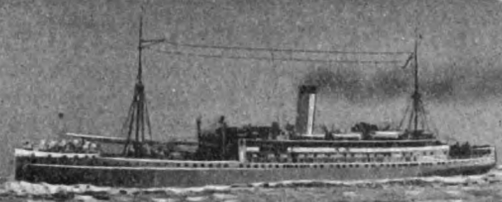
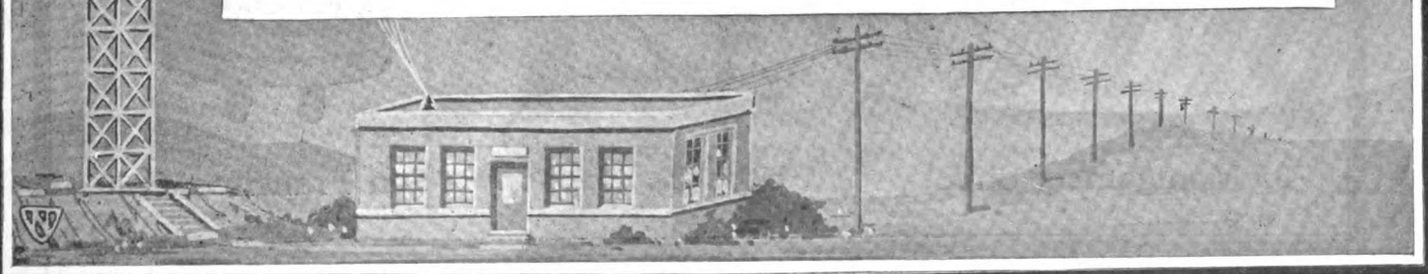
JULY, 1921

20 CENTS

PACIFIC RADIO NEWS



Pioneer Journal of Western Radio News and Development.



Be waiting on 350 meters JULY 2

BULLETIN RADIO WILL "COVER" BIG FIGHT JULY 2

"Listen in," wireless fans!' Get your "sets" tuned up for the big fight!

Round by round the story of the Dempsey-Carpentier ring battle will be relayed to you by radio just as soon as each new development comes into The Bulletin over its leased wires on the day of the fight—July 2.

All you have to do is "tune 'er up," and "listen in." Anywhere within 800 miles of San Francisco on land, or as far away as 2000 miles at sea, The Bulletin's flashes will reach you. Just clamp the head-set over your ears on the afternoon of the big day and wait for the news to come 'a.

From the highest wireless sending station in San Francisco, that of the Leo J Meyberg Company at the Fairmont Hotel, the leased wire messages will be radiated out over land and sea by The Bulletin.

Within the space of seconds after the final gong sounds you will know the decision if you are "listening in," at The Bulletin's "wireless party." This service is given to you without the expenditure of labor or money. It's as free as the air that carries the electric waves through space.

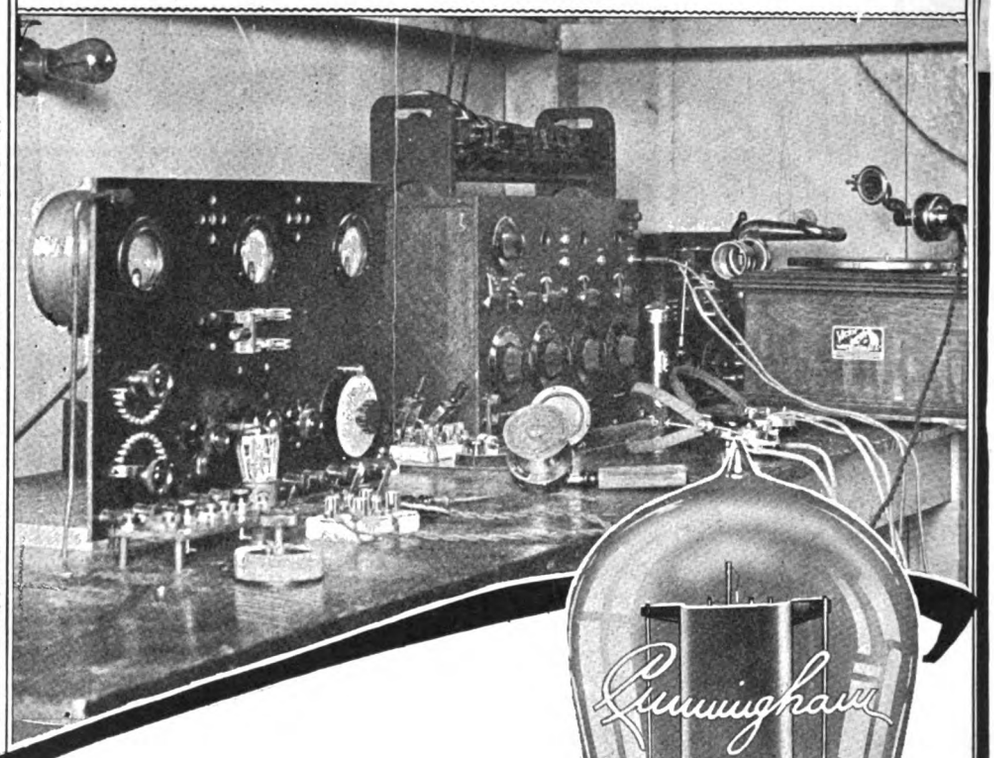
Don't wait until the last minute to get your instruments attuned to thew ave length used by the Meyberg station! Get busy now and listen for the series of phonograph records being played daily and sent out from the Fairmont just to familiarize operators with the wave length.

The day of the big match isn't far off. Take advantage of service "direct from the ringside to your private 'set.'"

"Listen in"

DEMPSEY JUST ENTERED THE RING!

That's the word that will be flashed by wireless telephone for The Bulletin the afternoon of July 2. And from that moment on there will not be a move or a blow struck in the ring at Jersey City that won't be described by The Bulletin's radio phone service. The photo shows the complete 5-watt radio phone installation installed at the Fairmont Hotel by the Leo J. Meyberg Company. This service may be heard for a radius of 800 miles inland and 2000 miles at sea. "Listen in" the afternoon of July 2.



ON July 2nd the Leo J. Meyberg Company, from their radio telephone station at the Hotel Fairmont, San Francisco, using the 5 watt Cunningham Power Tube C-302, will send out the complete returns of the Dempsey-Carpentier World Championship fight.

Cunningham Detector Tube C-300 and Remler 330 Detector Panel is the most efficient combination for listening in for this big news.

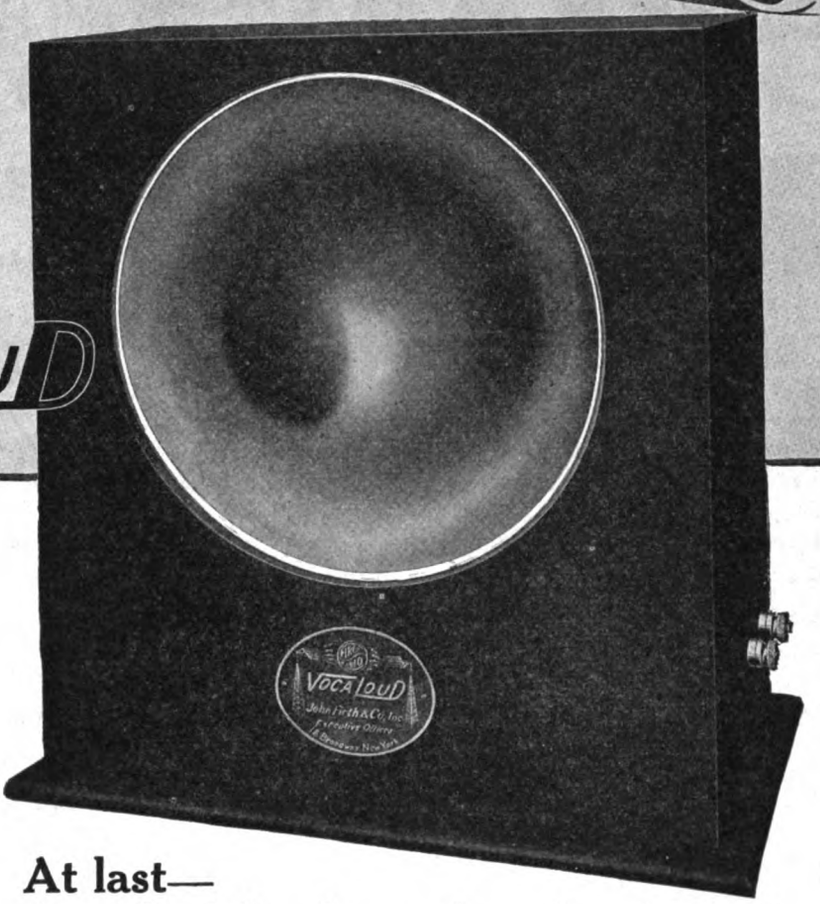
Connect up for this big event. Use Cunningham Tubes and Remler apparatus for clear reception.

E. T. Cunningham

35 Montgomery Street — *Trading as Audiotron Mfg. Company Since 1915* — San Francisco, Calif.

Announcing the

VŌCALOUD



Vocaloud
Laboratory Type.
(Shown above)
Complete with 6 ft. cord, $23.00.
Sound chamber alone, $12.00.
Sound chamber, with base, $15.00.
Vocaloud reproducer with 6 ft. cord, $9.00.
Station Type, $25.00.
(Complete as shown in large photo.)

At last—
An ideal loud-speaker for $25.00

Hook a Firco Vocaloud right on to your receiving apparatus, in place of your phones, and get your signals QSA—*all over your house!* No batteries,—no adjustments, no extra equipment needed whatever! Just hook your Vocaloud in and listen!

Vocaloud reproduces wireless *telephone* perfectly, as well as code. Mr. P. E. Fansler of Stamford, Conn., received wireless telephone from the S.S. "Gloucester" (125 miles distant) with just one tube! He writes, "The conversation was entirely intelligible and perfectly modulated. The reproduction of the human voice was fully equal to that in a phonograph reproducer."

Vocaloud reproduces voice and music just like a high priced phonograph, because the *reproducing elements are the same.*

The reproducer itself employs the famous Baldwin *amplifying* mechanism, with genuine mica diaphragm. The sound chamber is designed and shaped like a *human ear,*—the most perfect sound amplifier known. These *exclusive* features are not duplicated in any other loud speaker at any price. Yet the price of a complete "station type" Vocaloud, (shown above) in an exquisite solid mahogany cabinet is only $25.00.

Examine a Vocaloud at your radio dealer's. If he should lack a supply, write for leaflet direct to

John Firth & Company, Inc., 18 Broadway, New York

FIRCO RADIO

FIRCO Audion Detectors and Amplifiers
Radio Frequency Amplifiers
High Voltage Units
(with any primary voltage)
Baldwin Phones
Firco Vocaloud
Saco-Clad Transformer
Firco Accessories
Kolster Decremeter
United States Bureau of Standards Wavemeter
Eldredge Meters
(individually calibrated)
Brownlie Phones
(adjustable)

FIRCO RADIO EQUIPMENT

"Pioneers–since 1901"

GENUINE AMPLIFICATION

RADIOTRON U.V. 200
The long distance detector
PRICE $5.00

Introducing Model U.V. 712

RADIOTRON U.V. 201
An exceptional amplifier
PRICE $6.50

The new inter-tube tone frequency amplifying transformer

RADIO AMATEURS! The problem of obtaining maximum signals in radio telegraphy is easily worked out.

SOLUTION: Radiotron U.V. 200 + Inter-tube transformer U.V. 712 + Radiotron U.V. 201 = maximum amplification.

Inter-tube transformer U.V. 712 is not a compromise. It was designed to "fit" Radiotrons by the engineering forces responsible for the development of Radiotrons. Tests prove conclusively its mechanical and electrical superiority. U.V. 712 provides unequalled amplification. Try it!

A descriptive bulletin on transformer U.V. 712 can be obtained from your Dealer or write direct to

The Radio Corporation's tubes are covered by patents dated November 7th, 1905, January 15th, 1907, and February 18th, 1908, as well as by other patents issued and pending. Tubes licensed for amateur and experimental use only. Any other use will constitute an infringement.

SALES DIVISION, COMMERCIAL DEPARTMENT, Suite 1804

Radio Corporation of America

WORLD WIDE WIRELESS

233 BROADWAY — NEW YORK CITY

CONTINENTAL NEWS

JULY, 1921

Published Every Month In Pacific Radio News By The Continental Radio and Electric Corporation

For use with the Phonetron, these long-lived 6-volt storage batteries are specially recommended:

STORAGE BATTERIES

10003 20- 40 amps.	$14.60
10004 40- 60 amps.	18.00
10005 60- 80 amps.	23.60
10006 80-100 amps.	29.30

A few Items from the Continental catalogue are listed below. Every one is right here in stock, ready to be shipped the day you order it.

TELEPHONES

No. 55 Murdocks, 2000 ohms	$ 4.50
No. 55 Murdocks, 3000 ohms	5.50
Brandes "Superior," 2000 ohms	8.00
Brandes "Trans-Atlantic," 2800 ohms	12.00
Brandes "Navy Type," 3200 ohms	14.00
Baldwins, Type C, Navy Standard	16.50
Baldwins, Type E, Super-Sensitive	20.00
Century, 2200 ohms, Government standard	12.50
Century, 3200 ohms, Government standard	14.00
Brown, 4000 ohms, Imported, Super-Sensitive, double armature	20.00

TRANSFORMERS (Acme, New Type)

250 Watt, mounted	$16.00
250 Watt, unmounted	13.00
500 Watt, mounted	22.00
500 Watt, unmounted	18.00
1000 Watt, mounted	33.00
1000 Watt, unmounted	28.00

VACUUM TUBE SOCKETS

No. R-300, DeForest	$ 1.50
No. M-300, Marconi	1.50
No. 55, Murdock	1.00
No. 156, Gen. Radio	1.75
No. R-400, Inverted Type.	2.40

VACUUM TUBES

Radiotron U.V. 200 Detector Tube	$ 5.00
Radiotron U.V. 201 Amplifying Tube	6.50
Electron Relay	6.00
Moorhead Amplifier	7.00
Moorhead extra hard Transmitter	7.50
Audiotron	6.00

ROTARY SPARK GAPS

Bell Gaps, in stock	$55.00
Benwood Gaps	30.00
Benwood Gap (Bakelite Case)	25.00
Large Murdock Gap	30.00

LINE PROTECTORS

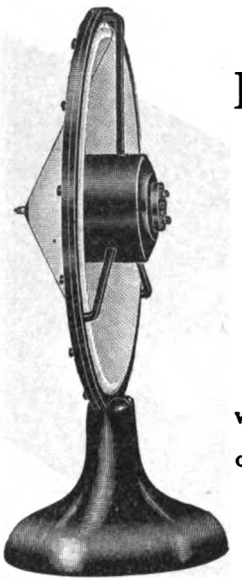
No. 379, Murdock Line Protector	$ 9.00
No. AM888, Dubilier Line Protector	4.00
No. CD888, Dubilier Line Protector	6.00

TUNGAR RECTIFIERS

2 Ampere Tungar, complete	$18.00
5 ampere Tungar, complete	28.00
2 ampere Extra Lamp	4.00
5 ampere Extra Lamp	8.00

DUBILIER CONDENSERS

D-100 23 ¼ KW 10000 V- .007 mfd.	$19.00
D-101 23 ½ KW 14000 V- .007 mfd.	30.00
D-102 23 1 KW 21000 V- .007 mfd.	45.00
D-103 23 1 KW 25000 V- .007 mfd.	50.00
D-113 23 1 KW 25000 V- .01 mfd.	55.00
Murdock 483-8 Transmitting Condensers	3.25
Murdock 488-8 Transmitting Condensers	5.00



The

PHONETRON

Electric Sound Converter.

More than a loud speaker:

Designed for both reception and wireless telephone transmission in place of a microphone transmitter.

Price $45.00

PHONETRON is distinguished from an ordinary loud speaker by the wide, rigid, cone diaphram, in place of a horn-shaped megaphone. It re-creates voice and music by wireless telephone, with a full, rich, natural tone. You will be surprised and delighted with the complete absence of any "horn tone" or reverberation. The sound waves emitted from the Phonetron are fully rounded and retain all the original sound values.

Phonetron is more than a loud speaker—it is a converter of electric energy into sound, or of sound into electric energy.

The illustration shows magnet block suspended in the center of the diaphram by three rigid supports. Thumb nut at the apex of the conical diaphram provides an easy way for critical adjustment.

Phonetron is rigidly constructed and mounted on heavy metal base. Size, 17 in. high by 9 in. wide. One 6 volt storage battery will supply sufficient current. For best results use at least one stage of amplification. With two or three stages, signals can be read distinctly several hundred feet distant.

Send stamp for illustrated leaflet, showing construction.

AS LONG as a Packard is worth more than a Ford, so long will a PARAGON R. A. TEN Receiver be worth more than other receiving sets. PARAGON is built to last a life time, and absolutely guaranteed for two full years. Spread over its years of service, the cost of a PARAGON will be lower than any similar piece of apparatus. And all during that time, you get PARAGON'S marvelous selectivity and amplification, never duplicated. As one amateur said, "Nothing like it ever heard before, especially for strength of signals on detector alone."

The best is always cheapest, regardless of initial cost. Order a PARAGON now, or send for Free descriptive booklet.

CONTINENTAL

Radio and Electrical Corporation

EXCLUSIVE DISTRIBUTORS FOR
PHONETRON AND PARAGON R. A. TEN

J. DI BLASI, SEC. J. STANTLEY, TREAS.

Dept. G 76 6 Warren St. New York

Order by mail from New York's leading radio store.

IT'S A lucky thing for a good many radio stores that amateurs are willing to blame the mails when they have to wait for their goods. You can order from Continental with the assurance that you won't have to wait. You can bank on it that your order will start toward you the day we get it. Everything listed in our catalogue is right here in stock—no delays. And there isn't much worth having, in radio, that isn't listed in the CRECO catalogue. It's not out of place to say that the Continental mail order stock includes worth-while apparatus for every part of your station. No matter what wireless equipment you need, you can be sure that Continental has it, or will get it for you quicker than you could get it yourself.

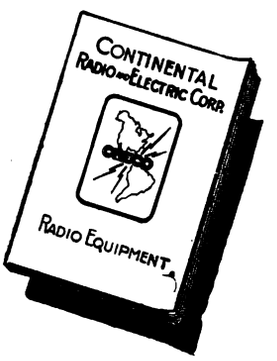
Send your next order to Continental. No matter how large or small, it will be filled promptly, courteously, carefully. Please make all remittances by bank draft or Post Office Money Order, to avoid any possible delay.

* * * * *

C. W.

Are you interested in C.W.? If not, get interested. Continental makes a specialty of Continuous Wave apparatus. See Creco catalogue.

* * * * *



Do you still own a quarter?

If so, and if you haven't already sent for the Creco catalogue, that's the best way to invest it. 112 pages for a quarter, chock full of illustrations, descriptions, prices, and all the radio apparatus you ever heard of. Also codes, abbreviations, tables, etc., that you will use daily. Be a sport. Risk a quarter on the best radio buy ever offered you! Anyway, you get credit for quarter on your first $5.00 order, so you really get the catalogue for nothing. Your copy is all ready to be mailed. Slip your name and your quarter into an envelope now!

VOLUME II JULY, 1921 NUMBER 12

PACIFIC RADIO NEWS

PAUL R. FENNER
Editor
LAWRENCE MOTT
Assoc. Editor
H. W. DICKOW
Advertising Manager
50 Main St., S. F., Cal.
Aug. Issue forms close on July 1st

PUBLISHED MONTHLY
Subscription Rate
$2.00 per year in the U. S.
$2.50 in Foreign Countries

RADIOTORIAL
BY THE EDITOR

DO YOU KNOW THE CODE?

THAT'S a funny question to ask radio men of experience," you think, "why, certainly I know the code."

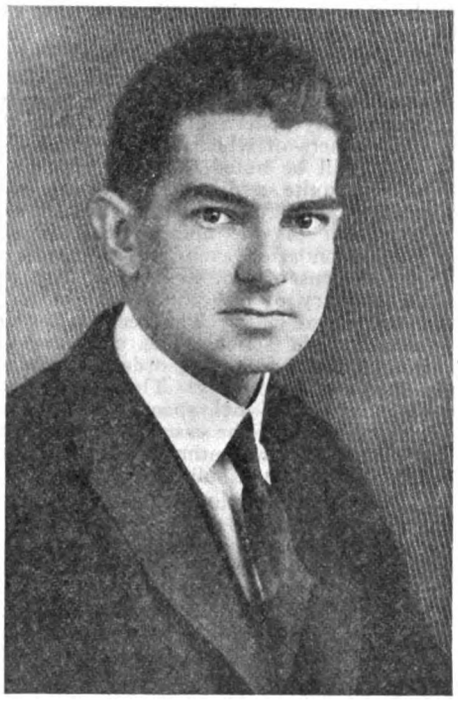
But DO you know the code? You know that A is dot, dash, and B is dash, dot, dot, dot, and so on down the line, and you probably know those dots and dashes so well that you can, upon hearing them in proper combination, copy at a rate of from twenty to as high as thirty words a minute and make good legible copy. But still, DO YOU KNOW THE CODE? Let's see if you do.

In your sending, are your dots exactly half, or a quarter or a sixteenth as long as your dashes? If you can answer that question you must have a tape record of your sending, or some equally effective method of actually measuring your sending. But this brings out the point; do you really know whether your sending is RIGHT?

The other night we were listening to one of the relay operators out in Ohio endeavoring to get a MSG to a nearby state. It really was a shame. The man could receive, and receive well, he had a good transmitter, well adjusted; he could be heard by the other relay station. everything was fine; BUT, we couldn't copy his sending if we were within a mile radius of his station. Yes, you've guessed it, the man COULDN'T SEND. Of course the other relay operator was a gentleman, he didn't wish to hurt the Ohio man's feelings, so he came back, "QRM", and the MSG was QTAed. We didn't ever find out whether the MSG got through, because it wasted too much time waiting for that QTA to finish, and it surely was awful.

And there's the trouble with many of us. WE DON'T KNOW HOW TO SEND. Now so far it's been all criticism of destruction—next for the constructive work, how to remedy the trouble.

Those men who can't send well are not to be blamed nor condemned, their faults have been gathered through the years through lack of proper guidance and absence of intelligent instruction. But those of us who now have those bad habits must sacrifice one thin in order to get up with the ranks of perfect senders, who can be copied so easily. That thing is SPEED, we must cut out the speed, not down to fifteen or twenty words a minute, but way down to five or ten words a minute. That sounds hard, but disregard our warning and you will be condemned to poor sending the rest of your life. And the worst of it is you won't improve, you'll get worse as time goes on. All right then cut down the speed.



PAUL R. FENNER
EDITOR OF "PACIFIC RADIO NEWS"

With reduced speed you can judge the length of the three important factors which go to make up perfect sending. These three factors are, dots of correct length, dashes of correct length, and space intervals of correct length. Ordinarily, instructors of code state that dots should be of half the length of dashes. This does not work out in practice, and the most readable sending is obtained in using dashes three times the length of the dots, and time spaces, between dots and dashes of the same letter, equal to the dot length. Considerable variation of the above is allowable and yet without sacrificing clearness and readability. The advantage of using the shorter dot, the one-third length dot as it may be called, is in increased speed of operating. This is because the space intervals between dots or dashes of the same letter, which are equal to dot length, or may even be a shade shorter, take less time to send a letter than if one-half length dot and equal space is used, and even greater accuracy is obtained.

But the greatest bane to sending, and the trouble most of us have that are poor senders, is in irregularity. That is, for example, in an H the first dot is shorter than the last three, or middle two, and the last short like the first. The dots in an H should be all of exactly equal length and the three spaces separating the four dots should be equal to each other in length also. Every dot in every letter should be of the same length, every space between dots and dashes should be of equal length, and letters should be regularly spaced. Practice it slowly and you can gradually find out your shortcomings and faults.

Often an operator has a poor sense of values (not through his own fault, or any discredit to him) and it is through this wrong sense of time intervals that his sending has developed poorly. In this case he should call to his aid an operator who actually sends very well and who can explain and understand his mistakes and who is able to tell him just what to do with the key to get the desired result.

Another fault is sending letters so close together that the letters mix up and the receiving operator might, in such a case make double dash out of BT, or PD out of AND, or 6E out of THE and

(Continued on page 430)

New York Office.....147 Sixth Ave. Portland Office.....420 Bd. of Trade Bldg. Seattle Office.....419 Pioneer Bldg.
Boston Office.....18 Boylston St. Chicago Office.....1306 Hartford Bldg. London Office....62 and 8a, The Mall, Ealing

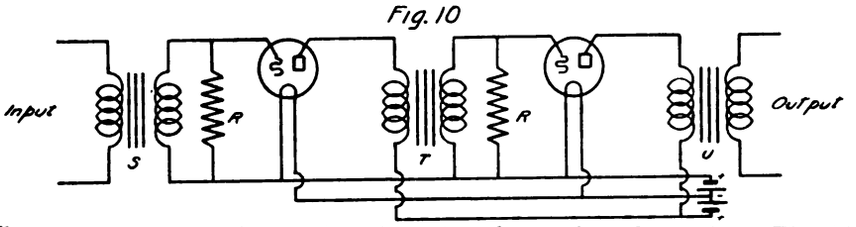
Entered as second class matter January 22, 1920, at the Post Office at San Francisco, Cal., under the Act of March 3, 1879.

POWER AMPLIFIERS

By A. K. ASTER
Instructor, Department of Physics, University of California.

IN the second article of this series, voltage amplifiers were discussed in detail. In this article we shall consider power amplifiers. Let us consider a usual, a typical circuit Fig. 8. The coupling (z) may be a pure resistance, a reactance or a transformer, in any case a mathematical investigation shows that a tube will deliver its maximum amount of power when the load impendance is equal to the plate impendance of the tube. Hence no matter what is placed at z, a resistance, a choke coil, or a transformer primary, its impedance should be equal to that of the plate impedance of the tube.

Fig. 10



The common type of coupling for power amplifiers is the transformer, some times of an air core but usually of an iron core type because the air core type has too much magnetic leakage and is too inefficient. For a given impedance an iron core has much less d.c. resistance than an air core one and low d.c. resistance is a decided advantage.

The air core transformer was advocated at one time because the hysteresis of iron at telephone or radio frequencies was considered too high for good results. But this has been shown not to be the case for the ordinary silicon steel transformer core work very well at telephone frequencies (900 cycles). For radio frequency a peculiar design of core is resorted to. Before designing a coupling transformer the band of frequencies over which the amplifier is to operate one has to be decided. Transformers can be designed with a very flat resonance curve but at best their operation is not entirely independent of the frequency. As has been previously stated the primary impedance of the transformer should be equal to the plate impedance of the tube and the secondary should be wound so as to produce the highest possible voltage on the grid.

For the design of a radio frequency transformer the following design is suggested. This transformer will give satisfactory results between 600 and about 6000 meters wave length, the peak of the resonance curve being at about

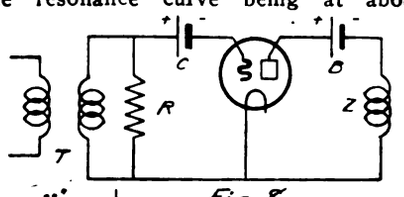


Fig. 8

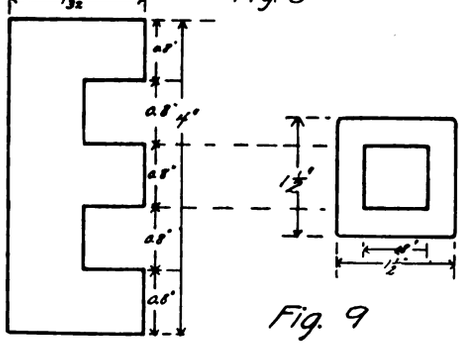


Fig. 9

3000 meters. See Fig. 9 for dimensions of the core punchings and winding spool. The core is of the shell type having butt joints. The iron should not touch at these joints but should be separated about one-sixteenth inch with paper or fiber. This gap is absolutely necessary as a completely closed magnetic circuit would not function properly at the extremely high frequencies at which this transformer is to be worked. The thickness of the core should be about nine sixteenths inches and should be made of the thinnest possible silicon steel. The clamp strip for the core must be non-metallic. The winding consists of a single layer of wire made up of three sections, two secondaries and a primary symetrically spaced on a paper tube the end washers of which are shown in Fig. 9. It will be noted that the winding is held at quite a distance from the iron as the rectangular tube has an outside dimension of one and one-half inches. The secondaries each are wound with ninety turns of No. 40 S. S. C. wire and the primary of one hundred eight turns of the same wire. The secondaries are connected in series. The coils are arranged in the following order—secondary —primary—secondary. There should be about one-eight inch space between each coil. These are the essential dimensions, the method of mounting the transformer, etc., is left to the builder.

For wave lengths below 600 meters the iron core coupling transformer is not recommended although some experimenters report excellent results with a transformer made according to the above given dimensions on wave lengths as low as 200 meters. For best results the tuned reactance coupled voltage amplifier is to be recommended for radio frequency work except when a special circuit to be discussed later is used.

For audio frequency work the transformer coupled power amplifier is very satisfactory for all work except for the very best reproduction of music as the band of frequencies over which music reaches is extremely large even for a transformer having an extremely flat resonance cure. I don't consider it necessary to give the dimensions of any audio frequency transformers here because one can buy very good transformers on the market today much cheaper than one can make them. On selecting a transformer the following points should be considered.

1. The primary impedance should be very nearly equal to that of the tube with which it is to be operated. The values of tube and transformer impedance can be obtained from the manufacturer.

2. The transformer should be of the closed core type with good magnetic joints, butt joints will not do, they should always be lap joints.

3. The voltage ratio must be as high as possible.

4. The core should be of good silicon steel, not store pipe iron and should be very thin. I have seen some that look more like armor plate than transformer laminations.

Figure 10 shows the usual connection used in practice for best results. When the transformers have very high ratios (above 1 to 3) the shunt resistance across the secondary is necessary for best results and should be about equal to the secondary impedance. It may be necessary to insert negative grid batteries, but depends entirely on the type of tube used. The amount of negative grid voltage, if any, for best operation of an amplifier tube can always be obtained from the manufacturer.

The above described amplifiers cover practically the entire field except the so-called "feed back" or "regenerative" type which will not be discussed here as they form a subject by themselves.

I stated previously that I would describe a device by which iron core transformers could be used for radio frequency work at 200 meters. The arrangement is as follows. Instead of amplifying the incoming signals at 200 meters, they are first converted to, say 3000 meters by hetrodyning them at radio frequency by means of a local tube oscillator to 3000 meters. See Fig. 11 for connections. In this diagram (S) is the first step of a radio frequency amplifier, the remainder of the radio frequency amplifier being designated by the rectangle marked (RA). The rectangles (D) and (A) represent a detector and audio frequency amplifier respectively, the telephones not being shown. Once the signals have been converted to 300 meters there is no further trouble in amplifying them with iron core coupled radio frequency amplifiers. This arrangement has many advantages. (1) The increased amplification and sharpness of tuning due to the hetrodyne effect is obtained, hence elimination of interference. (2) The iron core transformer amplifier work very steady and are free from noise due to bad contact on resistance rods, etc. (3) The iron core coupling transformers need no tuning, all tuning being concentrated in the primary of the loose coupler and the local oscillator, the secondary of the

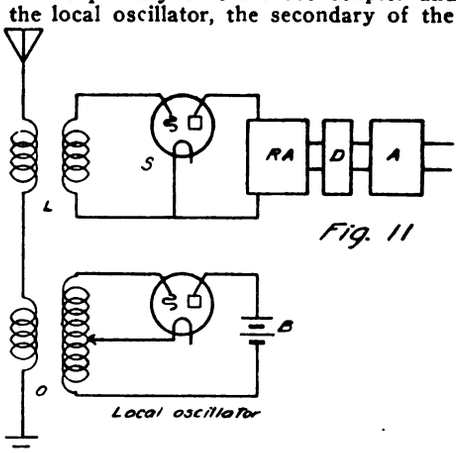


Fig. 11

loose coupler being left tuned to, say 300 meters.

The local oscillator should be prefer-

(Continued on page 428)

THE MAGNETIC AMPLIFIER

A Treatise on its Theory, Design, and Construction.

By Jennings B. Dow

Published by Permission of the Secretary of the Navy.

PART II.
DESIGN

The magnetic amplifier has made its debut into the radio field quite recently—its development has been confined to the efforts of a very few, and its commercial application has been somewhat limited. For these reasons, the following treatise on the design cannot be generalized, but must be considered in its application to a particular case. We shall, for the remainder of this article consider as our particular case, the design of a magnetic amplifier, or iron relay, as it may be more appropriately called here, for use with a 60 K. W. Federal Poulsen Arc. This case probably represents one of the most difficult ones that could be selected for the reasons that the arc is a most unstable generator of radio-frequency currents, the period of oscillation is seriously influenced by almost anything that can be placed in the circuit, and these characteristics follow no fast laws upon which computation may be based. The selection of this case results merely from the fact that it represents an actual one, thoroughly investigated in practice. This permits us to deal with facts.

Consider first the case of an arc converter (Fig. 5) connected to an antenna through suitable loading inductance, and the antenna circuit oscillating at a frequency of 30,000 cycles per second, which corresponds to a wave length of 10,000 meters.

Assume that the damping factor of the receiving circuit in use in the reception of signals from this station is such that a signal having a wave length 400 meters longer than the resonant wave will just render the incoming signal inaudible. In other words, changing the frequency of the emitted wave from 30,000 to 29,000 cycles per second would produce sufficient change in the strength of the received signal to accomplish the desired result. Neglecting the resistance of an oscillating circuit the frequency of oscillation is

$$n = \frac{1}{2\Pi\sqrt{LC}}$$

or when the constant L and C are expressed in micro units

$$n = \frac{3 \cdot 10^8}{1885\sqrt{LC}}$$

The formulae do not ordinarily hold for computing the frequency in the case of an arc, but we may assume that their values are approximate and that the resistance of the arc does not change with the small change in frequency considered here.

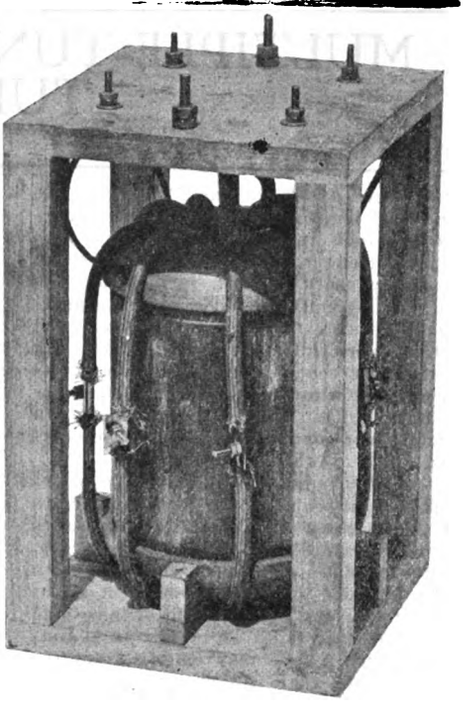
$$10{,}000 = 1885\sqrt{LC}$$
$$10{,}400 = 1885\sqrt{LC}$$

L and L_1 may easily be found by solving each equation for C and equating, or by substituting the measured value of C in each equation, then solving for L and L_1. The difference between these two values L and L_1 will give the change in inductance necessary to detune the resonant condition existing between transmitting and receiving station, to the desired extent.

Assume C = 0.002 micro-farad
L = 14.10 millihenries
L_1 = 15.25 millihenries

$L_1 - L = 1.15$ millihenry required in the form of additional inductance.

From this, it is obvious that very little inductance will be required. The question may arise here—why limit our change of inductance to 1.15 millihenry? In this particular case, the answer is—owing to the instability of the arc as a generator of high frequency oscillating currents, any instantaneous change in the characteristic of the wave, which represents a change in the operating condition of the arc itself, is liable to extinguish it, or make it momentarily unstable. For this reason, the change must be limited to the requirements of the problem.



Assembly, 60 K.W. Relay

As stated heretofore, we are designing a device to control the output of a 60 K. W. Poulsen Arc operating at a frequency of 30,000 cycles per second. With an antenna having a fairly low resistance, this will, under ordinary conditions, result in a radiation of approximately 80 amperes. The magnetizing effect of this current may be shown graphically by plotting current against time (Fig. 6).

The exciting or control current for this device may, of course, be made any desired value, and the control winding must be designed to give the desired magnetizing

(Continued on page 432)

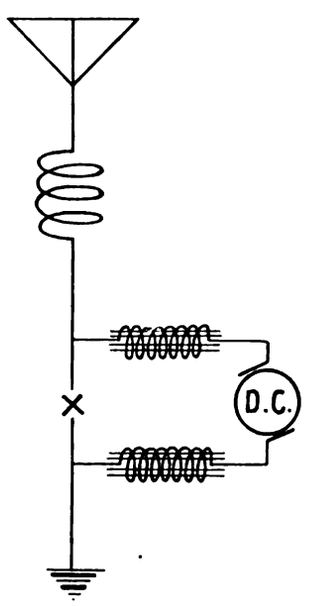
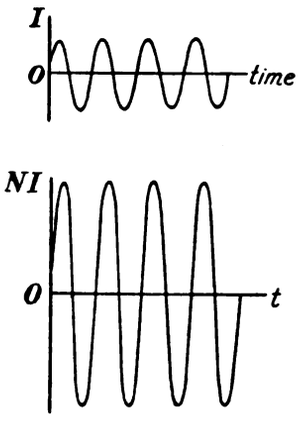


Fig.-5



Magnetizing Effect of a current A, shown by ampere turns in B.

Fig.-6

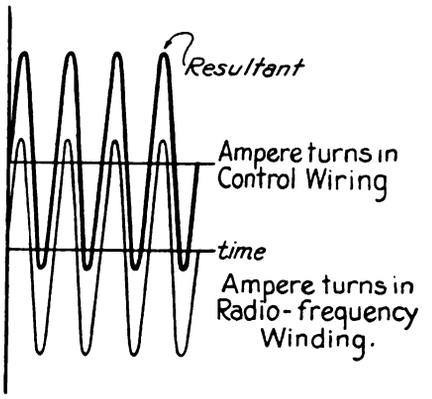


Fig.-7

MULTIPLE-TUNED ANTENNAE FOR VACUUM TUBE TRANSMISSION

By H. TENNY

IT is almost safe to say that, with the universal application of the Armstrong-vacuum-tube receiving circuit, and with the present standardization of both quenched and rotary spark circuits, further development of transmitting and receiving apparatus as regards fundamental electrical and mechanicl principles will be negligible, or practically absent, as long as communication without wires is conducted along present lines, with the sole exception of the vacuum tube as a generator of oscillations.

Even the vacuum tube, as at present developed, has been so thoroughly analyzed and investigated that it's characteristics can be calculated to a delightful nicety. Future revolutionary work in application of the vacuum tube will be brought about only through the development of new and entirely distinct types of tubes. It is conceivable that a tube may emerge from the distant future that will operate without a plate battery, using the dynamic energy of the electron discharge as a source of power. The imaginary possibilities are unlimited, but the present actual limitations of the vacuum tube have been acutely and definitely reached.

Perhaps the greatest drawback to the tube as a generator of high frequency current is that it operates solely as a variable resistance device, instead of a variable genertor of electro-motive force. To this is due the fact that a tube, in a perfect theoretical circuit, must waste at least fifty per cent of the applied energy. In actual use a loss of eighty per cent is considered indicative of efficient operation!

A more keen appreciation of this fundamental weakness of the vacuum tube as a generator, or even as a detector, can be had by trying, in imagination, to picture our central power stations converting direct current to alternating by short-circuiting a giant resistance unit, in series with the line, one hundred and twenty times per second! This would, of course, produce only a pulsating current, but which could be subsequently converted to true A. C. by passing it through a static transformer. And that is exactly what we do in generating oscillations by the tube method. The more mathematically inclined among us can easily calculate that, in order to have the gretest effect on the line voltage, the energy consumed by the resistance so used must be exactly equal to that of the useful load. Efficiency: per cent 50.

This feature of the vacuum tube is inherent in the three electrode type which represents the cream of our research work to date. It is due to the adaption of the tube to the modulating of an extraneous applied e. m. f., and will be overcome only when a tube is brought forth which will generate its own primary voltage, varying same at the frequency desired. All indications and conclusions of present research work hold little hope for such a development. Time alone will tell.

The principal advantage of the present day tube, however, is its action as a positive, self-timing generator of continuous oscillations of such freedom from harmonics, and such perfection of sine waveform, as to enable their adaption to the multiple-tuned antenna for radiation purposes.

The significance of this phase in the development of amateur radio is as yet hardly realized, even among our leading spirits. This is probably due to the lack of general knowledge of the principal underlying the multi-tuned radiating system, due to its almost exclusive use of installations of the highest power, for transoceanic communication.

The multi-tuned antennae operates on a distinct and quite revolutionary set of electrical principles, which are all its own. Upon investigation, however, these strange newcomers are quickly identified as some of our oldest and most respected theories. Chief among these, and most important, is the established fact that a number or units

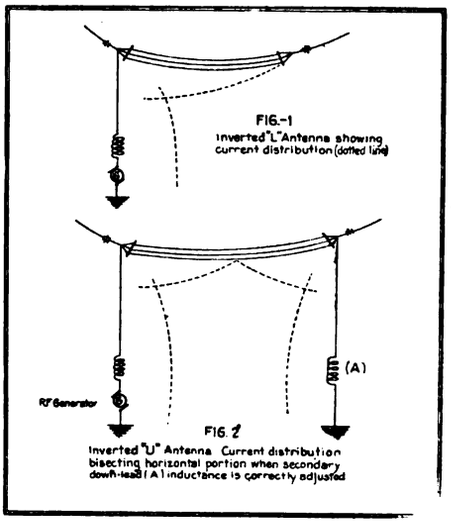


FIG.-1
Inverted "L" Antenna showing current distribution (dotted line)

FIG. 2
Inverted "U" Antenna. Current distribution bisecting horizontal portion when secondary down-lead (A) inductance is correctly adjusted

in parallel will behave quite contrary to the way that is to be expected when they are connected in series.

Coming back to fundamental principles, it is well known that the lifting of a quantity of electricity a certain distance and then lowering it to the starting point involves a certain amount of electrical work. And that this work varies directly to the quantity of electricity moved and the distance it is moved.

In addition to this, when electricity is so moved, the resultant electrical displacement, or disturbance, involves a small loss of energy due to the radiation into outward space of an electrical wave. The amount of energy so radiated is therefore dependent on both the amount of electricity moved and the distance through which it is moved. Good.

If the said electricity is moved through the same distance, or space, a given number of times per second, another factor is introduced into the proposition, which is. that the energy so radiated is also proportionate to the number of times per second that the said movement takes place.

The capacity of the antenna determines the amount of electricity moved into it with a given pressure, and the height of the antenna determines the distance which the electricity is moved. It also determines, to a large extent, the inductance, or electrical inertia, of the antenna.

Owing to the necessity of working an antenna at or near it's fundamental frequency, which is a product of the capacity and inductance, we soon find the orthodox type of antenna to be the possessor of several serious drawbacks. When we increase it's capacity to increase the amount of electricity we can pump in and out of it, and therefore increase the energy which we thereby cause to be radiated, we find that the said increase of capacity increases the length of time required for the said pumping, and by so lowering the frequency of successive chargings, decreases the effective radiation, and, for practical purposes of radiation, neutralizes the beneficial effects of the increased capacity.

In high powered stations for long distance work this loss of effective radiation is compensated by the better traveling ability of lower frequencies, or longer wavelengths. When we are restricted to a short wavelength of 200 meters, however, the problem taken on a different aspect altogether. To work long distances we must increase the amount of power used. To increase that we must increase the size of the antenna used for radiating it, and when we increase the size of the antenna we increase it's fundamental wavelength and make it unusable to our requirements. The multiple-tuned principle, however, makes it possible to increase the size of the antenna without the undesired consequences.

The former method of increasing the size of an antenna system was to increase either the height of the area or length of the flat top, or horizontal portion, or to increase both in proportion. An increase of one hundred percent in the length of the horizontal portion of an antenna is equivalent to merely adding, or connecting in series with it, a second anntena flat top of the same physical dimensions. In other words, it is equivalent to connecting two similar antennas, or their horizontal portions, in series.

In the Alexanderson method we connect the two, or more, antennas in parallel.

Figure 4 illustrates the schematic electrical circuits of series and parallel arrangements of a standard oscillating unit. In this regard attention must be called to the fact that an aerial circuit is in effect an oscillating circuit having inductance and capacity. In figure 4 (A) represents a closed oscillating circuit subject to unilateral impulses from an exterior source. It is well-known that when these superimposed impulses are timed to the exact resonant frequency of the oscillating circuit, an undampt oscillation will be set up in the closed circuit.

With a view of tripling the electrical size of the closed circuit we take recourse to the method shown in (C), that is, we connect the inductances in series and the capacities in parallel. In doing so we triple, theoretically, the power storing capacity of the circuit, but we also lower the resonant frequency to one-third of the former value. In order to obtain the desired increased power storing capacity, without affecting the frequency, we can use the arrangement shown in (B), Figure 4. As all three oscillating circuits are identical in inductance and capacity, they will all oscillate at the original frequency, but the three circuits will, of course, have triple the power storing capacity of a single circuit. This is the fundamental idea of the Alexanderson Multiple-tuned antenna.

As at present used, the multi-tuned antenna consists of a long horizontal "Flat-top" with a number of vertical down-leads, evenly spaced along its length, and each one

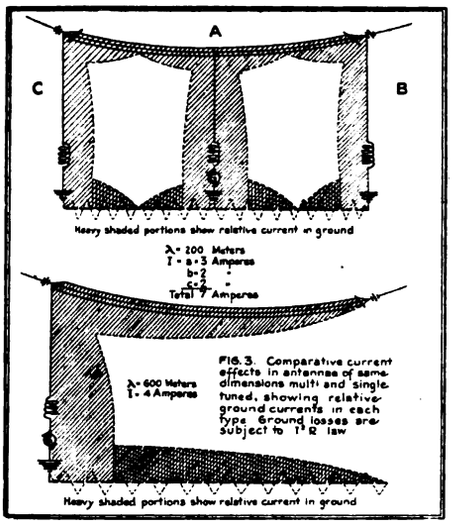


FIG. 3. Comparative current effects in antennae of same dimensions multi and single tuned, showing relative ground currents in each type. Ground losses are subject to I^2R law

individually tuned to the frequency of the transmitted wavelength. In roughly calculating the fundamental wavelength of such an antenna, the length of the horizontal portion is divided by the number of downleads, and the same formula used as for a simple, uni-tuned antenna, or approximately four and one half times the length of the vertical downlead plus the length of the horizontal portion divided by the number of down leads, measured in meters, or $4.5 \frac{DL \times H}{N}$ = Fundamental wavelengths.

DL = Length of down lead in meters.
H = Length of horizontal portion in meters.
n = Number of downleads.

This formula holds good to a sufficient extent unless the downleads are spaced too close together. It has been found that the quantity $\frac{n}{N}$ should approximately equal the length of the downlead.

For best results on amateur wavelengths of two hundred meters, then, the optimum length of the down leads should be fifty feet, or slightly less. The length of the horizontal portion and the corresponding number of downleads will depend upon the power desired to be radiated. A safe rule for medium powers and high efficiency is one downlead for every twenty-five watts of antenna input, When using sets of much higher power than present vacuum tube practice, this may be raised to fifty watts.

For a fifty watt tube set, which evidently will soon be a universal matter, an antenna sufficient for good efficiency will consist of a flat top one hundred feet in length, with a fifty foot down lead at each end. This will be approximately double the electrical size of the average 200 meter spark antenna now in use.

The transmitter, or impulser, is connected in either downlead. It must be remembered that a multi-tuned antenna is not, in the strictest sense of the word, a positive tuned antenna. In other words, it will not oscillate, or electrically vibrate, in the same manner as a uni-tuned antenna, when subjected to an electrical impact or discharge. For this reason it will be found impossible to obtain any satisfactory results with any sort of transmitting apparatus except an undampt, self-timing, radio-frequency generator, of which the vacuum-tube is the only one available for 200 meter operation.

The action of such a generator on a multi-tuned antenna is quite different from the action of a spark discharge circuit upon a unituned antenna. In the latter case the function of the spark circuit is to subject the antenna to impulse the antenna circuit with a series of widely separated and roughly timed impacts, resulting in a series of dampt oscillations being formed in the antenna circuit. The characteristics of these resultant oscillations, in a well designed set, being mainly determined by the decrement and inductance-capacity ratios of the antenna circuit.

In the multi-tuned installation the process is quite different. A number of oscillating circuits are connected in parallel, and are all simultaneously and equally impulsed in a given direction and at a definite periodicity to which each separate circuit is tuned. In the actual antenna construction these individual oscillating circuits are formed by each individual down lead and the part of the flat top and ground area immediately adjacent to it. The characteristics of the oscillations so produced in the separate circuits are entirely independent from their individual electrical characteristics or inductance-capacity ratios. The impulsing source must be completely self-timing, that is, there must be no reaction of the oscillating circuits upon the timing circuit.

Returning to the above mentioned 200 meter multi-tuned antenna, we will designate one of the downleads the "Timing" lead and the other down-lead the "Oscillating" lead. In such an installation on the grounding system must be made the subject of great consideration in order to secure greatest uniformity of power and current distribution between the two respective down-lead circuits. This can be best done by connecting the ground terminals of both downleads by two lengths of half-inch copper strap, buried several feet in the ground, paralleling each other about twenty to thirty feet apart.

The generating apparatus for such an installation would be preferably a fifty-watt tube used as a radio frequency amplifier, and a five-watt tube as an oscillator for timing same. For telephony an additional five-watt tube can be used as a modulator. In proper construction the frequency and purity of the generated oscillations are entirely determined by the characteristics of the primary oscillating circuit used with the five-watt oscillator, and are entirely free from feed-backs from the higher power amplifier.

The amplifier must be coupled to the antenna circuit in the usual manner, that is, inductively. The oscillating downlead is connected to the grounding system through a radio frequency inductance, which must be of such construction as to be variable to an extremely fine degree.

In the preliminary tuning this inductance is set at its maximum value, which must be somewhat greater than that of the timing lead, which is coupled to the transmitting set. The Inductance of the timing lead is then adjusted to resonance with the transmitting amplifier until a maximum antenna current in it is obtained, the oscillating lead inductance is then adjusted until a similar result is obtained in it. It will be found that tuning the oscillating lead will have a tendency to detune the timing lead, and they will have to be alternately readjusted until a maximum total current is obtained.

When properly adjusted the current in the timing lead will be from thirty to fifty per cent greater than that in the oscillating lead, and that the current in either may be considerably lower than that obtained in a uni-tuned antenna of approximately the same physical proportions as the multi-tuned one. In this connection it must be remembered that, as regards the strength of signals at the receiving station, the actual amount of energy radiated off into space will be proportional to the total sum of the currents in both downleads, or in all

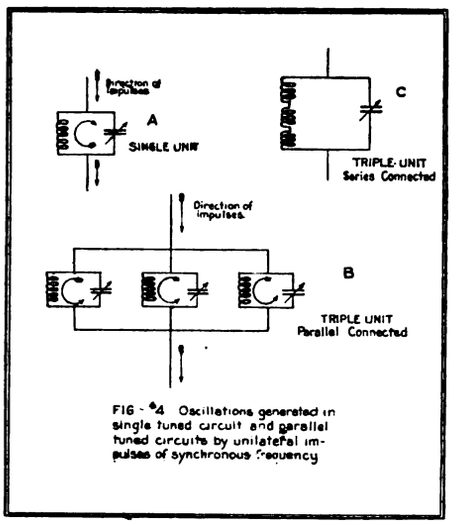


FIG. 4 Oscillations generated in single tuned circuit and parallel tuned circuits by unilateral impulses of synchronous frequency

the downleads in an antenna of three or more. In the above described installation a fifty watt transmitter should induce about three amperes in the timing lead and about two in the oscillating lead, a total of five amperes. How many one kilowatt spark transmitters can show a good, clear five amperes in the antenna circuit, leaving all consideration of zero decrement out of the question?

Another fundamental advantage of the multi-tuned antenna is due to the basic fact that the total resistance of several resistances in parallel is much less than that of the same resistances in series.

Figure 3 is intended to illustrate this idea more or less clearly. In most shore installations the ground losses are often much greater than the total amount of energy radiated. This is especially the case in the 200 meter transmitter, due to the extremely high frequencies. The ground losses are mainly joulean heat losses, and are therefore subject to the I^2R law, that is, they vary directly with the resistance of the conductor, which in this case is the grounding system, and with the square of the current. Reduction of this loss has heretofore been attempted through the use of elaborate grounding networks of copper cables buried in the earth. In the Alexanderson system this method is improved upon by the reduction of the current carried by the grounding system. Due to the square law, a reduction of current of 50 per cent reduces the ground losses by 200 per cent.

In Figure 3 the heavily shaded portions are indicative of the intensities of current at different points beneath the antenna. The relative areas so shaded in each type of antenna will give some idea of the minimization of losses, which, owing to the second power entering into the formula, are considerably greater than the relative areas would indicate.

By reference to Figure 2 it will be seen that there is a node of current at a point in the flat top between the two down-leads. Where more than two down-leads are used, a node will be present between successive down-leads. In the ideal installation this node will be exactly in the geometrical center of the horizontal sections, but in average practice will vary 10 to 30 per cent. This variation will be due to slight lack of symmetry of form of the different sections of the antenna, as well as variations in various parts of the grounding system, and to neighboring electrical conductors in or near the field of the antenna. Owing to this fact, the amount of inductance which must be introduced in each down-lead will vary somewhat in the different leads.

(Continued on page 430)

JUDGE MAYER SUSTAINS ARMSTRONG RADIO PATENT

As a result of litigation extending over a period of years, the Armstrong radio "feedback" patent, controlled by the Westinghouse Electric & Manufacturing Company, has been held valid by Judge Mayer.

This patent covers what is probably the most important circuit arrangement in use in modern radio. It made possible trans-oceanic radio communication and has contributed much to the art of radio telephone communication.

The feedback circuit magnifies the signals received by wireless instruments thousands of times, so that signals previously inaudible are now easily readable, and it further permits of very great selectivity, making possible reliable communication between two stations regardless of atmospheric conditions and of the transmission of messages by other stations.

Judge Mayer, in his opinion, says:

"This case is another contribution to the romance which has so often characterized the history of forward inventions. As a boy of 15, Armstrong became interested in radio and erected a radio station at his home. In the Spring of 1912 he began a close study of the fundamental action of the audion and read all the literature on the subject. Sometime during this period, he connected a condenser across the telephone of a simple audion receiving system and noticed that on some bulbs an increase in signal strength would result. It is important, at this point, to realize that Armstrong is a remarkably clear thinker. His achievement was not the result of an accident, but the consummation of a thoughtful and imaginative mind. Step by step he proceeded with the study and experiment. He was obtaining what seemed to him remarkable results, and in December 1912 he had succeeded in improving the sensitiveness of the audion by means of a new connection. The merit of the invention was soon recognized, and the very apparatus of which Armstrong made the invention was subsequently utilized commercially at Sayville, Long Island, shortly after the outbreak of the war in 1914, to overcome difficulties in the reception of signals from Nauen, Germany."

When the United States entered the war, Armstrong, who was then working with Prof. Pupin in the Hartley Research Laboratory, Columbia University, was commissioned as Captain in the Army and served in the Signal Corps, A. E. F., where he rose to the rank of Major. The invention, which by that time had become widely known, was used by the Signal Corps of all the armies in the field for receiving radio messages under the difficult conditions of warfare.

The commercial value of the invention was appreciated at an early date and licenses were taken out by the Atlantic Communication Company, the Goldschmidt Company and the Marconi Company during the years 1914 and 1916.

All radio amateurs are familiar with the circuit. It permits them to receive on a simple small antenna the radio signals transmitted from great distances. Thus it is possible for an amateur in and about New York with his antenna located on his apartment house and using the Armstrong feedback circuit to hear messages from Nauen, Honolulu, Darien, Norway, Philippine Islands, Lyons, and the great Lafayette Station installed by the Americans during the war at Bordeaux, France. It is also depended upon in the delicate work of direction finding which requires receiving instruments of the utmost delicacy. It was used on the NC Navy planes which crossed the Atlantic.

Prof. M. I. Pupin of Columbia University says:

"Edwin H. Armstrong's contribution to the radio art is epoch making. No one who has employed his feedback can fail to appreciate its eminent value and inexhaustible possibilities. Armstrong made his invention when he was about 21 years of age and before he graduated in the Department of Electrical Engineering at Columbia University in 1913. The regenerative receiver and the regenerative oscillator will always figure among the classical inventions and will occupy a foremost position in the research laboratory, as well as in the commercial wireless service. It entitles Armstrong to a very high place among electrical inventors."

The principal defences urged by the DeForest Company and the American Telephone & Telegraph Company were prior invention by Dr. DeForest and that Armstrong's invention was of a very limited character. Judge Mayer held that Armstrong was the first inventor and that the invention was of a very broad character covering any feedback arrangement.

The DeForest Company was represented by Darby & Darby (Samuel E. Darby Jr., of counsel); the American Telephone & Telegraph Company as amici curiae by Mr. Charles Neave and Mr. William R. Ballard; and Armstrong and the Westinghouse Electric & Manufacturing Company by Pennio, Davis, Marvin & Edmonds (William H. Davis, W. Brown Morton, and Willis H. Taylor, Jr., of counsel) and Mr. Thomas Ewing, all of New York City.

AN APPRECIATION OF LIEUTENANT STONE'S LITERARY CONTRIBUTION TO RADIO EFFORT

BY LAWRENCE MOTT

RARELY indeed is a scientific work both successfully that, and of entrancing interest—as an exceedingly readable volume—besides!

Yet such is **"Elements of Radiotelegraphy"** by Lieutenant Ellery W. Stone, U. S. N. F. R., published by D. Van Nostrand Company, New York.

As one who is keenly interested in radio matters I have read many—very many!—varied—very varied!—and sundry tomes on radio effort and progress. From some I have gleaned bits of useful knowledge, but of the majority, the less I say, the better! And for the reason that I became hopelessly involved in mazes of dry-as-dust figures, scientific to the nth degree, and far above the head of the average radio student.

In his book, however, Lieutenant Stone has succinctly set forth the more salient points that are necessary unto him who has

(Continued on page 431)

CONTEMPTIBLE AND DANGEROUS WORK

By Lawrence Mott
(Associate Editor)

IN slang parlance: let's get down to brass tacks! There are certain amateurs among us who are riding for a nasty fall!

A contemptible case, not only of the mis-use of another's call, but of the deliberate forging of his name to a postcard, purporting to be from him, has been brought to my attention, and to that of the Radio Inspector at San Francisco. Unfortunately the offender has not been—as yet—located, but that he IS in Los Angeles, has been ascertained—and many ears are listening, o'nights, for any future attempts to "fool" some one!

In brief, as I think it well that the matter should be aired, a certain conscientious, earnest amateur in Eureka, California, received a postcard, purporting to be from another eminently trustworthy amateur in Los Angeles. Said postcard reads so oddly that I reproduce it herewith:

L. A., Calif., March 25, 1921.

"Dear fellow amateur:

"I reached you on the evening of March 24th (Thursday) between the hours of 10:30 and 12:00. You came in QSA although I was interfered with a great deal by QRM. I received NPW strong as well as a great many other northern stations. I believe this to be a coastwise record. I will call you again later.

Sincerely yours,

Pardon delay.

——(——)"

On the face of it the thing is an impudent forgery, as I happen to know the script of the **purported** writer—well! And there is no iota of resemblance!

That this is the work of some stupid mischief maker is evident by the fact that he writes of a "coastwise record" (!) and the wording and spelling are both incorrect. There has been a 'deal of correspondence in the matter, which has been forwarded to me in order that I might take the affair up publicly—and I am forced to the brutally frank statement that we have, in our peaceful midst, an out-and-out forger, and a wilful user of another's Call Letters!

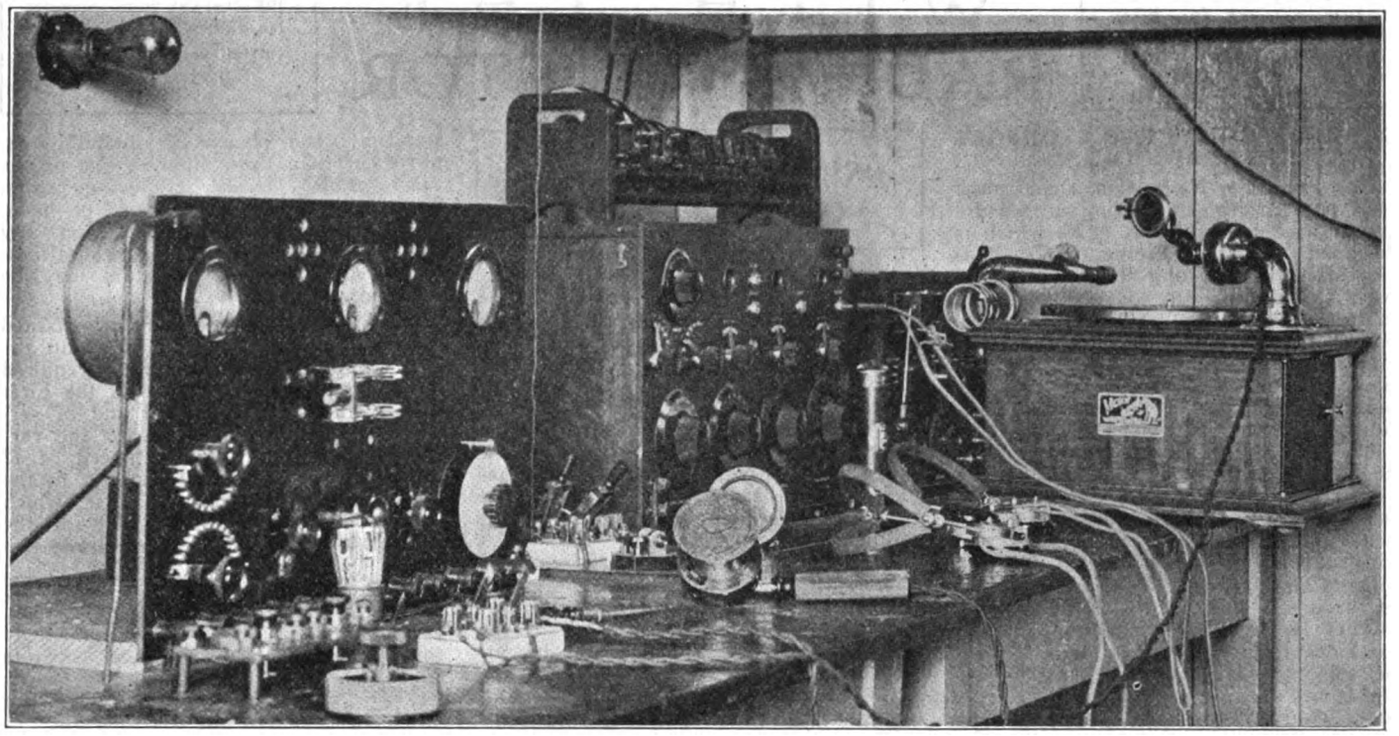
These are the sort of things that put a stigma on amateur radio effort, and that gain for it an ill repute with the authorities! And it is this same sort of recklessly-criminal work that is going to bring down the just wrath of all and sundry on the heads of offenders—and at no far distant date—either!

To me it is a matter of vast astonishment that there is, among a certain kind of amateurs, so crooked and devious a manner of doing things! To deliberately and with malice-aforethought sit down and **plan** how to try and deceive earnest operators is entirely beyond my comprehension! Where is the "fun" (?) of the thing? What is its object?

Perhaps in no other line of effort does the old saying—"Truth will out"—hold so true as in radio! Law evaders, law breakers, manage to "get away" with it for a time—but only for a time! And the sooner each honorably-intentioned operator constitutes of himself an air

(Continued on page 427)

6XG—THE FAIRMONT RADIO TELEPHONE



ONLY a few weeks ago the many radio experimenters of the Pacific Coast experienced a pleasant surprise in the form of an announcement that the Leo J. Meyberg Company of San Francisco was about to install a radio telephone station in the Fairmont Hotel.

Following closely in the wake of the announcement was the actual opening of the station and the work that it has so far accomplished, as well as the extreme satisfaction expressed by those who have heard the daily radio telephone concerts, proves beyond a doubt that the Fairmont station has set a new efficiency mark for vacuum tube transmission.

Reports have been received that music and voice reception were QSA over one thousand miles. Among the towns reporting are Pullman, Washington; Plainview, Oregon; Boise, Idaho; San Diego, Los Angeles and Hollywood, California; Portland, Oregon and hundreds of others within this radius. At the present time the Hobrecht Elect. Co. of Sacramento is receiving these concerts daily, throwing the music all over their store through a Magnavox. Sacramento is about one hundred miles from San Francisco. Also many other radio houses within this radius are demonstrating the ability of this 10-Watt Radiophone, with Magnavox reception. All reports received state modulation is exceptionally good and very little fading is noticed, although no special care was taken in aerial construction to prevent fading. The aerial is a 60-foot T type, 50 feet high, and a lead in about 50 feet long.

The accompanying photograph shows the entire equipment of 6XG. The transmitter is of the panel type, very compact, and wired in bus-bar style. The Heising circuit of modulation is employed and the emitted voice from the Fairmont phone is free from all distortion.

Station Operates Daily

The Fairmont station is in operation daily from 3 to 4 p. m. A musical program is provided between the hours mentioned, and also on Monday and Thursday evenings from 8 to 9 p. m. The Leo J. Meyberg Company has installed a large Magnavox in their sales rooms on Market Street and passers-by are invited to listen to the daily concerts.

Visitors are allowed access to the station upon being furnished with passes that are issued by application. All requests are filled in rotation as only a limited number of persons can be accommodated daily. The Fairmont Hotel has long been a center of radio telephone activity, being formerly used by the National Radio Company of San Francisco.

Fairmont to Report Big Fight on 350 Meters

The Fairmont phone will be used to broadcast the returns of the Dempsey-Carpentier fight, scheduled for July 2nd. All radio experimenters within range of 6XG are requested to listen in at 10 a. m., when a musical program will be in progress. The first returns will probably reach San Francisco at 11 a. m. and immediately upon receipt of same they will be broadcasted from the Fairmont.

This unique service will be made possible through the co-operation of the San Francisco "Bulletin."

In order to provide entertainment between the fight returns, musical numbers will be resorted to. Various radio and electrical stores in the Bay Cities have installed radio receivers and Magnavoxes in an endeavor to announce the returns long before they reach the outlying districts by the regular wire service.

Constructional Details of the Transmitter

The following apparatus is mounted on a Formica Panel, 18x24x¼", and the arrangement can be seen by a careful study of the above photo:

1 0-1 Amp. General Radio Radiation Meter.
1 0-250 Jewel Milliameter.
1 0-500 Volt Jewel DC Meter.
2 General Radio 1½ Amp. Rheostats.
2 Remler Sockets.
1 Acme Modulation Transformer.
2 12-Point Switches to vary aerial inductance.
1 Inductance wound with 36 turns of No. 12 soft-drawn copper wire, on a 3" Formica tube, separated about 1-16" apart, commencing 13 turns from the ground lead 11 taps are taken off, one every two turns and connected to two 12 point switches in parallel.

A Protective Condenser of .001 mf. capacity is used in the plated lead to inductance to keep the DC out of the aerial circuit. This may be dispensed with, if desired. A Dubilier type D182 will answer for this purpose. A radio frequency choke coil may be made as follows:

Take a small thread spool and wind about 300 turns of No. 30 DCC wire, and fasten to binding posts mounted on ends of spool to prevent breaking off.

The Audio frequency choke is made by winding a soft iron core ½" in diameter, with No. 32 DCC wire, lengths of winding 4" and diameter of same 1⅛". This coil is to keep generator coil constant and its use is imperative for the successful operation of the set. A double pole, double throw switch is mounted on panel for changing from voice to buzzer modulator. A Clapp-Eastham Variable Potentiometer, semi-circular, is used for the grid leak. A .0005 mf. Dubilier condenser, type D181, is used for the grid condenser. A DeForest .0015 mf capacity variable condenser is used for tuning, although any standard condenser will work, if of suitable capacity. A Century high frequency buzzer is used for buzzer modulations. The Magnavox tone arm is used for transmitting phonograph music; also a Magnavox hand transmitter for talking. A Western Electric transmitter was tried and gave very good results. The motor generator is a standard 100 watt, 500 volt machine, with a field rheostat of 5000 ohms and a 43 volt variable "B" battery is used for the "C" battery. The full 43 volts is found to give best results. Two 5 watt Cunningham power tubes are used and a radiation of 1 1-10 amperes can be depended

(Continued on page 433)

This Department is conducted by the U. S. Radio Inspectors of the Sixth District.
CO-OPERATE!

WITH THE RADIO INSPECTOR

Questions answered by the Inspector.
No names will be printed.
Initial your letters only.

DEPT. OF COMMERCE SPONSORS NEW RADIO BILL

The Bureau of Navigation, Department of Commerce, is sponsoring a measure known as Senate Bill No. 1628, which is designed to supply some minor deficiencies in the existing Radio Laws and Regulations, and also to provide a permanent committee, which shall have power to formulate such rules and regulations as may be found necessary from time to time, in order to conserve the optimum interests of radio communications throughout the United States.

The bill differs from the one introduced by Senator Poindexter, in as much as it insures commercial control of radio generally, by having the committee composed chiefly of Commercial radio engineers, instead of Naval and Military officers as proposed in the Poindexter measure.

There is every reason to hope that at least one member of the Committee will be selected from among the amateurs and that amateur interests will receive more consideration than has ever been accorded them in the past. In case the bill becomes a law, the efforts of all amateurs should be concentrated upon the personnel of the Committee. Every care should be exercised in the selection of a real live amateur for appointment to the committee, which will be empowered to allot wave-lengths and formulate the regulations which will govern the operation of their stations.

Those Amateur Radioites who believe in the predominance of Civil over Naval or Military Law, during the normal peace times; who believe that our commercial industries and institutions should be governed by Civil, rather than by Military Laws during peace times, ought to take time by the fore lock and express their preference in the matter, otherwise there is danger that some law detrimental to commercial and amateur interests may be enacted. Eternal vigilance should be the general slogan.

DEPARTMENT OF COMMERCE
Navigation Service
Office of Radio Inspector
Custom House
San Francisco, Cal.
June 4, 1921

Editor,
Pacific Radio News,
San Francisco, Calif.

Dear Sir:

I am enclosing a copy of a circular letter, which contains all information concerning the issuance of the new classes of Commercial Radio Operator Licenses, which will clear up, and explain a number of points which have caused a considerable amount of confusion among many radio operators, and others interested, which is effective July 1, 1921.

There are established, under these regulations, the following classes of licenses:

1. Commercial First Class, 1st Grade.
2. Commercial First Class, 2nd Grade.
3. Commercial First Class, 3rd Grade.
4. Commercial Second Class, 1st Grade.
5. Commercial Second Class, 2d Grade.
6. Commercial Second Class, 3d Grade.

All operators having at least 12 months actual commercial service, which is proved to be satisfactory, as shown by their service records, will, provided they pass a 25 word code speed test, be issued First Class, First Grade Licenses.

Operators who have six months, or more satisfactory service, but less than 12 months, will be eligible to a First Class, Second Grade License, provided he is capable of copying at least 20 words per minute.

Operators who have never before held a commercial license, or who possess less experience than required for the above grades of licenses, will be issued First Class, Third Grade Licenses. This refers particularly to graduates from radio schools, amateurs, and others who are entering the radio service for the first time. The rumors current of "student grade", and other classes of licenses, have absolutely no foundation, and should be given no credence by anyone.

All operators who hold First Class Licenses, regardless of grade, will be eligible to operate at any and all stations where commercial first grade operators are at present required, without further formality. That is, all ships where two first grade commercial operators are required, will require at least two operators of the new First Class; however, these men may hold **any** grade of license, although it will, of course, be understood that those holding first and second grade licenses will usually stand a better chance of obtaining employment than those holding one of the third grade. Third grade operators, however, without any danger of being penalized, hold **any** position, on **any** ship, or at **any** shore station, where first, or lower classes of operators may be required.

Second Class Licenses may be issued to those persons who fail to attain the percentage in the examination required for the issuance of a license of the First Class; otherwise the condit and of service, etc., will be the same for the various grades, except that a speed of 12 words in the third grade applies to the third grade second class license, which corresponds to the speed test for the present Commercial Second Grade License.

All persons holding valid First and Second Grade Commercial licenses, which have been issued under the old conditions will continue to operate under these licenses until they expire. At their expiration date, the holder of the expired license will be issued a license of the new classification, the class, and grade depending on the service shown on the previous license, and, in case of applicants for First Class First Grade, the issuance will also depend on the applicant's ability to copy at a rate of 25 words per minute, Continental Morse.

No change in the Commercial Extra First Grade License, which will be issued, upon examination, as provided in the regulations, (Paragraphs 101 to 106, inclusive, Radio Laws and Regulations, Edition Aug. 15, 1919).

There will be no change in the present First and Second Grade Amateur Operator's licenses. All instructions, information, etc., apply to the commercial license exclusively.

Respectfully,
D. B. McGown,
Assistant Radio Inspector.

QUESTIONS ANSWERED By the RADIO INSPECTOR

QUESTIONS AND ANSWERS.

Q.—In calling a person by radiophone will it be permissible to say: "This is John Brown, Sacramento, calling," or must he say: "This is 6—— calling?"

Ans:—In calling it will be necessary to say "6——, calling, John Brown calling." The name may be used as shown, if desired, but this name not being the official call, it will be necessary to use the official call at all times, in order that any station receiving may know who is calling.

Q. Is it permissable for a friend who knows nothing about radio to speak into the transmitter when a licensed operator is with the apparatus, and if so, is the licensed operator responsible for his utterances?

Ans. The Radio Laws and Regulations state: "Under the supervision of a licensed operator an apprentice, or unlicensed person may learn the art by the actual use of the apparatus, but the licensed operator who fails to enforce obedience to the regulations by the apprentice or unlicensed person serving under his supervision is liable to penalties as if he had himself violated the regulations." This refers to radio telephone stations where the communication is by word of mouth as well as by radio telegraph stations, and operators thereof.

GRADING OF COMMERCIAL OPERATOR'S LICENSES
Department of Commerce
Bureau of Navigation
Washington
May 6, 1921.

Radio Inspectors and Others Concerned:

The Commercial First Class and Commercial Second Class radio operators' licenses which replace the Commercial First Grade and Commercial Second Grade Licenses on July 1, 1921, will be issued to applicants who pass the examinations now given for First and Second Grade Licenses.

Holders of First and Second Class Licenses, irrespective of grade, will be eligible for employment in any station now requiring First and Second Grade Licenses.

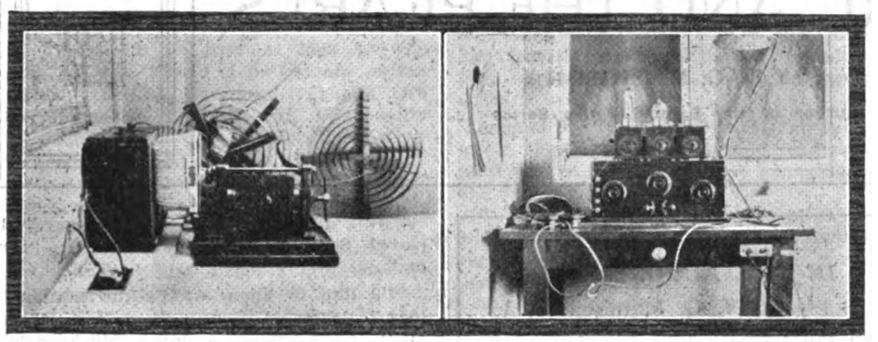
The First Class and Second Class will have three grades each.

The grade determines the service and code speed of the applicant.

The code speed of twelve words in the third grade applies to the Second Class Licenses only.

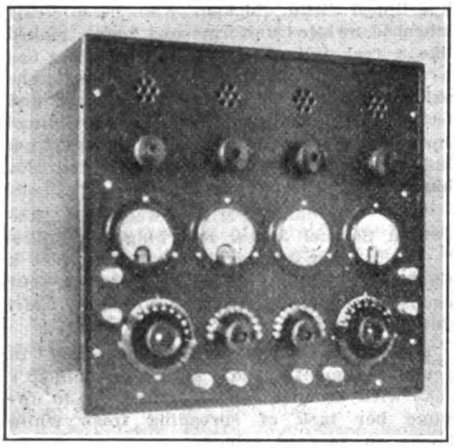
(Continued on page 416)

6ZU-FRESNO, CAL.



Here's one of the "select few." 6ZU uses a 1-2 KW Packard transformer, Dubilier 0.007 condenser, Amrad Quenched Gap, oscillation transformer and an anchor gap in the ground lead for a break-in system. A variometer receiving set is used, together with an Acme two step amplifier and Baldy phones. The aerial is of the semi-fan type, suspended from two 60 foot poles, 50 feet apart.

The ground system is unique. A counterprise of ten wires, 10 feet above the ground, directly under the aerial is used. Stations worked include 7ZG, 7EX, 7BP, 7AD, 7BC, 6ZZ, 6ZA, 6ZH and many others.

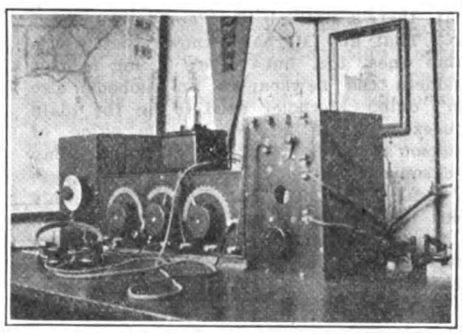


Mr. O. Schuwendt of Fresno, Cal., has discarded his panel spark transmitter in favor of CW and radio telephone equipment. The photo shows his four tube CW set, a description of which will appear in future issue of this magazine. Full constructional details will be given in order that the experimenter can build an exact duplicate of the transmitter.

-6EA-

This photo shows the receiving set used by H. C. Seefred, 6EA, during the winter months of 1920 and 1921. The usual "Calls Heard" list received from 6EA speaks well for his receiving set, all of which goes to prove that Seefred has efficiency spread all over his station.

6EA has been heard for the first time in the Eighth District. He was reported heard by 8AIB, Dayton, Ohio, about a month ago.



PROGRESSIVE ACTIVITIES OF THE RADIO CORPORATION OF AMERICA

BY LAWRENCE MOTT
(Associate Editor)

TO write of the activities of a business of such colossal magnitude as The General Electric Company—with which is associated The Radio Corporation of America—is no mean feat! Even to adequately describe any one of its various kinds of manufactures is not a simple matter!

However, I have been most courteously supplied with certain vastly interesting information by Mr. E. E. Bucher, the Commercial Engineer of The Radio Corporation, and the well-known author of many most useful works on radio effort. This information I would pass along for the benefit of PRN readers, feeling rather sure that herein contained is much of which they have, so far, known nothing, and much that will be of value, especially to CW enthusiasts.

Most amusing letters have reached me from set-in-the-rut spark operators, bitterly decrying CW—and almost in same breath admitting that it IS the only real method of radio transmission, and that it will, eventually, entirely supplant the spark—of ancient vintage!

There has been a great deal of deep and dark "mystery" about power tubes—as all CW men know! Did one have a VT-2, one

(Continued on page 424)

SOME TRANSMITTING TUBE DATA

By B. F. McNamee

Chief Engineer, Moorhead Laboratories, Inc.

THE amateur who has just started experimenting with CW generally finds out that he has something to learn about transmitting tubes. The sad fact is that he generally burns out a few while learning. A few precautions are therefore timely.

Of course, we all know that an overdose of voltage across the filament terminals will soon terminate the activities of any respectable vacuum tube, but only a few seem to realize that there is any other method of overloading a transmitting tube.

It is not safe to operate a tube on high plate voltage without a plate current meter. This should be a D. C. milliammeter having a range suitable to the size and the number of the tubes used. The correct plate current for any particular make of tube should be obtained from the manufacturer, as the life of the tube depends very much on how closely one conforms to this rating. With a plate current of 20 milliamperes the life of an A-P transmitting tube is about 250 hours, while if the plate current is kept down to 15 milliamperes the life is about doubled. It is easy to obtain a plate current of 50 or 60 milliamperes through one of these tubes, but its life under such conditions would be about half an hour.

When an amateur has been obtaining an enna current of several amperes with his park set, and starts CW work, it is most natural that he would try to obtain just as much. Many articles in former numbers of QST have shown that a small CW antenna current will carry as far as a spark set having an antenna current many times greater. The writer has obtained as much as one ampere in an average amateur antenna from a single A-P tube; the space current was excessive, and the life of the tube some twenty minutes. Consequently, a boast about high antenna current from a small tube set means nothing as to the ability of the boaster; it really means inefficiency when one considers the ratio of output to upkeep.

A case somewhat analogous to overloading a tube would be attempting to use a one-horsepower motor on a two-horsepower load. The motor might revolve with such an overload, but it would draw about twice as much current from the line, would heat badly, and would soon burn out.

Because a tube will oscillate with a full six volts on the filament is no reason why a filament rheostat should not be used. After a tube has started oscillating it is generally possible to cut down the filament current quite a bit without decreasing the antenna current. This will, of course, lengthen the life of the tube. The filament of the A.-P. transmitting tube is designed to work on six volts with a rheostat in series. The filament current is .75 to .8 amp.

Recent tests made at the University of California by Mr. A. K. Aster of the Physics Department show that the resistance between adjacent prongs in the condensite base of these tubes is 100 megohms. The measurement was made with 1500 volts D. C. Moisture in the atmosphere has no appreciable effect on this result.

The results obtained with the A-P transmitting tube show that CW is not only the solution of the QRM problem for the amateur, but the means of carrying on the long distance relay work as well. The achievement of Mr. Hugh Robinson (2QR) of talking to Scotland was accomplished with four of these tubes. Very recently Mr. R. Rheem (6AH) of Oakland, Cal., talked to Los Angeles with the same equipment in daytime. Both these amateurs were using rectified A C on the plate.

THE GIRL AND THE PEARLS

BY V. G. MATHISON

Author of the Samuel Jones Series

SAMUEL JONES has got into the lime-light for fair. There appears this morning in one of the 'Frisco papers this headline:

"WIRELESS OPERATOR OUTWITS CUSTOMS
SMUGGLES PEARLS WORTH THOUSANDS"

Beside this front-page caption there is a real picture of the notorious brass-pounder and below comes this amazing item:

"In spite of a minute search and an extreme watchfulness on the part of the local customs inspectors, Samuel J. Jones, the chief wireless operator of the big passenger liner 'La Hermosa,' just in berth from Panama and Mexican coast ports, is believed to have successfully smuggled ashore a package of pearls, said to be worth $225,000.00."

"The details surrounding the affair are most extraordinary. The pearls, which belong to the well known mning millionaire, Carter Jackson, are alleged to have been stolen from him last summer by Lucerita Carmello, a Spanish dancing-beauty, rumored to be one of the mining man's former flames, who, gaining access to a private safe in his residence at Burlingame, secured the pearls and disappeared. The jewels were eventually recovered in Mexico City, but when Mr. Jackson had them brought up on one of the Pacific Mail steamers, he was informed by Rudolph Merboler, in charge of the local customs, that since there was nothing to prove them the identical ones stolen, and, in fact, nothing to prove that the originals had ever been lost at all, the pearls from Mexico City would not be admitted without the payment of the full duty, which would amount to almost ninety thousand dollars. At a Federal hearing, the decision of Merboler was sustained, but Mr. Jackson, declaring the duty had been paid once, when the pearls were originally brought in, refused to pay it again, and sent the jewels back on the Mail steamer to Mazatlan.

"It appears that when Jackson formerly lived on his copper-mining properties at Santa Rosalia, in Lower California, he owned a yacht, the 'Querida,' upon which Samuel J. Jones was for a time radio operator. It is said that the wireless man stands on a remarkably friendly footing with his former employer; and when the difficulty over the pearls arose, he offered to run them through the customs for the other.

"Merboler, learning of the plan, put a small package agent on board the 'La Hermosa' last trip, who saw a small package delivered to the radio man, when the ship touched at Mazatlan, northbound. Upon the liner's arrival yesterday, the customs inspectors went over the ship with a fine tooth comb, without finding anything; and though every precaution was taken to prevent the pearls being smuggled ashore; nevertheless, it is rumored that Carter Jackson received them safely last night."

IN THE AUGUST ISSUE

Mr. V. G. Mathison

will tell you what happened to Samuel Jones while acting as Radio Operator in an Alaskan codfish village.

A HARD BOILED BUNCH

is the title of the next story. It's great!

"Well, I don't see nothin' wrong about it," insisted Samuel Jones, blinking a rather black-looking eye, as with his friend Cunningham, he stepped out of the elevator, on the way to lunch; "Jackson paid the duty once; si why should he pay it again?"

"No-o, not if they're the same pearls," qualified Cunningham.

"Well, they are," averred Samuel Jones; "On the last trip of the 'Querida,' when Jackson moved up here to Frisco from Mexico, the pearls was on board then, an' I saw 'em declared; six in a settin' an' forty-one in a string—some beauts, too!"

"But that don't prove these are the same ones," doubted the audiotron man.

"If you'd seen 'em, you wouldn't say that—there's nothin' like 'em in all Mexico. That guy Merboler knows they're the same ones, too, but there's a lot to this business the newspapers an' nobody else ain't onto. Merboler used to be the main squeeze in the Frisco branch office of Jackson's mines, but; finally, one day Jackson caught him in a dirty, double-crossin' deal, an' kicked him out—an' not only that, but Merboler was after that Spanish jazz-baby himself, an' he's got a grudge like death against Jackson because he beat his time—believe me, I know all the ins an' outs of this racket."

"Perhaps you're right. At any rate, you were lucky to get by the customs men as you did."

"Humph, that's somethin' else the fool newspapers ain't onto," sniffed Samuel Jones; "I had a hunch somebody'd gave me away, an' so—he paused and looked around, cautiously, "—an' so I never brought the pearls up a'tall. Jackson's makin' the papers an' everybody else think he's got 'em, so's to put Merboler off the track; an' I'm really bringin' 'em up next trip—but, here, come with me: I'm goin' to show you a new eatin' joint.

With this abrupt shift of the subject, Samuel Jones led Cunningham to a large marble basement-stairway.

"Say, here, where are you going," objected Cunningham, reading the inscription, "Leighman's Cafeteria;" "I thought you said you wouldn't eat in a cafeteria."

"Well, I'll eat in this one, anyway," declared Samuel Jones, determinedly; "come on."

"I'd like to know what's the confounded idea," protested Cunningham, ten minutes later, as carrying a large luncheon-filled tray, he stumbled over somebody's umbrella and narrowly avoided a disastrous collision with the rear end of a detestably fat woman; "you know I never had any use for these wait-on-yourself places; and you always said you wouldn't be found dead in one of them—and now here—!"

Cunningham's complaint died on his lips. Approaching their table was a dream of girlish deliciousness, a Venus-shaped, rose-bud-lipped little chicken, who in a stiffly starched white uniform and cap, looked like a real, living doll.

"How are you today, Mr. Jones," she asked, glancing shyly at Cunningham; and bestowing a charming smile upon Samuel Joes, as she began taking the dishes from his tray and carefully arranging them for him on the table.

"Fine an' dandy, Miss Sweetness," answered Samuel Jones, returning her smile, "—an' I know you are, too, if you feel a thousandth part as good as you look—but excuse me—Miss Lillian Vernaldt, Mr. Cunningham."

The little blonde smiled demurely in acknowledgment; and, after a moment's chat with Samuel Jones, drifted off to resume her task of spreading fresh white linens on vacated tables.

"No wonder you insisted on coming down here!" exclaimed Cunningham, admiringly, as he watched the girl threading her way among the crowded tables; "some little peach, all right!"

"Well, you don't need to gape your confounded head off!" growled Samuel Jones, with ill-concealed jealousy, "I brought you down here to eat."

"Go ahead and eat, yourself, and quit looking so green in the face," retorted Cunningham, good humoredly. "But, joking aside, she is a pippin. How did you happen to meet her?"

"By gettin' this," enigmatically answered Samuel Jones, tenderly feeling his blackened left eye.

"What, did she give you that!"

"No, of course not!" exclaimed Samuel Jones, indignantly. "You know, last night I was out to Burlingame to see Jackson an' tell him why I didn't bring up the pearls this trip. I left his place about ten o'clock, an' was standin' just outside his high iron lawn-fence, when all of a sudden, somewheres pretty close, I hears a scream. There's lots of trees along the streets out there, makin' things pretty dark; an' right in the darkest place, I hears somebody scufflin'. I advances along the sidewalk, navigatin' pretty cautious like at first, but when I gets up close, I sees it's a girl grapplin' with a fellow. Course then, right away, I rushes in an' slams the guy one—an' quick as a cat, he turns on me, an' cracks me right square in the eye! Believe me, that was all he ever did, too!—I just

lit into him an' hammers the everblastin' daylights out of him, finishin' him up with a tap under the jaw that lays him out on the sidewalk. I was thinkin' of calling a cop to cart him to the cooler, but first I lights a match to have a look at the geiser; an' who should it be but one of the cadets on the 'La Hermosa.' Though he's been on the ship only a trip, I'd already sized him up for a sneaky, yellow-livered skunk, an' I had no use for him, but when I recognizes him there on the sidewalk, I thinks to myself that shipmates is shipmates, an' he's probably only full of jackass moonshine, anyway; so, instead of callin' a cop, I just disposes him comfortable in the gutter an' leaves him there. Then I takes Peaches-an'-Cream home—an' that's how I met her."

"She lives near Carter Jackson, in Burlingame, then?"

"No, she lives in Oakland, but last night she was out to Burlingame to visit a sick friend, she said."

Cunningham suddenly became thoughtful.

"That sick friend business is surely old stuff," he remarked, cryptically.

"I don't get you."

"I mean, I think you're a bigger sucker now than you were ten years ago fresh from the hay ranch. On the identical night you go to Burlingame, this girl, who belongs across the bay in Oakland, happens to be way out there; and just at the very minute you come out of Carter Jackson's place, she is attacked right close by—and then you fall for a silly story about a sick friend, and forget all about the fact that right now you are the object of a lot of attention on the part of certain government officials—for you know, they may have a suspicion that you haven't brought up those pearls yet."

"An' this little chicken picked up the cadet somewhere, an' slipped him a five or a ten spot to start all the racket last night—she's the queen of the secret service out to string me, I s'pose, huh!"

"She's mighty pretty and clever looking to be working here." Cunningham was serious.

"Aw, fergit it!" scoffed Samuel Jones. "Because some of the hams use your audion bulbs till they get dark inside an' burn out from pure old age, an' then send 'em back to you an' say ther're no good, you're beginnin' to think the whole world's crooked! Anybody can see that this is just a sweet, jolly little dame—"

"Oh, you're in love again—and every time you fall, you fall harder. Come on and eat, if you're going to.

One afternoon, a few days later, Samuel Jones was leisurely strolling down Market Street. It was Thursday, Lillian's day off, and Samuel Jones was going to meet her at three o'clock. She had expressed a desire to see the "La Hermosa" and he was going to take her down to the Mail pier and show her over the big ship. Drifting down Market Street, Samuel Jones paused before a big show window, filled with a dazzling display of artificial diamonds and pearls. He lingered thoughtfully before the window for a few minutes, and finally entered the store.

Later emerging, he wandered on down Market; abstractedly turned into Battery, and, almost before he knew it, found himself in the chili shadow of the customs house. Involuntarily quickening his step, he was about to hasten by, but chancing to glance up at the entrance, who should he see coming out of the revolving door but Lillian Vernaldt. Samuel Jones stopped, abruptly, and then the girl saw him.

"Oh, hello," she smiled, coming to him; "I never thought I'd meet you down here."

"Well, I never expected to run into you here, neither," answered Samuel Jones, constrainedly.

"I just came down here a few minutes ago looking for sister," she replied. "Sis is a stenographer here in the hydrographic office."

Samuel Jones looked penetratingly into the sweet young face, but he could read nothing of deceit in it. If she was stringing him, she was indeed an artist.

"I was just wanderin' around killin' time, waitin' for three o'clock," he remarked, rather awkardly. "Shall we go down to visit the 'La Hermosa' now?

The girl assented, and they took a car to the Mail docks. Assisting the little blonde up the ship's gangway, Samuel Jones observed up on the bridge deck, the hulking figure of the cadet he had thrashed the night at Burlingame.

The fellow looked as though he had just returned aboard from his long drunk, and Samuel Jones wondered that the man had not been discharged from the ship. His clothes were soiled and rumpled, and his coat-tail was conspicuously ripped. Catching sight of the girl and her escort, he slunk out of sight into the wheel house.

Samuel Jones spent an enjoyable hour showing his pretty charge over the big liner. At last they came to the wireless room.

"This place looks pretty good now," remarked Samuel Jones, after he had gone through the time worn explanation of the radio equipment, "but you ought'a seen the shack the first day we came in, after that blasted customs bunch got through with it: It sure was a wreck, all right."

"What's this funny looking thing for?" curiously asked the girl, picking up the shiny brass mouth-piece of the wheel house speaking tube.

"That's what I hid my pearls in last trip," jested Samuel Jones, taking the tube from her hand. "You see, there's a whistle in the mouthpiece that's held shut by a spring; an' so all I had to do was to slip the pearls into it and—but I'll be darned if that confounded whistle hasn't fell out again!"—Stooping and searching about the floor, he picked up a little conical metal object. "I don't know what's the matter with this blamed thing," he grumbled, scrutinizing the convex disc closely, "it seems to keep fallin' out of the mouth piece all the time, latey—"

"Oh, mercy, do you know, what you just said about those pearls of yours reminds me of something I was going to tell you,"—broke in the girl, a troubled look in her pretty eyes. "Remember, just now, I told you about sister's working in the hdrographic office?"

"Yes," prompted Samuel Jones, wondering.

"Well, oh dear, maybe there's nothing to it, but sister told me just last night that as she was going down a corridor in the customs house yesterday, afternoon, she heard some men telling another one that you haven't brought those pearls at all, as the papers say you did; and she said she heard the man say he was pretty sure you would have them with you next trip."

"Sufferin' wildcats! Jackson was right!" ejaculated Samuel Jones, half-involuntarily.

"Who?"

"The man the pearls belong to," answered Samuel Jones. "You know, the reason I was out to Burlingame the other night when I met you, was to tell Jackson why I'd left the pearls behind last trip. We was in his library, which has a big French window openin' onto his garden, an' somehow he had a hunch all the time that somebody was snoopin' around outside listenin' to us—an' I guess he was right, too!"

"Then you actually are going to bring up those wonderful pearls next trip?"

"Yes, I'll have 'em next trip, all right; an' I don't give a whoop if that confounded customs crowd do know it—they're only a bunch of boneheads, anyway."

"And are you really going to put them in that thing there?" she queried, wonderingly, pointing to the speaking tube, which Samuel Jones still had in his hand.

"No, I was only jokin' you about that—that's the first place they'd look," answered Samuel Jones, smiling at her innocent credulousness, "There's all kinds of places to hide a little package like that aboard this big ship, but the idea is to put it in something it can be slipped ashore in—an' believe me, I've got a humdinger of a scheme for doin' it, too."

"How?" she asked, simply.

Samuel Jones seemed unconsciously driven on by the little blonde's infantile gaze of wide-eyed curiosity. Opening a locker, he took out an audion B-battery.

"You see, this thing is all full of little dry cells," he explained, holding the object up to view. "Now, s'posing, I take this battery to pieces an' dig the filler out of every cell, I can put two or three pearls in the bottom of each one; then I can shorten up the little carbons an' put 'em back with the filler; seal up the tops; an' finally put all the cells together in the box an' run it full of the sealing-compound. If the job's done careful, it'll look natural; but the best of it is, the B-battery will give juice, same as ever, an' I can put it right into the receivin' cabinet an' use it. Then, when we get into Frisco, I'll bust a wire or somethin' in the cabinet, so the wireless company's inspector'll have to send it ashore to the shop. The B-battery will go with it; an' it'll be no trick for me to breeze into the shop long about lunch time an' get the battery out—an' the stunt's all done."

Once more the "La Hermosa" made the run to Panama. Northbound, at Mazatlan, the package of priceless pearls were delivered aboard, into the hands of Samuel Jones; and the audacious brass-pounder made but little effort to conceal the fact.

In the course of his watches north, he carefully took apart, and reassembled, the spare B-battery. Having brought some extra sealing compound along for the purpose, he did the job with such minute and painstaking care that when finished the B-battery appeared to have never been tampered with. It showed an almost normal voltage, and Samuel Jones put it into the receiving cabinet, removing the other one.

The night before the arrival of the "La Hermosa" at San Francisco, there came a message from KPH:

"Jones La Hermosa Found serge Beware Jackson."

A strange message; but Samuel Jones thought he understood it, and he smiled, grimly.

Almost before the big liner had dropped anchor in quarantine, the customs' tugboat was alongside. Samuel Jones sat in the radio cabin, calmly awaiting developments. He had not long to wait. The wireless room door was thrown open, and in marched two inspectors. With them was their blotchy-faced, coarse-featured chief, Merboler himself. Also in the party, and carrying his tool kit, was the sour-tempered wireless

(Continued on page 422)

CORRESPONDENCE FROM OUR READERS

PAUL F. JOHNSON
2940 Malden Lane
Altadena, California

Pacific Radio News,
50 Main Street, San Francisco.

April 12, 1921.

Dear Fellows:

Here is a list of calls I have heard during the first three months of 1921, arranged in a different manner than usual. Several lists similar to this from different parts of the Sixth and Seventh Districts would give a fair idea of what stations may be worked. All are QSA or I would not hear them, being partially deaf, and none are listed that I am not fairly sure of.

Place	Distance	Calls Heard by 6ABA
Pasadena	Less than 25 miles	6FU 6GD 6GH 6GP 6HJ 6KS 6PC 6RN 6WH 6ACB 6ACY 6ADL 6ADN 6AGS 6ALD 6ALL
Alhambra	" " " "	6DS
South Pasadena	" " " "	6OD
Glendale	" " " "	6ID 6OL 6OY 6AGM
Los Angeles	" " " "	6CU 6EA 6EB 6EF 6EK 6EL 6EN 6ER 6FT 6GI 6HY 6IQ 6IU 6IX 6JD 6JG 6KA 6KP 6KY 6LC 6MF 6MK 6MN 6MO 6MW 6TL 6VZ 6AAB 6ABG 6ADG 6ALU
Baldwin Park	" " " "	6IS
Whittier	" " " "	6NY 6AHA 6AJK
Huntington Park	" " " "	6WS
Sherman	" " " "	6TY
San Fernando	" " " "	6JM
Anaheim	28 miles	6AAG 6AGN
Wilmington	30 miles	6ADX
Long Beach	33 miles	6IF 6ABP
Santa Ana	35 miles	6ED 6PQ
Laguna Beach	50 miles	6SK
Avalon	60 miles	6BX
Fresno	195 miles	6DH 6DK 6NF
Pacific Grove	275 miles	6ACR
Santa Cruz	290 miles	6DP 6OW 6PR 6ABM
San Jose	300 miles	6AT 6CO 6GY 6PO
Stockton	310 miles	6KM
Stanford University	315 miles	6AE
Hayward	325 miles	6FN
Burlingame	330 miles	6ZR
Walnut Grove	335 miles	6AK 6EJ
Rio Vista	335 miles	6NT
Alameda	335 miles	6AN
Oakland	340 miles	6CC 6FV 6FX 6JR 6KL 6LN 6ABK
Berkeley	340 miles	6EX 6QS 6VH 6ACM 6JN
San Francisco	340 miles	6AC 6AF 6AP 6CH 6OC 6PD 6AKH
Sacramento	355 miles	6GF 6GN 6IC 6NC 6WG
Roseville	360 miles	6AIW
Napa	365 miles	6ACA
Grass Valley	380 miles	6DD
Santa Rosa	390 miles	6AID
Colusa	405 miles	6TC
Willows	430 miles	6LU
Ukiah	435 miles	6AGF
Richfield, Utah	450 miles	6ZH
Douglas, Ariz.	530 miles	6IG
Eureka, Cal.	560 miles	6ND
Salt Lake, Utah	570 miles	6JT 6NQ
Silverton, Ore.	795 miles	7IN
Pullman, Wash.	865 miles	7BQ

If I have made any errors, I hope I may be corrected.

Yours as ever,
PAUL F. JOHNSON (Radio 6ABA).

FULLERTON UNION HIGH SCHOOL
Fullerton, Calif.
May 17, 1921

Mr. Lawrence Mott,
Associate Editor, "Pacific Radio News",
Avalon, Calif.

Dear Sir:

In looking over the last issue of Pacific Radio News I find an article by yourself, in regard to CW transmission and will say that it surely sounds good to me.

I am not a professional wireless amateur like yourself, but for the last year I have been seeking the mysteries of this most interesting subject and have come to the conclusion that CW is the superior of all wireless communicating methods.

I am an instructor in manual training in the Fullerton Union High School and have had about twelve complete receiving stations built by boys taking work in my department. I have advised some twenty or more from the surrounding grammar schools in regard to work being done by them. Some of these stations are very original in their construction and are giving fine service.

Some very complete sets have been built and enclosed in desks that when closed show nothing that would be out of place in a drawing room.

My department has handled about $1200 worth of supplies purchased through the Western Radio Electric Co., Los Angeles; and used by the boys in making their sets.

I feel that no "up to the minute" manual training man can afford to ignore the enthusiasm of the boys for wireless. Every field that is covered in the manual training shops is brought out in the radio work and I find that if boys work on projects that appeal to them the problem of discipline takes care of itself.

We have done nothing this year in the building of sending sets but we expect to delve into that part of the art next school year. We are preparing to build six one hundred watt five-hundred volt motor generator sets, frame of motor and generator, base and coupling to be of aluminum. Field laminations, etc., we are buying from the Westinghouse Electric Co.

We expect to use the celebrated "Heising Circuit" with two five-watt Cunningham tubes, one modulator and one oscillator. Plate voltage and filament current furnished by the unit we are building.

I understand you have had a great deal of experience with this circuit and others using CW and would be pleased to have any information you can supply us.

I would like to inquire through the medium of your paper, as to what other schools are doing for their boys in the radio field. We would be glad to furnish you with photographs, circuit diagrams and a short history of our experiences in building one of our best sets, if you should care to publish them.

Hoping to see many articles in your paper, contributed by the manual training men of the state, telling of the work they are doing in the wireless field and giving their opinions of the benefits derived by the boys in doing Wireless Work in the Manual Training Department, I am,

Yours for a greater CW Club in Southern California,
(Signed) E. A. AMES.

WITH THE RADIO INSPECTOR

(Continued from page 412)

The first license of either class issued an applicant will be marked Third Grade.

After six months satisfactory service in the Third Grade the operator can have his license marked Second Grade, provided he has passed a code test at the rate of twenty words a minute, sending and receiving.

After twelve months satisfactory service in the Second Grade the operator can have his license marked First Grade, provided he has passed the code test at twenty-five words a minute, sending and receiving.

For the purpose of grading, service must be rendered under the class of license held, and any service credited on the Second Class License will not be applied to the First Class Licenses.

In renewing licenses which were issued prior to July 1, 1921, holders of Commercial First Grade Licenses will be issued Commercial First Class Licenses, and holders of Second Grade Licenses will be issued Second Class Licenses. The grade will depend upon the previous service record under the class of license held and passing the code test required for the grade.

The grade should be followed by the date effective and initials of the radio inspector in his own handwriting.

Outstanding First and Second Grade Licenses will be valid until they expire and will not be graded under the new rule until the renewal license is issued.

(Signed) E. T. Chamberlain,
Commissioner.

CORRECTIONS

Mr. 6ANL'S name was spelled Cenner, instead of Conner, in a previous issue of the PRN. Beg pardon, 6ANL, perhaps the printer ran out of "O's."

6IQ tells us that they have changed the name of the street on which he lives. His address is now 323 North Brannick Street, Los Angeles, Calif.

ERRATA

Owing to the printers' numerous errors in substituting English characters for the conventional Greek letters used in the formulae of the original manuscript, the following corrections are made.

Under Fig. 1, page 367 of the June instalment, correct to read as follows: "section of the coil is of any shape and its dimensions are small compared with the axial length, is

$$H=\frac{4\pi NI}{10}$$ (lines per square centimeter)

If a bar of some magnetic substance such as iron is substituted for the air core, a flux density,

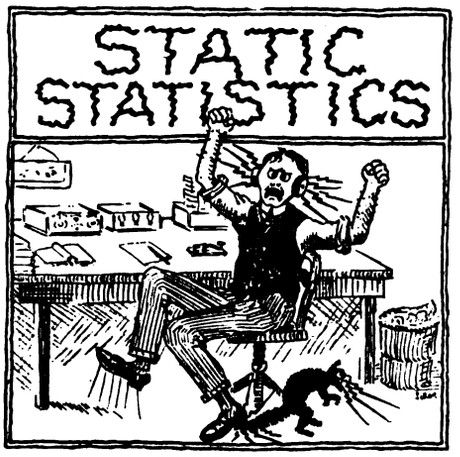
$$B=\frac{4\pi Y}{10}$$

will be produced in the iron for every ampere turn.

The relation, $\frac{B}{H}$, represents the permeability, and for low degree of magnetization, its value in iron may be as great as 6000."

To avoid errors from a similar source in the installment for this month, the following nomenclature will be used:

Y—Permeability.



By SQUAWK McGUFF

Well, boys, at the time of me closing this here column, account old man Dickow sayin' as how his magazine must go to press right now, I see that KET is still on 200 meters with that fish horn note and I wanna make a motion here and now that KET confines his fish-horning to Fridays. I thought his spark was the fish man and sent the kid out for two-bits' worth of halibut. He sure comes in fine on us guys' waves. Maybe if he could get a couplamore amps it might be more QSA and sell more fish. At present, I suppose acct his broad wave, he can only be heard a thousand miles. I don't see why he don't tune sharp on 200. Rattlegap told me that a guy had to tune sharp for efficiency. How can he get efficiency working on every wave in the fourth dimension? The Department of Commerce has sure got to hand it to us amachewers for working out knotty problems in this here ether stuff. We have now come to a point where we compete with KET, NPG, the Tigh Tenshun Power Company and 6ZR.

I notice a lot of competition lately between the phones and the sparks. I don't know which will win, but hurry up and get it settled one way or the other. I ain't getting much concert lately.

EXTRA! EXTRA!! All about de big debate between 6SN and 6AAW.

"You are very broad—what is your coupling?"

Incidentally 6APH entered, but under protest was debarred by the Chamber of Commerce for one day.

Mr. Hadley, prominent among us, has entered a vigorous protest against the phrase of 6XW at the end of each selection of "Just a minute, please, and we'll have another." This, he says, is reminiscent of the days when schooners went over the bar without antenna or ground. However, the bulbs would oscillate freely and the boys could send to beat the band. With a shot of the present-day "Jackass," I think a much greater speed could be attained.

"Just a minute and we'll have another."

Gee, that last one was clever, wasn't it? I had a swell job in the army. I was a pilot, PILOT. The lieutenant would say: "Pileut here, pileut there, and pileut in the coal shed.

That's old stuff, though. But when all amateurs quit scrapping and when 6ZK outworks 6ZR—that's new stuff.

Two Japanese fishermen were returning home late one night and discovered in the vicinity of the old KPH station a rather wierd jovicentric artist walking around with a fish pole in the air with a box attached underneath. After sizing him up they finally decided he was harmless, at least for the time, and gained courage to inquire as to his purpose.

"I'm fishin' for leaks. High tenshun leaks."

Now these Oriental gentlemen were seasoned disciples of Isaac Walton and were at a loss to think of any animal in their piscatorial profession called "High Tenshun Leaks." However, it might come under the category of flying fish. So they hailed a protectorate of the law, commonly known as a "cop," who, in turn, was not satisfied with Watkins' explanation. He landed in the "hoosgow."

The judge, not being a Batchelor of Science, was rather dense as to the meaning of it all. It took a lot of valuable time explaining to the elicitious judiciary how he would go to each pole transformer hunting a leak that had been bothering KPH for some time.

Finally the judge decided to dismiss the case, but the medical examiner (who tells us whether we are bughouse), shook his learned head. He was not satisfied as to whether the young man was a catatoniac. He should be held on the charge of fishing without a commercial license.

A grizzled old grandpop of the way back days was talking with another alfalfa-chinned veteran of the sixties. "By gosh, Ezra, what's comin' nex'. Submerines, airships, wireless telyfonies, and now I hear the boys cussin' about AIR HOGS. That's what I calls scientific farmin'."

6IC, the Sacto wiz, has come to the conclusion that his set is spoofing his jazzalations. But if he will look for that little green wire the fellers run from his lead to the ground once in a while, he might be more solid financially. As a tip, my dear 6IC, the next time them gamblers want to wager you can reach the city limits, ask them if they can buy any mothballs and go hunt the little green wire.

Boys, I sure got a sticker in the mails the other day. Of course, me being a EXPERT, I don't very often have to go outside if the US for advice, but this bein' so hard, if I haven't got it correct, please advise:

QUESTION: I have a one inch spark coil which I operate on two dry cells. My radiation is 50 amperes at the terminals of the oscillation transformer but only 10 amperes in the antenny. Hw pls?

(Signed) Herbert, Vacaville.

ANSWER:

My Dear Herbert,

Way up in Vacaville:

I had one whistletree of a time locating that town of yours on the map. I also had a lot of difficulty in ascertaining your exact trouble, as you see above. But after all it's so simple I have to laugh at myself. Simply run your antenny down hill. Current follows the line of least resistance. Hoping I can be of further valued assistance, as I always like to help the boys, I am,

S. Quawk McGuff.

6UQ has that far-away oil tank swing accompanied by a spark of distance characteristics, that fading, fading, jazzy, ringy tone. Sometimes when 6UQ is radiating four and six elevenths, he gets as far as the beach. This inaugurates bookkeeping. Everybody in SF logs him for a DX including 6CH.

6AR in store asking for fone cord.

"How much does it run for?" he asked, anxiously fingering his pocket.

"Oh, quite a ways for $100," said the clerk.

Have you noticed NPG's hump on our lil' ole' tantalizing 200 meters? 6WZ, who is some sort of a navy expert or other, probably other, says that they are working on it. I thought he meant working to eliminate it. However, he was WORKING ON IT last night and it came in so good I sent him a card thusly: "Heard you QSA last night. OM, what are you using? How do you get me? 73. Ans. soon."

Just to show my clientele how the Chinese are progressing, I am publishing a letter received by 6XG complimenting him on the new addition to the air versatiles.

Mr. Radio Experiment Station,
Dear Sir:

Hello, hello. This is first time I write you, yes, yes, your voice he come in like 5 thousand tons chop-suey, sharp as razor. I can hear the music when I leave my phone 20ft away from me. My received set is regiar Chinese model. 3 flat coil, as 1 for pri, 1 for sec, and other for tick. Dector set consist of 2 blow-in jar. Double filament. A bat 2 volt, b bat 10 volt, c bat 40 volt. No d bat. The above apratus is my hmemkeple, never had any burnt-out trouble. When comes weak point I stick in new one, no trouble. I wish you find me record name Jolly Coppersmith, if so please give number of that record. I guess that about all for me. Hell, goodbye.

Yours truly

Geo. S. Chong.

Radio Eperimentor Station, Fiisco, China-town.

HIGH POWER STUFF

I been in this biz since nineteen six,
Which is a very long time ago,
But since listening in each night
I got a whole lot yet to know.

Fights are going on each night,
War is hell, no doubt;
But Sherman never seen a fight
That compares with a wireless bout.

I try to work some DX bird
At some far-off distant point,
When in comes 6EX and knocks
My ear-drums out of joint.

They tell me that I'm very broad,
Also tell me QRX and QRT.
And when I try to get in
They write to 6ZE.

"Close up your bloomin' station," says he,
"You're making too much noise,"
But I couldn't figure it out at all
Unless radiating off the counterpoise.

But alas! I have human patience;
In short, I'm getting sore.
If one K. W. is not enough
I'll put in twenty more.

That seems to be the spirit,
So everybody get their best.
Get yourself a United Coffin
And 6ZE will do the rest.

WAILINGS FROM L. A.

Be careful how you send at night
Squawk M'Guff may be in L. A.
Or he may have a listening guard
So be careful what you say.

You said something, Brother Poet, and I observe that if 6EB would work as hard at the key as he does at changing things he might be picked up by the League of Nations. Those are pretty nice instruments, Lyndon. Verafine indeed.

And I further observe that if a feller is sending himself at the wrong moment how can he police the air? Don't need his a-tail.

6JE is on the job with his phone and takes up considerable ozone. However with all us sparks he's got about as much chance as a mothball in Salome's wardrobe. More power is the answer.

Frank was the first in the old days to hear Honolulu but when he gets that new invention calibrated he promises to keep us posted on the Yap question. Where is the Meteor Electric Company, Hi. Hi.

6XN, Senior, is so busy selling wireless apparatus that it was necessary to pospone his weekly tonsorial regatta. Nothing must interfere with business, however, bath or no bath.

NORTHWEST STATISTICS

After looking over my friends in the Northwest I see they are to have a big banquet and dance to be given by the Northwest Radio Association on June 25 at the East Side Business Men's Club Hall, at which all are cordially invited to attend. Mr. R. V. Russ, chairman of the banquet committee, requests that all persons wishing to attend notify him in advance so that he may order the required amount of stimulation, etc. The banquet is for ladies n everybody, he says. Exhibits of radio apparatus will be shown, and it is anticipated that a large number will attend from outside points. These men of the Northwest are not asleep by any means, and it does our heart good to see the N. R. A. blossom out so rapidly.

The N. R. A. is putting out a monthly paper called the "Hamograms," which is of a local nature. Mr. J. D. Tait (7JW) is the most able editor.

The Northwestern Radio Association of Portland is turning out to be one of the live and wideawake clubs of the Coast. It is not a new organization, as it was started many years before the war, under the name of Northwestern Audion Association. During the war the club died out, but upon the raising of the ban upon amateur radio the club came to life under the new name.

Dr. H. A. Labby, a local dentist and radio enthusiast, is president of the club, and many rocks have been missed since he has been at the wheel.

One of the main activities of the club is the control of local sparks in such a way

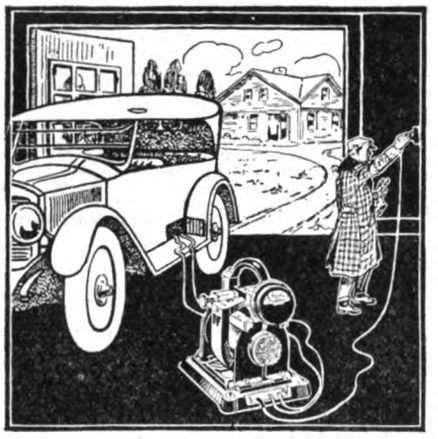
(Continued on page 422)

AMERICA LEADS THE WORLD COMMERCIALLY BECAUSE YANKEE INGENUITY IS PERMANENTLY ON GUARD

WHEN the world war in Europe began in August, 1914, and every cannon fired was sending the cost of living up all over the world, the American Look-Outs, Yankee Inventors, seeing their natural enemy, the cloud of increased costs rising on the horizon, cleared their decks for action and threw the clutch of their inventive genius into full speed ahead to dissipate that cloud, so as to at least in America maintain that high standard of living which has given to its citizens, both in their homes and industries, the so-called necessary conveniences and appliances, which we have come to look upon as common and natural, but which would have taken an active imagination for even the extravagant Caesar to wish for.

When that first S. O. S. of distress came in from a dentist whose cost of primary battery chemicals and renewals, which he was using to run his dental lathe, had jumped to $1.00 an hour for current alone, which was prohibitive, the France Brothers, who were at that time building auto accessories, started assembling his means of attack and, for $35.00 built him their first Storage Battery Charger or Battery Booster, which reduced his cost from $1.00 to 10c an hour, by charging a Storage Battery from a Lamp Socket and forever doing away with his need for primary batteries, besides giving him a far more satisfactory service, and saving him 90 cents an hour in his operating cost.

These France Brothers then perfected this Storage Battery Charger, and their Full Wave, Automatic, Dependable and Economical product, which is now on the market under the name of the F-F Battery Booster, is reducing the cost of charging storage batteries to 10c from $1.00 for thousands of Auto Owners, Wireless Operators, Experimenters and Storage Battery Users all over the world, and a single Battery Booster has been known to produce a profit of over $600.00 for its owner, who used it to charge Storage Batteries commercially, which gives one an idea of their marvelous Durability and Economy of Operation.



The New Types in their perfected assemblages are complete with Ammeter and Battery Clips, everything mounted in one compact self-contained and portable unit, ready to screw its plug into a lamp socket, snap its clips on a Storage Battery and turn the switch, which automatically starts it charging, its Ammeter showing the amount of current owing.

No skill is required to operate, and the complete equipments are being sold at $15.00 and up by The France Manufacturing Co. of Cleveland, Ohio, who mail complete descriptive literature free to all who write for it.

CALLS HEARD BY WESTERN AMATEURS

This department has met with such favor that we will devote as much space to same as possible. Unusual Records are Particularly Desirable. Your list should be neatly printed in ink, using one side of paper only. All errors will thereby be avoided.

Calls Heard and Worked at 7BK, Seattle, April 15th to May 15th

Canadian 5BA 5CP 6AK 6CH 6DD (6DP) 6DY 6EX (6FH) (6HC) 6IY 6KK 6KL 6KM 6LC (6OC) 6OH 6OW 6PR (6QR) (6TC) 6TM (6TV) 6VM (6VX) 6WD 6AAN 6AAU 6AAW 6ABM 6ABX (6ACR) 6ADH 6AFV (6AGF) 6AID (6AIW) 6AJE 6ALA 6ANK 6APH 6ZA 6ZH 6ZN 6ZR 6ZU 6ZX 6ZAA 7BH) 7BQ 7BV (7CU) (7CW) (7DA) (7ED) (7FI) 7FQ 7GA 7GP 7HF 7HN 7IN 7JN (7JW) (7KB) 7KJ (7LS) (7MH) 7MY 7NL (7NN) 7YA 7YG (7YS) 7ZG 7ZI (7ZJ) 7ZK 7ZM. The above list includes only stations over 40 miles from Seattle.

Calls Heard by 6ANK, 818 F Street, Sparks, Nev.

6AAK 6AAR 6AAT 6AAW 6ABM 6ACG (6ACM) 6AD 6ADL (6ADQ) 6AE 6AFG 6AFN 6AH 6AID 6AIL (6AJR) 6AJV 6ALA 6ALI (6ARS) 6CH (6CP) 6DK 6DP 6EA 6EB 6ED 6EJ 6ED 6EX 6FH 6FI 6GP 6HC 6HH 6IG 6KA 6KL 6KM 6KP (6KS) 6LC 6MH 6NH 6OH 6OW 6PQ 6QA (6QR) 6RN 6TP 6VX 6XZ 6ZA 6ZH 6ZJ 6ZM 6ZN 6ZX 6ZY 6ZZ 7BC 7BP 7CC 7CW (7DA) 7FI 7KM 7IN 7YA 7ZJ.

Heard During May by 6SU

6ZA 6AJ 6AK 6AO 6DP 6EN 6EB 6FH 6GN 6GQ 6HC 6IC 6II 6IM 6LC 6MQ 6OW 6PQ 6RN 6SR 6TM 6WU 6ZB 6ZN 6ZU 6ZX 6ZZ 6ABM 6ABX 6ACR 6AEI 6AGF 6AGL 6AIW 6AJE 6AJW 6ANJ(cw and fone) 6APH 7CW 7DA 7FI 7MY 7ZJ.

Radio 6IQ, W. R. Hone, 323 North Brannick Street, Los Angeles, Cal.

Calls heard at my station during the last two months to May 24. Station marked worked have been worked in the last three or four days. Only those fairly QSA have been listed:

5IF 5ZA 5ZC 5ZJ 6AE 6AK 6CC (6DA) 6DP 6EX (6FB) 6FM 6HA 6HH (6IC) 6II (6IS) 6IV 6IY 6JR 6JT 6KF 6KL (6KM) (6MZ) 6NR 6OC 6OE (6PQ) 6QR 6QS 6RS 6RZ 6SB 6SK (6SR) 6TA (6TF) (6TL) 6TV 6VT 6WN 6XA 6XK 6XS 6XZ 6YA 6ZA 6ZB 6ZH 6ZJ 6ZK 6ZL 6ZM 6ZR 6ZS (6ZU) 6ZX 6ZZ 6AAW (6AID) (6AGF) 6ACM 7BP 7BQ 7CU 7DA 7IN 7KM 7ZO 7ZJ. Anyone hearing 6IQ please QSL.

Calls Heard by 7JW, Portland, Ore.

5BA 5ZA (6AH) (6AN) (6CH) 6DD (6DP) 6LB (6FH) (6FM-cw) 6GF) (6HP 6IE 6IS (6JR) 6JM (6LC) (6OC) (6OH) (6OW) (6PR) (6QR) (6SV) 6TV 6VA 6ZAA 6ZU (6ZX) 6AAT-cw) 6ABM 6AGF 6AJH 6A. A 6APH 7AD 7BA (7BK) 7BG 7EX (7FI) 7FG (7NN) 7OF (7YA) 7ZG 9OE 9WU.

Calls Heard by 7MF, Eugene, Ore.

6OW 6ABM 6PR 6AK 6IY-cw 6DP 6EA 6EJ 6FH 6ZN 6DH 6DE 6BP 6KM 6TU 6DD 6IF 6FH 6EE 6DM 6ACM 6JJH 6AFN 6APH (6AGF) 6QR 7AD 7AE 7BK 7BE 7BA 7DP 7DA 7GA 7BH 7IM 7BP 7EU 7EW 7EB 7EN 7NX 7NN 7MW 7FL 7FI 7ZG 7ZJ 7ZM 7LR 7PH 7YA 7YS 7QY 7ZH 7IY 7LU 5EL 5IF 5BA 5ZA 9LR 9XI-cw.

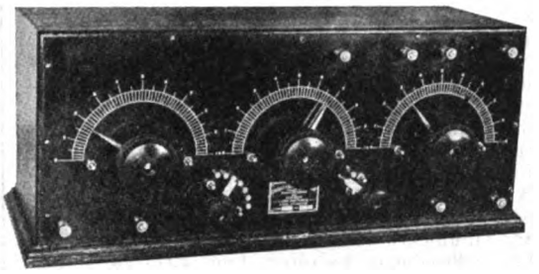
Stations Worked and Heard at 6RN, Pasadena, Cal.

5IF (5ZA) (6AE) 6AK 6AH 6AN 6CU 6CZ (6DD) 6DP (6FH) (6FI) (6HC) 6HH 6IC 6II 6IM 6IR 6IS 6JM 6JR 6JI 6KF 6KL 6KM

(Continued on page 434)

NEW CHICAGO RADIO LABORATORY CATALOG

"Z-Nith Long Distance Radio Apparatus" is fully described in Bulletin F-21, recently issued by the Chicago Radio Laboratory of Chicago, Ill. The Bulletin is in the form of a complete catalog containing 48 pages. It is well illustrated with good half-tones and no amateur's library will be complete without a copy of this interesting Bulletin.



Z-NITH
REGENERATOR
The Most Perfect Regenerative Tuners

Just Recently Developed to Function Perfectly on Wavelengths from 180 to 1200 Meters

THE man who buys the Z-Nith regenerator today knows beyond reasonable doubt that he stands at the threshold of a highly satisfactory experience.

Already he has enjoyed it in his own station; or at least he has observed its splendid operation elsewhere.

And now with its many new features, among which is the ability to tune to and function properly on wavelengths from 180 to 1200 meters, it is the most reliable and practical of regenerative tuners.

With the advent of CW came a demand for an instrument that would tune more sharply. And we have solved the problem. The new Z-Nith regenerator carries a variocoupler that is *variable thru 180 degrees* of coupling, not 90.

This wonderful new development has just doubled the accuracy of tuning. The tedious tuning of CW is no longer. There is not an instrument at any price that can compare with it.

This beautiful, highly developed Z-Nith regenerator is ready for immediate delivery at the reasonable price of $55.00 f. o. b. Chicago.

Our new illustrated catalog upon request.

"Radio as you go"

CHICAGO RADIO LABORATORY

See it at the First National A.R.R.L. Radio Show Chicago Aug. 30-Sept. 3, 1921

Offices and Factory: 6433 Ravenswood Ave. **Testing Station 9zn-5525 Sheridan Rd.**

Z-NITH PRODUCTS THE WORLD OVER

Manufacturers of the best radio apparatus made

Pacific Coast Radio Amateurs Wanted

THE U. S. S. "California" latest addition to Uncle Sam's fighting fleet, will go into commission shortly, manned by a full crew of Californians. There are several vacancies for California radio amateurs to act as operators on the new superdreadnaught. This is a good opportunity for a few of our best amateur operators and it will be of interest to state that good ratings will be given to those who take advantage of the opportunity by enlisting at once. Ensign J. B. Dow, whose writings in "Pacific Radio News" appear from time to time, is Radio Officer of the new greyhound and he will be pleased to receive communications from California amateurs who desire to offer their services.

STATIC STATISTICS

(Continued from page 417)

that there will be a minimum amount of interference and no broad waves. The tuning committee, of which Mr. Austin (7XF ex 7ZI) is chief, has the job of visiting the different local stations with a wave meter and tuning them on 200 meters and with a decrement some place under 0.2.

NEW C. W. CATALOG

The complete line of CW transmitting and receiving apparatus manufactured by the Standard Radio Company of Los Angeles, Calif., is now ready for distribution. Those interested in busting through the summer static will do well to send for a copy of the catalog.

SPECIAL LICENSES ISSUED.

6YA, Y. M. C. A., 715 So. Hope St., Los Angeles, Cal.,

6ZAC, Clifford J. Dow, Lihue, Kauai, Hawaiian Islands.

LIEUT. FASSETT WITH MEYBERG CO.

Lieut. L. O. Fassett, U. S. N. R. F., one of San Francisco's oldest and best known radio men, will augment the sales department of the Leo J. Meyberg Company on July first.

THE GIRL AND THE PEARLS

(Continued from page 415)

company's inspector. It was he who spoke first.

"So you're going to play me for a sucker with your pearl game, eh?" he snarled, sarcastically, "Well, now we'll proceed to see who's the biggest sucker!"

He advanced to the table, opened the receiving cabinet, and took out the B-battery. Laying it on the floor, he got a hammer out of his kit and began to break it to pieces. Pulling apart the cells, he got out a jackknife and cut one of them open.

There was absolutely nothing in it but carbon and filler! The next one was the same, and so were all the rest.

For a moment, Samuel Jones, himself, was amazed; then, in a flash, he realized that in changing the B-batteries, he had got them mixed up, and had put the same battery back in the cabinet he had taken out. Involuntarily, he glanced toward the locker, in which the other B-battery was lying. The customs men saw and immediately interpreted his glance. Opening the locker, they took out the spare battery. Breaking it into pieces, likewise, the company inspector cut open a cell, and there, in the bottom wrapped in a bit of tissue-paper, now ammoniac-soaked, were two large pearls.

"Well, that's all of them," said the shop man, ten minutes later, as he tore up the last cell; "forty-seven, altogether."

"That's about right," returned Merboler, smirkingly; "We understand there was six in a setting, and forty-one in a necklace, which makes—what the hell!"—the chief was picking up the pearls, and, as he did so, his face assumed an expression of amazement and disgust. "Pearls, you call them!" he sneered, staring at them, closely; "the damned things are light as feathers—they're fakes!" He pinched one, and it broke to pieces—a mere shell!

Everybody gaped in amazement.

Merboler's face was distored by a mocking grin.

"Somebody's been double-crossed for fair, I'll say!" he chuckled, derisively. He threw the things onto the table, and they fell as lightly as a shower of popcorn.

"Sorry you had all that work for nothing, young man," said Merboler, tauntingly, to Samuel Jones, who sat looking extremely crestfallen; "take your pearls to Carter Jackson, with my compliments!"

When the "La Hermosa" had berthed at the Mail dock, and the passengers were all ashore, the chief radio operator, no longer in uniform, violently kicked a certain hulking cadet down the gangway. Once on the pier, the obstreperous brass-pounder set upon him, blacking his eyes and battering him unmercifully, before a half-a-dozen members of the crew could rush ashore to the rescue of the half-killed cadet.

"I'll eat my hat, if I can make head or tail of it," declared Cunningham to Samuel Jones, as the two threaded their way through the five o'clock crowds of homeward-hastening office folk; "the pearls turned out to be fakes, and you've half-murdered a poor, harmless cadet, and, judging by the way you talk, you're just as crazy as ever about that little squab who double-crossed you! What's the answer to all these riddles, anyway?"

"The answer is that you're all wrong about the girl, an' the pearls, an' the poor, harmless cadet," answered Samuel Jones, enjoying the other's mystification; "'an when I give you the dope you'll see why. You know I never was much doubtful of Lillian, but still I was afraid Merboler might get next some may to my havin'

left the pearls behind last trip; an' so I figures out a swell scheme to make the whole game dead safe. I goes into a jewelry store an' buys forty-seven big artificial pearls; an', like you already know, those are what went into the bottom of the B-battery cells. I had it all planned out to send Merboler a anonymous letter, tippin' him off about the B-battery scheme, but the way it turned out, I got that done for me by the cadet—"

"By the cadet?"

"Yes. You see, when I took Lillian aboard the "La Hermosa" last trip I see the cadet sneakin' into the wheel-house, an' a little later in the wireless shack, I happens to discover that the whistle is out of my speakin' tube, which runs up to that same wheel house. The whistle was lyin' on the floor, an' when I picked it up, I sees that it'd not fell out a'tall, but had been yanked out—an', you know, if a fellow listens in on a speakin-tube that's got no whistle blockin' it at the off-shore end, he can hear darned near everything that's said anywheres near it. Knowin' the cadet's in the wheel house, I sees through his little game right away; so I gives Lillian a spiel about the B-battery scheme—an' all the time I'm holdin' the tube right in my hand, so's the stool-pigeon will be sure to hear it. A little later, I takes the girl up to the wheel house, showin' her around an' soon's I get a chance, I drifts over an' gets hold of the radio room speakin' tube—an', sure enough, it's still warm, where the fellow's been holdin' it to his ear!"

"Then, besides that, I'd noticed a piece ripped out'a the coat tail of the sneak's shore clothes, which looked kind'a queer to me, someway. On the run south, I gets to thinkin' how the night out at Burlingame, Jackson had thought he'd heard somebody eavesdroppin' on us; an', pretty soon, just like the dick in the dime-novel, I gets the idea that the stool-pigeon might have ripped his coat scramblin' over the iron fence around Jackson's garden, which is high an' sharp-pointed, an' would be a darn mean one to climb. It all figures out pretty good; so I wires Jackson from Mazatlan to have his fence searched all around for a rag of blue serge. Sur as shootin' the night before we makes Frisco, I gets a wire from Jackson, sayin' he'd found it. Of course then I knows for sure the cadet is Merboler's stool pigeon.

"In quarantine, in the mornin', Merboler an, his gang comes rushin' aboard, an' as per the cadet's dope, digs right down into the B-batteries. Then, when they found the pearls was all flooey, they just though somebody's cold-decked the deal down in Mexico. The idea tickles Merboler so much the damn fool never thinks to look around for any other pearls;—an' there I am sittin' with the whole works right in my pocket! Of course, I reckon the fake pearls bein' salted down so nice an' neat that way would've fooled even a brainy guy, not to speak of Merboler, who ain't got no more brains than the back end of a burro."

"So they goes ashore, an' the ship docks; an' I was feelin' so hell-fired happy I just chases that sneaky, yellow-livered stool-pigeon down onto the dock an' drums the daylights out'a him—I just could'nt help it, I felt so good!"

"Then I suppose Jackson has his pearls, at last?"

"You'd do more'n just suppose it, if you'd saw the check he gave me," returned Samuel Jones, exuberantly; "it's got four figures in it—an' the first figure's no small one, neither—an' oh boy!—this evenin' the little blonde baby an' I are going to charter a

(Continued on next page)

THE GIRL AND THE PEARLS

(Continued from page 423)

buzz wagon an' have one grand blow-out! Believe me, there's goin' to be a hot time in the ol' town tonight!"—and, parting with Cunningham at the corner, Samuel Jones turned his face toward "Leighman's Cafeteria."

PROGRESSIVE ACTIVITIES OF THE RADIO CORPORATION

(Continued from page 413)

carried it about in one's vest pocket, or kept it buried in the back yard! I had eight VT-2's given me six months ago, and they roosted under my bed—when not in use!!

These matters have, to a great extent, clarified and The Radio Corporation is the first in the amateur field with wonderful apparata of all kinds—and suited to every purse (which is important news, to the average amateur!)

And it is of this apparata that I would briefly tell.

I preface the body of this article by saying that at my own Special Station at Avalon, Catalina Island, California (6XAD ex 6BX) I have been using—among other tubes—three of the Radio Corporation's U. V. 202's for transmitting purposes, and I have had remarkable success. 6XAD has been reported as QSA from all the States adjoining California, and my signals have been very well received at Nampa, Idaho, by 7LN. The approximate distance from his station to mine is 1800 miles, and this transmission was accomplished on ICW, using 3-U. V. 202's, in parallel, deriving power from the 110 AC Avalon city current, through an especially-designed transformer and transmitter—both of which were built for my station, with the greatest of success, by The Western Radio Electric Company, of Los Angeles. The antenna current that I obtain is from 1.5-2 amps. And it should be noted that this work was done on my amateur-length antenna—NOT on the others, that I use for higher wave lengths! Transmission of 1800 miles on but three of the five Watt tubes is phenomenally good, and speaks volumes in itself for Radio Corporation products! Word—authentic—also reaches me that an amateur, on but one of these tubes, talked over 50 miles, any by daylight!

I am having another especial transmitter built by The Western Radio Company now; the power plant to go with it is being designed by F. W. Falck, of The Advance Electric Company, Los Angeles. On this new set I shall use the Corporation's U. V. 203's—the 50 Watt tube—and their U. V. 204's—the 250 Watt. If, with 3 U. V. 202's, I can reach 1800 miles—QSA—how far will 3 U. V. 204's carry my signals? Better put it t'other way about: how far will they not carry?

I also use, with eminent satisfaction for long distance work, the Corporation's U. V. 200 and 201. The former is an excellent detector, and the latter an amplifier that is extraordinarily efficient and simple of operation. These tubes I use on my Kennedy long-wave, regenerative receiver—an instrument, by the way, that is a sheer joy and continued DELIGHT! With but 1-step of amplification I read POZ without the slightest difficulty, and sometimes in full sunlight! **Verbum sapienti!**

There are three kinds of power tubes—so far—offered the amateur by The Radio Corporation: the U. V. 202—whose efficiency I have mentioned. The U. V. 203 and the U. V. 204. The latter is a new tube of great power, and of very long operative life, 250 Watt, and a remarkable oscillator. The former is a most successful tube, 50 Watt,

whose price—$30—puts it within the reach of practically every amateur's bank account. Trustworthy reports come to me that with 2 of the U. V. 203's, fine results have been attained from an amateur station on Long Island, N. Y.—to one in South Dakota! Very fine work—that!

And Mr. Bucher informs me that during the summer a still MORE powerful tube (!), to be known as the U. V. 206, will be placed on the market.

Using such apparata as this it will be no trick at all to "work" across the United States—and even father. I expect to be in touch with Honolulu—in that direction—and the Atlantic Coast, in the other, by the autumn!

It is an indubitable fact that CW and radiotelephony are the two methods of communication that are rapidly attaining unto the center of the radio stage. And to meet the hugely increasing demand for the necessary apparata The General Electric Company is now manufacturing for The Radio Corporation a splendid list of CW devices and all manner of accessories—both for amateur work as well as for more advanced investigational and research effort. The Radio Corporation's range of apparata is from power transformers—that will supply both high and low voltages to transmitting tubes, from 60 cycle, 110 V sources—to a newly-developed magnetic modulator, that will enable direct modulation of the antenna current of a tube transmission set. This latter device is one of the utmost simplicity, and is certain of finding instant favor in the eyes of amateurs, the nation over! For instance: with the Magnetic Modulator 2 of the 50 Watt, or two of the 5 Watt, tubes may be connected in a circuit for the production of oscillations, and their output directly modified by the new Modulator for telephony, without the necessity of a special modulating tube! The simplicity and the great advantages of this arrangement needs no dilating upon!

Furthermore: this autumn the Radio Corporation has intent to place on the market complete radio telegraph and telephone sets, of the vacuum tube type—ranging in antenna output from 200 Watts to 4 K. K. Some of these provide for CW, ICW and radiotelephony. Some are for telegraphy, alone—either CW or "tone". All these sets will be complete in every detail, and sold ready to install. Needless to add, they are all of the newest design, and incorporate the very latest word in vacuum tube construction and operation.

Various combination sets will be offered. On these, by the simple throwing of one switch, either of the three kinds of transmission that I have mentioned, will be instantly available. A special wave changer will be provided. In short: combined with the highest efficiency, the Corporation's manufactures will be of the utmost simplicity—a God-sent in itself!!

To my mind the set that will make a great deal of CW history is that which will be known as "the 200 Watt set"—employing 4 U. V. 203's for oscillation production. This set will not be so strenuously expensive but that a very large number of amateurs may own one. Going higher—the 1000 Watt set will use 4 U. V. 204's—each 250 Watts!

Satisfactory rectifying has ever been a bugbear to radio workers. Hence The Radio Corporation took up the matter and it now manufacturers self-rectifying tube transmitters, giving an output of 2 KW!! These sets operate from a 50-60 AC. power supply, employing either a rectifying unit, or the magnetic method, for the plate current

(Continued on page 428)

CONTEMPTIBLE AND DANGEROUS WORK

(Continued from page 410)

police of one, and instantly reports all violations to the Inspector-in-Chief, the better for our amateur organization!

Without any authority so-to-do, I venture to say that Washington would be quick to appreciate such action on our part, as an outward and visible intent to obey the laws, and to see to it that others also—obey them!

Let me say to you, gentlemen, that there is, today, in Washington, a very strong influence indeed, that is trying to take Radio supervision from the Department that now has such—and that is kindly disposed—placing said supervision and control in the hands of another department from which the amateur fraternity will not (!) receive the same consideration—no, not by the greatest stretch of the human imagination! Mind you, I am far from saying that, should this plan succeed—which God forbid!—amateur radio would go out of existence, but I most distinctly state that the present list of stations would be so ruthlessly cut—by severe examinations—that those surviving the "ordeal" would be but a comparatively pathetic few.

That this would practically kill amateur effort, is a foregone conclusion! And it is only the fact that, during the last war, amateurs did such effective work in the Government Radio Service **—because of their knowledge gained by private communication, one with the other, experimenting, and so forth—**that amateurs have the courteously-long "rope" that they now enjoy!

My pertinent query is: WHY HANG OURSELVES WITH IT?

Solemnly I say to you all that unless you keep on your alloted wave lengths; unless this forging of correspondence and calls, the illegal use of power, etc., are all put an end to, there is very serious trouble for all amateurs hanging in the wind!

Be wise and—take heed!

PROGRESSIVE ACTIVITIES OF THE RADIO CORPORATION OF AMERICA

(Continued from page 425)

source—which is energized directly from an AC supply, at 10,000 volts.

The General Electric Company is also at work, developing for The Radio Corporation, other tube telegraph transmitters, giving antenna outputs up to 4 KW—the plate circuits of which are fed from a rectified AC supply at high voltages using the new General Electric kenotron rectifier valves.

From this cursory article it will be seen that The Radio Corporation intends to specialize in CW apparata of every kind. So progressive a spirit is certain of meeting with the enthusiastic appreciation of amateurs—the seriously-minded operators—all over the United States, and the Sales Division of the Corporation, at 233 Broadway, New York City, notify me that they will be very glad indeed to answer inquiries with regard their manufactures. The Corporation's engineers stand ready to advise with prospective customers—or with them that have already acquired R. C. apparata—and to supply them with all data and information having to do with tube sets in order to obtain the best results from them. Inquiries should be addressed to the offices of the General Electric Company throughout the United States and in other lands.

From a purely personal point of view, I should like to publicly express my appreciation to Mr. E. E. Bucher, the Commercial Engineer of The Radio Corporation, for his great assistance and courtesy to me in matters having to do with my station—that utilizes Corporation products extensively—and most satisfactorily. I also desire to thank Mr. W. O. Batchelder, the manager of The General Electric Company's offices at Chicago. The assistance of both of these gentlemen has been invaluable.

VOLTAGE AMPLIFIERS

(Continued from page 406)

ably provided with its own filament and plate batteries although I believe that if the proper radio frequency chokes were inserted in both filament and plate circuits, that the oscillator would be operated from the amplifier batteries. The reader should try this for himself and see what can be done along this line. Personally I have never had time to actually try this arrangement.

The above mentioned arrangement using a local oscillator for converting all incoming signals to a definite wave length should prove very valuable for relay work especially in connection with a device to be described in the next article whereby the signals can be printed on a Morse recorder.

The reader may wonder how he is to know how to set his local oscillator so as to get a resulting wave length of say 3000 meters. Proceed as follows: Get a wave length frequency table. Look up the frequency corresponding to 3000 meters and to the wave length of the incoming signals of say 200 meters. Add or subtract the 3000 meter frequency from the incoming frequency and either value will give you an oscillator setting which will produce a 3000 meter wave length; choose the most convenient one. The oscillator should be calibrated with a good wave meter and then it is a very simple matter to make the necessary adjustments.

DO YOU KNOW THE CODE?

(Continued from page 405)

so forth. Therefore, space your letters evenly, and leave word spaces about twice as long as letter intervals so there is no mistake at the receiving end in separating words.

There are many radio operators who have gone on for years sending so poorly that nobody but a mind reader can copy them. The reason they never find out they are deficient in sending is that none of their friends are kind enough to tell them so. Are we so proud and such "bad loosers" that we are not game to hear someone tell us our faults? We ought to be men enough to take our friends' advice and see, after all, if we are not faulty, and then correct the fault as quickly as possible.

By sending RIGHT an operator is distinguished. A good sending operator flatters the receiving operator because good, clear, regular, sending is more easily readable at high speeds, and the receiving operator can really copy at a greater rate than with a poor man at the key.

"A poor workman blames his tools," but how about, "A good workman always keeps sharp tools." The latter applies to our sending keys. They must be right. The trunnions or pivot bearings of keys should be adjusted with no play at all, and yet loose enough so the key lever will drop (without the spring) onto the contact from its own weight. Springs should be just tight enough to return the key lever to its up position quickly, and most certainly should not be tight so that an operator has to use more than a very light pressure to depress the key. Why use heavy muscular force to send, when sending without a single error for an hour steady should not consume any great amount of energy? Muscular force is not needed so much as rythmical even, clean-cut applications of light muscle action. The wrist should NOT do the sending. The dots and dashes should be made with the forearm, the elbow resting on the table in a comfortable position. Your key must be far enough back on the table so this can be done. Keep your wrist loose, using it as sort of a shock absorber or refiner for the more or less rough impulses coming from the forearm.

With a steady, earnest, plugging away at this art of sending, a little practice each day, with good advice to be had, and always holding down on the speed, a poor operator can develop into a remarkably good one.

Let's all KNOW THE CODE!

MULTIPLE TUNED ANTENNA

(Continued from page 409)

For medium-powered tube sets these oscillating lead inductances can consist of helices of bare copper wire, about No. 12 gauge, about six inches in diameter. By the use of clips the inductance can be adjusted as closely as necessary. Where they are placed outside of the building they can be protected from the elements by a suitable water-tight housing. Tuning the system to a desired wavelength will be found to be a rather awkward procedure at first, but once tuned, any slight falling off in total antenna currents can be corrected sufficiently by slight readjustment of the oscillating timer and the radio frequency amplifier coupling.

AN APPRECIATION OF LIEUT. STONE'S LITERARY CONTRIBUTION

(Continued from page 410)

set his feet on the upward trail of radio—the trail that eventually leads to success!

The author has so clear and terse a way of placing things before his readers that the veriest tyro may easily grasp the matters under discussion, to his profit. And yet he who is well along the radio way will find much that is of great value in the 400 pages. Lieutenant Stone has a lucidity of style that is near-phenomenal in a scientific writer—making it a decided pleasure to read him—rather than a "grind." His work has all the qualities of that of an expert, and none of the cumbersome verbiage that is found in the average technical volume.

Chapters 2, 5, 7, 9, 10 and 11 are of extreme interest, and the student of radio who thoroughly digests their contents will have a goodly store of practical knowledge tucked away for effective use.

In heavy type, most appropriately bound, with well executed drawings of various hook-ups, and apparata of many kinds, "Elements of Radiotelegraphy" is a most decided acquisition to the library of the earnest worker in the vast field of radio development.

RADIO CLUB DIRECTORY

Published every month. It keeps you posted on important meetings.

United Radio Telegraphers' Association, Pacific Coast Division—Rooms 418-420, 24 California St., San Francisco Cal. Phone Douglas 706. All commercial operators eligible for membership. Address communications to above address.

San Francisco Radio Club, Inc., S. F. Gymnastic Club, Sutter and Divisadero Sts. San Francisco, Calif. Meetings every Thursday evening at 8:30 P. M. Visitors welcome at any meeting except first meeting of the month. Initiation fee $2.50. Monthly dues 50c. For experimental and commercial radio operators, address communications to the secretary. —adv.

THE MAGNETIC AMPLIFIER

(Continued from page 407)

effect from the selected exciting current. If telephonic control of the arc output is desired, the exciting current will be limited by the method of modulation, and by attenuation of the radio-frequency wave resulting from the impedance of the control winding. If key control is desired, this exciting current may be made any value convenient to handle. Regardless of the value of this current, the ampere turns in the exciting, or control winding, should be equal to the ampere turns in the radio-frequency winding to produce maximum control with efficiency, and the total resultant ampere turns at the amplitude of a radio-frequency oscillation must be sufficient to bring the operating conditions of the iron well up on the flat part of the magnetization curve for the particular iron, in order that its permeability will be a minimum.

The magnetic effects of control and controlled current may be superimposed, and a curve representing the upper magnetizing characteristic may be obtained as a resultant (Fig. 7). This characteristic shows the importance of the proper relation between control current ampere turns, and ampere turns in the radio-frequency winding. If the latter be excessive, a reversal of the magnetization in the iron will be produced and control will be unstable for the portion of the oscillation producing the reversal. In addition control will not be a maximum because of the preponderance of magnetization from the radio-frequency current.

Another factor to be considered here is the effect of mutual inductance between the radio-frequency winding and the control winding. Disaster to the control winding is almost certain to result from any great amount of mutual inductance. There are two simple methods of eliminating this. The first one, and the one that we shall consider here, is to wind the turns composing the two windings at right angles, and the second one, which was used by Alexanderson, is to loop the magnetic circuit included by the radio-frequency winding in such a way as to neutralize the effects of the radio-frequency current.

It was stated heretofore in this article that the permeability of a given sample of iron is unaffected by the frequency of alternating magnetism. However, owing to the multitude of eddy currents in iron which is under the influence of a high frequency current, apparent permeability, rather than actual permeability, must be considered in problems of design. Wherever eddy currents exist, secondary magneto-motive-forces exist. And with increasing frequency at constant impressed magneto-motive-force, the resultant magneto-motive-force decreases, due to the increases of the demagnetizing secondary, or eddy currents. An attenuation of the resultant magneto-motive-force takes place, which increases with depth below the surface of the iron owing to the summation of the effects of the demagnetizing eddy currents—which results in the so-called "skin effects at high frequencies." This lack of uniform magnetization results in an apparent change in permeability.

The effective penetration of the alternating magnetism into the iron, or the thickness, t, of a surface layer which at constant induction, B, would give the same total magnetic flux as exists in the iron; or in the case of a laminated core, in a lamination, is:

$$t = \frac{1}{(1-j)C}$$

or, in absolute value,

$$t = \frac{1}{C\sqrt{2}}$$

The apparent permeability, r', is:

$$r' = \frac{2r}{CT\sqrt{2}}$$

hence, $$r' = \frac{2r}{aT\sqrt{2f}}$$

where,

T = thickness of a lamination.
f = frequency.
λ = conductivity in micohm cm.
r = permeability.
$C = a\sqrt{f}$.
$a^2 = 0.4\,\Pi^2\,\lambda\,r\,10^{-8}$

For a derivation of these formulae, the reader is referred to "Transient Electric Phenomena and Oscillations", Steinmetz.

Assuming that number 29 guage "Apollo" Special Electrical High Silicon Alloy, as manufactured by the American Sheet and Tinplate Co., is selected for this apparatus, we can proceed in detail with the problem. This material has a conductance of approximately 50 microhm centimeters and a thickness of 14 mils. By referring to the magnetization curve, Fig. 1, it will be seen that at the small value of field intensity H=1 the permeability,

$$r = \frac{B}{H} = 3500$$

at H = 180, $$r = \frac{B}{H} = 120$$

and at H = 360, $$r = \frac{B}{H} = 62$$

Substituting these values of r in

$a^2 = 0.4\Pi^2\ r\ \lambda\ 10{-}8.$
$a = 1.66$ for $r = 3500$
$a = 0.307$ for $r = 120$
$a = 0.22$ for $r = 62$

Continuing the substitution in

$$r' = \frac{2r}{aT\sqrt{2f}}$$

$r_1' = 475$
$r_2' = 90$
$r_3' = 63$

These are the values of apparent permeability at a frequency of 30,000 cycles per second.

The maximum field intensity obtainable from the effects of the control current of 1.2 ampere is 180, and inasmuch as the ampere turns in the radio frequency winding are equal in number to those in the control winding, the value of field intensity, 180, is doubled when the amplitude of a radio frequency oscillation is reached on the positive side of the cycle. At this point, the apparent permeability of the iron is reduced to 63 as found above.

(To be continued)

THE FAIRMONT STATION

(Continued from page 411)

upon at this particular station. The filter system consists of two 21 AA Western Electric, one mf condenser and two Acme choke coils.

For the information of those desiring to build a set of this kind, the following points will be of value:

When starting up the set, tubes should be lighted to proper brilliancy and a plate potential of about 350 volts applied. This will give you an approximate reading of 75 milliamperes on the plate meter. Then adjust the two inductance switches and tuning condenser; also grid leak, until maximum radiation is obtained. All of these adjustments are fairly critical. After set is radiating the plate potential can be increased until the plates of the tubes glow red. The tuning condenser should not be adjusted too critical for maximum radiation, for if the set stops radiating an excessive amount of current can be applied to plates and might burn out the tubes. Three dry cells are found to give best results in connection with the modulation transformer, Magnavox and Western Electric transmitters. The clarity of the three dry cells used with the above should be tested for best modulation.

Wiring Diagram of 6XG

Many requests have been received for a wiring diagram of the Fairmont phone transmitter, as well as other constructional details of the set. For this reason we are going to give you the complete wiring diagram in the next issue of "Pacific Radio News."

Classified Advertisements

ADVERTISEMENTS IN THIS SECTION ARE THREE CENTS PER WORD NET. REMITTANCE, IN FORM OF CURRENCY, MONEY ORDER OR STAMPS, MUST ACCOMPANY ORDER.

RADIO CABINETS—Mahogany or oak finished or unfinished, to your design. Send rough sketch for quotation. Prompt service. Formica cut to size. Radio supplies, parts, etc. Pacific Radio Exchange, 439 Call Bldg., San Francisco, Calif.

THE BEST HONEYCOMB COILS AT THE LOWEST PRICE. Many satisfied customers are using them. Immediate delivery on the following sizes: 25 turns, 45c; 35 turns, 45c; 50 turns, 55c; 75 turns, 60c; 100 turns, 65c; 150 turns, 70c; 200 turns, 75c; 250 turns, 80c; 300 turns, 85c; 400 turns, 90c. Postage extra. Superior Coil Co., 1831 Balboa St., San Francisco, Cal.

EDISON BATTERY, 6 Volt 40 ampere-hour. $30.00. Ideal for radio work. W. S. LEVIN, 709 Larkin St., San Francisco.

DANDY Audion set for sale, and other radio material cheap. F. HALL, 211 Edgewood Ave. (Sunset District), San Francisco

RADIOTRONS, $4.25; Paragon Rheostats, $1.25; Sockets, 80c; Murdock Variables, 0.001, $3.75; Honeycomb Coils; Grid Condensers; B Batteries; Amplifying Transformer, $5.75. JIM CALDWELL, 480 Pine St., San Francisco.

TWO brand new A. P. Amplifier Oscillator Tubes, regular price $7.00 each. sell both for $12.00. RADIO, 251 Duboce Ave., San Francisco.

BI-LATTICE COILS (Duo-Lateral). For long distance reception this is the best type of inductance. SINGLE LAYER COILS. For short wave reception a set of these coils compares favorably with the best regeneratives; and the cost is but a fraction of the regular regenerative set. Send 3c for bulletin. Our prices will surprise you. P. J. STOCKWELL, Box 157-D, Reading, Mass.

NEW set Hawkins Guides. $8.00 postpaid. WM. BOWERMAN, Redding, Cal.

FOR SALE—Account of going into the CW line, will sell half kilowatt transmitter described in March "Pacific Radio News" for less than cost of material. If interested, write to O. SCHUWENDT, 1046 Blackstone Ave., Fresno, Cal.

FOR SALE—Murdock oscillation transformer, $3.50; four sections Murdock transmitting condenser, $2 section; all for $10. H. J. McCOY, Jr., 1305 Arch St., Berkeley, Cal.

VARIOCOUPLERS, wound on bakelite tubes, $5.25; variometers, inside windings, $4.25; complete for panel mounting; also carry all parts for above units. Magnet wire, DCC, No. 24, ¼ lb., 40c; No. 26, DCC. 50c, ¼ lb. Other sizes in proportion. MEADE BAKELITE AND RADIO APPARATUS, 522 Central Ave., Brooklyn, N. Y.

CALLS HEARD

(Continued from page 418)

6LR 6MZ 6NQ 6OC 6OH 6OT (6OW) (6PR) (6QF) (6QR) 6QY (6RT) (6SK) 6SR 6TC 6TV 6VM 6VV 6VX 6WZ 6XZ 6ZA 6ZB-cw 6ZH (6ZR) (6ZU) (6ZX) (6ZY) 6ZZ (6AAK) 6AAT 6AAU 6AAW 6ABH 6ABM 6ABX 6ACM 6ACR 6ADA 6AFN 6AGF (6AID) (6AIK) 6AIW 6AJE 6AJT 6AJX 6AKH 6ALA 6AOY-cw (6APH) (6XAD-cw) (7BH) 7CU 7DA 7YA. Anybody hearing me please QSL. All will be answered. 6RN reported QSA at 9YW, Rapid City, S. D.

6AKW, Fullerton, Cal., for Month of May

6ZR 6ZU 6ZX 6ZZ 6ZN 6XA 6XAD-cw 6OH 6OW 6CU-cw 6XD 6MZ 6HH 6JE-cw 6MK 6XAA 6ZB 6AGF 6ADA 6KC 6AA 6AK 6IK 6AJW 6APH 6APB 6APR 6KC 6WR 6EX 6TF 6AGM 6AD 6KL 5ZA.

Heard During May by ASA, S. Keller, Cashmere, Wash.

6AAR 6ABM 6AFN 6AFU 6AGF 6AIW 6AK 6APH 6APR 6FF 6GX 6IF 6KL 6KM 6MK 6QR 6ZA 6ZAA 6ZR 6ZX 7AD 7BC 7BJ 7BK 7BQ 7BV 7CE 7CO 7CW 7DA 7DG 7ED 7FI 7FQ 7GS 7IY 7JM 7JW 7KB 7KM 7LD 7LG 1LM 7LN 7LS 7LW 7LY 7MY 7NL 7NN 7OF 7QQ 7RK 7YA 7YS 7ZG 7ZI-cw 7ZJ 7ZK 7ZM.

Calls Heard by 6KC from February 1 to June 1

5ZA 6AE 6AK 6AM 6AN 6CC 6DP 6EA 6EB 6FN 6FR 6FI 6FT 6FS 6GH 6GI 6GN 6HY 6IF (6IL) 6JD 6JM 6JR (6KA) 6KP (6LC) 6OH 6PD (6SK) (6TL) 6TV (6WH) 6ZA 6ZH 6ZK 6ZR 6ZU 6ZX 6ZZ (6AAK) (6ABP) (6ACY).

CW DOPE

STATION 6BS has been heard at various times in the fleet off San Pedro. Ensign J. B. Dow, U. S. N., formerly Radio Officer of the U. S. S. "Texas", and now attached to the U. S. S. "California" reports the following: May 21, 5:15 p. m. Calling 6GC, "Yes, my station is above San Francisco." Signals very loud.

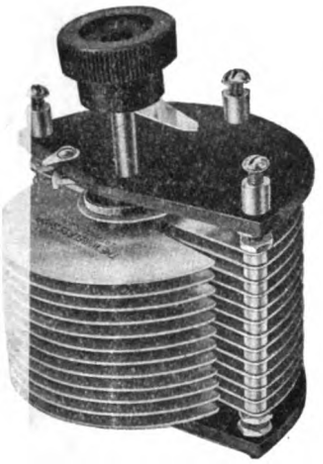
U. S. S. "CALIFORNIA" HAS POWERFUL RADIO

THE new flagship "California" is equipped with a 20 K. W. arc set 10 K. W. spark set, 2 K. W. spark set, 1 K. W. spark set, and a high power tube set by means of which any officer may talk directly from his room to any other ship similarly equipped or through several of the Navy's new shore telephone stations to the land telephone systems. In addition there are six sound proof booths containing seven complete receiving sets.

CALIFORNIAN OFF TO BUILD WORLD'S GIANT RADIO SYSTEM

Palo Alto, June 1.—R. R. Bealz chief engineer of the Federal Telegraph Company of this place, will sail for Shanghai to establish for the Chinese Government a $5,000,000 wireless communication system which will set a new world's record for both dimensions and power. It will exceed in these respects the Lafayette-Bordeaux system in France, which was also installed by the Palo Alto concern.

One of the masts to be constructed will be 1006 feet high, the tallest structure in the world, the Eiffel Tower being 1000 feet, the guyed steel masts at Tuckerton, N. J., and the masts used in the Lafayette-Bordeaux system being 850 feet high.—S. F. Call.



At Last, Fellows– –A Real Condenser– Built for Your "C.W." Set

Wireless Shop Variable Condensers" Are Quality Instruments

That is the reason the up-to-the-minute amateur was so quick to recognize and specify them. Are you using them in that new set you are building? If not, why not? You can't go wrong, as we fully guarantee them to give satisfaction or cheerfully refund your money. You couldn't ask anything more.

The new "Wireless Shop CW" Variable Condenser was developed to meet the demand for a condenser which would not break down when used with high plate voltages. You don't have to take your receiving condensers to pieces and add spacers any longer. The NEW WIRELESS SHOP CW VARIABLE CONDENSER does the trick.

Heavy construction and only the best of materials and workmanship make this condenser even the most critical. These condensers are at the present time furnished in three capacity, but if you need a special capacity for your own particular set, write us. We are well equipped to make you anything you may need in the condenser line, as that is our specialty.

——PRICES——

No. 1500—15 plate, approximately 0004 m. f. max. capacity.....$6.00
No. 2500—25 plate, approximately .0006 m. f. max. capacity..... 7.50
No. 3500—35 plate, approximately .0008 m. f. max. capacity..... 9.00

Regularly fitted with mounting screws and knob and pointer. Will be supplied with a metal dial instead of pointer at 75c additional, or with a moulded Bakelite knob and dial, finely engraved with graduations and numbers filled in white at $1.00 extra.

Postal charges and insurance must accompany all orders. Insurance charges on any of the above condensers is only 5c.

THE A.J. EDGCOMB WIRELESS SHOP

511 WEST WASHINGTON STREET LOS ANGELES, CAL.

RADISCO COILS

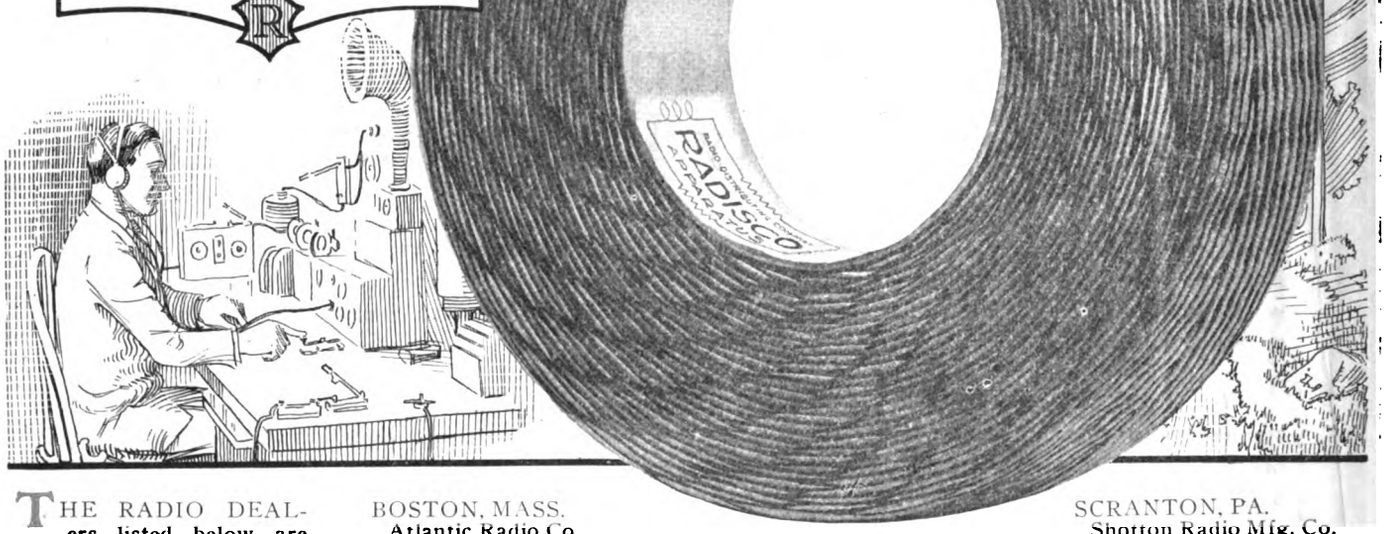
To buy Radisco Coils is to invest in permanent satisfaction at the lowest prices consistent with an unvarying standard of quality.

Radisco Coils, mounted and unmounted, in ranges to meet every known wave length, are available at the nearest Radisco agency listed below. They range in price from 70 cents to $2.65. Larger sizes wound with 20/38 Litz at a moderate increase. Three of the larger sizes are also furnished with three taps, to give a wider wave length range.

There is surely some Radisco Coil that will exactly fill your need. And remember, the universal winding that has stood the test of time will make good for you, also.

Note: If you mount your own coils, Radisco coil mountings are made to fit without bending or filing!

This Mark RADIO-DISTRIBUTING-COMPANY RADISCO APPARATUS *Your Guarantee*



THE RADIO DEALERS listed below are progressive merchants. They are equipped to give you helpful advice and real service in selecting your radio equipment. As an indication of their up-to-date methods, they carry a complete line of Radisco apparatus, including the new vario-coupler, Radisco Coils, Better "B" Batteries, Corwin Dials, etc. Go to the nearest Radisco agency, and be sure of satisfaction.

ALBANY, N. Y.
Shotton Radio Mfg. Co.
8 Market St.

ASHEVILLE, N. C.
Hi-Grade Wireless Instrument Co.

ATLANTIC CITY, N. J.
Paramount Radio Supply
Arkansas & Pacific Aves.

BOSTON, MASS.
Atlantic Radio Co.
88 Broad Street.

BROOKLYN, N. Y.
Kelly & Phillips,
312 Flatbush Avenue.

CHICAGO, ILL.
Chicago Radio Labs.,
1316 Carmen Ave.
Branch, Peoria, Ill.

EUREKA, ILL.
Klaus Radio Co.

KANSAS CITY, MO.
McCreary Radio Supply
4th and Delaware Sts.

NEWARK, N. J.
A. H. Corwin & Co.,
4 West Park St.

NEW ORLEANS, LA.
Rose Radio Supply,
604 Gravier St.

NEW BRUNSWICK, N.J.
Geo. N. DeLaplaine,
306 George St.
8th and Magnolia Sts.

OMAHA, NEB.
O. B. Radio Supply Co.,
406 Brown Building.

PHILADELPHIA, PA.
Philadelphia School of Wireless Telegraphy,
Broad and Cherry Sts.

PLAINFIELD, N. J.
Paul R. Collier,
154 E. Front Street.

PITTSBURGH, PA.
Radio Electric Co.,
3807 Fifth Ave.

PORTLAND, ME.
Atlantic Radio Co.,
15 Temple St.

PROVIDENCE, R. I.
Rhode Island Elec. Equip. Co.,
45 Washington St.

SEATTLE, WASH.
Northwest Radio Service
609 Fourth Ave.

SCRANTON, PA.
Shotton Radio Mfg. Co.
P. O. Box 3.
Branch, 8 Kingsbury St.
Jamestown, N. Y.

WASHINGTON, D. C.
Eastern Radio and Electric Co., 1405 Florida Ave., N. W.

WICH[illegible], KAN.
The Co[illegible]radio Co.,
1725 Fairmont Ave.

Canadian

BEINVILLE, QUEBEC
Canadian Radio Mfg. Co.

MONTREAL, QUEBEC
J. B. Miller,
136 Vendome Ave., N.D.G.

TORONTO, ONTARIO
The Vimy Supply Co.,
567 College Street.

To Responsible Dealers: If you are in a town where there is no Radisco Agency, you will benefit by writing for the Radisco plan.

RADIO DISTRIBUTING CO., Newark, N. J.

RADISCO

"Your Assurance of Satisfactory Performance"