Gives complete details with working drawings for making 12 simple but operative electric motors. Several built from sheet "tin." Others with castings.

35c each any **THREE \$1.00** postpaid

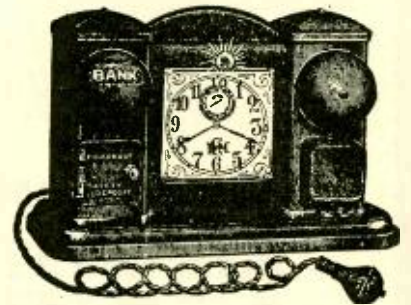
GET THEM NOW

PRICE MAY ADVANCE ANY DAY
COLE & MORGAN, Inc. Publishers
Dept. 124, 19 Park Place, New York

Electric Alarm Clock and Bank

SERVES FIVE DISTINCT USES

Electric Alarm, Electric Call Bell, Electric Lamp, Savings Bank, and Safety Deposit
Guaranteed Accurate Timekeeper. Alarm Rings Until You Get Up and Stop It.



It rings up the Dial of the Clock at any time of the night. Alarm is continuous—rings until you get up and stop it. Simply press the button on top of cord and it instantly ceases, not only the clock, but the entire room. By changing the switch you can see how or call bell as desired. As a call bell in sick room, office, shop or home, it is a ware ready and at hand. Not the least, useful parts shown in this clock are the Savings Bank and Safety Deposit. The Safe Deposit opens by turning the handle of the clock. The Clock is an Excellent Timekeeper, made of steel, fully plated—finished. It is operated by an ordinary No. 6 Dry Battery, which lasts for months and can be replaced at slight expense. Batteries are obtainable everywhere.
Price \$10 Shipped by Express, charges collect, or by parcel post, prepaid, if you add \$1.00 more. Weight, 9 lbs.
JOHNSON SMITH & CO., Dept. EB, 3224 North Halsted Street, CHICAGO

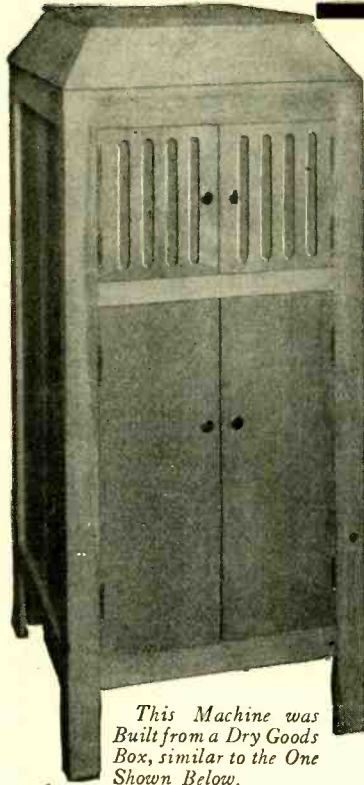
Earn \$75. a Week!

See page 1235



Wrestling Book FREE

Be an expert wrestler. Learn at home by mail. Wonderful lessons prepared by world's champions Farmer Burns and Frank Gotch. Free Book tells you how. Secret holds, blocks and tricks revealed. Don't delay. Be strong, healthy. Handle big men with ease. Write for free book, **Stano, Farmer Burns, 7444 Range Bldg., Omaha, Neb.**



This Machine was Built from a Dry Goods Box, similar to the One Shown Below.

Build This \$150 PHONOGRAPH Out of a Dry Goods Box!

WE MAKE IT EASY

The cut at the left, shows a beautiful Phonograph, which you can build out of a common dry goods box, similar to the one illustrated below. This machine is handsome in design and will be an ornament to any home. Its lines are simple and pure Colonial. All who have heard it, say it has

A Tone of Surpassing Beauty Equal to Any \$250 Machine

rich, sonorous, like a violincello, due in part to the shape of the sound chamber, an exclusive feature in all our machines. It plays all records, giving them a new beauty which has been a delight to all who have heard them.

All are astonished at the great volume as well as the superior quality of the tone, and a superior tone is what all phonographs are judged by, and what all makers strive for. We have made it an easy matter to build a phonograph out of ordinary material with the aid of our

Simplified Plans and Instructions

which are so easy to follow, as they are completely worked out in every detail. Any person who has a few, ordinary tools—saw, hammer, plane, screw driver, and some sand paper—can now build a phonograph with our help, and with no chance for failure.

This is amply proved when you look again at the machine illustrated above. You, too, can build one like it out of a dry goods box with the aid of our plans, because, what one man did, you can do. You will be amazed how easy it is and how fascinating when you get started, also how cheap.

We Cut the Costs on Phonographs

We have not only made it easy, but cheap to build a phonograph under our plan. We furnish all mechanical equipment—double spring motor, (plays three 10-inch records), 12-inch turn table, speed regulator, tone arm, (plays all records), continuous cover hinge, cover support, four butt hinges, four socket casters, one modulating rod, four door-friction catches, four door knobs, with simplified building instructions, and three 10-inch records,—all for \$20. A machine of similar quality, with this equipment, would be priced at \$150. in any store! And there is another angle to the proposition that will interest you. As soon as your friends hear your machine, they are going to want one just like it, because of its beauty of design and wonderful tone. In this way it will not be long before you find yourself with orders ahead, and in an incredibly short time will be started—well started—in

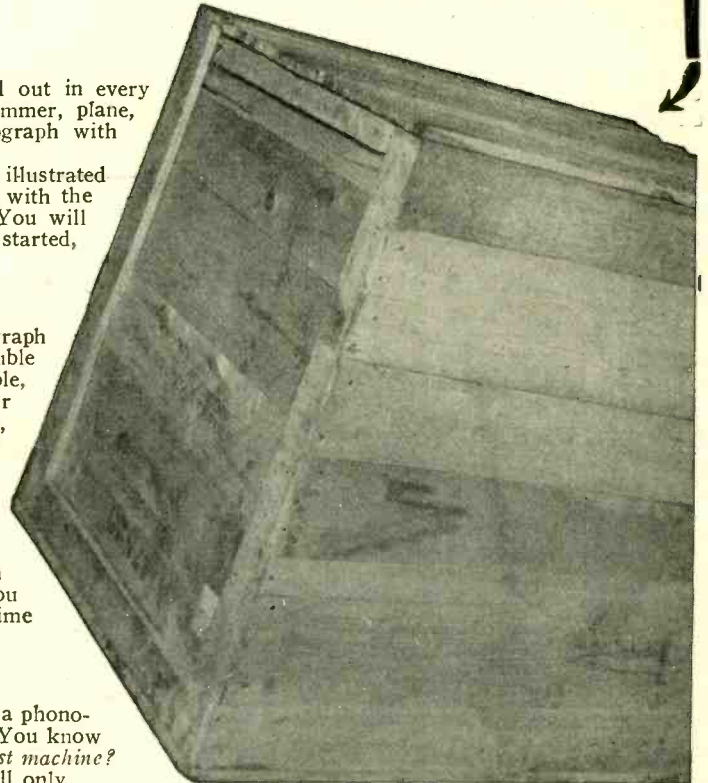
The Business of Building Phonographs

and there is no business on earth that pays better. People want a phonograph in the home, because of the enjoyment it brings to all. You know this of course. Why don't you decide right now to build your first machine? The business end of the proposition will quickly follow. It will only cost you a two-cent stamp to get full details. The coupon will bring them promptly.

Agents Are Making Money

under our plan and we want to hear from more men who are ambitious and are looking for the Big Opportunity to get into business for themselves on a small capital, and be independent for life. Write today for full details. Use the coupon. Take advantage of the wonderful times ahead. 1920 will be America's banner year. Get your share of this prosperity. Let us help you. Exclusive territory allowed.

MODERN PHONOGRAPH SUPPLY CO.
243 Springer Bldg., 313 S. Clinton Street, Chicago, Ill.



MODERN PHONOGRAPH SUPPLY CO.

243 Springer Building, 313 S. Clinton St.
Chicago, Ill.

Send me full details of your Build Your Own Phonograph proposition, and the Big Opportunity for Agents.

Name

Address

City or Town..... State

THE
CONQUEST
OF
POVERTY

By HELEN WILLMANS POST

The most popular book in the range of Mental Science (New Life and Self Help). It brings freedom to the mind, and through the mind to the body.

This book is wonderful. The demand has been so great that now we offer a cheap edition that we sell at \$1.00 a copy for a short time only.

Dr. B. Lust's Publishing House
Dept. E, 110 EAST 41st ST.
NEW YORK CITY

**SEND NO MONEY
WE TRUST YOU**



We are giving away thousands of dollars worth of valuable presents, such as Watches, Sterling Silver in Water Buck, Air Rifles, Guns, Moving Picture Machines, Musical Instruments, Cameras, Printing Presses, Typewriters, Telescopes, Books, Puzzles, Games, Tricks, Toys and Novelties, Rubber Stamps, Household Labor Saving Devices, etc. All you have to do is send your name and we will send you, without any charge, 20 extra large De Lusa colored pictures, to sell at 25c each when sold, and the (\$5.00) and we will give you goods of your own selection to the value of \$4.00 from our wonderful 400 page premium catalog. Remember, you get these goods as a premium for selling the picture and sending us the money. You do not have to pay one cent for them.

By continuing the sale of our goods you can earn a magnificent bicycle and many other expensive presents. We are a large and responsible concern, having a million customers on our books. Our goods have been extensively advertised in "Popular Mechanics" and all the leading magazines for many years. You can have your choice of \$4.00 worth of these goods, and by our method we actually provide you with the means of purchasing these valuable presents. Send in your order and we will immediately send you the first lot, accompanied by our big catalog to select your premiums from.

JOHNSON SMITH & CO.
Dept. E8, 3224 N. Halsted St., CHICAGO

SWALLOWS RIFLE NOISE

A wonderful invention—
and a wonderful experience
to shoot without noise.
Equip your .22 rifle with a

Maxim Silencer

\$6.00 from dealer or factory, complete with coupon. Attach it yourself. Send 6c for descriptive catalog and booklet of astonishing experience of Silencer users.



Maxim Silencer Co.
89 Homestead Av.
HARTFORD, CONN.

PROSPECTIVE STUDENTS

B. C. N. will give you your N.D. degree in two years, day and night classes. This institution teaches Electrical Therapeutics, Static, High Frequency, Violet Ray, Galvanic Current, X-Ray, Osteopathy, Orthopaedics, Chiropractic, Psychology as embodied in the Tripartite of Sciences known as Natureopathy. The field is unlimited right now for Natureopathic Physicians. Our experienced faculty of fourteen practical Physicians will guide you surely and carefully to attain success. Earn while you learn if you so desire. Graduates of single branch schools who are here now say that the Blumer System is the most wonderful drugless healing system in existence. Write today for our catalogue. Start right. Address Executive Secretary,

BLUMER COLLEGE of NATUREOPATHY
97 Ann St., Dept. H., Hartford, Conn.

15 cents postage will bring to you "The Scientific Natureopathy." Address Publicity Dept. of the above college.

Hello Mars!

By H. WINFIELD SECOR
(Continued from page 1250)

well, and it is not formed of any earthly combinations or codic conjugation with which you are familiar. Can you imagine what your first effort would be towards solving this problem?

For the moment we may even consider that you have at your disposal even the interplanetary wireless telephone, but of course in its infancy, so far as communication with the Martians is concerned.

Is it not a most interesting philosophical conundrum to try and think just what you would do in this case? Would you try to talk to the Martian and encourage him in the English tongue in your endeavor to find out what the word "gouka" meant? Or perhaps, if you are a linguist of high attainment, you might possibly try talking to him in several different tongues, of which there were at the last count, 420 different species on the face of the earth.

But we won't keep you guessing any longer, because we know you will undoubtedly tire of this reasoning, and in the next issue we shall tell you what this (supposed) Martian word means.

Looking at Fig. 4 once more, take a piece of paper and cover up the little animal at the left of the word r-a-t, and just imagine what a quandary you would be in upon your first sight of the word rat, even tho by long and patient study you had learned the outlines of the letters and knew that they constituted elemental parts of a certain language,—it matters not which one. Remember, the Martian could not talk to you, even tho he had a wireless telephone transmitter which reached the earth, because he does not know your language. And how are you going to ask the Martian in a language which you know nothing about what the word means, and what is still worse, how would you know the proper pronunciation of the word? The answer is, you could not!

But supposing that after you had been looking at this word for a long, long time, that suddenly one night an outline appeared alongside of it of an animal that looked like a rat! In other words, remove your piece of paper from over this part of the illustration on the left of Fig. 4 and lo and behold! you at once perceive that R-A-T equals a rat. All your difficulties have been swept away instantly.

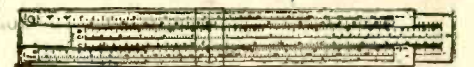
And so it begins to look as if the only logical method by which to start a communication with the Martians in either direction is by means of words and pictures. This method is not entirely new, for several of our foremost astronomers have made this suggestion; but in the latest outburst from our radio and other communication experts, who are talking of sending radio or flash-light signals to Mars, or, in other words, dots and dashes of the Morse code, forming letters of a language which we know,—the homely philosophy and simplicity of the kindergarten rule have been entirely forgotten, it seems!

Picture yourself standing opposite a man whom you never saw before and whose language bears no similarity whatever to yours, and that by means of a semaphore or by a wireless instrument or perhaps a telegraph sounder, he starts shooting dots and dashes at you! Suppose the dots and dashes correspond to letters in his language. Can you by any stretch of the imagination conceive as to how you are going to interpret these dots and dashes and finally ascertain what in Sam Hill he is driving at?

(Continued on page 1304)

ELECTRIC Talking Machine
Never Wind It
Stops itself when through playing. Fits any cabinet.
Electro Mechanical Parts Co.
160 N. Wells St., Chicago, Ill.

RICHARDSON'S POLYPHASE SLIDE RULE



has the regular A, B, C, and D Scales; also a CI or Polyphase Scale, Logarithm, Sine and Tangent Scales. All graduations are printed on white coated steel from engine divided plates. These Scales are accurate and will retain their accuracy indefinitely. They are not affected by acids, alkalis, water or grease. Length of rule 10". A 100 page Instruction Book which teaches all there is to know about slide rules, is sent with each order.

Price of the Richardson's Polyphase Slide Rule, in case with 100 page Instruction Book \$2.00.
An Ideal Slide Rule. It is low priced and an equal to any other rule in appearance, accuracy and durability. Be convinced. Your money will be promptly refunded if you are not satisfied.

Send for our 40 page catalogue of supplies. It describes rules ranging from 50c to \$10. each. Instructions in Logarithms and Trigonometry free with every catalogue.

GILSON SLIDE RULE CO. NILES, MICH.

STAUNCH

TOOL Chest economy means a Union Tool Chest—the chest of stancher construction for stancher service. Built of solid oak, top and bottom rabbited in and frame joints lock-cornered, not dove-tailed. Union Tool Chests outlast the tools they contain. Bangs, knocks, jolts, falls, bad weather do not hurt your tools when you keep them safe and secure in a Union Tool Chest. 10 Styles and Sizes.

Write for Catalog, prices and name of nearest dealer and guarantee. If no dealer near you, write for special offer.

Union Tool Chest Co., Inc.
36 Mill Street
Rochester, N. Y.



**Latest Book On
SELENIUM CELLS**

Their Construction, Care and Use
By F. W. BENSON
73 pages, 15 diagrams and 3 half-tone page plates, 7 1/2 x 5 1/4 inches. Cloth.

PRICE \$1.50
Uses of Selenium
Measuring Light - Transmitting Speech through the Telephone—Automatic Control of Buoys, Street Lights and Illuminated Advertising Signs—Control of Ships and Boats at a Distance—Most Efficient Burglar Alarms, etc., etc.
SPON & CHAMBERLAIN
120 G Liberty Street, New York

**Send To-day for the
"Electrical Worker's Friend"**

An electrical book of 66 motor drawings with complete instructions for rewinding and reconnecting A.C. motors. Special at \$4.00
Or write for full particulars of this valuable book
SMITH & SMITH PUBLISHING CO.
Dept. B, 1524 Lowrie St., N. S., Pittsburgh, Pa.

BLANK CARTRIDGE PISTOL \$1
Prepaid ONLY
7 inches long, real revolver style. For protection and sport, every man, woman and boy should have one. Order at once. Get an American flag FREE. Money refunded if desired.
G. P. LEWIS CO., 1402 Broadway, New York City

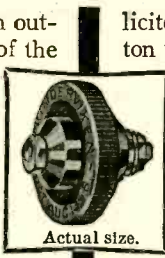
SKINDERVIKEN TRANSMITTER BUTTON

MOST SENSITIVE MICROPHONE

YOU can easily make a highly sensitive detectophone by using a **FOR \$1.00** **A** button electrical experimenters the

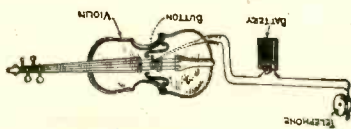
collect the sound waves. You can build your own outfit without buying expensive equipment. Think of the fun you would have with such an instrument! It's very simple, too, and inexpensive.

You can install an outfit in your home and hear the conversation being held all over the house. You can connect up different rooms of a hotel. *This outfit was used by secret service operatives during the War. It is being used on the stage.*



Actual size.

So much for its commercial adaptations! You can procure apparatus of the same type.

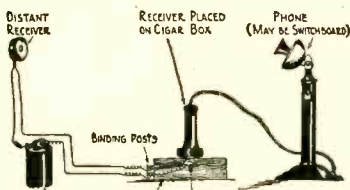


One of the main advantages of the Skinderviken Transmitter Button lies in its ultra-sensitiveness. You can place it in any position you like. It is the greatest invention in micro-phones and has won recommendations from men of high standing in the scientific world. It is being used all over the world. You can mount it most anywhere. Card board boxes, stove pipes, stiff calendars and hundreds of other places will suggest themselves to you. The buttons cannot be seen by any one in the room as they are so small and light. Only a small brass nut is exposed to the view.

Full directions for connecting up the button for use as a detectophone are given in booklet which is sent with each button.

The only instruments needed to complete a detectophone outfit, in

addition to a Skinderviken Transmitter Button are a receiver, battery, and, if desired, an induction coil.

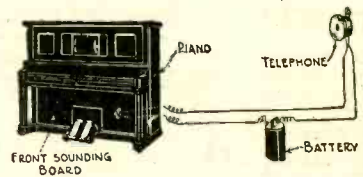


It is not uncommon to receive unsolicited letters like these: "I received transmitter button today and I wish to inform you that it works great and is the best I have ever seen or heard of for the price. I will certainly recommend it to my friends. I wish to thank you for your good service."

"I have been using one of these transmitter buttons, and it has proved to be worth more than its value in my experimenting."

"I received one (Transmitter Button) some

time ago, and they are just O. K. for experimenting." "I have been using one of these transmitter buttons for experi-



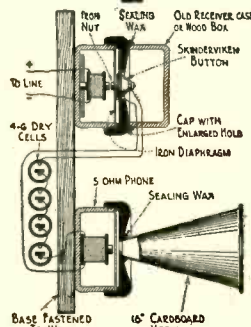
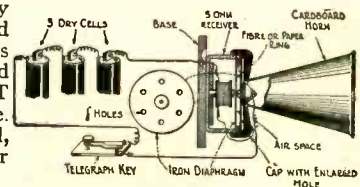
mental work and it certainly lives up to all you say for it and then some."

Mr. H. Gernsback, editor of this magazine, who is the dean of electrical experimenters, said: "In the writer's opinion, obtained by actual elaborate tests, the Skinderviken Transmitter Button is probably the most efficient device of its kind on market today, due to its simplicity and other outstanding features. Should have a great future."

The same circuit connections apply to all experiments, regardless of how the transmitter button is mounted.

The Skinderviken Transmitter Button operates on one or two dry cells. It often happens that two cells produce too much current and the sounds are deafening. We recommend either one fresh cell or two worn out cells.

We have the utmost faith in this transmitter button. We guarantee satisfactory service or we will refund the purchase price. Boys—Young and old—send in a dollar bill RIGHT NOW! You can't lose. If you're not satisfied, you receive your dollar back. Isn't that fair?



AS A DETECTOPHONE ON PICTURE



PHONOGRAPH MUSIC AT A DISTANCE



TALKING THROUGH CHESTY

JOHNSON SMITH & CO., Dept. E-16, 3224 N. Halsted Street, Chicago

USE THIS COUPON

Johnson Smith & Co., Dept. E. 16, 3224 N. Halsted St., Chicago, Ill.

Gentlemen:—Please ship at once to address below.....Skinderviken Transmitter Buttons for which I enclose \$.....

Name
Address City State.....

BE AN EXPERT



Auto and Tractor Mechanic Earn \$100 to \$400 a Month

Young man, are you mechanically inclined? Come to the Sweeney School. Learn to be an expert. I teach with tools not books. Do the work yourself, that's the secret of the

SWEENEY SYSTEM

of practical training by which 5,000 soldiers were trained for U. S. Government and over 20,000 expert mechanics. Learn in a few weeks; no previous experience necessary.

FREE Write today for illustrated free catalog showing hundreds of pictures men working in new Million Dollar Trade School.

LEARN A TRADE Sweeney

SCHOOL OF AUTO-TRACTOR-AVIATION
66 SWEENEY BLDG. KANSAS CITY, MO.

AN EASY WAY TO MAKE MONEY

Don't be content to plod along on a small salary. Be independent. Go in the tire repairing business. One man says "I made \$60.00 the first day." Others average \$200 to \$500 a month. Very little capital needed. Jobs plentiful. Every motorist a possible customer. No experience needed. We teach you.

SHALER Tire Repair Outfit

Improved Wrapped Tread Method Used by Tire Manufacturers

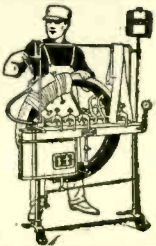
Does as good work as the big high priced vulcanizing outfits. A boy can use it. It's the only vulcanizer that has Automatic Heat Control, and can't undercure or overcure a tire. Requires no watching or regulating.

FREE Book

"How to Open a Tire Repair Shop." It tells how to make big money. Don't delay. Write quick.

C. A. SHALER CO.

2203 Fourth St. Wausau, Wisconsin



Hello Mars!

(Continued from page 1302)

It is of course evident that as aforementioned, and granted that both parties have average intelligence, most likely one can make the other understand numbers from zero to nine, so that number combinations could be transmitted and interpreted—but think of hearing for the first time or, for that matter, a thousand times, a string of five dots and five dashes of the Morse code. In the other man's language it might mean "d" or "h" or "z" and again it might mean a house or a cat-boat or a three-ringed circus, for all you are concerned.

HOW DO WE LEARN FOREIGN "EARTHLY" LANGUAGES?

It is common to hear people say: "Why, that is easy,—when they happen to overhear a discussion of interplanetary language communication,—"If this is as hard as it sounds," say they, "then how do you account for the fact that a Frenchman readily learns German, or a German learns Dutch?" And yet it is commonplace! Very true, it is a common, ordinary everyday occurrence, but did you ever really stop to think about it at all, and how it takes place? Several very important and peculiar things happen when you learn a word of a foreign language. Supposing you are an American and that you visit France, let us say.

As you leave your ship and take a railroad train for the great city of Paris your attention is suddenly arrested by a large electric sign erected on a tall building. Remember, now, that you do not know a word of French, and assume that all of those around you knew not a single word of the English language. How would you find out what the illuminated word meant?

Possibly, if you nodded your head in the direction of the display a sufficient number of times to make the Frenchman near you eventually awaken to the fact that you were in doubt as to the word on the sign, he would make some bodily motion to give you some inkling as to what the word meant. But unless you happened to live to be so old that you could look thru a marvelously high-power telescope a couple of thousand years from now, which would magnify the Martian himself, so that you can see his bodily movements, then it is evident that you are going to have a merry old time finding out what a similar strange word, if presented to you in the form of illuminated letters on Mars or otherwise could mean.

While speaking on the subject of how we assimilate the language of another nation, it should be remembered that never do we learn a word of a strange tongue and its full meaning unless we see in some way or other a comparative picture of what the words means.

The American Doughboys in France picked up many French words. Of course they did, why not? The French man or woman would show him a bottle or cup, or saucer or stove and utter at the same time the French word. Naturally, as he is an intelligent being, he will know that the particular word uttered in each case represents the object which was shown him.

So once more we see that it is in every case the simplest and the shortest method and in fact the only logical method whereby to teach the language of one nation to the other,—that is, by words and pictures simultaneously, or by a similar and equally clear illustration.

Another very important element in inter-language relations is the fact, particularly in Europe, that there are a dozen and probably several dozen different languages, so-called, which have a very large number of common generic roots, and this explains all

(Continued on page 1306)

What 15 Cents

Will bring You From the Nations' Capital

The little matter of 15 cts. in stamps or coin will bring you the Pathfinder 13 weeks on trial. The Pathfinder is an illustrated weekly, published at the Nation's center, for the Nation; a paper that prints all the news of the world and tells the truth and only the truth; now in its 27th year. This paper fills the bill without emptying the purse; it costs but \$1 a year. If you want to keep posted on what is going on in the world, at the least expense of time or money, this is your means. If you want a paper in your home which is sincere, reliable, entertaining, wholesome, the Pathfinder is yours. If you would appreciate a paper which puts everything clearly, briefly—here it is. Send 15c to show that you might like such a paper, and we will send the Pathfinder on probation 13 weeks. The 15c does not repay us, but we are glad to invest in new friends.

Washington has become the World's Capital and reading the Pathfinder is like sitting in the inner council with those who mold the world's destiny.

THE PATHFINDER, Box 976, Washington, D. C.

35 Miles per hour

Is Record of this Car



Boys, Build This Car. This nifty car is driven by gasoline motor, can be built by any boy. Parts are furnished by us and are very cheap. Send 25c for building plans and price list of parts showing how to build this lad's car.

SYPPER MFG. CO.
158 Warren Street
TOLEDO, OHIO.

THE "ALSO-ALL-SPARK"

will make old carbon-choked plugs fire like new—can be installed on any four-cylinder car. Send for illustrated catalogue—or remit for device on money back guarantee.

\$7.50
ALLSPARK IGNITION CO.,
13X Water St., New York

The Seneca Built for the Owner \$1185

Simple, Sturdy construction. Low cost of up-keep and operation. Cantilever springs in rear. Comfortable E-Z riding. 4 cyl. - 27 H.P. 108 in. wheel base



Dealers Wanted Immediate deliveries. Fifth anniversary year. Increased output. Liberal newspaper advertising in dealers' territory. Wonderful opportunities. Write or Wire NOW.
THE SENECA MOTORCAR CO., 43 Seneca Factory, FOSTORIA, OHIO

DENINGER WILL SAVE

\$40 BIG MONEY SAVINGS FOR YOU
Used and rebuilt motorcycles, single and twins. \$25 to \$100. Used bicycles, \$6.00; tricycles, \$10. All machines guaranteed in good working order. New bicycles and motorcycles at factory prices. You save dealers' profit. Make your own and auto-motive tires too, \$3.00. Complete line of parts and supplies.
Send for catalogue
Deninger Cycle Co., Rochester, N.Y.
YOU 25 TO 50 DOLLARS

Tire Agent

We want one exclusive representative in each locality to use and sell the new Mellinger Extra-Ply, hand made tires. Guarantee Bond for 8000 Miles. (No seconds). Shipped prepaid on approval. Sample sections furnished. Don't buy until you get our Special Direct Prices. Write
MELLINGER TIRE & RUBBER CO.
801 OAK ST. KANSAS CITY, MO

A STEFFEY MOTOR

on your wheel will convert it into a practical and successful high grade motorcycle that will cost you less to operate than the more expensive machines. Write at once and secure lowest factory prices. Excellent opportunity for agents. Send stamp.
STEFFEY MFG. CO., Dept. E. 5025 Brown St., Phila. Pa.

Lighting Fixtures

Ready to Hang
(Direct from Manufacturers)
Completely wired, including glass-ware. New designs.
Send for catalogue No. 18
ERIE FIXTURE SUPPLY CO.
Sta. C Erie, Pa.

TIRES 1/3 LESS

Perfect, new tires, all sizes, non-skid or plain, fabric or cord. Prepaid on approval for 10,000 Miles Guaranteed
30,000 Customers. Catalog Free. Agents Wanted.
Service Auto Equipment Corporation
995 Service Bldg., Kansas City, Mo.

SLIGHTLY USED STANDARD MAKE TIRES

Size	Price	Size	Price
30x3	\$5.00	33x4 1/2 (Cords)	\$16.00
30x3 1/2	6.50	34x4 1/2	12.75
32x3 1/2	8.00	35x4 1/2	13.75
31x4	6.75	36x4 1/2	14.50
32x4	9.50	37x4 1/2 (Cords)	25.00
33x4	10.50	35x5	14.75
34x4	11.75	36x5	15.00
32x4 1/2 (Cords)	15.00	37x5	15.50

Special Brand New Tubes, Guaranteed.

Size	Price
30x3	\$1.75
30x3 1/2	2.00
31x4	2.35

Order now. Shipment made the same day. \$1 deposit required with each tire ordered. Balance C. O. D., subject to your examination. Specify whether you desire to have clincher or straight side tire. Special cash discount of 5 per cent. if full amount accompanies order.

G. & H. TIRE & VULCANIZING CO.
2559 S. State St., Chicago, Ill.

Charge Storage Batteries

For Convenience or Profit
From any alternating current lamp socket with the Cambridge Rectifier. For home or garage use. As simple as turning on a lamp and fully guaranteed.

Quickly saves its cost and doubles the life of your battery. Always ready when you want it. Rectifier Bulletin R sent on request.

Bulletin Y of Wireless Telegraph Apparatus sent for 3 cent stamp.

Clapp-Eastham Co.
131 Main St. Cambridge, Mass. The Cambridge Battery Charger, Price \$25



Learn Autos and Tractors

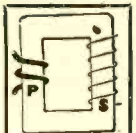
Wonderful opportunities constantly offered trained men; we train you thoroughly to start your own business or make good money as motor expert, driver, shop foreman, etc.
5000 Graduates making good. Catalog Free.
Cleveland Automobile School, 1807 E. 24th St., Cleveland, O.





Electricity

taught by a practical man



The Burgess Service is so universally successful, that we give positive assurance of perfect satisfaction on completing the course or money refunded. There are no strings tied to this—you are the judge.

Hundreds of Burgess-trained men and boys have advanced to better positions by means of the practical electrical knowledge easily learned at home by this method. Give a little of your spare time and you can do the same.

Home Study For Beginners and Electrical Men

This home study course is based on the years of practical experience of Yorke Burgess who gives personal attention to each student. Burgess students are invariably promoted and get better salaries. Beginners get employment in electrical work after taking the course a short while. Burgess students are in demand, over 80 per cent are now engaged in electrical work.

FIFTY-FIFTY EASY TO LEARN—EASY TO PAY FOR

A simple method of learning practical electricity—supplied on easy payments, including apparatus, instruments, materials, etc. Start any time—stop any time. Your payments cease if you are not satisfied. Send for Burgess catalog today. Gives full information without cost or obligation.

YORKE BURGESS, Supt.

BURGESS ELECTRICAL SCHOOL, 745 East 42nd St., Chicago, Ill.

BURGESS BLUE BOOK

a practical and handy reference book for **ELECTRICAL MEN AND STUDENTS**
Contains over 200 CALCULATION FORMULAS and WORKED OUT PROBLEMS showing their use. DRAWINGS of ELECTRICAL MACHINERY DEVICES—INSIDE CONNECTIONS—ALTERNATING CURRENT CALCULATIONS and hundreds of every day problems are also covered. Recommended by electrical men all over the country. Purchased by electrical concerns for their employes and customers.

PRICE \$1.00

We refund your money if the book does not meet your approval.

BURGESS ENGINEERING CO., 750 East 42nd St., Chicago, Ill.

YORKE BURGESS, President

Consulting Electrical Engineering. Power Plants, R. R. Signals, Electric Railroads, Industrial Problems a Specialty. Information furnished on electrical subjects. Inventions perfected.

Electrical Slide Rule

Invaluable to Any Electrical Man

In response to many requests, Mr. Burgess has prepared a set of simple and concise lessons for those who desire to take up the use of this practical instrument.

A HIGH GRADE SLIDE RULE

in a leather case, and a COMPLETE COURSE OF INSTRUCTION will be supplied at a very reasonable

SPECIAL COMBINATION PRICE

We have selected the best rule for the purpose. The simple lessons will enable you to understand its use thoroughly.

Write us for full information

BURGESS ELECTRICAL SCHOOL

750 East 42nd St.

Chicago, Ill.

Learn Wireless at Home

OPERATORS EARN \$125 TO \$250 PER MONTH

We teach you wireless by mail. A thorough, practical course written by men with years of actual experience and each a U. S. Licensed First Grade Operator. You learn easily and quickly. After ten weeks to four months of studying we guarantee you a position, either at sea or in a land station, paying from \$125 to \$250 a month with board and quarters.

Start Now—Pay While Learning

You can start at once by making a small deposit and then pay the balance while learning. We give you FREE with each course, a complete set of learning instruments and all necessary text books.

Our mail course entitles each student to a month's FREE tuition at our school in Baltimore where we have a complete ship installation.

Sign and Send the Coupon for the Whole Story



423-425 Courtland Street
BALTIMORE, MARYLAND

Sign-Clip-Mail

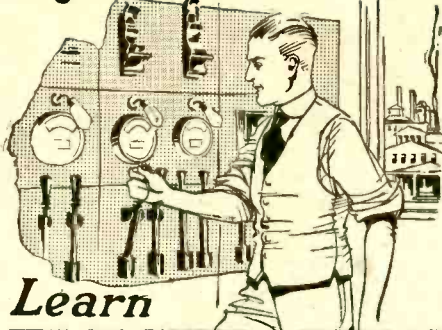
NOW!

Southern Wireless Institute, 423 Courtland Street, Baltimore, Md.

Send me FREE literature on Wireless. Also, explain just how I can pay for your Home Study Course while learning.

Name
Address
.....
.....

Big Money for Boys!



Learn ELECTRICITY

There is a wonderful opportunity right now for boys who like electricity. Boys who are ambitious and will train themselves in spare time can step into positions just as soon as they are ready. Good salaries are offered to start with splendid chances for rapid promotion.

For 28 years the International Correspondence Schools have been training boys for success in electricity and over 200 other subjects. They will help you prepare right at home for a position in the line of electrical work you like best—or in any other work that appeals to you. Thousands of boys, through I. C. S. training, have stepped into fine jobs, but never were opportunities so great as now.

Let the I. C. S. help you. Choose the work you like best in the coupon below, then mark and mail it today. This doesn't obligate you in the least, and it will bring you information that will start you on a successful career. This is your chance. Don't let it slip by. Mark and mail this coupon now.

TEAR OUT HERE

INTERNATIONAL CORRESPONDENCE SCHOOLS BOX 6228, SCRANTON, PA.

Explain, without obligating me, how I can qualify for the position, or in the subject, before which I mark X.

- | | |
|--|--|
| <input type="checkbox"/> ELECTRICAL ENGINEER | <input type="checkbox"/> CHEMICAL ENGINEER |
| <input type="checkbox"/> Electrician | <input type="checkbox"/> SALESMANSHIP |
| <input type="checkbox"/> Electric Wiring | <input type="checkbox"/> ADVERTISING MAN |
| <input type="checkbox"/> Electric Lighting | <input type="checkbox"/> Window Trimmer |
| <input type="checkbox"/> Electric Car Running | <input type="checkbox"/> Show Card Writer |
| <input type="checkbox"/> Heavy Electric Traction | <input type="checkbox"/> Outdoor Sign Painter |
| <input type="checkbox"/> Electrical Draftsman | <input type="checkbox"/> RAILROADER |
| <input type="checkbox"/> Electric Machine Designer | <input type="checkbox"/> ILLUSTRATOR |
| <input type="checkbox"/> Telegraph Expert | <input type="checkbox"/> DESIGNER |
| <input type="checkbox"/> Practical Telephony | <input type="checkbox"/> BUSINESS MANAGEMENT |
| <input type="checkbox"/> MECHANICAL ENGINEER | <input type="checkbox"/> Private Secretary |
| <input type="checkbox"/> Mechanical Draftsman | <input type="checkbox"/> BOOKKEEPER |
| <input type="checkbox"/> Ship Draftsman | <input type="checkbox"/> Stenographer and Typist |
| <input type="checkbox"/> Machine Shop Practice | <input type="checkbox"/> Cert. Pub. Accountant |
| <input type="checkbox"/> Toolmaker | <input type="checkbox"/> Traffic Management |
| <input type="checkbox"/> Gas Engineer | <input type="checkbox"/> Commercial Law |
| <input type="checkbox"/> CIVIL ENGINEER | <input type="checkbox"/> GOOD ENGLISH |
| <input type="checkbox"/> Surveying and Mapping | <input type="checkbox"/> STATIONARY ENGINEER |
| <input type="checkbox"/> MINE FOREMAN OR ENG'R | <input type="checkbox"/> CIVIL SERVICE |
| <input type="checkbox"/> ARCHITECT | <input type="checkbox"/> Railway Mail Clerk |
| <input type="checkbox"/> Architectural Draftsman | <input type="checkbox"/> Textile Overseer or Supt. |
| <input type="checkbox"/> PLUMBING AND HEATING | <input type="checkbox"/> AGRICULTURE |
| <input type="checkbox"/> Sheet Metal Worker | <input type="checkbox"/> Poultry Raising |
| <input type="checkbox"/> Navigator | <input type="checkbox"/> Automobiles |
| | <input type="checkbox"/> Spanish |
| | <input type="checkbox"/> Italian |

Name _____ 7-25-19

Present Occupation _____

Street and No. _____

City _____ State _____

Learn Wiring! See page 1235

BE AN EXPERT

Pinman

Wonderful, new device, guides your hand; corrects your writing in few days. Big improvement in three hours. No failures. Complete outline FREE. Write C. J. Ozment, Dept. 44, St. Louis, Mo.

Hello Mars!

(Continued from page 1304)

the more clearly how it is, for example, that an European comes to America and tells you he speaks six or eight languages, or possibly ten. Of course he can do it, and so would you as an American, if you were continually thrown in with people of other nations as the people of Europe are intermixed, some of the countries being very small, and if the languages of these different peoples had numerous generic roots similar to your own. But when you meet one of these high-brows ask him if he speaks some radically different tongues, such as English, Chinese, Eskimo, Indian, Russian and Turkish, which have no similar generic roots. That is another story, you can bet!

HOW A CHINAMAN LEARNS ENGLISH.

Fig. 5 shows an interesting case right in line with the would-be Martian conversationalist's theories. This experiment has actually been tried out as a professor of languages explained to the writer, and shows just what he has always contended,—that, lacking a picture or verbal description together with a word of a strange language, or else some other visual effect, such as a motion of the body, jerking of the head, or pointing of the finger, etc., that it is practically impossible for two exponents of two radically different languages to interpret a single word of what the other is talking about.

The illustration at Fig. 5 shows how a Yankee and a Chinaman were placed on either end of a telephone line. This happened some years ago in the South Pacific Islands, where the linguist aforementioned was stationed at the time, and this gives a very good illustration of what we have been talking about, as the two languages are widely separated and have no comparisons in common. If you think they have, go into the nearest Chinese laundry and get John the Chinaman to wish you a "Happy New Year" or some equally plain or well-understood salutation in his native tongue.

***!!-?-* Would you ever recognize it? Well, to make a long story short, the "Yank" gabbled away at the telephone at his end of the line—and the "Chink" did likewise. They kept this up for a good many days, in fact for several months all in all, and the sum total of all this talking and wasting of dry batteries,—not to mention the time which might have been enjoyably spent fishing on the coral shores,—was **NOTHING!**

Very few linguists have attempted to learn Chinese, but that language is no more difficult for a moment than trying to learn *Martian*; for you can go to China (if you have the price) or for that matter get acquainted with a Chinaman who speaks English, right in New York City or your home town, and after spending several months in special sessions with him you will perhaps have an idea of a few (?) Chinese words. Some languages are simple and some not so simple. Ours is fairly so, and the Chinaman thinks his is first class, altho his children spend the greater part of their lifetime mastering its intricacies.

There are about 16,000 different signs used in the Chinese language to indicate the different objects. If you want to write the word house, you make a sign like this and if you want to become a real high-class Chinese college man, you must learn over twice this number, or 40,000 signs each signifying a different object. Suppose the Martians have such a language? How do we know? We don't; and even with word-pictures it would be a slow job, for their objects might not be familiar to us.

Delivered TO FREE

Your choice of 44 styles, colors and sizes in the famous line of "RANGER" bicycles. We pay the freight from Chicago to your town.

30 Days Free Trial allowed on the bicycle you select, actual riding test.

EASY PAYMENTS, if desired, at a small advance over our Special Factory-to-Rider cash prices.

Do not buy until you get our **great new trial offer** and low Factory-Direct-To-Rider terms and prices.

TIRES—LAMPS, HORNS, pedals, single wheels and repair parts for all makes of bicycles at half usual prices. **SEND NO MONEY** but write today for the big new Catalog.

MEAD CYCLE COMPANY
Dept. S-107 CHICAGO

Rider Agents Wanted
Boys make big money

ALL MOVING PICTURE MACHINE AND WIRELESS OPERATORS USE

SOLDERALL 25c PER TUBE

SOLDERING TORCH \$1.25 IN GOVERNMENTS

A PASTE THAT TURNS INTO METAL WHEN HEATED

A match will do it. Requires no acid or soldering iron. Joins or repairs wires, metals or metalware. Sold by hardware and electrical stores, or sent by us postpaid.

SOLDERALL CO., Dept. 9
129 Sussex Ave., Newark, N. J.

COMBINATION SET Tube and Torch Complete \$1.50

USED BY U. S. AND ALLIED GOVERNMENTS

Build and Fly Model Aeroplanes

Learn about Aeroplanes and how they fly. Build a Model Aeroplane that will fly like a real one. With **IDEAL** Scale Drawings and Building and Flying Instructions you can build exact 3 ft. duplicates of famous 'planes. Send now for Drawings and Instructions for the one you want to build.

35c Each Postp'd

Catalogue of **IDEAL** Model Aeroplanes and Supplies, 5c, if you write at once. Regular price, 10c. None Free.

IDEAL AIRPLANE & SUPPLY COMPANY
Making Model Aeroplanes Since 1911
159-161 Wooster St., Cor. West Houston St., New York

N C-4 (4 1/2 ft.) Naval Curtiss Seaplane
DeHAVILLAND Battle Plane
Curtiss Military Tractor
Bleriot Monoplane
Nieuport Monoplane
Taube Monoplane

"EARN WHILE YOU LEARN"

If you are earning less than **\$50.00 PER WEEK** and like to draw—you should study **Commercial Art**

Leading Art Managers—the men who know—recommend us and employ our students. We will guarantee to make you successful—Learn at home in your spare time—or in our resident school—Day or evening. Many of our students earn money by the sale of their drawings while learning. Write for **FREE** illustrated catalogue.

COMMERCIAL ART SCHOOL
708, 116 So. Michigan Avenue, Chicago, Ill.

Build Your Own PHONOGRAPH

IT'S EASY WITH OUR HELP

A few hours interesting work saves many dollars and gives you a machine exactly to suit your ideals. We furnish motors, tone arms, case material, blue prints and full instructions. Plays any record. You can make fine profit building phonographs for your friends.

Write Today for Our Free Blue Print Offer

Agents wanted for our ready built phonographs

Cheraleon Phonograph Co.
407 Cheraleon Bldg., Elkhart, Ind.

SAVE OVER HALF

NEW AUTOMATIC ADDER, \$3.50

Makes adding easy. It's accurate, quick, durable and easily operated. Capacity 8 columns. Saves time, brain work and errors. 65,000 pleased owners. Fully guaranteed. Price \$3.50 delivered. With metal operating bands, \$5.00 delivered. Agents wanted.

J. H. BASSETT & CO., Dept. 138, 1458 Hollywood Avenue, Chicago Ill.

WHAT THOMAS A. EDISON AND SIR OLIVER LODGE SAY.

Thomas A. Edison believes, according to a recent published interview, that contrary to the contentions of many eminent radio scientists, the Heaviside ionization layer in the upper atmosphere of the earth would prevent earth-borne radio signals from passing out into interplanetary space—that these earth-borne radio signals would be propagated into interstellar space for hundreds of thousands of miles by means of the ether waves, and that it is possible that the Martians, if there are such beings, had received these signals, altho they might not have the slightest idea as to what they might mean.

As he jocularly remarked in an interview at the recent celebration of his seventy-third birthday, and granting that the messages radiated by our powerful trans-Atlantic radio stations had reached such distances as Mars, how do we know whether they are received or impinge upon a human or a chimpanzee? It is the opinion of the writer that the stray signals to which both Dr. Marconi and Dr. Tesla refer to, as having been heard in their long-distance radio stations from time to time, are either signals from unknown distant stations or else they are static disturbances caused by disturbances of the electrical equilibrium of the atmosphere, or possibly of the earth itself.

Now that everyone in the scientific world is taking a crack at the interplanetary communication game, Sir Oliver Lodge, the well-known British scientist now touring the United States, made the following suggestion:

"Nonsense," said he, when asked if he thought it possible to communicate with other planets by wireless telegraphy. "It would be possible to place an immense geometrical figure, say on the Sahara Desert and then, if the inhabitants of Mars are of a high order of intelligence, they may be able to distinguish the figure and determine that it had been the work of man. Geometry is a universal science, and it is not unlikely that if they are of a higher order of intelligence than we that they can interpret the gigantic figure as an effort at communication." (See illustration, Fig. 6.)

"ILLUMINATED WORD PICTURES" FOR THE MARTIANS.

A writer in the Western Electric News recently made the following suggestion which seems almost comic and, in fact, tragic, when we come to figure the bill, but still it has the essence of sound logic in it, when it comes down to real Earth-Martian intercommunication. He suggests that we take a large piece of ground, such as the whole State of Illinois, and install upon this nice flat piece of ground several million 1,000 candle-power flood lights fitted with reflectors and shutter attachments. These, of course, would all point sky or Martianward, then he continues: "Choose a dark night and start the flood-lights working. I would suggest that a complex network of shutter control circuits he hooked up with some automatic printing telegraph machines, so that by shoving a piece of perforated tape thru the automatic transmitter the whole set of lamps could be illuminated in any pattern desired

"For instance, an outline of the United States could be shown by the lamps (see Fig. 7 herewith) and at the bottom huge letters, about three miles long, can spell out the words 'U-N-I-T-E-D S-T-A-T-E-S.' By the aid of their modern ultra-powerful telescopes, the scientists on Mars can or should see at a glance what we were driving at, and it would not matter whether they saw the period mark or not."

SPERRY PROPOSES 250,000,000 C. P. MARTIAN TORCH.

And now comes a proposal by Elmer G. Sperry, inventor of the world's most power-



Suppose you are being choked

YOUR opponent has you about the throat—he is choking you! What can you do? Simply reach up with your hands, get hold of his two little fingers and give them a quick snap back. He will let go immediately.

Or suppose he has his arms around your waist, and is forcing you back and down. How can you break that hold? Simply put your two thumbs on your opponent's eye-balls and your other fingers on his forehead. Then, while pressing upward and inward with your thumbs, give your opponent's head a quick snap backward. He will release you at once. (Be careful if you try this on friends.)

Then if you knew something about boxing, you would be in a position to give him a sound thrashing. You would know how to put the entire weight of your body behind each smashing blow, and how to land the blow where it would hurt most. And at the same time you would know how to guard against his blows for your face, stomach or ribs.

Don't you see now, that no matter how big, strong or brave you are, unless you know something about boxing and self-defense, you're not able to defend yourself like a man?

Wouldn't you like to learn boxing and self-defense quickly by a new method, at half cost of a single term of lessons by the old method? You can. The Marshall Stillman Association teaches boxing by mail. The complete course only costs \$5, and to prove that it is practical, we send it to you on five-day approval. You examine it, practice the lessons. If you are satisfied, you keep the course, and send us \$5; otherwise you return the course. That ends the matter. What could be fairer? We couldn't do it if we were not sure of ourselves. We know from experience that nine chances out of ten you will keep the course if you give it a thorough trial. There are over 10,000 students studying it now—some of them as young as 12 years, others as old as 60—and the letters they write us show that after a few weeks' study the aver-

age Marshall Stillman student is able to out-box stronger and bigger opponents. Y. M. C. A. physical directors and boxing instructors in the United States and Canada know this. That is why they use the course, and recommend it to others—to save time and money.

Marshall Stillman was Mike Donovan's sparring partner—Mike Donovan, you know, taught boxing for over thirty years at the New York Athletic Club. So Marshall Stillman followed his methods and adapted them to home study in a very unique way. The first lessons take place before your mirror. You begin with things you already know—the breast stroke in swimming, holding out your hand for a coin, etc. Step by step Marshall Stillman leads you from these movements to the movements in boxing which are very similar to them, and before you know it, you find yourself subconsciously practicing the rudiments of boxing; the hit, guard, ducking, feinting, foot work, etc.

In addition, you receive 16 lessons in standing wrestling and jiu-jitsu, and a lesson on daily exercise to keep you in good physical condition. And to every student we send a free copy of Mike Donovan's famous book, "The Science of Boxing", specially bound for home study. The fact that there are 175 illustrations shows how complete the lessons are—yet they are compact and simple.

This course used to sell for \$10. In getting out the Home Study Edition, we printed a great quantity at one time, with the idea of being able to offer it to the public for \$5. But printing is costing more every day, so we cannot promise to maintain the \$5 price indefinitely. If you are at all interested, mail the coupon right away—remember, you don't send any money, and if after five-days' trial you are not convinced that we can teach you boxing and self-defense, you may return it. Mail coupon to Marshall Stillman Association, Suite E-4, 461 Fourth Ave., New York.

Free Approval Coupon

Marshall Stillman Association, Suite E-4, No. 461 Fourth Ave., New York. You may send me on approval your Home Study Course in Self Defense, including 5 Lessons, one set of daily exercises, 3 rounds of shadow boxing, 8 bone-breaking holds and releases; 8 holds in standing wrestling, and a free copy of Mike Donovan's book, "The Science of Boxing." I will return the course or remit \$5 within 5 days.

Name.....

Address.....

Make \$2,500 to \$4,000 a Year in

HAYWOOD'S TIRE SURGERY

5,000 More Miles To Old Tires

Stations Needed Everywhere

You know what 4,000 to 5,000 additional tire mileage means to motorists. Haywood's Tire Surgery is a new tire repair method that gives new life and thousands of miles of additional service to tires which before would be thrown in the junk pile. Think of what this means, man, as a money making opportunity. Think of the business that is going begging to pay you big money if you're ready to act.

HAYWOOD'S TIRE SURGERY Is a Wonderful Business

Easy to Learn—No Experience Necessary

Uncountable millions of tires are cut, torn, gashed and bruised, broken down, worn out, yet with the Haywood method of tire surgery all these tires, no matter how far gone, can be put back into service. Every town, every hamlet, every city needs Haywood Tire Surgeons, and it's that we are offering you—a business of your own—a business that is already making hundreds of men rich and so will make you.

YOU CAN LEARN IN A WEEK. Walk right into \$2500 to \$4000 a year—be independent in business for yourself. Let us send you all the facts.



Mail Coupon—Get My Free Book

Just put your name and address on the coupon below, send it to me by return mail, and I'll send you without obligation full particulars of this money making opportunity. My Free Book explains everything. Tells how to start business with very little money. Now you can easily and quickly learn all about tires and my method of Tire Surgery. It will tell you how to handle every detail of the business. In fact, how to succeed and make money. Don't wait. Write me today. The postage for a stamp or post card will prove the best investment you ever made.

M. HAYWOOD, President
HAYWOOD TIRE & EQUIPMENT COMPANY
1261 CAPITAL AVENUE INDIANAPOLIS, INDIANA

Mail To-day For All Facts

M. HAYWOOD, President
HAYWOOD TIRE & EQUIPMENT COMPANY
1261 Capital Avenue, Indianapolis, Indiana

Dear Sir—Send me quick, without obligation, full particulars of Tire Surgery.

Name _____

Address _____

Earns \$800 Month

This is

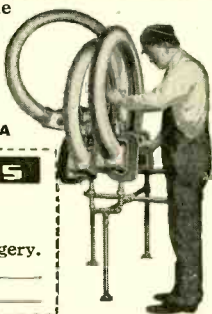
E. T. Buchman

He is a Tire Surgeon at Chicago. He says: "Am earning \$800.00 per month, and confining myself solely to re-building of Tires by Haywood Method."



\$6,500.00 Home Paid For

John W. Blair, Toledo, Ohio, says: "When I started three years ago, I had just \$50.00 left after paying for my outfit. I now have a \$6,500.00 home paid for, \$1,000.00 in one bank, and deposits in several others."



ful electric searchlight, shown in the accompanying photographs, to utilize a battery of 200 of his 1,250,000,000 C. P. searchlights in one gigantic bank and to concentrate their rays into one powerful beam of light, which it is figured that the Martians cannot miss. It is claimed that this flash of light would be visible on Mars as a star of the seventh magnitude, which is easily picked up by our telescopes.

The accompanying photographs were taken on the roof of the Sperry Gyroscope Company's factory in Brooklyn, New York, and certainly shows in a very interesting manner the great power of this most powerful electric searchlight ever built. Two hundred of these searchlights would give a total candle-power for Martian signaling of 250,000,000,000—rivaling the sun itself.

The fan arrangement of light beams in one of the photos was formed by an arrangement of six large reflecting mirrors which produced a very brilliant and spectacular effect, as will be seen. See Figs. 1 and 1-A.

MYSTERIOUS DOTS AND DASHES MIGHT FORM MARTIAN PICTURE.

Mr. H. Gernsback has suggested that if the proper interpreting apparatus was brought into play, that the mysterious dots and dashes received on the radio antenna of the Marconi station, and also those cited by Dr. Tesla, might yield some very surprising results. In other words, if these were recorded, as for instance by a light beam controlled by a set of magnets connected to the radio receiving apparatus antenna as shown at Fig. 8, on a sensitized photographic cylinder, fitted with a threaded axle or shaft, which would cause it to move longitudinally as well as rotatively, past the fluctuating light beams, that when this was unrolled from the drum there might be developed a word-picture or such as we have shown in Fig. 8.

Now, there is nothing startlingly novel about this apparatus. As a matter of fact it has been used about ten years ago for the transmission of pictures by radio and considerable success was had with this method. The pictures can be transmitted entirely either by dots or by dashes—it makes no difference which, and a minute's consideration will show that with a transmission of this kind no regular sequence of the dots or dashes is feasible or even possible.

In other words, the time element between the succeeding dots or dashes all vary and will never be alike. Due to these differences in time between succeeding signals, the radio picture is built up.

As Mr. Gernsback points out, were the Martians to send us such radio pictures, they would probably first pick out some astronomical fact, as for instance the planet Saturn with its rings. Alongside of this would then appear the symbol in the Martian language whatever they might be.

This is shown in our illustration, Fig. 8. If the Martians were to send us pictures such as these, extending over a number of months, it would be very simple for anyone versed in deciphering foreign languages to become acquainted with the Martians' alphabet or language, as the case might be, and very soon we would master the language without much trouble. By this method the Martians could show us how they transmitted the messages to us, and we in turn could then follow suit and answer back by a like method.

This idea was prompted by the fact that it is apparently almost impossible for us Earthians to interpret intermittent signals such as dots and dashes or short and long flashes of light hurled toward us by another planet, into intelligible language—and as the Martians are supposed to be far more intelligent and more scientifically developed than we, it is possible that some such scheme as this may be eventually worked out by our scientists. Many wonderful things have

SPRING TONIC

Your battery needs a spring tonic more surely than the human dynamo. Not brimstone and treacle, but some pure unadulterated electrical energy easily and economically obtained by the use of the

F-F BATTERY BOOSTER

Bantam Type 6-6 ampere 6 volt battery \$15.00
Bantam Type 12-5 ampere 12 volt battery \$20.00

Operate from 110 to 120 volt 60 cycle A.C. Lamp Socket.
Weight 10 pounds complete with Ammeter and Battery Clips.
Include Postage and Insurance Charges with remittance on Parcel Post shipment.

Circular No. 12 gives full information on these and larger sizes for operation on A.C. or D.C. current or Farm Lighting Plants.
Ask for Bulletin No. 12

THE FRANCE MANUFACTURING CO., Cleveland, Ohio



\$15 AND UP

MODEL AIRPLANE SUPPLIES

Build and fly Model Airplanes

Send 5¢ for catalog of complete and knocked-down scale models of new machines, parts, fittings, and supplies.

Wading River Mfg. Co. 672 Broadway, Brooklyn, N.Y.

happened in the past twenty-five years and in the past one hundred years there has been a greater advance in science than in all the centuries that went before.

SOME OTHER OPINIONS.

Dr. James Harris Rogers, of Hyattsville, Maryland, the well-known inventor of the underground and underseas wireless, has recently announced that he is preparing to set up delicate radio receiving instruments in his laboratory capable of responding to signals up to 150,000 meters wave length. This is said to be 50,000 meters greater wave length capacity than that used at the Marconi station, where the mysterious signals have been noticed by Marconi himself and which he believes to have come from some far distant planet—such as Mars.

In a recent interview Dr. Nikola Tesla had the following to say: "That the planets are inhabited is a foregone conclusion. I believe that the time has come for a serious attempt in the direction of interplanetary communication. We can begin by erecting a plant for transmitting the signals conveying the knowledge of numbers, which would be the simplest truth that could be communicated to the Martians or other worlds' inhabitants, and which would be answered immediately if the planet is populated by a race as civilized as ours. Once the first step is successfully carried out, it would then be very easy to install more elaborate apparatus for the transmission of pictures, by means of which the most intricate thoughts can be communicated."

Another writer on interplanetary communication, believes, like Sir Oliver Lodge, that geometric figures would be very plausible as the first stepping stone to open up relations between the earth and the Martians, and the sponsor of a very interesting theory, Mr. J. G. Carter of Clifton, Ohio, puts forward the suggestion that the snow flakes which fall during our winter season may even be influenced in a positive manner by agencies controlled by the inhabitants of other planets, such as Mars. This theory is based on the fact that there is a very large number of different geometric designs assumed by falling snow flakes.

In closing, we may very well take a few moments to digest some remarks of an interested reader, Mr. Martin C. Hansen, on the subject of communicating with Mars.

"From some recent newspaper clippings I have noted the following statement: 'Some wireless experts believe we shall soon be able to exchange wireless messages with such planets as may be inhabited.' YEH! says I. And again, one article claims Venus to be a 'younger' sister of the earth. Well! well!

"Now, if Venus is so much younger than the earth, then we must also concede its race of inhabitants are also younger, both in nature and inventions. If this is true then we may have to 'feel' them for radio signals for generations to come, before we can hope to get any answer. And just as Martians are supposed to have done the same thing with us for hundreds, if not thousands of years; so will we have to keep on signaling the Venerians.

"To return to the subject of intellectual Martians. If the Martians are so much wiser than we by a million or more years, then they have NOT tried to wireless us for the past thousands or more years, as they certainly ought to have telescopes and other instruments to actually ascertain what we are doing along the line of inventions and mechanics, etc., and they would not be such fools as to signal us, when they would know we had no instruments of any kind to record their signaling.

"If Venerians are a million years younger than we (if we knew this to be true), then we are certainly the most consummate fools in believing we can send messages to them because they are as yet the lowest cave men of the stone age."



The Things That Bigger Pay Will Bring You

You want these things and probably many others, so why don't you double and treble your pay? **You can do it.** With double and treble the amount you are now earning you can go to the bank each pay day and put away a sum of money for a "rainy day," or that can be used for profitable investments or building your own home. Bigger pay would enable you to own an automobile and to get many pleasures out of life that you cannot now afford. To be able to go to the bank each pay day and steadily build up a bank account **without missing it** is alone worth any effort it may take to increase your earning power. Then think of the things you want that are not pictured here. Whether you ever enjoy those things depends entirely on yourself.

Every day you see men around you stepping up into better jobs and drawing bigger pay. It isn't a question of "how do they do it?" You

Don't Dodge a Better Job

know they have trained themselves to handle the jobs ahead of them. The question is "WHY DON'T YOU DO IT?" You want the things that better pay will bring you so why not decide NOW to prepare yourself for a better job and better pay?

Promotion and better pay is up to you and not the boss. The big pay checks go to those who can think, act and do things for themselves. Training will make you a master of your work and place you in the job you want. There are no two ways about it; while you ignore the benefits of training you are dodging a better job. Without interfering with your work you can prepare for bigger pay right in your own home—after supper in some of the hours you now waste. The thousands who have marked and mailed the Coupon to the right have doubled and trebled their pay. That is just what you can do—so do as they did. Send the Coupon.

AMERICAN SCHOOL OF CORRESPONDENCE

Dept. G-264, Chicago



TRAINING THE KEY TO SUCCESS

Please send me booklet and tell me how I can fit myself for position marked X



-High School Graduate
-Western Union Courses
-Telephone Engineer
-Draftsman and Designer
-Automobile Engineer
-Automobile Repairman
-Airplane Mechanic
-Fire Insurance Expert
-Sanitary Engineer
-Photoplay Writer
-Heating and Ventilating Engineer
-Master Plumber
-Civil Engineer
-Structural Engineer
-Mechanical Engineer
-Shop Superintendent
-Employment Manager
-Steam Engineer
-Lawyer
-Business Manager
-Certified Pub. Accountant
-Accountant and Auditor
-Bookkeeper
-Stenographer
-General Education Course
-Com. School Branches
-Electrical Engineer
-Electric Light and Power Superintendent
-Hydroelectric Engineer
-Wireless Operator
-Architect
-Building Contractor
-(Foreman's Training Course)

Name

Address

A Chain is No Stronger Than Its Weakest Link



E. W. GOODMAN
Reproduced from "Strength"

and your body is no stronger than its weakest member. You can not expect strength from a weak chain, or health from a weak body.

For the body is like a chain—in order to be healthy it must be strong and dependable in all parts. This can be accomplished only by a proper system of exercise—a system which will provide for the regular and systematic use of the entire muscular system.

Start forging a link in the chain of health to-day. Send for

Catalog of adjustable bar-bells and dumbbells } **BOTH**
Folder No. 18 describing our } **FREE**
system of exercise

The Milo Bar Bell Co.

Diamond & Third Sts.

Dept. 5

Philadelphia, Pa.

Light and Power from the Sun

(Continued from page 1241)

A year or so ago there was described in this journal another solar power plant and an elaborate scheme was detailed and illustrated therein for revolving glass heating units in perfect synchronism with the sun by means of an electric-clock regulating device, so that not only did the complete bank of solar units rotate from east to west, but also the angle of the surface of the units was tilted so that this surface was kept exactly at right angles with the solar rays, which means that the surface of the glass tank or units must swing from right to left in the course of the daylight period from eight to ten hours, and also they must be tilted from a nearly vertical position in the morning—thence to a horizontal position at noon—and then once more to an approximately vertical position again in the evening.

In Mr. Willsie's solar power plant there is a trough arranged at the bottom of the glass heating tank into which the heated water at a temperature of 150 degrees or more runs off thru a pipe into the storage tank which is insulated with layers of dry sand. Mr. Willsie explains that the water will remain hot from four to ten days when stored in this tank, and here we have the key to a very novel principle involved in Mr. Willsie's plant, viz., that he can run his engine and dynamo at night without any storage batteries and obtain electric lights, etc., which he actually did at his Arizona plant.

Originally, however, when the plant is put into complete operation, the heated water runs from these storage tanks into the sulfur dioxide engine and boiler system, as shown clearly in the diagrammatical illustration herewith. Sulfur dioxide, as is well known, has a low boiling point, so that it can be placed in the boiler and heated up, allowing the hot water to come into contact with the boiler tubes containing the sulfur dioxide. When the sulfur dioxide in the boiler commences to boil, you then obtain the necessary sulfur dioxide steam wherewith to run the engine. In other words, instead of using the fire to make steam in the boiler, hot water is used instead, which originally obtained its heat from the sun directly.

As the sulfur dioxide steam leaves the engine cylinder it is not exhausted into the open air, owing to its initial high cost, but it is exhausted into a series of pipes over which cold water is sprayed. This water, in the case of irrigation plants, such as that developed by Mr. Willsie in Arizona, is the same water that is pumped by the engine (the pump being a separate machine connected to the engine by belt or otherwise) for irrigation purposes, so nothing is lost in this stage, but the sulfur dioxide steam is condensed and is then re-pumped or otherwise directed back again into the boiler, only to be heated all over again by the hot water coming from the sun tanks.

As Mr. Willsie has pointed out, electric light was had at night at his Arizona solar plant, which was actually made by the rays of the sun shining during the preceding day, a seeming paradox, were it not for the facts explained heretofore—that he has found it possible to cause the hot water to retain its quota of heat energy even for several days at a time, when it is stored in properly built tanks insulated with layers of dry sand, or other heat insulating materials.

Where this may not be practicable, we can always have recourse to electric storage batteries, in which the dynamo would pump electric energy during the day on

DEPENDABLE KNAPP Motors, Electrical Toys and Specialties Are Best



KNAPP DYNAMO MOTOR

Will electroplate, charge storage batteries, run lamps, motors, train of cars, induction coils,—in fact, the number of experiments it can be used for is unlimited. Runs on 4 to 6 Volts or can be connected to run on 110 Volts through a transformer.

Price, Complete, \$9.00

Order to-day. Or your dealer can secure them for you. DESCRIPTIVE CIRCULAR and CATALOG of celebrated KNAPP MOTORS and Electrical Specialties from 10c up mailed FREE on request.

KNAPP ELECTRIC & NOVELTY CO., 523 West 51st Street, New York City

Knapp Goods have stood the test for 29 years. No detail in construction has been spared to make them the best that money can buy. The complete Knapp line includes Toy and Power Motors, Generators and Dynamos. Specialties and Novelties that amuse and instruct. Fans, Rheostats, Compasses, etc. And Knapp prices are always lowest. Always insist on Knapp Goods.

KNAPP "LEARNELECTRICS"

A complete Electrical Laboratory, including a very valuable instruction book by H. P. Gorman, A.I.E.E. Covers all subjects clearly and concisely.



Price, Complete, \$4.00



ACHROMATIC TELESCOPE MADE UPON NEW SCIENTIFIC PRINCIPLES.

Positively such a good Telescope was never sold for this price before. Eastern Telescopes are made by one of the largest manufacturers of telescopes in America; we control entire production; measure closed 8 inches and open over 2 1/2 feet in 4 sections. They are nicely brass bound, with scientifically ground lenses. Guaranteed by the maker. Every sojourner in the country or at the seaside resorts should certainly secure one of these instruments, and no farmer should be without one. The scenery just now is beautiful. A Telescope will aid you in taking views. Objects are brought to view with astonishing clearness. Sent by mail or express, safely packed, prepaid, for only 99 cents. Our new Catalogue of Watches, etc., sent with each order. This is a grand offer you should not miss it. We warrant each telescope just as represented or money refunded. Send 99 cents today. To dealers 6 for Four Dollars. EASTERN NOVELTY CO., DEPT. 67, 172 E. 93d STREET, NEW YORK.

certain days. Then whenever the battery became sufficiently low in its charge, the electric energy required could be drawn from the storage battery at night or at any other time. Under certain conditions it would probably not be necessary to operate the solar plant to charge the storage battery more than one day a week, as, for instance, where such a plant was installed (of the proper size, of course) for, let us say, lighting a private dwelling or farmhouse and outbuildings, etc. By having a sufficiently large storage battery which would generate the energy required for lighting purposes for a period of one week, this could be taken care of by charging for just one day complete.

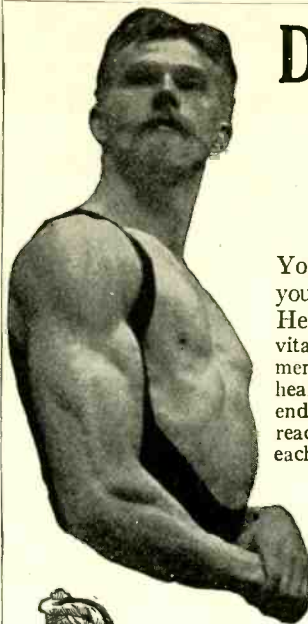
At any rate, it is a case of getting *something for nothing*, so far as spending the "coin of the realm" is concerned, and this is what most people are worried about today, with the H. C. L. still soaring skyward. Of course, it is not something for nothing in a strict sense of the word, for we are utilizing the *energy of the sun's rays*. The foregoing covers the doubt expressed by many people when they first hear about solar energy plants, for their invariable and natural first question is "What about cloudy weather, and, even though we have quite a number of sunny days, you may even have three or four cloudy days in one week?" This is very true, but the aforementioned explanation as to charging the storage batteries but one or two days a week, or possibly, as Mr. Willsie points out, by suitably storing the heated water in special storage tanks, explains this problem.

And, anyway, it will probably not come to pass very soon that we shall be selling and installing solar electric lighting plants on the roofs of apartment houses, in the northern parts of the United States, as if these were as cheap as sand in the Sahara Desert, the average city dweller would not bother with it, when he can spend \$2.00 or so a month and have the local electric lighting company supply all the "juice" he requires without bothering his head about it. But it is another question when we come to consider the vast stretches of land such as those in the South and Southwestern parts of the United States, where the fight for survival of plant life is seen to be dependent upon the all-important quantity—*water*. And here is where these solar plants should and will find their ultimate goal and adoption in large quantities, for it is uneconomical under any consideration, to attempt on a large scale an irrigation of such large tracts of desert by means of *coal or oil driven plants*, as these fuel commodities are becoming more expensive each year.

TRANSMITTING ENERGY.

Wireless telegraphy and wireless telephony suggest the possibility of transmitting energy by wireless waves. "Suggest" is right—we'll say. A Rumanian engineer, M. Constantinesco, has been experimenting in England with a method that seems novel.

He uses a tube filled with water or some such liquid, in which vibrations of the nature of sound waves are produced at one end and the energy is reconstructed at the other end in a mechanical form. The details of the apparatus are kept secret, but Constantinesco's researches have been financed by the British Government, and it has already been applied in the mechanism that stops the discharge of bullets from the rapid firing gun of an aeroplane each time that the blade of the propeller passes before the muzzle. This is what makes it easy to fire 2,000 shots a minute thru a propeller making between 1,000 and 2,000 revolutions a minute. (But what has this got to do with the wireless transmission of energy? Leave it to the daily "news technicians."—EDITOR.)



**Double Your Strength!
Improve Your Health!
Lengthen Your Life!**

Your Success in Life—your business, your happiness, your social position, your future—all depend upon your Health and Strength. No other two factors are so vitally important in making good as a man and a leader of men. Every Real Man feels the ever present desire for a healthy, perfectly developed body, more nerve force, greater endurance and control. And yet these very gifts are within reach of any one who is willing to devote a few minutes each day to health-building, with the aid of the greatest invention of its kind in existence.

I guarantee that my system of Condensed Exercise with the scientifically perfected

**Automatic
Exerciser**

will more than double your constitutional and muscular strength in from two to three months, improve your health day by day and add a gratifying number of happy, active, productive years to your life. Hundreds of my pupils throughout the country will gladly testify that the Automatic Exerciser will do these things.

Ten minutes daily on the Automatic Exerciser will build up a wonderful degree of fundamental, physical strength that will make life and work a pleasure. It will give you a Clear Brain, Powerful Heart, Massive Chest, Strong Lungs, Fine Back, Broad Shoulders, Well Shaped Arms and Legs and a Wrist of Steel.

The Automatic Exerciser fortifies the entire area of the abdominal walls throughout all its layers. Its influential effect on the digestion eliminates the "special diet" question. It strengthens entire organism and insures immunity from the many ills the "busy man" knows so well. It instantly relieves brain and body fag, making nervousness and complications a thing of the past.

You quickly outgrow any "mail course"; the results are but temporary. But you cannot outgrow the Automatic Exerciser. It does not use up your vitality—it generates **MORE Vital Energy**. Like the heart, which has a rest between each beat, so in my system there is a resting period between each contraction of the muscles brought into play with the Automatic Exerciser.

This enables you to develop a superior physique without undergoing the strenuous and exhaustive training which the ordinary gymnasium methods require. The patented mechanism of the Automatic Exerciser induces complete relaxation in the nerves and muscles and develops great strength and flexibility in the joints. It will cure any case of "muscle bound" condition in a short time. The



Resistance on abdomen increases automatically



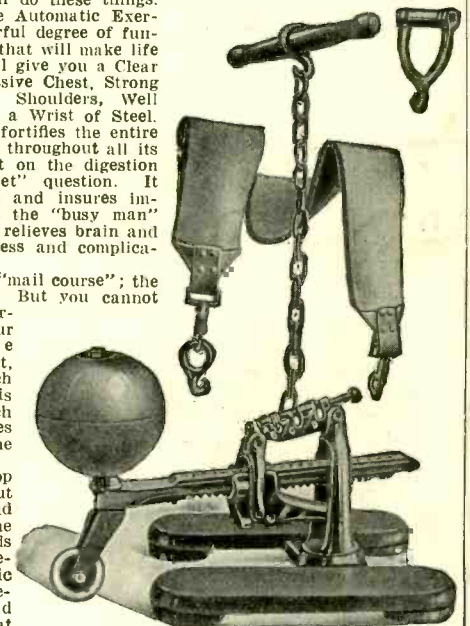
Overhead exercise for straightening and strengthening spine and shoulders



Wrist and upper arm



Massages and exercises the small of the back



attachments for different parts of the body are hooked to the chain at any point desired. The resistance increases automatically with each pull and the numbers on the ball REGISTER the increase at each pull as the lever bar moves ahead one cog at a time. The resistance and increase is **POSITIVE** and **UNIFORM** and can be adjusted to less than a pound or several pounds to meet the requirements of the different parts of the body.

WHAT OTHERS SAY

"I am well pleased with the **Automatic Exerciser**. Before taking exercise on your machine my blood and liver were slow and sluggish—but now! what a difference—I am full of energy. "It is worth a hundred times the price I paid for it." **EARL PINNEY**, Wichita, Kansas. "The Automatic Health Exerciser is a wonder. It has done more for my health and strength in two months than all the exercises and apparatus put together which I have tried in years." **MATRICE DALY, JR.**, Daly Billiard Academy, N. Y. City.

Mr. Anton Hromatka, City Infirmary, St. Louis, Mo., sends records of his results, which he secured with my machine and instructions in four months.

Strength of	First Record	Second Record	Strength Gained
Thighs	754 lbs.	2,000 lbs.	1,246 lbs.
Knees	754 lbs.	1,800 lbs.	1,046 lbs.
Calves and Ankles	410 lbs.	892 lbs.	482 lbs.
Back	508 lbs.	1,382 lbs.	874 lbs.
Shoulders and Arms	356 lbs.	641 lbs.	285 lbs.
Neck	185 lbs.	375 lbs.	190 lbs.
Biceps	87 lbs.	280 lbs.	193 lbs.

His fingers show an average gain in strength of 100%.

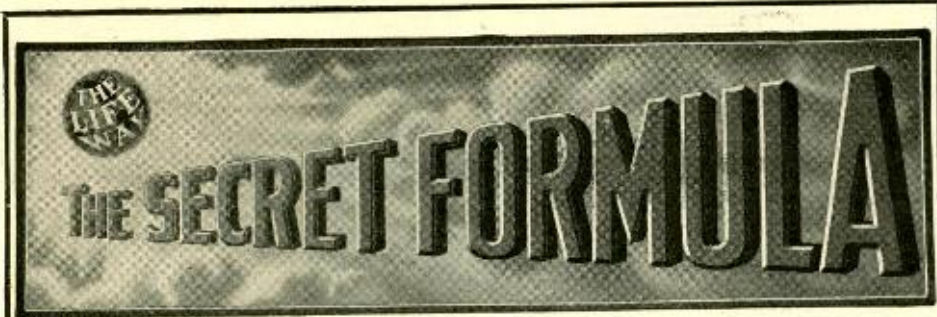
Records of one month's results by Mr. Thomas Waring, Hamilton, Ont., Can.

First Record	Second Record
159 lbs.	411 lbs.
134 lbs.	461 lbs.
54 lbs.	88 lbs.
41 lbs.	86 lbs.
20 lbs.	54 lbs.
Abdomen	
46 lbs.	102 lbs.

IF YOU ARE BATTLING WITH FUNCTIONAL WEAKNESS IN ANY FORM, SEND FOR "LIFE'S BACKBONE"

Prof. ADRIAN P. SCHMIDT
Suite 304-D, 1947 Broadway, New York City

which gives a full description of the Automatic Exerciser, how it works, what it will do, etc. *Don't judge my machine until you have read this booklet.* I will send it on receipt of 4c. postage. Kindly spell out your name and address plainly.



There is a Secret of the Ages. It is the open sesame which swings wide the doors of life, gives to him who seeks and who wills the power to enter and possess, and enables him to whom it is revealed to get what belongs to him, to realize the heart's desires, to make the dreams of years come true, and to make of life a work of art and a glorious success.

YOU have doubtless heard of THE LIFE WAY PLAN. It is based upon a great scientific fact—which is, that within yourself you have all the essential elements for Health, Wealth, Success and Happiness, and THE SECRET FORMULA shows you just how to “swing wide the doors of life”—that is, to release your latent and dormant forces, and to set them at work, earning dividends for you.

Also, how to develop superb muscles, and have quiet nerves, restful sleep, organs that function loyally and supreme mind control, with improved memory, and intensified power of concentration, and how to gain a new consciousness, get out of the ruts, make a fresh start, raise your income, get what belongs to you.

There is a clamorous call today for men and women to fill the better places, and here is an unparalleled opportunity for self promotion and a PLAN which is easy and delightful, soul inspiring, life transforming and epoch making.

Hundreds of thousands have tried this PLAN and have succeeded. Would you not love to try it?

The first step in demonstrating THE LIFE WAY PLAN for yourself is to get my free book—THE LIFE WAY. It explains the PLAN and is brimful of facts you will be glad to know. It tells you how you may have for your very own this “Secret of the Ages,” and go singing the song of abundance through life.

So no matter what your problems may be, or what methods you have tried, send now for your copy of THE LIFE WAY. It is free, and without cost or obligation on your part, I will promptly send you the book.

EARL WARD PEARCE, The Life Way Studios, Dept. 56, Los Angeles, Cal.



Electro-Medical Frauds

By JOSEPH H. KRAUS
(Continued from page 1254)

concern, in advertisements, claims that low sounds and whispers are plainly heard and altho it may be used in a few cases, the claims are misleading.

The device is a small oiled silk artificial drum having a waxed silk thread attached to it. A piece of flexible rubber tube is likewise included for insertion of the “phone.” The total price which the Morley concern charge for this device is \$5.00, its cost being about 25 cents. Something similar was originally constructed in 1852 by Toynbee, altho the heads of the Morley concern claim the invention, having secured several patents on the same. It is nothing but an artificial drum head, which is inserted into the ear. Indications for the use of the same can only be determined by a *competent aurist*, after a most rigid examination.

Another drum of a similar nature is being sold by the Artificial Ear Drum Co., which is a rubber contrivance called a *Medicated Ear Drum*. Each end of this is enlarged with a constricted portion in the center. All that is necessary is to push the device into the ear and Zowie! you can hear!

Likewise, we have yet to see where a case of discharging ears has been remedied by a similar device. The Wilson ear drum is another of the wonderful wireless telephones for the ears for which great claims and testimonials have been advanced.

Quite different from the above devices is one even now on the market and claiming International Notoriety, called the *Macaura blood circulator* shown in Fig. 6. The inventor organized institutes and gave lectures for the sake of perpetrating the sale of his blood circulator or pulsator. This prince of fakers, Dr. Macaura, then went so far as to rent auditoriums and gave two shows weekly. His advertisements appeared the world over. Finally, after having the most marvelous advertisements, rivaling everything in splendor and imagination in various papers, announcing the discovery, and after having shifted his scene of operations thru various countries, the self-styled “Doctor,” who had swindled so many thousands, was imprisoned for three years and fined \$600.

It is here called the *Cirkulon*, and costs over \$15.00. It is a simple hand-operated, vibratory device which will do none of the things claimed for it, and is far less efficient than the vibratory massage devices being sold at a much cheaper rate.

The greatest series of ridiculous and nonsensical devices are those known as the *gas pipe cures*, among which are found the *Electropoise*, *Oxydonor*, *Oxygenor*, *Oxyopathor*, *Oxytonor*, and *Oxybon*.

These wonderful discoveries consisted of a nickel plated gas pipe, beautifully finished at both ends, with two wires running into the same. This cylinder was about 3½ inches long and weighed about 5 ounces. At the end of the wire is a small disc which is attached to the wrist or ankle, or both, by means of an elastic band and buckle, according to the treatment. In general, they are filled with either *nothing* or else a worthless compound, such as carbon, either in stick form or pulverized, iron filings or perhaps coke dust.

The first two of the aforementioned devices were *empty*, altho claimed to possess remarkable *electric* (?) qualities. The *Oxygenor* was claimed to *oxygenate* the blood of its victims. This fake was filled with “rare and costly” materials, according to the makers (sulphur and charcoal by analysis). The ozone so generated traveled directly “thru the pores” and was so pow-

The Breakers
Atlantic City's Newest
Fire-Proof Hotel

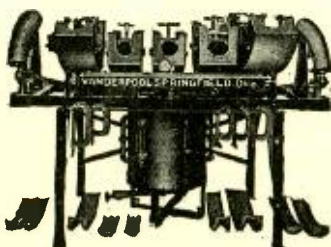
Ocean Front. Unusually attractive during the Autumn and Winter seasons.

American and European Plans

Luxurious lobbies, spacious verandas and sun parlors overlooking the ocean. Charming afternoon musicales and evening concerts. A palatial residence for those seeking rest and recreation. Sea water baths. Fireproof garage. Illustrated booklet sent on request.



GRASP THIS OPPORTUNITY TO MAKE BIG MONEY!



Open a **TIRE REPAIRING SHOP**—it is sure to be a success. Figure it out yourself. Hundreds of automobiles mean hundreds of tires that need constant repairing. You get this business and make big money. No previous training necessary. We instruct you free—teach you everything.

VANDERPOOL VULCANIZER
(5 Cavity)

has capacity of \$300.00 worth of work a day—repairs tires just as they are made at the factory. Investment small and immediate returns. Write today for full particulars and **FREE TIRE REPAIRING MANUAL**.

WM. VANDERPOOL COMPANY, Springfield, Ohio
In answering address Dept. L

erful that a *regulating cord* had to be attached to the device.

It cured everything from chicken-pox to epileptic fits and from measles in childhood to heart failure at old age. When placed into a tube of water it absorbed all the oxygen from it and *pumped* it into the blood—(at least the inventors said so). Particularly in view of the fact that water is made up of two atoms of hydrogen and one of oxygen, we are hence, questioning what the water looked like after all the oxygen had been removed!

Another of these same *gas pipe* frauds was guaranteed to cure everything except cancer and tumor, on which it had no effect. Of course, the makers had to admit that there was some *trivial* disease that could not be cured, as a *cure-all* is sometimes looked upon as being a fake, but if glaring headlines state that we can cure everything but tumors, why, of course, that sounds more reasonable.

These devices were sold at prices ranging from \$10 to \$35. Their actual cost not being more than 50 cents to one dollar, and their actual value being about .00007 mills, i. e., they would bring this as *junk*.

The magnetic blanket shown in (Fig. 8) is another of the magnetic frauds which need not be discussed at any great length as magnetic devices have already been described. It is another method of extorting the "coin" from an unsuspecting public.

A wonderful seller at one time was the *vacuum head cap* which stimulated the scalp and induced the naughty hairs which the great bald headed man desired, to stop playing hide and seek and come out for a little air. It just seemed to suck this hair out. This rubber cap, connected by a hose to a pump operated by foot power (or a motor driven suction device if the person had the wherewithal to pay for the same), was clapt on the head and placed into operation.

As to the fallacy of the *modus operandi*. When a suction device is applied to any part of the body, it causes the blood to be drawn to that part, *but at the same time causes a congestion* in the superficial veins, arteries, and capillaries, hence, the much desired results are not produced.

In addition, it may be of some slight value to note that the hairs are only modifications of the skin and consist of the same structure as that membrane. When therefore, once the root of a hair has been killed, and its follicle destroyed so that a shiny bald pate presents itself, it is impossible to coax any hair from the head.

**Storage Battery
Repairing**
By HENRY KLAUS
(Continued from page 1277)

battery out of an old one, altho this is not the case every time. A method of refilling the old frames was given in a back number of the EXPERIMENTER, but they would have to be sawed off in order to get at them and then welded back on. It is better to put in new plates and refill the old grids for use in small cells which can be sold to run toys for kids.

A battery with the plates short circuiting will show little or no voltage, while one with the active element gone will give the normal E.M.F. but hardly no amperage.

When the plates must be taken out you will be careful and not spoil the rest of the outfit. Ordinarily it is practical only to take out one cell at a time. The connections between the cells must be unscrewed or unfastened if possible or else sawed in two. The pitch around the ends is melted and the plates pulled out as shown in the diagram. We have used two methods for this, the blow torch, and moderately high pressure steam. The first is more practical because it is more convenient, handier,

LEARN WIRELESS AT HOME

The Demand for Wireless Operators Far Exceeds the Supply

The New York Wireless Institute will make you an operator—AT HOME—in your spare time—quickly, easily and thoroughly. No previous training or experience required. Our Home Study Course has been prepared by Mr. L. R. Krumm, Chief Radio Inspector, Bureau of Navigation, N. Y. Radio experts able to impart their practical and technical knowledge to YOU in an *easy to understand* way, will direct your entire Course. The graded lessons mailed you will prove so fascinating that you will be eager for the next one. The instruments furnished *free*, will make it as easy to learn the Code as it was to learn to talk. *All you will have to do*, is to listen.

Big Salaries

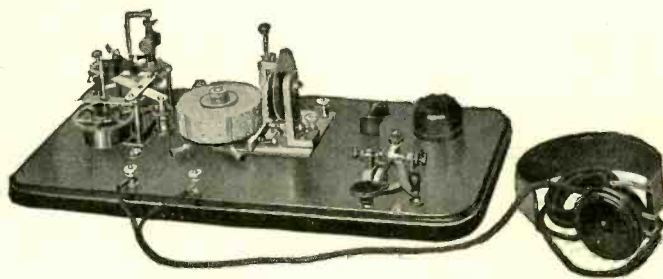
Wireless operators receive excellent salaries ranging from \$125 to \$200 a month and it is only a stepping stone to better positions. There is practically no limit to your earning power. Men who but yesterday were Wireless Operators are now holding positions as Radio Engineers, Radio Inspectors, Radio Salesmen at salaries up to \$5000 a year.

Travel the World Over

A Wireless Operator can visit all parts of the world and receive fine pay and maintenance at the same time. Do you prefer a steady position without travel? There are many opportunities at the numerous land stations or with the Commercial Wireless or with the Steamship Companies.

FREE Instruments and Text Books

We furnish free to all students, during the course, the *wonderful receiving and sending set exactly as produced in the illustration*. This set is not loaned, but given to all students completing the Course.



This wonderful Set for learning the Code furnished free with our Course

The Transmitter shown is the celebrated *Omnigraph* used by several Departments of the U. S. Government and by the leading Universities, Colleges, Technical and Telegraph Schools throughout the U. S. and Canada. Start the *Omnigraph*, place the phone to your ear and this remarkable invention will send you Wireless Messages, the same as though you were receiving them, through the air, from a Wireless Station hundreds of miles away. When you apply for your license, the U. S. Government will test you with the *Omnigraph*—the same model *Omnigraph* as we furnish to our students. Ask any U. S. Radio Inspector to verify this.

FREE Post-Graduate Course

A one month's Post-Graduate Course, if you so desire, at one of the largest Wireless Schools in N. Y. City. New York—the Wonder City—the largest port in the World and the Headquarters of every leading Wireless and Steamship Company.

Easy Payments

A small payment down will enroll you. We will make the payments so easy that anyone ambitious to enter the fastest growing profession—Wireless—may do so.

Send for FREE Booklet

Without obligating you in any way, send for our booklet "How to Become an Expert Wireless Operator"—it is free. Mail the coupon below, or postal or letter—but do it today.

NEW YORK WIRELESS INSTITUTE
Dept. 12, 258 Broadway
New York City

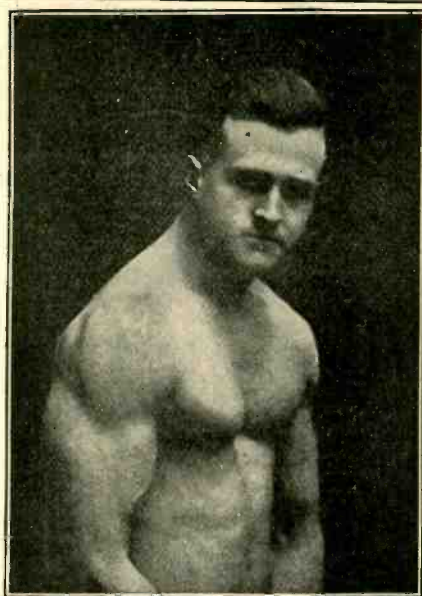
New York Wireless Institute
Dept. 12, 258 B'way, N. Y. City

Send me free of charge, your booklet "How to Become an Expert Wireless Operator," containing full particulars of your Course, including your *Free Instrument Offer*.

Name

Address

City or Town.....State.....



EARLE LIEDERMAN
The Acme of Physical Perfection
BE A MAN OF STRENGTH AND POWER
What I have already done for thousands of others I can do for you: I will broaden your shoulders, deepen your chest, (increasing your lung power) enlarge your arms and strengthen every muscle of your body. I will fill you with vim and pep so that you will be admired for your perfect physique and dominance of strength.

Send for MY NEW BOOK
"Muscular Development"
It tells the secret. Handsomely illustrated with 25 full page photographs of myself and some of the world's best athletes whom I have trained. This valuable book and my special offer will be sent on receipt of 10c, stamps or coin, to cover cost of wrapping and mailing. Don't delay! Send for it now, while it is on your mind.

EARLE E. LIEDERMAN
Dept. 219 203 Broadway, New York

illations of small extent about an axis perpendicular to the diafram. Light from a source, such as an arc, or, it may be, the sun, is focust by means of the first lens upon the vibrating mirror, whence it is reflected to the second lens. The latter is arranged so that the vibrating mirror is at its focus, and the beam of light is thus made parallel, ready for projecting to a distance. Close up to the first lens is placed a grid, with spacings equal and alternately opaque and transparent. A second exactly similar grid is placed close to the second lens. The incident light is thus split up into segments (indicated by the unshaded parts) and these segments are reflected by the small mirror to the second grid. Now when the small mirror turns through quite a small angle, the reflected segments of light turn also, and the amount of light penetrating the second grid evidently depends on the position of the vibrating mirror. In the diagram the position shown is that in which 50 per cent of the maximum is being transmitted. When the vibrating mirror is set in oscillation by speech sounds the light filaments shown on the left hand side of the second lens get broader and narrower and we have the fluctuating beam of light which is required. The advantages over Graham Bell's method are obvious. The grids need not be inordinately narrow, provided the distance between them and the vibrating mirror is considerable. The grids themselves do not move at all, but we still get the effect of a shutter which is controlled by the speech sounds.

A photograph of the mounting of the vibrating mirror and the sound box is shown in Figure 3, and Figure 4 is a photograph of the whole transmitting apparatus mounted for use. In this case the sun is being used as the source of light. The sunlight falls upon the large mirror shown on the left-hand side, whence it is reflected thru the first grid on to the small mirror, thence again thru the second grid and the projecting lens. The apparatus is mounted on the equivalent of a gun mounting and provided with sights so that the beam of light may be projected in the desired direction, and thus caused to fall upon the collecting lens, which concentrates the light upon the selenium cell.

The reproduction of the speech sounds by the selenium is extraordinarily faithful. It is easy to recognize the voice of the speaker. Of course, for conversations to be carried on, there must be two transmitters and two receivers.

It remains to add a few remarks concerning the ranges over which speech can be transmitted in this way. Everything depends on the brightness of the source of light used, and the sizes of the transmitting and receiving lenses or mirrors. The sun is the best source of light. With it, and using lenses only 6 inches in diameter for transmitting and receiving, speech is readily audible 8 (eight) miles away. There is no reason why, with larger apparatus, and more sensitive receivers, this range should not be greatly extended. It is necessary, of course, to have an uninterrupted straight line between sender and receiver. Fog, also, interferes to some extent, altho, owing to the fact that selenium is very sensitive to red light and this light penetrates fog better than blue, the interruption is not as great as might be supposed. The curvature of the earth will impose the ultimate limit of range, and for this reason telephony by light could not be a substitute for the electrical wireless telephony which is now developing so rapidly. But light ray telephony has the considerable advantage of complete secrecy. It is only those upon whom you purposely shine the light who will hear what you say. For this reason telephony by light over comparatively short ranges, particularly between ships at sea, and between hills in sunny countries on land, may in the future prove of considerable use.



GLORIA SWANSON
Cecil B. DeMille Artcraft Player
WALLACE REID
Paramount Star

Hermo "Hair-Lustr"
(Keeps the Hair Dressed)
FOR MEN AND WOMEN

The hair will stay dressed after Hermo "HAIR-LUSTR" has been applied. No more mussed, untidy looking hair. Adds a charming sheen and luster, insuring the life of the hair, as well as its beauty. Dress it in any of the prevailing styles, and it will stay that way. Gives the hair that soft, glossy, well groomed appearance so becoming to the stars of the stage and screen. Guaranteed harmless and greaseless.

Two Sizes—50c and \$1
\$1 size three times the quantity of 50c size. SEND FOR JAR TODAY. Remit in coin, money order, or U. S. stamps, and we will send Hermo "HAIR-LUSTR," and the Hermo Booklet, "Guide to Beauty," prepaid, under plain cover, at once. Use it five days and if not entirely satisfactory, return what is left, and we will REFUND YOUR MONEY IN FULL. Once you use Hermo "HAIR-LUSTR" you will never be without it. SEND YOUR ORDER TODAY.
HERMO CO., 542 E. 63rd St., Dept. 104 CHICAGO

1/2 SAVED
GET OUR
BIG BOOK

DO YOUR OWN PLUMBING & HEATING NEW CUT-TO-FIT PLAN

You can install your own complete heating or plumbing system by this method as well as a practical plumber. You save time, high labor costs and unused materials. All parts come to you Cut-to-Fit with plans and information furnished by our Engineers. Our wholesale prices save you 1/2 the first cost.

Make Your Property Worth 50% More
and do the work yourself. Home improvement is your best investment. Our hot-water and steam heating plants, pipeless furnaces, water supply systems and plumbing supplies are the most modern made. They are Guaranteed satisfactory. Send Today for the



Handy Man Book
It illustrates more than 10,000 different plumbing and heating fixtures at our low wholesale prices. It contains information invaluable to the property owner, farmer, carpenter or contractor. You can tell just what your improvements will cost. It explains our plan in detail.
We have spared no effort or expense in preparing this valuable book. To keep from sending it broadcast to uninterested persons we ask a temporary deposit of 25c which will be refunded with your first order. Send for it today.

HARDIN-LAVIN CO.
40 years at 4510-20E Cottage Grove Avenue, Chicago
\$500,000.00 Factorles Back Our Guarantee

NUXATED

"I believe my own great physical activity is due to my personal use of Nuxated Iron", says Former Health Commissioner Wm. R. Kerr, of the City of Chicago. "From my own experience with Nuxated Iron I feel it is such a valuable blood and body building preparation that it ought to be used in every hospital and prescribed by every physician in the country." Nuxated Iron helps to make healthier women and stronger, sturdier men. Used by more than 3,000,000 people annually, in this country alone. Increases the strength and endurance of weak, run-down, nervous folks in two week's time, in many cases. Satisfaction guaranteed or money refunded. At all good druggists.

IRON



The Electric Safety razor makes shaving a pleasure. Blade vibrating 7,200 times a minute cuts the beard smoothly and without slightest pull or irritation—feels like a gentle massage. Can be used with or without electric current.

All users of the **Lek-Tro Shav** speak well of it

A barber says—"Have shaved for years and have never used any shaving device near its equal."
A home user says—"The most pleasing shave I've ever had in my life. Shaves my face closer than I used to shave, but there is no after irritation or ill effects as I usually get from another razor."

No. 1 Made for use from Light Socket.
No. 2 Made for use from Dry Battery.
Write for illustrated circular describing Lek-Tro-Shav Safety Razor fully.
VIBRATING ELECTRIC RAZOR CO.
Dept. 122, Omaha, Nebr.

If you are not Satisfied with your job-- See page 1235

RAISE HARES FOR US

Big demand. Wonderful profits easily and quickly made raising BELGIAN HARES in backyards, sheds, cellars, attics, etc. We furnish guaranteed class A Stock and buy all you raise at \$7.00 to \$12.00 a pair and pay express. Valuable illustrated book and contract FREE.

GENESEE VALLEY FOOD AND FUR ASSOCIATION
25 Gladstone Street, Rochester, N. Y., Dept. No. 86

Telegraph Pictures BY ELECTRICITY

Complete sets of two machines of this marvelous equipment at ridiculously low prices. Instructive, mystifying and useful. This picture of President Wilson was telegraphed by these machines. Will transmit pictures; maps, drawings and hand writing. Picture telegraphing is the coming science. Write today.



J. LEISHMAN CO., Dept. T Orden, Utah

Genuine Typewriter \$2

Sent Postpaid Only
A real typewriter that writes letters as clearly and intelligently as one that costs \$50.00. Write business and social letters. Do school work. Learn to typewrite. A remarkable machine, fully guaranteed, for only \$2. Every man, woman, boy and girl should have one.
A. F. LEWIS TYPEWRITER CO.
1400 Broadway New York

GET WELL—BE YOUNG—GROW TALL



This University discovery in the most important health invention of the Century.
It remakes and rejuvenates the human body. It produces normal spines. It frees impinged and irritated nerves, corrects contracted muscles, shortens ligaments, eliminates constipation, improves circulation and drainage of the body. It will increase the body's length.
THE PANDICULATOR CO., 332 Advance Bldg., Cleveland, O.

YOUR FUTURE

depends upon the use you make of present opportunities. Write now for literature explaining our day and evening courses in Chiropractic, the greatest science of the age. Hurry for prices advance soon.

The New York College of Chiropractic
1416 Broadway, New York City

TELEGRAPHY

Both wire and wireless, and Station Agency taught thoroughly and quickly. **BIG WAGES NOW PAID**, some of our recent graduates procuring \$138.00 per month to start. Great opportunities for advancement. Our school the oldest and largest—annual enrollment 600 students. Endorsed by railway, telegraph, wireless and government officials. Expenses low—chance to earn part. Catalog free. Write.
DODGE INSTITUTE, 22nd St., Valparaiso, Ind.

WHAT EVERY GIRL SHOULD KNOW

SENT PREPAID FOR ONLY 50c
This book is written by Margaret Sanger, the great birth control advocate and contains information never before published. Anyone reading this book cannot help but be benefited. It is highly endorsed by eminent physicians. Send us your order at once. Don't delay.
Truth Pub. Co., Dept. B. T., 1402 B'way, N. Y.

STAMMERER

Send 10 cents for my remarkable book, "How To Stop Stammering." Kill the fear of stammering. Re-education the key.
The Hatfield Institute, 105 N. Dearborn St., Chicago, Ill.

Learn Watchwork, Jewelrywork and Engraving
A fine trade commanding a good salary, and your services are always in demand. Address HOROLOGICAL Department, Bradley Institute, Peoria, Ill., for our latest catalog.

This Fire Alarm "Talks"

(Continued from page 1264)

separates, resulting in the weight being released. This immediately lifts up the hook on the telephone and allows the phonograph to start its call, which has been previously inscribed on records adapted for this purpose. The record is also fitted with a very simple mechanism which causes it to be repeated many times over and either stops its action because the motor is run down, or else that the fire has dangerously neared the fireproof box of the apparatus, when the link outside the cabinet fuses and separates; the telephone hook then drops down into its normal non-operating position. In the electrical system for operating the announcer an idea equally clever has been utilized. Regular thermostats are placed thruout the building so that a rising temperature of 130 degrees will affect the closing of their contacts. In this way a magnetic device very similar to a telegraph sounder, having a tooth filed in the beam, would be drawn toward the magnets. Into this "V"-shaped tooth or notch is fitted a two-pronged hinge so that it is free to drop downward when the circuit is closed.

A steel ball is attached to the cord holding the weight up. This cord is now past thru the opening between the prongs so that the ball rests nearer the hinged portion, and thus very little weight is applied directly to the beam of the sounder. The instant the armature is drawn toward the magnets, the pronged fork is released and drops downward, due to the slight weight upon it. Immediately the pole is free to slide from between the forked lever and the weight coming downward with a sudden thud releases the phonograph and raises the telephone receiver hook.

When the link on top of the box fuses, the weight drops harmlessly to the bottom, releasing at the same time the hook which it had previously held suspended, causing the phonograph to stop.

The phonograph can at any time be removed from the cabinet and used for pleasure purposes and no connections whatsoever are made to the telephone, except for the string which is caught around the receiver hook.

"Rabbit Contest" Awards

(Continued from page 1269)

SIXTH HONORABLE MENTION

The phenomenon of the film of the rabbit electrified to 500,000 volts, shown on page 798 of Dec. 1919 issue, may be explained as follows:

Motion picture films are taken at about the rate of sixteen exposures per second. Each exposure I presume lasts about 1/100 of a second or perhaps a little more. The streamers or flashes from the rabbit do not occur at every cycle of the 200,000 cycle high frequency current. The rabbit acts as a capacity and holds the charge for an instant. When the rabbit is fully charged, the charge escapes into the air in the form of streamers and corona. The duration of the charge was not too short to allow more than one discharge to occur during the time of exposure, but too fast for the eye to perceive. The first five pictures of the portion of film shown were taken just before or after the full discharge, hence showing the streamers leaking out. At the sixth exposure, a full discharge took place at the instant. The last two pictures were exposed just at the time when the charge was being accumulated by the capacity of the rabbit right after a full discharge had taken place.
JOHO YASUMURA.
R. No. 1, Sumner, Wash.

No Other Typewriter Can Do This:

MULTIPLEX HAMMOND'S
Instantly changeable type
Many styles, many languages
Two types or languages at a time in the machine!
Just Turn the Knob to change



The World's Most Wonderful "Writing Machine"

Here's a polyglot machine that writes all languages from Eskimo Indian to Kata Kana Japanese. There are over 365 different type-sets to choose from. The type is instantly interchangeable—two different languages or type-sets are always on the ONE machine. You "Just turn the knob"—to change language or type.



MANY TYPEWRITERS IN ONE

Sounds like an Arabian Nights story—but the machine itself is very practical, very real. It is the typewriter President Wilson uses personally—the typewriter he took with him when he visited King George.

Types for all purposes
and for all languages

Spacing to suit size of type

Perfect alignment

Automatic Type Impression

All on one MULTIPLEX

The marvelous, INSTANTLY interchangeable type feature is only one of the 16 reasons why thousands of prominent men and women in all walks of life prefer and personally use the Multiplex.

For the Mathematician, Engineer, Chemist, Astronomer, Surveyor, Navigator—there is no typewriter like the Multiplex Hammond! The Multiplex does many things that no other typewriter can do!

The Mathematical Multiplex contains the characters and signs used for writing in higher and lower mathematics, and for engineering, mechanics, etc., as well as for all the ordinary work that can be done on any typewriter.



THE HEART OF THE HAMMOND

MAIL COUPON FOR FREE BOOKLET showing the many languages and type sets of the Multiplex—there's a type for every profession, every business, every science, including technical signs and symbols and chemical keyboard.

THE HAMMOND TYPEWRITER CO.
589 East 69th Street New York City

Name

Address

.....
Please write your occupation below.

Also an Aluminum PORTABLE Model. 11 lbs. Full capacity. Ask for special Folder.

Watching Plants Grow

(Continued from page 1247)

This outflow of water is roughly adjusted by opening the stop-cock to a greater or lesser extent. The finer adjustment is then effected by the suitable variation of the difference of level in the two limbs of the syphon. One end is connected with a flexible india-rubber tube, which is attached to a string passing over a pulley, and fixed to the adjustable wheel B, attached to the observer's table. Rotation of the wheel in one direction will depress this end of the syphon, so increasing the flow, and in the other direction will raise it, diminishing it.

The rate of descent of the float is thus regulated with the utmost nicety, till an absolute balance is obtained. The observer recognizes the condition of the balance when there is no drifting of the spot of light on the recording-drum. The adjusting wheel is now fixed at this position of balance. If any agent should induce an acceleration of growth, the balance is disturbed, and the spot of light moves, say, to the right, or in a *positive* direction. Any agent which induces retardation will, on the other hand, cause a deflection of the spot of light in a *negative* direction.

The record is made in the usual manner on a revolving drum. Our figure illustrates the complete apparatus, which enables us to obtain a record under *balanced*—or by closing the stop-cock of the syphon, also under *unbalanced*—conditions. The wheel is graduated, and the absolute value of the compensatory movement, at any position of the circular scale, can be previously calibrated, by fixing the plant mirror, and observing the extent of movement of the spot of light on the drum, due to the subsidence of the float in a given time.

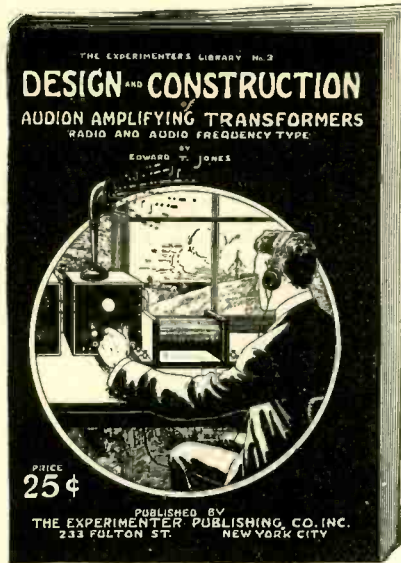
JUST OFF THE PRESS

Design and Construction of Audion Amplifying Transformers Radio and Audio Frequency Type

This latest and important book by Mr. Edward T. Jones, late Associate Editor of *Radio News*, will be of great interest to all radio amateurs throughout the land. The transformers shown in these books have never been described in print before, and have usually been considered a manufacturer's secret. Anyone who has several vacuum tubes cannot afford to do without this book because it will enable him to build the necessary amplifying transformers very readily. The designs are very simple and rugged, and anybody can make them without trouble.

Mr. Jones, the author, is a practical man who is an experimenter himself and knows whereof he speaks. The book is printed on good paper and has an attractive cover in two colors. Paper bound. Size 5 in. x 7 in. Contains many illustrations, diagrams and working data necessary to build the transformers.

PRICE, 25c Postpaid



25c Postpaid

Two Remarkable Books

No. 1—How to Make Wireless Sending Apparatus.

No. 2—How to Make Wireless Receiving Apparatus. By 20 Radio Experts.

Written and published entirely for the wireless enthusiast who wants to make his own radio apparatus. Only strictly modern instruments are described and the illustrations and descriptions are exceptionally clear and simple.



25c Postpaid

THE EXPERIMENTER PUBLISHING CO.
Book Dept., 233 Fulton Street New York

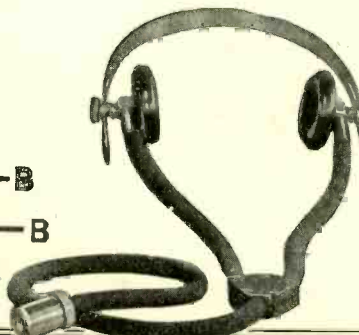
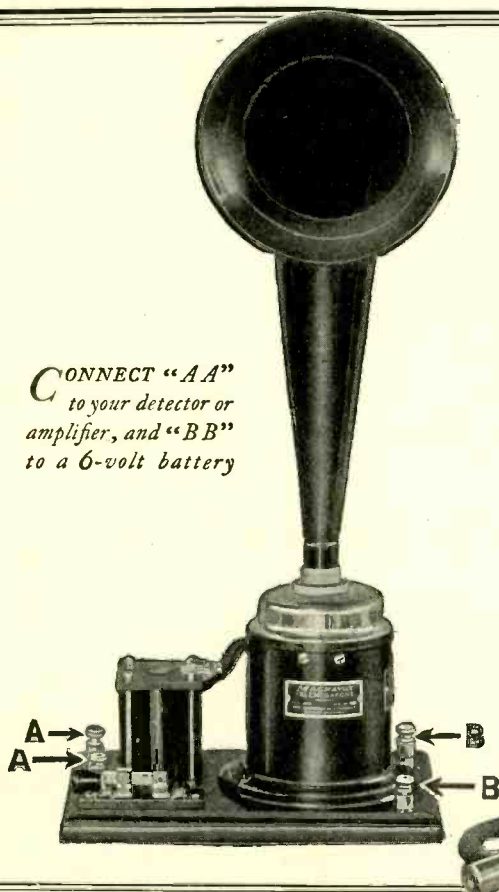
MAGNAVOX
RADIO TELEMEGAFONE

When used with one or more stages of amplification will reproduce signals with great volume. For the small fraction of a watt output of your receiver that is available for the production of signals, the MAGNAVOX TELEMEGAFONE will produce the greatest volume of sound

With Small Horn, as Illustrated \$75.00
With Large Music Master Horn 93.00

WRITE FOR BULLETIN No. 21020

CONNECT "AA"
to your detector or
amplifier, and "BB"
to a 6-volt battery



THE MAGNAVOX Co.

PATENTED IN U.S.A. AND FOREIGN COUNTRIES

2701-2765 EAST 14TH STREET
OAKLAND, CALIFORNIA

Electrifying Canal Boats and Barges

By ROBERT G. SKERRETT
(Continued from page 1262)

ble of energizing the otherwise powerless boats. The latter would have the space now occupied by boilers and engines to utilize for revenue, devoting it either to the carriage of more cargo or a greater number of passengers, and would not be hampered or made dirty by frequent fueling. The prime movers, on the other hand, could go direct to the coaling pockets or the fuel-oil tanks and, being designed purely for motive purposes, grime and smoke would not entail the same property injuries. Finally, this separation of the steam plant from the freight or express vessel would measurably reduce fire hazards and lead to the lowering of insurance rates.

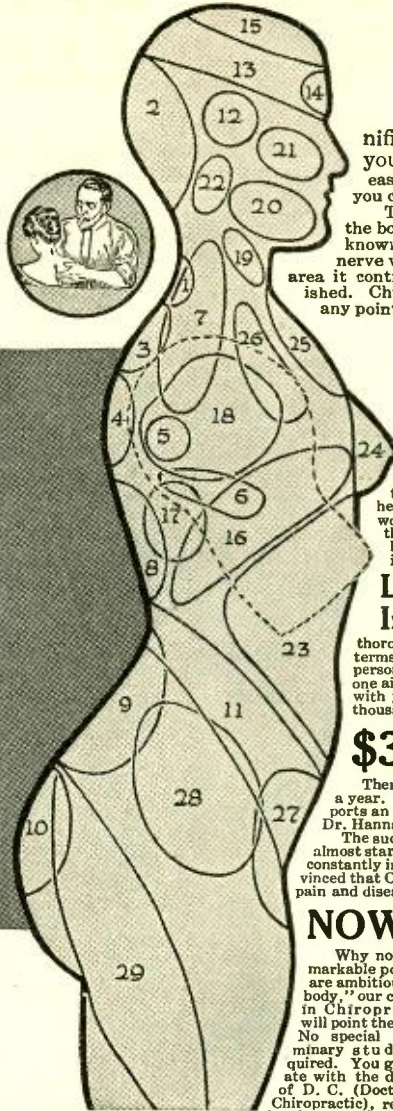
But probably the most conspicuous gain would be in shortening the lay-over periods. That is to say, the power steamer would be kept well-nigh continuously on the job; moving one ship by day and starting back shortly afterwards with another during the hours of darkness. Thus a single central plant would be able to take care of two "trailer vessels" upon a twenty-four-hour schedule. Fantastic as such a project may appear offhand, still a little analysis shows how thoroughly rational the scheme really is. In effect it amounts to nothing more radical than applying afloat principles and practices that have become commonplace in the operating of electrified railways and the running of multiple-unit trains.

And now the reader will ask, what has Mr. Donnelly done both to satisfy himself and to convince others that there are not insuperable obstacles in the path of putting his system of distributive propulsion into effect? To begin with, a little over four years ago he built and operated his yacht, the *Dawn*, a craft 50 feet overall of 12 feet beam and drawing close to 4 feet of water when laden. By way of power plant he installed a prime mover in the form of a 60-horsepower gasoline engine, and this he connected directly with a 40-kilowatt electric generator working at 450 revolutions a minute. To drive the *Dawn* he provided a 20-horsepower motor directly connected to the propeller shaft, and this, when making 450 turns a minute, sufficed to give the boat a speed of 9 miles an hour. It will be observed that the generator was capable of furnishing more than double the current needed to energize the motor for the yacht's screw.

Last summer another yacht, the *New Era*, modeled and dimensioned like the *Dawn*, was constructed and equipped with a 20-horsepower motor for the little vessel's propulsion and arrangements were made by which the needful electricity could be supplied from the *Dawn* to insure a speed of 9 miles an hour. The conducting cable is led from a reel over an elevated pulley at the bow of the *Dawn* and thence thru the water to the stern of the *New Era*, where it is linked with the latter's operating circuit. This cable is less than an inch in diameter, and trails with a very modest pull astern of the *New Era*, looping easily and smoothly between the boats when they are maneuvering.

The *New Era* is provided with a number of storage batteries from which "juice" is drawn for lighting and cooking service when the yachts are at anchor. At one time during a trial run from New York City to Schenectady and return something went wrong with the *Dawn's* gasoline engine, which called for the machine's stoppage. However, the boats went right on—both of them obtaining, for the time being, their motive energy from the storage batteries of the *New Era*. The normally de-

Learn to Treat Disease This Way



This is a small reproduction of one of 22 magnificent charts all of which we want to send you **ABSOLUTELY FREE**, just to show you how easily you can master Chiropractic and how successfully you can treat disease by this modern drugless healing method.

These charts show the different pain and nerve areas of the body. The science of Chiropractic is based upon the well known principle that when there is bone pressure on a trunk nerve where it leaves the spinal column there will be pain in the area it controls; and that by relieving the pressure the pain is banished. Chiropractic teaches you how to locate nerve pressure at any point along the spinal column and how to relieve it.

BE A DOCTOR OF CHIROPRACTIC

Advanced Science of Spinal Adjustment

The great profession that within the past few years has taken the longest forward strides ever known in the history of drugless healing. It has called to its ranks thousands of ambitious men and women from every walk of life. Today it is calling more insistently than ever because the tide has turned strongly in favor of drugless healing. Right now the demand for Doctors of Chiropractic is far greater than the supply.

Learn at Home In Spare Time
The American University method of teaching enables you to study by mail or in class and obtain a complete mastery of Chiropractic in the shortest time consistent with thoroughness, while you hold your position. You can pay on easy terms. From the day you enroll your instruction will be under the personal direction of a splendid faculty of Chiropractic experts. Our one aim will be to make you successful. We will work whole-heartedly with you to advance your interests so that in a short time you, like thousands of Chiropractors, can earn a good income.

\$3000 to \$5000 a Year

There are many instances of Chiropractors earning from \$3000 to \$5000 a year. Some upwards of \$10,000. Dr. M. D. Moore, of Kentucky, reports an income of \$9,000 a year. Dr. L. H. Roche, New Jersey, \$5,000; Dr. Hanna, of Kentucky, over \$5,000 yearly.

The success of Chiropractors in many cases has come so quickly as to be almost startling. And yet, it is not to be wondered at when you consider the constantly increasing number of intelligent, thinking people who are now convinced that Chiropractic is the common-sense and really scientific way to relieve pain and disease and who, therefore, demand the services of Chiropractors.

NOW—Your Great Opportunity

Why not qualify now for this splendid profession that offers such remarkable possibilities for making you prosperous and independent? If you are ambitious to make money, increase your social standing and be "somebody," our course in Chiropractic will point the way.

No special preliminary study required. You graduate with the degree of D. C. (Doctor of Chiropractic), receive handsome diploma, FREE, and are ready at once to open your office.

Get Free Charts offer at once. Regular value of the 22 magnificent charts is \$31.50. Many of these charts are handsomely lithographed in life-like colors. Mail coupon and get all the facts. We will send you our beautiful new illustrated book, full particulars regarding course, easy terms, together with free charts offer immediately. Don't put it off—mail coupon or send your name on a postal card—today.

AMERICAN UNIVERSITY
Manierre Bldg., Dept. 720 Chicago, Ill.

AMERICAN UNIVERSITY
Manierre Bldg., Dept. 720 Chicago, Ill.

Without cost or obligation send me by mail, your new illustrated, 72-page book and your Free Charts offer.

Name.....

Street No. or R.F.D.....

City.....State.....



When Choosing Your Profession— It Will Pay You To Investigate Electrical Engineering!

The men who reap the benefits of success in this ever-developing and expanding field must have a thorough technical training.

THE COLLEGE OF ELECTRICAL ENGINEERING

of the School of Engineering of Milwaukee offers you an opportunity to train in fully equipped laboratories, drafting rooms and modern classrooms, under the expert guidance of foremost experienced engineers and technical specialists.

Bachelor of Science Degree in 3 Years

Entrance Requirements Moderate. But 14 High School credits are necessary for entering the College of Electrical Engineering. What credits you may lack can be quickly secured in our Institute of Electrotechnics.

SPRING TERM OPENS APRIL 1ST

Clip the Coupon NOW for catalog and full particulars.

SCHOOL OF ENGINEERING OF MILWAUKEE
180-373 Broadway Milwaukee, Wis.

CLIP HERE

School of Engineering of Milwaukee Milwaukee, Wis.

Gentlemen:—Without obligation, send me catalog, Photo-Story book and particulars concerning your 3-Year Electrical Engineering Course with B. S. Degree.

Name.....

Address.....

City.....State.....

Age.....Education.....

SCHOOL OF ENGINEERING OF MILWAUKEE
180-373 Broadway Milwaukee, Wis.

"The Baby" Double Action Revolver

A Handsome and Most Effective Weapon. Measures but 4 1/2 inches Long. Takes Regular .22 Calibre Cartridges. The new Baby Double Action Hammerless Revolver has been produced to meet the ever increasing demand for a revolver that combines small size and light weight with the essential features of efficiency and practicality. It is small in size, yet is as effective as any revolver. As the most expensive weapon you can buy. Every one should have a revolver and should know how to use it. And there is no safer or better one made than this. A great feature is its safety, that guards against accidental discharge, making it quite safe for youth and ladies. The illustration gives an idea of its appearance, but it must be seen and used in its entirety. The standard .22 calibre cartridge, obtainable everywhere, is used in the operation of the charging mechanism in an extremely rapid and absolutely reliable manner. Its well aimed shots can be fired in as many as ten seconds. The revolver is very well constructed, with finest nickel plated fluted barrel of cylinder, and it weighs only 4 3/8 pounds. The price of the Baby Revolver is only \$8.50 sent by mail, p. p. in any address.



ONLY 35c

Cut Your Own Hair WITH THIS SAFETY HAIR CUTTER. Cut with your own hands. The hair with the razor. Cut the hair as you desire length, short or long. Does the job as nicely for your own hair as for the hair of others. You can cut the children's hair at home in a jiffy. Can be used as an ordinary razor to shave the face or finish around the neck. Shaved like any razor. Lasts a lifetime. Saves the coat that time and money. PRICE 35c. Sent by mail, p. p. in any address. **JOHNSON SMITH & CO., Dept. F-17, 3224 N. Halsted Street, CHICAGO**

THE U. S. BABY TANK

It goes with real Yankee Pop—by its own power. Most remarkable Toy ever invented. By drawing the Tank back over the floor or table and then placing it down, it will crawl along, overcoming all obstacles, in the same playful manner as the larger Tank that proved so deadly in the war. What makes it go is somewhat of a mystery, for there is no mechanical gear to wind up, as is usually understood with mechanical toys, yet this Tank will keep plodding along for hours. A VERY striking and uncommon toy. Sent by mail, p. p. in any address. It is a wonderful thing, and should be seen and used in its entirety. The standard .22 calibre cartridge, obtainable everywhere, is used in the operation of the charging mechanism in an extremely rapid and absolutely reliable manner. Its well aimed shots can be fired in as many as ten seconds. The revolver is very well constructed, with finest nickel plated fluted barrel of cylinder, and it weighs only 4 3/8 pounds. The price of the Baby Revolver is only \$8.50 sent by mail, p. p. in any address.

ONLY 35c

MAGIC FLUTE Wonderfully Sweet Toned and Musical. The Magic Flute, or Humano-tone, is a musical instrument that is played with the mouth. It is a combination of a flute and a harmonica. It is a wonderful instrument, and should be seen and used in its entirety. The standard .22 calibre cartridge, obtainable everywhere, is used in the operation of the charging mechanism in an extremely rapid and absolutely reliable manner. Its well aimed shots can be fired in as many as ten seconds. The revolver is very well constructed, with finest nickel plated fluted barrel of cylinder, and it weighs only 4 3/8 pounds. The price of the Baby Revolver is only \$8.50 sent by mail, p. p. in any address.

LUMINOUS PAINT Make Your Watches, Clocks, Etc., Visible by Night. The very latest discovery in the scientific world is the use of LUMINOUS PAINT, which is a substance that glows in the dark. The DARKER THE NIGHT, THE MORE BRILLIANT IT GLOWS. A little applied to the dial of your watch or clock will enable you to tell the time by night. You can coat the dial buttons or watch plates of your electric lights, match boxes, and innumerable other articles, make your own Luminous Candles, Luminous Rosettes, etc. Small bottle, net 25c. Large bottle, net 50c. Sent by mail, p. p. in any address. **JOHNSON SMITH & CO., Dept. F-17, 3224 N. Halsted Street, CHICAGO**

Mystic Skeleton

A skeleton in its own right. It is a wonderful toy, and should be seen and used in its entirety. The standard .22 calibre cartridge, obtainable everywhere, is used in the operation of the charging mechanism in an extremely rapid and absolutely reliable manner. Its well aimed shots can be fired in as many as ten seconds. The revolver is very well constructed, with finest nickel plated fluted barrel of cylinder, and it weighs only 4 3/8 pounds. The price of the Baby Revolver is only \$8.50 sent by mail, p. p. in any address.

Serpent's EGGS Box contains 12 eggs. When lit with a match, each egg glows in the dark. A little applied to the dial of your watch or clock will enable you to tell the time by night. You can coat the dial buttons or watch plates of your electric lights, match boxes, and innumerable other articles, make your own Luminous Candles, Luminous Rosettes, etc. Small bottle, net 25c. Large bottle, net 50c. Sent by mail, p. p. in any address. **JOHNSON SMITH & CO., Dept. F-17, 3224 N. Halsted Street, CHICAGO**

- All the Latest Surprising and Joke Novelties
- Pharo's Serpents Eggs, box 10c
- Misunderstood Penny-edges the Law 20c
- Minutiae Water Pistol 10c
- Misunderstood Tembler and Venab. 20c
- Cleopatra's Snake (very lifelike) 10c
- Real Musical Chess (Friend) 20c
- Automatic Pistol (Latched) 20c
- Magic Plate Lifter 20c
- Great Bangum 20c
- Electric Pistol (2c, 2c different, \$8.50)
- Rubber Snapper (removable) 10c
- Bill-Tick-Punk Notion 10c
- Green Mind Reading Waterbury, 10c
- Invention Bed Bugs 20c
- Thursdon's Mystery Trick Ude. 10c
- Ray Noctivo 10c
- Trick Pencil 10c
- Rubber Tacks (a good job) 10c
- Motorizing William's Basi Trick 20c
- Glass-Waich 20c
- Snout Ring 20c

The Physiophone

By H. GERNSBACK.

(Continued from page 1253)

does. They have not the slightest conception of perspective and will invariably put the hands out before the eyes in order to judge the distance. The far away mountain will look to them just as near as a wall three feet away, and it is only gradually that a previously blind person learns to judge the distance, i. e., by experience.

The same is the case with the deaf person and physiological music. He must first learn the rhythm of the music, and after a

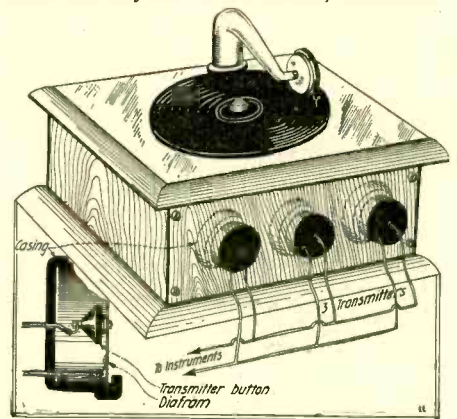


Fig. 1. Experiment to Transmit Sound Impulses Into Electrical Impulses. This Scheme Works Very Well to Transmit Music.

while it will become easy for him to understand what the music or even the human voice is like if introduced to him by means of the Physiophone.

I even go further and predict that sooner or later a totally deaf person will carry around with him an apparatus along the line of the "deaf-phone" type, the apparatus consisting of a sensitive microphone such as is used with the deaf-phones now. The microphone will be in series with a portable battery and telephone coil, while the secondaries of this coil will go to metallic wrist bands of the wearer. Then when he is spoken to he will soon be able to understand the meanings of the small electrical shocks which are the result of the human voice impinging upon the sensitive microphone.

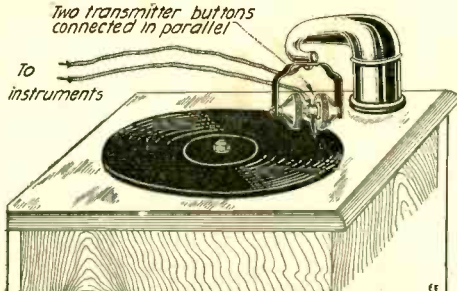


Fig. 2. Two Transmitter Buttons Connected in Parallel, Attached to Phonograph Arm. This Scheme Works Fairly Well For Transmission of Music, But Not so Well in Connection With the "Physiophone."

Coming back to our phonograph experiments, the deaf person can now enjoy dancing which he certainly could not do before, for he had no music or rhythm to dance by. One of our illustrations shows how deaf persons will now be able to dance by means of phonograph music and the Physiophone. The revolving wheel below the ceiling in the room or dance hall has flexible wires hanging down, which in turn connect with the secondaries of the telephone coils. These are connected with the microphone and battery near the phonograph in the manner stated above. Wires hanging down from this wheel connect to metal wrist pieces attached to each one of

BUILD A WHITE FIREFLY \$2.00
TEACH YOURSELF TO FLY
World's lightest and simplest acroplane. Designed by George D. White, America's foremost aeronautical engineer. Weight 150 pounds, length 15 ft. Needs 8-12 H.P. motorcycle engine. Lands and takes off at 24 miles per hour. Useful load 165 pounds. Can be built in a few weeks at home. Send \$2 for complete working drawings, building instructions and price list of parts. SEND \$2 NOW!

AVIATION FREE Information
Send us your name and address for full information regarding the opportunities now open and how we prepare you at home, during spare time, to qualify. Our new book "Opportunities in the Airplane Industry" also sent free if you answer at once.
AMERICAN SCHOOL OF AVIATION
DEPT. 7744. 431 So. Dearborn St., CHICAGO

DIAMONDS ON CREDIT
Write for Free Catalog. Over 2,000 illustrations of Diamonds, Watches, Jewelry. Select any article desired, have it sent to you prepaid. If satisfactory, send us one-fifth of the purchase price and keep it, balance in eight equal monthly amounts.
MOFTIS National Credit Jewelers Liberty Bonds Accepted
DEPT. M-22 108 N. State St. CHICAGO, ILL. Stores in Leading Cities

GO INTO MOVING PICTURE BUSINESS
Our Small Capital Starts You
on our easy payment plan. Begin now and get your share. We sell everything. Write today.
Atlas Moving Picture Co.
\$25.00 to \$350.00 per day. Dept. 50 538 S. Dearborn St., Chicago

Book on Law Free
Write today for our new 171-page book on "The Power of Law Training." It carries a vital and inspiring message to every ambitious man. Find out about the opportunities that await the law trained man. Find out how you can learn from masters of the law right in your own home. No obligations. The book is absolutely FREE. Write Today—now while we are making a special reduced price offer.
American Correspondence School of Law
7445 Manhattan Bldg. Chicago, Illinois

COPY THIS SKETCH
And let me see what you can do with it. Many newspaper artists earning \$30.00 to \$125.00 or more per week were trained by my course of personal individual lessons by mail. PICTURE CHARTS are original drawings, easy to learn. Send sketch of Uncle Sam with 6c in stamps for sample Picture Chart, list of successful students, examples of their work, and evidence of what you can accomplish.
Please state your age
The Landon School of Cartooning and Illustrating
1510 Schofield Bldg., Cleveland, Ohio

HEADACHES NEURALGIA FLU WOMEN'S ACHES ASK FOR A-K TABLETS

YOU Can Double Your Ability to Earn Money! Hold Friends! Win Love and Happiness! Our System of Personal Efficiency tells you how! Success Studygram and Personality Sketch for 10c and birth date. Thomson-Heywood Company, Dept. 350, Chronicle Building, San Francisco.

"The Ellis Music Master Reproducer"
made for all phonographs. Pleases the most exacting music lover. Eliminates twang. Perfect harmony of accompaniments, individuality of artists, voices and instruments reproduced from records in life like reanimation. It sells on its merits. Send 10c for booklets E, "Hints to Music Lovers" and "Music Masters." Agents wanted J. H. ELLIS, P. O. Box 882, Milwaukee, Wisconsin

158 Genuine Foreign Stamps—Mexico War Issues, Venezuela, Salvador and India 10 Service, Guatemala, China, etc. Only Finest Approval Sheets 50% to 60% AGENTS WANTED. Big 72-p. Lists Free. We Buy Stamps. Established 25 yrs. HUSSMAN STAMP CO., Dept. 67, St. Louis, Mo.

THE "SHIMMIE DANCER"
Picture of lady in bathing costume. Press back of figure and see it "shimmie." Lots of fun!
PRICE ONLY 25c
R. Dougherty, 4103 N. Crawford, Chicago

ELECTRICITY IN "MOVIES"

Here lies a wonderful field for the specially trained electrical man. The proper knowledge of electricity, scientifically applied, is the secret of the success of all the big motion picture houses. Every detail of the correct use of electricity in a moving picture theatre explained in

MOTION PICTURE ELECTRICITY

By J. H. Hallberg
A remarkable book by a practical electrical expert. Written for the electrical man who wants to specialize or for the moving picture theatre owner who doesn't know a thing about electricity. Explains all electrical terms, formulae and principles. Contains chapters on electricity, D. C. and A. C. current, resistance and resistance devices, electric service, wiring, lighting, etc. Also contains practical suggestions and all necessary reference tables on wire sizes and capacity, weights and measures, heat units, etc., etc. Explains the principles of correct illumination, both inside and outside as well as for advertising purposes. Instructs in the correct projection of pictures. Gives prices of equipment and cost of operation. 280 pages, handsomely bound, profusely illustrated.

Price \$2.50 Postpaid

Order your copy today.

CHALMERS PUBLISHING CO.
516 Fifth Avenue, Room 604, New York City

SEX KNOWLEDGE

An illustrated book which gives all the sex information you should have—in a wholesome and clean way. Sent prepaid, in plain wrapper, for \$1.00. Send for free circular of our other books.
MODERN BOOK CO., Dept. 9004, 32 Union Sq., N.Y.C.



In this Department we publish such matter as is of interest to inventors and particularly to those who are in doubt as to certain Patent Phases. Regular inquiries address to "Patent Advice" cannot be answered by mail free of charge. Such inquiries are published here for the benefit of all readers. If the idea is thought to be of importance, we make it a rule not to divulge all details, in order to protect the inventor as far as it is possible to do so.

Should advice be desired by mail a nominal charge of \$1.00 is made for each question. Sketches and descriptions must be clear and explicit. Only one side of sheet should be written on.

SPECIAL NOTICE!

Of late we have received so many letters from our correspondents regarding patent advice, that it has been quite impossible to publish all of them. Altho printed in the smallest type possible, we cannot accommodate more than ten or twelve answers a month. At the present time we are about four months behind. Of course, if our correspondents have time, no harm is done! We would however, advise that if a quicker answer is wanted, correspondents should avail themselves of our special service, as per the notice printed at the head of this column.

All letters are answered in turn as they come into this office, and for this reason it will be understood why it takes so long for an answer to be published. Will correspondents please bear this in mind?—EDITOR.

Printing Stamp.

(No. 380) Russell Fletcher of St. Louis, Mo., says as follows:

"I have an idea on which I would like to ask your advice.

"It is a rubber stamp working like a date stamp now greatly in use, but instead of the numerals running from 1 to 9-0, it has the alphabet upon each rotating line or rubber belt. This stamp could be made as wide as wished, or as narrow by manufacturers. Instead of stamping dates it would be used to stamp words (any words). I think this would be a great deal better than the small printing outfits now sold in department and 10c stores."

A. This is a good idea, but is neither new nor very practical. It would be all right for somebody who had a tremendous amount of time to spare, otherwise it would be impractical. Take for instance, if you would wish to spell out the word "extraordinary." This would mean that you would require thirteen bands, and the average word having seven or eight letters, the amount of bands to manipulate would be very tedious, and we do not think that people would wish to bother with it.

Electro-Magnetic Brake.

(381) Ralph E. Hast, Elkins, W. Va., submits the following:

"A number of powerful electro-magnets are placed along the under frame of the cars directly above the rails, and very close to the rails. An automatic coupling socket is at the end of each car so that when the cars are coupled a circuit is completed. The amount of current used is determined by the number of cars, and is controlled by a rheostatic switch within the cab of the engine. The current is supplied by one or more generators in the engine, used in connection with storage batteries. The electro-magnets would be connected in series.

"This method of breaking would prevent the 'flat wheels' resulting from the present form of 'air brake' as the wheels would continue to revolve until the train came to a standstill.

"As additional cars are added to the train, more current is used when braking. This braking would also, I think, be more easily controlled.

"Of course the proximity of the electro-magnets to the rails would have to be determined by the average weight and speed of the cars."

A. There have been many patents taken on electro-magnetic brakes in the past, but for some reason they have not proved very successful, as none of them have been adopted to the best of our knowledge. It seems that electro-magnetic brakes do not stop the train very much quicker than an ordinary brake does. It should always be borne in mind that a train is heavy enough to brake itself once the ordinary brakes have been applied and the wheels grind along the rails. Any additional tractive effort on the rails would not be worth while expending extra energy. Besides in order to energize these electro-magnets, an extra current supply would be necessary, which is not always available on all trains.

Snow Melter.

(382) Hugh Reynolds, Brooklyn, N. Y., writes us:

"I have been very much astonished that New York was unable to run its street cars for weeks

at a time because of the recent snow storm. I have personally examined the third rail slot and I convinced myself that in some cases ice covered all of them as high as one foot. It occurred to me that it should be possible for the traction companies to place an electrically heated boiler on a specially designed car and then generate steam. Three jets of steam would be expelled in front of the car, one for each rail and one for the trolley slot. With this steam it seems to me that it would be only a matter of a few hours to thaw out the railroad. Of course, where the snow and ice was over one foot thick the progress of the steam car melting its way thru the snow and ice would be naturally slow, perhaps only a few feet per hour. But, the main point is that in a day a vast stretch would thus be melted out. I would like to know why a scheme such as this is not practical? If so, please give me the reasons. If you think it is practical, could I obtain a patent on it?"

A. It seems that we have read of a similar scheme that had been tried before, somewhere in the West, but we believe it was not very successful. While it is possible to use a device of this kind, we think the main trouble lies in the fact that it is difficult to keep up sufficient steam by means of electrical power, because the amount of steam which would be required to do the thawing would be quite prodigious. Furthermore, it would not be practical just to thaw away the ice and snow only where it covered slot as well as the rails, because if the snow were deep enough the cars could not proceed unless all of the snow and ice had been melted on the roadbed, and this probably would require too much power. This is one of the reasons why we believe the scheme would not prove practical.

Patents and Citizenship.

(383) Max Kroner, Detroit, Mich., seeks our advice.

"I wish to apply for a patent in the United States, but I am not a citizen of this country, having been born in Denmark. Can I apply for a patent, and will the United States Patent Office grant me a patent if I do apply?"

A. Yes. You can apply for a patent, and the United States Government will issue the patent to you. You will, however, have to state of what country you are a citizen in your application. You do not have to be a citizen of the United States to obtain a patent.

"Interference."

(384) Pierre Bordeaux of Los Angeles, Calif., writes to us:

"If I applied for a patent and another man has also applied for a patent at the same time on

U.S. PATENTS



SEND FOR THIS FORM

Don't Lose Your Rights

Before disclosing your invention to anyone send for blank form "Evidence of Conception" to be signed and witnessed. A sample form together with printed instructions will show you just how to work up your evidence and establish your rights before filing application for patent. As registered patent attorneys we represent hundreds of inventors all over the U. S. and Canada in the advancement of inventions. Our schedule of fees will be found reasonable. The form "Evidence of Conception" sample, instructions relating to obtaining of patent and schedule of fees sent upon request. Ask for them,—a post card will do.



255 OURAY BLDG., WASHINGTON, D. C.

"Originators of form Evidence of Conception"

PATENTS

TO THE MAN WITH AN IDEA

I offer a comprehensive, experienced, efficient service for his prompt, legal protection and the development of his proposition.

Send sketch, or model and description, for advice as to cost, search through prior United States patents, etc. Preliminary advice gladly furnished without charge.

My experience and familiarity with various arts, frequently enable me to accurately advise clients as to probable patentability before they go to any expense.

Booklet of valuable information and form for properly disclosing your idea, free on request. Write today.

RICHARD B. OWEN, Patent Lawyer
164 Owen Building, Washington, D. C.
2276-8 Woolworth Bldg., New York City

PATENTS TRADE-MARKS AND COPYRIGHTS

Before disclosing an invention, the inventor should write for our blank form "EVIDENCE ON CONCEPTION." This should be signed and witnessed and if returned to us together with model or sketch and description of the invention we will give our opinion as to its patentable nature. Electrical cases a specialty.

Our illustrated Guide Book, "HOW TO OBTAIN A PATENT," sent Free on request. Highest References Prompt Attention Reasonable Terms

FREE COUPON

VICTOR J. EVANS & CO., Patent Attorneys

Chicago Offices: 1114 Tacoma Bldg. Pittsburgh Offices: 514 Empire Bldg. Philadelphia Offices: 135 S. Broad St. San Francisco Offices: Hobart Bldg.
New York Offices: 1001 Woolworth Bldg.

MAIN OFFICES: 779 NINTH, WASHINGTON, D. C.

Name Address

You benefit by mentioning the "Electrical Experimenter" when writing to advertisers.

CAN YOU

think of a simple, practical idea that will fill one of the many requests we have on file for new inventions? It may mean a fortune for you. Thousands of things are needed RIGHT NOW. YOUR brains can help. Send today for our great new book—"Inventions and Trade Marks, Their Protection and Exploitation" and learn more about making money from ideas than you ever knew before. It tells many things that are wanted, too. A postal will do—it is free.

We help our clients, without charge, to get the dollars out of their ideas—having facilities none others possess.

Advice free. Don't delay—get the book at once.

AMERICAN INDUSTRIES, INC.
225 Patent Dept., WASHINGTON, D. C.

PATENTS ADVERTISED For SALE FREE
In INVENTION And MANUFACTURING SUPPLEMENT.

Published for the man with an idea. Send for free sample copy. One year's subscription 50c.

PATENTS

WRITE FOR THIS FORM



INVENTOR'S BULLETIN

Sent without charge. My free blank form

INVENTOR'S RECORD

For disclosing your idea. Simplifies procedure.

WILLIAM H. MULLIGAN
REGISTERED ATTORNEY

391 WOODWARD BLDG., WASHINGTON, D. C.

PATENTS

C. L. PARKER
Formerly Member Examining Corps. U. S. Patent Office.
PATE, T. LAWYER
McGill Bldg. Washington, D. C.

Patents, Trade Marks, Copyrights, Patent Litigation

Handbook for Inventors, "Protecting, Exploiting and Selling Inventions," sent upon request.

WILLIAM C. LINTON
Consulting Engineer and Patent Attorney

"Inventor's Adviser" mailed free on request. Gives full information as to Patents, Trade Marks and their Cost.

OFFICES

364 University St. Montreal, Canada

919 F St., N. W. Washington, D. C.

PATENTS

Send sketch or model for preliminary examination. Booklet free. Highest references. Best results. Promptness assured. Watson E. Coleman, Patent Lawyer, 624 F St., Washington, D. C.

a similar device, who will get the patent? How does the Patent Office discriminate in such cases?"
A. This is technically termed "interference." In other words, when two inventors apply simultaneously for a patent as a rule the Patent Office throws the case out and the two inventors will have to revert to litigation.

The Physiophone

(Continued from page 1320)

the dancers. As soon as the music starts, the dancers become conscious of the music and begin to dance, enjoying the dancing, perhaps, even more than normal human beings, due to the electrifying effect of the current. As the dancers progress, the overhead wheel keeps turning so that the wires do not become entangled.

As for the normal human being he can also enjoy the physiological effect of the electrical current for the principal reason that Faradization is healthy and invigorating and entirely harmless. Another one of our illustrations shows what can be accomplished along these lines for the normal

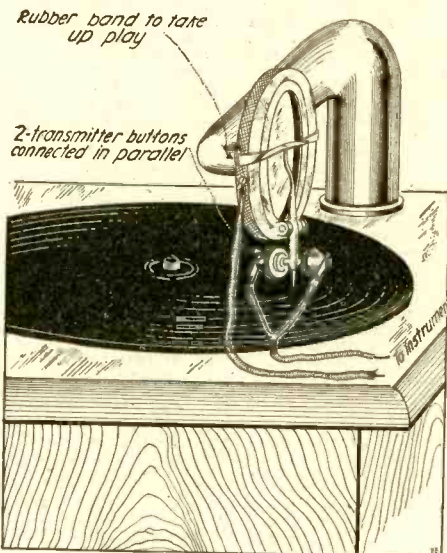


Fig. 3. Using Two Transmitter Buttons in Parallel. Note Feathering Arrangement.

human being. Picture a concert hall, along the stage of which a battery of sensitive microphones is located. The current is led to the primary of a large induction coil in series with the battery. Secondary leads go to metallic handles hung at the back of each orchestra chair thruout the theatre. As soon as the music starts, every one in the audience can grasp the handles, and they will now experience the novel effect of not only hearing the music but also feeling it in a very invigorating manner. This thing has already been tried out by the writer in a small way. It is perfectly possible to put your body in series with a loud-talker telephone. Of course, the music coming out of the horn will now be weakened, but if your hands are wet or moist, the weakening of the loud-talker music is not too great. You are now enabled to hear the music as well as feel it. It will be noted in one of the photographs that a rheostat is used, which is quite necessary to reduce the current. Some phonograph records as for instance band music are so loud and act so powerfully upon the microphone diaphragm that it is quite impossible to hold onto the handles comfortably. It should be noted that on some phonograph records not all the sounds can be transmitted. In other words, very high sounds do not make themselves felt at all, and some such records as the flute or other soft musical instruments do not lend themselves well for physiological effects. Records containing xylophone, piccolo, band music and the ones with singing voices are probably the best.

PATENT-SENSE
The Book for INVENTORS and MANUFACTURERS
SIXTH EDITION

The Book for Inventors and Manufacturers

SIXTH EDITION.
By return mail FREE. Write LACEY & LACEY Dept K, Washington, D.C.

THE INVENTOR'S MANUAL OF VALUABLE INFORMATION
E. E. DELANEY

A BOOK OF KNOWLEDGE FOR THE INVENTOR

Based on actual experience. Shows the pitfalls to avoid and the proper course to follow in applying for a patent. Contains a list of inventions needed. There are fortunes to be made in simple inventions. Do not let ignorance of patent laws deprive you of rightful profits. Start right. Send for

The Inventor's Manual of Valuable Information \$1.50 per copy, postpaid.
G. E. PERRY CO., PUBL.
Dept. 20 1328 Broadway, New York

Free Book on PATENTS

Contains valuable information and advice to inventors. Tells how to secure Patents. Written by prominent patent lawyer of over 20 year's experience. Send model or sketch of your invention for opinion of its patentable nature—FREE. Write today for your free copy of this valuable book.
TALBERT & TALBERT, Patent Lawyers
4287 TALBERT BLDG., WASHINGTON, D. C.

PATENTS

Hand Books on Patents, Trade Marks, etc., sent free. Our 70 years of experience, efficient service, and fair dealing, assure fullest value and protection to the applicant. The Scientific American should be read by all inventors.
MUNN & CO., 622 Woolworth Bldg., N. Y.
Tower Bldg., Chicago, Ill. 622 F St., Washington, D. C.
Hobart Bldg., 582 Market St., San Francisco, Cal.

INVENTORS HAVEN'T YOU SOME IDEA

that you can't just work out? Give us the idea—we will develop it for you. Mechanical and electrical ideas developed. Experts in model and experimental work and in perfecting inventions. Designing and building labor-saving machinery a specialty. Get in touch with us—we can save you money.

ELK MFG. CO., INC.
1926 Broadway, New York

Patents Promptly Procured

Send sketch or model for actual search of U. S. Patents. Highest references. Personal service. Moderate fees. Write for Free Patent Book.

GEORGE P. KIMMEL, Patent Lawyer
99-E Loan & Trust Bldg. Washington, D. C.

PATENTS

If you have an invention and desire to secure a patent, send for our Free Guide Book, HOW TO GET YOUR PATENT. Tells our Terms, Methods, etc. Send model or sketch and description for our opinion of its patentable nature.

RANDOLPH & CO.

Dept. 172 Washington, D. C.

PATENTS

Record your invention, before filing application, by using my form "Fixing the Essential Dates of Invention," sent upon request with full information. Prompt personal services by an attorney-at-law having over twelve years' actual experience. Reasonable pre-war charges. B. P. Fishburne, 324 McGill Bldg., Washington, D. C.

Do you know every move your attorney makes?

INVENTORS

My clients are immediately informed of every step in the prosecution of their applications. Write now—PATENTS—Send sketch.

Office of **WARNER I. CUBBERLEY, Patent Atty.**
22 National Union Bldg., Wash. D. C.

The Electrical Machinist

(Continued from page 1278)

at Fig. 3-B. In leveling medium and large size dynamo and electric machinery, recourse is often had to the methods shown at Figs. 3-C and D. At Fig. 3-C a leveling trammel or bar is used, and this is placed across the two machined surfaces on front and rear of the motor or dynamo base.

As these are accurately machined and in perfect alignment with the two bearings of the machine, this invariably gives accurate results. However, this gives the alignment of the machine but in one position only, and it must also be leveled in a crosswise direction by placing the leveling trammel or bar across the machined surfaces where the field frame is secured.

The scheme of leveling shown at Fig. 3-D implies a taut cord or else a piece of shaft which may be past thru the two bearings of the motor frame. The frame is then leveled until the shaft shows it is at the correct point or else the frame is leveled until the bearings measure with equal spacing around the center cord or string. In this case also the base must be leveled in a crosswise direction, as at X, by placing a leveling board or bar across the two machined surfaces where the field frame will later rest.

SECURING MOTORS IN PLACE.

Small and medium-sized dynamos and motors are frequently secured in position after they have once been aligned with the shafting or other machinery which they are to drive, by means of lag bolts. A lag bolt is, in reality, a glorified wood screw, and it resembles a bolt at one end and a wood screw at the other, this end being brought to a point so that it can be driven into wood and then turned with a monkey wrench, which will cause it to thread its way into the wood the same as any ordinary screw.

At Fig. 4-A a motor is shown fastened to a wooden ceiling. It is usual to place two pieces of wooden joist across the feet of the motor as shown at A, and these joists are lagged to the wooden floor beams. The heads of the lag bolts should be countersunk down into the wood so that the surface of the joists present a perfectly level plane. Then the motor is blocked or held in position, and the feet of same are secured to the small cross-joists by the lag bolts. It is usually necessary to prevent splitting the wood with large lag bolts, to drill a small hole before they are started with the hammer and then turned with the monkey wrench.

At Fig. 4-B another method of motor installation is shown. The floor beams under which the motor is here secured may be of wood or concrete.

Cotter pins passing thru small holes drilled thru the ends of the bolts are best used, but some motor concerns who supply bolts for this purpose provide self-locking nuts, or else cut spring-lock washers, which are placed behind the nuts so that when these are tightened up against the washers, the spring in the washers will exert pressure against the nuts, and thus prevent them from being shaken or vibrated loose.

At Fig. 4-C one scheme for mounting a motor on a concrete floor is detailed. The motor is mounted on two wood stringers made of two pieces of joist placed under the feet of the motor. These joists are countersunk for lag bolts, which are threaded down into expansion sleeves placed in suitable holes drilled for them in the concrete. The motor is later placed on these wooden stringers and secured by suitable size lag bolts threaded down into the wooden joists.

(This series to be continued.)

The toolmaker says:

"Yes, I've got quite a number. No more, probably, than most toolmakers, but quite a number just the same. But then, I ought to have a lot of 'em. I've been buying Starrett Tools ever since I was an apprentice.

"You know my work calls for pretty close limits, and some way or other I've got a feeling of confidence in Starrett Tools that makes it easier for me to do good work.

"When did I get my first Starrett Tool? Oh, somewhere back in the 80's. In fact, it must have been pretty soon after the Starrett factory started. There's one thing that always impressed me. Right from the start, Starrett Tools have been designed and made by men who knew machine shop practice. You know, practical men. And somehow it shows in the quality of the tools."

The L. S. STARRETT COMPANY
THE WORLD'S GREATEST TOOLMAKERS
Manufacturers of Hack Saws Unexcelled
ATHOL, MASS.

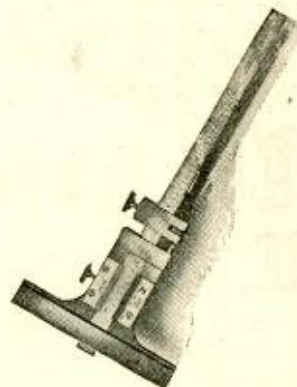
Accuracy, utility, and quality are built into every Starrett Tool. Write for Catalog No. 21 "LE"



42-988



Starrett Tools



BOYS! — BE A REGULAR MAGICIAN

Mystify your friends, give real mystery shows,— you can do it easily with the

Mystero Show Outfit

(Only \$1—Postpaid)

Contains 12 new surprising tricks, used by professional magicians. Complete illustrated instructions in every box. All the tricks will be as clear as day to you, but no one else can understand them.

Send your name and a dollar bill to

UNIQUE GAME & TOY SERVICE

1328 Broadway

New York, N. Y.



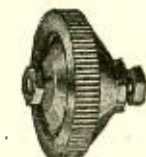
SKINDERVIKEN TRANSMITTER BUTTON

The smallest and most sensitive transmitter in the world. Send \$1.00 for button and booklet with circuit diagrams.

J. SKINDERVIKEN

Inventor and sole manufacturer

335 Broadway, New York, or 154 West Randolph St., Chicago, Ill.



GREEN AUTOMATIC MACHINE



ADD TO YOUR INCOME

WITH LITTLE EFFORT
\$5 to \$10 A DAY MADE
EASY WITH

New Improved Green Automatic Machine

Sharpens, Hones and Stropps all kinds of safety razor blades, in one operation, from four to six blades per minute. For both quality and quantity, this machine is in a class by itself. There is nothing like it on the market. Let us send you our free booklet explaining everything including the "AMERICAN" Key Cutter—cuts square, angular or round slots.

AMERICAN SHARPENING MACHINE CO. (Inc.), Dept. E E, 184 W. Washington St., CHICAGO



"AMERICAN" Key Cutter



ELBERT HUBBARD II, Editor-in-Chief ROYCROFT

The Greatest Book Ever Published!

An American Bible

A Biffs bigotry, slams shams and superstition, and gives the lie laryngismus! ¶ The gospel according to Franklin, Jefferson, Paine, Lincoln, Ingersoll, Whitman, Emerson and Elbert Hubbard. ¶ Printed Roycroftie in two colors and craftily bound in pebble-grain flexible leather.

An Outspoken Little Magazine

The Roycroft

A lively, likeable monthly publication edited by Elbert Hubbard II. It stands for Americanism and progressiveness and speaks the truth with force and directness. It is a magazine that will increase your capacity for friendship, your thinkery, your ideals.

BOTH, for \$2.50!

Use the coupon!

THE ROYCROFTERS, East Aurora, N. Y.

Send me AN AMERICAN BIBLE and ROYCROFT MAGAZINE (for one year) for which I enclose \$2.50.


Name

Address

FREE  **\$20**

TENOR BANJO Ukulele, Hawaiian Guitar, Violin, Mandolin, Guitlar, Cornet or Banjo

Wonderful new system of teaching note music by mail. To first pupils in each locality, we give a \$20 superb Violin, Mandolin, Ukulele, Guitar, Hawaiiin Guitar, Cornet, Tenor Banjo or Banjo absolutely free. Very small charge for lessons only. We guarantee success or no charge. Complete outfit free. Write now. No obligation. SLINGERLAND SCHOOL OF MUSIC, Inc. Dept. 41, CHICAGO, ILL.

I TEACH Penmanship BY MAIL 

I won World's First Prize for best course in Penmanship. Under my guidance you can become an expert penman. Ampleing many of my students as instructors in commercial colleges at high salaries. If you wish to become a better penman, write me. I will send you FREE one of my Favorite Pens and a copy of the Ransomerian Journal. Write today. C. W. Ransom, 511 Essex Bldg., KansasCity, Mo.

The "Finer Workings" of Static Electricity

By FREDERICK VON LICHTENOW;
(Continued from page 1275)

However, as I have stated before, induction takes place first, and that is what we have here to do with. Then follows attraction. After the short while occupied by neutralization of their "in-between" charges, the light objects retain only their induced "outer" charges (naturally opposite to those of their respective sources!) and upon separation fly, "stronger than ever" over to these and make contact with them (See Fig. 7-a).

The behavior of the balls during neutralization evidences in this as well as in experiment No. 4, Part 1, very graphically what I have said in reference to their properties as conductors and insulators. They are a mixture of both; they are the "Guinea pigs" of the electrostatic-research worker, for they respond to anything belonging in that sphere.

Whenever an object susceptible to an electrostatic charge is subjected to the neutralizing process while under the influence of an inductive (outside) force, such object will invariably become charged (in this case oppositely!) to the extent of holding the charge for a given period. In other words: if neutralization is followed instantly by induction, a charge will be effected without the usual resort to contact (with the charging body!). This is clearly demonstrated by the action of the gold leaves of an electroscope, when the latter is inductively charged. The neutralizing process is the magic factor, which makes this possible and, to emphasize again, it must take place "just ahead" of (almost simultaneously with!) the inductive action. This magic factor was made use of by the author in the successful workout of Experiments Nos. 3 and 4, of Part 1.

(To be continued)

Measuring Electric Current with the Eye

By C. A. BRIGGS

(Continued from page 1276)

the figure, by means of a potentiometer connected by leads to a standard resistance interposed in the circuit.

In using the device the current to be measured is past thru the bulb nearest the eyepiece and the current in the other bulb is varied until the observer sees that the filament at one point disappears against its background, on account of the intensities being matched. From the value of the current past thru the bulb at the closed end, as shown by the potentiometer, can be determined the current passing thru the other bulb.

A temporary set-up of an instrument of this character showed that very good results can be obtained. This accuracy is in part due to the fact that under ordinary circumstances a small change in the currents heating either filament will produce a proportionally greater change in the intensity of the illumination. It was found that by this arrangement the value of an electric current could be established to within an accuracy of two parts in a thousand; and with further development it is very probable that the accuracy could be increased. Before use this apparatus is calibrated against direct current instruments.

ELECTRICAL—FIRES

are feared by all fire fighters. Water or ordinary chemicals are dangerous to use and have no effect on fire. A



Nu-Ex
FIRE-KILLER

breaks electrical arcs and extinguishes the fire instantly. It can be directed into electrical machinery without damage to apparatus or injury to operator.

Write for
Our Agency or Distributors Plan
THE NU-EX FIRE APPLIANCE CO.
COLUMBUS, OHIO



ART

Publishes cash art assignments, lessons and articles on Cartooning, Designing, Illustrating, Lettering and Chalk-Talking. Criticises amateurs' work. Full of information for artists and art students.


Satisfactory or money refunded. 20c a copy, \$1 for 9
Send \$1 NOW, Thrift Stamps Taken
G. H. Lockwood, Editor, Dept. 593, Kalamazoo, Mich.

The ROGERS
Violet Ray, High Frequency Generator
Does not burn out. No sparking—therefore all shocks are eliminated. An ideal outfit fully guaranteed as to material and workmanship.

PRICE COMPLETE \$25.00
With One Surface Applicator
Send for free descriptive Booklet
The Rogers Electric Laboratories Co.
Dept. B, 2056 E. 4th St., Cleveland, Ohio

Learn Watch Repairing
Be a watchmaker—you can learn this profitable trade by correspondence in a few weeks in your own home by the DeSelms Chart System. After you complete the course you will know a watch from A to Z. You will know just what the matter is and how to repair one. When you graduate you will be a practical watchmaker and repairer and competent to fill any position. Positions for our graduates.
Ask for our Free Book. It explains our system and terms.

THE DeSELMS WATCH SCHOOL
720 Perry St., ATTICA, IND.

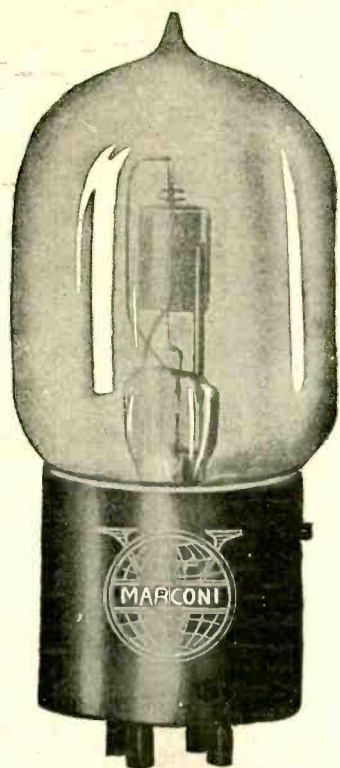


You can be a DRUGLESS PHYSICIAN
A well-paid profession is open to you. The field beckons to both men and women. Combined home study and college course. Heal without drugs. Free catalog. International College of Drugless Physicians, Dept. E, 4200 Grand Blvd., Chicago.

Send for a Complete Catalog of
MASONIC BOOKS
Jewelry and Goods
REDDING & CO.
Publishers and Manufacturers
200 Fifth Avenue, N. Y.
Dept. 5



UMAKEM
Airplane Workbench, containing aircraft work table with mitre cutting board and length gauge, steel drill, steel bummer, Model Maker's steel square, screwdriver, sandpaper block, 10" scroll saw, together with finest quality reed and bass wood, aluminum, silk, para rubber, full set of blueprints, directions, and all fittings for building one 36" Bierlot Model flying Monoplane. Price \$10.00. Other Umakem Outfits 50c to \$50.
W. R. PRICE, Inc.
No. 2 Umakem Building, 127 Fifth Avenue, New York



Fleming Pat. No. 803684
De Forest Pat. Nos. 841387-879532

A WARNING

to Manufacturers
Importers
Dealers
Jobbers
Agents
Amateurs
Purchasers
Users of

Vacuum Tubes The Marconi V. T. Patent is Basic

United States Letters Patent to Fleming, No. 803,684, November 7, 1905, has been held to be valid by Judge Mayer of the United States District Court for the Southern District of New York, and by the United States Circuit Court of Appeals for the Second Circuit.

It is a basic patent and controls broadly all vacuum tubes used as detectors, amplifiers or oscillations in radio work.

No one is authorized to make, sell, import or use such tubes for radio purposes, other than the owners of the patent and licensees thereunder. Any others making, selling, importing or using them alone or in combination with other devices, infringe upon the Fleming patent and are liable to a suit for injunction, damages and profits. And they will be prosecuted.

THE AUDIOTRON AND THE LIBERTY VALVE ARE NOT LICENSED UNDER THE FLEMING PATENT

The price of the genuine Marconi V. T. delivered is \$7.00 each. The standardized socket is \$1.50 additional. The standard resistance, complete, costs \$1.00 and is made in the following sizes: $\frac{1}{2}$ megohm, 1 megohm, 2 megohms, 4 megohms, 6 megohms.

Do not take chances by making, importing, selling, purchasing or using vacuum tubes for radio purposes not licensed under the Fleming patent. By selling, purchasing or using licensed tubes for radio purposes you secure protection under the Fleming patent and avoid the risk of litigation for infringement thereof.

This warning is given so that the trade and public may know the facts and be governed accordingly.

Send all remittances with order to COMMERCIAL DEPARTMENT

MARCONI WIRELESS TELEGRAPH CO. OF AMERICA
RADIO CORPORATION OF AMERICA
235 Broadway
New York

Sole Distributors for De Forest Radio Telephone & Telegraph Co.

Schofield Bldg., Cleveland, Ohio
American Bldg., Baltimore, Md.

Retail Office and Exhibition Rooms, 25 Elm St., New York
Insurance Exch. Bldg., San Francisco, Cal.
136 Federal St., Boston, Mass.

301 Commercial Bank Annex, New Orleans, La.
109 South 2nd St., Philadelphia, Pa.

**MURDOCK
No. 55**



2000 OHM SET.....\$4.50
3000 OHM SET..... 5.50

That these Murdock No. 55 Sets have earned a nationwide reputation for value, is due, not so much to the fact that they are, without question, the best low priced receivers obtainable anywhere, as it is to the recognized fact that they closely approximate in operation the sensitive performance of the most expensive sets.

The customary assurance of "Satisfaction or Money Back" affords the opportunity of proving the exceptional value of these 'phones at no risk to you.

Other instruments — MURDOCK MADE—of recognized merit at equally reasonable prices are illustrated in Bulletin 19B, a copy of which will be mailed on request.

WM. J. MURDOCK CO.

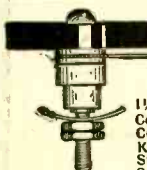
55 Carter St.

CHELSEA (BOSTON 50) MASS.

509 Mission St.

San Francisco, Calif.

**If you want to
become an
Expert Wireman
Read page 1235**



**WILCOX PANEL
SWITCH**

"The Best"

1 1/2 In. Radius Postpaid Price
Complete Switch, polished brass finish... 50c
Complete Switch, nickel plated finish... 60c
Knob, turned and polished... 25c
Switch points, brass finish... 2c
Switch points, nickel plated finish... 4c

THE WILCOX LABORATORIES, Lansing, Mich.

Advertising Talks

NUMBER 6

(Continued from page 1296)

our columns clean and allow only reliable firms to use them. And if there are any readers who have not understood the point you bring up I hope they will read this letter carefully and write me if they feel they have not been justly treated in any transaction.

On the other hand, I do think that manufacturers should publish the shipping weight of all articles which they do not ship prepaid. Many of them do, but to those who don't I want to recommend it now, right here, and I hope that all who read this will think it over and follow the suggestion.

Write again, Mr. Reed.

Very cordially yours,

R. F. Gowen
Advertising Manager.

**Some Long Distance
Radio Telephone
Tests**

By ROBERT F. GOWEN

(Continued from page 1281)

reporting good reception when using only one receiving tube.

While continuing tests with Mr. Charles Candler at St. Mary's, Ohio, the signals and speech were picked up by Mr. R. H. G. Matthews, Chief Engineer of the Chicago Radio Laboratory at his Chicago Station. He reported that the speech could be heard plainly at a distance of over 10 feet from the telephone, altho the buzzer on the modulated wave was slightly louder. The power input for these tests was 285 watts.

A continuance of tests with Mr. Matthews during the last week in January, brought in reports from Little Rock, Arkansas, and from Valley City, North Dakota, distances of about 1200 and 1500 miles respectively. Mr. Clayton at Little Rock reported the speech particularly understandable, but Mr. Pray at Valley City, North Dakota, stated that the speech was weak, but that he was using a very inefficient receiving set. In February, the speech was successfully heard and copied at Baudette, Minnesota, which is nearly as far away as Valley City, and many letters have been received from St. Paul, St. Louis, Minneapolis, and many cities in Michigan to the same effect. In the latter instances, however, the input was increased to 510 watts and in one or two cases the tests were made on a rearranged schedule.

In practically every instance the reports were most enthusiastic as to the modulation or clearness of the speech. Whole spoken sentences were quoted and some even went so far as to comment upon the accent of the person talking. The reports unanimously indicated that once the receiving station found the tune of the transmitted wave, there was no difficulty in hearing the speech clearly and loudly. Mr. Candler at St. Mary's reported one night that he could not use his two steps of amplification as it hurt his ears. He telegraphed back that the writer's voice fairly screamed at him.

The experiments have shown that with a remarkably small power input, stations practically half way across the United States can be reached even when the set is operating very inefficiently on an aerial and on wave-lengths for which it is not designed.

The tests are being continued at eleven o'clock nightly and the writer would be pleased to hear from those who are interested as to their results in receiving him at some distance.

Super-Sensitive Microphone ONLY \$8.00



This instrument is offered at an extremely low price. It is excellent for building your own amplifier. Can also be used in many experiments where a sensitive microphone is required.

Detectagraph, \$18.00

This detecting instrument of marvelous sensitivity can be used for detecting secret conversations. Outfit consists of Sensitive Transmitter, 25-ft. Black Cord, Receiver, Headband, Case and Battery.



Detectagraph \$18.00

Send for One To-day and Convince Yourself



THE \$18.00 MICROPHONE DEAF-PHONE

is a super-sensitive instrument which has been developed to meet the demands for a practical and efficient hearing device at an extremely low price. It is equal to any \$35 instrument made and superior to most of them. The outfit consists of One Super-Sensitive Transmitter with cord connector; One Super-Sensitive Ear Piece with small black cord; One Black Single Headband; Black Case and Two Batteries.

Adjusted Model "B" Horn, with No. 20 High Grade Loud Talking Receiver, Cord Plug and Desk Stand Base, Price, \$12.00 Complete.

Write To-day for Free Booklet

G. BOISSONNAULT CO.

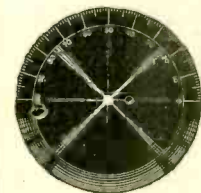
26 Cortlandt St.

New York

Makers of Super-Sensitive Microphone Apparatus



3-INCH DIAL INDICATOR



Black Composition with Brilliant White Filled Engraving

No. 66 Dial only..... 75 cents
No. 67 with Bakelite knob, \$1.30

For sale at all RADISCO Agencies

Sent postpaid.

NEW CATALOG JUST OUT, ready for distribution at once. Contains News, Illustrations and descriptions of all standard radio parts. Sent anywhere upon receipt of 10c.

A. H. CORWIN & CO.

4 West Park St.

Newark, N. J.

What are the Wild Waves Saying?

You can find out with "Ace" equipment.

We can furnish parts for audion control panels and amplifiers. The panels are 3/16" formica, grained finish, lettering in white. Control panel includes socket, grid leak, grid condenser, rheostat, binding posts and formica panel. Amplifiers include the above and transformer, etc., all ready to wire.

**A
A
C
E
E**

Audion Control Panel \$7.50
One Step Amplifier..... 10.00
Audion Control Panel and One Step Amplifier on large panel \$17.50
Two Step Amplifier on large panel..... 20.00

You may pay more, but you can't buy better

THE PRECISION EQUIPMENT CO. (Inc.)

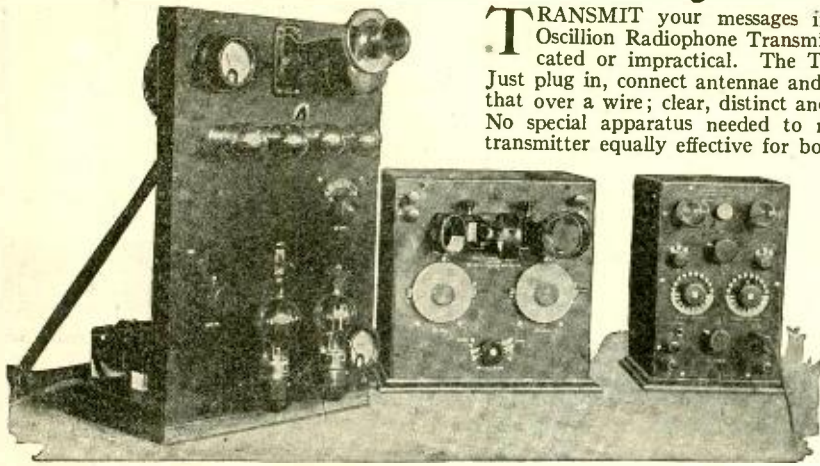
Manufacturing Engineers

2437 Gilbert Ave., Dept. E, Cincinnati, Ohio

DE FOREST

A Wireless Telephone Now Possible for Every Radio Amateur!

TRANSMIT your messages in words instead of dots and dashes! Install a DeForest Oscillation Radiophone Transmitter as part of your set and you can do it. Nothing complicated or impractical. The Type "O" Transmitter shown below plugs into lamp socket. Just plug in, connect antennae and ground, push a button and talk! Voice quality superior to that over a wire; clear, distinct and continuous. Once adjusted it requires no further attention. No special apparatus needed to receive Radiophone messages over limited distances. Same transmitter equally effective for both telephone and telegraph. Throw a switch and telegraph; throw it back and talk! Not an experiment or an impractical instrument. Absolutely perfect in performance and guaranteed to operate as claimed when instructions are followed.



DeForest Complete Radiophone Transmitting and Receiving Station

Type "O," "A C," Oscillation Transmitter for Radio Telephone and Telegraph (left); Type T-200 Multicave Tuner (center), and Type P-300 Combination Audion-Ultratunon Detector and One-Step Amplifier (right). This outfit comprises a complete Radio Telephone-Telegraph Station for both transmission and reception. The instruments may be purchased separately. Send for a catalogue and get complete details.

Add the DeForest Oscillation Radiophone Transmitter to your set and you can send messages by telegraph or telephone. Its cost is not prohibitive and it is the coming development in Radio Service. Find out all about it—

Send for the DeForest Catalogue

A 56-page book full of vital Radio information for the Amateur, including wiring diagrams and other data. Sent postpaid for 10 cents in stamps. Send for yours today.

DEFOREST RADIO TELEPHONE & TELEGRAPH COMPANY

Inventors and Manufacturers of High Grade Radio Apparatus.

1399 Sedgwick Avenue

New York City.

DE FOREST

LICENSED BY DE FOREST AUDIOTRON

The Original Tubular Vacuum Amplifier

The AudioTron Vacuum Tube is now manufactured and sold as a genuine audion licensed under DeForest Patents Nos. 841,387 and 879,532 to be used only for amplification in radio communication and only for experimental and amateur purposes and only in audio frequency circuits.

The AudioTron has a double filament of special thorium tungsten and the operating life is over 2,000 hours. No special socket is required. The electrical and mechanical dimensions result in a heavy plate current and corresponding signal strength. Plate voltage under 40. Our guarantee insures satisfaction.

PRICE \$6.00 EACH

If your local dealer cannot supply you we will ship postpaid when cash accompanies order.

The AudioTron Exclusive Guaranty: Each and every AudioTron is guaranteed to arrive in good condition and to prove fully satisfactory. Replacement of unsatisfactory tubes will be made free of charge.

AudioTron Audio-Frequency Transformer \$7.00

Laminated closed core, two coil type.

DEALERS:—Write for our attractive trade Proposition.

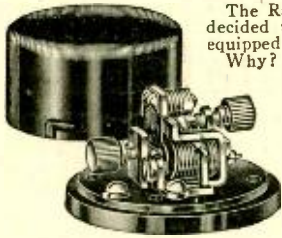
AUDIOTRON SALES CO.

Lick Bldg.

SAN FRANCISCO, CALIF.

Mesco Radio Buzzer

With Shunt Resistance—
U. S. Navy and U. S. Army Standard



The Radio Officers of the NC Planes, after testing all other buzzers, decided to use the "Mesco" on their radio equipment. The R-34 was equipped with two Mesco Radio Buzzers.

Why? Because of its reliability and constancy in operation; greater output efficiency; ease of adjustment; unaffected by extreme variations in weather conditions; exposed wires eliminated.

Sparking is almost entirely eliminated, so that the energy lost in light and heat in the operation of other buzzers is here conserved and radiated in the form of oscillating energy.

This buzzer maintains a constant note and is recommended as an exciter for checking wavemeters where pure note and ample energy are required.

List No. 55, Mesco Radio Buzzers. Price \$2.05.

Get a Copy of Our Complete Wireless Catalog and Order All of Your Radio Material from One Source of Supply and Save Trouble.

Send 25c for a Copy of Wireless Manual and Catalog. Ready May 10.

You cannot get satisfaction from wireless instruments unless they are absolutely perfect. The slightest imperfection in construction destroys their efficiency. We offer for sale wireless apparatus only of the highest quality, guaranteed to be mechanically and electrically perfect.

Our combined Manual and Catalog illustrates and accurately describes the uses of standard radio instruments and should be of great assistance, not only to the amateur but also to the professional user and experimenter in selecting proper radio material.

We make a charge of 25c for this Manual, issuing a coupon redeemable on an order for \$5.00 or more.

It is the last word in wireless catalogs. Send for a copy now. You cannot afford to be without one when you want to buy.

MANHATTAN ELECTRICAL SUPPLY CO., INC.

New York,
17 Park Place.

St. Louis
1106 Pine St.

Chicago,
114 So. Wells St.

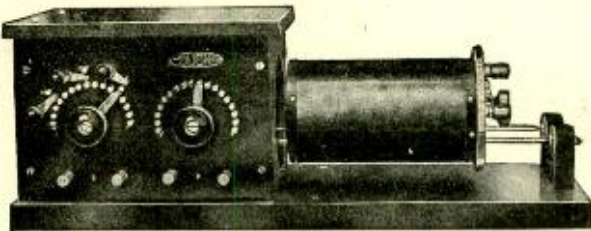
San Francisco,
604 Mission St.



DUCK'S New Big-200 Page No. 14 Wireless Catalog and 100 Page Electrical Catalog

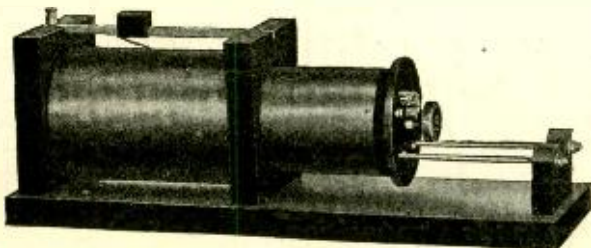
The wireless catalog mailed for 12c and the electrical catalog for 6c, either in stamps or coin, which amount you are privileged to deduct on your first order of \$1.00. Catalog positively not sent otherwise. This edition of our wireless catalog is the most complete and elaborate we have ever put out. It embraces everything in wireless worth while.

As an encyclopedia of information it is invaluable. It is printed on excellent paper and with a beautiful cover. Your amateur friend will tell you that there never has been any wireless catalog to take the place of Duck's, and above all, that you can absolutely rely on the quality of every instrument listed in this catalog. In a word it is all worth while catalogs in one.



NEW MODEL 5BB. NAVY TYPE RECEIVING TRANSFORMER

A big improvement over our former model. Primary divided into four sections, with three dead end switches, greatly improving selectivity. Secondary divided into three sections, with two dead end switches, eliminating harmonics. The change in the construction of the guide rod support makes it possible to obtain a looser coupling. It is a wonderful improvement over our old model both in performance and appearance. Only \$23.50.



OUR IMPROVED ARLINGTON RECEIVING TRANSFORMER

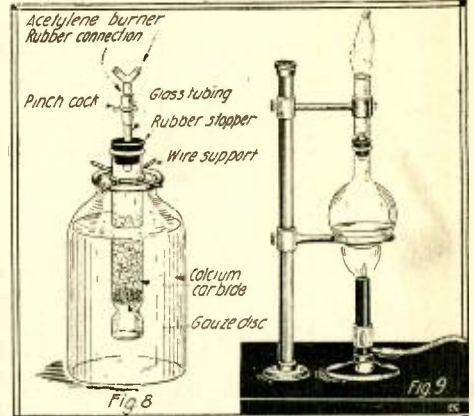
The secondary on our new type Arlington is divided into three sections with two dead end switches eliminating dead end effect and harmonics and giving greater selectivity. The end support is similar to that on our Navy type permitting a looser coupling. It is a beautifully finished instrument.

Price only \$12.50

THE WILLIAM B. DUCK CO., 230-232 Superior St., Toledo, Ohio

Practical Chemical Experiments

By PROF. FLOYD L. DARROW
(Continued from page 127)



Here You Are, Boys. Make Your Own Gas Light for Your Lab.

A Gas Formed by Boiling Borax, Sulfuric Acid and Alcohol Gives a Beautiful Green Flame When Ignited.

Put the apparatus together as shown in figure 8. Then fill the chimney two-thirds full of lumps of calcium carbide and pour water into the bottle. Open the pinch cock and the water will rise thru the disc and coming in contact with the carbide will generate the acetylene, which in a few moments may be lighted at the burner.

PRODUCING A GREEN FLAME

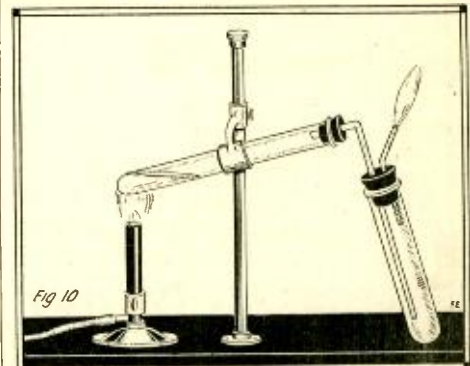
In a small flask place a mixture of 3 grams of borax, 3 c.c. of concentrated sulfuric acid and 20 c.c. of alcohol. In the neck of the flask insert a stopper and short length of glass tubing. Over this, as shown in figure 9, mount a short length of medium sized combustion tubing. Boil the mixture and light the vapor issuing from the top of the large tube. The result will be a brilliant green flame.

GENERATING COAL GAS.

Arrange apparatus as shown in figure 10, placing in the hard glass test tube some pulverized soft coal. Heat the tube strongly with a Bunsen burner flame and presently a gas will be given off which may be lighted at the end of the delivery tube, where it will burn with a luminous smoky flame.

In the condensing tube will be found a tarry distillate, which is commercially known as coal tar and is the source of a host of organic compounds.

In the hard glass tube will be left a steel gray residue of coke.



Even Coal Gas Generation is Not Exempt, Provided You Have Two Test Tubes, a Burner and Some Sort of a Stand to Hold the Same. The Gas Coming From the Small Tip in the End of the Terminal Test Tube Can Be Ignited and Will Be Seen to Burn With a Luminous Flame.

"ASK ANYONE WHO HAS USED IT"

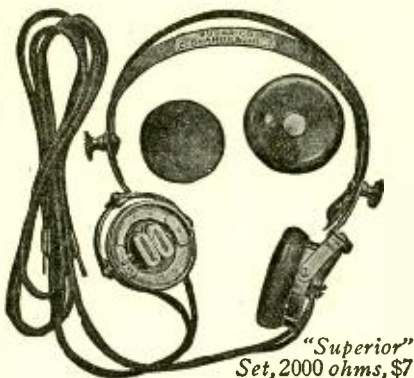
WHAT OUR PATRONS SAY

"I can hear the signals three times as loud and clear as I could with my old receivers." (Name on request.)

BRANDES WIRELESS HEADSETS

CLEAR TONE LIGHT WEIGHT
DEPENDABLE SERVICE

Score 100% efficiency in actual use.
Sharp, Unblurred, Readable Signals
assured by



"Superior"
Set, 2000 ohms, \$7

"BRANDES MATCHED TONE"

Exactly matching the tone of both receivers in each set and thus eliminating all confusion due to unmatched harmonics.

TRIAL OFFER

Buy a Brandes Superior Headset and use it critically for ten days. Then, if it doesn't come up to our claims or your expectations, return it and your money will be cheerfully refunded. Test it—compare with others—for sensitiveness, clearness, distance. Prove for yourself the fine quality, the "matched tone." The two diaphragms toned exactly alike, strengthen the signals and prevent blurring. Used by many U. S. Government experts, and experts abroad; by colleges and technical schools; and by professionals and amateurs everywhere.

SEND 4c FOR CATALOGUE E

C. BRANDES, Inc.
Room 814

32 Union Square
New York City, U. S. A.

WIRELESS RECEIVER SPECIALISTS

Complete Line of Brandes Receivers for those in Canada. Send stamp for Pamphlet "E" Scientific Experimenters, Ltd., 11 St. Sacramento Street, Montreal, P. Q., Canada

Experimenters!

FOR RESULTS USE

Triode

(Trade Mark)

Vacuum Tubes

Immediate Delivery \$7.00 Each Postpaid

FOR DETECTORS OR AMPLIFIERS

WILL FIT ANY STANDARD FOUR-PRONG SOCKET
TRIODE Appliances also include Eaton Oscillators, Two-step Amplifiers, Vacuum Tube Sockets, Grid Locks and Audion Frequency Amplifying Transformers. When ordering radio apparatus specify TRIODE to insure receiving only apparatus and appliances supplied by the Wireless Specialty Apparatus Company. Catalog will be sent on receipt of 25c in stamps.

WIRELESS SPECIALTY APPARATUS CO.
BOSTON, U. S. A.

PREPARATION OF WATER GAS.

Water gas is one of the most important fuel and illuminating gases and may be prepared as follows:

Set up apparatus as shown in figure 11, using a hard glass combustion tube 18 inches long and $\frac{3}{4}$ of an inch in diameter. In the end of the tube next to the flask of boiling water insert a roll of previously ignited asbestos paper, into which the tube from the boiling flask should lead. The asbestos is to prevent the breaking of the tube from the condensation of steam. In the combustion tube place lumps of charcoal and heat them to redness with a 4-tube burner. Then boil water in the flask and pass the steam over the glowing charcoal.

REFINING CRUDE PETROLEUM

Arrange a distilling flask and condenser exactly as they were for the distillation of alcohol, as described in the February issue. Be sure all connections are tight.

In the flask place some glass beads and fill it half full of crude petroleum. The thermometer used should be able to register as high as 360° C. Having provided a wet towel to smother the flames in case of accident, begin heating the flask. Notice that the petroleum very soon begins to boil. Catch the distillate in a small dry flask and when the temperature has risen to 70° C., replace it with another flask. Continue the distillation changing the receiving flask at 80° C., 120° C. and 150° C. stopping when 300° C. has been reached. This will give five fractions and a thick tarry residue in the flask.

The products are practically the same as the petroleum products sold on the market:

- Petroleum ether
- Light gasoline
- Heavy gasoline
- Naphtha
- Kerosene
- Lubricating oils
- Vaseline
- Parafine

} Obtained from
the residue in
the flask.

Pour the residue from the flask while it is still hot and rinse the flask with gasoline.

FLASHING POINT OF KEROSENE

A sure index to the grade and safety of kerosene is its "flashing point." This is the temperature at which the vapor rising from oil will "flash" when a flame is brought near it.

In a tin cup placed over a Bunsen burner pour four tablespoonfuls of kerosene. Try to light it with a match. If it is a good grade of oil you will not succeed. Gently heat the cup and contents and at frequent intervals try to light the vapor, at the same time taking the temperature. The temperature at which the vapor will just ignite is approximately the *flashing point* of the oil. The flashing point of good grades of kerosene is from 120 F. to 140 F. If the oil does not simply flash and go out but continues to burn you have past the flashing point. In that case put out the flame by covering the cup with a glass plate and allow its contents to cool. Every minute or two test with a lighted match. The lowest temperature at which the vapor will just ignite is the *flashing point*.

(The next paper will appear in an early issue.)

ATTENTION!!!

RADIO, ELECTRICAL and CHEMICAL laboratory owners, refer to our monthly laboratory contest on Page No. 1288, for prizes offered for laboratory pictures. We have not received any worth while photos for several months. Now is the time to get busy with that camera and take a photo of your "Lab," and do not forget one of yourself! The more good ones we get, the more we will publish,—so send us some "real Lab" photos by the very next mail, won't you?



MIGNON "RW4" UNDAMPED WAVE RECEPTORS

NO Loose Couplers
Loading Coils
Variometers
Amplifiers

"RW4," Size 12" x 9" x 6 1/2"

Strongest, Most Distinct Signals

IMPORTANT NOTICE

The Mignon System Apparatus, "RW1," "RW2" "RW3" and "RBD8" are no longer manufactured and are superseded by the improved "RW4," "UW1" and "BD1." These apparatus are manufactured exclusively by the MIGNON MFG. CORP., sole owners of the Mignon System Patents. (See U. S. Letters Patent No. 1329672.)

INFRINGEMENTS WILL BE PROSECUTED.

MIGNON MANUFACTURING CORPORATION, - - NEWARK, N. J.

DAMPED AND UNDAMPED WAVE APPARATUS FOR ALL PURPOSES

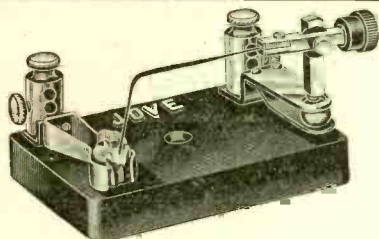
Endorsed by Radio Department of D., L. & W. R. R. Co.

Write for Literature.

MIGNON MFG. CORP.

NEWARK, N. J.

Dept. E



Jove Detector (Patented)

Bunnell Instruments Always Satisfy—

**Our Jove Detectors
Simplest and Best—**

Sample by Mail, \$1.80

Tested Galena Crystals, 25c per box.

Our Keys, Spark-Gaps, Condensers, Transformers, etc., are High Grade, but inexpensive.

Send Stamp for our New Catalog 42 E.

J. H. BUNNELL & CO.

32 Park Place, New York

(Marconi Licensee)

Build Your Own Wireless Receiving Set

Think of the pleasure and practical experience you will gain in making your own set. You can save at least \$25.00 by buying the parts and assembling it yourself. This is not a toy, but a regular, large sized set (16" x 8" x 6") capable of receiving messages ranging in wave length from 170 to 2,500 meters. We will furnish you with large, full sized blue-print and full information concerning winding of coils, mounting of instruments on panel, "hook up"—in fact complete detailed instructions, written in plain easy to understand language.



OUR OFFER IS THIS

Send \$1.00 and we will send you the blue-print and instruction sheets—also prices of all parts. When you order at one time \$5.00 or more worth of parts, you may deduct this \$1.00 from the total. Since the blue-print and instructions alone are worth \$1.00 and since we can save you money on wireless material, you cannot possibly lose. So send \$1.00 today before this slips your mind and start making your set as soon as possible.

K & G WIRELESS SUPPLY CO.

Dept. 15A, 152 Chambers Street

New York City

War Versus Pre-War Apparatus

By "SPARKS", C. E. Radio U. S. N.

(Continued from page 1285)

ments are purchased intelligently and carefully, the amateur station can pick up signals from stations many thousand miles distant.

TRANSMITTING APPARATUS.

The prevailing question in Amateur circles in regard to transmitting apparatus seems to be whether or not it will be "arc or spark." Personally, I am firmly convinced that the spark will stay for some time to come. The arc is being widely developed commercially, but so is the spark, and for short wave lengths, the spark has proved the more satisfactory to date. In view of the rapid development of the arc, two or three manufacturers have put an amateur undamp wave transmitter on the market, all of which are excellent sets of their kind. They are capable of doing very good work with the small amount of power which they consume. They may also be used as radio telephones, with a slightly decreased range than when used as telegraph transmitters.

A vacuum tube transmitter is also on the market now, and looks promising, but the choice today lies with the individual Amateur. It will probably mean that a bunch of us will have to install arcs at the same time or let the old spark do the work for a few years longer. She has done so well in the past, and there is still such room for improvement in spark sets that it's a little early to think of undamp waves for two hundred meter work. Let's turn our attention to better results with the spark sets. Develop the non-synchronous rotaries. There is room and then some for improvement there. Get after them and let's see what can be done toward making an ideal spark set. Go after oil condensers, or at least those with reliable insulation. Oscillation transformers should be wound with heavy ribbon and of a width that will count—not quarter inch stuff, or even half. Make one or one and a half inches wide for a one-kilowatt set. Transformers, too, should be of proper design and are often better purchased than made at home. Above all, keep your leads short, and heavy, and get enough turns into your oscillation transformer to chase the energy across. What will a quarter turn in the primary do?—make it one and a half, and cut down your leads elsewhere.

There is a vast field for the development of a good spark coil set. We don't all live in the city where we can have "AC" by turning a switch. Get a spark coil with a good vibrator or substitute some sort of interrupter for the vibrator—they are woefully poor at best. Then see what you can do with it, and if you hit something real good, let us all know about it—don't keep it to yourself. In your spark coil experiments, tho, watch your wave, for the spark coil and little boy are the pests of the "relay game," and no one wants to be clast with them.

Get busy now, and let's see if we can't have some really good stations this season. We had scores before the war, but we want hundreds now. Let's have descriptions and data on the good stations and apparatus so that we may all benefit. I have made receiving outfits such as described herewith, and they have given me wonderful results. Lying in the harbor at Antwerp, Belgium, quite a way inland, I had no trouble in getting Arlington's spark, Tuckerton's alternator and several U. S. arcs, with one bulb. If they prove as satisfactory on short waves as they have proved on the long ones, I'm going to describe them for you fellows. Let's all do that.

WIRELESS AMATEUR

Send a 2c stamp for full description of the most efficient detector in the wireless field today. Tested by Marconi Wireless Telegraph Co. and U. S. Government. Instantly adjustable at a constant pressure.

L. STEWART BARR, Inventor, Vice-President of The Service Radio School

THE BARR MERCURY-CUP DETECTOR

Dept. A, The Wyoming, Washington, D. C.

ANNOUNCEMENT

SUMMER session opens May 1st. Complete course preparing you for license and best paying positions. Rapid progress, individual attention, classes of limited size. Write for descriptive literature.

Y. M. C. A. RADIO SCHOOL

Marcy Avenue near Broadway
BROOKLYN, N. Y.
Telephone, Williamsburg 3800

RADIO APPARATUS

Distributors of Reliable Experimental and Laboratory Radio Apparatus for High Schools, Colleges and Individuals.

More than a store



Try our service

At F. D. Pitts Co., Inc., you will find an exposition of reliable radio apparatus and supplies from the foremost manufacturers of the country. No other store has such a complete line of equipment, nowhere else is such an opportunity to choose from the products of so many radio manufacturers. A feature which must appeal to experimenters is that we keep things in stock. Immediate delivery! Give our service a trial! Send 6 cents in stamps for new catalog. Every experimenter should have it.

F. D. PITTS CO., Inc.

Dept. D

12 Park Square, Boston 11, Mass.



BOYS Get the most attractive warning sign made. Your den is incomplete without it. Printed in red on white cardboard 7 1/2" x 11 1/4". Reduced to 10c each. Send 2c for postage. Don't buy plain printed signs.

FREE We are giving away hundreds of expensive wireless instruments, electrical apparatus, supplies, etc., for selling a household article that goes like wildfire.

Answer this advertisement only if you will remit for catalogue and you will be able and willing to leave a deposit of 75 cents for our goods. Don't send the deposit now. Just send for information. If dissatisfied, deposit will be returned.

L. BECK NOVELTY HOUSE
1298 Carroll Street Brooklyn, N. Y.

You can be quickly cured, if you

STAMMER

Send 10 cents coin or stamps for 70-page book on Stammering and Stuttering, "Its Cause and Cure." It tells how I cured myself after stammering for 20 years.
Benjamin N. Bogue, 765 Bogue Bldg., Indianapolis

Electricity Foils German Seals

By FRED C. KELLY

(Continued from page 1251)

One of the five men had established himself as a lookout in a public washroom down the corridor, a few paces from the outer door of the consulate.

It was arranged that if danger should threaten he would walk down the corridor and give two quick taps on the door. On the night mentioned he did hear some one coming up a stairway. Quickly he gave the alarm and then hastened back to his secret post in the lavatory. Then men who had been operating on the filing cases flicked off their electric light, which was a specially arranged one that illuminated only a limited area. They gained hiding places under tables and behind desks barely in time to be out of sight when the watchman, if such it was, opened the door and peered inside. But he was there evidently just as a matter of routine, in the course of his regular rounds, and did not chance to notice anything unusual about the office, tho one of the searchers was lying within four feet of him. After a moment or two he continued on his way.

Every detail of the plan of restoring the safes and filing cases to their usual condition was carefully thought out. One man was even assigned to the job of seeing to it that the dust on the filing cases was about as it had been. He swept up dust from the floor and placed it where finger marks might have showed.

The visits of the five men continued, beginning probably late in April, until the early part of July, and it is believed that in the early morning of the Fourth of July, by way of patriotic coincidence, the last of the German documents were removed from the consulate.

On this final visit the five men arranged to open a section of filing cases and also the steel trunk, which was locked and sealed about as the safes had been. It had been left until the last, because, for some reason, the men had an idea that the papers it contained might be of the least importance. The truth was that the Germans had intended this trunk to contain the most important documents of all.

But when the men succeeded in opening the one remaining section of the filing cases and this steel trunk they had a surprise that left them breathless.

Both the filing case and the steel strong box were already empty!

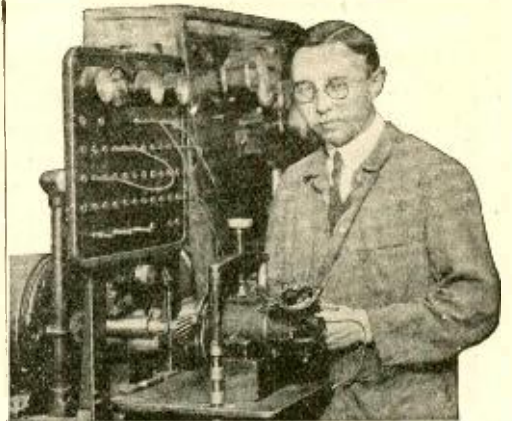
They had been carefully sealed up by the Germans without containing any papers at all. It is now pretty well understood that the papers had been secretly taken away by one of the Germans who was intrusted with the job of storing and sealing them up. Just what personal use he intended to make of them never has been disclosed. They were found by the merest chance, so I have been told, in two large suitcases and a steamer trunk in an obscure storage warehouse some weeks later.

When discovered these papers were promptly turned over to the United States Government. It so happened that they reached the possession of Government officials at about the same time as the other papers taken by the five adventurers from the consular offices.

FIVE ADVENTURERS UNKNOWN.

Thus it came about that the United States Government does not know even to this day how, when or by whom the papers were captured.

Having once obtained the papers, the Government set translators at work on them. The variety of information then acquired was really astounding, for the seized correspondence showed how intricately Germany had allied its industrial with its espionage system.—*New York Tribune.*



**A New Profession
AUTOMOTIVE
ELECTROTECHNICS**

is open to YOU! The field is rapidly growing—the time to train is ripe!

A most complete equipment of standard apparatus and testing instruments in charge of Prof. E. L. Consoliver, well known Automotive Specialist, and a staff of experienced, competent instructors. Automobile, Airplane and Marine engine,

IGNITION

STARTING

LIGHTING

practically and thoroughly taught in courses of convenient length and moderate cost.

2 Years

6 Months

3 and 4 Months

courses,—day or evening.—

"Earn While You Learn"

system permits you to assist yourself toward paying expenses.

New Term Opens March 29th.

Clip the coupon NOW for catalog and full particulars FREE!

School of Engineering of Milwaukee

181-373 Broadway Milwaukee, Wis.

CLIP HERE

School of Engineering of Milwaukee, Milwaukee, Wisconsin.

181-373 Broadway,

Gentlemen:

I am interested in Automotive Electro-technics. Kindly send full particulars.

Name

Address

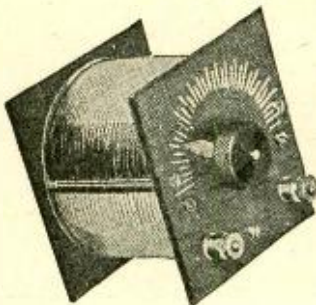
Age..... Education.....

TEWNO WIRELESS PRODUCTS OF QUALITY

In all of the products shown below you will find we have used the finest of materials and the most accurate workmanship. All material guaranteed against factory defects, as it has always been a principle with us to manufacture products of superior type but at a reasonable price.

"Tewno" Variable Condenser

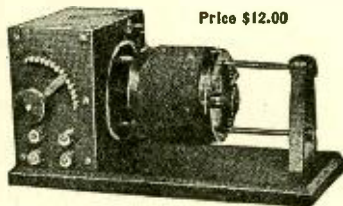
The rotary variable condenser is a necessity for all experimental wireless work and one or two of them are to be found in almost any wireless station. The two most popular types are the 43 plate and 21 plate with capacities of .001 mfd. and .0005 mfd., respectively. The large size has 21 rotary aluminum plates and 22 stationary aluminum plates. The small size has 10 rotary and 11 stationary plates. The ordinary rotary variable condenser is mounted in a cheap round metal case with a cheap composition top and coarse scale. Its plates are 0.15" thick and the shaft is 3/16" in diameter. The "Tewno" Rotary Variable Condenser has two genuine "Formica" ends, a clear glass case, a 1/4" shaft and plates 0.4" thick of a special grade of aluminum. However, the biggest feature in favor of our condenser is the form of end-piece used. It is square, facing the operator. It is not necessary to look over one's hand to see the scale, as was the case in the old upright type of condenser. The scales on these instruments are calibrated to 2 1/2 degrees. We recommend our 43 plate condenser for primary and secondary tuning on sets of fair range and for use in oscillating circuits. Our 21 plate condenser is well adapted to short wave tuning for use in small wave meters and a great variety of work calling for a small variable capacity. Do not be fooled by an instrument that is "just as good." These are to date the best condensers on the amateur market.



No. 53—21 plate—.0005 mfd. Price, \$4.75 No. 43—43 plate—.001 mfd. Price, \$5.50

"Tewno" Receiving Transformer (Short Wave)

Directly prior to the war, the amateurs were doing wonderful work with specially made short wave couplers of their own construction and through the use of Armstrong circuits or with straight audion circuits. Up to that time no manufacturer had placed such an instrument on the market. In our short wave receiving transformer the amateur will find the embodiment of all of his ideals. It is designed for use on amateur aerials of from 150 to 200 M. fundamental wave length and with a small capacity of variable condenser across the secondary will easily tune to 600 M. The windings are of the very efficient type known as bank wound (an expensive process) and are of heavy stranded conductor in silk sleeving. They are wound upon non-shrinkable tubes. Variation is obtained by means of two 12-point switches mounted upon "Formica." Switches and contacts are satin finish, nickel plated, which is in accord with the Government's specifications. All other metal work is polished and nickel plated. Woodwork has a beautiful hand rubbed mahogany finish.



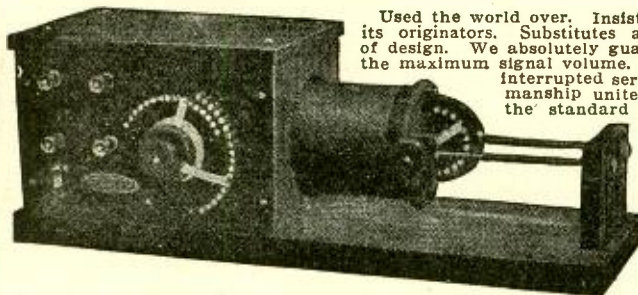
Price \$12.00

No. 23—Price \$12.00

Order today as orders will only be filled in rotation as they come in. Remit by postal money order or check.

The TEWNO COMPANY, 150-152 Chambers St., New York City

TRACO QUALITY RECEIVING TRANSFORMERS



Used the world over. Insist on the genuine, built by its originators. Substitutes are expensive, irrespective of design. We absolutely guarantee our tuners to give the maximum signal volume. Delicate refinement, uninterrupted service and high class workmanship unite to make TRACO tuners the standard whereby all others are judged. If your Dealer does not handle them, order direct from us.

LIBERTY DETECTOR VALVES. RADIO AMPLIFYING PHONES, type used by the UNITED STATES, BRITISH and FRENCH GOVERNMENTS, now in stock, for sale. Send stamps for bulletins.

The Famous 5A and 5C Models

THE RADIO APPARATUS CO.,

Pottstown, Penna., U. S. A.

"DEPENDABLE"

Radio Equipment

DORON BROTHERS ELECTRICAL CO.

Hamilton, - - Ohio

Manufacturers of

Binding Posts, Switch Points, Special Screws, Nuts, Parts, Variable Condenser Shafts, Separators, Plates, etc. Automatic Screw Machine and Punch Press Products of any kind. Get our prices on your Parts.

Have you a copy of our Radio Catalogue No. 9? It's free.

STORAGE BATTERIES FOR WIRELESS SERVICE

Batteries especially adapted for the amateur operator are described and illustrated in our new Bulletin No. 175, copy of which will be furnished on request.

THE ELECTRIC STORAGE BATTERY CO.

The largest maker of storage batteries in the world
1888 PHILADELPHIA, PA. 1920

New York Boston Chicago Washington Denver San Francisco Cleveland
Atlanta Pittsburgh Minneapolis Kansas City St. Louis Detroit Rochester
Special Canadian Representatives, Chas. E. Goad Engineering Co., Ltd., Toronto and Montreal

You benefit by mentioning the "Electrical Experimenter" when writing to advertisers.

The Battle Tracer

(Continued from page 1242)

tom of which is attached a driving wheel with a periphery of sharp teeth preventing the Tracer from slipping off the table.

When a distant transmitter is actuated, this motor in the Battle Tracer is simultaneously operated, causing the driving wheel underneath the Tracer to move slowly along the table, carrying the Tracer with it. The distance traversed in this way is exactly proportional to the actual distance traversed by the ship itself.

Lines of perforations are made by the teeth of the driving wheel to trace the course of our own vessel. The inner dial likewise is made to turn by a third motor, and the picture of the ship engraved upon it will show the direction in which our vessel is traveling. In other words, the engraved outline of the ship on the movable dial is kept in plane with the rotation of the driving wheel carrying the Battle Tracer along the table.

The pointer (D) heretofore described going to the outer surface of the movable dial and the inner surface of the fixed dial indicates on the outer dial (A) the true compass bearing of the target, and when read with reference to the inner dial (B) indicates the true bearing of the target with respect to the ship.

A second pointer (E) controlled by another electric motor passes to the smallest of the three dials and gives a reading of the speed of our own ship transmitted, as has been stated, on the revolution converter.

The enemy arm is continually being moved in accordance with the range, coming from the target bearing transmitter. On this arm is located a small carriage having two pencil points, and traveling on tiny rollers. The distance of this carriage to the center of the Tracer is directly proportional to the range of the target. This distance is regulated by a fourth motor, actuated by the auxiliary range transmitter. On the big gun turrets of the battleship are the range-finding instruments. These instruments consist of an arm 30 feet long with mirrors and lenses at each end; one is set at a 90 degree angle and is moved until the operator's eye, looking thru a hole near the center of the instrument, spots the enemy. Immediately he attempts to twist the other end mirror so that the enemy may be observed at the same time. The angle thus formed allows the computation of the range. The range thus determined is transmitted to the Tracer room, where an operator turns the Auxiliary Range Transmitter in accordance with the information he receives from the range-finding instrument. In this way communication to the Tracer is obtained.

Scales are provided for reading the range directly. Likewise, pencil points operated on the ends of magnets controlled by a clock, produce dots along side of the course. Now, then, let us see what all these results come to. First, we plot automatically by communications directly from the propeller shafts and gyro-compass the course and speed of our ship on a large sheet of paper.

This is one definite factor that is known. Secondly, instruments, on the mast-heads of the vessel, keeping a "line" upon the enemy vessel, cause the enemy arm to trace another course upon the table. See diagram herewith.

All of this is figured out to mathematical accuracy and system of ratios so that if the enemy is eight miles away, the pencil

RADIO OPERATORS

\$125.00 per month and upward plus all expenses.

Modern Equipment—
Special Short Course
Individual Instruction
Finest Staff of teachers available

Dormitory—Swimming Pool

Call or write for illustrated booklet

Y. M. C. A. Radio School

Dept. R

152 E. 86th Street, New York, N. Y.

"BEST RADIO SCHOOL IN THE EAST"

A Real Electric TELEPHONE

THAT WILL OPERATE UP TO 200 FEET ON 2 ORDINARY DRY BATTERIES

Price per set (2 Phones) **\$1.50**

2 Transmitters and 2 Receivers **\$1.00**

Send stamp for catalog

INLAND-SPECIALTY CO.

1562 N. Robey Street
CHICAGO, ILL.

Radio Men Wireless Amateurs

We carry a complete line of Grebe, De Forest, Marconi, Murdock, Clapp-Eastham, and all other leading makes of Radio Apparatus, from Contact Points to Complete Sets.

Agents for RADISCO Apparatus including Coils, "B" Batteries, Indicating Dials and other parts distributed by them. Mail orders given prompt attention.

Open Evenings until 9:30 P.M.

KELLY & PHILLIPS
312 Flatbush Avenue, Brooklyn, N. Y.
Telephone Sterling 2380

Become a Licensed Electrician!
Read page 1235

line for the enemy will extend out a definite radial distance from the center of the Tracer proper. If the distance between the two ships decreases the course of the both ships will approach each other as clearly noted on the Tracer table chart.

Should at any time one of the instruments lose bearing of the enemy, the operator at that observing station releases a button and no mark is placed upon the Tracer table until he again finds the range. Thus we now have the complete and definite data of the speeds of both ships and the courses they are pursuing.

If we could fire a shot at the instant that we obtain the enemy's position, it would be very easy to put the other vessel out of commission, but it takes time to elevate the guns and make other necessary changes. Hence, a matter of predicting range is made use of. Calculating our own ship's position by a very simple adjustment which fits on the Battle Tracer, and knowing that we ourselves are not moving to any appreciable extent, it is simple enough to predetermine exactly what position the other ship may be in, in say one minute from that period.

Accordingly, instruction is sent to the gunners, the guns pointed, and the instant that the ship gets into the position which had been predicted for it, the order to fire sends out a broadside salvo which invariably causes marked destruction of enemy life and property. Strange to say, even the time required by the shells in reaching their intended victim, is allowed for.

The device is worked out to the greatest accuracy, even to a correcting device for tides, winds, ocean currents, etc., and provision is made for the condition of the ship's hull—all automatically.

At the revolution converter is an automatic indicator which corrects the speed of the motors in the Tracer table in accordance with the chart used. These charts can be set to a scale of 1-30,000, 1-40,000, 1-60,000, 1-80,000.

The advantages of Tracer equipment on any vessel regardless of whether the vessel is engaged in war or not, are manifold. Chief among these are the uses that it can be put to in recording accurately a ship's log, plotting at all times the course of the vessel and being of a great advantage in what is known as *dead reckoning*. By this, we mean that a vessel may leave a port during a storm and perhaps two or three days later, may attempt to locate itself, but due to the fact that there is no sun in order that observations may be taken, it does not know its latitude and longitude, simple because it cannot recall how far or how fast it traveled, even though the compass readings have been carefully jotted down hourly. Similarly, in submarine work where a vessel is submerged, probably for days, all that is necessary, is to determine its location, on the day it sailed, and the Tracer will tell you where you are any time you may desire, having already made correction for tides, winds, and vessel conditions. —Photos Courtesy Sherry Gyroscope Company.

ATTENTION!!!

RADIO, ELECTRICAL and CHEMICAL laboratory owners, refer to our monthly laboratory contest on Page No. 1288, for prizes offered for laboratory pictures. We have not received any worth while photos for several months. Now is the time to get busy with that camera and take a photo of your "Lab," and do not forget one of yourself! The more good ones we get, the more we will publish, — so send us some "real Lab" photos by the very next mail, won't you?



HIGH SCHOOL COURSE IN TWO YEARS

YOU ARE BADLY HANDICAPPED if you lack High School training.

You cannot attain business or social prominence. You are barred from a successful business career, from the leading professions, from well-paid civil service jobs, from teaching and college entrance. In fact, employers of practically all worth-while positions demand High School training. You can't hope to succeed in the face of this handicap. But you can remove it. Let the American School help you.

FIT YOURSELF FOR A BIG FUTURE This Course, which has been prepared by some of America's leading professors, will broaden your mind, and make you keen, alert and capable. It is complete, simplified and up-to-date. It covers all subjects given in a resident school and meets all requirements of a High School training. From the first lesson to the last you are carefully examined and coached.

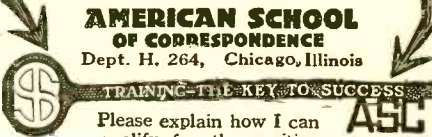
USE SPARE TIME ONLY Most people *idle* away fifty hours a week. Probably you do. Use only one-fifth of your wasted hours for study and you can remove your present handicap within two years. You will enjoy the lessons and the knowledge you will gain will well repay the time spent in study.

TAKE 10 LESSONS FREE So that you may see for yourself how thorough and complete our training is. We invite you to take ten lessons in the High School Course—or any Course of specialized training in the Coupon below—before deciding whether you wish to continue. If you are not then satisfied you are not out one cent. We absolutely guarantee satisfaction. On that basis you owe it to yourself to make this test.

Check and mail the coupon NOW for full particulars and Free Bulletin.

AMERICAN SCHOOL OF CORRESPONDENCE
Dept. H. 264, Chicago, Illinois

TRAINING—THE KEY TO SUCCESS
Please explain how I can qualify for the position marked x



- ..High School Graduate
- ..Electrical Engineer
- ..Elec. Light & Pr. Supt.
- ..Hydroelectric Engineer
- ..Telephone Engineer
- ..Telegraph Engineer
- ..Wireless Operator
- ..Architect
- ..Building Contractor
- ..Civil Engineer
- ..Structural Engineer
- ..Shop Superintendent
- ..Steam Engineer
- ..Draftsman & Designer
- ..Photoplay Writer
- ..Lawyer
- ..Business Manager
- ..Certified Pub. Account't.
- ..Accountant & Auditor
- ..Bookkeeper
- ..Stenographer
- ..Fire Insurance Expert
- ..Sanitary Engineer
- ..Master Plumber
- ..Heating & Vent. Eng.
- ..Automobile Eng.
- ..Automobile Repairman
- ..Airplane Mechanic
- ..General Edu'n Course
- ..Common School Br'ch's
- ..Employment Manager
- Foreman's Training Course

Radio Diagrams and Formulae in Loose Leaf Form

The publishers of the CONSOLIDATED RADIO CALL BOOK have completed the preparation of diagrams and instructions on—

- Measurement of Capacity of a Condenser. (Substitution Method.) Calibration of a Variable Condenser. Two Diagrams and Curve.....No. 1
- Measurement of Inductance of a Coil or Circuit. Two Methods—Two Diagrams.....No. 2
- Measurement of Distributed Capacity of an Inductance. Diagram and Curve.....No. 3
- Measurement of Fundamental Wavelength of an Antenna. Three Methods. Three Diagrams.....No. 4
- Measurement of Wavelength of Distant Transmitting Station. Two Methods. Calibration of a Receiving Set. Two Diagrams.....No. 5
- Measurement of Effective Antenna Capacity. Two Methods. Two Diagrams.....No. 6
- Measurement of Inductance of Antenna and a Third Method of Measuring Effective Capacity of Antenna. One Diagram.....No. 7
- Measurement of Antenna Resistance. Substitution Method.....No. 8
- Schematic Wiring Diagram of Regenerative Audion Receiving Set Suitable for Receiving High Power Undamped Wave Stations. Connections shown are those used in most Navy and Commercial Receivers.....No. 50
- Table giving the value of LC (Product of Inductance and Capacity) for wavelengths from 300 to 20,000 meters. Inductance in Microhenrys.....No. 100
- Table same as above but with Inductance in centimeters.....No. 101
- Schematic Wiring Diagram of Signal Corps Type SCR-68 Radio Telephone Transmitting and Receiving Set.....No. 51
- Schematic Wiring Diagram of Type CW-936 (Navy Submarine Chaser) Radio Telephone and Telegraph Transmitter and Receiver.....No. 52
- Schematic Diagram of Type S.E. 1100 (Navy Flying Boat) Radio Telephone and Telegraph Transmitter.....No. 53

These diagrams and instructions are the most CLEAR, CONCISE, COMPREHENSIVE and CONVENIENT form of instruction that has ever been presented. They are printed on pages size 8½ x 11.

Complete Set of 14 Sheets as described, sent postpaid **75c**

CONSOLIDATED RADIO CALL BOOK CO., Inc.
41 Park Row, New York, N. Y.

FREE! FREE! B-BATTERIES

Descriptive Circulars of

OUR "BETTER QUALITY" TYPE



To enable every amateur to use our SUPER "BETTER QUALITY" B-BATTERIES, they are now offered at a price within reach of all. Remember that our B-Batteries are sold to you on a Money-back basis. They are FULLY GUARANTEED, and your money CHEERFULLY REFUNDED if not satisfied. Our motto "RETAILING AT WHOLESALE PRICES."

Cat. No.	Voltage	Average Life	Our Price	Shipped By
BB-154	22.5	4 months	\$1.25	Express
BB-158	22.5	8 months	2.20	Only
SBB-3012	45	1 year	4.35	Only

Audio Tron Amplifiers \$6.00 postpaid and insured
THE H. S. WIRELESS CO.
164 Ross St. Dept. D, Brooklyn, N. Y.

on the desk, on the body, on the floor, on the door knob—inside or out—not anywhere. It's beyond me."

"Couldn't come in thru the outer office, eh?" Fenner's eyes were roving over the room. Frank shook his head slowly in negation. "Three girls and the head book-keeper out there all evening, working overtime. All swear not one of them has been in this room this evening. Corey came in thru the outer office—the only way he could come in, for this office has only the one entrance—and closed the door. About half past eight one of the girls opened the door to come in. She saw that something had happened to Corey, and she didn't cross the threshold. All of them had sense enough to stay out. They telephoned for us. I was the first man in."

"No other doors?"
"Nope. Only one way in. Thru that office."

Fenner was gazing at the wall on the street side. "Did you open that window?" he asked.

"No. It was open. But it might as well have been bricked up for all the good it's going to do us. Corey opened it himself, no doubt. It's just sixteen stories to the street, and you can bet no one climbed up to it. It's five stories to the roof. One chance in one thousand that any one climbed down. It would take nerves of steel to drop over the edge on a rope, and if some one did have the nerve, they couldn't have gotten in that window noiselessly enough not to warn Corey. And just assuming that they did, they'd surely leave a mark doing it, wouldn't they?"

Fenner nodded. "They would indeed," he acquiesced. "How about the people in the office out there? Are they all above suspicion?"

"All above it," complained Frank, "and not only that, but the very number of them lets them out without question. It's not reasonable to suppose that three girls and a man, all trusted employees, would conspire to kill their employer without a motive for doing so. One of them might try it, or maybe even two, but it's hardly likely that all four would be against the man."

"Right you are," admitted Fenner, "I thought that way myself, but we have to eliminate the possibility of an inside job first. Well, Chief, I don't see that I can do you any good in this matter. It is unusual enough to be interesting, and if you don't mind I'll drop in and have a look around in the morning."

"Help yourself," gloomed Davidson. "I don't believe you can do anything in this case myself. I just took a chance. You might have, you know."

"I wish that I could have. And I'll look it over in the morning on the off chance. Good night, Frank, and good luck. Good night, Chief. Come on, Bill," And we left.

As we walked homeward, Fenner said: "It seems that the day of miracles is not gone by, after all. What do you think of that for a puzzle?"

"It's beyond me," I replied, soberly. "The only possible explanation that I can think of is that the man committed suicide."

Joe stood still and rocked with laughter. "Oh, Bill, Bill," he gasped, "there's only one man in a million—yes, I'll make it a billion—that commits suicide by stabbing himself in the back, to say nothing of calmly disposing of the weapon just after he's dead."

"Well, then," I demanded, sullenly, "how do you account for the thing?"

He grew thoughtful at once. "I can't," he admitted, "unless —"

"Unless what?" I asked, as he paused.

"Unless—unless—well, I wouldn't want to say unless anything just now. Would you like to go down with me again tomorrow morning?"

COPPER AERIAL WIRE 50c FOR 100 FEET

We are putting on another sale of absolutely pure No. 14 gauge copper aerial wire at 50c per 100 feet. We also have in stock some of this wire in No. 12 gauge the price of which is 80c per 100 feet. All orders must be accompanied by parcel postage and insurance charges. We make no C. O. D. shipments. Prices subject to change without notice.

Induction coils—primary 1 ohm, secondary 55 ohms—shipping weight 2 lbs. each. 50c
Desk telephones—standard type just as used in all large cities and towns, is equipped with sensitive transmitter and receiver, switchhook with genuine platinum contacts and hard rubber mouthpiece. The telephone is nickel-plated and is slightly used but guaranteed absolutely by us. The new price on this telephone is \$10.00. The shipping weight is 5 lbs. Our price \$3.50

We can furnish the same as above in a wall type telephone being equipped in addition with a 1000 ohm ringer. Cabinet finished in dark oak. The new price on this telephone is \$14.50 but since they are slightly used we are closing them out at \$4.75. Shipping weight 15 lbs.

Be sure and include postage and insurance with each of the above items when ordering; otherwise they will be shipped by express collect.

Send 5c for our illustrated catalogue
ELECTRICAL SPECIALTY CO.
Dept. E-48-50 So. Front St., Columbus, Ohio

HAVE YOU HEARD

of the immense savings RADIO EXPERIMENTERS are making on all makes of radio apparatus, raw material, etc.?

Members of this Association buy through us at a saving, due to our wholesale buying. You also can save money and get quick delivery on anything advertised in this magazine.

Special Offer

MARKO 4V 60 Amp. storage batteries \$7.00 net to members only. Supply limited.


If you are not a member write immediately for details.

Mutual Purchasers Association

Dept. E21:—2-4 Stone Street
New York City.

American Electro Technical Appliance Co.,
235 Fulton Street
New York City

SPECIALS

 Audion Detector \$6.00
Panel for

Crystal Detector .75c
Stand for

Jeweler's Time Signal Set,
De Forest make, Complete with large Eveready "B" Batteries \$25.00
Without Bulb

All parts for the Amateur to build his own sets. Catalog ready within three weeks.

MEMORIZE WIRELESS CODE ALMOST INSTANTLY

My method is the short cut. Complete chart and full instructions. Two dimes.

C. K. DODGE
Box 100, Mamaroneck, N. Y.

RADIO TELEPHONE & TELEGRAPH

Apparatus of Merit

Distributors for
DEFOREST

MURDOCK-AMRAD
MULTI-AUDI-FONE
PERFECTION

And Other Prominent Mfgs.

IMMEDIATE DELIVERIES

Send Stamp for Catalog

YOUNG & McCOMBS

Dept. 67

Rock Island, Ill.

Recognized as the largest and best



Send ten cents for descriptive catalogue

900-902 Penna. Ave., N. W. Washington, D. C.

Arnold

Loose Couplers
Combination Loose Coupler Parts and accessories.

Send 3c stamp for literature which is sure to interest you.

J. F. ARNOLD

2082 Lexington Av. N.Y.
Established 1910

CATALOG J.

Contains 24 pages of reliable apparatus, standardized parts and raw materials. Complete line switch points, knobs, switches, rod, aerial wire, etc.

Send 5c in stamps for your copy today.
Shotten Radio Mfg. Co., P. O. Box 3, Scranton, Pa.

Universal Radio System

Up to the minute radio apparatus for progressive users who can recognize quality.
Send stamp for catalogue.

Universal Radio Mfg. Corp.

Dept. W

Elmira, N. Y.

LEARN WIRELESS

At the OLDEST, LARGEST and BEST EQUIPPED school of its kind in New England. Positions guaranteed. Thousands of satisfied graduates all over the world. Splendid opportunities now in the Merchant Marine. Day and Evening classes. Start any Monday.

EASTERN RADIO INSTITUTE

899 Boylston St.

Boston, Mass.

WIRELESS Apparatus, Raw Materials, Magnet wires, motors, experimenters' needs, novelties listed in our Catalogue C-3. Assure yourself of prompt service and right prices by buying from this world famed, reliable, Experimenters' Supply House. 99 of every hundred orders received shipped within 24 hours. Catalogue C-3 FREE on request.

THE NEWMAN-STERN CO., Cleveland, O.

"I certainly would," I rejoined, instantly. "This thing's got my goat."

"All right, then. I'll stop for you on my way down."

I lay awake for hours trying to figure out how the thing could have been done. There didn't seem to be a plausible explanation. If the facts in the case had been handed to me as a sort of a puzzle, I would have said that it simply couldn't be done. And yet—there was the dead man.

Eventually I gave it up and fell into a restless slumber.

Next morning Fenner called for me as arranged. "Well," he asked, cheerfully, "have you solved the mystery over night?" "No," I said. "It seems more baffling than ever after a night's thought. Have you found the answer?"

"Not yet. Do you happen to have a good pair of field glasses?"

I had, and I produced them. "That's fine," said Fenner after examining them. "Let's go."

We had no trouble getting into Corey's offices. The body had been removed, and practically all traces of the tragedy had disappeared.

Fenner dropped into the chair which so lately had been used by the hapless victim. As he sat at the desk his back was to the window, which had been closed.

"Well," he mused, "how was this man killed? If this chair could only talk. Suppose I was across the street in another building. Ah! Say I'm an old whaler. I have a harpoon and a coil of rope. The window is open in this office. That broad back is a fine target — Bill, look out that window and see if I couldn't do it."

I turned to Fenner, and in my most sarcastic tones I said: "You could, Joe, if you had an educated harpoon. After you threw it, it would pause cannily in mid-air, turn at an angle of forty-five degrees, leap agilely up about six stories, make another forty-five degree turn, slide gracefully thru the window, and —"

But Fenner was on his feet and beside me. His face was grave, but his eyes twinkled. "Sufficient, William," he said, "your sarcasm is excellent, but I'm too busy to listen to the rest of it. Let's have those field glasses."

Ten minutes past. I began to grow fidgety, when he suddenly handed the glasses to me. "Bill," he said, "do you see that building out there—the one that appears to be as high as this one?"

"I do," I replied. "That could only be the Yeakle. It and the Atwood are the two tallest buildings we have."

"Well, look it over carefully, and tell me if you make out a clothes line on the roof."

I gazed. At first I didn't see one, but presently I located it. I told Fenner that there was undoubtedly a clothes line there.

"So I thought," he said, absently. "Well—let's call Davidson over here. It's up to him now."

I stared, amazed. "Up to him," I parroted. "What's up to him?"

"The arrest of the murderer," said Fenner, rather impatiently. "You're on to the thing, aren't you?"

"Do you mean that you know who killed Corey?" I asked, excitedly, as Fenner reached for the telephone.

He paused with his hand on the receiver. "No, I don't. But I know what he was killed with—and Davidson will find out the rest."

"Well," I demanded, "what was he killed with?"

Fenner called a number into the 'phone and gave me a sweet smile over his shoulder as he waited. "That chunk of clothes line, and—" he grew exceedingly sarcastic, "an educated harpoon."

Nor would he say more until Davidson, with Frank at his heels, burst into the room seething with excitement.

Get The JOY Out OF LIFE



WHAT'S the good of living at all, if Life is just one miserable day after another, full of discomfort and failure, often of actual suffering? You can't enjoy life, or make a success of anything, while you are undeveloped, weak, ailing; a sickly grouch whom nobody wants to help along or even have around. When you wake up in the morning with a rotten taste in your mouth and a weight in your chest; with your brain woozy and your nerves all on edge, tired out before you even begin the day, **YOU ARE IN A BAD WAY.**

Put Your Human Machine In Order

STRONGFORT
The Perfect Man

Dyspepsia, indigestion, biliousness, constipation, nervousness, and a host of other ailments are simply signs that your internal machinery is not running right—that **REPAIRS ARE NEEDED**—fresh blood, new and vigorous body and brain tissues. It isn't the discomforts you suffer from such chronic ailments that is important; it's the serious internal condition that they indicate. Heed those warnings of Nature. **Make the needed repairs before it is too late.** You never will be well and strong and capable until you do. You will get worse—each day—until the final collapse or breakdown comes. That is the Law of Nature. There's no dodging or getting away from the penalty she exacts when her warnings are not considered.

Make Yourself Fit

You can do it, if you will only make up your mind to get out of the way of putting the matter off "until tomorrow" and begin at once to Build Up yourself. Nature has implanted in every human organism a wonderful revivifying, revitalizing force, which she will exert to the utmost when you learn her methods and observe her laws. Patent medicines won't put you right. Druggist's dope won't do you any good.

Let Me Show You Nature's Way

I have spent my life studying Nature's methods of building up and revitalizing without broken-down humanity. Her laws are fixed, immutable, absolute, operating for every individual alike. I KNOW what they can and will do for YOU, through my own experience and that of thousands of my pupils, who came to me weak, ailing, discouraged, and are now strong, well, able, ambitious men and women. It makes no difference what your present condition is; it makes no difference whether or not it was caused by your own early indiscretions or excesses. Let me show you the straight, sure path back to health and strength and happiness. It's Nature's way, and there's no more doubt about the operations of Nature in the human frame than there is of the daily rising and setting of the sun.

Send for My Free Book

It will tell you all about Strongfortism, the Science of gaining and maintaining vitality and vigor in Nature's way—NOT through any iron-clad courses of muscle-trying exercises, starvation diets or any other fanciful fads—but by Living Life as Nature meant it to be lived, and thereby getting the greatest enjoyment out of it. Write now for a copy of "Promotion and Conservation of Health, Strength and Mental Energy," Don't put off sending for it. IT'S FREE, but it's worth good money to you, as you will see when you have read it. Fill out the coupon below and enclose it with three 2c stamps to cover packing and postage and I will mail you a special letter with the book on the subject you are most interested in.

LIONEL STRONGFORT

Physical and Health Specialist

1240 Strongfort Institute, Newark, N. J.

— CUT OUT AND MAIL THIS COUPON —

Mr. Lionel Strongfort, Newark, N. J.
Dear Strongfort:—Please send me your book, "Promotion and Conservation of Health, Strength and Mental Energy," for postage of which I enclose three 2c stamps to cover mailing expenses. I have marked (X) before the subject in which I am interested. (1240)

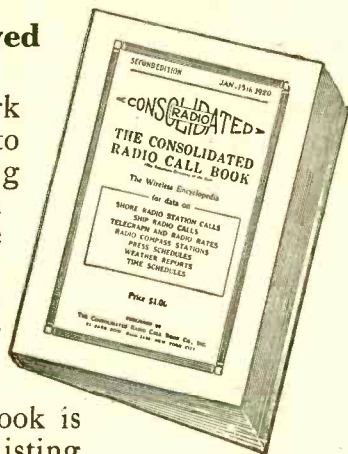
- | | | |
|----------------|-------------------|----------------------|
| ... Colds | ... Deformity | ... Weak Eyes |
| ... Catarrh | ... Insomnia | ... Falling Hair |
| ... Asthma | ... Heartweakness | ... Poor Memory |
| ... Obesity | ... Short Wind | ... Rheumatism |
| ... Headache | ... Flat Feet | ... Poor Circulation |
| ... Thinness | ... Constipation | ... Skin Disorders |
| ... Rupture | ... Biliousness | ... Dependancy |
| ... Neuritis | ... Torpid Liver | ... Round Shoulders |
| ... Neuralgia | ... Indigestion | ... Lung Troubles |
| ... Flat Chest | ... Nervousness | ... Increased Height |

NAME.....
AGE..... OCCUPATION.....
STREET.....
CITY..... STATE.....

The Second Edition of the Consolidated Radio Call Book

Has Been Unavoidably Delayed

owing to the vast amount of work involved in bringing it right up to date and in compiling the big amateur section that will be a special feature. We urge all those who have placed their orders to be patient—you'll be glad you waited when you receive your copy, which will be very soon.



The Consolidated Radio Call Book is the only book in print officially listing all the radio calls as issued by the Bureau of Commerce. Every vessel and land station in the world is represented and listed alphabetically, according to names of vessels or land stations, and according to call letters; Revision of American coastal stations under U. S. Naval control, and their new calls.

All Amateur Calls Also Listed

SPECIAL Given Free with Each Copy

A Wireless Map of the World in colors is given absolutely free with each copy. This map shows the locations of all the high powered RADIO stations in the world, including the time signal stations. In addition it tells at a glance how far away any of these stations are. Of greater interest are the time zones, which enable the amateur to compute instantly the correct time for the zone in which he is located from any time signal station.

Price \$1.00 Prepaid

Either Direct from us or for sale by
the following responsible Dealers:

American Electro Technical Appliance Co.
235 Fulton St., New York, N. Y.
Atlantic Radio Co.
34 Battery March St., Boston, Mass.
L. Bamberg & Co.
Newark, N. J.
Cutting & Washington Co.
6 West 48th St., New York City.
L. W. Cleveland Co.
441 Congress St., Portland, Me.
J. H. Bunnell & Co.
32 Park Place, New York City
Doubleday Hill Electric Co.
719 Liberty Ave., Pittsburg, Pa.
Lester I. Jenkins
923 Purchase St., New Bedford, Mass.
A. T. Hovey
61 Belvidere St., Boston, Mass.
Klaus Radio Apparatus
Eureka, Ill.
Manhattan Electrical Supply Co.
17 Park Place, New York City
114 S. Wells St., Chicago, Ill.
McCarthy Bros. & Ford
75 W. Mohawk St., Buffalo, N. Y.
E. P. Noll & Co.
21 N. 7th St., Philadelphia, Pa.

Nola Radio Co.
134 Chartres St., New Orleans, La.
Newman-Stern Co.
1874 E. 6th St., Cleveland, Ohio
National Radio Supply Co.
1405 U St. N. W., Washington, D. C.
Pioneer Electric Co.
137 E. 5th St., St. Paul, Minn.
James W. Poole, Inc.
16 Columbia St., Boston, Mass.
F. D. Pitts Co.
12 Park Square, Boston, Mass.
Precision Equipment Co.
2437 Gilbert Ave., Cincinnati, Ohio
Radio Distributing Co.
4 West Park St., Newark, N. J.
Reuter Electric Co.
34 E. 6th St., Cincinnati, Ohio
Radio Equipment Co.
639 Washington St., Boston, Mass.
Southern Electrical Co.
3d and E Sts., San Diego, Cal.
H. E. Williamson Electric Co.
316 Union St., Seattle, Wash.
Jos. M. Zamolski Co.
Baltimore, Md.

Published by

Consolidated Radio Call Book Co., Inc.
41 Park Row, New York City

"What's this, Joe," panted the Chief. "Find something? Got anything?"

Joe leaned back in his chair, and I saw that he was enjoying himself immensely. "Yes, Chief," he said, cheerfully, "I know what Corey was killed with."

The Chief darted a fiery glance at Frank. "Find it in here some place, did you?" he barked.

"No," I could positively feel Frank's relief, "but I know what it was done with."

"Damn," exploded the Chief. "So do I. It was a knife, but where—"

"Oh, no, it wasn't," smiled Fenner. "It was a harpoon."

The Chief's lower jaw sagged and Frank darted to the window. Then he turned back listlessly to Joe. "Come again, Fenner," he said. "It can't be done."

"Not from those buildings below very handy," admitted Joe, "but this harpoon came from the Yeakle."

The Chief laughed shortly. "That's a poor joke, Joe," he snapt. "The Yeakle is a good quarter of a mile away."

Fenner laughed. "Yes, but this was an educated harpoon," he said.

The detective Frank gave a sudden start. "I get you, Fenner," he yelled, and he was in motion while he spoke. "And I'll get him and bring him here."

"Hey," yelled the Chief, "What—"

But a slamming door was the only answer. Frank was gone.

Davidson turned to Fenner. "What kind of a game is this?" he demanded. "You're a pair of crazy asses, you and Frank. Now tell me what you're up to."

"Bright boy, Frank," observed Fenner, "it didn't take him long to tumble, once he got the tip. Now sit down and wait until he gets back."

For a half hour we waited in silence. Fenner smoked nonchalantly and refused to talk. The Chief fumed and paced the room. "A waste of time," he muttered again and again. The minutes dragged by.

And then the door opened and Frank pushed into our presence a swarthy little man with wax mustaches and a decidedly foreign air. He was handcuffed. Two uniformed policemen came behind, bearing a long wooden box, which they placed on the desk. "Here's the bird, Chief," chortled Frank; "Fenner you're a dandy."

The Chief and I stared. "Sure you got the right man?" he demanded. Then to the prisoner, "What have you got to say? Remember, it may be used against you."

"There is nothing to say," said the prisoner, in perfect English, "except that I killed Corey—"

"You confess?" yelled the Chief.

The man shrugged hopelessly. "Confess!" he echoed, "what else is there to do? I suppose you want to know why. Well, because Corey ruined me financially. He stole my purse; I stole his life. But I'd like to know how you picked up the trail."

Fenner stepped over to the unfortunate man. "I found it," he said, simply. "Why didn't you keep that clothes line of yours indoors?"

The man started, paled, then cried in anguish, "My God, I never thought of that. I could have, couldn't I?"

"You could," agreed Fenner, grimly, "and if you had, you never would have been caught. Send him over, Chief, and I'll tell you how the trick was done."

The man departed in charge of the two officers and Fenner tore the lid off the wooden box which the officers had brought. He turned to me. "And here, Bill," he said, mockingly, "is your educated harpoon."

And he placed before my astonished eyes an educated harpoon in very truth. It was a small airplane, wirelessly controlled, and its nose was a long, bayonet-like knife.

"Then the clothes line—"

INVESTMENT

is a magazine that is teaching thousands of people how to make a profit on listed stocks and bonds. Write for this week's issue, which contains up-to-date information about several established securities that can be bought now to yield a liberal return. INVESTMENT IS FREE. WRITE TODAY.

KRIEBEL & CO.
INVESTMENT BANKERS
141W South La Salle St. Chicago

ORDER IT TO-DAY
See page 1235

LEARN ENGINEERING

Expert electrical engineers are being paid fabulous salaries—thousands needed today. We give you personal and thorough training—practical, technical courses 3 months to 2 years under expert engineers in electricity, steam, gas, auto, armature winding, drafting, etc. Extensive laboratory and shop equipment. Not a trade school. Training is condensed—if your time is limited, come to the Finlay Engineering College—only one of its kind in the West. Day and night sessions—enroll anytime. Write for FREE catalog, a post card will do.

FINLAY ENGINEERING COLLEGE
1003 Indiana Ave. Kansas City, Mo

MATHEMATICS MADE EASY

The Arcosopes—the Combination Triangle with a Brain—will multiply, divide, figure percentage and proportion, solve all problems in trigonometry and geometry, draw symmetrical figures, plot arcs, etc. Superior to any slide rule. Simple to operate. Also includes a TRANSPARENT TRIANGLE, PROTRACTOR and THREE RULES. Used at Columbia University, West Point, U. S. Aeronautic Schools, etc. Only 83 cents Postpaid. Order today before you forget.

Dept. J, L. J. LEISHMAN CO., Ogden, Utah

SELENIUM CELLS

Made by entirely new process. Highly sensitive and quick-acting. Suitable for all experiments. From \$5 up.

Write for Catalog

Selenium Laboratories
Good Ground, Long Island, N. Y.

Fun, Magic and Mystery!

56 Feats in Magic, 250 New Jokes, 21 Puzzles, 1 Fortune Telling Tablet, 52 Money-Making Secrets, 15 Card Tricks, 71 Toasts, 58 Verses in Comic Poetry, 10 Funny Readings, 41 Epitaphs, and 11 Parlor Pastimes. You get all the above-mentioned and our big illustrated Catalog of 125 Magic Tricks for only 10 cents. Write today.

DETROIT TRICK & NOVELTY CO.

454-456 Dix Avenue Detroit, Mich.

STAMMER

If you stammer attend no stammering school till you get my big new FREE book and special rate. Largest and most successful school in the world curing all forms of defective speech by advanced natural method. Write today North-Western School for Stammerers, Inc., 2331 Grand Ave., Milwaukee, Wis.

STUDY HUMAN NATURE
MAKE PEOPLE LIKE YOU get along better, make more money, develop a winning personality, learn to know people as they are. Send 5 cents (stamps) for "Personal Power," a little book that points the way. Address, Progress League, 2931 Union Sq., New York.

SPEED LATHES, GASOLINE ENGINE CASTINGS
M. & J. Specialty Co., 252 South Park St., Pontiac, Michigan

"Was his aerial," cut in Joe, "and for the distance over which he wanted to work he might just as well kept it inside. Just look this thing over carefully, old man." It's a shame that fellow stooped to murder. He has ideas worked out here that would have retrieved his fallen fortunes. Notice that the airplane attachment is really two complete planes. I've been wondering ever since I realized how the job was done; how under the sun, after the knife was buried in Corey's back, it was gotten out again. Now I see. When it came thru that window the wings were right back of the propeller and the knife and the rudder were in the rear. Now notice the hinging arrangement which folded those wings into a rudder and opened the rudder out into a complete set of wings. The whole machine was reversed. Even an auxiliary propeller has been provided. And the lag of the knife in the wound held the whole thing like a brake just long enough for the propeller to get up speed before it gave and released the machine. At that the fellow must have had an anxious minute until he got the contrivance out thru the window again. Only the fact that this is a large room allowed him to get the machine high enough to clear that window sill on its way out. The selective control offers nothing new. The control points are constantly traversed by a revolving, clock-work driven switch, and these miniature vari-colored lights were the tell-tales that told the distant pilot on what contact point the blade rested at any given minute. For instance, when the light showed red, the rudder could be swung to the right; when on green to the left. He followed its course thru powerful night glasses. Take a look at this coherer. You never saw the like before. I'll bet it's a peach. And this relay's weight or rather, lack of it, would amaze you. But the masterpiece of the whole thing is the power plant. He must have worked for months on this model gasoline engine. I can imagine that for its weight it produces an awful power, and it is absolutely silenced.

"There are at least a dozen new ideas involved here, and new applications of hundreds of old ones. Under the spur of a great emotion—REVENGE—this man has produced a thing of terrible possibilities. You have seen what happened to Corey."

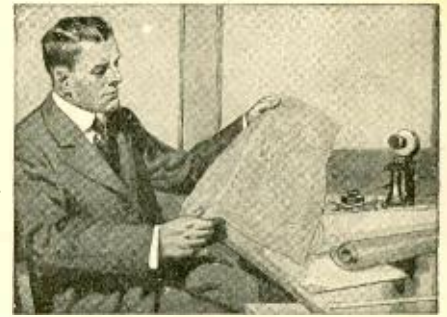
The Chief and I were gazing in awe at the little plane. I appreciated the disposition of wing surface which cut down the span sufficiently to allow it to pass thru a window three feet in width. And I realized the patient paring away of a fraction of an ounce there that brought the total weight of the machine low enough to allow of the small supporting surface. There was not an unessential piece of material to be found on the plane. The only thing not needed in the operation of the thing was the knife, and even it had been ground down until it was little more than a very thick needle along its length, with a large cutting surface at its point.

The Chief finally broke the silence. "I think," he said, "that the educated harpoon is too dangerous a contrivance to survive. Science may need a lot of these do-funny things on it, but it will have to worry along without them. The details will not be made public, and just as soon as that man is convicted I'm going to personally destroy it."

Fenner nodded thoughtfully. "Yes," he agreed, "it's a shame to do it, but God help us all if its constructional features become known."

He lifted it tenderly and placed it in the wooden box. With the lid in his hand he paused, looking down. His eyes shown with the love of an enthusiast for the delicate, wicked, creation. "Good-bye, Educated Harpoon," he breathed.

Mechanical Engineering



Learn at Home!

Employers everywhere are looking for men with mechanical ability. Splendid salaries and rapid advancement are offered.

There is an easy, delightful way in which you can learn right at home in spare time. For 28 years the International Correspondence Schools have been giving men and women just the training they need for success in mechanical engineering and more than 200 other subjects. Hundreds of thousands have stepped into good positions through I. C. S. help, but never were opportunities so great as now.

Let the I. C. S. help you. Choose the work you like best in the coupon below, then mark and mail it today. This doesn't obligate you in the least and it will bring you information that will start you on a successful career. This is your chance. Don't let it slip by. Mark and mail this coupon now.

INTERNATIONAL CORRESPONDENCE SCHOOLS BOX 6229, SCRANTON, PA.

Explain, without obligating me, how I can qualify for the position, or in the subject, before which I mark X.

- | | |
|--|--|
| <input type="checkbox"/> ELECTRICAL ENGINEER | <input type="checkbox"/> CHEMICAL ENGINEER |
| <input type="checkbox"/> Electrician | <input type="checkbox"/> SALESMANSHIP |
| <input type="checkbox"/> Electric Wiring | <input type="checkbox"/> ADVERTISING MAN |
| <input type="checkbox"/> Electric Lighting | <input type="checkbox"/> Window Trimmer |
| <input type="checkbox"/> Electric Car Running | <input type="checkbox"/> Show Card Writer |
| <input type="checkbox"/> Heavy Electric Traction | <input type="checkbox"/> Outdoor Sign Painter |
| <input type="checkbox"/> Electrical Draftsman | <input type="checkbox"/> RAILROADER |
| <input type="checkbox"/> Electric Machine Designer | <input type="checkbox"/> ILLUSTRATOR |
| <input type="checkbox"/> Telegraph Expert | <input type="checkbox"/> DESIGNER |
| <input type="checkbox"/> Practical Telephony | <input type="checkbox"/> BUSINESS MANAGEMENT |
| <input type="checkbox"/> MECHANICAL ENGINEER | <input type="checkbox"/> Private Secretary |
| <input type="checkbox"/> Mechanical Draftsman | <input type="checkbox"/> BOOKKEEPER |
| <input type="checkbox"/> Ship Draftsman | <input type="checkbox"/> Stenographer and Typist |
| <input type="checkbox"/> Machine Shop Practice | <input type="checkbox"/> Cert. Pub. Accountant |
| <input type="checkbox"/> Toolmaker | <input type="checkbox"/> Traffic Management |
| <input type="checkbox"/> Gas Engineer | <input type="checkbox"/> Commercial Law |
| <input type="checkbox"/> CIVIL ENGINEER | <input type="checkbox"/> GOOD ENGLISH |
| <input type="checkbox"/> Surveying and Mapping | <input type="checkbox"/> STATIONARY ENGINEER |
| <input type="checkbox"/> MINE FOREMAN OR ENG'G'R | <input type="checkbox"/> CIVIL SERVICE |
| <input type="checkbox"/> ARCHITECT | <input type="checkbox"/> Railway Mail Clerk |
| <input type="checkbox"/> Architectural Draftsman | <input type="checkbox"/> Textile Overseer or Supt. |
| <input type="checkbox"/> PLUMBING AND HEATING | <input type="checkbox"/> AGRICULTURE |
| <input type="checkbox"/> Sheet Metal Worker | <input type="checkbox"/> Poultry Raising |
| <input type="checkbox"/> Navigator | <input type="checkbox"/> Spanish |
| | <input type="checkbox"/> French |
| | <input type="checkbox"/> Automobiles |
| | <input type="checkbox"/> Italian |

Name _____

Present Occupation _____ 7-28-19

Street and No. _____

City _____ State _____



WANTED-Railway Mail Clerks

\$1300 First Year

Hundred Men—
Women Needed

paid Vacation.
Life Job. Pull
Unnecessary.

FRANKLIN INSTITUTE
Dept. R101 Rochester, N.Y.
Sirs: Send me, without charge (1) sample of Spring Railway Mail Clerk Examination questions; (2) schedule showing places of all U. S. Government coming examinations; (3) list of other government jobs open to men and women and (4) free book describing them.
Name _____
Address _____

Opportunity Ad-lets

YOU will find many remarkable opportunities and real bargains in these columns. It will pay you to read and investigate the offerings made every month by reliable firms, dealers and amateurs from all over the country. No matter what you may be seeking, whether supplies, automobile accessories, the opportunity to make money, or anything else, you will find listed here the best and most attractive specials of the month.

Advertisements in this section nine cents a word for each insertion. No advertisements for less than 75c accepted. Name and address must be included at the above rate. Cash should accompany all classified advertisements unless placed by an accredited advertising agency. Ten per cent discount for 6 issues, 20 per cent discount for 12 issues. Objectionable or misleading advertisements not accepted. Advertisements for the June issue must reach us not later than April 28.

The Circulation of the Experimenter is over 150,000 and climbing every month

EXPERIMENTER PUBLISHING CO., INC., 233 Fulton Street, New York, N. Y.

Auto Accessories.

Wanted—Good live selling agents for our garage testing instruments and publications. Write for catalogue and particulars. H. E. Phillips & Company, Service Division, Union City, Ind.

Fords run 34 miles per gallon with our 1920 carburetors. Use cheapest gasoline or half kerosene. Start easy any weather. Increased power. Styles for all Motors. Runs slow in high gear. Attach yourself. Big profits for agents. Money back guarantee. 30 days' trial. Air-Friction Carburetor Co., 270 Madison Ave., Dayton, Ohio.

Four Dollars Insures You for life against being kicked cranking your Ford. Write today for free booklet "KANT-KICK." The Safety Device for Cars. Easily attached. Buffum Tool Co., Louisiana, Mo.

Miracle Motor-Gas amazes motorists. 3c worth equals gallon gasoline. Eliminates carbon. 300% profit. Isom, Idaho, wires: "Ship 500 packages. Made \$70 yesterday." Investigate. Chas. K. Butler, Co., Toledo, Ohio.

Battery Charging pays big profits. City current or gas engine operates. Easy terms. Hobarts, Troy, Ohio.

Auto Motors and Supplies. Buick, Hupp, Franklin, Michigan, Everett, Hudson, Chalmers. Both water and air-cooled motors, \$40.00 each and up. Bosch Magnets, \$15.00 each and up. Presto Tanks, \$5.00. Coils, Carburetors, Head Lamps, Horns, Air Compressors, Generators, Starters. Write for bargain bulletin second hand auto accessories. Johnston, West End, Pittsburgh, Pa.

Tires—Direct to you prices. Exclusive representatives wanted each locality to use and sell Mellinger Extra Ply Tires. Guarantee Bond 8,000 Miles. Sample Sections furnished. Mellinger Tire Company, 980 Oak, Kansas City, Missouri.

Power increased, carbon eliminated; results guaranteed. Write for booklet. No-Leak-O Piston Ring Co., Baltimore, Md.

Save-All Carburetor Attachment makes Fords run better. Gives more miles, power and speed. Free trial. Savall Company, 3716 North Clark Street, Chicago.

Aeronautics.

Flying School. We teach you to fly. Lowest rates consistent with the service we render. New classes always forming. Philadelphia Aero-Service Corporation, 636 Real Estate Trust Building, Philadelphia.

100 Model Aeroplanes. Good flyers. 15c brings working Drawings and Prices. F. Bruland, Redford, Mich.

Scout Airplane, all metal, Military model. Complete with wheels and propeller. A beauty; 50 cents postpaid. Immediate delivery. American Airplane Works, Chevy Chase, Md.

Ornithopter and gravity flyer with warping and adjustable wings 16"x22". Durable and scientific. The only successful flapping flyer made. Price, \$3.00. Adams Aeroplane Co., 252 West 53rd St., N. Y.

Blue Jay Monoplane. Build it yourself. 3500 feet altitude with motorcycle engine. Complete plans \$5.00. Send stamp for full information. Mitchison Bros., Baltimore, Md.

Motorcycles.

Bargains in Rebuilt Motorcycles. Lowest prices. Indians, Excelsiors, Harleys. Overhauled. Tested by experts. Guaranteed. Shipped subject to inspection. Write for free list. We furnish Bank References. Floyd Clymer, Desk E, "Largest Motorcycle Dealer in Western America," Denver, Colorado.

Scenery For Hire.

Collapsible Scenery for all plays. Decorations. Amelia Grain, Philadelphia.

American Made Toys.

We Offer an Opportunity to manufacturer with facilities for large production, also to homeworkers on smaller scale, to manufacture Metal Toys and Novelties. Unlimited field and enormous business open for ambitious people. No experience required. No tools needed. Our casting-forms turn out goods complete. Since the different Toy Expositions, manufacturers are covered with orders until December. You can enter this field now, by manufacturing "American Made Toys." We furnish casting-forms for Toy Soldiers, Army, Navy, Marine, Cannons, Machine Guns, Indians, Cowboys, Warships and other novelties. Casting-forms, complete outfit, \$3.00 up. We buy these goods, direct from manufacturers. Yearly contract orders placed with reliable parties. We pay very high prices for clean painted goods. Samples furnished. "Bird-Whistles," great seller, just added to our stock list. Booklet, Information, Instruction free, if you mean work and business. No others invited to write. Toy Soldier Manufacturing Co., 32 Union Square, New York.

Novelties.

Big Trick and novelty catalog free. United Sales Co., Springfield, Ill.

"New" Magazine Bead Necklaces. \$1.50, postpaid. All colors. The Oddity Centre, 60 Vine St., Wyandotte, Mich.

Office Devices.

Multigraphs, Addressographs, Duplicators, Sealers, Folders. Less than half price. Guaranteed one year. Pruitt Company, 112-C North La Salle, Chicago.

Addressographs, Multigraphs, Duplicators, Folders, Sealers Bought, Sold. Guarantee. Office Device Company, 156-X North La Salle, Chicago.

Phonographs.

Build your own phonographs and manufacture them for profit. Drawing, Instructions, Parts Price List, Blue Print, etc., complete, sent free upon request. Write today. Associated Phonograph Co., Dept. E1, Cincinnati.

Make Your Own Phonograph. Particulars free. DeSciO-Phone, P. O. Box 720, Attica, Indiana.

Build Your Phonograph. "Perfection" high-quality spring and electric motors, tone arms, reproducers. Wonderful results. Big saving. New catalog and building instructions mailed for 10 cents. Indiana Phonograph Supply Co., Indianapolis, Ind.

Build Phonographs—Reliable Dayton Motors, Tone Arms, Hardware and Accessories. Illustrated Catalogue for two cent stamp. Sam R. Kremer, 118 Court Ave., Dayton, Ohio.

Build your own phonograph. Other companies sell parts. We show how to make them. Plans 50c. Wright, 541 Commercial Ave., Superior, Ncb.

Postcards and Pictures.

Classy Pictures—Do you like real "snappy" pictures? Boys, these are all nifty pocket size pictures and we know you will like them. Make fine den decorations. Send for a set today. Prices, \$1.00 per dozen; set of 30 for \$2.00. Fifty for \$3.00. Two samples, 25c. United Sales Co., Springfield, Ill.

Girls in bathing costume, 15 beautiful postcard size photographs \$1, or ten 5x7 for \$1. Sample of each 25c. Money refunded if dissatisfied. A. D. Tinklepaugh, 3440 5th Ave. So., Minneapolis, Minn.

Rare Real Photos. Bathing beauties, models, the right kind. We are reliable. Samples 25c coin. Artiste. Auburn, Ind.

High Art Subjects. Beautiful models in classic poses. Send 10c for illustrated miniature reference sheet and price list. United Sales Co., Springfield, Ill.

Blueprints.

Blueprints. Learn blueprint reading. From 33 large Blueprints. It matters not what line you are in. We show you how. It's easy. It's job insurance. Get our circular—or send \$1. We will mail you first four Blueprints. If satisfactory order the balance. Chas. J. H. Freeth, Consulting Chief Draughtsman, Mechanic Improvements Association, Dept. 24, 1628 W. Lehigh Ave., Philadelphia, Pa.

Chemicals.

Experimenters, are you interested in novel, chemical experiments? Send 10c for large collection. Merel Sager, 44 Apple St., Tiffin, Ohio.

Newest, Chemical, Novelty. Send 15c. Walter Hunter, Swedesboro, N. J.

20 Different Chemicals, 75c. 15 different chemicals, 50c. (No stamps accepted.) Leslie Evans, Box 86, Audubon, N. J.

Microscopes, Chemicals, apparatus, laboratories! Everything for the experimenter. Send for price list. Radio Chemical Supply Co., 915 Westcott St., Syracuse, N. Y.

Photo Developing.

Mail us 15c. with any size film for development and six velvet prints. Or send six negatives any size and 15c for six prints. Or send 25c for one 8 x 10 mounted enlargement. Prompt, perfect service. Roanoke Photo Finishing Co., 255 Bell Ave., Roanoke, Va.

Clean, Neat, Perfect Kodak Finishing at the lowest prices. Work returned the same day received. Send film for sample print and copy of catalogue on developing, printing, enlarging and hand coloring, also copy of Photo Craft Magazine, which will help you make better pictures. Photo Craft Co., Box 69, Ann Arbor, Mich.

Dancing Instruction.

Learn Fox-Trot, Waltz, Two-Step and One-Step in your own home by wonderful Peak System of Mail Instruction. Thousands taught successfully. No music needed. Write for free information. William Chandler Peak, M. B., Room 231, 821 Crescent Place, Chicago.

Electrical Supplies and Appliances.

Battery Charging pays big profits with HB Equipment. Electric Light Generators and Motors can also be furnished on easy payments. Full information free. Hobart Brothers, Troy, Ohio.

Storage Batteries. Learn to make them for Automobiles; we furnish everything. Sample plates, 40c. Windsor Specialty Co., 5419 Windsor Ave., Chicago, Ill.

Small Induction Motor castings and punchings. Robert Vondrau, Preston, Ont., Canada.

Inventors: Models, Dies, Tools, 28 years' experience, work guaranteed, lowest price. Manufacturing of specialties our hobby. Peerless Die & Tool Co., 121 Opera Pl. D. B., Cincinnati, Ohio.

Mansfield's Automatic Water and Oil Finder a proved success, silver medal awarded. Particulars from Edwin A. Mansfield & Co., 94 Victoria Road, New Brighton, England.

Blueprints—Motor connections. 236 A.C. Single, two, and three phase, including voltage, cycle, phase, speed changing. 123 D. C. diagrams. Shows voltage changing, testing, etc. 120 Transformer diagrams. Single, two, and three phase. 170 rheostats, controllers, compensators, automatic starters, and voltage regulating devices, with both internal and external connections. 10 Samples A. C. 25c. Particulars free. Charles Chittenden, Dept. A, 3024 Matthews Avenue, Kansas City, Missouri.

Welding Instructions for operating Oxy-Acetylene apparatus on all metals; sent postpaid fifty cents. Address E. E. Bertschy, Cedar Rapids, Iowa.

Agents Wanted.

Traveling Men, Women—Best side line in the world; nothing to sell; information only. J. H. Walker, Boulder, Colo.

Agents. Sell raincoats, gabardines, leatherettes. We deliver and collect. No advance payments. Sample coat free. Largest commissions. Temple Raincoat Co., Box 9, Templeton, Mass.

Your Opportunity. Get in business for yourself; mail order or local; manufacture your own products; employ other agents; everything given clearly in our big magazine of plans, schemes and ideas. Three months, 25c.; sample copy, 10c. Special Service, 421 Shannon Bldg., Pittsburgh, Pa.

Science creates new auto wonder. Solves puzzling problem; no more rain or snow-blurred windshields; Mystic Cloth, works like magic; deposits invisible chemical film; one rub keeps glass clear 24 hours; one agent sold 5,000. Security Mfg. Co., Dept. 242, Toledo, Ohio.

Wanted. Agents to call on garages and service stations. Best line of testing instruments and publications on the market. Complete catalogue, H. E. Phillips & Company, Service Division, Union City, Ind.

Beginners—Complete Mail Order System. C., Box 1005, Atlantic City.

Men and Women make big daily cash profits in handling our Patented "Stick-On" Window Lock. Locks window when open for ventilation. Stops rattling. Instantly attached or removed. No screws or tools necessary. Prevents children from falling out of open window. Big demand; sells on demonstration; as many as one dozen to each home. Whole or part time. Mail 10c for sample and proposition. Address Room 202, 147 Fourth Ave., New York City.

Agents. Big returns, fast office seller; particulars and samples free. One Dip Pen Co., 12 Daily Record Bldg., Baltimore, Md.

500 Agents wanted at once for Mitchell's magic marvel washing compound; 300% profit, enormous repeater. Washes clothes spotlessly clean in 10 to 15 minutes; 1,000 other uses in every home. Astounds and delights every woman. Nothing else like it. Nature's mightiest cleanser. Contains no lye, lime, acid or wax. Free samples furnished to boost sales. We positively guarantee the sale of every package. Exclusive territory. Own your own business. You cannot fail to make big money. Barber, Ohio, made \$600 last month. Send for free sample and proof. Hurry, hustle, grab this chance. L. Mitchell & Co., Desk 318, 1312-1314 E. 61st St., Chicago.

Agents—\$40-\$100 w.e.k.; free samples; gold sign letters; anyone can put on store windows; big demand; liberal offer to general agents. Metallic Letter Co., 433-Z, N. Clark, Chicago.

Make and Sell Your Own Goods. Formulas by Expert Chemists. Manufacturing Processes and Trade Secrets. Write for formula Catalog. Chapin Mystic Company, Washington, D. C.

Mexican Diamonds flash like genuine, fool experts, stand tests, yet sell for 1-50th the price. Few live Agents wanted to sell from handsome sample case; big profits, pleasant work. Write today. Mexican Diamond Imptg. Co., Box F1, Las Cruces, N. Mex.

Wonderful Chance. Men's Shirts and Furnishings at wholesale rates or make \$10 daily as agent starting real business. Goodell Co., 107 Duratex Bldg., New York.

\$10 Daily refinishing chandeliers, brass beds, automobiles by new method, without capital or experience. Free particulars and proofs. Write today. Gunmetal Co., Avenue D, Decatur, Ill.

Agents and Crew Managers, new fast-selling food specialty. Livest article. Packed your label. Write or wire. Federal Pure Food Co., 2303-H Archer Ave., Chicago.

Sign Letters for windows at honest prices. Genuine gold leaf. Chicago Sign System, G 326 River St., Chicago.

350% Profit—Whirlwind seller; Klean-Rite. Washes Clothes Quick without Rubbing. Samples free. Besco, 3233-E1 Belleplaine, Chicago.

Insyde Tyres, inner armor for automobile tires double mileage and prevent punctures and blow-outs; quickly applied; cost little; demand tremendous; profits unlimited. Details free. American Automobile Accessories Co., Dept. 54, Cincinnati, Ohio.

Wide-Awake Man to take charge of our local trade. \$4 to \$5 a day, steady. No experience required; pay starts at once. Write today. American Products Co., 1504 American Bldg., Cincinnati, Ohio.

Short Stories, Manuscripts, Wanted.

Short Stories, poems, plays, etc., are wanted for publication. Literary Bureau, 165 Hannibal, Missouri.

Song Writers.

If You Will Write—The words for a song I will write the music and guarantee publisher's acceptance. Poems on any subject acceptable. Ethwell Hanson, Room 131, 3808 Broadway, Chicago, Ill.

Business Opportunities.

You Can Earn \$50 to \$150 weekly writing advertisements. Experience unnecessary. Particulars for stamp. R. P. Koehler, 156 West Vernon, Los Angeles.

You can Earn over thirty dollars weekly working spare time for us. H. E. Phillips & Company, Service Division, Union City, Ind.

Free Information gladly sent regarding large earnings made Raising Canaries. Instructive, fascinating Pastime. No capital required. Bird Farm, Lynnhaven, Virginia.

Young Men to Sell Our Card Specialties. Easiest selling novelties in the world. Outfit Free. John W. Burt, Coshocton, Ohio.

3,384 Money-making Plans. Formulas. Trade Secrets. "Encyclopedia Business Opportunities." 3 volumes \$1. Ideal Book Shop, 5501-EV North Robey, Chicago.

Dollars Yearly in Your Back Yard. No ginseng, mushroom dope. New ideas. Investigate. Particulars free. Metz, 313 East 89, New York.

Money-Talks Magazine. Published for progressive men. Send for sample copy. 70-B Park Place, Newark, New Jersey.

Patents for Sale. To sell, buy or obtain patents write Patent News, 309, Washington, D. C.

\$1 Does It. Texas oil land making holders big money every day. Bank references furnished. Investigate us thoroughly, that's all we ask. Results count. Our plan \$1 down, balance monthly; few months gives you Warranty Deed to land. May pay profits \$200 or more monthly. Maps, reports, established facts FREE. Address Spurlake Texas Oil Co., 867 DeMenil, St. Louis, Mo.

Signs—Start a business at home, something every store needs. Learn to make Glass and Electric Signs by our new easy process without the use of brush. Big money, easy to learn. First sign will pay cost of learning. Morris Electric Sign & Mirror Co., Box 74, Westport Station, Kansas City, Mo.

Substantial manufacturing corporation wants capable men to establish branch and manage salesmen; \$300 to \$1,500 necessary. You handle own money. Will allow expenses to Baltimore if you will qualify. For particulars address Secretary, 416 N. Howard St., Baltimore, Md.

Enter a new business. Earn \$3,000 to \$6,000 yearly in professional fees making and fitting a foot specialty, openings everywhere with all the trade you can attend to; easily learned by anyone at home in a few weeks at small expense; no further capital required; no goods to buy; job hunting, soliciting or agency. Address Stephenson Laboratory, 18 Back Bay, Boston, Mass.

I Made \$30 a Week evenings with a small Mail Order Business. Home Free Booklet tells how. 2c postage. Alex Scott, Cohoes, N. Y.

Breed Canaries—Profitable pastime. Particulars free. Bird Farm, Lynnhaven, Virginia.

Help Wanted.

Detectives and Investigators are in demand. Travel and earn big money. Learn this fascinating profession by home study. Particulars free. American School of Criminology, Dept. E, Detroit, Mich.

Detectives Earn Big Money. Excellent opportunity. Particulars free. American Detective System, 1968 Broadway, New York.

Be a Mirror Expert. \$3-10 a day; spare time home at first; no capital; we train, start you making and silvering mirrors French method. Free Prospectus. W. R. Derr, Pres., 579 Decatur Street, Brooklyn, N. Y.

\$100 to \$150 Month. Hundreds openings. U. S. Government positions. Men-women, 18 up. Experience unnecessary. List positions free. Write immediately. Franklin Institute, Dept. R-26, Rochester, N. Y.

Detectives Make Big Money. Travel, be your own boss. Either sex. We instruct, small cost. Write Johnson's Detective School, 232 Sheldon Ave., Grand Rapids, Michigan, Dept. A.

Earn \$25 Weekly, spare time, writing for newspapers, magazines. Experience unnecessary; details free. Press Syndicate, 5665 St. Louis, Mo.

Wanted m. n. Become Automobile Experts. \$35.00 week. Learn while earning. Franklin Institute, Dept. R-806, Rochester, N. Y.

Firemen, Brakemen, Baggage-men, \$140-\$200 Colored Porters by Railroads everywhere. Experience unnecessary. 897 Ry. Bureau, East St. Louis, Ill.

Salesmen Wanted.

Salesman—Side or Main line, to sell low priced 5,000 mile guaranteed tires. 30x3 1/2 non-skid sells for \$11.95; other sizes in proportion. Good money making proposition for live wires. Write, Consolidated Tire Co., 616 So. Michigan, Chicago.

For the Photographer.

Do you take pictures? Write for free sample of our big magazine, showing how to make better pictures and earn money. American Photography, 465 Pope Building, Boston, Mass.

For Advertisers.

24 Words in 100 Syndicate Magazines, \$1.00; inch display, \$4.00. Lists free. Stanford Advertising Co., Pittsburgh.

Attention compelling, order coaxing letters, circulars, \$3. Mailpress, Swift Bldg., Cincinnati.

Money? Jacobus Art Ads make small space pay big dividends. Price \$5.00. Write today. Jacobus Service, 1073 Sanford Ave., Irvington, New Jersey.

Formulas.

1,000 Formulas, 25c. Luminous paint—Resilvering mirrors—Renewing dry batteries—Mechanics soap—Carbon remover—Gas tonic—Puncture plugger—20c each. Entire collection, 50c. Satisfaction guaranteed. Ideal Book Shop, 5501-EF North Robey, Chicago.

Million Tested Formulas, Trade Secrets, Processes. Everything! Thousand pages. Cost? Only \$2.00. Postpaid. Can I find it? Yes; and 999,999 others. Write us. L. Goodnow, Highland Ave., South Sudbury, Mass.

1,000,000 Formulas. Processes. Trade secrets for every business. 1016 pages, \$2. Ideal Book Shop, 5501-EE North Robey, Chicago.

Here's a "Hummer"—Valuable Veterinary Formulas, for the treatment of Mange, Distemper, Fits, Worms, Canker and Paralysis in dogs. As prescribed by a specialist, \$2.00 each, 6 for \$10.00. Compounded at any drug store. Practical Specialty Co., New Haven, Connecticut, Box 1525.

For the Hair

I Was Bald. Obtained hair growth by an Indian's ointment containing genuine bear oil and rare plant juices. Many others have had wonderful results. Fine for dandruff. Harmless. Will send box, postpaid, with recipe, 10c. John Hart Brittain, 150 E. 32d St., BB-300, New York.

Health Resorts.

"Youngborn" Butler, N. J. Nature Cure Institution. All Physical Culture and drugless methods employed. Ideal resort for rest and regeneration. Open all the year. Dr. Benedict Lust, Butler, N. J. New York City office: American School of Naturopathy, 110 E. 41st Street, Prospectus free. Explanatory literature, 25c.

Dr. B. Lust, Florida Drugless Health Resort. Wonderful results in stubborn cases. Best equipped, best located, best conducted Nature Cure Institution in the Sunny South. Open October first to June first. Benedict Lust, N.D., M.D., Tangerine, Fla.

Health.

Cigarette, pipe or chewing habit conquered. Guaranteed. Write for free brochure. Edw. J. Woods, TB-300 Station F, New York.

At Last! Constipation Permanently Removed Nature's Way. No drugs, internal baths, exercise or massage. Perfectly harmless. Easily made at home. Formula, \$1. B. White, 2310 Valentine Avenue, New York.

Tobacco or Snuff Habit Cured or no pay; \$1 if cured. Remedy sent on trial. Superba Co., SA, Baltimore, Md.

Pyorrhea (Rigg's Disease—Bleeding or Swollen Gums.) Hundreds have been helped by "Pyorem," the successful home treatment. Purifying, healing, preventative. Full month's treatment, consisting of a very beneficial massage paste and an antiseptic tooth-cleaning paste to be used in place of your ordinary dentifrice together with full directions for treatment, \$1 postpaid. Or, write for free Booklet "E." Pyorem Mfg. Co., 439 Seventh Street, Brooklyn, New York.

Too Fat? Reduce weight easily, pleasantly, no self-starvation, no strenuous exercise. Reliable, guaranteed. Obtain Oil of Korein at any busy pharmacy or write for free brochure to Korein Co., NA-300, Sta. F., New York.

Free—Stop using tobacco. We will give free information how to conquer habit easily and permanently. Results guaranteed. Anti-Tobacco League, Dept. C, Omaha, Neb.

For Men.

Books and Pictures—Catalog free. United Sales Co., Springfield, Ill.

Send Us Your Dull Safety Razor Blades. We will re-sharpen them so they shave like new blades for 3c each, any kind. Quick service. Entire satisfaction guaranteed. Antiseptic astringent pencil given free with every dollar order if you mention "Electrical Experimenter." Send your blades to-day. Keeneed Company, Inc., Dept. L, 184 Washington St., Chicago, Ill.

Get Vital Strength. Retain youthful vigor. Wonderful results. Intensely interesting booklet free. Winslow H. Chase, Washington, D. C.

Detectives Earn Big Money. Travel. Great demand. Experience unnecessary. We train you. Write for free particulars. American Detective System, 1968 Broadway, N. Y.

Musical Instruments.

Viols. Deep, Mellow, Soulful—on credit! Easy terms for wonderful instrument. Get details today. Gustav Henning, 231 11th St. Miami, Florida.

(Continued on page 1342)

Books.

World's Best Book for Auto Mechanics. Covers Elementary Electricity, Motor Car Electric Systems, The Gas Engine and Driving Cars. Nearly six hundred diagrams. Prepaid to you for \$2.50. Order to-day. H. E. Phillips & Co., Service Division, Union City, Ind.

Books on Sex for Men and Women. Catalog free. United Sales Co., Springfield, Ill.

"How to Thought Read." Mind Reading at any Distance, 20c. "Hypnotic Suggestion" the Secret of Success. 208 pages, \$1.00. Circulars free. Science Institute, E1818 North Wells, Chicago.

Are Spiritist Seeing Things? or hoodooed—which? Read 119-page booklet. Biblical expose and facts concerning strange spirit "phenomenon." 15c post free. R. C. Polston, People's Information Service, Omaha, Ill. Box 74.

Rare Instructive and Entertaining Books. Catalog free. United Sales Co., Springfield, Ill.

Dear Reader. If Occult, New-Thought and Scientific books appeal to you, send for my catalog, it's free. I have books on Personal Magnetism, Concentration, Spiritualism, Clairvoyance, Seership, Will, Mind, Hypnotism, Mesmerism, Character Reading, Healing, Mysticism, Success, Salesmanship, Mechanics, Entertainments, etc. A. W. Martens, J-49, Burlington, Iowa.

Book of Nature. By Dr. Faulkner. Plain facts about sex matters every man and woman, married or about to marry, should know. 10 cents. United Sales Co., Springfield, Ill.

World-Romic System. Masterkey to all languages. Six textbooks, \$1.44; French chart, 37c.; Spanish, 37c.; aviation dictionary, \$1.50; French-English aviation dictionary, 61c. Languages, 143 W. 47th St., New York.

Books for Men. Also "classy" pictures. Catalog free. United Sales Co., Springfield, Ill.

Nature Laws married and engaged people should know, 50c. Central Company, 601 Ninth Ave., New York. Book lists free.

The Abuse of the Marriage Relation. For single, engaged and married men and women. Saves disappointment, prevents diseases, and makes happiness. Postpaid for seventeen 3-cent stamps. Naturopathic Publishing Co., 110 E. 41st St., New York.

Concordia Magazine contains essays, short stories, travel stories, boy scout news, editorials, current events and poetry, formulas and plans. Two years' subscription, 50c. Concordia Magazine, 9 Water, York, Pa.

Perpetual Motion, by Percy Verance. A history of the efforts to discover same from earliest days to the present, together with a scientific discussion regarding the possibility of its ultimate achievement. Profusely illustrated, 357 pages. Price postpaid, \$2.00. The Enlightenment Specialty Co., 305 Fourth St., Edwardsville, Ill.

Experimental Electricity Course in 20 Lessons. By S. Gernsback and H. W. Secor, E.E. A Course of the theory and practice of Electricity for the Experimenter. Every phase of experimental electricity is treated comprehensively in plain English. New experiments are described and explained and nearly every application of Electricity in modern life is given. 160 pages—400 illustrations. Flexible cloth cover, 75c postpaid. Stiff cloth cover, \$1.25 postpaid. Experimenter Publishing Co., Book Dept., 233 Fulton St., New York City.

Just Off the Press—Design and Construction of Audion Amplifying Transformers, Radio and Audio Frequency Type. This latest and important book by Mr. Edward T. Jones, late Associate Editor of "Radio News," will be of great interest to all radio amateurs throughout the land. The transformers shown in these books have never been described in print before, and have usually been considered a manufacturer's secret. Anyone who has several vacuum tubes cannot afford to do without this book because it will enable him to build the necessary amplifying transformers very readily. The designs are very simple and rugged, and anybody can make them without much trouble whatsoever. Mr. Jones, the author, is a practical man who is an experimenter himself and knows whereof he speaks. The book is printed on good paper and has an attractive cover in two colors. Paper bound. Size 5 in. x 7 in. Contains many illustrations, diagrams and working data necessary to build the transformers. Price, postpaid, 25c. The Experimenter Publ. Co., Book Dept., 233 Fulton St., New York.

Old E. E. Back Numbers. We have some valuable old E. E. back numbers on hand as follows: 1915—Jan., March, April, May, June, July, Aug., Sept., Oct., Nov. and Dec.; price each, 35c. 1916—Jan., March, May, June, Nov., Dec.; price each, 35c. 1917—Jan., April, Aug., Dec.; price each, 35c. 1918—March, May, July, Aug., Sept., Dec.; price each, 35c. 1919—Jan., Feb., March, April, 35c.; May, Aug., Sept., Oct., and Nov., price each, 20c. 1920—Jan., Feb., April, 20c. We can fill orders at once receipt of your remittance. If you have these numbers already, now is your chance to get them, as they probably will be sold very quickly. Experimenter Publishing Co., 233 Fulton St., New York City.

Books—Continued.

Wireless Course in 20 Lessons. By S. Gernsback, A. Lescarbourea and H. W. Secor, E. E. Tells you everything you want to know about "Wireless" theory, practice and history. A clear, concise course on every phase of this subject. 160 pages—350 illustrations, 30 tables. Flexible cloth cover, 75c postpaid. Stiff cloth cover, \$1.25 postpaid. Experimenter Publishing Co., Book Dept., 233 Fulton St., New York City.

Exchange.

For Sale or Exchange—Electrical Apparatus, Musical Instruments, Cameras, etc. Write for complete list at once. F. J. Bretzke, Brownsville, Wis.

Two Motors, wireless outfit, motorcycle wheels, Oliver typewriter, tools, miscellaneous articles. Box 255, North Bennington, Vermont.

Cycle Incubator, \$7. Harry C. Cooper, Parkton, Md.

Listen, My Children, \$17.00 takes my wireless outfit, \$7.00 my aeroplane. Write Wallace Cutler, Franklin, N. H.

Paint—Roof and iron, waterproof, stops leaks, guaranteed five years; barrels, 70c gallon. Continental Co., 405 Lexington Ave., N. Y.

Sell. Swap No. 4 Victrola records, etc., \$20—Worth Apparatus for Wireless; Details. Alfred Embowitz, Washington, Depot, Conn.

For Sale. ½ H. P., 110 volt, D. C. Dynamo, \$36.00. One pair Newy-Type phone, \$12.00. S. S. Knapp Dynamo Motor, \$5.00. 100 volt A. C. Magneto Generator, \$3.00. B. Flojnacki, 1428 W. Superior Street, Chicago.

Wanted to buy 2' or 3" Spark Coil. Geo. F. Howell, Pasadena, California.

For Sale—Used Mechanical Drawing Materials. Leder, 1187 2nd Ave., New York, N. Y.

For Sale. Rotary Spark Gap, No. 2 Junior Omnigraph, Remington 22 Repeater and Audio Tron. Bud Hartmann, 73 Liberty St., Meriden, Conn.

1 KW-E-Clapp Eastham transformer, Key, Oil transformer ribbon, Beck insulator, Condenser, Switchboard switches, Kickback preventer and Hot Wire Ammeter, all apparatus sets on back of board. Also R-L-C-4-S Mignon Receiving set designed for one-step amplifier. Best offer takes it. F. W. Mann, 523 S. Park St., Kalamazoo, Michigan.

For Sale. Bicycle, new, fully equipped. Carl Madden, Clarksville, Ohio.

Must Sell—Complete electrical and chemical laboratory. Send stamp for particulars. Karl Peterson, Lane, Ill.

Exchange—Bausch & Lomb Microscope, fine condition, complete with case, for Audion panel Receiving set or Audion control panel, complete. Lloyd Smith, McGill, Nev.

Two Step Multi-Audi-Fone. Will sell dirt cheap. Write, Sherman Whiting, 2010 Park Ave., Bridgeport, Conn.

Bargain. Complete wireless outfit \$15. Powerful water motor \$5. Clifford Anderson, 2105 15th St., Moline, Ill.

For Sale. Good printing press, and supplies, including \$3 worth of type. Express prepaid \$8. Eugene Mauer, 1624 Wis. St., Racine, Wis.

Song Poems Wanted.

Write the Words for a Song. We revise poems, write music and guarantee to secure publication. Submit poems on any subject. Broadway Studios, 197C Fitzgerald Bldg., New York.

Write the Words for a Song. We write music and guarantee publisher's acceptance. Submit poems on war, love or any subject. Chester Music Co., 920 So. Michigan Ave., Room 265, Chicago, Ill.

Song-writers' Manual and Guide Sent Free! Contains valuable instructions and advice. Submit song-poems for examination. We will furnish music, copyright and facilitate publication or sale. Knickerbocker Studios, 319 Gaiety Bldg., New York.

You Write the Words for a Song. We'll compose the music free and publish same. Send Song Poem today. S. Lenox Co., 101 West 42nd St., New York.

Song-writers. Market your compositions. Our successful plan brings results. Work examined free and honest advice given. Morrison Music Shop, Dept. E, Indianapolis, Indiana.

You Write Words for a Song—We write the music, publish and secure a copyright. Submit poems on any subject. The Metropolitan Studios, 914 So. Michigan Ave., Room 113, Chicago, Ill.

Write a Song—Love, mother, home, childhood, patriotic or any subject. I compose music and guarantee publication. Send words to-day. Thomas Merlin, 326 Reaper Block, Chicago.

Instruction.

Crystal Gazing—The craze. Send self-addressed stamped envelope for free instructions. Zancigs Studio, Asbury Park, N. J.

Instruction—Continued.

Used Correspondence Courses. All kinds bought and sold. E. Moffett, Ruston, Louisiana.

Cartooning Comics and Lettering. Complete Course only \$5, postpaid. Over 300 illustrations. Stamp brings easy lesson. Cartoonist Ernie, Elyria, Ohio.

Study at Home: Dentistry, chemistry, etc. Write Metropolitan College, Box 210, Station "A," Boston, Mass.

Letter Specialists.

Letters and advertising matter so strenuous and so injected with pulling power and pep they can't fail to sell your goods. Nelson, 1210 South Broad, Philadelphia, Pa.

Music.

12 Songs for \$1. In order to popularize our great hit, "Desertland," retail price 30c, for a short time we will offer it and eleven other popular song hits postpaid \$1. Offer limited, send \$1 today sure. Riviera Music Company, Room 121 Chateau Theatre Bldg., Chicago, Ill.

Moving Picture Plays.

Photoplays Wanted. Big prices paid. You can write them. We show you how. Free particulars. Rex Publishers, Box 175, E-12, Chicago.

Miscellaneous.

Clean Your Wall Paper, it's easy to do. New process, no experience or apparatus required. Complete copyright instructions, only one dollar. James T. Herr, 2919 W. North Ave., Baltimore, Md.

Be Well, Strong, Happy, Successful. Drugs and surgery unnecessary. Modernized Natural Healing insures success, also a profitable, philanthropic and educational profession. Convincing literature free. Science Institute, E-1818 N. Wells, Chicago.

Shawnee, Oklahoma—a live city. Questions answered. Board of Commerce, Shawnee, Oklahoma.

Popcorn for Home Popping, shelled, dependable, sent anywhere. Write for price card. Five Brothers Popcorn Co., Ames, Iowa.

Wanted—Small Gasoline and Steam Engines, Small Lathes, Drill Presses and other light machinery. Will pay high cash prices for good material. Johnston, West End, Pittsburgh, Pa.

Fine beautiful, evergreen, ornamental firs, any address, \$1.00. Order now. B. B. Lee, Sta. A, Vancouver, Wash.

Pershing's famous letter to Foch photograph mailed quarter. Nelson, 1210 South Broad, Philadelphia, Pa.

Motor Engines and Dynamos.

Small Motors and Generators. Cancelled Government Contracts. A. C. Motors, \$9.50 each and up. 12 Light 110-volt generators, \$26.50 each; battery-charging outfits, \$30 each and up. New motors ¼-½ up to 5 H. P. for all phases and requirements of current. Write for late bulletin. Bargains in motors and generators. Address Motor Sales Dept., No. 12, West End, Pittsburgh, Pa.

Motors Electric, no delay, ¼ Hp., 110 volt, 60 cycle, single phase. New, money-back guarantee, \$22.50. We buy motors of various sizes, 25% with order. balance C. O. D. General Distributing Co., 22 West 1st St., Duluth, Minn.

News Correspondents.

Earn \$25 Weekly, spare time, writing for newspapers, magazines. Experience unnecessary; details free. Press Syndicate, 566 St. Louis, Mo.

Stammering.

St-Stu-t-t-tering and Stammering cured at home. Instructive booklet free. Walter McDonnell, 105 Potomac Bank Bldg., Washington, D. C.

Tricks, Puzzles and Games

"10 Select Card Tricks" and latest catalog of pocket tricks, jokes and novelties 6c. Lowest prices. Send today! Lyle Douglas, Sta. A-1, Dallas, Texas.

Send ten cents for large (beautifully illustrated) catalogue which contains all the latest tricks, jokes, puzzles and illusions. Oaks Magical Co., Dept. 549, Oshkosh, Wis.

Magic. Entertain at home. Tricks, puzzles, novelties. Send for free catalog. Martinka & Co., Inc., 493 Sixth Avenue, New York City.

Tricks, escapes, puzzles, photos, books, catalogues free. Magicraft Co., Dept. G, Box 251, Detroit, Michigan.

Magic—Card Tricks. Sensational escapes, jokes, novelties. Everything in the amusement line. Large illustrated catalogue of a thousand tricks free. Write today. Largest amusement goods manufacturers in the world. Heaney Magic Co., Desk 212, Berlin, Wis.

Marvelous Handcuff Escapes. How accomplished. Professional secret. Send 12 cents to cover postage, etc. Money back if not satisfactory. O. Kam, 834 No. 8th St., Manitowoc, Wis.

Patent Attorneys.

Patents. The Expert Personal Service of this firm is of great importance to you in properly protecting your invention by patent. (Est. 1897). Write to John B. Thomas & Co., 902 F Street, N. W., Washington, D. C.

Patents Procured—Trade Marks Registered. A comprehensive, experienced, prompt service for the protection and development of your ideas. Preliminary advice gladly furnished without charge. Booklet of information and form for disclosing idea free on request. Richard B. Owen, 130 Owen Bldg., Washington, D. C., or 2278 T, Woolworth Bldg., New York.

Patents, trade-mark, copyright, inventors, business men, artists, write. Metzger, Washington.

M. F. Miller, Ouray Bldg., Washington, D. C. Patent Attorney, Mechanical and Electrical Expert. Best quality of work and results. Moderate charges. Advice free.

"Inventors' Adviser" sent free on request. William C. Linton, 918 F Street N. W., Washington, D. C., 363 University Street, Montreal, Canada.

Don't lose your rights to patent protection. Before disclosing your invention to anyone send for blank form "Evidence of Conception" to be signed and witnessed. Form and information concerning patents free. Lancaster and Allwine, 242 Ouray Building, Washington, D. C. "Originators of the Form 'Evidence of Conception.'"

Patents—Herbert Jenner, patent attorney and mechanical expert, 622 F St., Washington, D. C. I report if patent can be had and its exact cost. Send for circular.

E. L. Greenwald, McLachlen Bldg., Washington, D. C. Attorney-at-Law and Electrical Engineer. Formerly Examiner, U. S. Patent Office. Electrical Patent Matters a Specialty.

Patents—Fees in installments. Frank T. Fuller, Formerly Lieutenant, Engineers, Washington, D. C.

Patents—Prompt, personal efficient service by an attorney-at-law, skilled in all branches of Patent Practice. Over 12 years actual experience; full information upon request. B. P. Fishburne, 330 McGill Bldg., Washington, D. C.

Inventors, send sketch of model of your invention for opinion concerning patentable nature and exact cost of applying for patent. Book, "How to Obtain a Patent," sent free. Gives information on patent procedure and tells what every inventor should know. Established twenty-five years. Chandlee & Chandee, 414 Seventh St., N. W., Washington, D. C.

Get Your Own Patents: Save attorney's fees; information and instruction free. Carl Larsen Co., Park Row Building, New York City.

Do you know every move your attorney makes? Inventors, my clients are immediately informed of every step in the prosecution of their applications; write now, send sketch. Office of Warner I. Cubberley, Patent Attorney, 22 Union Union Bldg., Wash., D. C.

Millions spent annually for Ideas. Hundreds now wanted! Patent yours and profit! Write today for free books—tell how to protect yourself, how to invent, ideas wanted, how we help you sell, etc. 212, Patent Dept., American Industries, Inc., Washington, D. C.

Patents—Trade-marks. Complete explanatory booklet on request. Reasonable terms. Prompt, personal service. Write now. Clarence O'Brien, Woodward Building, Washington, D. C.

Patents. In all matters pertaining to invention consult National Institute of Inventors, 118 Fulton, New York City, having three thousand members. Booklet free.

Wanted to Buy.

It is like finding money when you mail us old or broken watches, false teeth, brooches, bracelets, old or broken jewelry, old gold, silver, platinum, diamonds, magneto points, platinum wire, contact points or crucibles, mercury, and anything valuable. We pay the highest prices in cash by return mail. Goods returned in ten days if you're not satisfied. The Ohio Smelting & Refining Company, 206 Lennox Bldg., Cleveland, Ohio.

For Sale—Good typewriter. Sell cheap or trade. W. P. Smith, Crescent, Iowa, Box 273.

Cash for Old False Teeth—We pay up to \$35.00 per set (broken or not). Also buy discarded gold, jewelry, gold crowns, bridges, platinum, diamonds, watches and silver. Send now. Cash by return mail. Package held 5 to 10 days for sender's approval of our offer. U. S. Smelting Works, Dept. 73, Chicago, Ill.

Printing.

Classy calling cards. Style sheet sent on request. Arrow Print, 333 Walnut St., Waterbury, Conn.

3000 two color labels, \$1.25. Irvin J. Wolf, Station E, Philadelphia.

For Inventors.

"Sell or Finance Inventions." Read Money-Talks Magazine. Send for free sample copy. 70-B Park Place, Newark, N. J.

Inventions Wanted—Cash or royalty for ideas. Adam Fisher Mfg. Co., 205 St. Louis, Mo.

900 Mechanical Movements, also illustrations explaining 50 Perpetual Motions. My book, "Inventor's Universal Educator," fifth edition, tells how to procure and sell patents. Government and other costs. Covers the matter from A to Z. 160 pages elegantly bound. Contains noted decisions of U. S. Supreme and State Courts on patent cases. Mechanical Movements greatly assist inventors, suggest new ideas that may prove of great aid in perfecting inventions. Tells how to select an attorney. Has valuable information regarding Patent Sharks, Selling Agents and Brokers. Price \$2. Postage free everywhere. Fred G. Dieterich, 603 Ouray Bldg., Washington, D. C.

Inventors write me about patents. My fees payable monthly. Booklet free. Frank Fuller, Washington, D. C.

Inventors, protect yourselves. Record idea before exposing it to anyone, even myself or other attorneys. Klein Cons. Eng., Reg. Patent Attorney, 21 Park Row, New York.

"Inventors' Guide" free on request; gives valuable advice and information for all inventors. Write Frank Ledermann, Registered Patent Attorney, 17 Park Row, New York.

Inventors—We do experimental, model, tool, die and jig work; light manufacturing. Miller & O'Brien Mfg. Co., Saint Paul, Minn.

Personal.

Write to famous Hawaiian Beauties, Swimmers, etc., membership 25c. Hawaiian Correspondence Club c/o L. de Roo, Box 306, Honolulu, Hawaii.

The Salesman Wins. Thousands of positions open. We teach traveling salesmanship by mail and guarantee offer of position or refund tuition. For interesting particulars address Kansas Vocational Bureau, Miltonvale, Kansas.

Men—Enjoy the pleasures of life; have pep, strength, courage. Try NERVO, the best known tonic; quickly restores strength to those suffering from despondency, nervous, weak, run-down condition. Write for interesting literature. Superior Supply Co., 1440 Niagara, Denver, Colo. Dept. 24.

Poultry and Animals For Sale.

Raise giant rabbits for me. I furnish breeders cheap, and buy all you raise at 30 to 60c per pound alive. Hundreds make big money. Send 10c for Breeders Instruction Book, contract, price list, etc. F. Cross, 6407 Ridge, St. Louis, Mo.

Roots and Herbs.

Ginseng. \$10,000 from 1/2 acre, easily grown in North America. 200 seeds and planting instructions only 60c. Box 3, Medical Plant Co., West Milan, N. H.

Rubber Stamps.

Rubber Stamps made to order. McCaddon Company, Zanesville, Ohio.

Stamping Names.

Make \$19 a hundred stamping names on key-checks. Send 25c for sample and particulars. Ex Keytag Co., Colhoun, N. Y.

Stamps and Coins.

Stamps—12 different from warring nations, 10c. 10 different foreign coins, 25c; 10 Uruguay stamps for 10c. Lists free. Toledo Stamp Company, Toledo, Ohio.

California Gold, quarter size, 27c; half-dollar size, 53c. Columbian nickel and catalogue 10c. Norman Shultz, King City, Mo.

Stamps—61 All Different Free. Postage, 3c. Mention paper. Quaker Stamp Co., Toledo, O.

200 All Different Stamps, including Bosnia, Bavaria, China, Guatemala, Bulgaria, Bohemia, Poland, Turkey, etc., and Dime Stamp Album, only one to customer, all for 25c. Our approval sheets contain bargains priced at 1c to 5c net. 150 different U. S. postage and Civil War revenues for only 75c. Indiana Stamp Co., Dept. E, Indianapolis, Ind.

Have you seen The Stamp Herald? Finest monthly stamp paper published. Subscription 50c a year, 3 months' trial for 10c. Stamp Herald Publishing Co., Dept. E, Indianapolis, Ind.

Old Coins Wanted.

We Buy and Sell Old Coins. \$2 to \$500 each paid. Keep All Old Coins; you may have valuable coins. Send 10c for New Illustrated Coin Value Book, 4 x 6. Guaranteed prices. Get posted. Clarke Coin Co., 109 N. Y.

Typewriters.

Typewriter Ribbons all typewriters, 50c. Abolt Typewriter Company, 38 East 23rd St., New York.

Startling Values in Typewriters \$15 up. Factory rebuilt. All makes. Shipped on trial. Write today for our Special Offer No. 158-B. Ribnsaver makes pale ribbons like new for one cent. Order today, 50c postpaid. Whitehead Typewriter Co., 186 N. LaSalle St., Chicago, Ill.

Wireless.

The Audion. Its early history and development. Electron Theory and Trigger Action, compiled by a Chief Electrician Radio who was stationed at the Naval Radio School as Instructor for two years, written by an old amateur for the amateurs in words that they can understand. Also blue print diagrams for hook ups for receiving damped signals, using both air exhausted and gas bulbs. Receiving undamped signals and regenerative circuits. Two-step amplifier, using same (A) and (B) batteries for both steps. Wireless telephony with power bulb. Working blue prints on how to build a "One to One" transformer for use with Audion Amplifier. All for \$2.00. Address T. O. McKenzie, 104 Warburton Ave., Yonkers, N. Y.

Switch Points—Approximately 1/4"x1 1/2"—head shank 3/8"—dozen 35c. Sample 5c. Toledo Radio Specialties, Toledo.

Special! Marconi Vt. two step amplifier \$18. Complete. Harold Jones, Ferndale, Wash.

Complete Receiving Sets, \$7.00 and up. With 1,000 ohm receiver, tested mineral; guaranteed. Bulletin for stamp. Jenkins, Room 2, 923 Purchase St., New Bedford, Mass.

Attention Amateurs! If you are building your own wireless outfits we can supply you with fibre, and Bakelite-Dilecto, in sheet, rod or tube, cut to size. Also brass, sheet, rod, screws, and nuts. Switch points, levers, knobs, and binding post. Experimental and machine work, done to your sketches. Send for our new price list at once and save money. O. L. Bortz Machine Co., Greenville, Pa.

Switch Points. Binding posts, switch levers, and small parts; send 2c for catalogue describing these and other goods. A. W. Bowman & Co., 23 Church St. (Harvard Square), Cambridge, Mass.

Audion Control Bakelite panelled, with condenser, grid leak, audion-ultraudion switch, rheostat and cabinet holding 40 volt "B" batteries. Present batch \$10.00 each without batteries postpaid. You will be delighted. Edmund Gunning, 273 West 22nd, New York.

Genuine "Jupiter" Aerial Wire 1 cent per foot, \$9.00 per thousand. Seven strands Number 22 solid copper. High Conductivity. Strong. Large surface. Low resistance. No. C. O. D. Send postage. Lee A. Bates, 8 Moen Street, Worcester, Mass.

"Silverplate" without electricity. Modern, efficient apparatus all silverplated. Bottle "Silverplate" plates whole set, 35c. Roberts, 11718 Detroit Ave., Cleveland, Ohio.

How to Make Wireless Sending Apparatus, 100 pages, 88 illustrations. Written and published entirely for the wireless enthusiasts who want to make his own radio apparatus. Contains more information on "How to make it" than any other book we know of. Paper bound, 25c postpaid. Experimenter Publishing Co., Book Dept., 233 Fulton St., New York City.

How to Make Wireless Receiving Apparatus, 100 pages—90 illustrations. Only strictly modern radio apparatus are described in this book and the illustrations and descriptions are so clear and simple that no trouble will be experienced in making the instruments. Paper covered, 25c postpaid. Experimenter Publishing Co., Book Dept., 233 Fulton St., New York City.

Just Off the Press—Design and Construction of Audion Amplifying Transformers, Radio and Audio Frequency Type. This latest and important book by Mr. Edward T. Jones, late Associate Editor of "Radio News," will be of great interest to all radio amateurs thruout the land. The transformers shown in these books have never been described in print before, and have usually been considered a manufacturer's secret. Anyone who has several vacuum tubes cannot afford to do without this book because it will enable him to build the necessary amplifying transformers very readily. The designs are very simple and rugged, and anybody can make them without much trouble whatsoever. Mr. Jones, the author, is a practical man who is an experimenter himself and knows whereof he speaks. The book is printed on good paper and has an attractive cover in two colors. Paper bound. Size 5 in. x 7 in. Contains many illustrations, diagrams and working data necessary to build the transformers. Price, postpaid, 25c. The Experimenter Publ. Co., Book Dept., 233 Fulton St., New York.

Wireless Course in 20 Lessons. By S. Gernsback, A. Lescarboura and H. W. Secor, E.E. Tells you everything you want to know about "Wireless" theory, practice and history. A clear, concise course on every phase of this subject. 160 pages—350 illustrations, 30 tables. Flexible cloth cover, 75c postpaid. Stiff cloth cover, \$1.25 postpaid. Experimenter Publishing Co., Book Dept., 233 Fulton St., New York City.

Health-Strength-Beauty Thru

Renulife VIOLETRAY

Treatments at Home

A recognized scientific effective means of handling your own case is afforded by the RENULIFE VIOLET RAY HIGH FREQUENCY GENERATOR. It is so designed and made that anyone can apply the wonderful corrective, upbuilding forces of the VIOLET RAY. This pleasant POWERFUL form of electricity has done and is doing wonders in relieving and eliminating pain and suffering. You owe it to yourself to investigate—find out the facts. Get our new booklet explaining the nature of the Violet Ray—its uses, benefits, and applications—send the coupon below at once.

WHAT USERS SAY

"The Renulife Violet Ray High Frequency Generator is superior in efficiency because of its perfect character and control of current, compactness and perfect insulation. The smallness and lightness of Electrode holder is also a great advantage." "The doctor told me that the trouble was hardening of the arteries. I would not be without it for all the money in the world." "I cannot recommend it too highly." "I have been using mine now for a week for Sciatica and I am highly pleased with results." "I think it is one of the best little machines that was ever invented." "I have used it with excellent results for the restoration of hair and stiff and sore rheumatic finger joints." "Am well pleased with the Generator, and the kind treatment received from your Company." "My Generator has stopped my neuritis." "Every house should have a Renulife Violet Ray High Frequency Generator for the treatment of Neuralgia; Neuritis; Sore Throat; Corns in Neck; Cramps; Headache; Stiff Neck Muscular Soreness; Rheumatism; Paralysis—in short, pain of all kinds."—M. D.

"I have been much relieved by the use of your Violet Ray Generator."
 "It is fine for insomnia."
 "I find it such a help in nervousness."
 "I would not part with it for five times the price. It is sure a little wonder."
 "I am more than pleased with the Generator, the whole family are using it."

THIS TYPE of Violet Ray instrument makes possible a light, convenient handle and permits large efficient units to be used contained in hand-some case.

OUR NEW BOOK

JUST OUT. This latest edition explains in detail, with many illustrations, the uses and benefits of Violet Ray. You should have one. Free for the asking.

SEND FOR BOOK!

THOUSANDS OF VOLTS

No Shock—No Harm—Simply Great Benefits

Current from your light socket is transformed into the most powerful, effective purifying Health and Beauty giving agency; yet as painless and pleasant as a ray of sunshine. Made safe for use in any home, on infant or weakest invalid. Attacks the deep seated source of diseases, at the same time relieving the aches and pains which may be the annoying symptoms. Learn how this modern form of electricity—The Violet Ray—so acceptable to the human body actually saturates the whole system with invigorating life-laden forces, bringing back normal conditions. You may treat the local area but results are not confined to that part alone—the blood, nerves, tissues are revitalized, toned and restored.

Send for the Booklet—full of information—that tells the story so you can understand it.

Natures Own Aid

What is the strange relation between electricity and life? Some declare electricity is life. We do not know. But life cells do welcome and respond marvelously to electricity in the form of Violet Rays. It works with nature to restore where many other methods fail. It treats fundamentally and therefore is specified by physicians for a wide range of ailments—for rheumatism, neuritis, nerve and blood disorders—etc., etc.—both chronic and acute. See the list on coupon and ask for full particulars. Blood is brought to area treated—enriched and purified—assimilation and digestion improved—functions restored to normal. Combines the benefits of electricity, vibration, exercise, stimulation, and oxidation. Get the information as to what you may expect from the Violet Ray. Its astonishing low price places it within the reach of all. The Trial Plan proves its value, in actual use. Receive full information by return mail.

Renulife Electric Co., Inc.

1204 Marquette Building, Detroit, Mich.
 Chicago Office, Room 410, 123 West Madison
 CANADIAN RENULIFE ELECTRIC CO., LTD.
 1204 Netting Building, Windsor, Ont.
 Toronto Office, 347 Adelaide St., West

LOWEST PRICED Efficient VIOLET RAYS

High Class Sales Distributors Write for Proposition

Several Models for Home and Professional Use

OZONE Inhaler

Pain and Ache Eradicator—Without Equal

For Catarrh, Throat, Lungs—also Anemia



Treat Your Own Face and Scalp as well as Specialists



Strengthens—Revitalizes—Builds up



COUPON FOR BOOK and Special Information

RENULIFE ELECTRIC CO.,
 1204 Marquette Bldg., Detroit, Mich.

Please send without obligation, your book "Health," explaining Violet Ray treatments with Renulife Generators, also give full particulars as to its application for ailments checked below.

TREATS SUCCESSFULLY

..Abscesses	..Facial Neuralgia	..Obesity
..Anemia	..Falling Hair	..Pain in Abdomen and Chest
..Asberia	..Femur Complaints	..Paralysis
..Arteriosclerosis	..Goitre	..Piles
..Baldness	..Gout	..Pimples
..Blepharitis	..Haemorrhoids	..Pleurisy
..Brain Fag	..Hay Fever	..Rheumatism
..Bronchitis	..Infantile Paralysis	..Sciatica
..Burns	..Insomnia	..Skin Diseases
..Catarrh	..Lameness	..Sore Throat and Throat Diseases
..Cold	..Locomotor Ataxia	..Sprains
..Chilblains	..Lumbago	..Toothache
..Dandruff	..Nervous Affections	..Weak Eyes
..Ear Diseases	..Neuritis	..Warts and Moles
..Eczema		
..Enlarged Prostate		

Name

Address

