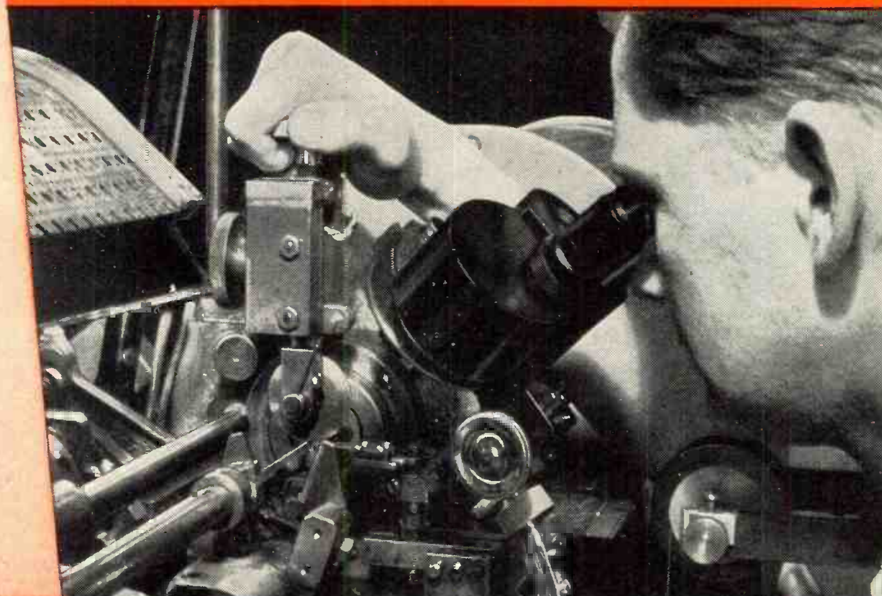
RADIO NEWS

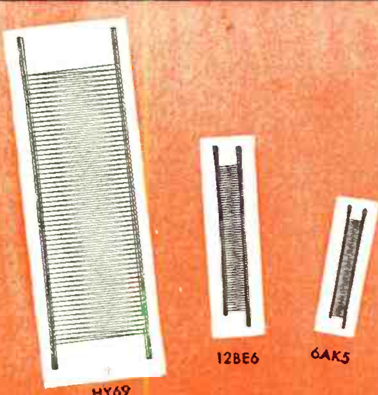
MAY
1946
35c
In Canada 40c

MAKING TUBES IS EASY *If* YOU KNOW HOW!

● On this automatic grid winding lathe, the two heavy side-post wires — drawn from two large spools — are pulled taut over a mandrel form. A cutting wheel nicks these support wires, as the mandrel, wires, and spools revolve on the lathe. Very fine lateral wire is simultaneously wound from another spool into these nicks, with the mandrel providing the proper cross-sectional shape. A swedging wheel presses the side-post rods, thus anchoring each lateral turn firmly into place. Finished grid strips approximately twelve inches long are then cut to the required lengths. Excess turns are removed from each end of these short lengths preparatory to assembly. The completed grid is finally micro-gaged and micro-inspected.



HERE'S AN EXAMPLE OF HYTRON KNOW-HOW..



NOTE THE SMALL DIMENSIONS OF THESE GRIDS

Tube	Grid	Turns Per Inch	Length of Winding	Width of Winding
HY69	Screen	30	1.417 in.	0.570 in.
12BE6	Control	76	0.776 in.	0.135 in.
6AK5	Control	200	0.322 in.	0.100 in.

12BE6 and 6AK5 grids cannot successfully be illustrated, because of their minute size.

MASS production and a watchmaker's precision usually are strangers — especially if unit cost is low. Here you see a job setter adjusting a precision lathe on which tiny grids are wound to tolerances as tight as .0005 inch. Keen eyesight, patient perseverance, and the skill of a fine toolmaker, are his requisites. Pitch, turns per grid, inside and outside diameters, cross-sectional shape must be right on the nose. Furthermore, they must be kept there despite engineering changes in specifications, variances in materials, and wear and tear of the machine.

With this lathe turning up to 1000 rpm, grids form faster than the eye can travel. It is amazing to watch the tiny parts take shape — to examine with a microscope the rugged manner in which each lateral turn is swedged into the side-post rods.

Yet as you see these grids produced at top speed, it all looks easy. Nothing to it—*if you know how*. Then you stop to think. You realize skilled hands and precision machines are part of the Hytron know-how which makes tough jobs easy—which gives you tubes of dependable, jewel-like precision at prices absurdly low.

OLDEST MANUFACTURER SPECIALIZING IN RADIO RECEIVING TUBES

HYTRON

RADIO AND ELECTRONICS CORP.

MAIN OFFICE: SALEM, MASSACHUSETTS

MAY, 1946

RADIO NEWS

REG. U.S. PAT OFF

VOLUME 35, NUMBER 5

AMATEUR

SERVICE

GENERAL

185 N. Wabash Ave., Chicago 1, Ill.

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Cover Photo
By IKE VERN

A studio scene at station WRGB, the General Electric television station in Schenectady, N. Y. 958 live talent shows have been telecast from this station from November, 1939 to September, 1944.

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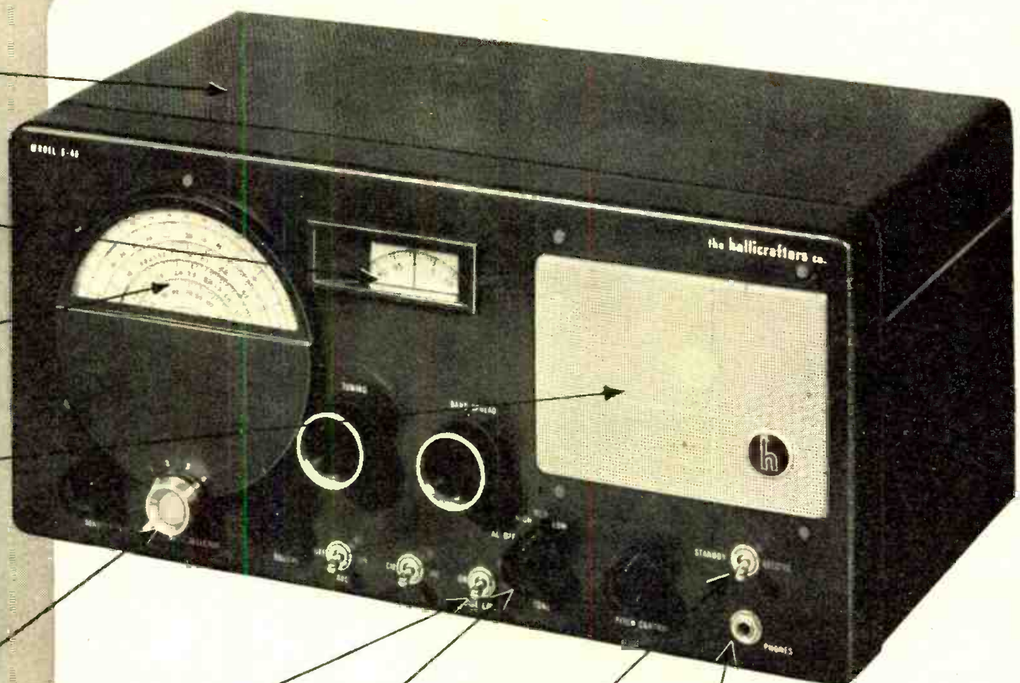
hallicrafters *new Model* S-40



New beauty and perfect ventilation in the perforated steel top

Separate electrical bandspread with inertia flywheel tuning.

Tuning range from 540 kc to 42 Mc continuous in four bands

Self-contained, shock mounted, permanent magnet dynamic speaker

All controls logically grouped for easiest operation. Normal position for broadcast reception marked in red, making possible general use by whole family.

Automatic noise limiter

3-position tone control

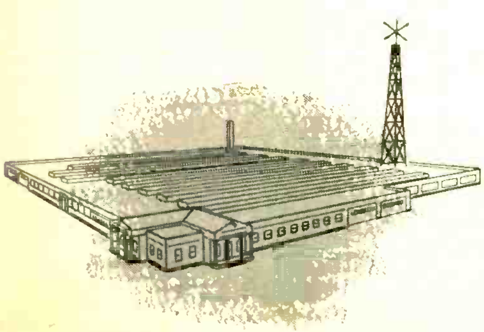
Standby receive switch

Phone jack

New design, new utility in a great new communications receiver . . .

(APPROXIMATELY) $79.50

Here is Hallicrafters new Model S-40. With this great communications receiver, handsomely designed, expertly engineered, Hallicrafters points the way to exciting new developments in amateur radio. Read those specifications . . . it's tailor-made for hams. Look at the sheer beauty of the S-40 . . . nothing like it to be seen in the communications field. Listen to the amazing performance . . . excels anything in its price class. See your local distributor about when you can get an S-40.



INSIDE STUFF: Beneath the sleek exterior of the S-40 is a beautifully engineered chassis. One stage of tuned radio frequency amplification, the S-40 uses a type 6SA7 tube as converter mixer for best signal to noise ratio. RF coils are of the permeability adjusted "micro-set" type identical with those used in the most expensive Hallicrafters receivers. The high frequency oscillator is temperature compensated for maximum stability.

From every angle the S-40 is an ideal receiver for all high frequency applications.

hallicrafters RADIO

THE HALLICRAFTERS CO., MANUFACTURERS OF RADIO AND ELECTRONIC EQUIPMENT, CHICAGO 16, U. S. A.

Sole Hallicrafters Representatives in Canada: Rogers Majestic Limited, Toronto - Montreal

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to sell that EXTRA set!!

FADA

5 EXQUISITE COLORS TO MATCH ANY COLOR SCHEME IN THE HOME OR OFFICE!

Illustrated are two of the new exciting line of 1946 FADA Table Models. Beautifully designed in 5 scintillating colors, these FADA radio receivers provide those "extras" that make your customers anxious to buy more than one.

FADA extra sales mean extra profits!

FADA Sensive-Tone

FADA 6 tube models are equipped with the new FADA "Sensive-Tone" . . . assuring greater sensitivity and clearer reception.

652 SERIES

6 Tube A.C.-D.C. Superheterodynes with the R.F. Noise Reducing Stage with Slide Rule Dial in Gemlike "FADA-LUCENT" Cabinets.

6 tube radio with 8 tube performance. Features include the new Lock in type tubes; Beam Power Output System; New Wonder Speaker ALNICO V; Automatic Volume Control and FADA-SCOPE built-in LOOP ANTENNA. Housed in beautiful "FADA-LUCENT" Cabinets in Five Gorgeous COLOR COMBINATIONS resembling precious stones.

1000 SERIES

6 Tube A.C.-D.C. Superheterodynes . . . In Gemlike "FADA-LUCENT" Cabinets with the New Gemloid Illuminated Dial and Noise Reducing R.F. Stage.

8 tube performance with 6 full working tubes; FADA-SCOPE built-in loop ANTENNA; Beam Power Output System; Automatic Volume Control; New Wonder Speaker ALNICO V. Housed in beautiful "FADA-LUCENT" Cabinets in Five Gorgeous COLOR COMBINATIONS resembling precious stones.

YOU CAN ALWAYS DEPEND ON

FADA Radio

Famous Since Broadcasting Began!

FADA RADIO AND ELECTRIC COMPANY, INC., LONG ISLAND CITY, N. Y.

For the RECORD.

● BY THE EDITOR

ANYONE acquainted with amateur radio communications but unfamiliar with the lures of the game finds it difficult to appreciate the intensity of interest displayed by the "ham."

We will try to reveal some of the thought patterns which lead to this ingrained enthusiasm in the hopes that we may tempt those of you who have never known the thrills of this diversion to try your hand at it. If you find it leading you to sleepless nights don't say that we didn't warn you.

Just what is this thing called amateur (ham) radio? What kind of people are "hams"? Why does the radio fever course so strongly through their veins?

It's a hobby open to anyone, young or old, boy or girl, that can qualify. It's the only hobby in the world requiring a government license! This factor alone gives the amateur a sense of accomplishment, a feeling of belonging. It sets him into a distinctive group of people he knows have a certain minimum of required knowledge of the radio art. He knows he is recognized by his government as being a responsible citizen. There is an inherent pride in acquiring a license to practice this "prestige" hobby.

(Incidentally, we have been speaking of the radio amateur as "he." Actually there are hundreds of the fair sex who own and operate amateur stations.) Further, on the emotional side of the hobby, there is a feeling of fraternity among hams which defies loneliness. A ham can never be without a friend. A flip of a switch and he can call into his home people he has never met before from far distant places and engage them in friendly conversation. There are thousands of instances where acquaintanceships sown through ham radio have ripened into warm personal friendships. Yes, even romance has been known to ride the ether. No one can avoid the broadening influences inherent in this radio hobby. It is impossible for a person to project himself into space through his radio voice without making contacts which spur his imagination and enable him to learn of other places and other people. There are people of all ages and widespread life interests in amateur radio. Students, working men, professional men and business executives are all embraced by this alluring hobby. Many an amateur who has had occasion to travel on either pleasure or business has found fellow hams helpful and friendly. More than one career has been launched from a "ham shack." Hundreds of top men in the radio industry have held an amateur license. There is no better place for a young person to catch on to the first rung of the ladder of radio success than through amateur radio.

When disaster strikes, the amateur is a priceless national asset. Floods, earthquakes or fires which might disrupt normal communications find the ham ready and eager to act in the emergency. Thousands of lives have been saved by the communications services of amateur radio operators in times of stress.

The hobby is neither difficult nor expensive for the participant. About $25 worth of parts and a few weeks of study to learn the code and fundamentals necessary for you to pass your license examination and you're in! Like any other hobby it will grow on you and you will want to improve your equipment. This growth will give you a never ending source of pleasure and sense of accomplishment. You will find your fellow amateurs ready, willing, even anxious to assist you in your development.

Were vast numbers of the youth of our country introduced to this fascinating radio game there would be far fewer furrows on the brows of law enforcement officials concerned with juvenile delinquency. Ham radio is a priceless gift to youth organizations (Boy Scouts, Girl Scouts, etc.).

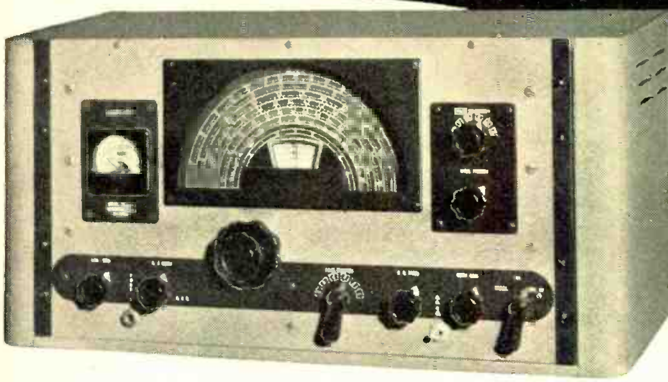
It is hoped that restrictions which limit the scope of amateur radio in some foreign countries will soon be lifted in order that free speech among these hobbyists in all lands can strengthen the cause of international understanding and good will. This freedom of the right to discourse in the realm of international ham radio might well be a valuable adjunct to the work being carried on by the branch of the State Department under the supervision of Mr. William Benton.

The *Radio Manufacturers Association* has taken cognizance of the importance of the amateur group as a vital factor in the industry by forming an *Amateur Radio Division,* manned by leading business executives who will devote themselves to the welfare of amateur radio.

Knowing that many of our readers want to explore the possibilities of the hobby for themselves RADIO NEWS is about to launch a series of articles based on the actual experiences of a young lady who decides to enter amateur radio. These articles will tell, in detail, the steps she takes to win her license. Those of you outside of the ham fold will enjoy the series as an introduction to the hobby while you within the ranks may become nostalgic as you recognize some of your own early experiences. We did. . . O.R.

For Earliest Delivery... ORDER YOUR NEW
COMMUNICATIONS RECEIVER
Now from ALLIED

AVAILABLE ON
Time Payments
TRADE-INS ACCEPTED



RME 45

The *new* RME 45 Receiver delivers peak reception on *all* frequencies—500 to 33,000 Kc. Full vision calibrated dial using one control for two-speed tuning. Five Amateur bands with ample band spread. DB calibrated signal level meter. 5 step variable crystal filter. Automatic Noise Suppression. Stable, variable pitch beat oscillator. Streamline cabinet with matching speaker. Net, with Speaker... **$186**

HAMMARLUND HQ-129X

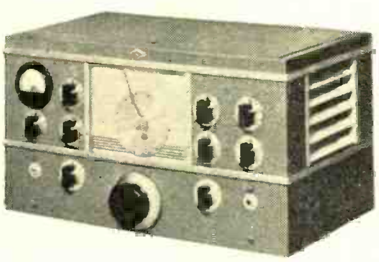
Designed to meet the most critical demands of professional operators. Full range .54 to 31 Mc., accurately calibrated. 4 calibrated Ham bands and one arbitrary scale. Variable selectivity crystal filter. Low drift beat oscillator for code and locating stations. Antenna compensator. Voltage regulation. Compensated oscillator to reduce drift during warm-up. Automatic noise limiter. Earphone jack. 3 i.f. amplifier stages. 2 audio stages. For phone or CW. Net ... **$129**

Speaker, net ... **$10.50**

HALLICRAFTERS S-40

Sensational new Hallicrafters receiver! Offers many advanced design and performance features at a popular price. Simple to operate. Frequency range 550 Kc. to 44 Mc. in 4 bands. Wide vision main tuning dial accurately calibrated. Separate electrical bandspread dial, inertia flywheel tuning. Beat frequency oscillator. A.V.C. switch. CW/a.m. switch. Standby receive switch. Automatic noise limiter. Separate RF and AF gain controls. Three position tone control. "Micro-set" permeability adjusted coils in RF section. Internal dynamic speaker. Net ... **$79.50**

Model SM-40 External "S" Meter ... **$15.00**



NATIONAL NC-2-40C

One of National's top receivers. 490 Kc. to 30 Mc. range in 6 tuning bands. Definite, accurate calibration for all bands. Actual single dial control. Stable high frequency circuits. Frequency drift reduction to a negligible value by temperature compensation. Automatic voltage stabilization. Wide range adjustable series-valve-noise limiter. Flexible crystal filter. Phonograph or high level microphone pick-up jack. Special r.f. coupling circuits maintain full sensitivity. Net ... **$225**

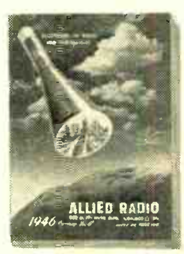
Speaker in matching cabinet, net ... **$15.00**

Other Communications Receivers

Hallicrafters SX-25	$94.50	Hallicrafters SX-28A	$223.00
National HRO	197.70	Hallicrafters S-36A	307.50
RME DB-20 Preselector	59.30	Hammarlund 400X	318.00
RME VHF-152 Converter	86.60	Hammarlund 400SX	318.00

Net. F. O. B. Chicago (All prices subject to change)

Free... SEND NOW FOR ALLIED'S NEW 1946 CATALOG



Here's your handiest, most complete 1946 Buying Guide for everything in radio! Includes latest communications receivers, Ham gear, code apparatus, parts, kits, tubes, tools, books, test instruments, public address and other equipment. 10,000 items at your finger tips . . . largest and most complete stocks under one roof. Nationally known makes. Fastest service—from one central source. Experienced staff of licensed radio amateurs to help you.

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Date ....

☐ Please enter order for

.... Model ....

☐ Enclosed $ .... ☐ Full Payment
☐ Part Payment (Balance C.O.D.)

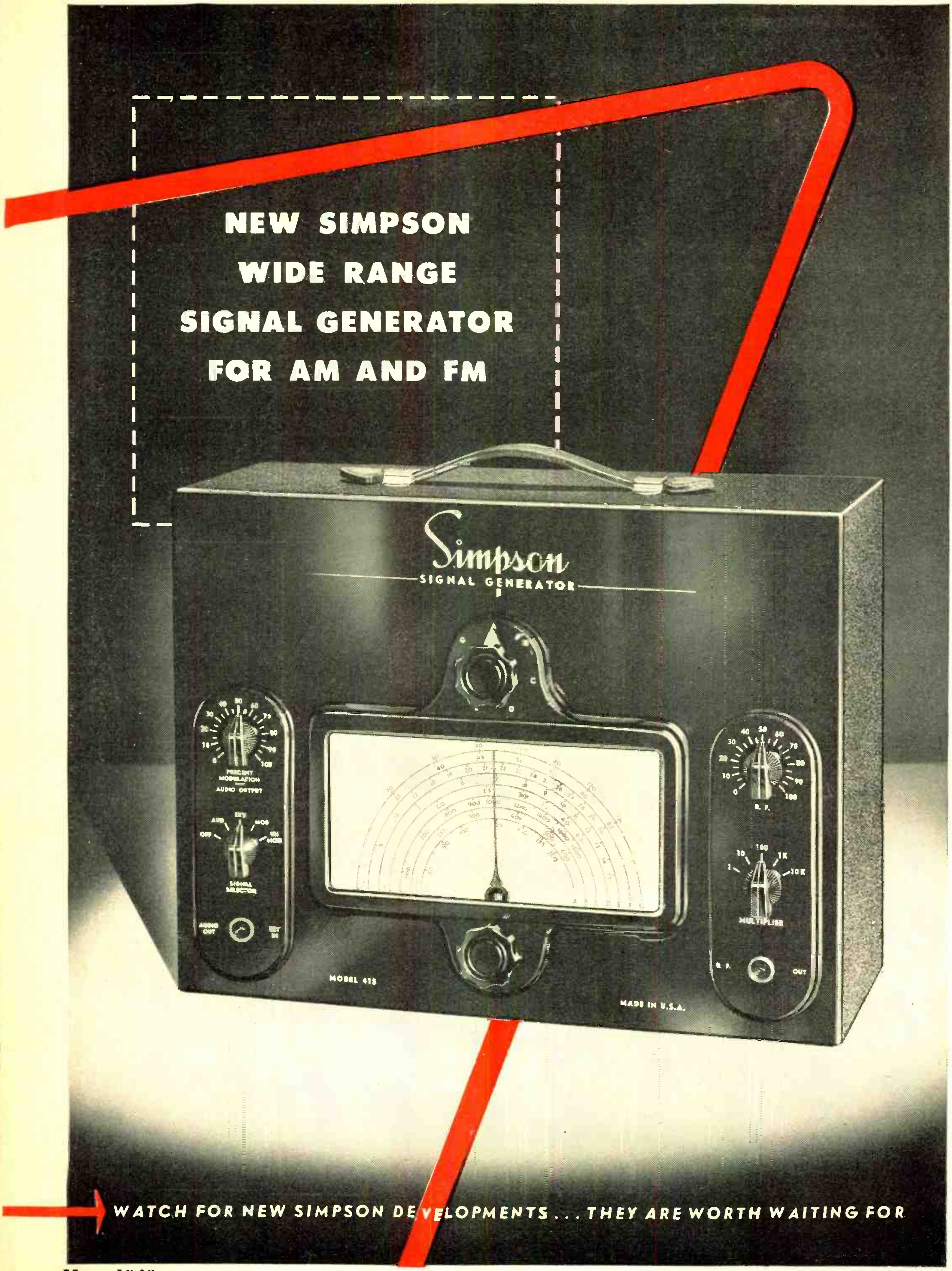
☐ Please send full information on Communications Receivers and Time Payment Plan, without obligation.

☐ Send FREE new 1946 Allied Catalog.

Name ....

Address ....

City .... *Zone* .... *State* ....


NEW SIMPSON
WIDE RANGE
SIGNAL GENERATOR
FOR AM AND FM
Simpson
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MADE IN U.S.A.
MULTIPLIER
WATCH FOR NEW SIMPSON DEVELOPMENTS . . . THEY ARE WORTH WAITING FOR

Spot Radio News

★ *Presenting latest information on the Radio Industry.*

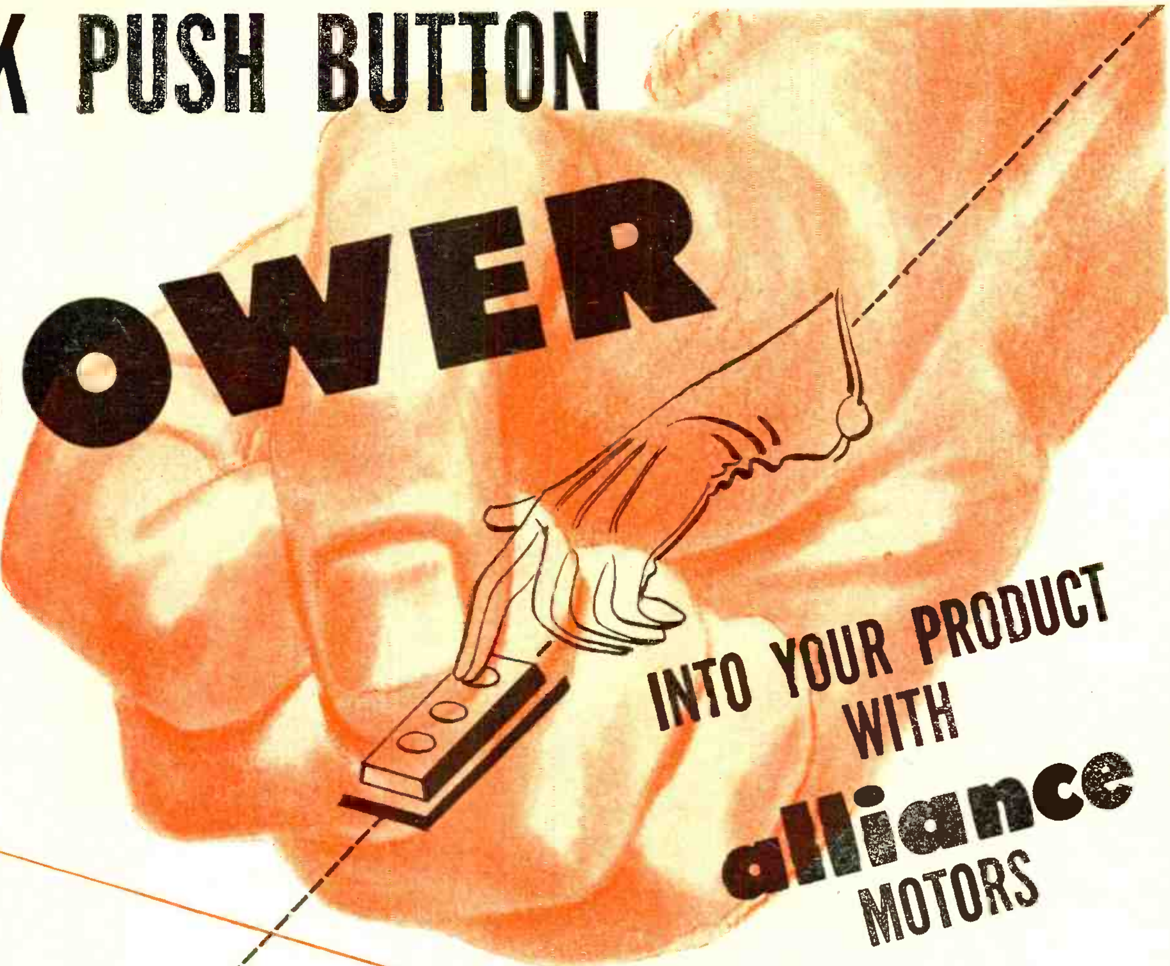
By **FRED HAMLIN**
Washington Editor, RADIO NEWS

HAM HOPES, born of war-year waiting to get back on the air in a big way, are busting out all over, according to deadline dope we gathered at the Federal Communications Commission. From an initial low of 19 applications the first week in February, ham license applications have steadily risen in number, some 700 coming in the week we went to press. The boom is so active that FCC has quit keeping score—all they hope to do is keep up with the routine of granting permits until all applicants are taken care of. . . . Ham activities, released from war-time shortages and stimulated by the return of service men who have learned to work and play with radio, will far outstrip post-war highs, it is believed. . . . Percussion cap for the present boom was the announcement of ham frequency bands late in February, plus additional information regarding the temporary allocation of the band 235-240 mc. released in mid-March. The 235-240 mc. allocation, FCC announced, is on a temporary basis, terminating not later than Jan. 1, 1949, at which time the amateur station operation on this frequency band will move to the 220-225 mc. band "in accordance with the Commission's post-war allocation plan." U.S.-British coordination of frequencies necessitated the FCC ruling. . . . The Commission's February announcement made available the following frequency bands for ham use, subject to the qualifications noted: 28.0 to 29.7 mc. using type A1 emission; 28.1 to 29.5 mc. using type A3 emission; 28.95 to 29.7 mc. using special emission for frequency modulation (telephony); 50.0 to 54.0 mc. using types A1, A2, A3 and A4 emissions and, on frequencies 52.5 to 54.0 mc., special emission for frequency modulation (telephony); and 144 to 148 mc., using A1, A2, A3 and A4 emissions and special emissions for frequency modulation (telephony and telegraphy). The portion of this band between 146.5 and 148 mc. shall not be used, FCC ruled, by any amateur station located within 50 miles of Washington, D. C., Seattle, or Honolulu. . . . FCC rounded out the picture on March 13 when it assigned three additional frequency bands for amateur use. One of these, the 3700 to 4000 kc. band, is the first below 25 mc. to be available for amateurs since they were reactivated last year. This band was made available as of April 1, the other two at the time of the announcement. They were the 235-240 mc. and 27.185 to 27.455 mc., available for hams both in the U.S. and in its territories and possessions. . . . Another thing we picked up in passing: hams are showing an active interest in television. Pretty soon now it's going to be not "How're you doing?" but "You're looking fine!"

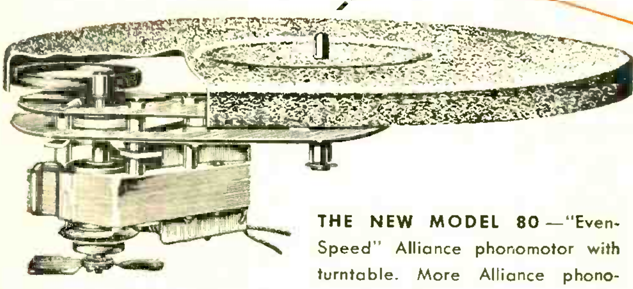
FM ACTIVITIES parallel the ham boom, FCC reports. As we go to press, the Commission has approved 350 conditional grants for frequency modulation stations throughout the country. Fifteen stations have received approval of their engineering plans, and it is anticipated that some 800 construction permits will have been issued by the end of the year. . . . A conditional grant is given applicants when no site is specified in the application and after that the Commission investigates the engineering plan for the station. Once the plan is approved and a site has been found, a construction permit is issued. Then the applicant may go ahead and buy equipment, build, and start test broadcasts. Between the time the station is completed and application is made for a license, these tests may be made, but no organized programs may be transmitted as regular features. Full-time operation must be held up till a license is granted. . . . On the optimistic side, the FCC points out that FM's anticipated 800 outlets compares dramatically with the approximately 1,000 AM stations now operating. But there's a catch in getting FM stations into operation quickly. Manufacturers have been delayed by supply and other problems in getting FM sets into production. Some few are expected to be on the market during April, but not many; old sets aren't adjusted for the new band, and the receivers with the new band aren't available on the open market. . . . Incidentally, FCC reports a lively veteran interest in the entire FM program. Hundreds have asked questions and scores have applied for licenses.

POSTWAR RADIO MARKETS are going to bulk large in the nation's sales totals if the past is an indication of the future. Latest case in point is a set of figures released with the bulky Federal Communications Commission report, "Public Service Responsibility

PACK PUSH BUTTON POWER



INTO YOUR PRODUCT WITH alliance MOTORS



THE NEW MODEL 80—"Even-Speed" Alliance phonomotor with turntable. More Alliance phonomotors are used in the radio industry than any other kind.

Alliance Powr-Pakt Motors are manufactured in shaded pole induction and split phase resistor types. Frequencies range from 40 to 60 cycles, voltages from 24 to 250 and power ratings from less than 1–300th on up to 1–20th horsepower.

New Uses for the Powr-Pakt Line! Electronic and electric controls, time, temperature, pressure and humidity controls, coin operated phonographs, drink and merchandise dispensers, fans, valves and blowers, door openers, signals, motion displays, movie projectors and scores of industrial applications.

Hook up your electronic, electrical and radio controls with Alliance Powr-Pakt Motors! They'll increase the flexibility and usefulness of any mechanical process.

Millions of Alliance Phonomotors are driving turntables, record changers, and radio tuning devices for the radio industry. With a few design variations Alliance is now mass producing Powr-Pakt motors at the same low prices. They'll actuate all kinds of moving parts and controls.

WHEN YOU DESIGN—KEEP alliance MOTORS IN MIND

ALLIANCE MANUFACTURING COMPANY • ALLIANCE, OHIO

ALLIANCE TOOL AND MOTOR LTD., TORONTO 14, CANADA of Broadcasting Licensees." You may remember that news stories played up the fact that FCC said there were too many soap operas and commercials on the air these days. . . . What the newspapers overlooked were facts in the back of the report showing that radio was a multi-million-dollar business even during the stringent war years. In the eight years prior to Dec. 31, 1944, the public spent a total of $2,078,000,000 on 53,800,000 receivers manufactured in that period. Radio listeners also spent an annual estimated $200,000,000 on electricity, batteries, and similar items; $25,000,000 for 22,000,000 replacement tubes; $60,000,000 on repair parts and supplies; and $50,000,000 on repair services. . . . FCC even figured out what it cost an average listener to listen during the period. On the basis of 55,000,000 listeners, cost per receiver per year was $11.49, or about 3 cents per receiver per day. . . . The Commission points out that "since few receivers were manufactured during 1942 and 1943, the money spent in this department would be normally much higher. With war-time shortages — and assuming that manufacturers can shoot the works on production — the future would seem bright, indeed.

MODEL SALES UNDER OPA pricing, as analyzed by the Radio Manufacturers Association, indicate a number of other and more recent sales facts. After three months of OPA pricing of radio sets and phonographs, RMA found that more than 85 per-cent of the radios priced—a total of 499—are table models. Only 15 per-cent are consoles. . . . A total of 582 sets, 141 phonographs, and 3 television models were tagged by OPA. Portable phonographs outnumber table models about two-to-one. Most popular table model prices: $25 to $35. Almost all of these are AM models only. Phonograph popular prices run higher — $35 to $50. Prices on the table models are as low as less than $15 on seven models, while five table model radio-phonographs go to more than $100. . . . RMA notes that 125 set manufacturers and private brand dealers obtained prices on radios in the three-month period and 80 manufacturers obtained prices on phonographs. Only 43 of the radio manufacturers were in production before the war.

GETTING BACK TO THE FCC blast at radio commercials, it led to a set of new words that the layman may want to add to his dictionary—and a tart response from Justin Miller, president of the National Association of Broadcasters. . . . The FCC was most critical of the overload on the airways of cowcatchers, hitchhikers, middle-commercials and soap operas—any one of which you can find by tuning in the nearest commercial set. A "cowcatcher," we learned, is a plug for a product which is inserted before the start of a radio program advertising another ware. A "hitchhiker" is the same thing only tacked on the program's end. The "middle commercial" is what the announcer talks about in the way of advertising just after he tells you that there will be a lot more news in just a moment. And a "soap opera" sells soap — or some similar product — by presenting sentimental drama. . . . FCC made it quite clear that if some stations didn't cut down on this kind of stuff, they'd lose their licenses next time they come up for renewal. The Commission pointed out that the standards set by the National Association of Broadcasters on commercials has "progressively relaxed, so that the NAB standards at present permit as much as one and three-quarter minutes of advertising in a five-minute period, and do not even require this limit on participating programs." FCC also stated that NAB standards place "no limitation whatever on spot announcements . . . and there is abundant evidence that even the present NAB standards are being flouted by some stations and networks." Complaint was made of the misuse of the patriotic interests of listeners, especially in time of war, and "discussions of body odors, sluggish bile, etc., are a distinguishing characteristic of American broadcasting." . . . "There is need," FCC concluded, "for a thorough review by the industry itself of current advertising practices, with a view towards the establishment and enforcement of sound standards by the industry itself."

NAB'S REPLY TO FCC was equally emphatic. As spokesman for the Association, Justin Miller, its president, characterized the Commission's report as reflecting "a philosophy of government which raises grave questions of constitutionality." . . . "The report overlooks, completely, freedom of speech in radio broadcasting," he said, pointing out that such freedom "was a primary consideration in the mind of Congress when it passed the Communications Act." "Considered from every angle," Mr. Miller stated, "the report reveals a lack of faith in the American system of free radio and a desire to impose artificial and arbitrary controls over what the people of this country shall hear. It indicates a reversion to that type of government control and regulation from which our forefathers struggled to escape. In this instance, just as with the issue of freedom of the press, there can be no compromise. The radio broadcasters recognize, frankly, that they, like all other human beings and institutions, are far from perfect. . . . On the other hand, the broadcasters are fully aware that they are the champions of the people in resisting both direct and indirect encroachments of government upon the freedom of speech. Encroachments, which in their inception, may seem innocuous to many people—and which, perhaps, may seem justified in

(*Continued on page* 102)

Learn RADIO ELECTRONICS DeFOREST'S MODERN "A-B-C" WAY *..at Home*

Plan your future the way business men do: Watch the headlines! Pick a field that's *"in the news"*—one with many opportunities for interesting, PROFITABLE EMPLOYMENT or a good chance for establishing a BUSINESS OF YOUR OWN with little capital. Pick a field that offers a variety of interesting opportunities—a field with one of America's most promising futures . . . and see how you may MAKE YOUR START TOWARD A PLACE IN THIS FIELD BEFORE JOB COMPETITION BECOMES ACUTE. *Write for DeForest's Big, Free, Illustrated Book*—"VICTORY FOR YOU." Learn how DeForest's prepares you at home, in your leisure time—without interfering with the work you are now doing—then helps you make your start in the vast BILLION DOLLAR Radio-Electronics field.

You Get EMPLOYMENT SERVICE

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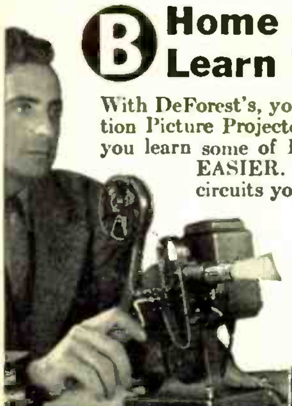

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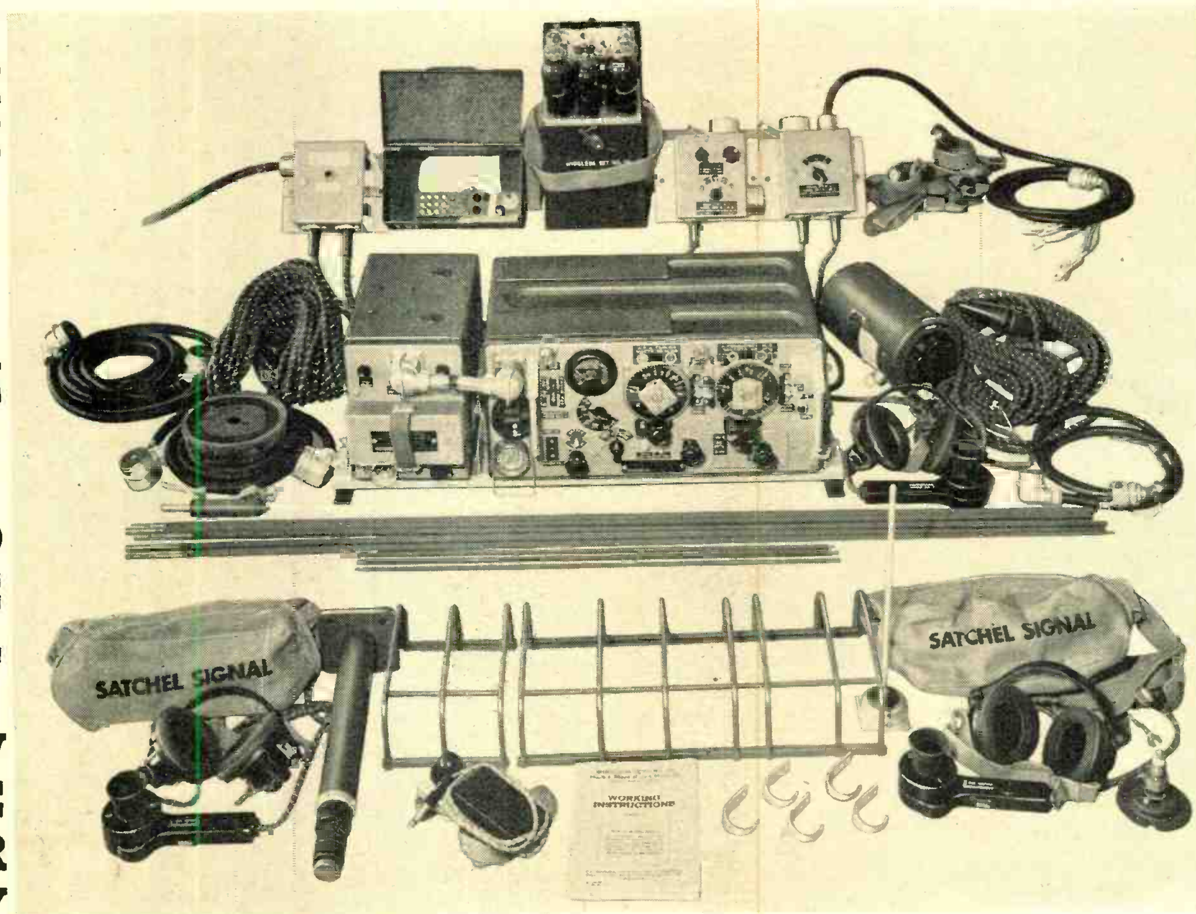

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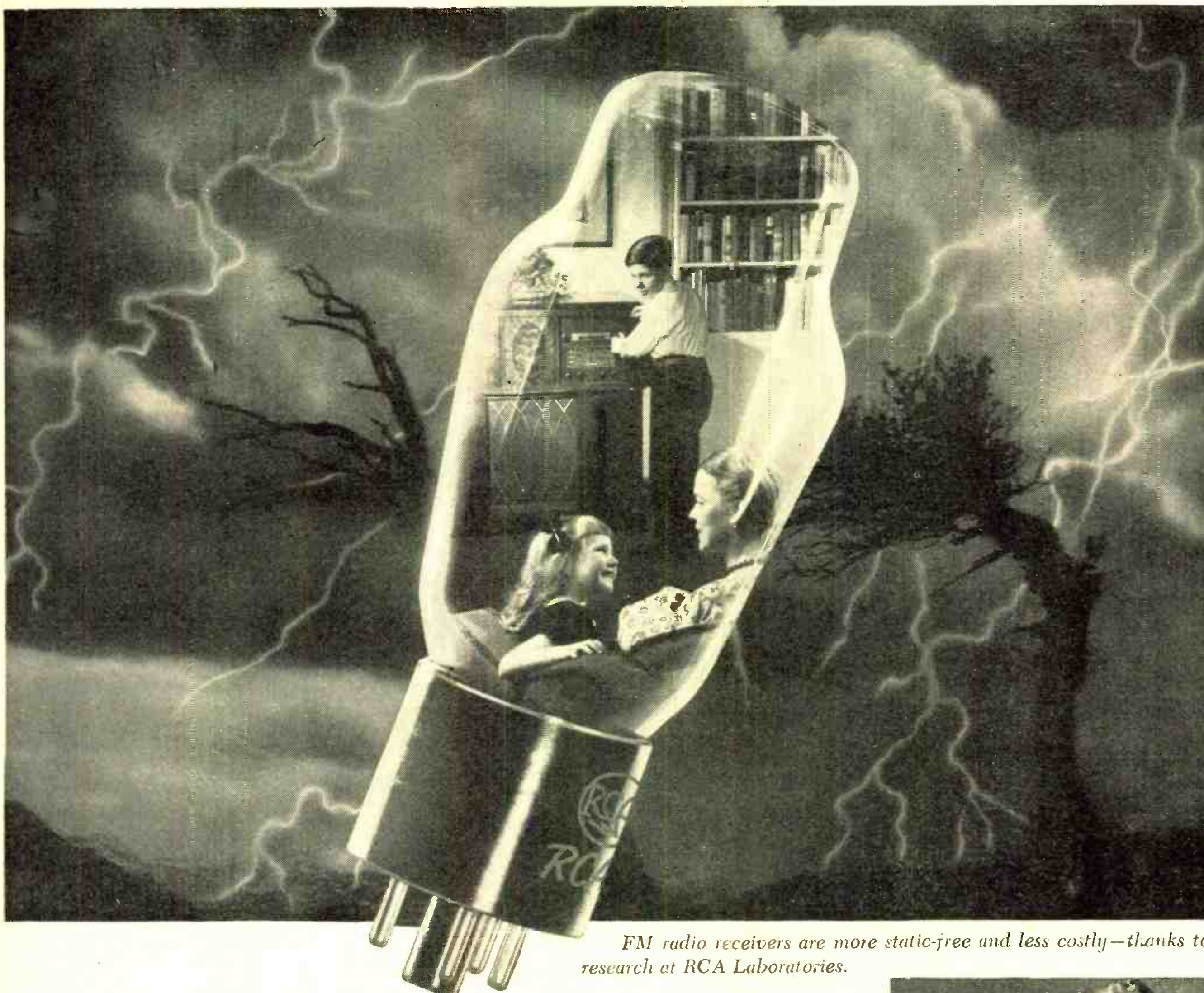

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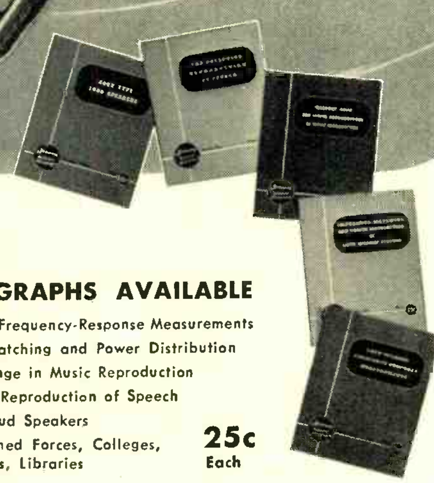

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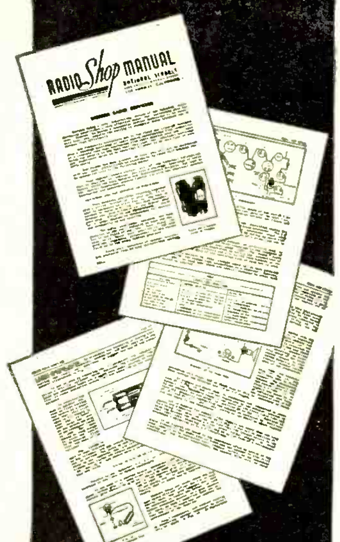

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MANUFACTURERS OF PRECISION COMMUNICATIONS EQUIPMENT

Report on EUROPEAN RADIO INDUSTRY

By
LEON LADEN
London, England

United States manufacturers, anxious to evaluate the absorption capacity of overseas markets for their postwar production outputs, are presented here with a factual and up-to-date picture of Europe's present-day supply and demand position in the radio and television field.

IN EUROPE, as much as in the United States, manufacturers of radio equipment are making prodigious efforts to catch up with accumulated demands for domestic radio and television receivers created by the long years of scarcity.

But while the volume of American radio production is slow in starting it may by the end of the year reach a staggering total (completed units) topping the 10 million mark recorded for 1939.[1] The necessarily incomplete figures available for measuring, with any degree of reliability, the current output of European radio production leave but little doubt of its utter incapacity to surge ahead and approach the comparable figure of 8 million receiving sets.

This divergence in the respective levels of output between the U. S. and European radio production is partially accounted for by the disruption of all types of civilian production due to hostilities, and the overriding needs for housing, food, clothing, and other necessities.

At the same time, however, it is also due in part to the fact that the American radio industry is a highly concentrated and efficient industry with an enormous home market, while the European radio industry, dispersed over many countries and forced to purchase parts in a closed market from firms with a monopoly position, is one of the most woefully backward and grossly inefficient industries in existence over here.

In fact, according to investigations conducted recently by Ian Mikardo, a well-known British production expert and member of Parliament, European radio production costs, despite considerably higher American wages, are invariably well above those in America, but comparable manpower efficiency figures average out nearly five times lower in the U. S. than in Britain, eight times lower than in France and much lower still than in Russia.

Of course, the economic utilization of labor cannot be regarded as the sole criterion of industrial efficiency and figures comparing output per operator, necessarily and admittedly compiled on the basis of approximations and conjectures, must be taken with a good many reservations even in an industry such as the radio industry where undoubtedly a high proportion of the final production cost is represented by labor cost.

In particular, it must be borne in mind that the American radio industry managed to increase its output per operator-hour through the installation of special mass assembly line machinery, geared to produce enormous quantities of standardized midgets, car radios, pocket radios, portable radio-phonographs, personal portables and similar items which are of a design, size and shape less cumbersome to make and offering greater economy in production than table and console models which are principally in demand in Europe.

Moreover, apart from the quantity of sets turned out per operator, quality, durability and the differing marketing conditions operative in European countries must also be taken

[1]Approximately half the world's combined total radio production output at the time without the U.S.S.R.

The Philips' factory at Eindhoven, Holland. Before the war this plant produced a high percentage of the European radio tubes.

into consideration. If this is done, it might appear perhaps less inefficient than sometimes assumed to make receivers that take longer to construct but strike a balance between production requirements and the consumers' demand for radios lasting longer and needing less repair or maintenance.

Nevertheless, it is fully realized over here that if the radio industries of the various European countries wish to take the brake off production and hold their own against outside competition, their efficiency levels will have to be raised substantially and slackness, incompetence, obsolete plant or outdated methods done away with.

That this is generally understood is evidenced by the present planning trend sweeping the continent and changing the traditional production patterns of its industries. This trend, engendered, guided and financed by the governments of most of these countries, notably Britain and France, aims at creating centralized, state-controlled agencies canalising the allocation of factory floor-space, stocks of machine tools, raw materials, labor and capital investment to manufacturing groups producing drastically reduced types of standardized and stereotyped models from single factory units.

Comparison Between U. S. and European Standards

In a way, this continent is effectively enlarging upon a trend of production policy which originally started at the time of the American invasion of the European radio market after the economic crisis of 1930, when such U. S. manufacturers as HMV, Philco, and I.T.T. established branch factories overseas, and the U. S., due to her superior production facilities, began to exercise a rapidly growing influence on European radio production standards by providing the lion's share of radio importations in the different countries. This resulted in U. S. receiver construction ideas, methods, and techniques being studied and copied so assiduously and faithfully over here that it is hardly possible nowadays to discern any marked difference between domestic radio sets manufactured in the U. S. and in Europe; especially since new developments on one side of the Atlantic have always been followed, almost immediately, on the other side, producing in time a uniform design and construction pattern irrespective of the country of origin.

Obviously, there do exist salient features distinguishing radio sets made in either of these two hemispheres, conditioned as much by the differing transmitting facilities (with one or two exceptions, all European broadcast transmitters are state-controlled or semi-state-controlled) as the different listening habits of the public. These features, however, can be summarized as being primarily related to practical issues and, apart from comprising such minor internal lay-out and build-up differences as the presence or absence of tuned high frequency bands, the number of intermediary stages or the sizes of loudspeakers, concern the more exacting requirements of European listeners for outward appearance, safety of operation and length of service as opposed to the American listeners' demand for ease of operation, accessibility or streamlining.

Especially the "life" expectancy of sets are different over here, and a European invariably expects a receiver, once bought, to give satisfactory service for a period of time varying from anything up to eight or ten years, while the U. S. citizen normally is accustomed to discard his radio after a couple of years of service, and then replace it with a more up-to-date model.

In contrast to the American public, people in Europe are averse to investing in eye-catching or ornamental receivers and are against buying radios with frequency-numbered, clock-like scales, as well as being almost totally indifferent about internal construction

These comparative production figures for radio receivers are indicative of Europe's 1946 production potential as compared to their pre-war output.

Country	Principal Manufacturers	Annual Radio Production 1938	Probable Radio Production 1946
BRITAIN	HMV-EMI, G.E.C., Pye, Philips, Decca, Ekco, Philco, Murphy, Cossor, Ferranti, MacMichael	1,400,000	1,367,000
FRANCE	La Radiotechnique, Thomson-Houston, Pathe-Marconi, LMT.	600,000	300,000
HOLLAND	Philips	500,000	400,000
U. S. S. R.	Electro-Prior	1,000,000	1,250,000
ITALY	Marelli, Magnadyne, Philips, Telefunken, F.I.M.I., C.G.E.	1,250,000	500,000
HUNGARY	Tungsram-Orion, Philips, Telefunken, I.T.T., Siemens	350,000	200,000
BELGIUM	S.B.R., Bell, Philips, Telefunken	300,000	250,000
SWEDEN	Philips, Telefunken, Stern & Stern, Aga Baltic, Svenska Radio, Luxor & Centrum	50,000	300,000
SWITZERLAND	Philips, Phillard, Dewald, Sondyna	60,000	100,000
DENMARK	Philips, Telefunken, Rasmus Rudholt, Hede Nielsen, Bang & Olufsen	65,000	50,000
NORWAY	Philips, Telefunken, I.T.T., Salve Staubo, Jan Wessel, Tandberg	65,500	40,000
FINLAND	Philips, Helva, Hellberg, A.S.A.	25,000	15,000

or tube types. Again, push-button and remote-control refinements and similar gadgets are hardly of the same commercial value in attracting the dilatory radio purchaser in Europe as in the States. Rather, of far greater and more decisive importance is the possibility of using a second loudspeaker, the provision for waveband changers, adaptability to different current supplies, a linearly arranged scale with readable station names, a housing built in good taste architecturally, and the color of the cabinet.

Europe's Manufacturing Potential

The state in which the respective radio industries of the European Continent find themselves today differs, naturally, with the differing political, social, economic or industrial conditions existing in the countries in which they are located.

Thus, for example, the once powerful German radio industry, which at one time claimed to have provided 75 per-cent of Germany's population and approximately one quarter of that of the rest of Europe's listening public with radios, and the less substantial and efficient Italian and Hungarian radio industries have all three made their exit for the time being.

On the other hand, vigorous radio industries, capable of ministering to their own needs on an almost self-supporting basis, have sprung up during the war in some countries, once almost entirely dependent on foreign importations, i.e., Switzerland.

A worth-while radio industry has been created in Sweden, a country with a long tradition in the manufacture of low-current apparatus, and is now making speedy headway as an exporter, on a limited scale, to other Scandinavian countries like Norway, Denmark and Finland, in which special safety regulations prohibit the sale to the public of sets not officially approved.

In predominantly agricultural countries and countries in which the general process of industrialization still remains in its infancy (Czechoslovakia, Poland, Rumania, Yugoslavia, Turkey, Bulgaria, Greece or the two countries on the Iberian Peninsula, Spain and Portugal), the pre-war picture has hardly changed at all and radio production, virtually non-existent before the war, has not materially developed beyond the original stage of making crude crystal detectors of the cat-whisker type and simple amplifying devices.

Great Britain

Of all these countries, Great Britain is probably the most important radio manufacturing country in Europe today with the largest number of receivers per capita and a manufacturing potential which, increased proportionally with war-time demands and based on a home market expanded to 10,000,000 sets, is qualitatively, as well as quantitatively, fully geared to compete for the $480,000,000 worth of radio and television purchases and replacements this country will need during the next five years, according to Sir Raymond Birchall, Director-General of the British Post Office.

Moreover, Britain's radio equipment manufacturers, who once exported

(*Continued on page* 108)

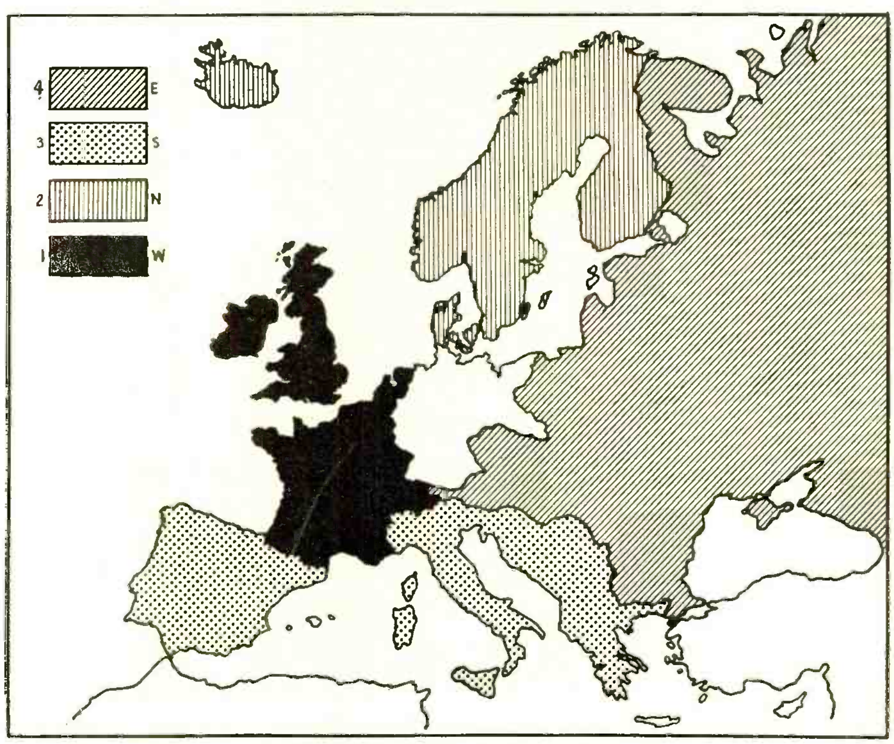
Country	Population	Number of Listeners
BRITAIN	44,000,000 (1945)	9,884,300 (1945)
FRANCE	42,000,000 (1944)	5,248,445 (1944)
HOLLAND	8,100,000 (1944)	410,197 (1944)
U. S. S. R.	170,000,000 (1940)	10,351,361 (1940)
ITALY	43,000,000 (1944)	1,020,845 (1944)
HUNGARY	7,000,000 (1944)	903,585 (1944)
BELGIUM	8,300,000 (1944)	902,445 (1944)
SWITZERLAND	4,600,000 (1945)	850,000 (1945)
SWEDEN	6,600,000 (1945)	1,900,012 (1945)
DENMARK	3,800,000 (1944)	402,361 (1944)
NORWAY	3,000,000 (1945)	225,464 (1945)
FINLAND	3,000,000 (1944)	478,506 (1944)
RUMANIA	16,500,000 (1944)	365,714 (1944)
SPAIN	25,000,000 (1944)	361,782 (1944)
PORTUGAL	7,800,000 (1944)	123,496 (1944)
TURKEY	17,200,000 (1945)	175,485 (1945)

Breakdown of European population, by country and number of radio listeners.

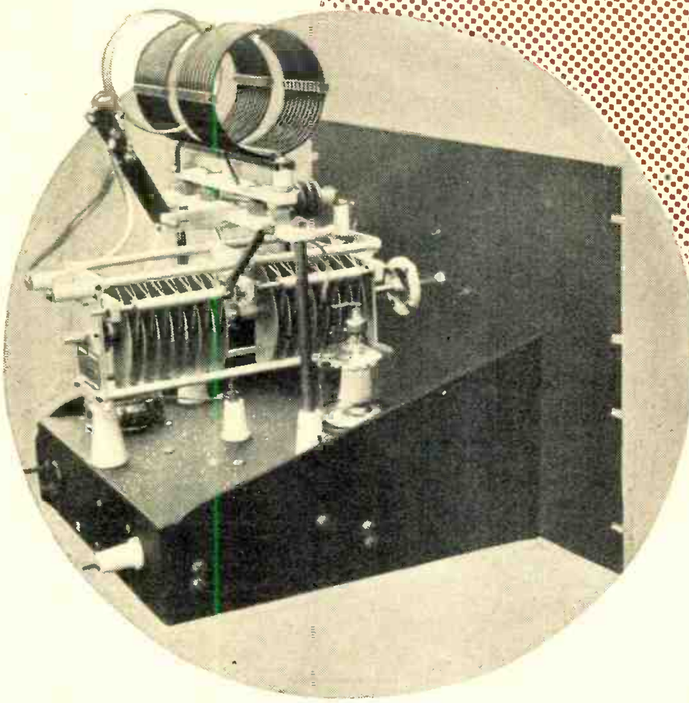
Country	Principal Manufacturers	Approximate Number of Sets in Operation Prior to War	Probable Receiver Production in 1946
BRITAIN	HMV-EMI, G.E.C., Scophony, Cossor, Pye, U.T.M., Ekco	20,000	50,000
FRANCE	La Radiotechnique, L.M.T., C.F.T.	5,000	2,000
HOLLAND	Philips	......	1,000
U. S. S. R.	Electro-Prior	600	5,000
ITALY	Alloccho-Baccini, Safar, F.I.V.R.E.	300	1,000

Estimated 1946 television receiver production as compared to the number of sets in operation pre-war. Figures available for only those countries listed.

European map broken down into four distinct areas (East, South, North, West). Radio receivers designed to be marketed in each of these areas must meet certain specific economic as well as technical requirements in order to be acceptable to the populace.



1000 Watt R.F. Amplifier for the HAM



Back view of completed r.f. amplifier.

By

HARRY D. HOOTON, W8KPX

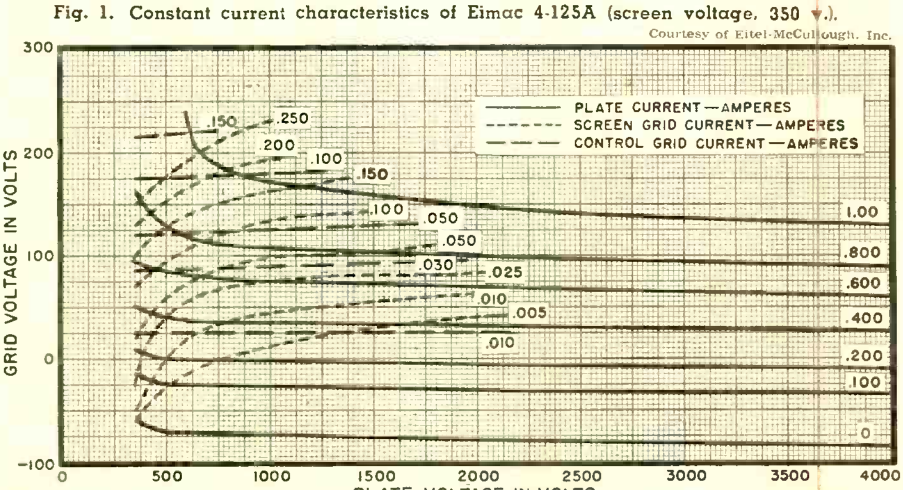
By using modern tubes this r.f. amplifier gives highly efficient high frequency performance, with exceptionally low driving power.

THE application of radio to radar and other devices during the war served to stimulate the design of apparatus which will operate at much higher frequencies, and at higher power input on those frequencies, than any used in the past for practical communications purposes. This general trend toward the higher frequencies has been reflected particularly in the design of the newer transmitting tubes released shortly before and since the end of the war. No longer is 30 megacycles considered the top full-input frequency limit; even 60 megacycles is not top frequency for the new tubes—the Eimac 4-125A, which is typical of the design trend, will take full plate voltage and input all the way up to 120 megacycles and will operate at reduced plate voltage and input up to 250 megacycles. This means that these new tubes offer, not only exciting possibilities on the u.h.f. bands, but new standards of dependability and performance on the regular 80, 40, 20, 13 and 10 meter bands. The extremely low excitation requirements permit circuit simplification to bare essentials. A good example of utter simplicity in high-power r.f. amplifier design, using the new tubes, is the 1000 watt push-pull 4-125A amplifier to be described.

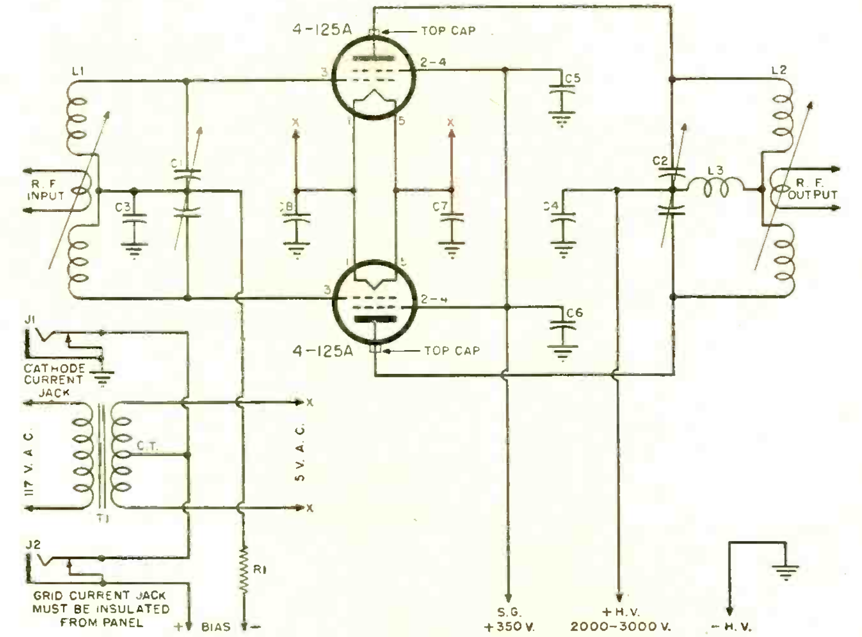
As shown in the schematic diagram, Fig. 2, and the photographs and drawings, the electrical circuit is entirely conventional. The mechanical layout of the amplifier is such that any lead, other than filament or ground wiring, in either the grid or plate circuit, is not over two and one-half inches long; the majority of the r.f. wiring leads are less than two inches in length. The two 4-125A tubes, the plate tank tuning condenser, and the plate tank coil are mounted above the 10 by 13 by 3 inch metal chassis; the grid tuning condenser, the grid tank coil, and the 5 volt, 13 ampere filament transformer are mounted underneath the chassis. Both the grid and the plate coils are of the *Barker and Williamson* variable-link type; the rating of the grid coil is 75 watts while the plate coil rating is 1000 watts. The plate tank condenser is a *Johnson* Type 100DD70, which has a capacity rating of 99 μμfd. maximum and 21 μμfd. minimum *per section*. The spacing is .175 inch and the peak voltage rating is 7000 volts. The grid tuning condenser is a *Johnson* Type 100FD20, which has 105 μμfd. maximum and 9 μμfd. minimum capacity *per section*. The spacing of the grid tuning condenser is .045 inch and the peak voltage rating is 2000 volts. Should tank condensers of other manufacture be substituted for those used here, it must be remembered that the maxi-

Fig. 1. Constant current characteristics of Eimac 4-125A (screen voltage, 350 v.).

Courtesy of Eitel-McCullough, Inc.



R_1—10.000 ohm, 25 w. fixed res.
C_1—Dual trans. cond., 105 μμfd. max., 9 μμfd. min. capacity per section. Spacing .045 inch. Peak voltage rating 2000 volts. Johnson Type 100FD20
C_2—Dual trans. cond., 99 μμfd. max., 21 μμfd. min. capacity per section. Spacing .175 inch. Peak voltage 7000 volts. Johnson Type 100DD70
C_3—.002 μfd. 1000 d.c., w.v., mica cond.
C_4—.001 μfd., mica cond., high-voltage transmitting type, 12,500 volts peak rating
C_5, C_6, C_7, C_8—.02 μfd., 600 d.c., w.v. paper dielectric cond.
(C_5 and C_6 should not be larger than .001 μfd. each when the amplifier is used for plate-modulated telephony. These capacitors are mounted as close as possible to the screen connection on the socket.)
L_1—Self-supporting trans. coil. Barker & Williamson "Juniors," 75 w. rating, 5-prong, plug-in base, variable center link, c.t. Type JVL
L_2—Self-supporting trans. coil. 1000 watts rating, swinging link. Barker & Williamson Type HDVL. Specifications are as follows: 80-HDVL, 47 μh., No. 10 wire, coil 3½" dia., 7½" long: 40HDVL, 18 μh., No. 8 wire, coil 3½" dia., 7½" long: 20HDVL, 5.2 μh., No. 8 wire, coil 3½" dia., 7½" long: 10-HDVL, 1.3 μh., wire, coil 2⅝" dia., 7½" long
L_3—R.F. choke, freq. rating 3.5 to 30 mc., 500 ma. Johnson Type 752
T_1—Fil. trans., 5 v. a.c., c.t. 13 amp. sec.
J_1—Closed circuit jack for measuring cathode current
J_2—Closed circuit jack for measuring grid current (must be connected as shown and insulated from the metal panel)
BIAS—Two 45 volt "B" batteries connected in series
2—Eimac 4-125A trans. tubes
Parts required but not shown on schematic diagram
2—Special 5-prong sockets for 4-125A tubes. Johnson Type 275
1—Swinging link, jack bar assembly for Barker & Williamson HDVL trans. coils, Type HDV
1—Ceramic socket, 5-prong, for grid coil. Johnson Type 225
1—Heavy duty, insulated coupler, ¼" to ¼" shaft. Johnson Type 262
1—Standard duty, insulated coupler, ¼" to ¼" shaft. Johnson Type 252



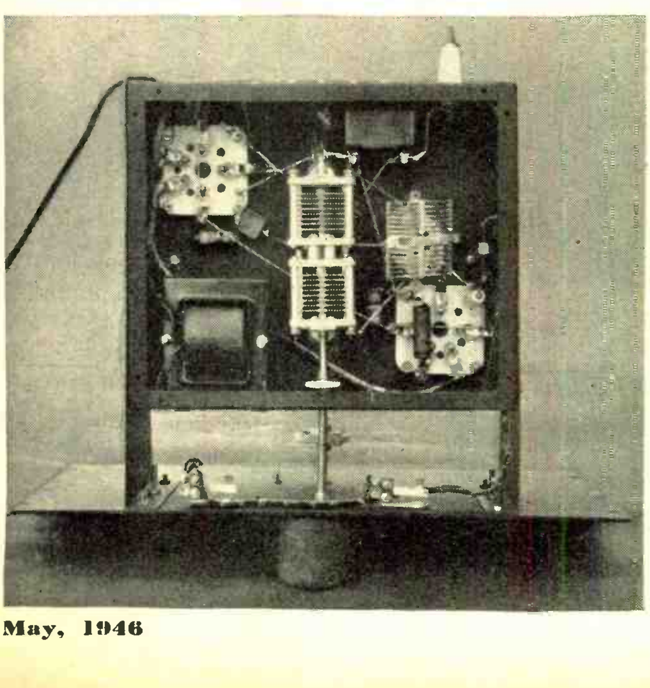
2—Feed-through insulators, 1¼" high. Johnson Type 40
4—Cone insulators, 2" high, Johnson Type 603
2—Cone insulators, 1" high (to support grid coil socket) Johnson Type 601
1—Bakelite socket, chassis mounting type, 8-prongs (for bias supply plug and cable)
2—Brass rods, ⅜" dia., 5" long and tapped for 10/32" machine screws
2—Brass extension shafts, ¼"x3"
1—Steel chassis, 10"x12"x3". Par-Metal Type B-4525.
1—Aluminum panel, 12¼"x19"x⅛". Par-Metal Type 6681
2—Steel chassis mounting brackets, 11" size. Par-Metal Type SB-711
1—Dial and handle, 4", 180 deg. scale. Johnson Type 204
NOTE: The manufacturer's name and part number are given for the convenience of the builder who may wish to make an exact copy of the unit. Components of different manufacture, but of equivalent quality and having the same electrical specifications can be substituted wherever desired.

Fig. 2. Wiring diagram of the 1000 watt r.f. amplifier. Two Eimac 4-125A tubes are used in push-pull operation.

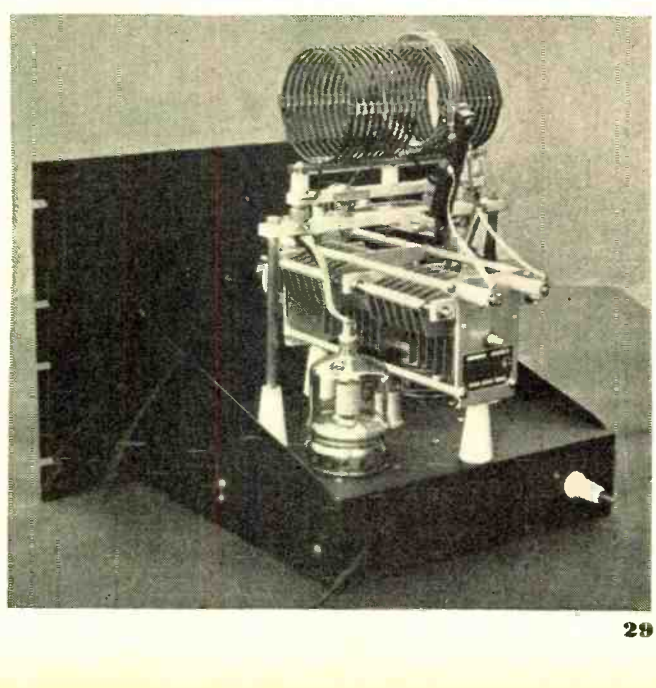
mum and minimum capacity ratings for the *dual* capacitor apply to *one section only;* in series, maximum will be slightly more than one-half and minimum approximately two-thirds the values specified for one section. In this article not only the electrical specifications are being given, but the manufacturer's name and part number as well. This is for the convenience of the builder who may wish to make an exact copy of the amplifier unit. However, it should be understood that components of different manufacture, but of equivalent quality and having the same electrical specifications, can be substituted wherever desired.

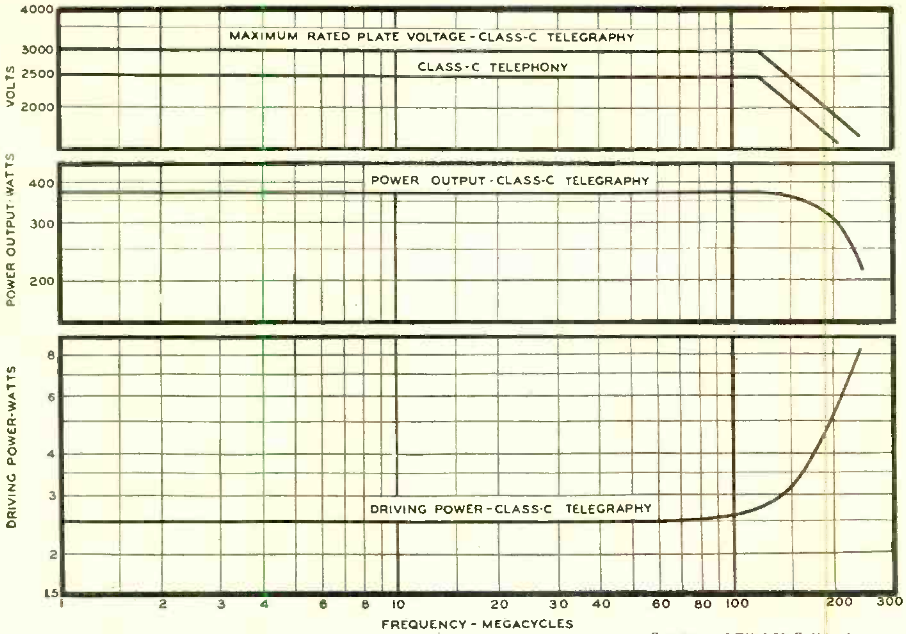
The wiring of the amplifier is quite simple but considerable care must be exercised in order to prevent r.f. losses, especially in the 28-30 megacycle region. It will be noticed from the photographs and drawings that the plate tank coil is mounted so that its axis is at a horizontal angle of 90° with respect to the main axis of the plate tank tuning condenser. This arrangement has several distinct advantages: (1) the aluminum tie rods and

Bottom view—all wires are to be kept as short as possible.



Rear view shows neat construction of top-of-chassis assembly.





Courtesy of Eitel-McCullough, Inc.

Fig. 3. Curves show driving power, power output, and maximum plate voltage plotted against frequency for the Eimac 4-125A.

D.C. Plate Voltage	2,000	2,500	3,000	v.
D.C. Plate Current	400	400	334	ma.
Plate Dissipation	250	250	250	w.
D.C. Screen Voltage	350	350	350	v.
D.C. Screen Current	100	80	60	ma.
Screen Dissipation	36	28	21	w.
D.C. Grid Voltage	—100	—150	—150	v.
Peak R.F. Grid Voltage	*230	*320	*280	v.
Driving Power (approximately)	5.6	7.6	5.0	w.
Grid Dissipation	3.2	4.0	2.4	w.
Plate Power Input	800	1,000	1,000	w.
Plate Power Output	530	750	750	w.

*Per tube measured with a suitable peak voltmeter connected between filament and grid.

Note: The above operating values are for two 4-125A tubes in push-pull connection.

Table 1. Class "C" telegraph operating conditions for frequencies below 120 mc.

the metal end plates of the condenser, in effect, form a short-circuit loop under the coil. If the coil is mounted on top of the condenser frame lengthwise, the "hot" ends of the coil will set up circulating r.f. currents in the metal loop and the losses conceivably could be quite large, particularly on the 28-30 megacycle band. It is true that the r.f. wiring from each end of the tank coil to the fixed plates of the capacitor would be short and direct; the losses in the condenser frame, however, would be much greater than the compensating advantages gained by a reduction of one inch or so in lead length. (2) The 90° mounting also allows the leads from the ends of the tank coil to the 4-125A plates to be taken off in the same direction as that of the coil windings. This is an important factor in the design of high-power r.f. amplifiers; if the connections are made in such a manner that the field from the lead is opposing the inductor field, the over-all inductance value will be decreased, requiring more capacitance to bring the tank circuit to a condition of resonance. The r.f. *resistance* of the lead, however, is *not* decreased in the same proportion as that of the over-all inductance value and there will be an appreciable lowering of the circuit Q as a result. (3) The "hot" ends of the plate tank coil are several inches removed from the vicinity of the metal cabinet and panel. This not only reduces the possibility of r.f. losses due to circulating currents in the metal, but allows a better balanced operating condition between the two push-pull tubes. This contributes greatly to the stability of the amplifier. The chief disadvantage of the 90° coil mounting is that it does not permit the variable link to be operated by a control on the front panel. In general, however, it is not necessary to readjust the link often; ordinarily, the link is adjusted for proper loading of the amplifier on any one band and no further adjustment is required except when changing bands. This arrangement is therefore not too inconvenient.

The grid coil, as mentioned above, is mounted underneath the chassis. This arrangement has the advantage of permitting very short and direct

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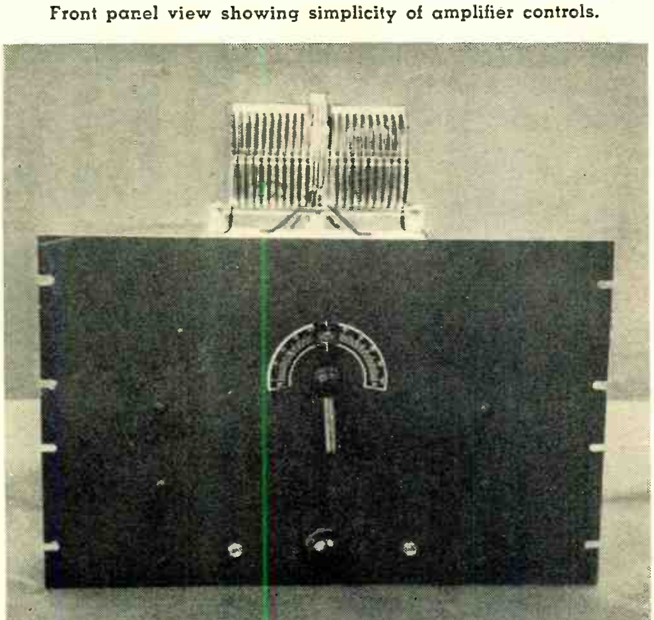
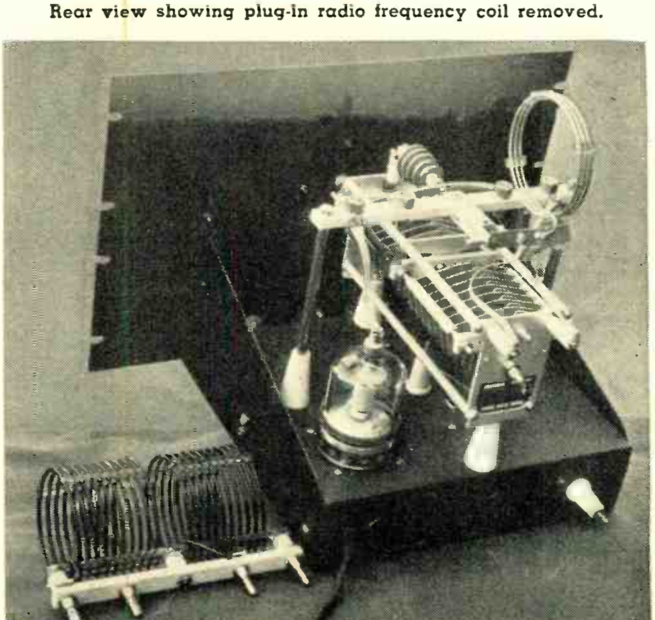
Front panel view showing simplicity of amplifier controls.



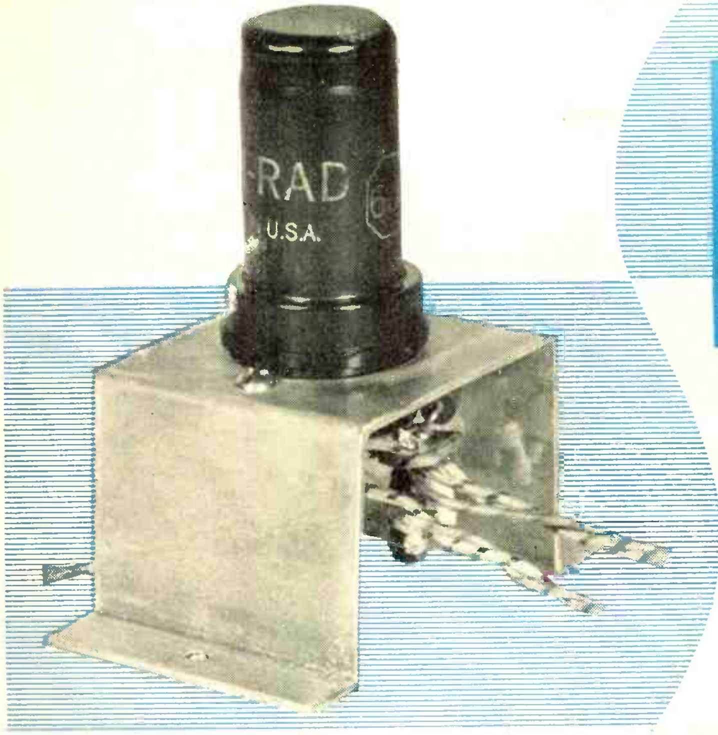
Rear view showing plug-in radio frequency coil removed.



A Simple FM CONVERTER

By
HARVEY KEES
Electronics Research, Inc.

One solution to prevent obsolescence of pre-war FM receivers. WMLL will supply their listeners with this converter.



FM converter in its final form.

> EDITOR'S NOTE: *In order to comply with FCC regulations all FM stations must move to the new 88-108 mc. band. Owners of pre-war FM receivers will, of necessity, have to replace or convert their present sets. The converter described herein is extremely simple in all respects. However, in view of the purpose for which it was designed this converter is limited in its application. This unit is designed to cover only from 92-108 mc. of the new band. It can, however, by simply changing the oscillator frequency, cover any bandspread which does not exceed nine megacycles, i.e.* **100-108** *mc., etc.*
>
> *If the entire 88-108 mc. band is to be covered, a switching arrangement can be employed, or a circuit such as that described in the June, 1945 issue of* RADIO NEWS *can be used instead.*

WHEN the Federal Communications Commission changed the FM broadcast band from 42-50 megacycles to 88-108 megacycles, FM broadcasters were faced with the dual problem of changing their transmitters to operate in the new band while retaining a listening audience. The problem was complicated by the scarcity of receivers capable of covering the new frequencies. Some broadcasters solved the problem by operating transmitters simultaneously in both the old and new bands, at best a temporary and costly expedient.

At WMLL, in Evansville, Indiana, the specific task confronting station engineers was that of changing from an operating frequency of 44.5 megacycles to 94.7 megacycles, and at the same time retaining the good will of several hundred set owners. The solution decided upon was to discontinue operation on the old frequency entirely, and supply listeners with a simple, low-cost converter for their receivers. The converter design finally evolved is extremely simple and is described herewith.

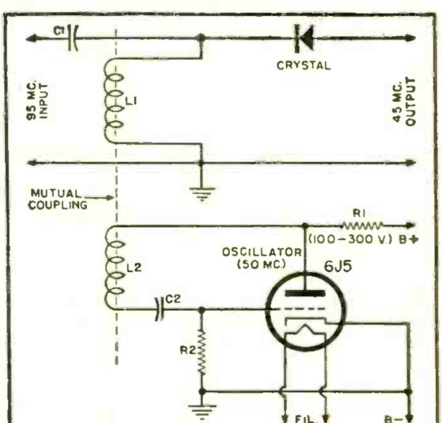
A number of converter circuits were tried, using dual purpose tubes to perform the functions of oscillator and mixer, the design centering around the idea of converting the 10 megacycle band of frequencies between 90 and 100 megacycles to a band extending from 40 to 50 megacycles using a fixed 50 megacycle heterodyning oscillator. The 40 to 50 megacycle output of the converter could then be received by a standard pre-war FM set, using only the normal tuning controls. It was desired to make the converter by a simple, easily-duplicatable design, if possible, involving no tuning controls or trimmer adjustments. It was found rather easy to eliminate trimmer condensers by winding all coils on high-ohmage resistors, using the resistors as coil forms. However, it was found rather difficult to use standard tube types, such as the 6SN7, 7J7, and 7S7, in the mixer stage of the converter, it being observed that converter gain at the frequencies involved was considerably less than was anticipated.

The advent of the *Sylvania* Type 1N34 crystal detector was a godsend. A converter using one of these crystals as a mixer and a 6J5 triode as oscillator proved to be, by all standards, the best design that could be evolved at a reasonable cost. The circuit was far simpler than one using vacuum tubes exclusively, and performance exceeded that of the best tube converters tried.

The circuit diagrams of Figs. 1 and 2 illustrate the simplicity of the WMLL converter. Fig. 3 shows the simple chassis layout, while the photograph presents an over-all picture of the unit. It is intended that power for the converter be obtained from the receiver with which it is used, a convenient means for doing this being the use of an adaptor under one of the audio output tubes in the receiver. Filament voltage can be obtained by connection to appropriate terminals on the tube socket, but some care must be exercised in obtaining plate voltage. In most receivers it is convenient to

(*Continued on page* 127)

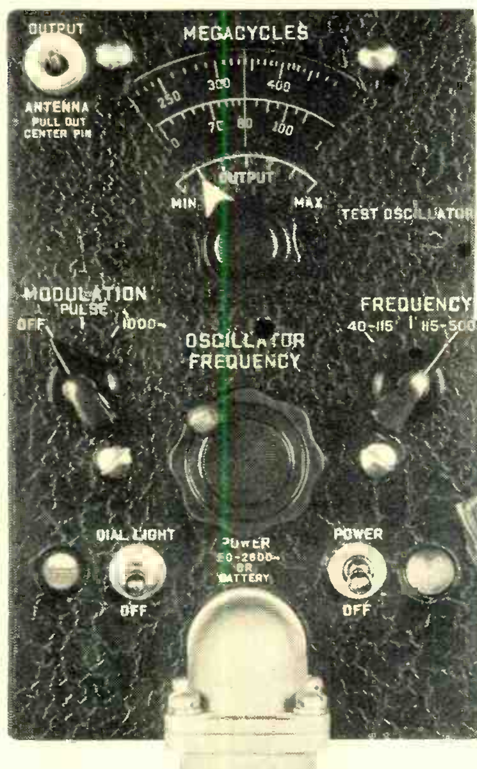
Fig. 1. Schematic diagram for FM converter.



R_1—8200 ohms, 2 w. res.
R_2—82,000 ohms, ½ w. res.
C_1—10 μμfd. mica cond.
C_2—20 μμfd. mica cond.
L_1—11 turns, #22 wire (See text)
L_2—25 turns, #28 wire (See text)
Crystal—Sylvania 1N34 crystal

TEST OSCILLATOR TS-47/APR

By
DAVID W. MOORE, Jr.
Engineer in Charge
Fairchild Camera & Instrument Corp.



Although military in design, this unit will be available as surplus material and its commercial counterpart is expected shortly. It is adapted for testing equipment in the various amateur bands from 50 to 450 megacycles.

Fig. 1. Front panel view of the instrument showing placement of various operating controls.

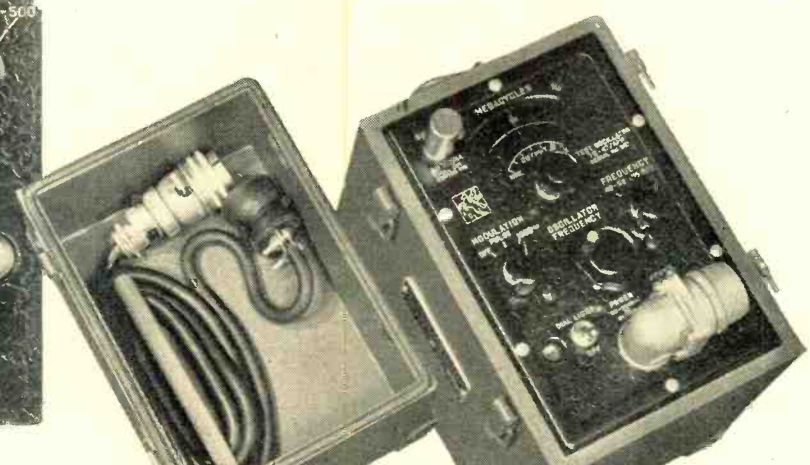


Fig. 2. Over-all view of assembled test instrument. Operating range is from 40 to 500 mc.

MODERN war is virtually run by radio. During any major battle the atmosphere is literally full of radar and communication signals without which the necessary close cooperation between the various activities could not be maintained. Since each radio service is assigned to a definite frequency its success depends upon the equipment operating upon the correct wavelength. To insure this, it was necessary for the government to supply its operating personnel with accurate calibration standards which would stand the rough treatment of field use. The test oscillator, TS-47/APR, is a small lightweight portable unit designed to provide a calibrated high frequency source for alignment and pre-flight check of receivers. This oscillator covers the frequency range of 40 to 500 mc. in two carefully calibrated bands. Higher frequencies may be obtained from harmonics of these fundamental frequencies. An instrument of this type is of special interest to amateurs and those who experiment with high frequencies since it provides a modulated frequency source for the high frequency amateur bands and for microwave experimental work with an accuracy of better than one percent.

Fig. 2 shows the test oscillator mounted in its carrying case which is built to stand rough usage, making it ideal for mobile operations or for portable use. The rugged design is apparent.

The control panel is illustrated in Fig. 1 which clearly shows the main tuning control, band switch, modulation control, output regulator, and "on-off" switches. The band switch selects either the 40-115 mc. band or the 115-500 mc. band, which ever is desired. The modulation can be set to 1000 cycle sine wave, or to a high frequency pulse for checking radar receivers. The output control, of course, varies the signal strength to make it suitable for the specific test.

The output plug is interesting. In the photograph it looks very much like a standard coaxial cable plug, and it may be used as such when a coaxial cable is used to connect the test oscillator to the instrument to be tested. If, however, the center pin is pulled out it will form a quarter wave stub which enables direct radiation of the high frequency signal. This feature permits considerable flexibility in setting up a test.

To insure frequency stability at these high frequencies, great care had to be taken with the basic oscillator design. The butterfly circuit was employed for the high frequency band, with a supplementary low frequency band coil as shown in Fig. 14. The circuit is of the Colpitts type, and is designed around the 9002 triode which has proven very satisfactory for this use. As is characteristic of butterfly circuits, the butterfly rotor changes both the capacity and the inductance of the circuit to maintain as nearly an optimum *LC* ratio throughout the bands as possible.

When the band switch is set for high frequency operation the low frequency coil is shunted by the butterfly stator which forms the high frequency inductance, and which, therefore, controls the circuit. When this range switch is opened the shunt across the low frequency coil is removed, lowering the frequency of the oscillator.

Fig. 4 is a side view of the instrument with the cover removed, showing the general mechanical layout of the butterfly oscillator very clearly. The thickness of the casting is indicative of the care which was exercised to insure mechanical rigidity. Fixed relationship between all circuit components is absolutely mandatory to secure any sort of frequency stability at these frequencies. If any of the parts is permitted to flex the least bit, the performance will be affected.

The bevel gearing shown operates the band switch which is of the multiple leaf type to permit stable performance. This point is emphasized so that it will not be thought that this crude bevel gearing would be satisfactory for controlling the butterfly rotor. It is satisfactory for operating the band switch which must only be opened and closed and not set to any definite position.

The lower compartment houses the power supply and modulator unit which will be described later.

Figs. 3 and 6 are views of the butterfly assembly removed from the housing, showing the constructional details. The tube socket has been incorporated in the butterfly end plate to minimize the number of parts and to provide the shortest practical lead length.

The low frequency coil of two and one half turns is clearly visible, and is of the self supported type. The band switch is also shown in Fig. 6 and it is apparent how it makes firm contact with each leaf of the butterfly.

The radio frequency chokes are conventional, as are the bypass condensers which serve as filters to restrict the high frequency voltage to the tuned circuits.

The heavy bus connection at the top of the butterfly is to connect the rotor shaft to ground. This rotor shaft is insulated from the rotor plates, but must be carefully grounded because an intermittent ground would cause erratic frequency shifts. It is also important that this shaft not be resonant in the useful frequency range of the instrument to preclude absorption dips in the oscillator output.

The tubular condenser shown in Fig.

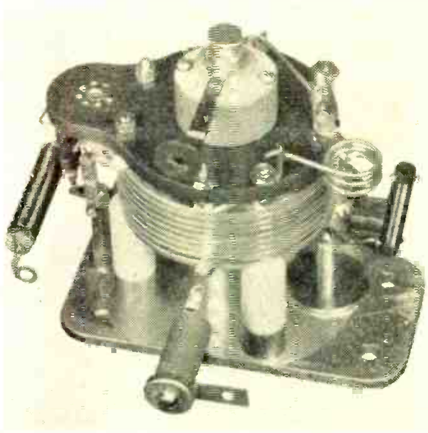


Fig. 3. "Wall side" view, butterfly assembly.

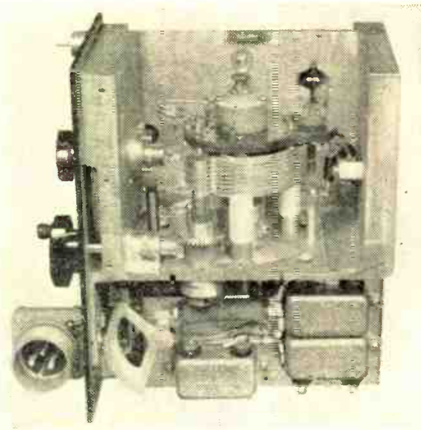


Fig. 4. Internal view with cover removed.

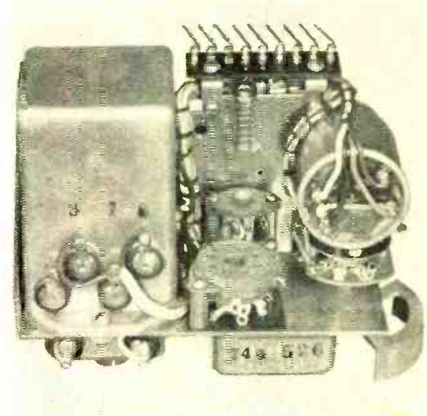


Fig. 5. Principal view, power shelf assembly.

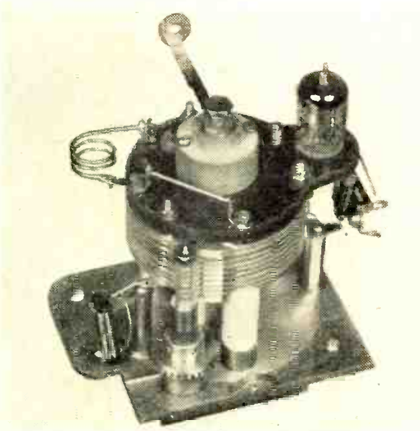


Fig. 6. "Open side" view, butterfly assembly.

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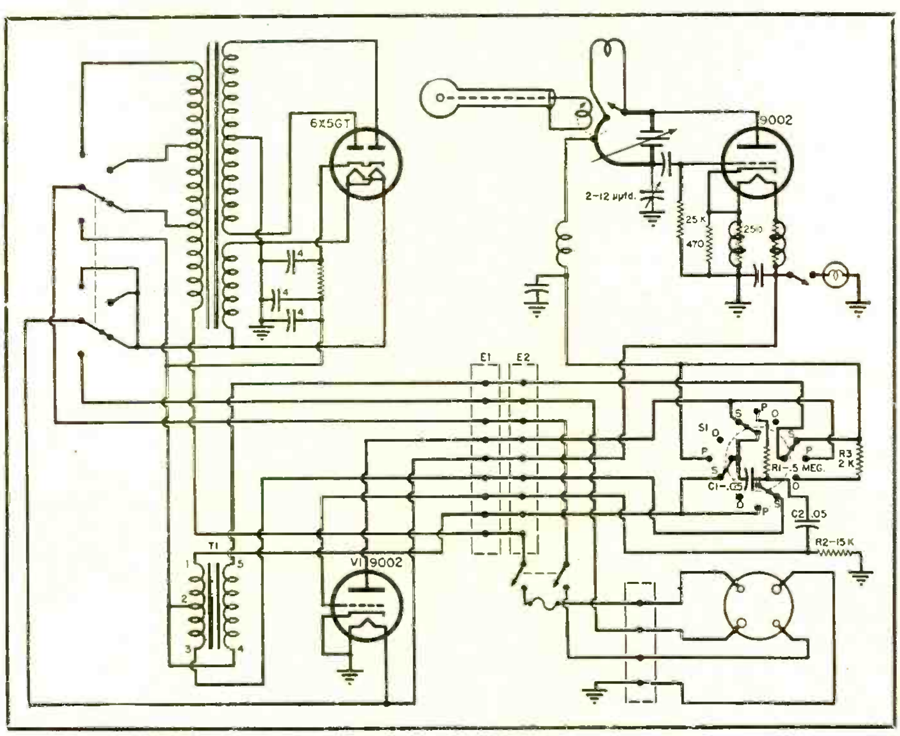
Fig. 7. Complete schematic diagram of TS-47/APR test oscillator showing the oscillator, modulator, and power supply, together with the interconnecting leads. Circuit illustrates how the modulator and power supply unit may be separated from the oscillator section by separating terminal boards, E_1 and E_2. Switch positions (S_1) are S, 1000 cycles sine wave; P, pulse wave; O, no modulation.



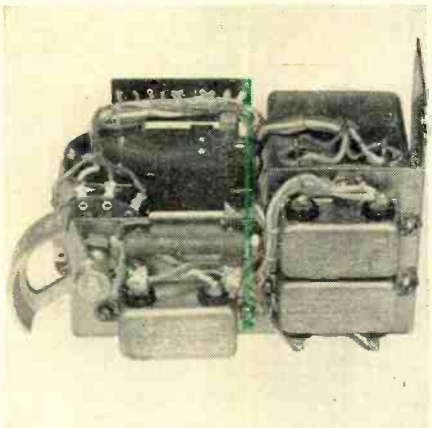


Fig. 8. Power shelf assembly, filter system.

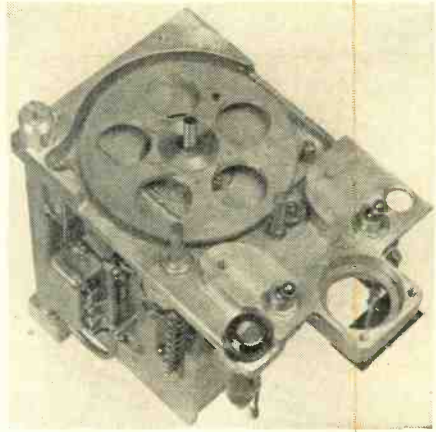


Fig. 9. Test oscillator, panel and dial off.

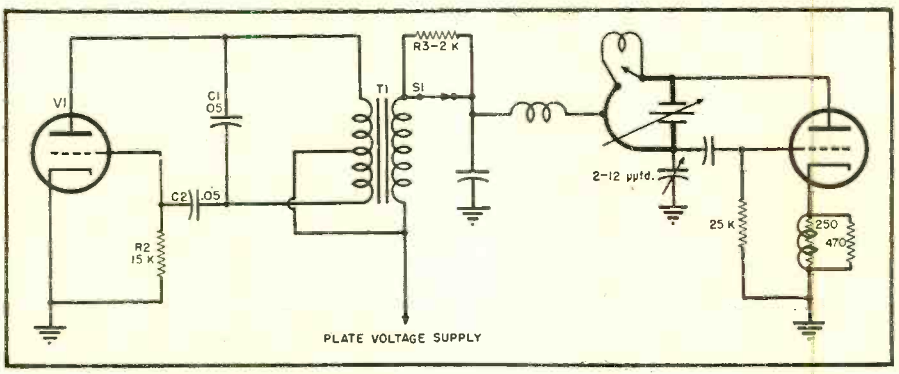


Fig. 10. Schematic of the modulator with the modulator switch set for sine modulation.

3 is a trimmer to effect adjustments of the oscillator to the correct operating frequency. This adjustment usually has to be made upon changing oscillator tubes since the internal capacities of these tubes vary unless they are carefully selected.

Fig. 7 is a complete schematic diagram, showing the oscillator, modulator, and power supply, together with the interconnecting leads. The circuit illustrates how the modulator and power supply unit may be separated from the oscillator section by separating terminal boards E_1 and E_2. All connections between the two units go through these two boards. This circuit will be considered in sections as was the butterfly oscillator.

Provision is made for modulating the oscillator with a 1000 cycle sine wave, or with high frequency pulses. Fig. 10 is a functional schematic of the modulator with the modulator switch set for sine modulation. The modulator tube, V_1 is a 9002 triode, and is connected to the primary of transformer T_1 which is tuned to 1000 cycles by C_1, forming a conventional Hartley oscillator. The transformer secondary winding is in series with the plate supply to the butterfly oscillator. The oscillator is therefore plate modulated at 1000 cycles. S_1, which is a portion of the modulator switch, is closed for sinusoidal modulation.

The modulator hook-up for pulse modulation is naturally quite different from the 1000 cycle modulation and is shown in Fig. 15. Here the 9002 modulator tube and transformer T_1 are connected in an inductive feedback circuit. Excessive feedback is provided, causing the tube to block as soon as any oscillation commences.

Resistor R_1 is now in series with the plate supply to the butterfly oscillator and is of such a high value that the high frequency circuit will not oscillate. During the brief oscillation of the modulator tube before the grid is blocked, a positive pulse is applied to the plate of the butterfly oscillator through condenser C_1. This positive pulse adds enough voltage to the plate supply to cause a momentary high frequency oscillation generating the desired pulse. As soon as the charge on C_2 leaks off through grid leak R_2, the modulator tube will burst into oscillation for a brief period and another pulse will be applied to the plate of the butterfly oscillator, generating another high frequency pulse. The pulse rate is then largely determined by the values of C_2 and R_2.

These modulator circuits may be used with different forms of high frequency oscillators, and may be fitted into various types of amateur and experimental equipment.

The power supply was designed to enable the use of a number of supply voltages and frequencies to permit extreme flexibility in the field. There is, however, nothing critical about the power supply and for amateur use it can be designed for a standard 110 volt, 60 cycle line, with provision for battery operation for portable or mobile work.

Fig. 5 is another view of the power supply and modulator shelf. The octal socket is for the 6X5GT rectifier tube, while the midget socket is for the 9002 modulator. The sealed components used and the type of wiring are characteristic of military equipment. All of these components must be capable of satisfactory performance throughout wide temperature ranges and under the most adverse circumstances. The wafer switch, visible under the modulator transformer, connects the power supply for the desired input voltage which is indicated by the dial at the lower right.

Fig. 8 is another view of the same component and gives a better idea of the general construction.

Fig. 11 is a side view of the complete oscillator, modulator, and power supply. The terminal boards which enable connection between the two basic components are shown. An interesting feature is the spring tube clip which holds the 9002 modulator in position and prevents its being jostled out by rough handling of the instrument.

The coaxial line from the butterfly oscillator to the power output plug is clearly shown. The high frequency energy is fed into this line by a small pick-up coil mounted in the electromagnetic field of the butterfly.

Fig. 12 is a top view of the test os-

(*Continued on page* 68)

Fig. 11. Side view of test oscillator.

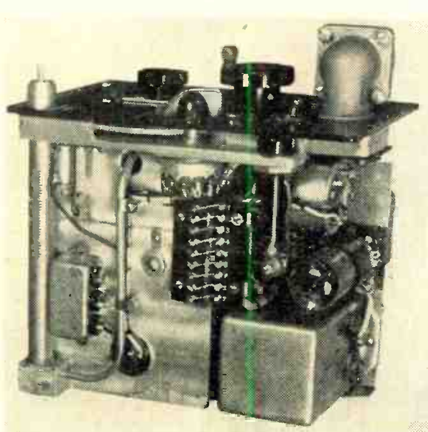
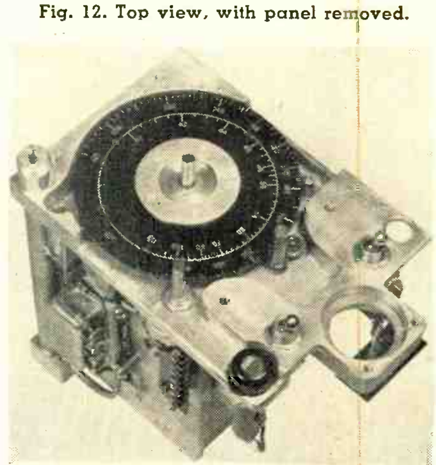
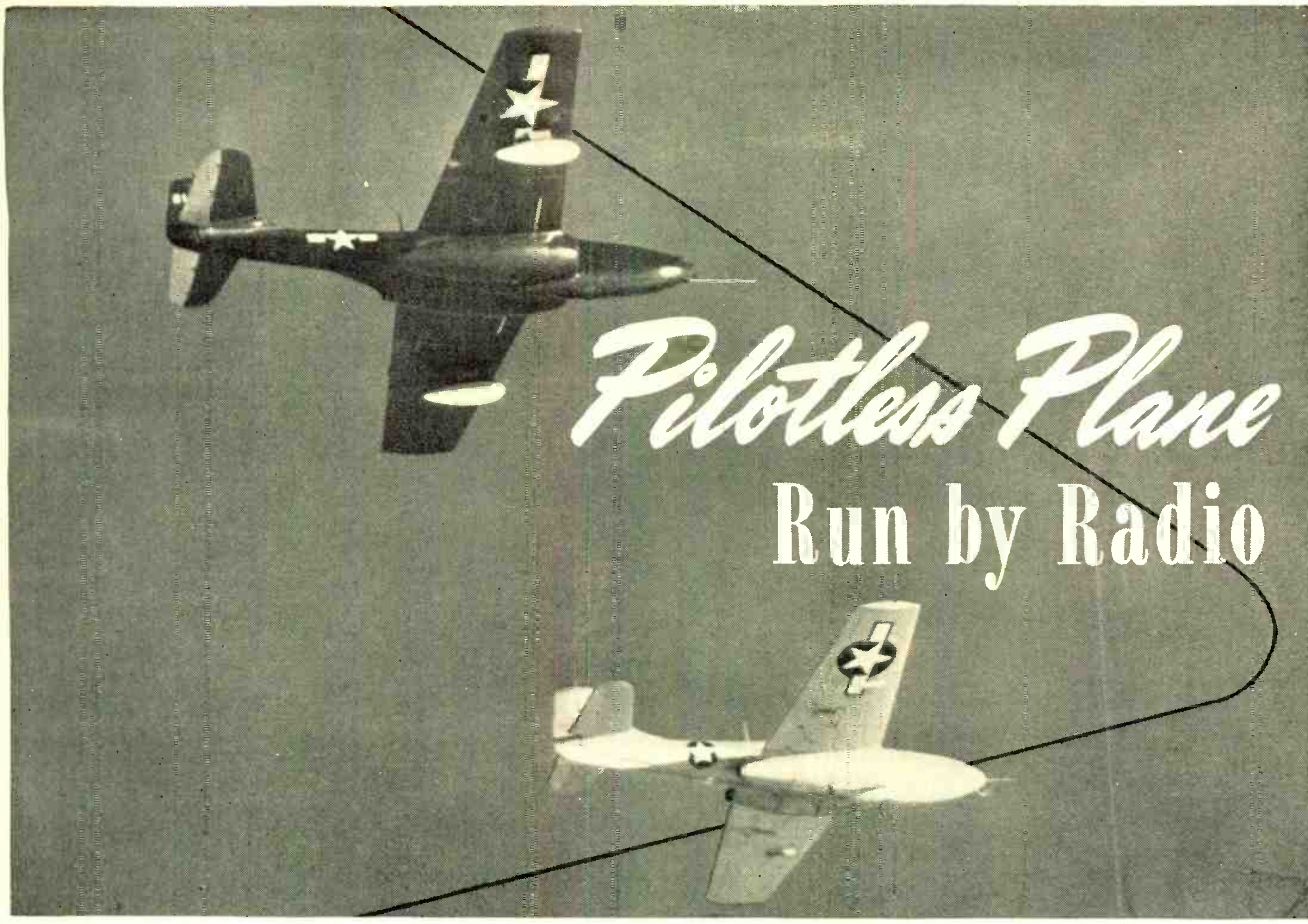


Fig. 12. Top view, with panel removed.





Pilotless Plane Run by Radio

Planes in the radio remote control of aircraft project, developed by the Air Technical Service Command and Bell Aircraft Corporation. Both are jet-propelled P-59 Airacomets with the controlling flight station, the "mother" ship, shown at the top.

The successful operation of aircraft by remote radio control has been proven practical by the A.T.S.C.

By
S. R. WINTERS

TRANSFORMING a 20-year-old vision into an actuality, a pilotless airplane is operated by a combination of factors involving the use of radio and television. The jet-propelled plane, a P-59 Airacomet, is remotely controlled either from a portable ground radio station, mounted on a truck, or from a "flying radio station" in another airplane which "mothers" the robot craft.

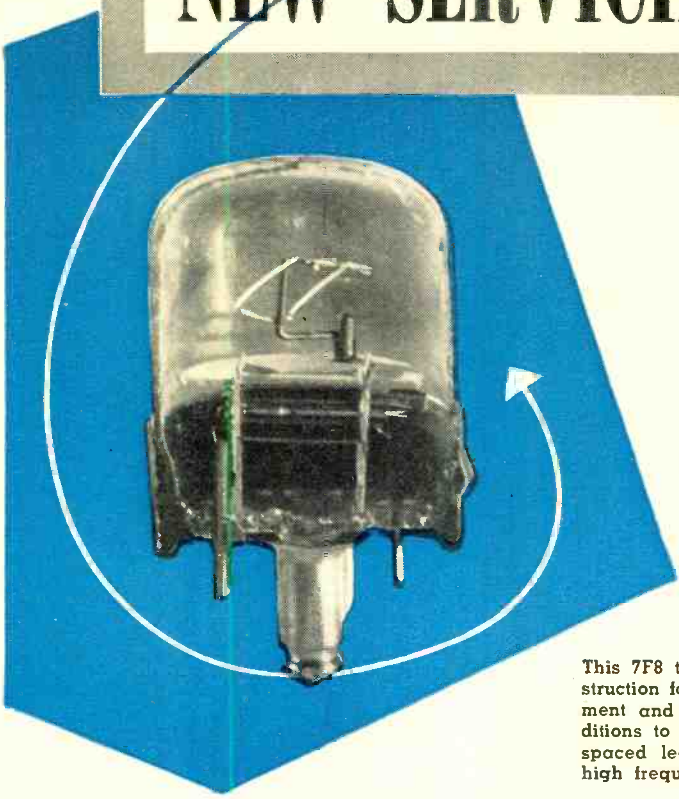
"Telemetering," a comparatively new term as applied to radio, and only recently recognized officially by the Federal Communications Commission, means that electronic apparatus installed on the pilotless flying craft transmits to the ground radio station visual images of the vibrations, accelerations, structural leads and strains, and similar stresses encountered by the robot plane. This new telemetering apparatus, designed by Princeton University, is concentrated in the pilotless plane and ground radio station, the "mother" plane being reserved for the exclusive function of controlling the "orphan" craft which flies without any person aboard. The process of determining structual strains and stresses, as well as other data from the pilotless plane, involves the use of resistance units in measuring the plane's performance electronically. Such information is fed, in sequence, to the electronic transmitter at a rate of 1100 cycles per second. This data is transmitted to the ground radio station for reception by a radio receiver that unscrambles the jargon of combined signals and then "siphons" them into separate receiver channels for graphic recording or visual observation, or both, on a many-channeled oscillograph.

The television equipment on the pilotless plane, manufactured by the *Radio Corporation of America,* serves a twofold purpose. One unit visualizes the instrument panel on the robot airplane, thus televising the behaviour of

(*Continued on page* 90)

Three physical components of the radio remotely controlled plane project developed by the Air Technical Service Command and Bell Aircraft Corporation. Left to right, the panel truck which operates the controlled, or robot plane and incorporating telemetering and television equipment for observation and recording of flight research data; the robot plane and the controlling plane. Both aircraft are P-59s.

100mc. RECEIVERS REQUIRE NEW SERVICING TECHNIQUES



By D. W. GUNN
Field Eng., Sylvania Electric Products, Inc.

Circuits and components become critical at frequencies above 50 megacycles. New service practice and new test equipment will be needed for adequate FM servicing.

This 7F8 tube demonstrates the necessity for precision design and construction for operation in the 100 mc. FM band. Note that the tube element and leads are designed to provide compact, rigid physical conditions to maintain stable electrical characteristics. Straight, accurately spaced leads of ample cross-section assure maximum conductivity at high frequencies and reduce inter-electrode capacitance to a minimum.

MOVING FM up above fifty megacycles has created an urgent need for entirely new radio service practice. Trouble-shooting, component replacement, testing equipment, circuit tuning and other adjustments that were wholly adequate for AM sets will not meet the requirements of new FM sets. Upping the frequency makes the difference. Above 50 mc. all circuits and components become more critical.

The tremendous demand for FM should prove to be a great stimulus to set production and the rapid development of FM broadcasting. It is now apparent that a variety of new FM sets will appear gradually over a period of two or three years. Manufacturers are faced with the problems of practical circuit design for initial production during 1946. Various circuits now in the development stage will be followed by fewer improved designs that will probably incorporate and combine the best and most practical features of those now being considered.

The first models offered may differ widely from each other until many of the circuits now being worked out tend to determine a standard pattern comparable to the superheterodyne circuit now widely used in AM receivers. FM circuit development may also tend to parallel that of AM superheterodynes in the mid-twenties. At that time superhets required eight or more tubes, including those for separate oscillators. The modern five-tube reflexed circuits were evolved out of them through the joint experience of circuit and tube engineers.

100 mc. FM may have a parallel period of development. In the meantime many sets may appear with multi-tube, straight-line circuits which tend to avoid the use of converters. While separate oscillators for the old medium-wave superhets presented no great problem of radiation, radiation from separate oscillators in 100 mc. FM sets may become a matter of considerable importance to servicemen.

The first sets offered will doubtless be AM-FM combinations. The more expensive sets will probably have separate AM and FM circuits and therefore be the easiest to service. Many inexpensive types will employ circuits in which AM and FM functions are not completely separate and these will be the most difficult to service.

The public acceptance of push-button tuning will inevitably create a demand for push buttons in FM sets which will increase the service problem. And, since thousands, perhaps millions of sets will be produced as AM-FM combinations, there will also be new problems resulting from the maintenance of switching arrangements.

New Tubes and Components for FM

Tube development has come a long way in the last twenty years but many tubes that give excellent service up to 50 mc. become either critical or unsuitable for circuits operating in the 100 mc. bands. This general consideration, coupled with the fact that new tube types and larger tube complements will appear in early FM sets, suggests that servicemen should follow tube developments closely and make it a point to thoroughly familiarize themselves with the characteristics of each type with respect to specific circuit applications.

100 mc. FM set development also may differ from the development of the standard superhet for AM, inasmuch as there may be relatively few sets introduced with straightline tube complements. Circuits may require

the combination of GT, lock-in, T 5½, subminiature, and other types. Each tube will be located to accommodate the electrical requirements of the circuit. Manufacturers have developed stable tubes for FM requirements. Most of them will be supplied with types of bases that are familiar to servicemen.

Since physical placement of components in 100 mc. circuits produce tremendous changes in electrical values, servicemen will not be able to modify sets to accommodate similar available tubes as they have been able to do, successfully, in AM wartime servicing. Tube replacements will have to be made type for type and without altering the physical position or electrical values of tubes in a given circuit.

This will also be true for other components. They will have to be built to very close physical and electrical tolerances and replaced with great care to prevent any change in the position or dimension of conductors. In many instances the use of test prods to check circuits may present entirely new problems or become an obsolete and unworkable technique. Soldering pigtails of replacement components may become a critical operation and require exact quantities and shape of solder to prevent introducing *LC* changes in circuits.

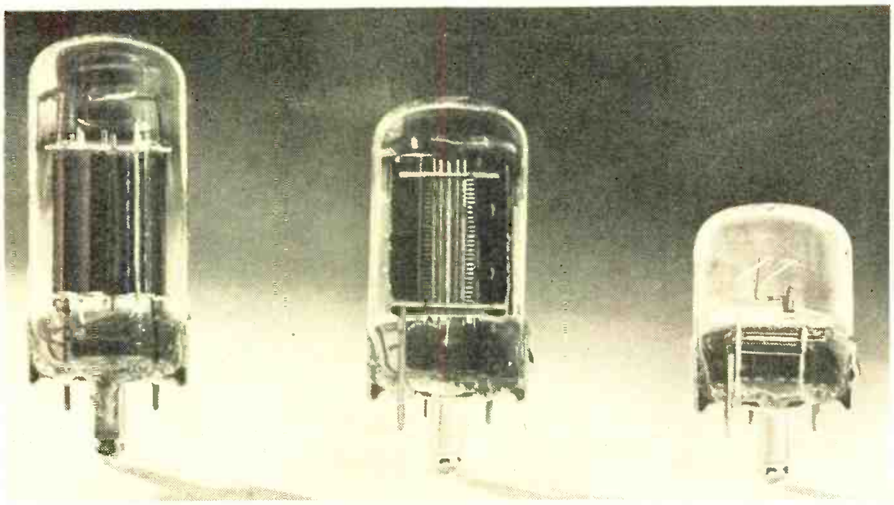
By the same token that servicemen should watch FM tube developments very closely, they should also follow the announcements of all FM components by manufacturers and seek all available information concerning points of difference between them and standard parts for AM sets. In addition to the electrical specifications of parts, physical sizes and shapes should permit their application to FM circuits without lengthening or shortening existing wiring, changing its position, or introducing new capacity constants.

New Testing Equipment for FM

Rule of the thumb practice and run of the mill test equipment that is useful in AM servicing will not do for 100 mc. FM sets. At the outset servicemen may find that they will have to build much or all of their FM servicing equipment. Until circuit patterns for FM tend to become standardized and more is known of troubles developing in the receivers in the hands of the owner, servicemen will probably have to develop test equipment in their own shops to follow particular needs as they arise.

Study and experience with circuits operating above 50 mc. will help to indicate the type and design of equipment needed. But like the FM circuits themselves, the requirements of test equipment will become more critical. While testers for AM generally fall in the category of practical indicating devices, those needed for FM will tend to resemble equipment built to laboratory standards.

This will mean that testing equipment and components may be much more expensive for FM than they have been for AM. Stock items that serve well in AM sets without matching or selection may not have true counterparts in the FM field. This outlook is reminiscent of the early days of radio servicing when components were not built to close limits.



Some of the newer types of tubes which servicemen will probably find in postwar frequency modulation receivers. Left to right, 7Z4, 7AG7, and 7F8.

Thus servicemen will have to invest in parts with greater care, carry many new, specialized items in stock and learn new, higher skills to put them to use practically and profitably. 100 mc. FM marks a new era in radio servicing. It has just begun. It represents a vast new market for sales and service for those who get in on the ground floor, develop the new skills required, and are ready to apply them when FM service calls come rolling in.

FM Means More Service Jobs

Because FM sets will be far less stable in all respects than AM sets, the importance of radio servicing will greatly increase. Tubes will probably require somewhat more frequent testing and inspection. Many currently developed circuits are sensitive to hitherto unimportant changes in heater and cathode temperatures. Other changes within tube envelopes toward the end of rated useful life may greatly affect FM set performance. This contrasts with tubes in AM sets which are often used beyond their useful rated life, in some instances are replaced only when they become wholly inoperative through heater failure or other mechanical fault.

This does not mean that tubes for FM will be an outstanding source of trouble. In all probability tubes will be one of the most stable parts of FM sets. Tremendous advances in tube design and mass production for high frequency applications during the war have adequately prepared tube manufacturers for the needs of FM receivers in the home. Unlike many other parts of the circuit, tube circuit values are secured in position and vacuum-sealed. All electrical values can be closely controlled and thoroughly checked before tubes are applied to the external circuit.

There is of course a great difference between high frequency wartime applications and the mass-produced FM receiver for the home. Rated-useful life of tubes, relatively unimportant in home receivers up to now, may become a new consideration of vital importance to the serviceman. No longer will it be a question of whether the tube "lights" and "sounds all right." It will be a question of how the tube actually operates and may be expected to operate in the FM circuit. Conven-

(*Continued on page* 68)

Electrical characteristics of several tubes that will be widely used in 100 mc. FM.

R.F. OR I.F. AMPLIFIERS

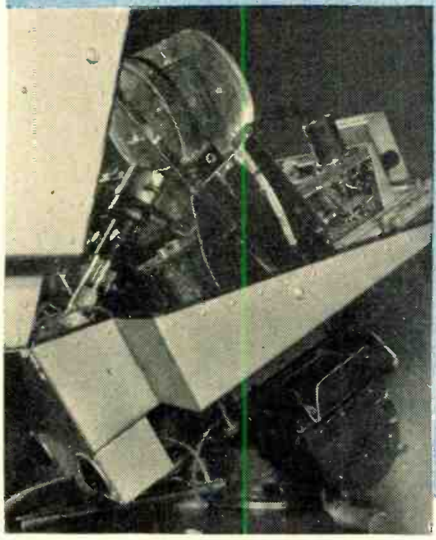
Type	E_f Volts	I_f ma.	G_m µmhos	C_{g-p} µµfd.		C_{input} µµfd.	C_{output} µµfd.	I_b ma.	I_{c2} ma.
					Max.				
7A7	6.3	300	2000	0.005	"	6.0	7.0	9.2	2.6
7B7	6.3	150	1750	0.007	"	5.0	6.0	8.5	1.7
7C7	6.3	150	1300	0.007	"	5.5	6.5	2.0	0.5
7H7	6.3	300	4200	0.007	"	8.0	7.0	10.0	3.2
7L7	6.3	300	3100	0.01	"	8.0	6.0	4.5	1.5
7W7	6.3	450	5800	0.0025	"	9.5	7.0	10.0	3.9
1204	6.3	150	1200	0.05	"	3.2	4.0	1.75	0.6

OSCILLATORS

Type	E_f Volts	I_f ma.	G_m µmhos	C_{g-p} µµfd.	C_{input} µµfd.	C_{output} µµfd.	I_b ma.
7A4	6.3	300	2600	4.0	3.4	3.0	9.0
7E5/1201	6.3	150	3000	1.5	3.6	2.8	5.5
7F8	6.3	300	5200*	1.2*	2.8*	1.4*	10.5*

* Per Section

Practical TELEVISION



Studio camera showing iconoscope, deflection yoke, and pre-amplifier with cover raised.

By

R. A. MONFORT*

Television Maintenance Supervisor, NBC

A semi-technical discussion of the principles involved in the transmission and reception of television signals. War born developments now assure an improved postwar television system.

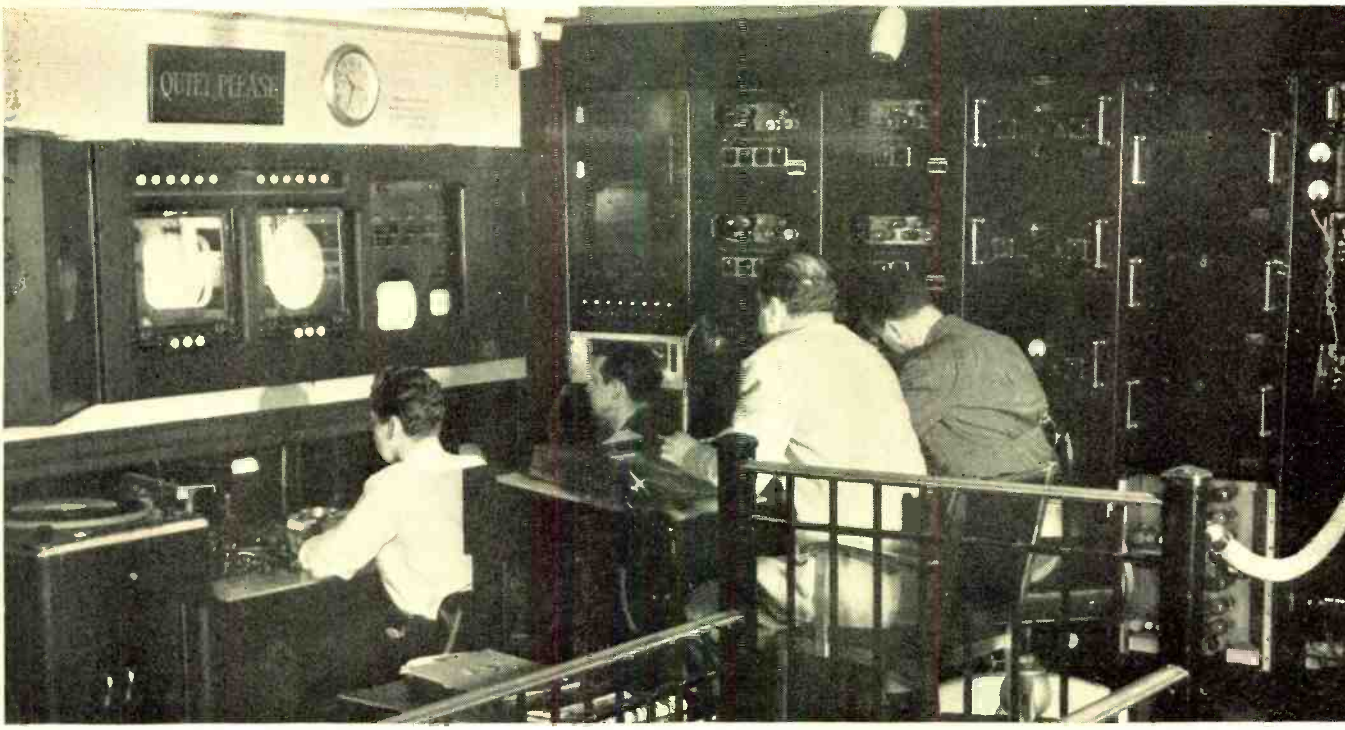
THE transmission of a picture by television requires that the picture be broken up into elemental areas, transmitted and received, then reassembled in the proper sequence at the receiving end. The intermediate steps in this process are many and varied; a rigorous treatment of each of them might well occupy considerable space, hence this discussion will be concerned, for the most part, with the practical aspects of a television system from the standpoint of those who are primarily interested in the reception and utilization of a television picture signal, but with the thought that some knowledge of how such a signal is generated will assist in a better understanding of the problem.

The process of separating the picture into elemental areas is known as scanning. In earlier systems, this was accomplished by means of the so-called scanning disc wherein a metal disc, having a series of small holes arranged in a spiral fashion around its outer edge, was rotated between a light source and the picture to be transmitted, in such a manner as to cause tiny beams of light to traverse the picture from side to side and successively downward. Mechanical scanning devices, however, are no longer used because of the inherent limitation of the inertia of the device, and the excessively small size of hole that would be required for the present relatively high definition of television pictures; however, it serves to illustrate what is meant by the process of scanning.

Present day pick-up devices make use of the inertialess beam of a cathode-ray tube. There are several versions of electronic scanning pick-up devices; the image dissector, the iconoscope, the orthicon, and other less well known versions. At the present time the iconoscope is the pick-up device which is the most commonly used. An iconoscope consists of a photosensitive mosaic onto which the picture is focused by means of a lens, and an electron gun so placed that its stream of electrons will strike the mosaic. This photosensitive mosaic consists of a very great number of individual photoelectric cells on a thin sheet of mica, i.e., tiny globules of silver which have been made sensitive to light by the application of caesium. Each of these tiny photoelectric cells is separate and distinct from its neighbors. Backing up the mica sheet is a sheet of aluminum, connection to which is made from the outside of the tube. If we consider for the moment, a single particle of the mosaic, we find that the back plate forms one side of the condenser, the mica is the dielectric, and the individual photoelectric cell is the other plate of a condenser. If light is caused to strike the photosensitive side of the condenser, a charge will be set up on the surface due to the movement of electrons caused by the light striking it. The other plate of the condenser will assume the opposite charge. If a beam of electrons is directed on the photosensitive surface, thus replacing those electrons that escape due to the application of light, that plate of the condenser will be restored to normal and the potential on the back plate will also return to normal. We have thus accomplished a change in voltage on the back plate, to which connection can be made, by first the application of light on the individual photoelectric cell, and then the application of electrons. Now, if we consider the photosensitive mosaic as a whole, with a picture having various shades of light focused on it, we will have a variety of potentials existing on the front of the mosaic, depending on the intensity of the light at any specific spot. By focusing the electron beam to a very fine spot and causing it to move back and forth across the picture from left to right and top to bottom, we find each individual area on the picture will be restored to equilibrium potential by the application of the electrons from the beam. This, then, is the scanning process in the electronic type of television pick-up device.

The precise manner in which the beam travels over the photosensitive mosaic is of considerable importance since the corresponding electron beam in the reproducing tube, or kinescope, must travel at precisely the same rate of speed, and in precisely the same manner, in order to properly reassemble the picture elements. The movement of an electron beam in scanning may be accomplished either by electrostatic or electromagnetic means. In any event, the manner in which it moves is a saw-tooth with respect to time; i.e., it travels relatively slowly from left to right, then snaps back from right to left very fast. Along with the horizontal movement there is also required a vertical saw-tooth movement such that, as the beam of electrons flies back from the left to the right of the picture and starts across again, it does not traverse the same path that it did on the previous time across. Once the beam has reached the bottom of the picture, the

* Photographs by John Tassos, Engineering Department, National Broadcasting Co.



Television equipment and control consoles for three cameras in a direct pick-up studio.

vertical fly back, or return, takes place and snaps the beam back to the top of the plate very fast. Under present FCC standards the scanning sequence is such that the first time the beam goes down the plate it scans lines numbers 1 - 3 - 5 - 7, etc., then when it flies back to the top of the plate it scans in between the first set of lines and thus picks up lines 2 - 4 - 6, etc. This is known as interlaced scanning and is accomplished due to the fact that the frequency relationship of the horizontal scanning to the vertical scanning is a whole number plus one-half; in other words, the present standard horizontal scanning frequency is 15,750 cycles. When this is divided by the standard vertical scanning frequency of 60 cycles, the result is 262½. It is this factor of ½ which causes the second scanning of the mosaic to be positioned midway between the lines traversed by the first scanning of the mosaic. If the deflection of the beam is to be accomplished by electrostatic means, a saw-tooth voltage of the proper repetition rate is applied to the deflection plates in the pick-up tube; if by electromagnetic means, a saw-tooth current is caused to flow through the coils of the deflection yoke which is placed around the neck of the iconoscope. In either case, the saw-tooth effect originates as a voltage change. To accomplish this, a small portion of the charging characteristic of a condenser is used. One of the simplest and most commonly used types of circuits is the so-called discharge tube, as shown in Fig. 1A. An impulse of roughly rectangular shape is applied to the grid of the tube. The bias on the tube is so adjusted that no plate current flows during the time interval from T_1 to T_2. However, during this time interval, the condenser C_1 is charging up through the resistor R_1. The normal charging characteristic of such an *RC* combination is a logarithmic curve of voltage with respect to time. It is necessary that the scanning beam travel at a uniform rate of speed, hence there must be no curvature in the output signal of Fig. 1A between T_1 and T_2. To accomplish this, the values of C_1 and R_1 are chosen sufficiently large so that the condenser C_1 arrives at only a small percentage of its fully charged condition during the time interval T_1 to T_2, thus the portion of the logarithmic charge curve which is used is so small that for practical purposes it is a straight line. During the time interval T_2 to T_3, the grid of the tube is driven more positive by the input signal, plate current flows through the tube and condenser C_1 is discharged; then at time T_4 the cycle starts over again. The charging circuit for C_1 is through the high value of plate resistor (R_1), and the discharging circuit is through the relatively low impedance of the tube, thus giving rise to the saw-tooth shaped output signal.

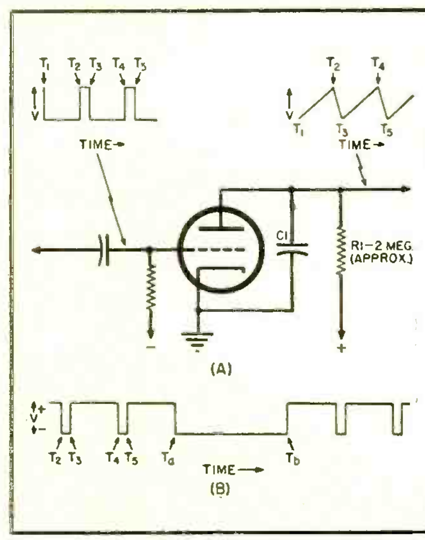
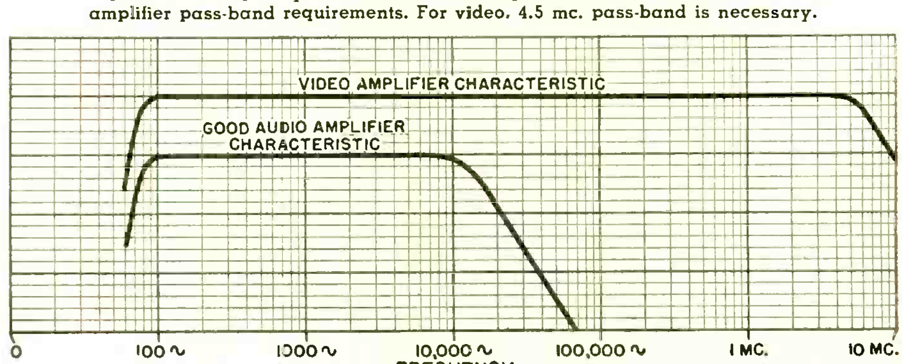
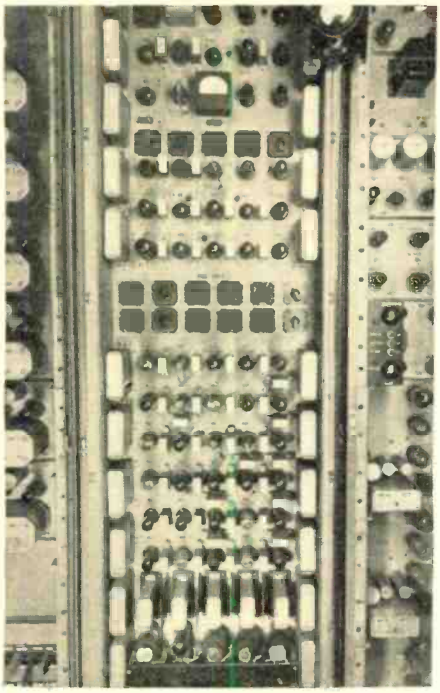


Fig. 1. (A) Basic discharge tube circuit used in development of saw-tooth voltage. Voltage is applied to deflection plates placed inside the iconoscope. (B) Signal voltage applied to grid of the iconoscope to extinguish the beam during retrace time of the scanning process.

Fig. 2. Gain-frequency characteristics clearly indicate the video and audio amplifier pass-band requirements. For video. 4.5 mc. pass-band is necessary.





Photograph of synchronizing generator with its many tubes and controls clearly indicates the complexity of present-day television transmitting equipment.

During the scanning process, the electron beam must be extinguished during the return trace (times T_2 to T_3 and T_4 to T_5 in Fig. 1A) in order to avoid upsetting the charge conditions which represent the lights and shadows of the picture on the mosaic. The effect of the beam not being extinguished during the retrace time will be a number of white lines which seem to contain no picture intelligence. The method of extinguishing the beam during these intervals is to apply an impulse to the grid of the iconoscope, of the proper shape and polarity, to bias the beam to cut-off at the right time. Again, there are several variations of the precise manner in which this may be done. The most straightforward method is to apply a signal as shown in Fig. 1B, to the grid of the iconoscope. Only a portion of the complete picture scanning cycle is indicated. The times T_2, T_3, T_4, and T_5 correspond to the same time indications in Fig. 1B, thus the grid of the iconoscope is driven negative to the point of beam current cut-off during the retrace times T_2 to T_3, and T_4 to T_5. The interval T_a to T_b represents beam current cutoff during the vertical retrace time.

The electron gun of an iconoscope requires a second anode potential of the order of 1,000 volts, hence the electrons in the beam travel toward the mosaic at a rather high velocity. Due to this high velocity, many secondary electrons are knocked loose from their orbits and go floating around in the space in front of the mosaic in search of a point of positive potential to land on. The second anode of the iconoscope is operated at ground, with the cathode 1,000 volts negative; the back plate of the mosaic feeds the grid of the first video amplifier stage and therefore its potential will not vary from ground by many volts; as the difference in potential between a brightly lighted and a dark area on the photosensitive surface is normally about 3 volts, hence the potential gradient in the vicinity of the mosaic is not great, and will vary as the picture content varies. The secondary electrons will move to where the most positive potential exists and cause a dark cloud effect to appear on the picture. This effect may be sufficiently pronounced to obscure large portions of the picture. The process of compensating for this electron cloud is known as shading. It involves the insertion of signals of various wave shapes, amplitudes, and phases into the video amplifier chain, such that their addition to the video signal will balance out the spurious portion of the signal due to the cloud of electrons.

Master control position showing line amplifiers, switching facilities, monitoring and test equipment used in present-day television transmissions.

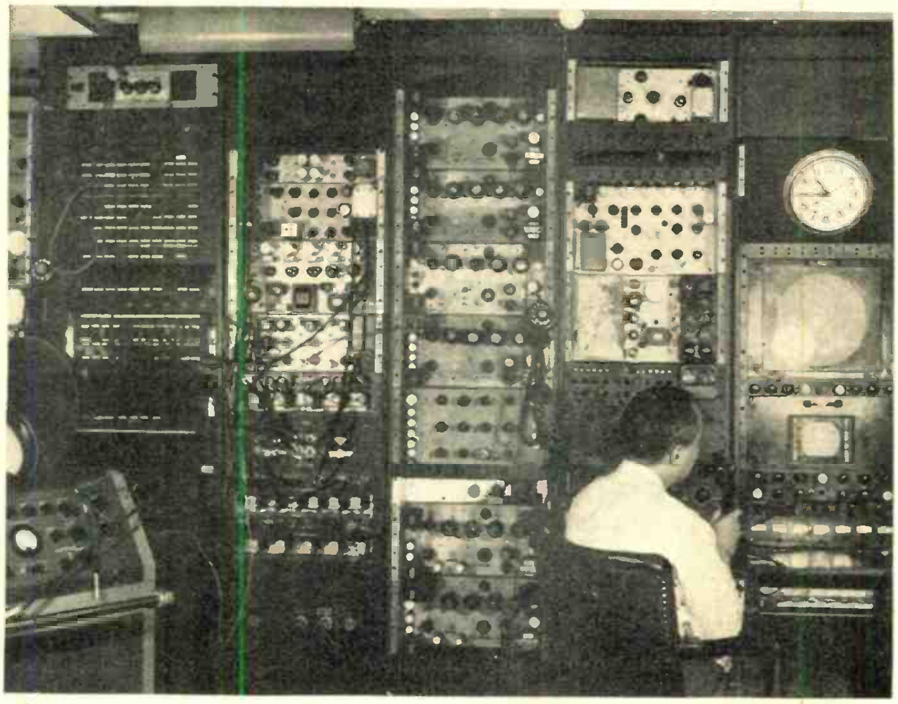


Fig. 3A indicates a single line trace of a picture wherein the picture content is reasonably uniform throughout, but the left side is abnormally light and the right side correspondingly dark, due to the cloud of secondary electrons. In Fig. 3B is shown a saw-tooth signal of line scanning frequency. If the saw-tooth of Fig. 3B and the picture signal of Fig. 3A are fed individually to the grids of two tubes, the plates of which work into a common load resistor, the signal which appears across the load resistor will be the algebraic sum of the two input signals, as shown in Fig. 3C. The objectionable dark spot components are thus balanced out, leaving only the desired picture components. This illustration represents a very simple set of conditions. In actual practice, the amplitude of the dark spot component will vary considerably, hence an amplitude control must be provided for the saw-tooth signal so that the correct amount can be injected. A still more complicating factor is the fact that the dark spot is almost never as symmetrical as in the illustration; the shape may be almost anything, and the position may be anywhere over the picture; and both shape and position vary with picture content. It is therefore necessary to make available additional shading voltages having wave shapes other than the saw-tooth previously mentioned. These additional voltages usually consist of sine wave and parabola, as indicated in Fig. 3D.

A normal complement of shading voltages and their controls consist of: 60 cycle and 15,750 cycle saw-tooth voltages, each with an amplitude control and provisions for reversing the polarity of the saw-tooth (slow build-up and fast decay time as compared to Fig. 3B); 60 cycle and 15,750 cycle sine wave voltages, each with an amplitude control and a phase shift control; and 60 cycle and 15,750 cycle parabola voltages, each with amplitude and clipping controls, and with provisions for reversing the polarity or turning the points in a negative direction, as compared to the parabola shown in Fig. 3D. The parabola voltages are obtained by the process of integration of a saw-tooth voltage, i.e., by passing the saw-tooth through a circuit consisting of a series resistor, followed by a shunt condenser. The parabola clipper is an amplifier stage whose operating voltages are such that the rounded side of the parabola is saturated or flattened. All of the shading voltages should be derived from the synchronizing generator, so that they are exactly synchronized with the scanning impulses.

The amplitude of the picture signal which is obtained from the back plate of the iconoscope mosaic is very low. The exact amount will vary considerably depending on the beam current, the amount of light, and other conditions; but it is normally of the order of .01 volts peak-to-peak. Obviously such a low amplitude signal requires a great deal of amplification to get it up to a usable level. Amplifiers which are used for this purpose are somewhat different than the type of amplifier to be encountered in ordinary radio receiver or transmitter equipment. In the first place the bandwidth required is at least 4.5 megacycles, as compared to the usual 10,000 cycles or so for audio amplifiers. In other words, the video amplifier must pass a band of frequencies which is 450 times wider than that required of a good audio amplifier. The difference between video and audio amplifier pass band requirements is indicated in the gain-frequency characteristics of Fig. 2. This bandwidth requirement comes about as a result of the scanning frequency and the necessity for reproducing rectangular impulses. During the course of scanning a picture, the finer the detail, the higher the frequency required; and the more abrupt is the change from black to white, or vice versa, the wider the frequency band requirement. It can be shown, theoretically, that in order to reproduce a square wave having infinitely steep leading and trailing edges an infinite number of odd harmonics of the fundamental frequency must be passed. For non-symmetrical or rectangular impulses, the bandwidth requirement is greater than for symmetrical waves. As an example, an impulse having a fundamental frequency or repetition rate of horizontal frequency (15,750 cycles) and a time duration of 20% of a cycle will require that 200 harmonics or roughly 2.5 megacycles be passed in order to reproduce the impulse with a reasonable degree of accuracy; whereas a symmetrical square wave of the same frequency can be reproduced to a fair degree of accuracy with a pass band of 20 harmonics due to the relatively lower amplitude of the high frequency components. Therefore, if a given picture should contain a vertical line whose width is approximately 20% of the width of the picture, a bandwidth of 2.5 megacycles will be required in the video amplifier. Obviously, there will be conditions where much finer horizontal resolution will be required, hence the 4.5 megacycle bandwidth. The number 4.5 megacycles is used here because the present frequency assignments in the radio spectrum will permit the transmission of no greater bandwidth. Actually, in television plant equipment, it is preferable to have a much greater bandwidth available, such as 6 to 7 megacycles.

In addition to the bandwidth requirements, there is also a phase characteristic requirement that is extremely important in television or video amplifiers. This phase requirement is that the phase shift change must be linear with respect to frequency. For this reason the bandwidth of an amplifier is usually quoted as being from well below 60 cycles, which is the vertical frequency scanning, to well above the 4.5 megacycle upper limit. This is an accepted practice in view of the fact that a sharp cutoff on any filter device gives rise to appreciable phase distortion, therefore, if the frequency response from 60 cycles, the lowest frequency component which is contained in any picture signal, downward toward zero, is a long, graceful slope, there is good reason to suspect that the phase characteristic has the required linearity down to at least 60 cycles. The same line of reasoning applies to the steepness of cutoff at the high frequency end of the pass band. The importance of this phase characteristic may not at first be apparent. We know that in audio amplifiers little attention is normally given to the question of the linearity of phase with respect to frequency. At the low frequency end of a video amplifier spectrum an incorrect phase characteristic may cause a large solid black area to shade off toward grey in the center. At the high frequency end of the spectrum, incorrect phase relationships will be made very apparent by the horizontal displacement of the very small, or fine detail portions of the picture with respect to the larger picture elements immediately above and below. Incorrect phase characteristics anywhere within the spectrum may cause distortion in the picture, such as lack of retention of the proper shade of grey, tiny black or white lines known as transients following high frequency components in the picture, and similar effects.

In order to accomplish amplification over such a wide range of frequencies, it is necessary to resort to resistance coupled amplifiers. There are no transformers which will satisfactorily pass everything from 60 cycles to 4.5 mc. The use of resistance coupled amplifier stages removes from consideration the large inductances of transformers, and substitutes instead pure resistances which, for the most part, may be considered as having no frequency characteristic. This does not mean, however, that a resistance coupled amplifier will pass an infinitely broad band of frequencies. There is still to

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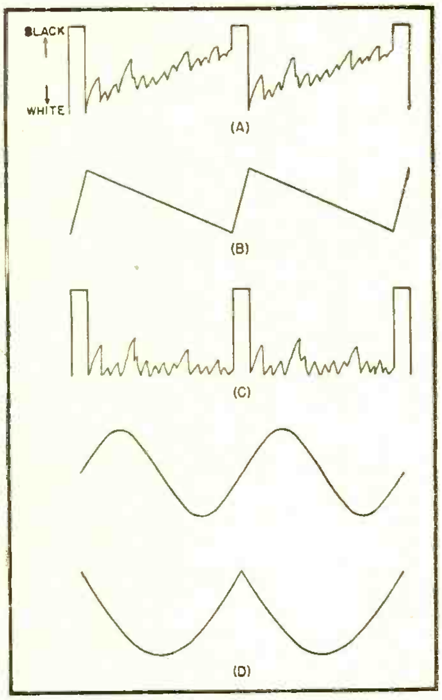
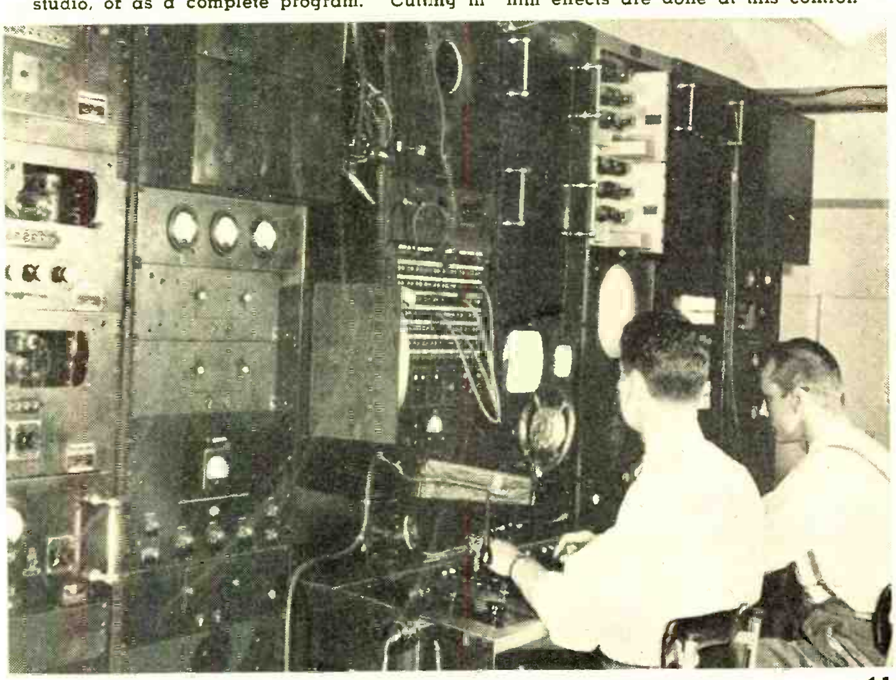


Fig. 3. The process of compensating for electron clouds is known as shading. Waves of various shapes, amplitudes, and phases as shown above are used.

Film control position. Film is often used for video effects impossible to obtain in the studio, or as a complete program. "Cutting in" film effects are done at this control.



By CARL COLEMAN

CONGRATULATIONS to the Veteran Wireless Operators Association on the occasion of its twenty-first, coming of age, birthday which was celebrated at a "Radio Victory Dinner" at the Hotel Astor February 16th. Eight awards for wartime achievement in radio were presented to some of the outstanding leaders in communications.

Dr. F. B. Llewellyn, President of I.R.E. and George Bailey, President of ARRL received plaques in recognition of the contributions of American radio engineers and amateur radio operators during the war. Maj. Gen. H. C. Ingles, Rear Admiral J. R. Redman, Comdr. E. M. Webster and Maj. Gen. H. M. McClelland were honored, the latter *in absentia,* as wartime leaders in their respective fields of communication service, the Army, Navy, Coast Guard and Army Air Forces.

Medals also went to two war heroes. Forrest L. Vosler, formerly a sergeant who was cited as the only radio operator to have received the Congressional Medal of Honor and Sgt. Irving Strobing who sent the last message by radio from Corregidor.

FRED HOWE, General Secretary-Treasurer of R.O.U. who called attention last December, in a letter to radio operators aboard ship to the many illicit signals being heard around the marine frequencies, has forwarded a copy of a more recent note and letter he has received from FCC. This is of greatest importance to all marine radio officers—FCC is tightening up now that traffic has been resumed and you should take serious note of the following—it may mean loss of your ticket if you disregard it, and your job. FCC's letter: "This Commission has recently completed the investigation of two cases of illegal operation by commercial ship radio operators in which call signs and procedures similar to those employed by amateur stations were used on frequencies formerly assigned to that service. Such operation was in violation of the Communications Act of 1934, as amended, as well as orders of the War Shipping Administration and a warning against such offenses was contained in a Navy Department 'BAMS' broadcast dated November 13, 1945. By means of long range Adcock direction finder bearings, we were able to successfully track the ships on which these stations operated from their ports of embarkation in Asia to their destinations in this country, and when confronted with this evidence, the operators immediately confessed. The Masters of these ships were amazed at the accuracy of the fixes which we had obtained by this means. It is realized that the Commercial Telegraphers Union does not condone such illegal operation by its professional operator members, and it would, therefore, be greatly appreciated if your organization would cooperate with us in eliminating such illegal activity. Measures which might be helpful would include the briefing of radio operators concerning such operations when hired, and the posting of notices in both union halls and the ship's radio rooms, calling attention to the seriousness of all such offenses.

"Could you put one of those on my wife?"

Any assistance which you might be able to render in this matter will be greatly appreciated." . . . The letter is signed by Mr. T. J. Slowie, Sec'y of FCC. . . . Use your transmitter for legitimate traffic only. That's what it's for and quit jamming the air with illicit signals.

HENRY SPENCER finally came back to New York aboard his Liberty and expects to be tied up for repairs for some time. Jack Hyams now on the Tacoma is an old time Matson man who has also been with TWA for several years on the West Coast. Leonard F. Garrett in the East Coast aboard his Marine Marlin. Dan Weber on a relief trip aboard the Darien out of the East Coast. Frank Sergi has been assigned to the Single Hitch.

D. J. Basile relieved Emile H. Knies aboard the Seatrain New Orleans. E. L. Brown sailed as a relief for two trips aboard the Pan Orleans of Waterman Line. Leo Elbert now aboard the Zacapa. J. W. Gullett now assigned to the Flying Eagle on the South American run for Mississippi Shipping.

THE first commercial installation of Loran, electronic long range navigation device that makes it possible to determine accurately a ship's position at sea has recently been made aboard the Swedish-American liner Gripsholm. The new gear, according to the manufacturer (Sperry), solves virtually all of the navigator's old problems of position. A "fix" can be obtained in approximately two minutes with the equipment and makes the present methods of navigation seem old fashioned.

IRWIN RESCH has been assigned the Alcoa Trader down in the Gulf. Robert Orr took out the Sea Hydra, Isthmian on a run to India. Bob Morenz sailed on the Coastal Stevedore. Mark Todd took the Coastal Highflyer out of Houston. Alan VanSickle arrived in New York recently aboard his Cape Cod with Theo. Smith second and A. D'Alton as third.

FOR those in the airways it will be of interest to know that United has "gone and done it." Considered one of the most conservative of the various airline companies, United recently announced the placement of an order for a turbine and jet driven plane to be delivered in 1947. It is to be service-tested on cargo runs before being placed in passenger service but it's a start toward the higher air speeds to come in runs of regular passenger service. Company officials report that the new craft will develop a speed of close to 400 miles per hour.

THE sixth vessel of its newly constructed cargo carriers has been turned over to United Fruit. They are WSA-UFCO operated for the present, five between Pacific ports and the

(*Continued on page* 151)

A Per-cent MODULATION METER

By

RUFUS P. TURNER, W1AY
Consulting Engineer, RADIO NEWS

This direct reading instrument will be an important addition to any ham's phone station.

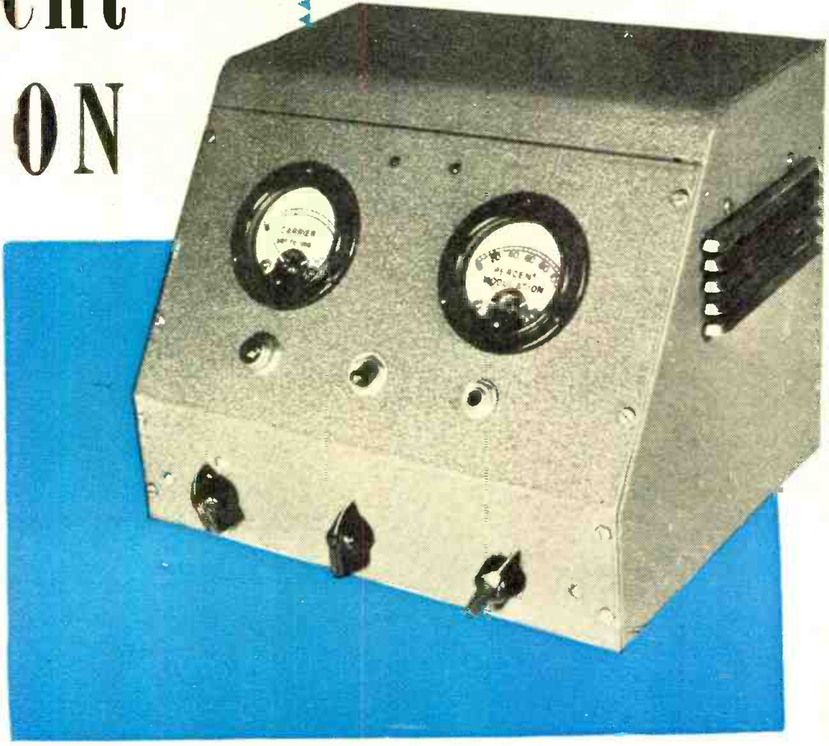


Fig. 1. External view of the completed instrument. Professional appearance is obtained by the use of a sloping panel housing.

PRIOR to the war-time shutdown, a good number of progressive amateurs were making regular checks of their modulation percentage. Modulation measurement is a requirement in all efficiently operated AM phone stations, and interest in modulation test gear has been revived with the opening up of the bands.

Most of the hams who check actual modulation percentage employ cathode-ray oscilloscopes arranged for trapezoidal, sine wave, or elliptical patterns. Few use real per-cent modulation meters. To be sure, a number of amateurs employ *carrier shift meters,* consisting of pick-up coil, diode tube, and d.c. milliammeter wired in series. But this arrangement shows carrier shift only and does not indicate the modulation percentage.

When employing oscilloscope patterns, the operator must measure the heights of modulated and unmodulated carrier amplitudes on the screen by means of a ruler, dividers, or a calibrated oscilloscope screen, and then substitute in a suitable equation in order to determine the per-cent modulation. This operation requires some time to complete and the manipulations and calculations do not excite the lazy operator. The accuracy of the oscilloscope method is reduced by the errors which inevitably creep into the transcribing of data from an oscilloscope screen. Because of the time element, the oscilloscope method is substantially a stationary one not especially suited to *continuous* monitoring of speech modulation.

The meter-type modulation monitor, on the other hand, provides continuous indications of modulation percentage and carrier shift as well. It employs direct-reading meters. These monitors are standard equipment in AM broadcast stations but have not been adopted by large numbers of amateurs chiefly because of the high cost of the manufactured monitors and the small amount of reliable information published up to this time on construction and calibration of such instruments.

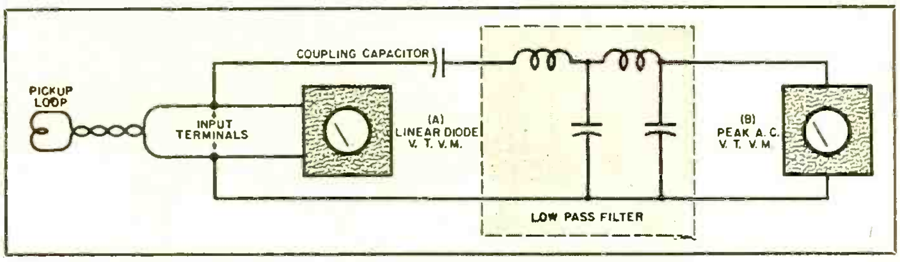
The instrument described in this article is a direct-reading modulation monitor which is easy to build and may be calibrated by any ham who has a reliable a.c. voltmeter and a 0-3 volt a.c. source. It will cost approximately $25 to build, using highest-grade parts. This instrument is compact. It employs two indicating meters; one a reference meter which will also show carrier shift, the other a direct-reading per-cent modulation meter graduated 0-100 which will show an overswing up to about 115%. This monitor, shown in Figs. 1 and 4, is entirely a.c. powered and requires no direct connection to the transmitter, it gives direct indications requiring no calculations, and its theory of operation is surprisingly simple.

Theory of Operation

The functional block diagram in Fig. 2 shows arrangement of the several sections of the modulation monitor. From this layout, it is seen that the instrument is essentially two v.t. voltmeters connected across common input terminals. The first is a linear diode type meter, A, with direct connections to the input terminals. The second is a rectifier-amplifier type meter, B, which is isolated by means of a coupling capacitor from the d.c. voltage developed by the diode circuit.

The deflection of meter A is proportional to the average carrier voltage, while that of meter B corresponds to the peak amplitude of the modulation envelope. A simple low pass filter, consisting of two radio frequency chokes and two capacitors, blocks pas-

Fig. 2. Block diagram shows arrangement of several sections of modulation monitor.



sage of r.f. to meter B where an erroneous deflection would be caused. However, the filter allows easy access to audio frequency currents. Modulated r.f. voltage is picked up from the transmitter inductively by means of a loop or bundle of a few turns of insulated wire connected to the input terminals of the instrument by means of twisted pair. Energy might also be picked up by means of a short rod antenna.

The complete modulation monitor thus consists of a radio-frequency v.t. voltmeter, A, and an audio-frequency v.t. voltmeter, B, with common input terminals. The function of the first meter is to read the carrier voltage of a modulated wave, while that of the second is to indicate the audio component. The modulation percentage might be determined from the readings of these two meters (if both deflections are peak or both r.m.s.) by dividing the carrier reading into 100 times the audio reading. At 100% modulation, the two meters read the same. In order to eliminate all calculations and to make the monitor direct reading, a certain arbitrary carrier voltage is selected and the meter A subsequently is set always to that value by varying the coupling to the transmitter. Meter B then may be calibrated directly in modulation percentages.

Complete Circuit

The complete circuit schematic of the modulation monitor is given in Fig. 3.

V_1 is the carrier meter rectifier, a 6H6 with both sections connected in parallel. The carrier meter, M_1, is a 0-1 d.c. milliammeter. The latter is bypassed for r.f. by means of a .001 μfd. mica capacitor, C_2. Meter M_1 is balanced to zero initially by means of a small bucking voltage controlled by potentiometer R_{11}. A midget variable capacitor, C_1, is connected across the input terminals. This component, which must have a maximum capacitance setting of 140 to 200 μμfd., permits adjustment of the signal input to a predetermined reference value, as indicated by a point on the scale of M_1. This capacitor will be found to accommodate most amateur radiophone frequencies if a few pick-up turns are connected to the instrument input terminals.

The low pass filter is composed of two 25 mh. r.f. chokes, RFC_1 and RFC_2, and two .001 μfd. mica capacitors, C_3 and C_4. This filter has a cutoff frequency of approximately 200 kc. and is very effective in eliminating the carrier from the audio signal rectifier, V_2.

The modulation meter is a rectifier-amplifier type of circuit comprised of diode V_2, which is one section of a second 6H6, and amplifier V_3, a 6J5. The modulation indicator itself is a second 0-1 d.c. milliammeter, M_2, connected in a plate circuit bridge consisting of resistors R_5, R_6, and R_7 and the plate-cathode resistance of V_3. The zero-set rheostat for this v.t. voltmeter circuit is R_8. R_4 is a standardizing rheostat which is set during the initial adjustment of the monitor and ordinarily will require no readjustment unless tube V_3 is replaced.

Power for operation of the instrument is supplied by a line rectifier circuit consisting of a type 1-V rectifier tube, V_4; limiting resistor, R_9; electrolytic capacitor, C_7; type OC3-VR105 voltage regulator tube, V_5; and voltage divider, R_{10}. Heater voltage to all tubes is supplied by the 6.3-volt filament transformer. This type of power supply was chosen because of the low plate voltage requirement of tube V_3 in this circuit, which did not justify use of a high-voltage power transformer. However more stable and hum-free operation was discovered to result from use of a filament transformer rather than series-heated filaments. Note that the "B" minus side of the power line is *not* returned to chassis. This is a safety measure, since otherwise the cabinet would be "hot" and dangerous to the operator. The chassis is connected electrically to the "B" minus point through a .1 μfd. capacitor, C_8. The power-line ON-OFF switch, S_2, is attached to the zero-set potentiometer, R_{11}.

Since a thorough examination of amplitude modulated signals requires that modulation percentage be checked on both positive and negative peaks, a peak switch, S_1, is included in the circuit. This is a d.p.d.t. toggle switch which changes the relationship of load resistor R_1, capacitor C_5, diode V_2, and capacitor C_6. Fig. 5 shows how the input circuit of the peak voltmeter is altered by this switching operation.

A normally-open phone jack, J, is supplied for headphones when it is desired to listen to the monitored signal. Insertion of headphones into the circuit in this manner will upset normal operation of the modulation monitoring circuit, but it is not customary to carry on aural monitoring over long periods.

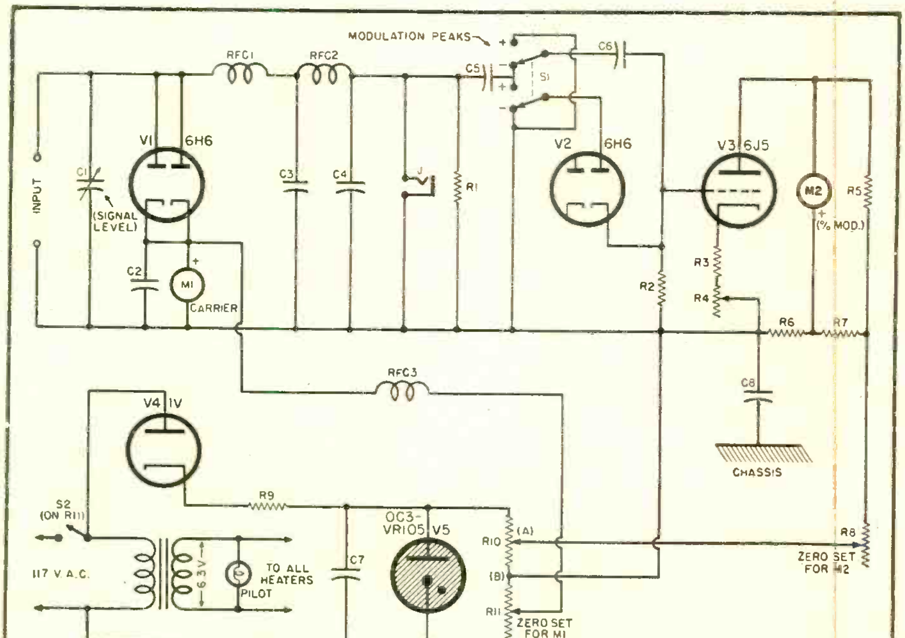
Mechanical Construction

The author's modulation monitor, shown in Figs. 1 and 4, is built on a steel chassis 9" long, 7" deep, and 2" high, and is mounted in a sloping front steel cabinet 10" long, 8" deep, and 8" high. Layout of this instrument is shown in Fig. 6. The monitor requires no critical layout and the individual builder consequently is free to follow his own tastes regarding panel and chassis arrangement.

Two-inch meters and other small-sized components are employed throughout the instrument illustrated on these pages. This was to keep overall size small. Here again, however, the reader may follow his own inclinations. Large-size meters and rack-panel construction are entirely feasible, if desired.

Because the chassis and front panel are not connected directly to "B" minus, it is necessary to insulate jack, J,

Fig. 3. Complete circuit diagram of the a.c. operated, 5-tube modulation monitor.



R_1—100,000 ohm, 1 w. res.
R_2—1 megohm, 1 w. res.
R_3—500 ohm, 1 w. res.
R_4—1000 ohm, wire-wound rheostat
R_5—3500 ohm, 5 w. wire-wound rheostat
R_6—7000 ohm, 2 w. res.
R_7, R_9—1000 ohm, 2 w. res.
R_8—10,000 ohm, wire-wound rheostat
R_{10}—9000 ohm, 5 w. wire-wound res. with adjustable tap.
R_{11}—500 ohm, wire-wound pot.
C_1—140 to 200 μμfd. midget var. cond.
C_2, C_3, C_4—.001 μfd. mica cond.
C_5—.02 μfd., 400 v. tub. cond.
C_6—.5 μfd., 400 v. tub. cond.
C_7—16 μfd., 350 v. midget tub. elect. cond.
C_8—.1 μfd., 400 v. tub. cond.
RFC_1, RFC_2—25 mh. r.f. choke
RFC_3—2.5 mh. r.f. choke
S_1—D.p.d.t. toggle sw.
S_2—S.p.s.t. toggle sw.
T—6.3 v., 3 amp. fil. trans.
M_1, M_2—2" 0-1 d.c. milliammeter
J—Midget insulated normally open phone jack
V_1—6H6
V_2—6H6 (one section)
V_3—6J5
V_4—1-V
V_5—OC3-VR105

and tuning capacitor C_1 from the panel. The author employed ordinary fiber shoulder washers to insulate the jack, and mounted the tuning capacitor on a bakelite subpanel about ½ inch behind the front panel. The hole through which the tuning capacitor shaft passes is reamed to a comfortable diameter for complete clearance.

The pilot light, switch S_1, and jack J are mounted on the sloping front panel under the meters. Twisted-pair leads from these components pass through the chassis top through grommet-lined holes. Tuning capacitor C_1 and controls R_8 and R_{11} are mounted under chassis, their shafts passing through the front lip of the chassis and the front panel. Control R_1 also is mounted below the chassis. Its shaft extends through the rear lip of the chassis and has been sawed off and slotted for screwdriver adjustment. The input terminals are ceramic-insulated feed-through components, and these likewise extend through the rear lip of the chassis. The filament transformer is mounted below chassis and is secured to one of the side lips directly behind the 1-V tube. All resistors and capacitors are below chassis and are mounted by soldering their leads to tube socket contacts and terminal strips.

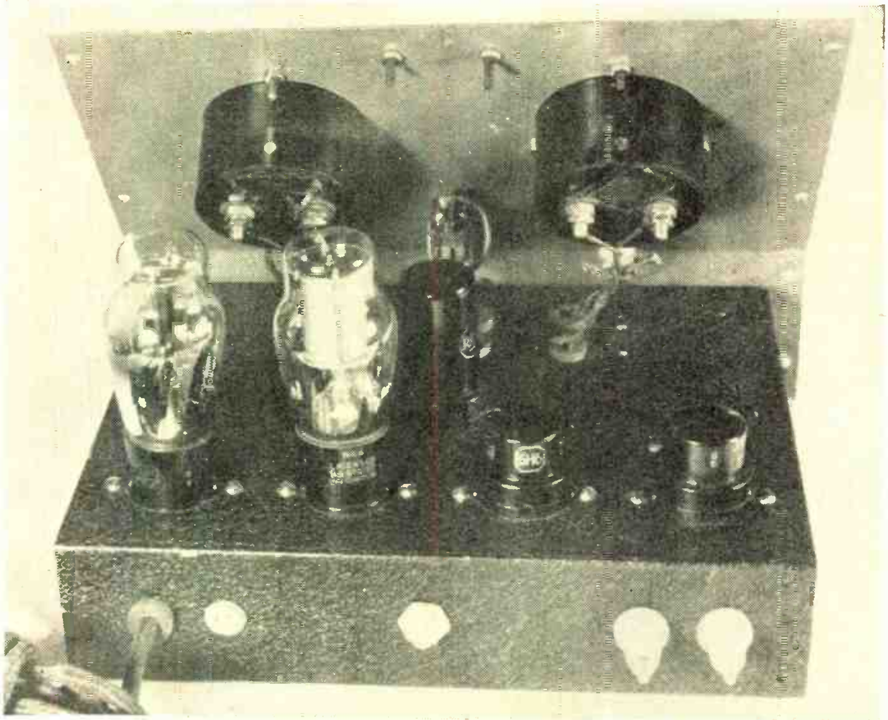


Fig. 4. Rear view of instrument shows proper placement of various component parts.

Adjustment

First, inspect all wiring and components to determine correctness and good condition, then proceed with the adjustment in the following manner: (1) Before connecting to power line, set slider on R_{10} halfway down this resistor. (2) With all tubes in sockets, turn on power to monitor and allow about 3 minutes for tubes to reach stable operating temperature. If either meter goes off scale, return to zero by adjustment of either R_8 or R_{11}, whichever applies. (3) Set slider on R_{10} exactly to 45 volts by means of d.c. voltmeter having at least 1000 ohms per volt resistance. (4) Set meter M_2 to zero by adjusting R_8. (5) Open grid lead to V_3 and connect source of d.c. voltage, variable from 0 to 3 v. between V_3 grid and "B" minus. (6) Set d.c. voltage source to 1.9 v. and adjust R_1 until full-scale deflection of M_2 is obtained. (7) Remove d.c. voltage and connect V_3 grid temporarily to "B" minus. There should be no shift of zero when this is done. If there is, reset to zero by adjusting R_8, reconnect 1.9 v. source to grid of V_3, and if M_2 deflection has varied from full scale, readjust R_1. Work back and forth in this manner until zero setting of M_2 does not change when grid of V_3 is grounded. (8) Restore V_3 grid connection in circuit. (R_1 usually requires no further adjustment until tube V_3 is replaced.)

Calibration

(1) Plug into 115-volt power line and allow about 3 minutes for warm-up. (2) Set switch S_1 to POSITIVE. (3) Set meter M_1 to zero by adjusting potentiometer R_{11}. (4) Set meter M_2 to zero by adjusting rheostat R_8. (5) Connect a.c. voltage source variable between 0 and 5 volts r.m.s. to monitor input terminals. (This may be a 5 or 6.3 volt filament transformer with a 10,000-ohm potentiometer across the low-voltage winding, or it may be an audio oscillator with output gain control. A good frequency for calibration of the modulation monitor is 1000 cycles. When using 60 cycles for this purpose, it will be necessary to connect 8 μfd. capacitors temporarily in parallel with C_2 and M_2.) (6) Connect reliable a.c. voltmeter (at least 1000 ohms per volt) to monitor input terminals. (7) Adjust a.c. voltage source, noting that both meters read, until meter M_2 is deflected to a value slightly under its full-scale reading. (8) Record the reading of M_1 as *carrier reference value* which will be used in all future settings of modulation monitor. (9) Record reading of M_2 as 100% modulation point. (10) Reduce a.c. signal voltage to 0.9 of its value at the 100% modulation point and record new reading of meter M_2 as 90% modulation. (11) Repeat at 0.8, 0.7, 0.6, etc., down to 0.1 of the initial a.c. voltage, recording M_2 readings as 80%, 70%, 60%, and so on.

In steps (9), (10), and (11), no change should occur in the M_2 reading at any signal voltage as peak switch S_1 is thrown back and forth from POSITIVE to NEGATIVE.

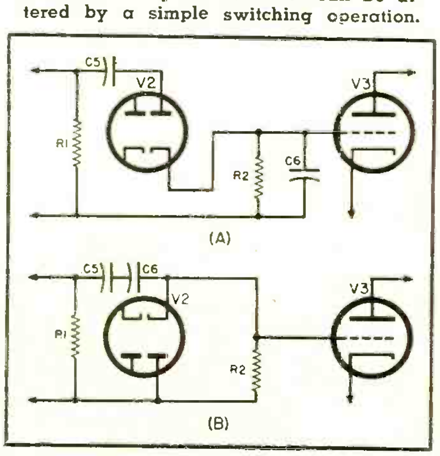
If the operator desires, he may later compare the per-cent modulation readings obtained with cathode-ray modulation patterns. Special meter scales may be prepared (as shown on the meters in Fig. 1). The only indication necessary on the scale of meter M_1 is a line at the carrier reference level. The scale of meter M_2 will be graduated according to the per-cent modulation points obtained in the steps just described.

Using the Monitor

Any signal pick-up device employed with the monitor must complete the circuit between the two input terminals, in order for diode V_1 to operate properly. In virtually every case, adequate pick-up will be provided by a few loosely-wound turns of insulated wire placed near the final amplifier tank coil in the transmitter and connected to the monitor input terminals by means of twisted pair. This scheme is shown in Fig. 2. However, some amateurs might favor employing a coil at the input terminals and link coupling this to a pick-up coil in the vicinity of the transmitter. When an antenna rod is connected to the upper input terminal, a 1-watt resistor of 100 to 1000 ohms resistance must be connected between the two terminals.

(*Continued on page* 120)

Fig. 5. Diagram shows how the input circuit of the peak voltmeter can be altered by a simple switching operation.



H. W. CLOUGH, Vice-President of Belden Mfg. Co., and President of Radio Parts and Equipment Shows, Inc.

1946 RADIO PARTS and Electronic Equipment CONFERENCE and SHOW

TENTATIVE SCHEDULE OF MEETINGS

NATIONAL ELECTRONIC DISTRIBUTORS ASSOCIATION

May 11, 10.00 A. M. Directors Meeting
May 12, 10:00 A. M. Delegates Meeting and Election
May 13, 9:00 A. M. General Membership Meeting

THE REPRESENTATIVES

May 13, 12:00 M. General Membership Meeting and Luncheon

OTHER EVENTS

May 13, 12:30 P. M. General Meeting and Luncheon for Members of Show Corporation and Joint Meeting of Association of Electronic Parts and Equipment Manufacturers, Sales Managers Club (Eastern Group)
May 13, 7:00 P. M. Radio Parts Industry Keynote Dinner, Grand Ballroom, The Stevens (1500 reservation limit)

THE largest gathering of radio parts and equipment manufacturers, distributors, and representatives in the history of the industry is expected to converge on Chicago May 13-16 this year. According to K. C. Prince, General Manager of the show, estimates of attendance range from 3500 to 5000. This attendance will be tops in parts show history in view of the fact that dealers and servicemen have not been invited and registration is limited to factory men, distributors, and representatives.

As early as February 28th reservations were pouring in, and taxing the facilities of the housing committee which had established a strict priority formula for the allotment of hotel rooms. The Stevens will house manufacturers and distributors while the Morrison Hotel, The Chicagoan, and The Brevoort will provide rooms for representatives and other guests. The exhibition hall of the Stevens will be used for manufacturers' displays and 166 manufacturers are scheduled to show their lines.

This 1946 show is sponsored by National Electronic Distributors Association, Radio Manufacturers Association, Sales Managers Club (Eastern Division) and Association of Electronic Parts and Equipment Manufacturers. Keynote of the show will be "Accent on Reconversion" and the entire program will be pointed toward current business and economic problems involving the industry.

There are indications that the production stalemate, which crippled the industry in the latter months of 1945 and early months of this year will be broken by the time of the show and conference. Clarifications of strikes, pricing complications and materials shortages which have plagued producers during the early months of reconversion could quickly change conditions for the better and lead to an unprecedented radio production in the last two quarters of 1946. While the major questions to be discussed at the conference at the time, we go to press, concern reconversion, a turnabout is possible which would involve consideration of selling and distribution problems. It is believed by many that the industry is at last about to enter the frequently heralded era of prosperity but those on the pessimistic side feel that a rapid development of latent productive capacity will quickly lead to a shortening of profit margins through normal competitive activities due to the entry of new factors in the field during the war. At any rate the gathering of industry leaders will provide an outlet for full expression of opinions and will provide an over-all yardstick on which parts and equipment manufacturers and distributors will base their planning. —30—

K. C. PRINCE, Show Manager and Executive Secretary, Electronic Parts & Equipment Manufacturers Association.

R. C. COSGROVE

BOND GEDDES

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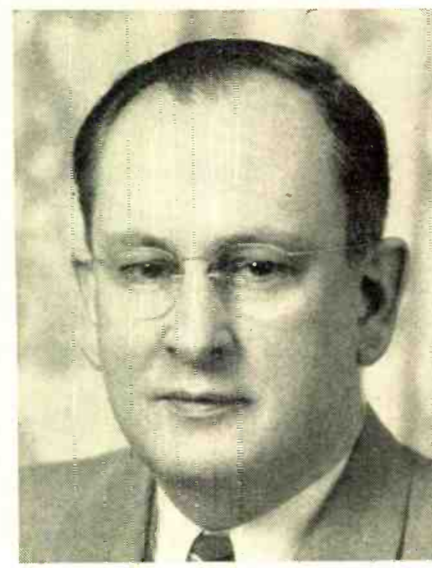

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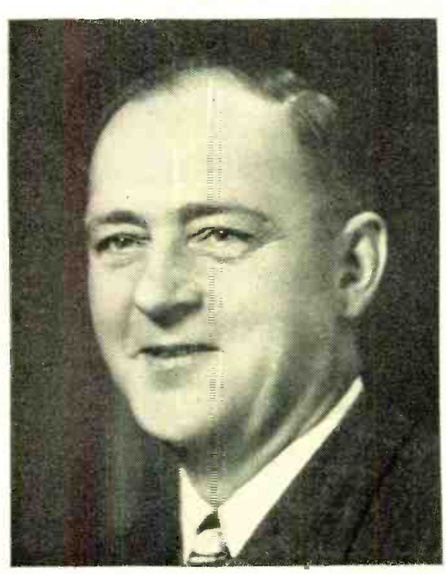
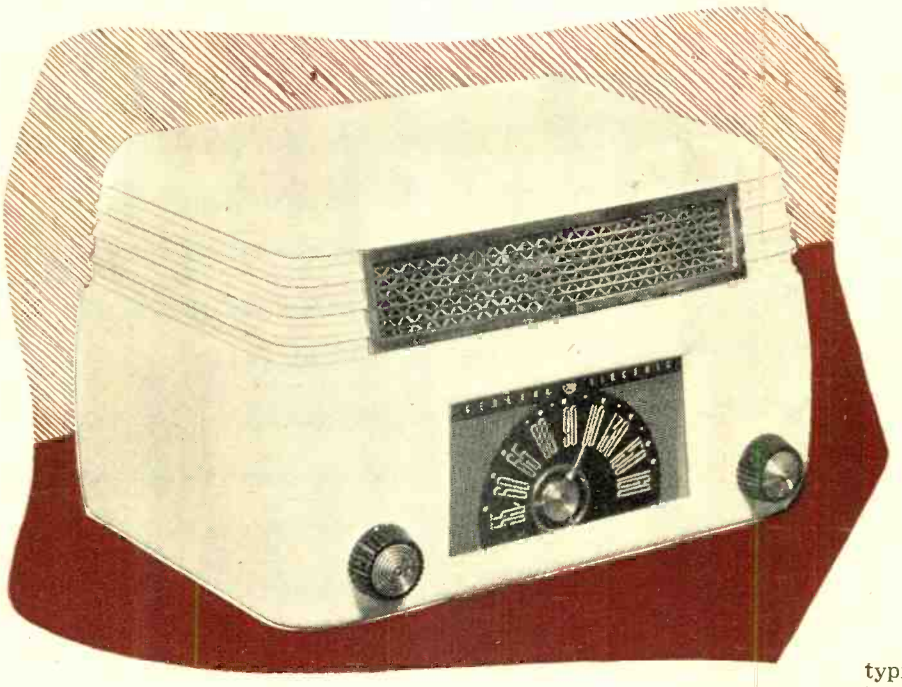


L. B. CALAMARIS

Practical RADIO COURSE



One of the many new 1946 table model receivers that are in production. This a.c.-d.c. model incorporates modernistic dial assembly and unique grille.

TWO previous articles of this series were devoted primarily to a study of the basic principle of the superheterodyne type of receiver.[1] It was found that the superheterodyne employs a "frequency-translating" or "converting" arrangement wherein any received signal (unmodulated c.w., audio modulated, or video modulated) whose carrier frequency lies within the tuning range of the preselector may be "converted" to a *similarly-modulated* signal of new *fixed* carrier frequency known as the *intermediate frequency* (abbreviated i.f.).

To perform this change in frequency (*frequency conversion*), an arrangement consisting of an oscillator and a "mixer" is employed. Both units considered together comprise the *frequency converter* (see Fig. 1). In the *mixer* portion, two voltages of different frequency, the r.f. signal voltage and the unmodulated voltage generated by the oscillator, are applied to the input. These voltages are caused to heterodyne within the mixer to produce a plate current having, in addition to others, a component whose frequency is equal to the *difference* between the signal frequency and the oscillator frequency. Moreover, this component contains modulations similar to those of the original signal. This modulated i.f. carrier is then fed to an efficient, selective fixed-frequency *intermediate amplifier* that builds it up to the desired level before detection or *demodulation* takes place in the detector.

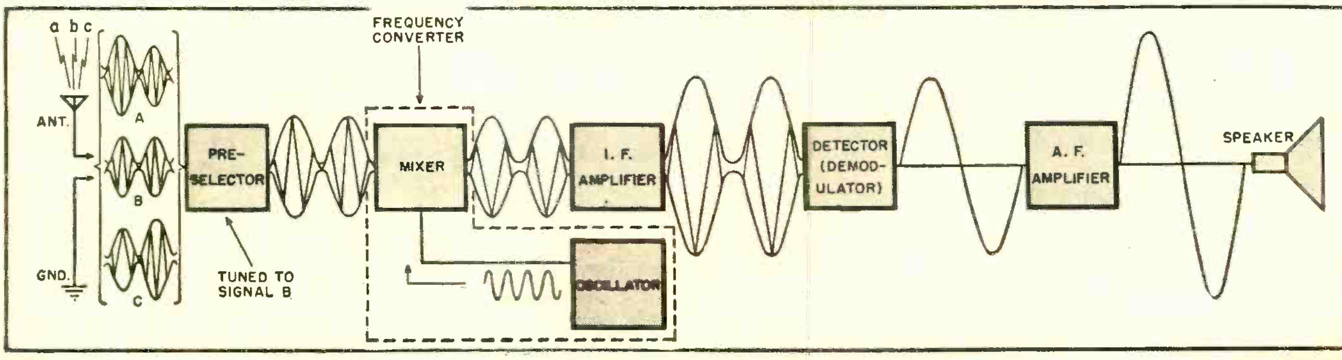
The functional block diagram of a typical AM superheterodyne receiver in which a separate oscillator and mixer tube are employed in the frequency converter, is presented in Fig. 1. The variable-tuned signal circuits in the preselector are assumed to be adjusted to select signal *B* from the three incoming signals *A, B, C* appearing in the antenna circuit.

[1] At this point, the reader is advised to review Parts 25 and 26 of PRACTICAL RADIO COURSE in the August and September, 1944 issues of RADIO NEWS.

Frequency Converter Development and Terminology

Ever since the invention of the superheterodyne method of reception in 1917-18, there have been important problems connected with the existing frequency-changing or conversion processes. These have led to the development of several types of tubes especially designed for frequency-conversion service, and the employment of several methods of operation for the mixer portion of the frequency converter. Every new development, though hailed as the final solution, has been followed by new problems as receiver design itself has progressed and become more complicated.

Fig. 1. Functional block diagram of a typical superheterodyne receiver showing the various changes that the selected modulated incoming signal, (B), undergoes as it progresses successively through the various stages of the receiver.



By

ALFRED A. GHIRARDI

Part 44. Frequency conversion in the superheterodyne receivers, including frequency converter terminology, and a discussion of single-electrode input type converters.

Because several different circuit and tube arrangements have been developed for accomplishing frequency conversion, and the actions taking place in those employed in early receivers were not too well understood, a rather confusing terminology has grown up around the subject. Some of the terms commonly used (such as "mixer," "converter," etc.) are not clearly defined; others are often expressed inaccurately in the voluminous literature that exists on the subject. Many of the difficulties beginners experience in understanding the various methods of accomplishing frequency conversion, and the relations between frequency conversion, modulation and detection, are caused mainly by this improper and confusing terminology. An attempt will be made to clear up this situation here.

A more modern improved terminology that shall be employed when referring to frequency converters and their components follows:

Detector: a device to effect the process of detection. A detector may be any device which in response to a modulated wave enables the signal (intelligence) imparted thereto to be heard, seen, felt, or recorded.

Mixer Tube: an electron tube which contains the electrode system of the mixer, but not the electrode system of the local oscillator.

Single-Electrode Input Mixer or Converter: a mixer or converter in which the signal and oscillator voltages are both applied to the same electrode.

Double-Electrode Input Mixer or Converter: a mixer or converter in which the signal and oscillator voltages are applied to different electrodes.

Converter Stage or Frequency Converter: a device to effect frequency conversion—a frequency changer. It includes *both* the local oscillator and mixer.

Converter Tube: an electron tube which contains the electrode system of the local oscillator as well as the electrode system of the mixer.

Additional terms will be defined as we proceed with our study.

General Classification of Frequency Converters

Before launching into a discussion of the mechanism of frequency-converter action, it will be well to first classify frequency converters according to the general method of operation of the "mixer" section—that is, according to the number of electrodes employed for introducing the signal and the oscillator voltages into the mixer. Following are the two general methods of operation:

1. *Single-electrode input:* operation with the oscillator voltage and the signal voltage simultaneously impressed on the *same* grid.

2. *Double-electrode input:* operation with the oscillator voltage impressed on one grid and the signal voltage impressed on a *separate* grid—both grids being located in the same electron stream.

Frequency converters of Type 1 are often referred to as being "circuit-coupled" because the oscillator and signal voltages must be coupled together by means of some suitable external electrical *circuit* arrangement. They were widely used before the availability of tubes especially designed for double grid (electron-coupled) frequency-conversion service. Even now they possess certain advantages that make them useful in certain types of receivers.

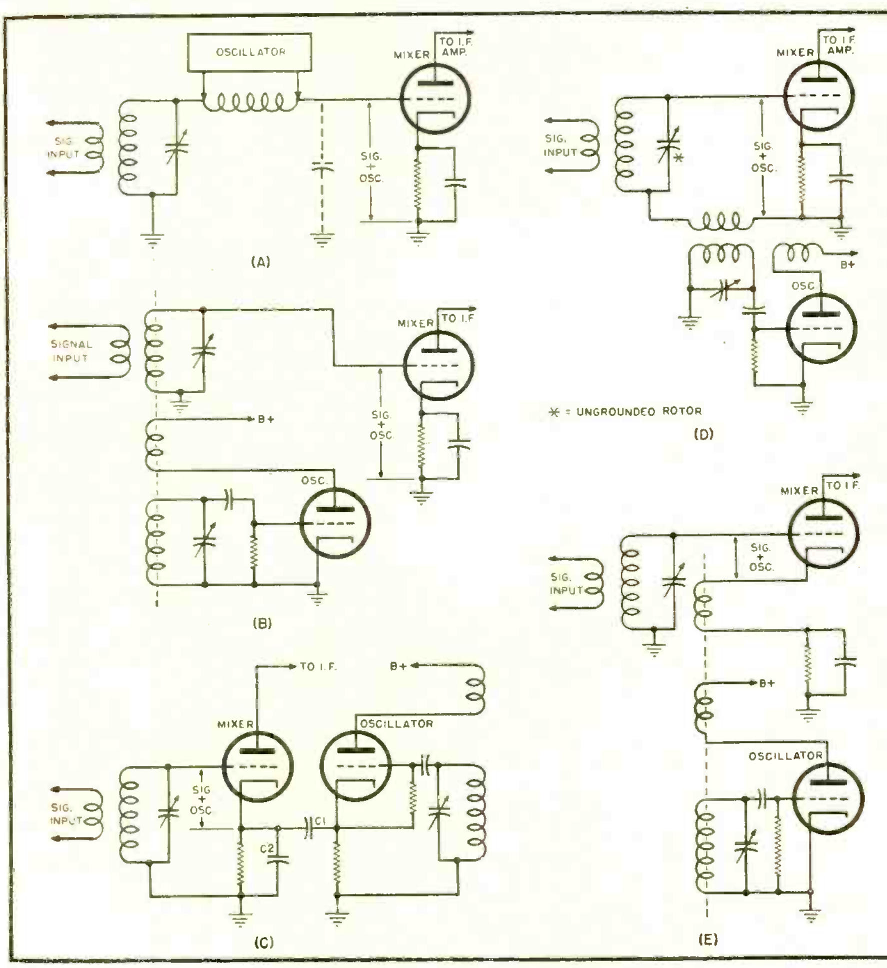
Those of Type 2 are referred to as "electron-coupled" because in them the oscillator and signal voltages are coupled via the common electron stream to the plate circuit.

Each of these two modes of mixer operation has characteristics which depend mainly upon the mode rather than on the type of tube used in it. Tubes which may be used in any one mode differ from another mainly in the degree in which they affect these characteristics. The explanation of frequency converters to follow, therefore, will not necessarily deal with specific tube types even though examples of typical tube types commonly employed for each mode of operation will be mentioned as a matter of interest and practical information.

The present article will deal with

(*Continued on page* 121)

Fig. 2. Various circuit-coupling methods employed for introducing oscillator voltage into signal circuit when signal and oscillator voltages are both applied to the same grid of the mixer tube.



Unique PHONO AMPLIFIER

By
CHARLES E. PETT, Jr.
RT 2/c U.S.N.R., W2GBZ
Staff-EE&RM School, N.T.C.

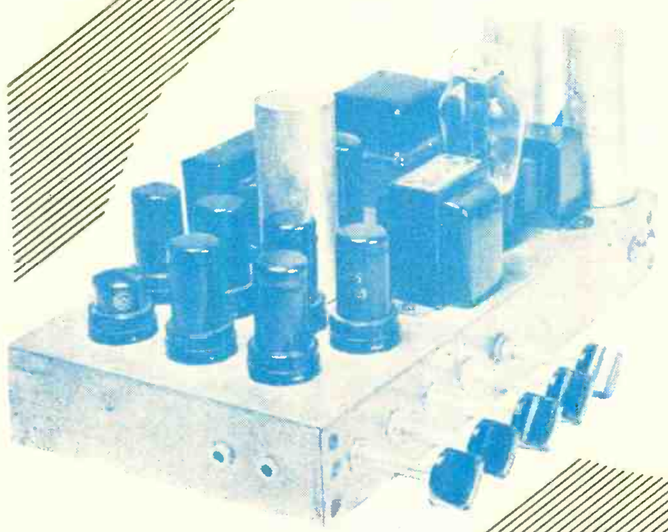


Fig. 1. View of completed unit. Tip jacks mounted on side of chassis are for input terminals.

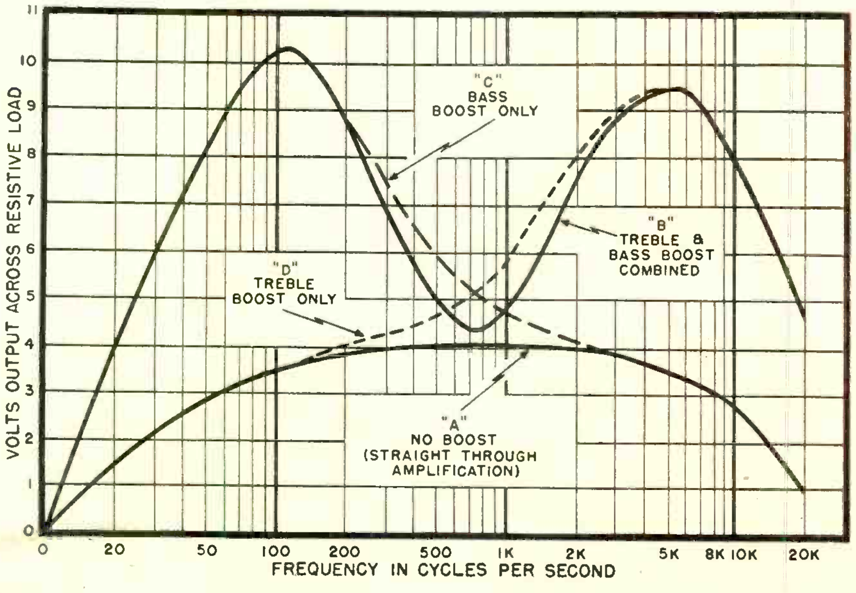
Featuring full-range volume expansion and individual high and low frequency boosts makes this unit ideal for full tonal reproduction.

MUCH of the brilliance of classical recordings is lost in reproduction due to the compression employed when the recordings are made. To assure true reproduction, it is necessary to restore all passages to their original relative level and this may only be achieved by means of an expander circuit. The desire for an amplifier which would provide true reproduction of phonograph records and restore the brilliance lost during the recording process led to the design of this amplifier.

Featuring full-range expansion, with individual attenuation or accentuation of either highs or lows, this amplifier should prove satisfactory to the most critical listener. Power sufficient for any home application is provided by the push-pull output stage which uses a 6N7. Adequate control of tone is achieved although only readily available parts have been utilized. Thus, this all-purpose unit may be easily constructed at the present time.

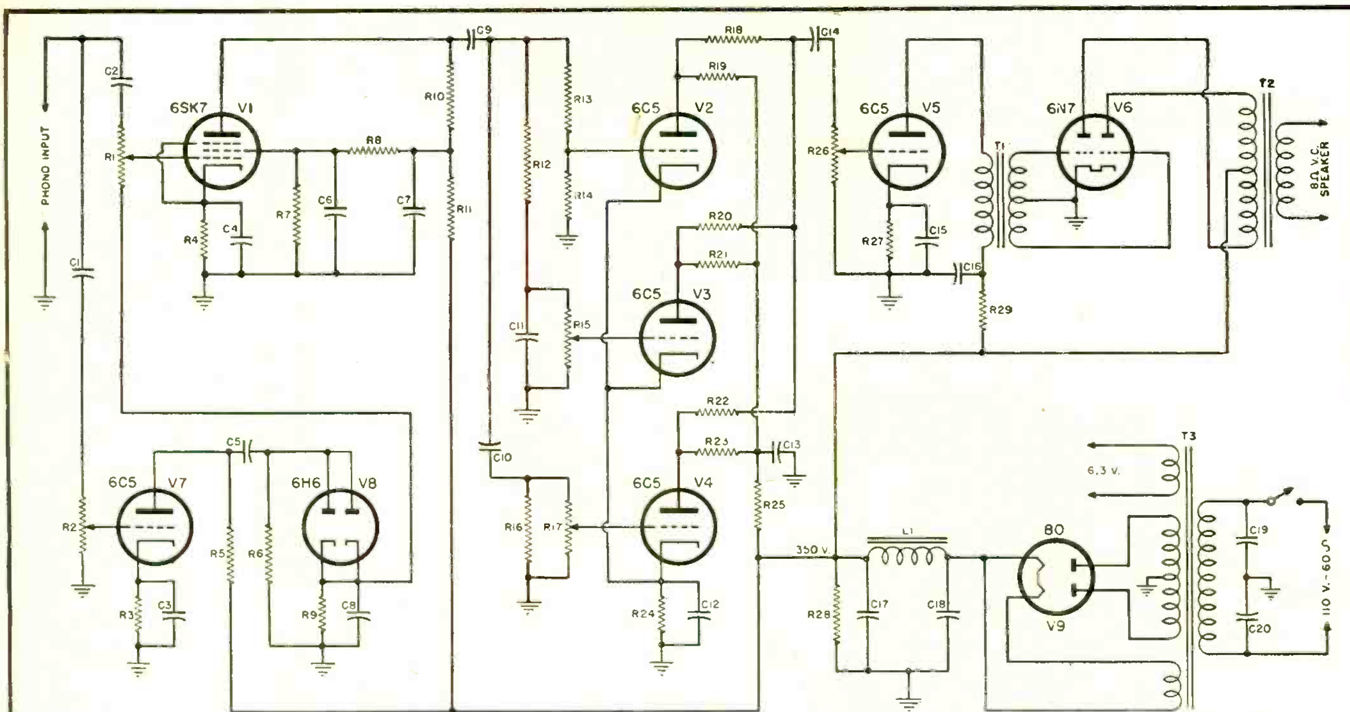
The amplifier uses a total of eight tubes; two in the expander circuit, two in the tone control circuits and four in straight-through amplification. The main features of the design are the volume expansion circuit which will give any required degree of expansion, and the tone control circuits which maintain boost at the desired frequencies but have little, if any, attenuation at other frequencies.

Fig. 2. Frequency response curves show available low and high frequency boosts.



The expansion circuit (Fig. 3) will be discussed first. In this design, a 6SK7, a variable gain tube, is used to obtain the variation in volume level desired and is used in the input circuit because of its limited signal capabilities. It is connected as a pentode with its screen grid kept at a very constant voltage by the use of a bleeder circuit. With no expansion, that is, with the potentiometer, R_2, turned all the way down, the bias on the 6SK7 (V_1) is determined by its cathode voltage. With R_2 turned up, the bias point and therefore the gain of V_1 is also determined by the amount of rectified positive voltage developed on the cathode of V_8 (6H6), which in turn is dependent on the relative volume level of the input signal—amplified by V_7 (6C5) and rectified by V_8. This particular design allows any degree of expansion action desired, no matter how the input gain control, R_1, is set. The long *RC* time constant of C_8 and R_9 (diode load) assures a slow fade out of expansion, following the general trend of the volume rather than the sharp rise and fall of a few notes. This circuit can be changed for volume compression operation with only a slight change in the wiring, as shown in Fig. 5.

Considering the tone control circuits, it will be noticed that the 10 db. bass and treble boosts are practically



R_1, R_2, R_{15}, R_{17}—500,000 ohm pot.
R_3, R_{27}—2000 ohm, 1/4 w. res.
R_4, R_{11}—6000 ohm, 1/4 w. res.
R_5, R_6, R_{10}, R_{19}, R_{21}, R_{23}—100,000 ohm, 1/4 w. res.
R_7, R_8—22,000 ohm, 1/4 w. res.
R_9, R_{12}—270,000 ohm, 1/4 w. res.
R_{13}—1 megohm, 1/4 w. res.
R_{14}—33,000 ohm, 1/4 w. res.
R_{16}—60,000 ohm, 1/4 w. res.
R_{18}, R_{20}, R_{22}—500,000 ohm, 1/4 w. res.
R_{24} 1750 ohm, 1 w. res.
R_{25}—2000 ohm, 1/4 w. res.
R_{26}—1 megohm pot.
R_{28}—25,000 ohm, 25 w. res.
R_{29}—12,000 ohm, 1/4 w. res.
C_1, C_2—.1 μfd., 200 v. cond.
C_3 C_4, C_8, C_{12}, C_{15}—25 μfd., 25 v. cond.
C_5—.01 μfd., 400 v. cond.
C_6, C_7, C_{14}, C_{19}, C_{20}—.1 μfd., 400 v. cond.
C_9—.5 μfd., 400 v. cond.
C_{10}—100 μμfd. mica cond.
C_{11}—.05 μfd., 200 v. cond.
C_{13}, C_{16}, C_{18}—8 μfd., 400 v. elec. cond.
C_{17}—24 μfd., 400 v. elec. cond.
T_1—Driver trans., Class "B", 5.25 to 1 ratio
T_2—Output trans., 8000 ohm to v.c.
T_3—Power trans., 700 v., c.t. @ 70 ma., 5 v. @ 3 amp., 6.3 v. @ 2.5 amp.
L_1—Filter choke, 20 henry, 80 ma.
1—6SK7 tube
1—6H6 tube
5—6C5 tubes
1—80 tube
1—6N7 tube

Fig. 3. Wiring diagram of the eight tube audio amplifier and its associated power supply.

independent in operation. V_2 is a conventional straight-through amplifier which maintains a flat response between 50 cycles and 8000 cycles in the output with no high or low frequency boost (curve *A* in Fig. 2).

The bass boost amplifier, V_3, takes its input signal from a low-pass *RC* filter network (R_{12}, R_{15} and C_{11}) which bypasses the high frequencies to ground through C_{11} and develops the low frequencies across R_{15}. R_{12} serves to isolate the input circuits of V_2 and V_3 from the shunting effect of C_{11}. By referring to Fig. 2, and comparing curves *A* and *C*, it will be observed that there is a gain of slightly over three-to-one at 100 cycles, which is about a 10 db. boost.

The treble boost amplifier, V_4, takes its input signal from the high-pass filter (R_{17}, R_{16}, and C_{10}) which develops the highs across the resistor, R_{17}, and the lows across the high impedance of C_{10}. R_{16} serves to lower the resistance of the potentiometer (R_{17}) to 50,000 ohms. The equivalent circuit could be replaced by a 50,000 ohm potentiometer. Referring again to Fig. 2, and comparing curves *A* and *D*, it will be noticed that a gain of slightly less than three-to-one at 6000 cycles is obtained, which is about a 10 db. boost.

The output signals of V_2, V_3, and V_4 are combined with the least amount of distortion by the use of separate plate load resistors (R_{19}, R_{21} and R_{23}) and isolating resistors (R_{18}, R_{20} and R_{22}) and coupled through C_{14} to the grid of V_5.

The driver stage is a conventional class "A" amplifier with transformer coupling to the class "B" power amplifier stage, also of conventional design, using a 6N7 power tube.

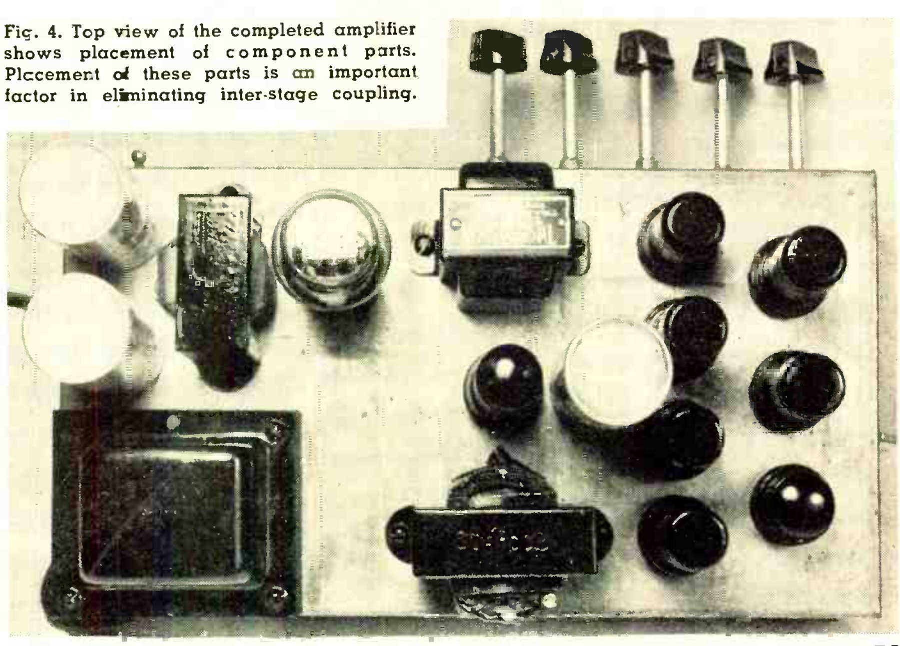
The three decoupling filters (R_{11}-C_7, R_{25}-C_{13}, and R_{29}-C_{16}) assure the least amount of feedback or coupling between stages.

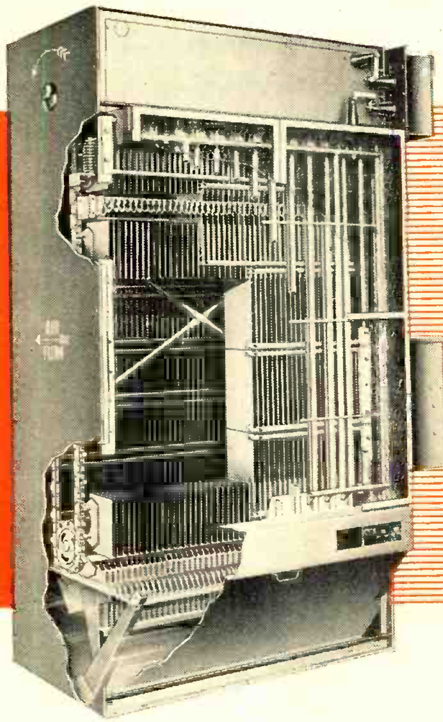
The power supply, for convenience, was incorporated with the audio amplifier on the same chassis thus making a very compact unit. The very large capacitor (C_{17}) was inserted across the output of the power supply to reduce 60-cycle hum which would be noticeable in this unit because of the very low frequency response of the amplifier.

The frequency response curves (Fig. 2) were plotted with a 10 ohm, 25 watt

(*Continued on page* 88)

Fig. 4. Top view of the completed amplifier shows placement of component parts. Placement of these parts is an important factor in eliminating inter-stage coupling.





Electronic AIR-FILTER

By BEN F. TAYLOR
American Air Filter Company, Inc.

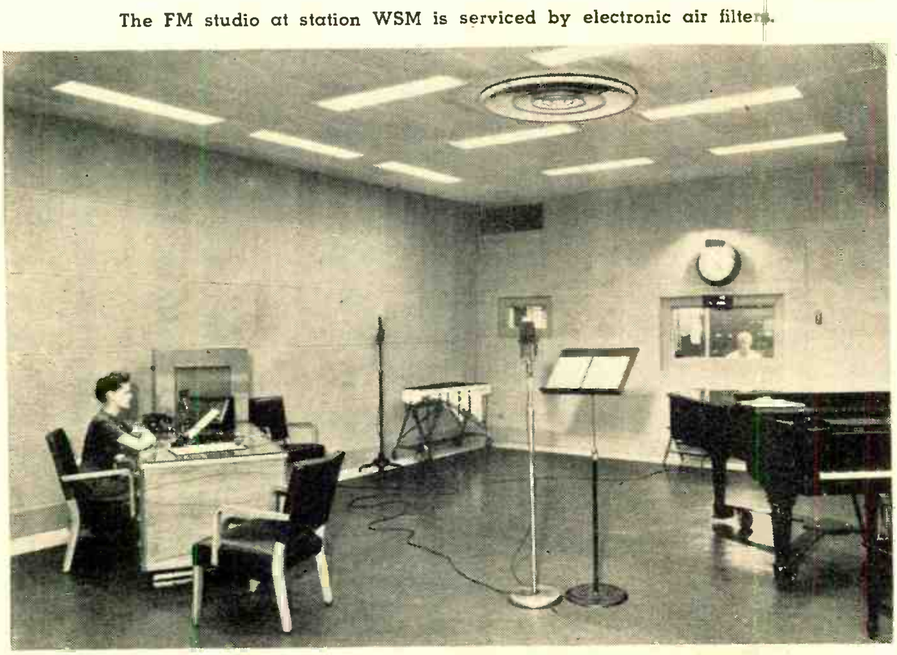
Cross section of the Electro-Matic, self cleaning air filter of the type used at Radio Station WSM. Illustrated are the ionizer and collector plate assemblies. The grounded collector plate assemblies are mounted on two endless chains to form a continuous movable curtain and rotate through an oil bath located in the bottom of the filter where they are cleaned and recoated with viscosine.

According to station WSM, electrical air filtering systems have reduced their maintenance cost by approximately 50 per-cent.

SINCE the radio industry is built upon electronics, a new application of this basic principle to cleaning should be of particular interest to the communication field.

While the electronic air filter is a fairly new development, the use of electrical precipitation to remove dust from the air dates back to 1906; a professor of Physical Chemistry at the University of California, Dr. F. G. Cottrell, developed the first such unit to be used commercially. The Cottrell Precipitator, while it has proved eminently successful for the collection of smelter fumes and fly ash from stack gases, is not practical for use in air supply systems. Due to its principle of operation, it generates large volumes of ozone and nitrous oxides which are harmful if breathed and which can cause rapid deterioration of many materials by accelerating oxidation.

The FM studio at station WSM is serviced by electronic air filters.



Several later patents mentioned the fact that the necessary functions in collecting dust via electrical precipitation could be done in successive stages instead of one operation as in the Cottrell Precipitator and thereby reduce ozone generation. Nothing was actually done about applying this method until 1931 when the first patent on two-stage electrical precipitation was issued to G. W. Penny, a research engineer. The development of the electronic air filter since that time has been most significant.

One of the pioneers in the use of electronic air filtration is radio station WSM of Nashville, Tenn., owned and operated by the National Life and Accident Insurance Co., Inc., on a frequency of 650 kilocycles with a 50,000 watt clear channel. Installing electronic air filters four years ago in the two air conditioning systems which serve all studios, control rooms, and executive offices, Chief Radio Engineer George Reynolds credits these filters with a 50% reduction in maintenance care for radio relays and other delicate equipment.

While a high percentage of atmospheric dust and dirt can be removed from the air by means of mechanical filters, it was not until the advent of electronic air filtration that it was possible to remove extremely fine soot and smoke particles—the worst offenders to the radio engineer.

Electronic air filtration is a method of removing entrained solids from air or gases by means of electrical attraction. It is based on the principle that *an electrically charged particle will be attracted to a charged electrode of opposite polarity and repelled by one of like polarity.*

With this development, high efficiency dust removal was extended into the realm of smoke and air-borne impurities so small that, like smoke, they defy the laws of gravity and respond to the Brownian movement. Such microscopic materials are considered permanent atmospheric impurities since they tend to remain suspended indefinitely in the air. Unfortunately, however, they settle—possibly by thermal or electrical precipitation—in concentrations capable of impairing the efficiency of radio communications equipment. Likewise, these microscopic materials settle on the interior surfaces of studios and offices, becoming smudge and discoloration.

The principle of the electronic air filter stems from the molecular theory that all substances are made up of molecules composed of one or more atoms of the basic elements in various combinations. According to the present day concept, the atom is made up of electrons which, being negative, revolve around a nucleus of positive protons and neutrons like a miniature solar system. The displacement of an electron from a gas molecule causes the polarity of the molecule to become positive, thereafter being referred to as a molecular ion.

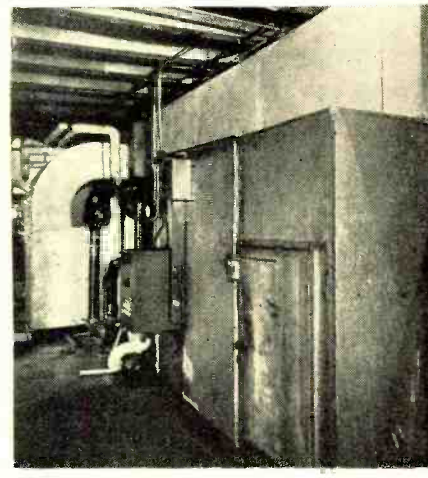
The ion, being positive, tends to travel toward grounded surfaces of opposite polarity, or to attach itself to dust and smoke particles, giving these particles a surface charge of positive polarity. In an electronic air filter it is necessary to produce ions in sufficient quantity to assure all the dust and smoke particles receiving a positive charge of optimum intensity to be drawn out of the air stream by electrical attraction upon entering the collector element. This is accomplished by means of an ionizing element consisting of fine wires equispaced between parallel electrodes.

In the ionizing elements of the electronic air filters in service at radio station WSM and developed by *American Air Filter Co.*, the wires are of tungsten .008" in diameter and the electrodes are streamlined shapes designed to minimize resistance to air flow, eliminate turbulence and assure uniform air velocity over the entire area of the collector element. With 12,000 volts direct current applied to the wires and the electrodes properly grounded, a strong ionizing field is set up in the space between the wires and the electrodes.

The collector element of a typical electronic air filter is a series of parallel plates alternately charged positive and negative. These plates are, in turn, coated with viscosine to trap the dust particle of opposite polarity which is attracted to the plate. After a period of time, depending on the amount of soot and smoke in the atmosphere, these plates must be cleaned and recoated if the filter is to operate at maximum efficiency.

Radio station WSM suffered heavily from soot and smoke. An abnormal amount of time was being spent in cleaning relays and other critical radio equipment. Nashville, being completely surrounded by hills, is in a low pressure area with the upper air currents rarely reaching a velocity of 5 miles per hour. As a result, the city is often blanketed for hours in a dense "smog"; hence, the goal of WSM was not only to procure an efficient air filter that would keep their studios and equipment free from the harmful dirt and dust, but also one that would not present a maintenance problem in itself. The filters used are *American Air Filter's* Electro-Matic, a self-cleaning type electronic air filter. Normally the components of this filter are so completely enclosed that it is impossible to describe the details of construction without a cutaway illustration. Since the bulk of the dust and smoke is deposited on the grounded collector plates, these assemblies are mounted on two endless chains to form a continuous movable curtain. This permits the grounded plates to be rotated through an oil bath in the base of the filter casing for cleaning and recoating with viscosine. A wiper in the reservoir "squeegees" the oil-soaked plates, removing the deposits of dust as well as the tarry residue of smoke. The dirt so removed settles to the bottom of this reservoir as sludge to be removed manually with a scraper or automatically by draining off the oil and removing the sludge by centrifuging or sedimentation.

The WSM installation called for placing the electronic air filters in penthouses atop the building at the two points of air intake for the air conditioning systems. They are conveniently located just behind the weather louvres. In one location the equipment consists of two 6' x 7' sections of the Model C Electro-Matic while in the other location are two sections of a later model known as the Model E, total dimensions being 7' x 7'. The total capacity of all the filters is 15,500 c.f.m.



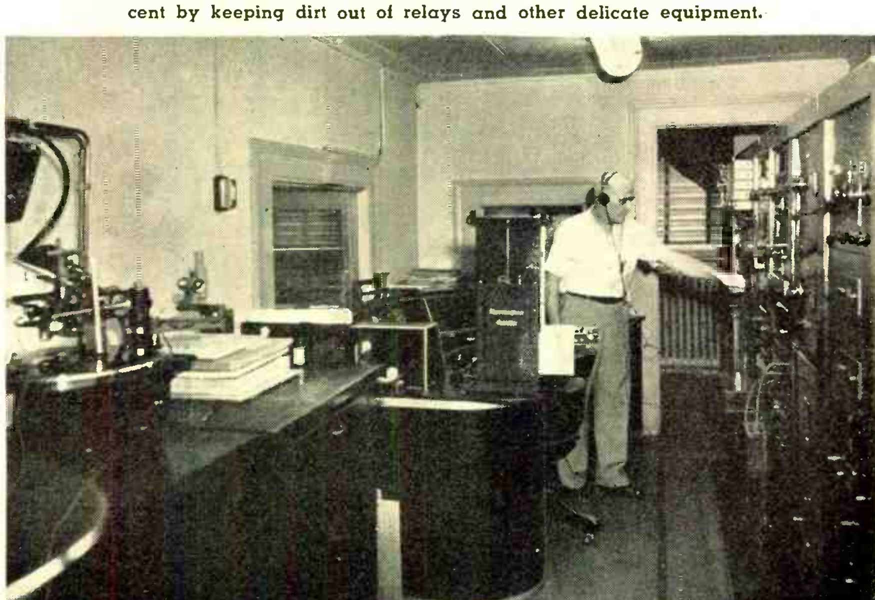
Exterior of duct work at point of outside intake, showing door in foreground leading into the duct and the dirty air side of electronic air filters in one location. Note power pack supplying 12,000 volts to ionizing unit of filter just beyond door. The intake air fan is shown at rear.

Shortly after the installation of one set of filters, an unusual treatment of the outside air intake was forced upon WSM by tenants in an adjacent apartment building on the floor level with the penthouse. They complained of the noise made by the large intake fans. This resulted in the construction of a "chimney" type air intake made of cinder brick to deaden the sound. The maintenance engineer reports, however, that this unconventional type air intake has performed most satisfactorily.

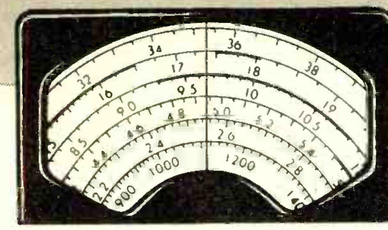
Worthy of mention also is the substantial reduction in redecorating expenditures for studios and executive offices that has been realized during

(*Continued on page* 134)

Main control room at radio station WSM. Super-clean air from electronic air filters has reduced maintenance care 50 percent by keeping dirt out of relays and other delicate equipment.



International SHORT-WAVE



***Compiled by* KENNETH R. BOORD**

FROM the Directorate General, All India Radio, New Delhi, I have received complete schedules of AIR, listed in Indian Standard Time, 5½ hours *ahead* of GMT and 10½ hours *ahead* of EST. Space will not permit giving the complete list, but I have listed below the programs of most interest to listeners in the Western Hemisphere (frequencies in italics indicate transmitters using 100 kilowatts), in EST:

8:30 p.m.—All Forces Programs, 90 min., *6.100,* 4.860.

9:45 p.m.—English News, 15 min., 9.680, 9.590, 7.275, 6.190.

10:30 p.m.—English, 15 min., 17.830, 15.350, *15.190, 15.160,* 11.870.

12:30 a.m.—English, 30 min., 15.350, *15.190,* 11.870.

1:30 a.m.—English, 15 min., 17.830, 15.350, *15.160,* 11.870.

2:30 a.m.—All Forces Programs, 90 min., *9.590.*

3:00 a.m.—English News, 10 min., 15.290, 11.830, 7.290, 7.275.

3:30 a.m.—English News Dispatches, 30 min., 15.350, 11.870.

4:30 a.m.—English, 15 min., 15.350, 15.290, 11.870, *9.590,* 7.290.

6:30 a.m.—"Voice of Britain Calling the Far East" from Delhi, English, 30 min., 15.350, *15.160,* 11.870, *11.760, 9.590,* 7.275.

8:00 a.m.—English P.O.W. Program, 90 min., *9.630,* 7.210.

8:00 a.m.—English News, 10 min., 11.790, 7.275, 4.960.

9:30 a.m.—English News, 15 min., *9.630, 7.290.*

10:00 a.m.—Western Music, 30 min., 9.670, *7.290,* 7.240.

10:50 a.m.—English News, 10 min., 9.670, *7.290,* 7.240, *6.190,* 6.100, 3.495.

11:00 a.m.—BBC News Relay, 10 min., 9.670, 7.240, 7.210, *6.190,* 6.100.

6:25 p.m.—Music, 5 min., 7.210, *6.190.*

AIR schedules begin at 7 a.m. Indian Standard Time (8:30 p.m. EST) and close at 5:45 a.m. Indian Standard Time (7:15 p.m. EST) *daily.* AIR changes schedules and frequencies almost constantly, but the above list should be a good guide. The best signal received here in West Virginia from All India Radio is around 8:30 a.m. EST over 11.760 (announced) which usually has a concert to 9 a.m. when schedules (in English) are read.

Frequencies listed for AIR were 17.830, 15.350, 15.290, 15.190, 15.160, 11.870, 11.830, 11.790, 11.760, 11.710, 9.680, 9.670, 9.630, 9.590, 7.300, 7.290, 7.275, 7.240, 7.210, 6.190, 6.150, 6.100, 6.060, 6.010, 4.960, 4.860, 4.840, 3.495, 3.335, 3.305, 1.167 kcs., 810 kcs., and 629 kcs.

A number of photographs enclosed with the schedules of studios, transmitters, antennas, and so on, clearly indicate that facilities of AIR are most up-to-date.

* * *

CHINESE "BEST BETS"

Direct by airmail from an official of the Central Broadcasting Administration, Chungking, comes the following "best bets" from China:

XGOY—11.913, 6.146, 7.153, Chungking, 8:40-10:40 a.m., English and Chinese dialects; English news at 9 and 9:30 a.m. (Note: By this time it is likely that XGOY has replaced 6.146 by 9.810; it will be heard best in the East between 6:40-8:30 a.m. but will probably run to 11:35 a.m. or later, with English news at 9 and 11:10 a.m.; 7.153 will continue to be used in parallel, while the 11.913 transmitter will likely be heard approximately 5-6 a.m.)

XUPA—9.695, Tai-Pei, Formosa, 6-7 p.m. and 10:55 p.m.-9 a.m. in various languages; English newscast at 8:40 a.m.

XORA—11.780, Shanghai, 6:45 p.m.-1 a.m. and 4-10:30 a.m. in various languages; English news at 6:45 p.m. (for NBC and CBS in the U.S.), 9:15 p.m., 12 midnight, 12:30 a.m., 5:45 a.m., and 8 a.m. (for NBC and CBS in the U.S.). (Note: Reliable American sources report XORA as *heard* on approximately 11.696.)

XPSA—6.990, Kweiyang, Kwachow, 12:30-1 a.m. and 5:30-10 a.m. in various languages; English news at 8:40 a.m.; relays XGOY.

The CBA official comments that "these stations are likely to be receivable in the U.S.A., especially in the area along the Pacific Coast." Address of the Central Broadcasting Administration is given as Chungsan Road, Chungking, China.

* * *

LONDON CHANGES

In a recent major schedule change, London put into use several additional 21-megacycle channels in the morning and effected the following new schedule to North America:

(*Continued on page* 94)

Chart listing time differences in the United States as compared with Greenwich time.

GMT	EST	CST	MST	PST
0100	8:00 p.m.	7:00 p.m.	6:00 p.m.	5:00 p.m.
0200	9:00 p.m.	8:00 p.m.	7:00 p.m.	6:00 p.m.
0300	10:00 p.m.	9:00 p.m.	8:00 p.m.	7:00 p.m.
0400	11:00 p.m.	10:00 p.m.	9:00 p.m.	8:00 p.m.
0500	12 midnight	11:00 p.m.	10:00 p.m.	9:00 p.m.
0600	1:00 a.m.	12 midnight	11:00 p.m.	10:00 p.m.
0700	2:00 a.m.	1:00 a.m.	12 midnight	11:00 p.m.
0800	3:00 a.m.	2:00 a.m.	1:00 a.m.	12 midnight
0900	4:00 a.m.	3:00 a.m.	2:00 a.m.	1:00 a.m.
1000	5:00 a.m.	4:00 a.m.	3:00 a.m.	2:00 a.m.
1100	6:00 a.m.	5:00 a.m.	4:00 a.m.	3:00 a.m.
1200	7:00 a.m.	6:00 a.m.	5:00 a.m.	4:00 a.m.
1300	8:00 a.m.	7:00 a.m.	6:00 a.m.	5:00 a.m.
1400	9:00 a.m.	8:00 a.m.	7:00 a.m.	6:00 a.m.
1500	10:00 a.m.	9:00 a.m.	8:00 a.m.	7:00 a.m.
1600	11:00 a.m.	10:00 a.m.	9:00 a.m.	8:00 a.m.
1700	12 noon	11:00 a.m.	10:00 a.m.	9:00 a.m.
1800	1:00 p.m.	12 noon	11:00 a.m.	10:00 a.m.
1900	2:00 p.m.	1:00 p.m.	12 noon	11:00 a.m.
2000	3:00 p.m.	2:00 p.m.	1:00 p.m.	12 noon
2100	4:00 p.m.	3:00 p.m.	2:00 p.m.	1:00 p.m.
2200	5:00 p.m.	4:00 p.m.	3:00 p.m.	2:00 p.m.
2300	6:00 p.m.	5:00 p.m.	4:00 p.m.	3:00 p.m.
2400 (0000)*	7:00 p.m.	6:00 p.m.	5:00 p.m.	4:00 p.m.

*Announced as "Zero Hours GMT."

Unless otherwise indicated, all time referred to herein is Eastern Standard Time. (EST).

TELEVISION Deflection Channels

CBS ultra-high-frequency, full-color projection model television receiver. The projection enlarges the picture to a width of 22 inches. With the exception of this feature, operation of the receiver is the same as for the smaller, direct-view model.

By
EDWARD M. NOLL
Television Tech Enterprises

Part 13. The theoretical design and operation of deflection channels used in television receivers.

THE deflection channels of the television receiver perform a number of tasks: (1) separation of sync from composite signal; (2) segregation of sync pulses; (3) generation of the sweep; and (4) amplification and shaping of the sweep.

Deflection circuits of the G.E. Model 90 receiver are shown in Figs. 1 and 2. Since sync and sweep generator circuits have been discussed in detail in the last two installments, they will only be touched on lightly in the discussion of the deflection channels.

In this receiver, Fig. 2, the composite i.f. envelope is applied to the separator after it has been increased in amplitude by the a.v.c. amplifier. It becomes the job of the separator to rectify the i.f. signal. However, the actual separation or clipping of the sync is performed in the next stage because the time constant of C_1-R_1 is too fast to develop the average bias necessary for sync separation. Thus the separator in this case is primarily a detector. The composite signal appears across R_1 and is coupled through choke L_1 and capacitor C_2 to the clipper stage.

A second output from the a.v.c. amplifier is coupled through a 100 μμfd. capacitor to the a.v.c. rectifier.

Delayed A.V.C.

The a.v.c. rectifier and delay diode form a delayed a.v.c. circuit. In delayed a.v.c. operation, a.v.c. action does not begin until the i.f. signal applied to the a.v.c. rectifier exceeds a certain value. Thus there is no signal suppression whatsoever until the signal amplitude becomes excessive, at which time the a.v.c. rectifier conducts and applies a negative bias to the i.f. amplifiers in proportion to the strength of the signals. This bias reduces the i.f. gain and prevents too great a signal from reaching the grid of the picture tube. An excessive signal on the picture tube control grid destroys the range of the reproduced picture, causing it to appear over-exposed.

The delay voltage, which the signal amplitude must overcome before the a.v.c. rectifier operates, appears across resistor R_2. It is a result of the bleeder network consisting of resistors R_4, R_3, and R_2 connected across the power supply bleeder from "+B" to ground. The series combination of resistor R_4 and the delay diode are also connected across the power bleeder from "+B" to a point slightly below ground potential. The algebraic sum of the voltage drop across resistor R_4 (caused by delay diode current) and the power supply potential between "+B" and ground serves as grid bias for the i.f. stages. This bias is negative because the voltage drop across R_4 is greater than the supply potential between "+B" and ground (cathode of diode connected to a point on the bleeder which is negative with respect to ground). Whenever the a.v.c. rectifier conducts, the voltage drop across resistor R_2 rises and more negative bias is applied to the grids of the i.f. amplifiers.

The a.v.c. rectifier resistor-capacitor combination, consisting of capacitor C_5 and resistors R_2 and R_5, has a sufficiently long time constant to hold a charge for the duration of a horizontal line. Consequently, the voltage which appears across resistor R_2 is set by the peak of the applied signal (tip of sync pulses) and, therefore, varies with changes in peak signal amplitude but not with changes in average brightness.

The positive composite signal from the separator-detector reaches the grid of the clipper through inductor L_1 and capacitor C_2. The clipper functions as a limiter-separator, and has the following limiter characteristics; reasonably low plate and screen voltages, cathode grounded, and long time constant grid circuit. Negative sync at the output of the clipper is fed into two channels, one path through a differentiating network, capacitor C_6 and resistor R_8, to the grid of the horizontal oscillator; a second path for the sync is through capacitor C_7 to the vertical sync amplifier.

The vertical sync circuit of the G.E.

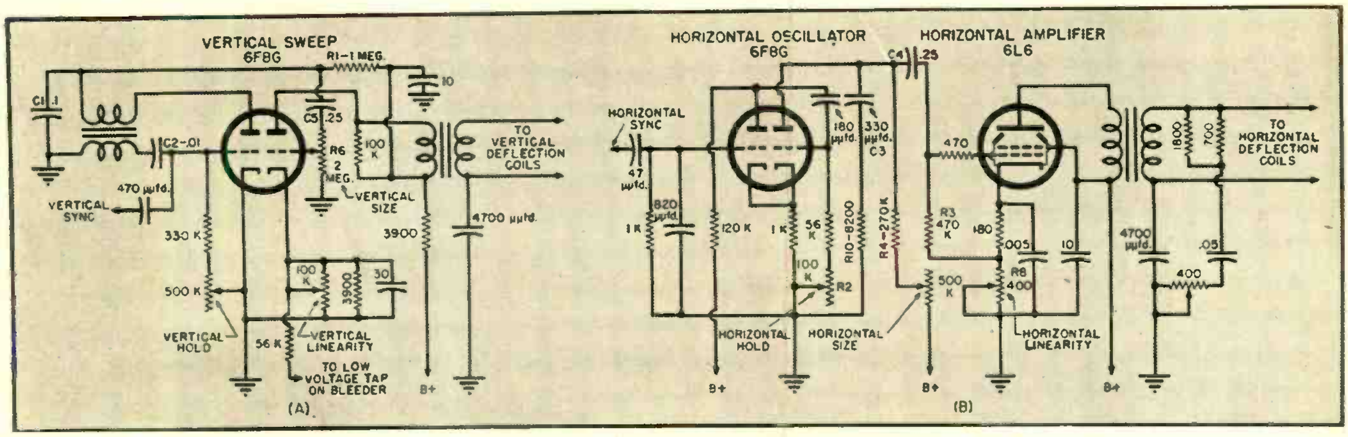


Fig. 1. Vertical and horizontal sweep circuits employed in G.E. Model 90 television receiver.

Model 90 is unusual because the trailing edges of the vertical pulses build up the charge which synchronizes the vertical oscillator. To understand this method, refer to the schematic and waveforms of Fig. 3.

Tube 1 is zero-biased (cathode grounded) and, therefore, with no applied signal it draws a high plate current through resistor R_1. When negative sync pulses are applied, waveform e_1, the pulse drives the grid rapidly to cut-off and capacitor C_1 begins to charge through large value resistor R_2 and small resistor R_1. The time constant of the resistor-capacitor combination (primarily R_2 and C_1) is long enough to prevent complete charging of the capacitor during the pulse intervals. However, it is a fact that the longer the tube is held at cut-off, the longer the capacitor continues to charge, and the greater the charge becomes. Thus, the capacitor charges to a higher level during the longer vertical interval.

Now at the end of a sync pulse interval, tube 1 is driven rapidly to the conducting level by the trailing edge of the pulse, and the high plate current drawn through resistor R_1 quickly removes the charge from the capacitor. A sharp negative pip appears across resistor R_4 during this discharge. When the capacitor charges, the current through resistor R_4 is relatively constant and small, but at the instant the capacitor discharges, a high discharge current flows through resistor R_4, developing a sharp high amplitude pip, waveform e_3. Of course, the capacitor has been charged to a higher level during the vertical pulse interval and the pip is correspondingly greater in amplitude.

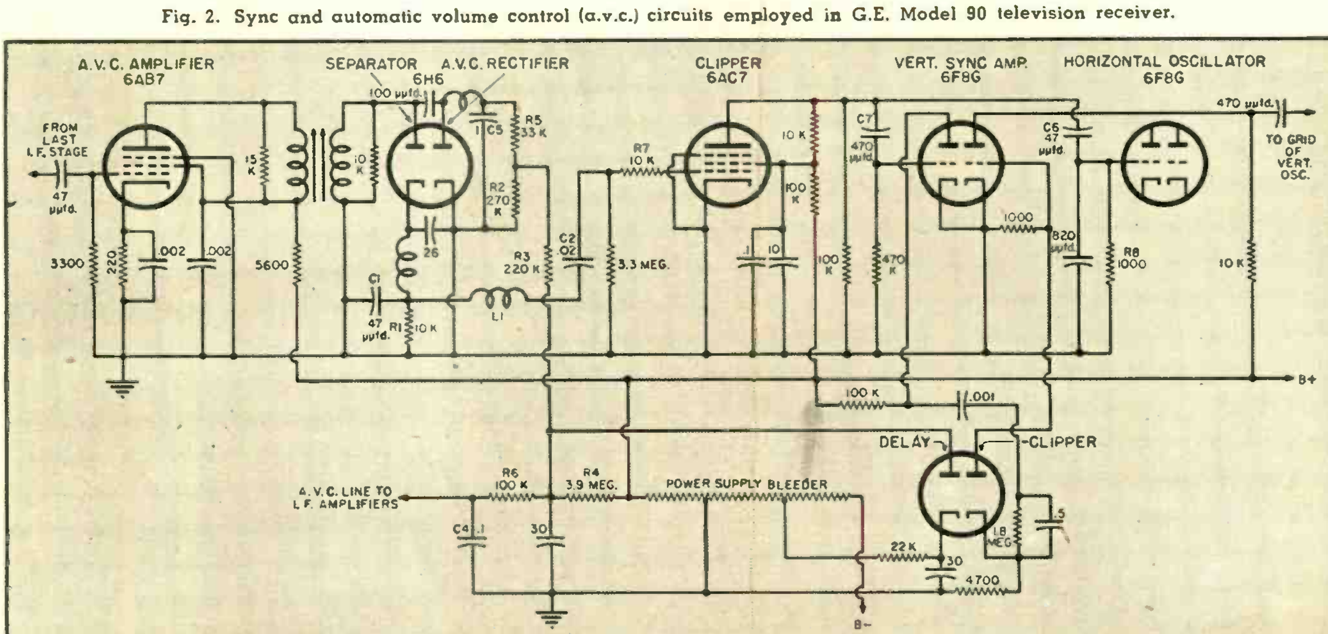
It is apparent the pips are greater for a vertical pulse, and if some means were employed to remove the lower amplitude pips, only the vertical pips would remain. This is the task undertaken by the diode, tube 2, and its associated long time constant combination C_2 and R_2. Thus, diode current flowing through resistor R_2 builds up an average voltage on capacitor C_2 which impresses a positive bias on the diode cathode which must be overcome before a pip of diode current flows through resistor R_3. Consequently, it is only during the high amplitude vertical pulses that a negative pip (e_4) appears across R_3 and on the grid of the tube. The negative pip is amplified by the triode, tube 3, and is present as a positive pulse across the output. Vertical sync amplifier and clipper of Fig. 2 functions in the same manner as the above discussed three tubes.

Saw-tooth Oscillators

Horizontal and vertical sync pulse outputs from the separators are coupled, through capacitors, to the corresponding horizontal and vertical sweep oscillators, Fig. 1. Positive vertical pulses charge capacitor C_2 and sync in the vertical oscillator; sharp negative horizontal pulses excite the grid of the number one multivibrator tube.

The frequency of the horizontal, multivibrator type, saw-tooth oscillator is controlled by potentiometer R_2 which adds or subtracts resistance from the grid discharge circuit. The amplitude of the saw-tooth (width of the scanning raster) is adjusted with the size control in the plate circuit of the second multivibrator section. The saw-tooth voltage, which is formed when capacitor C_3 charges through resistor R_4, is coupled through capacitor C_4 to the grid of the horizontal

Fig. 2. Sync and automatic volume control (a.v.c.) circuits employed in G.E. Model 90 television receiver.



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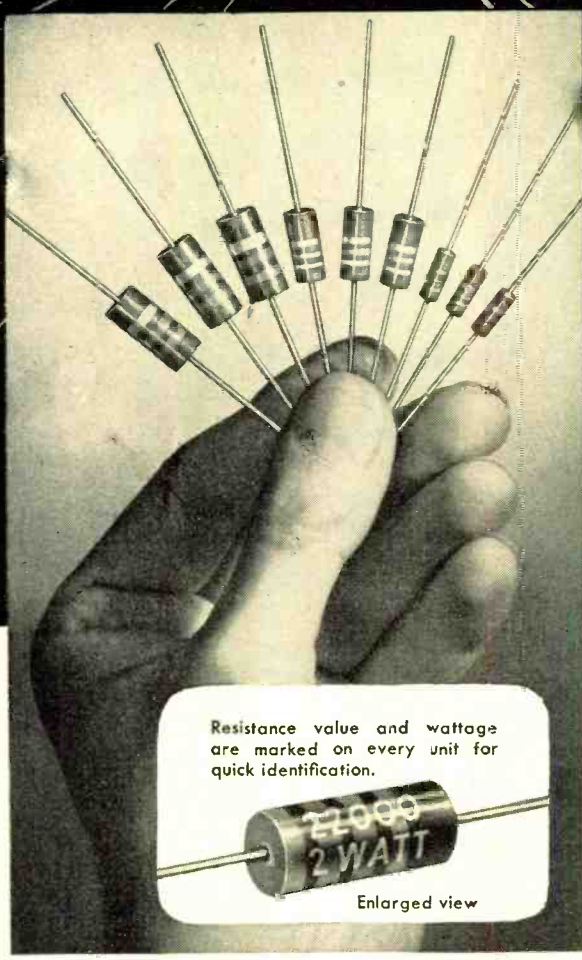

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AVAILABLE FROM STOCK IN STANDARD RMA 10% TOLERANCE VALUES

TYPE	SIZE		RESISTANCE RANGE	MAXIMUM VOLTS	LIST PRICE
	LENGTH	DIAM.			
½ Watt	⅜″	9/64″	10 Ohms to 22 Meg.	500	13c
1 Watt	9/16″	7/32″	10 Ohms to 22 Meg.	1000	17c
2 Watt	11/16″	5/16″	10 Ohms to 22 Meg.	3500	25c

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Ratings for maximum continuous RMS voltage drop are high: 500 volts for the ½ watt unit—1000 volts for the 1 watt unit—3500 volts for the 2 watt unit. Units have high insulation breakdown voltage.

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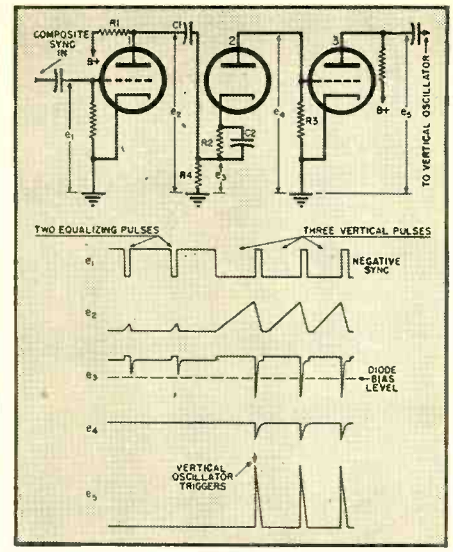


Fig. 3. Vertical sync circuits.

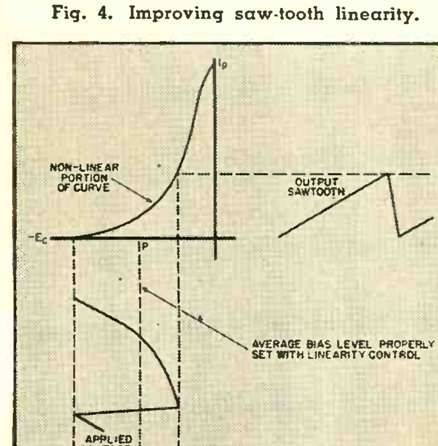
saw-tooth amplifier. Frequency of the vertical saw-tooth generator is controlled by the vertical hold potentiometer, which adds and subtracts resistance from the grid discharge circuit. Although in both vertical and horizontal circuits precise control of the saw-tooth frequency is a function of the sync pulses, the horizontal and vertical hold controls must be adjusted until the frequency comes within the range in which the sync pulses can lock-in the oscillators. The amplitude of the vertical saw-tooth (height of the scanning raster) is adjusted with the size control in the grid circuit of the vertical amplifier and determines amplitude of saw-tooth applied to amplifier. The saw-tooth voltage, developed across C_1, which charges through R_1, is coupled through C_5 to the grid of the vertical amplifier.

Sweep Amplifiers

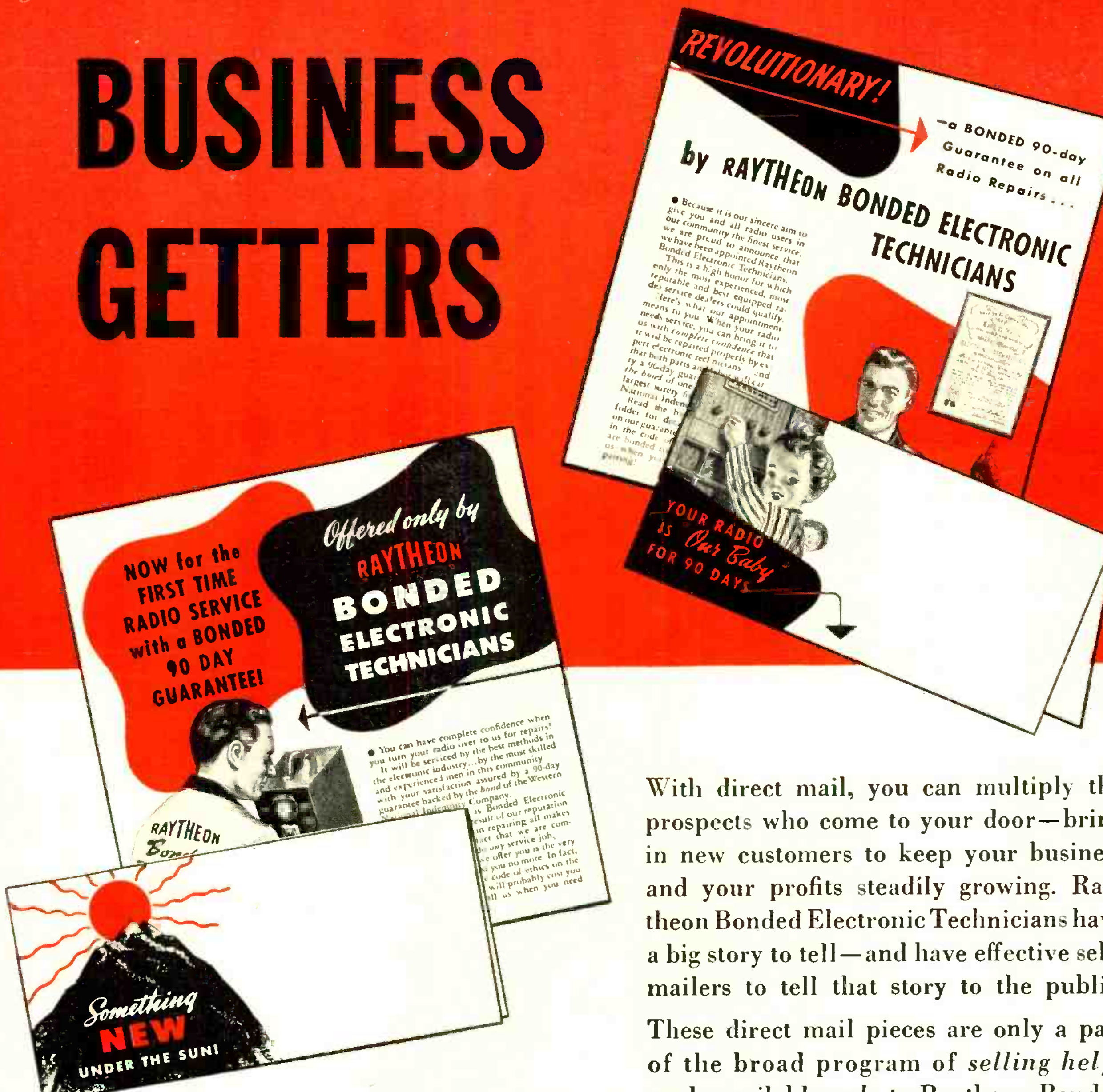
The vertical and horizontal saw-tooth amplifiers increase the amplitude, and improve the linearity of the saw-tooth voltages. Although rigid precautions are taken in the sweep generating circuits to form a linear sweep, there is always a small curvature which must be corrected. Final correction is made by proper adjust-

(*Continued on page* 144)

Fig. 4. Improving saw-tooth linearity.



BUSINESS GETTERS



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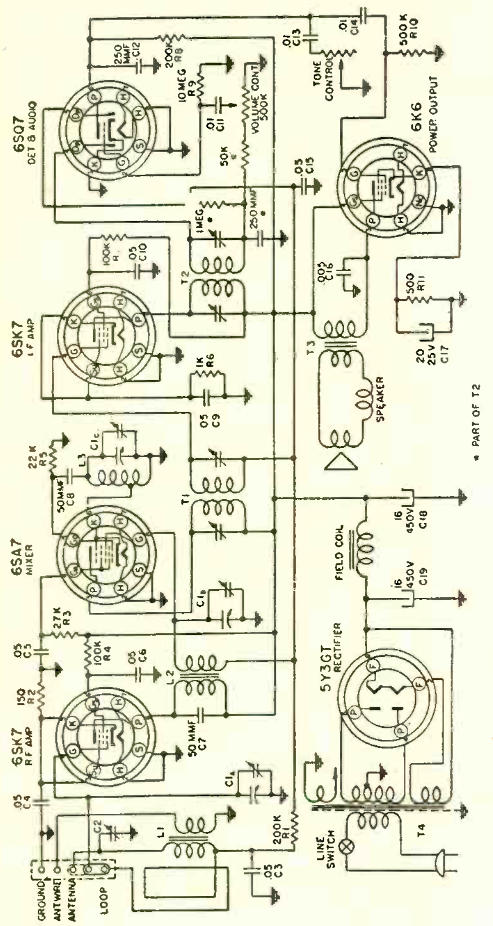
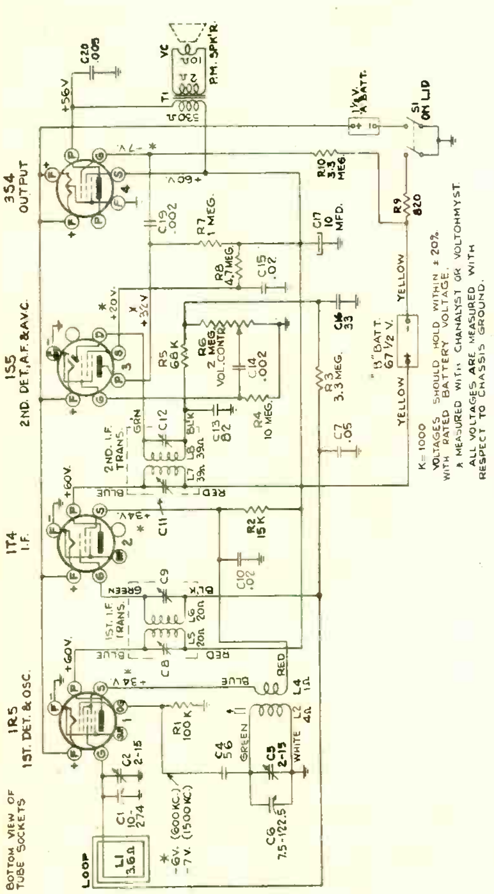
CIRCUIT FILE

This is the first presentation of a special service feature of Radio News, published for the benefit of radio technicians. Here, and on following pages, are circuit diagrams and parts lists of many new postwar radio receivers. In succeeding months Radio News will bring you other circuits.

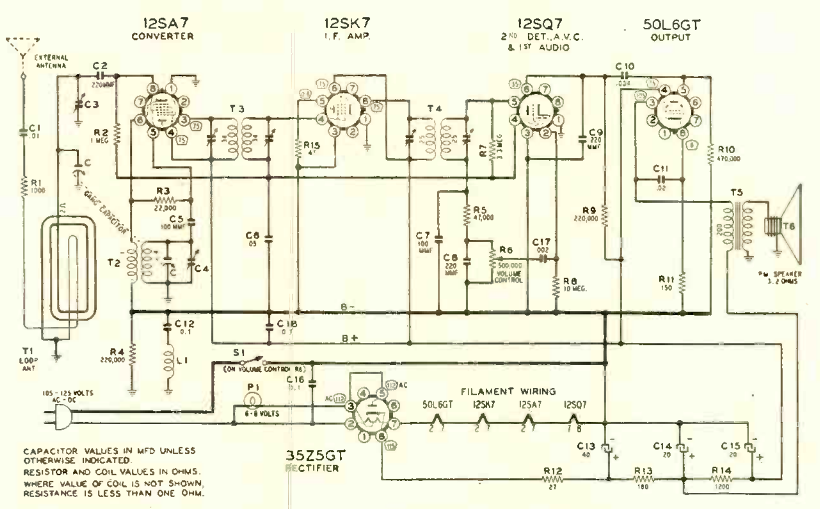
RADIO NEWS, MAY, 1946 — CLARION MODEL C104



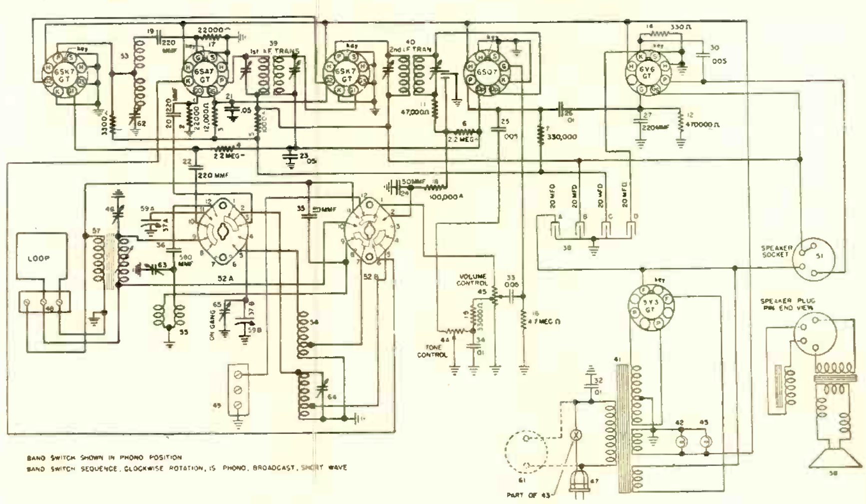
RADIO NEWS, MAY, 1946 — RCA MODELS 54B1, 54B1-N, 54B2, 54B3



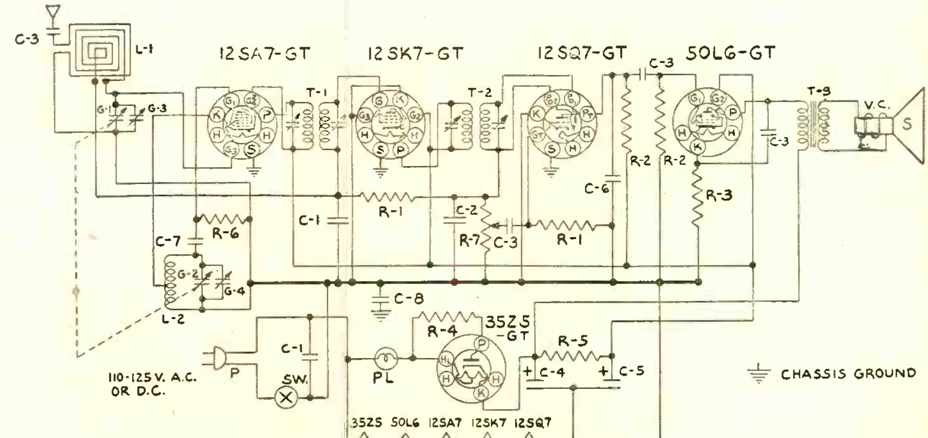
RADIO NEWS, MAY, 1946 — WARD MODELS 54BR-1503A, 1504A



RADIO NEWS, MAY, 1946 — CROSLEY MODELS 66CP, 66CA, 66CQ

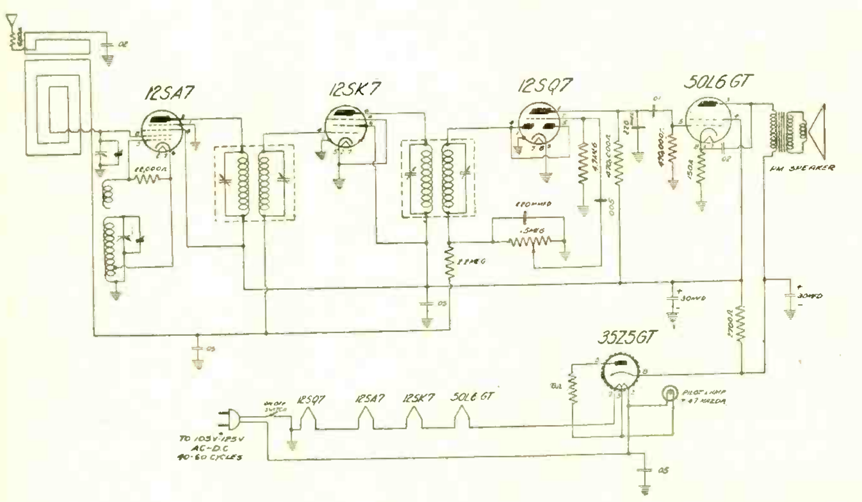


RADIO NEWS, MAY, 1946 — TRAV-LER KARENOLA MODEL 5000

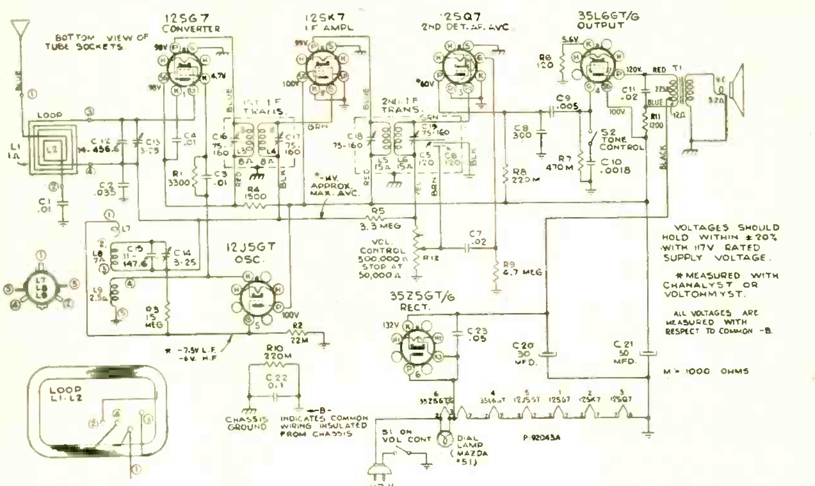


NOTE: After cutting along all dotted lines these circuits can be pasted on standard 3" x 5" file cards. You will now have the start of a ready-reference circuit file which will come in handy when new receivers begin to come into your shop. Here's a tip, it is easy to take the entire page cut of the book before you cut out the individual circuits by drawing a very sharp knife or razor blade down the page from top to bottom. If you simply try to tear the page out you will get a ragged edge or may tear into the diagrams. *Please do not request circuits which do not appear in this department. We will print circuits as quickly as possible after we receive them from the manufacturer.* We will appreciate your suggestions regarding this new Circuit File Department.

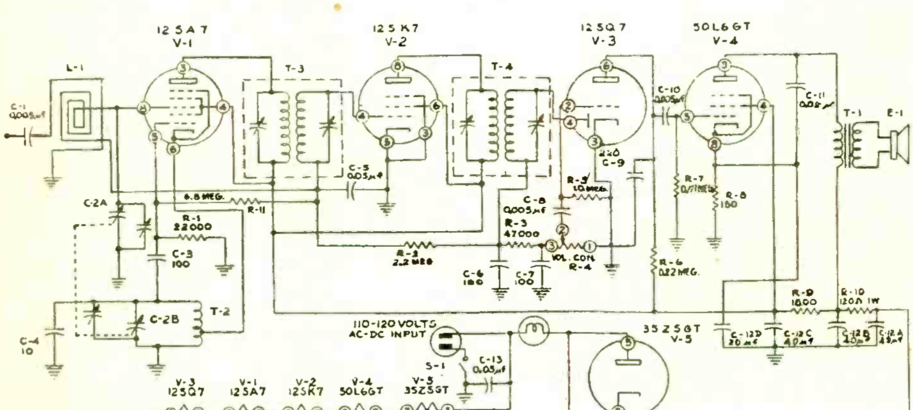
RADIO NEWS, MAY, 1946 — **DEWALD MODELS A500, A501, A502, A503**



RADIO NEWS, MAY, 1946 — **RADIOLA MODELS 61-1, 61-2, 61-3**

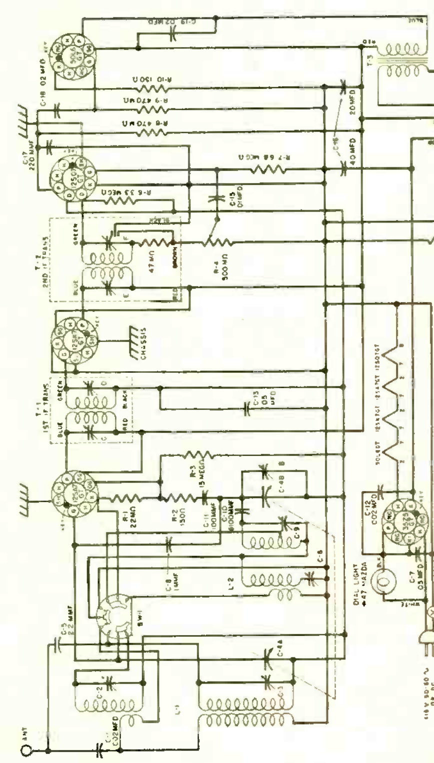


RADIO NEWS, MAY, 1946 — **TEMPLE MODELS E-510 TO E-519**



NOTES:
1. RESISTORS ARE IN OHMS, CAPACITORS ARE IN μμf, INDUCTORS ARE IN μH UNLESS OTHERWISE MARKED.
2. VOLUME CONTROL R-4 IS 0.5 MEGOHMS, WITH SWITCH S-1 MOUNTED ON REAR.
3. IN A FEW EARLY MODELS C-12D WAS A SEPARATE 25μf CAPACITOR, C-12A WAS 80μf, C-12C WAS 20μf AND R-11 WAS NOT USED.

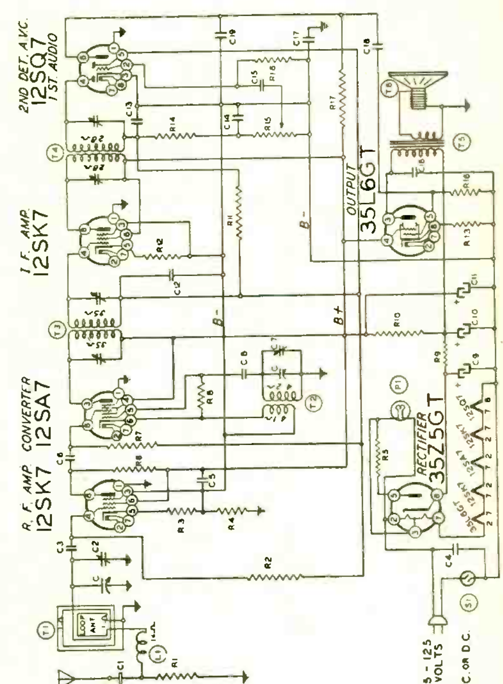
RADIO NEWS, MAY, 1946 — **DETROLA MODEL 568**



455 KC IF

ALL TUBE SOCKETS SHOWN FROM PIN END VIEW. SWITCH (SW-1) SHOWN IN COUNTERCLOCKWISE POSITION (SHORT WAVE POSITION).

RADIO NEWS, MAY, 1946 — **BELMONT MODEL 6D111**



Additional circuit diagrams are presented on page 66

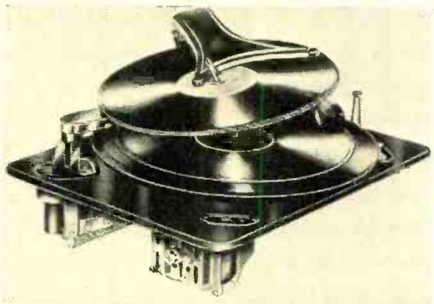
See page 76 for complete parts lists for these circuit diagrams. These parts lists should be cut out and pasted on the back of the 3" x 5" card on which the circuit diagram is pasted. In this way you will always have the circuit diagram and the parts list together in easy-to-read form.

What's New in Radio

RECORD CHANGER

The *Garrard Sales Corporation* of New York has recently announced a new addition to their line of fully automatic record changers, the Model RC 60.

This new record changer incorporates several patented *Garrard* features, namely, the non-slip record spindle and selector mechanism to handle mixed records in any combination, and automatic speed control.



This unit comes with a choice of a magnetic pickup for interchangeable needles or a new one-ounce crystal cartridge. This record changer is suitable for original installation or replacement in existing sets.

Further details of the Model RC 60 will be furnished to those requesting them from *Garrard Sales Corporation,* 401 Broadway, New York 13, New York.

CARDIOID CRYSTAL MICROPHONE

A new cardioid unidirectional crystal microphone, with high output and dual frequency response selection has been announced by *Electro-Voice, Inc.* of South Bend, Indiana.

This new Model 950 "Cardax" features wide angle front pickup but is dead at the rear. An exclusive "Mechanophase" principle of unidirectivity gives this microphone substantially reduced pickup of background noise and reverberation, while nearly doubling front pickup range. This principle also permits users more freedom of movement and allows increased loud speaker volume.

The microphone has a rugged die cast case finished in satin chrome, with built-in cable connector. A standard ⅝"-27 thread is included for stand mounting. Twenty feet of shielded cable comes with the microphone.

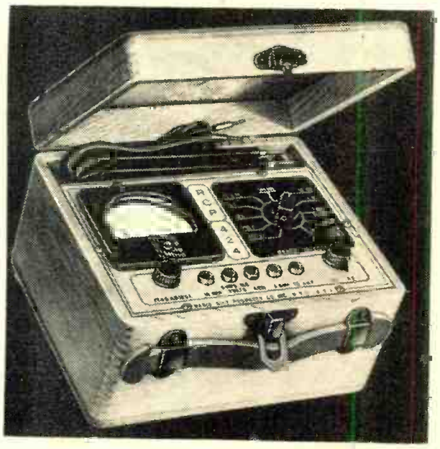
Further details of the "Cardax" Model 950 will be furnished by writing *Electro-Voice, Inc.* 1239 South Bend Avenue, South Bend 24, Indiana.

NEW V-O-M

Radio City Products Company has announced a new volt-ohm-milliammeter, Model 424.

This instrument uses a three inch meter with a sensitivity of 2500 ohm/volt and a movement of 400 microamperes.

Ranges for the unit are: d.c. voltmeter, 0-2.5-10-50-250-1000 volts; a.c. voltmeter, 0-10-50-250-1000 volts; d.c. milliammeter, 0-10-50-250-1000 ma.; ohmmeter, 0-500-10,000 ohms, 1-10 megohms; decibel meter, —10 to +15, —4 to +29, —18 to +43, —30 to +55. The decibel range is calibrated for a line of 500 ohm impedance. For lines of other impedances, correction charts are supplied.



This meter is available either as an open-faced instrument or as a portable unit in a hardwood case with handle. Both models are complete with self-contained batteries.

Details will be furnished by *Radio City Products Company,* 127 West 26th Street, New York, New York, upon request. Please specify Model 424.

COAXIAL SPEAKER

Jensen Radio Manufacturing Company of Chicago has announced the first of their new postwar series of coaxial speakers, the Type H.

The Type H Jensen Coaxial consists of two units, each reproducing a portion of the total frequency range. A compression-type high frequency unit is attached to the back of a 15 inch direct radiator low frequency unit. The horn for the high frequency unit is formed by a passage of expanding cross section through the core of the low frequency unit, the shaped diaphragm of the low frequency unit forming a continuation of the high frequency horn. The low frequency diaphragm is driven by a conventional voice coil assembly.

Full details of this speaker will be furnished to those requesting them from *Jensen Radio Manufacturing Company,* Chicago, Illinois. Be sure and specify type number when making inquiries.

DECADE VOLTAGE SUPPLY

An instrument which furnishes a.c. potentials of laboratory accuracy in 1/10 volt steps from 0-111 has been developed by *Clippard Instrument Laboratory* of Cincinnati.

This unit is designed for laboratory or production line use in testing and calibration of a.c. meters, vacuum tube voltmeters or other circuits where a known source of a.c. voltage is required.

This unit, the *Clippard* 60 Cycle Decade Voltage Supply, Type D.S. 111, incorporates a precision transformer of the true isolating type with a primary tapped to adjust within one tenth of one volt of line voltages from 100 to 132.

A Weston meter is placed in the secondary circuit for accuracy and is calibrated with a single red line to indicate proper primary voltage adjustment. When the primary is adjusted to 100 volts, the instrument may also be used as a variable ratio transformer provided input voltage do not exceed calibration settings.

Full information on this decade voltage supply will be forwarded upon request to *Clippard Instrument Labo-*

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833A HIGH POWER TRIODE

Taylor Tubes, Inc., of Chicago has announced a new improved 833A transmitting triode in the high-power classification.

This new tube is similar in almost every respect to the conventional 833A

but contains a zirconium-coated anode with the coating sprayed only on that part of the plate which is most subject to heat during operation.

Maximum signal outputs are: as class "B" modulators (pair), 2700 watts; as r.f. class "B" amplifier, telephony, 250 watts; as r.f. class "C" amplifier, plate modulated, 1500 watts; and as r.f. class "C" amplifier, telegraphy, 1600 watts.

Physical dimensions and electrical characteristics of this tube will be furnished upon request to *Taylor Tubes, Inc.,* 2312 Wabansia Avenue, Chicago, Illinois.

TESTING LIGHT

An inexpensive, all-purpose testing light for electric appliances, locating blown fuses, testing a.c. lines, checking polarity, tracing grounds in a.c. circuits, r.f. indicator, etc., is being marketed by the *Ne-O-Lite Mfg. Co.* of Rockford, Illinois, under the trade name Ne-O-Lite Electric Test-Lite.

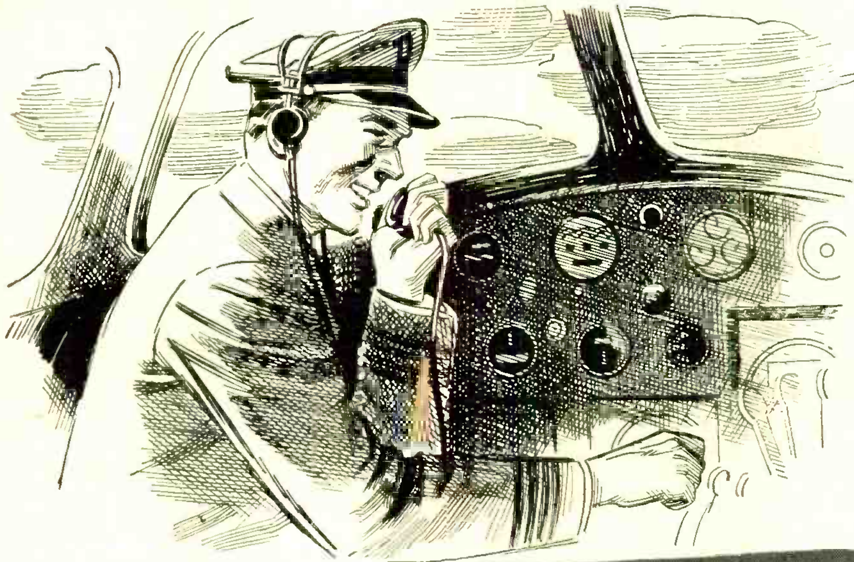
An improved construction features a new clear plastic tip and shell, insulated test points and improved body design. The unit will handle voltages from 60 volts, a.c. to 550 volts, a.c. or d.c. Variable light intensity indicates amount of voltage.

Information on this unit will be furnished promptly to those requesting it from *Ne-O-Lite Mfg. Co.,* Rockford, Illinois.

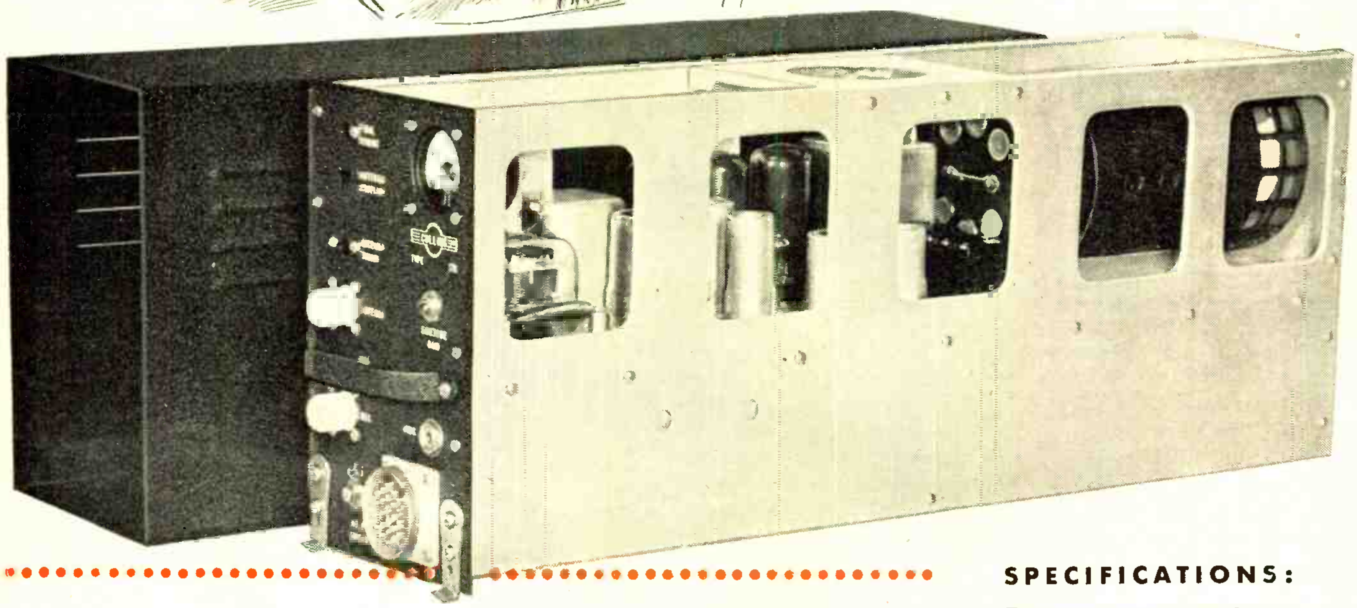
APPLIANCE TESTER

A single unit in which are combined all of the necessary tests for domestic electrical appliances has been an-

(*Continued on page* 147)



The Collins
17K-1 Transmitter



SPECIFICATIONS:

Frequency range: 122-132 mc.
Size: ½ ATR unit.
Total weight: less than 20 pounds.
Number of frequencies: five.
Frequency control: quartz crystals.
Power output: 5 watts minimum.
Type of emission: voice modulation.
Output impedance: 50 ohm concentric line.
Power source: 12 volts d-c or 26.5 volts d-c.

Lightweight VHF for Aircraft

The 17K-1 is a five frequency, crystal controlled radio transmitter for commercial and itinerant aircraft use in the 122-132 mc band. The complete transmitter, including a dynamotor power supply, is housed in a single ½ ATR unit cabinet. Transmitter, control box, and interconnecting cable weigh less than 20 pounds.

Remote control facilities allow complete freedom in locating the 17K-1 in the plane. An antenna transfer relay is available, if desired, in order to operate a receiver from the transmitting antenna.

The power output, adequate for the VHF range, is conservatively rated at 5 watts. Total power drain is held to a minimum during both stand-by and operation.

The audio circuit employs peak clipping to raise appreciably the effective modulation level and allow full use of the carrier power.

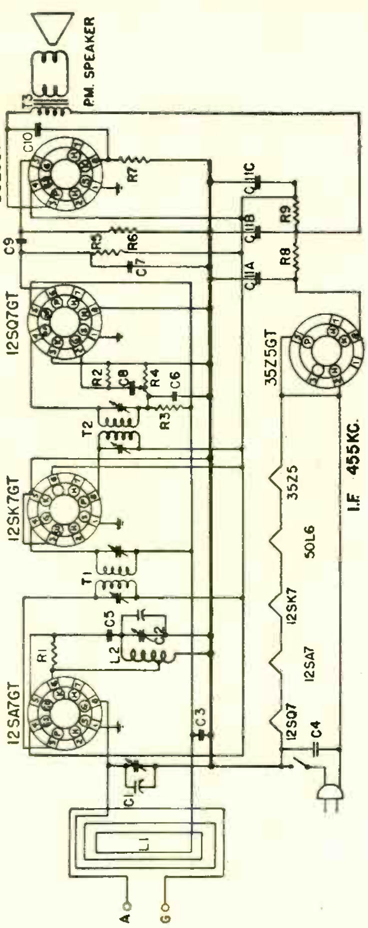
The 17K-1, thoroughly engineered and flight tested, enables its owners to obtain maximum benefit from the new VHF aircraft frequencies. Write today for early delivery. The Collins Radio Company, Cedar Rapids, Iowa; 11 West 42nd Street, New York 18, N. Y.

IN RADIO COMMUNICATIONS, IT'S . . . COLLINS

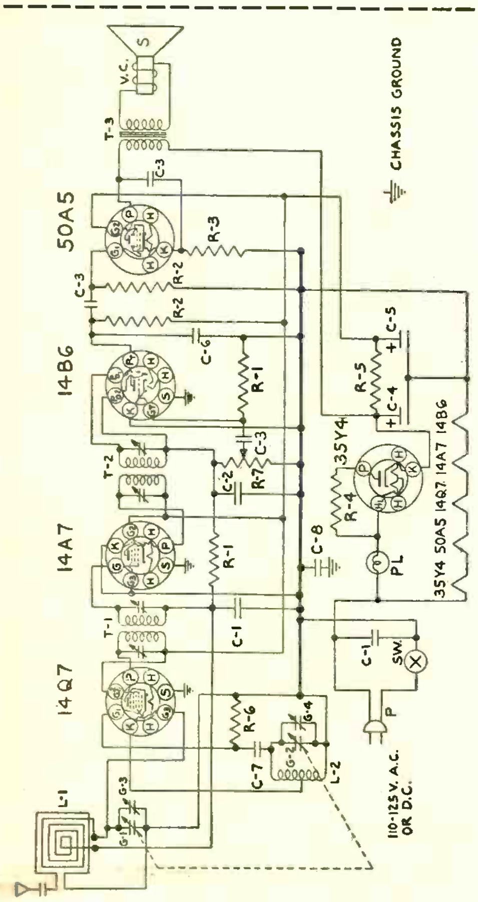
CIRCUIT FILE

(Continued from page 61)

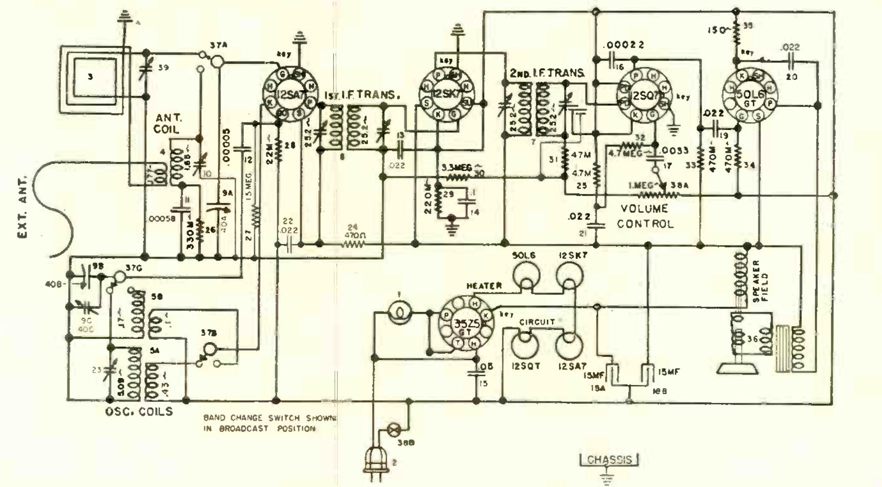
RADIO NEWS, MAY, 1946 — MECK MODELS 5C5, A, B, AND C



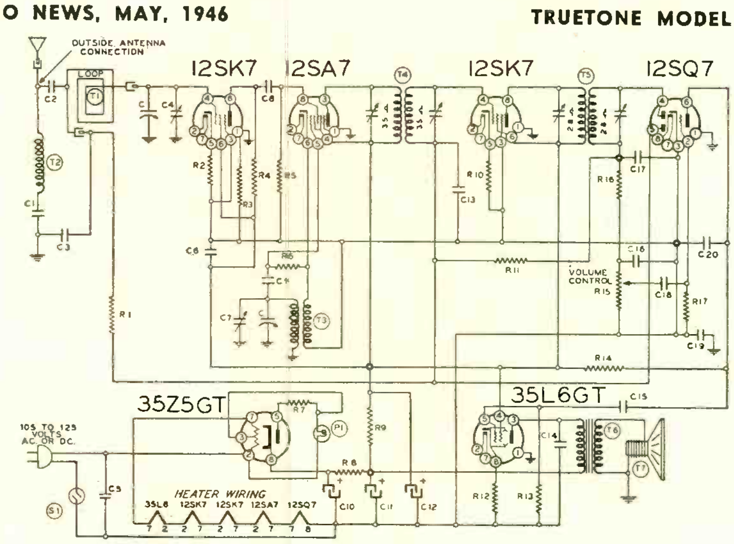
RADIO NEWS, MAY, 1946 — TRAV-LER KARENOLA MODEL 6000



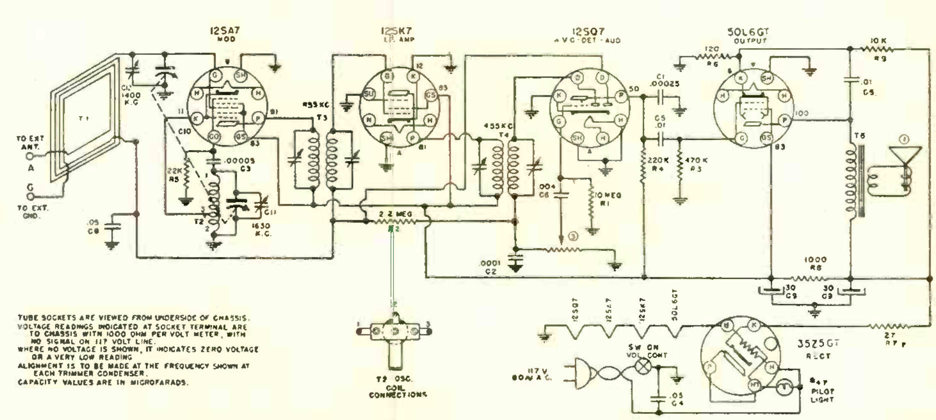
RADIO NEWS, MAY, 1946 — CROSLEY MODELS 56TA, 56TW, 56TC



RADIO NEWS, MAY, 1946 — TRUETONE MODEL 2615



RADIO NEWS, MAY, 1946 — CLARION MODEL C100



(For parts lists see page 76)

FM Service Techniques

(*Continued from page 37*)

tional tubes are rated at 1000 hours useful life, but in AM sets they may "sound good" or satisfy some set owners much longer.

Antennas Provide Starting Point for FM Service

Built-in antennas may serve the requirements of apartment dwellers in cities, but in rural areas many FM owners will quickly realize the importance and value of a good outside antenna installation. They will be willing to pay good prices for optimum FM reception, including a maximum selection of stations, which is available only with good antennas properly installed. In this way alert servicemen can begin to extend their service and their profits in the FM field by making sets perform satisfactorily as soon as they are purchased.

Through the sale of FM antennas and the labor of installing them, servicemen can learn where FM sets are located and what brands are purchased. During antenna installation servicemen will also be able to learn, from actual experience in the home, just how different brands of sets perform and note progress in FM chassis arrangements and tube complements. It is also just possible that new owners will request servicemen for instruction in FM set operation. Recent surveys show FM owners and non-owners consider high fidelity an outstanding FM feature, but that many owners apparently do not know how to tune sets for high fidelity results.

—30—

Test Oscillator

(*Continued from page 34*)

cillator with the cover removed showing the dial mechanism and the mounting of the various components. The extreme ruggedness of construction is again apparent and its importance to this type of equipment cannot be overemphasized.

Fig. 9 is the same view with the dial removed to better show the dial gearing. This gearing should be compared with the crude bevel gearing to operate the band switch, shown in Fig. 4. The idler gear between the knob shaft and the large butterfly gear is so adjusted as to preclude any backlash in the system. The large butterfly gear is connected by a shaft to a worm drive to the butterfly rotor shaft as shown in Fig. 13 which is a bottom view of the equipment. The butterfly rotor shaft is spring loaded to remove any play in the worm gearing.

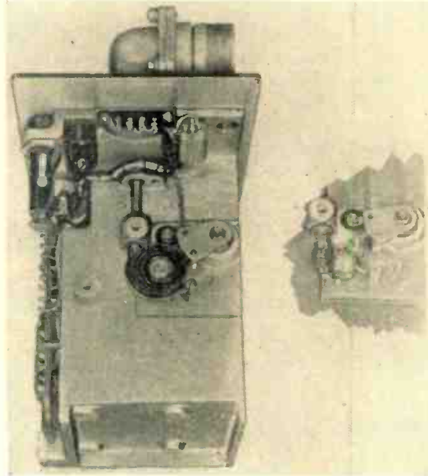


Fig. 13. Bottom view of test instrument.

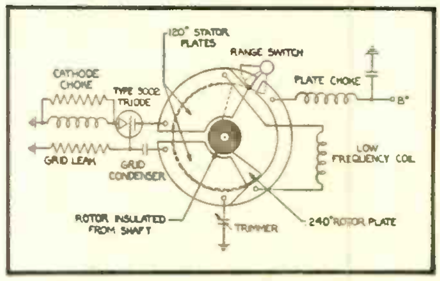
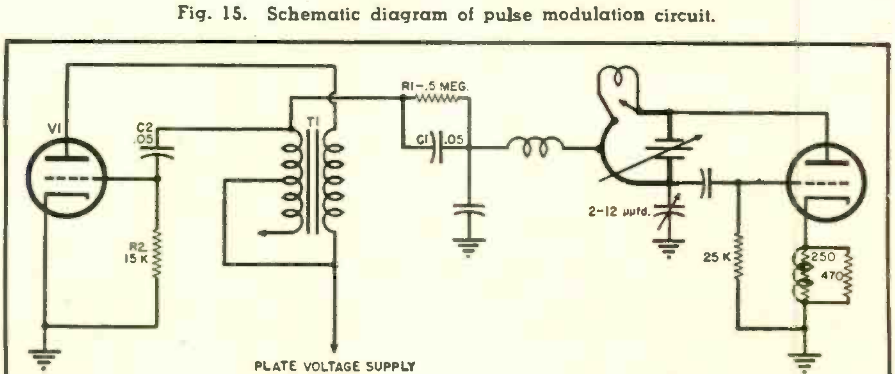


Fig. 14. Diagram of r.f. oscillator.

This oscillator is a good example of high frequency design for large quantity production. Careful study of the layout, as well as of the circuits used, will be of help to the experimenter planning to investigate seriously the very high frequency spectrum. As mentioned before, too much stress cannot be laid on the construction, and effort to secure component rigidity will be amply rewarded by simple and accurate operation. A test oscillator is used as an example of this, but it applies equally well to all high frequency equipment.

—30—

Fig. 15. Schematic diagram of pulse modulation circuit.



Class "C" GRID BIAS MODULATION

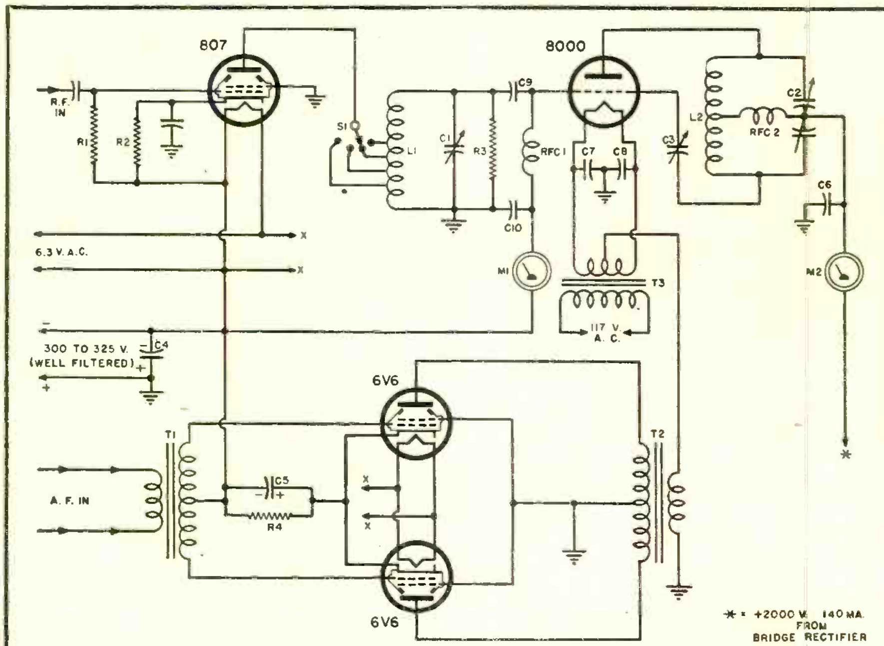
By W. W. SMITH, W6BCX

Part 2. Continuing our study of the design of some novel circuit innovations employed in class "C" grid bias modulation. Part 1 was covered last month.

IF THE r.f. driver is itself driven to saturation, which usually is the case if grid current is the rated normal value for c.w. service, a considerable variation in load impedance will produce but little change in r.f. voltage developed across the tank. If the tank is coupled to the grid of the modulated stage through relatively large coupling capacitors and the initial excitation adjustment is made by positioning the excitation tap, fairly good regulation will be had at the grid modulated stage without resorting to a "swamping resistor," or stabilizing load. However, the use of such a resistor nevertheless is recommended.

The swamping resistor may be made up of one or more of the inexpensive 10 watt, non-inductive wire-wound units, and is most effective when placed *between the grid excitation tap and r.f. ground,* because in this manner leakage effects are minimized. The optimum depends upon many factors, but as a general rule to follow, the resistance should be such that when the required excitation voltage is obtained the power dissipated in the resistor is between 2 per-cent and 4 per-cent of the d.c. input to the modulated stage. The former figure is satisfactory for triodes which are known to be easy to excite and the latter figure is more suitable for triodes which are known to be somewhat hoggish on excitation. Beam tetrodes and pentodes require less, 1 per-cent being a good design figure. The r.f. driver should be capable of delivering about twice the power required by the swamping resistor when running at normal grid current and preferably somewhat less than normal plate current. The latter condition will ensure inherently good regulation in the driver tube itself.

Fig. 1. Partial schematic diagram of an inexpensive 100-125 watt grid modulated transmitter (low-power stages omitted), incorporating several novel features discussed in the text. The use of r.f. driver plate voltage for bias on the modulated stage not only is economical, but actually results in improved performance.



C_1—Suitable for bands covered, 500 v. spacing providing high C Tank
C_2—Suitable for bands covered, split stator, 1 inch or wider air gap
C_3—10 μμfd. cond., .2 inch or wider air gap
C_4—16 μfd., 450 v. elect. cond.
C_5—25 μfd. 25 v. elect. cond.
C_6—.002 μfd. 5000 v. mica. cond.
C_7, C_8, C_9, C_{10}—.002 μfd. 1000 v. mica cond.
L_1—High C grid coil, tapped as described in text
L_2—250 w. rating tank coil, suitable for band (antenna coupling method optional)
M_1—0-15 ma. d.c. meter
M_2—0-200 or 0-250 ma. d.c. meter
R_1—100,000 ohm carbon, 1 w. res.
R_2—200 ohm, 2 w. res.
R_3—5000 ohm, non-inductive, 10 w. res.
R_4—250 ohm, 2 w. res.
RFC_1—2.5 mh. 125 ma. r.f. choke
RFC_2—1 mh. 250 ma. r.f. choke
T_1—Push-pull input (interstage) trans.
T_2—2.5 to 1 step-down ratio (total pri. to sec.), capable of handling 15 w. with 150 ma. d.c. in secondary
T_3—Filament trans., 10 v. at 4.5 amp.

Disadvantages of Link Coupling

Some readers undoubtedly have a preference for link coupling, and will wonder why it isn't advocated for a grid modulated stage. While link coupling into a grid modulated stage *can* be used satisfactorily, nothing is to be gained and more excitation power and more components are required. The inherently good regulation of a heavily driven driver stage is compromised when the output is link coupled, because the arrangement exhibits a "constant current" effect at the secondary.

If the frequency involved or mechanical considerations, such as distance between the r.f. driver and the modulated stage, make link coupling mandatory, then approximately twice the values of power indicated for capacitive coupling should be dissipated in the swamping resistor in order to provide adequate regulation of the r.f. drive, and the swamping resistor should be placed across the *grid* coil.

The A.F. Modulator

The conventional method of supplying audio power to the variable impedance, represented by the grid circuit of the modulated stage, is to employ much the same type of a.f. output stage as would be used to drive a class "B" modulator. And no one can deny that a pair of class "A" 45s or 2A3s coupled through a suitable transformer will do a good job. However, the leakage reactance of the coupling transformer may make it impossible to realize the full capabilities of the regulation inherent in the tubes.

Much more audio power can be obtained for the same outlay by using 6V6s or 6L6s. The hitch is their high plate resistance. But this can be cured by incorporation of inverse feedback and loading them with resistance. By placing this resistance across the *secondary,* the deleterious effects of leakage reactance in the transformer are minimized.

A method of providing a load for

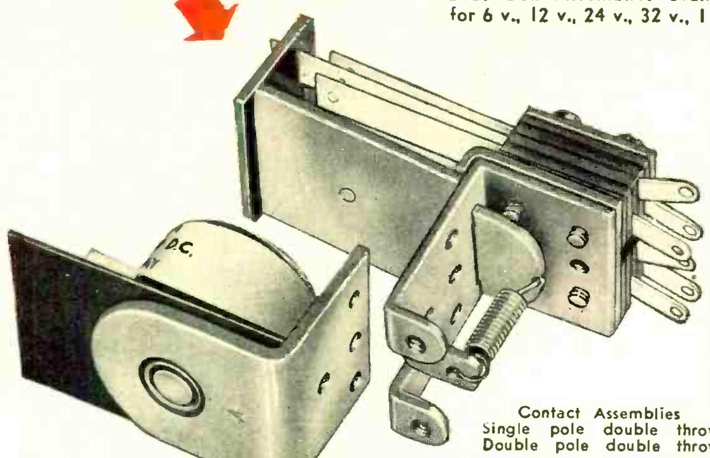
New! Series 200

A RELAY BY GUARDIAN with *Interchangeable Coils*

BUILT IN TWO PARTS

A.C. Coil Assemblies available for 6 v., 12 v., 24 v., 115 v.
D.C. Coil Assemblies available for 6 v., 12 v., 24 v., 32 v., 110 v.

★ Two basic parts—a coil assembly and a contact assembly—comprise this simple, yet versatile relay. The coil assembly consists of the coil and field piece. The contact assembly consists of switch blades, armature, return spring, and mounting bracket. The coil and contact assembly are easily aligned by two locator pins on the back end of the contact assembly which fit into two holes on the coil assembly. They are then rigidly held together with the two screws and lock washers. Assembly takes only a few seconds and requires no adjustment on factory built units.



Contact Assemblies
Single pole double throw
Double pole double throw

SERIES 200 RELAY

On Sale at Your Nearest Jobber NOW!

See it today! . . . this amazing new relay with interchangeable coils. See how you can operate it on any of nine different a-c or d-c voltages —simply by changing the coil. Ideal for experimenters, inventors, engineers.

TWO CONTACT ASSEMBLIES

The Series 200 is available with a single pole double throw, or a double pole double throw contact assembly. In addition, a set of Series 200 Contact Switch Parts, which you can buy separately, enables you to build dozens of other combinations. Instructions in each box.

NINE COIL ASSEMBLIES

Four a-c coils and five d-c coils are available. Interchangeability of coils enables you to operate the Series 200 relay on one voltage or current and change it over to operate on another type simply by changing coils.

Your jobber has this sensational new relay on sale now. Ask him about it. Or write for descriptive bulletin.

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the beam tube modulators which have inherent inverse feedback characteristics within the modulated stage is illustrated in Fig. 1. It should *not be confused with cathode modulation*, because the latter system implies an appreciable amount of plate modulation with respect to the amount of grid modulation. To achieve the amount of plate modulation required for conventional "cathode modulation," a tapped arrangement ordinarily is provided whereby only a small fraction of the voltage swing applied in series with the cathode is impressed upon the grid.

In the arrangement shown here, the full cathode voltage is applied to the grid, and the amount of plate modulation is only a very small fraction of the grid modulation, particularly if tubes of moderately high amplification factor are employed. For instance, with a tube having a mu of 30, the plate voltage modulation is only about 5 per-cent at 100 per-cent modulation, while in a typical "cathode modulated" stage the plate voltage modulation runs about 40 per-cent.

While on the subject of cathode modulation, it might be in order to point out what keeps the system from being head and shoulders above either plate modulation alone or grid modulation alone. The amount of audio power required for straight plate modulation varies as the *square* of the modulation percentage (expressed as a fraction). However, the audio power required for 100 per-cent modulation of a cathode modulated stage varies *directly* as the percentage plate modulation employed. Thus, while it takes only 8 watts of audio power to plate modulate 100 watts input 40 per-cent, it takes 20 watts of audio to provide 40 per-cent plate modulation in a 100 per-cent modulated cathode modulated stage running the same 100 watts input.

When it is considered that in addition to this, the plate input to a cathode modulated stage is higher than a plate modulated stage for the same carrier power, it becomes apparent why the system is not as economical and efficient as might appear at first glance. Actually it ranks about on a par with class "C" grid modulation and straight plate modulation as regards over-all equipment cost and operating expense per carrier watt. As cathode modulation is simply a compromise between the two, this is to be expected.

When cathode injection is used for grid bias modulation of a class "C" stage, the load impedance offered to the modulation transformer may be estimated closely by the following empirical formula:

$$\text{Impedance} = \frac{\text{Cut-off Bias} \times 1.6}{\text{D.C. Cathode Current}}$$

The power required for 100 per-cent modulation may be determined closely by the following:

$$\text{RMS Power} = \text{Cut-off Bias} \times \text{D.C. Cathode Current} \times 0.8$$

The impedance looking into the cath-

ode will in most cases fall between 200 and 2000 ohms. This requires a somewhat unusual transformer, one which is designed to handle a comparatively small amount of audio power, but capable of carrying through its secondary the full cathode current to the modulated stage.

A Practical Transmitter

The transmitter of Fig. 1, incorporating various features discussed in the preceding text, represents an economical design of a 100 to 125 watt grid modulated transmitter. Only the basic parts of the circuit are shown, the r.f. and a.f. "front ends" being left to the preference of the reader. The only care to be observed other than what would ordinarily be employed is to follow through with the same "hot cathode" arrangement on any additional stages so that the one 300 volt power pack can be employed for everything except the modulated stage.

The maximum carrier power which can be obtained up to 30 mc. without exceeding the plate dissipation of the tube will run between 110 and 130 watts, depending upon the distortion tolerated. Above 30 mc. the capacitive coupling arrangement to the modulated stage will become troublesome.

The use of cathode injection as a means of applying modulation to the control grid provides a load on the beam tube modulators that has an inherent inverse feedback characteristic, particularly if the tubes are worked into a plate-to-plate load slightly lower than that specified for maximum undistorted output. Cathode injection also makes good use of the audio power which would otherwise be wasted in a swamping resistor, by supplying a slight amount of plate modulation—not enough to qualify the system as "cathode modulated," but nevertheless enough to squeeze a few extra watts into the antenna for the same plate dissipation.

The excitation taps on the final amplifier grid coil (or do you want to call it the driver plate coil?) will have to be determined by cut and try. A 6 prong coil form permits 4 taps. The taps should be so placed that switching to an adjacent tap causes the plate current to the modulated stage to change approximately 10 per-cent. A good place to start is to try tapping down ⅓ of the way from the "hot" end for the first tap. A haywire "trial" coil with clip connection for the tap will permit quick determination of the data required for a finished coil.

Because of the relatively high voltage/current ratio of the high voltage power supply, it is most economically constructed as a bridge rectified affair, utilizing 5R4-GY rectifiers.

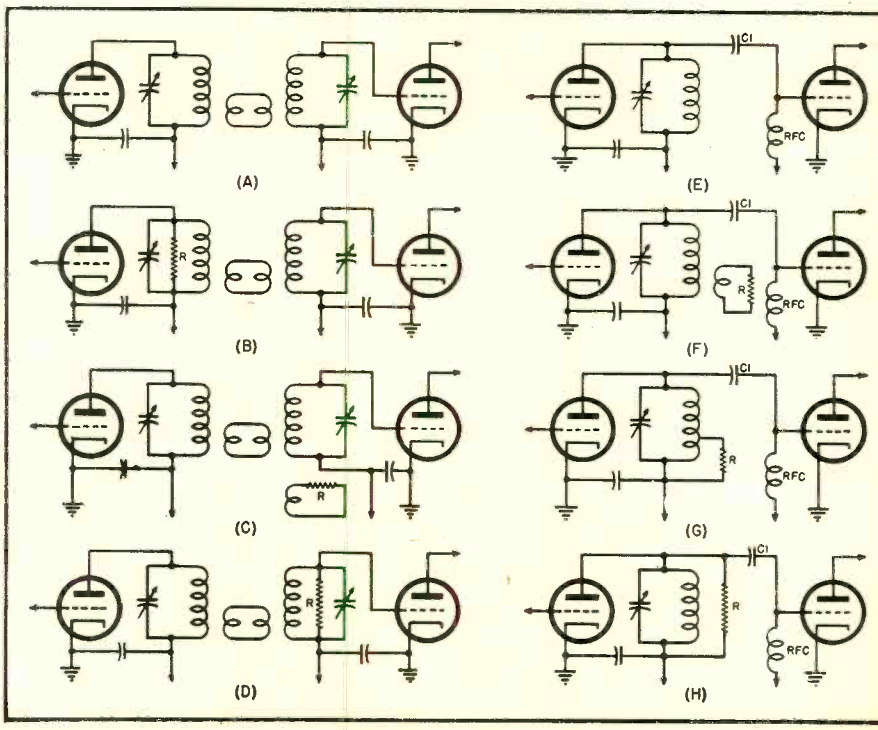
Standard Adjustment

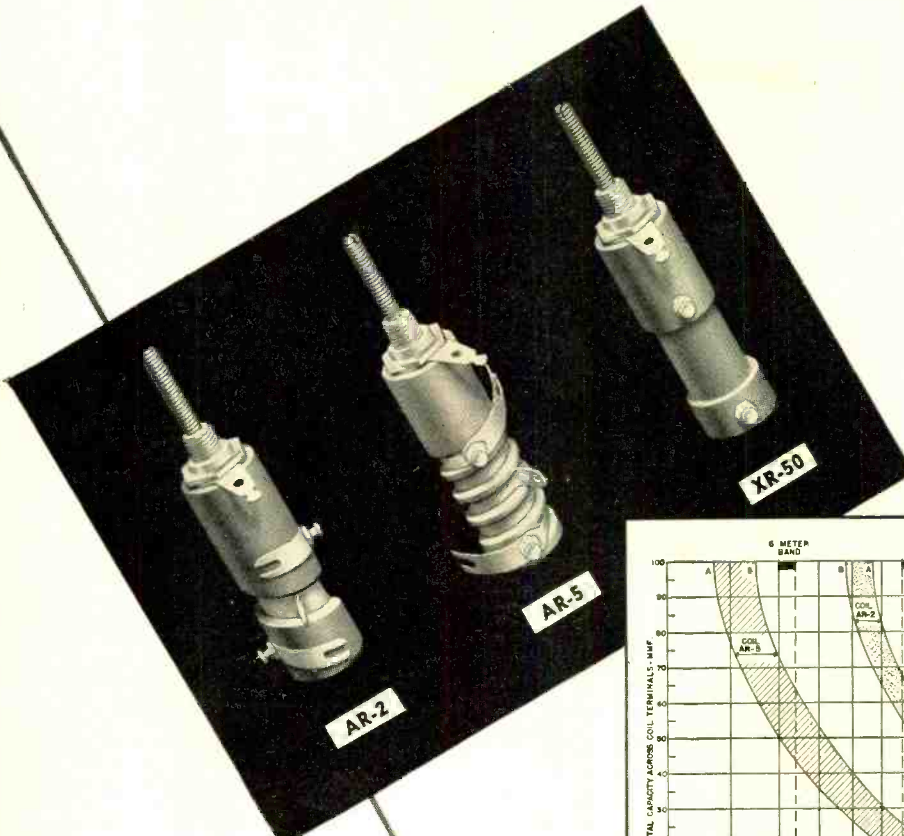
The adjustment of any class "C" grid bias modulated rig follows the same general pattern, though some individuals prefer to make adjustments from left to right while others insist upon right to left.

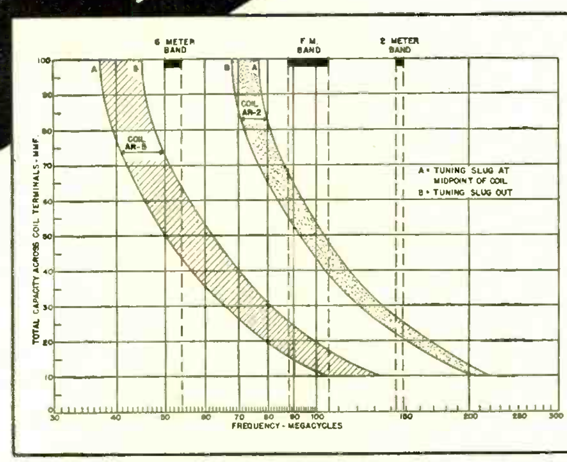
For any given value of antenna loading, there is a corresponding value of effective excitation voltage which, if exceeded, does not produce an appreciable increase in output. (*Effective* excitation voltage may be defined as the peak r.f. exciting voltage minus the difference between the operating

(*Continued on page* 129)

Fig. 2. Showing various types of common interstage coupling methods as regards r.f. driver regulation. The non-inductive "swamping" resistor, R, is assumed to be of such a value as to dissipate the same power in each case. The coupling condenser C_1 is assumed to be of low reactance (.001 to .002 μfd. for frequencies above 2 mc.).







Here are the postwar high frequency coils amateurs will need for work with the micro-waves. Originally designed to meet Navy requirements, these new high-Q units have adjustable inductance and give fine performance as high frequency oscillators, RF stages or frequency multipliers. Two coils are available covering the range from 37 to 220 Mc. A blank form, Type XR-50, may be wound as desired. All three are small and compact, and all are designed for convenient single-hole mounting.

NATIONAL COMPANY, INC., MALDEN, MASS. U.S.A.

Parts Lists

(FOR CIRCUIT DIAGRAMS APPEARING ON PAGES 60, 61 AND 66.)

CROSLEY—MODELS 66CP, 66CA, 66CQ

Part No.	Code and Description
39281-16	1—3300 ohm, ½ w. res.
39281-21	2—22,000 ohm, ½ w. res.
39016-38	3—12,000 ohm, 2 w. res.
39281-33	4—2.2 megohm, ½ w. res.
39040-13	5—1000 ohm, 1 w. res.
39281-33	6—2.2 megohm, ½ w. res.
39281-28	7—330,000 ohm, ½ w. res.
39281-23	11—47,000 ohm, ½ w. res.
39281-29	12—470,000 ohm, ½ w. res.
39015-19	14—330 ohm, 1 w. res.
39281-22	15—33,000 ohm, ½ w. res.
39281-35	16—4.7 megohm, ½ w. res.
39281-21	17—22,000 ohm, ½ w. res.
39281-25	18—100,000 ohm, ½ w. res.
39004-9	19, 20, 22, 27—220 μμfd., 500 v. mica. cond.
39001-41	21—.05 μfd., 400 v. cond.
39001-65	23—.05 μfd. 200 v. cond.
39004-5	24, 35—50 μμfd., 600 v. mica cond.
39001-11	25, 30, 33—.005 μfd., 600 v. cond.
39001-37	26—.01μfd., 400 v. cond.
W-30805	32—.01 μfd., 400 v. cond.
39001-61	34—.01 μfd., 200 v. cond.
GC-210685-143	36—580 μμfd., 300 v. mica cond.
B-134995	37A, 37B—var. cond.
B-132807	38A—20 μfd., 360 v. cond.
B-132807	38B—20 μfd., 275 v. cond.
B-132807	38C—20 μfd., 245 v. cond.
B-132807	38D—20 μfd., 25 v. cond.
AW-134065	39—First i.f. trans.
AW-134158	40—Second i.f. trans.
B-134625	41—Power trans.
W-43567	42, 43—Bulb (Dial light, Type 51, 715 v., .25 amp.)
B-135651	44—3 megohm, tone control
B-135859	45—1 megohm, vol. control & sw.
W-132267-1	46—Trimmer cond.
B-132300-1	47—Cable and plug (power)
39019-3	48, 49—Terminal Board Assembly
W-134968-1	51—Socket (speaker)
B-134639	52A, 52B—Sw (Band change)
AW-135907	53—r.f. coil assembly
AW-135908	54—Oscil. coil assembly
AW-135909	55—Antenna coil assembly
AW-135910	57—Antenna Loading Coil Assembly
B-134700	58—Speaker
B-132386-7	62, 63, 64—Cond. (trimmer)
R-135237	Cabinet (66CA)
R-134957	Cabinet (66CP)
R-134350	Cabinet (66CQ)
AC-135299	Ant. Loop Assembly (66CA)
AC-134782	Ant. Loop Assembly (66CP)
AC-135100	Ant. Loop Assembly (66CQ)
AB-134935	Floating Jewel Needle Assembly (66CP,66CQ)
AW-134793	Dial Face Assembly

RCA VICTOR—MODELS 54B1, 54B1-N, 54B2, 54B3

Part No.	Code and Description
3252	R_1—100,000 ohm, ¼ w. res.
36714	R_2—15,000 ohm, ¼ w. res.
12928	R_3, R_{10}—3.3 megohm, ¼ w. res.
30992	R_4—10 megohm, ¼ w. res.
14138	R_5—68,000 ohm, ¼ w. res.
70439	R_6—Vol. Control
30652	R_7—1 megohm, ¼ w. res.
30931	R_8—4.7 megohm, ¼ w. res.
14076	R_9—820 ohm, ¼ w. res.
70438	C_1, C_2, C_5, C_6—Var. tuning cond.
60954	C_4—56 μμfd., ceramic cond.
71013	C_7—.05 μfd., 400 v. cond.
70442	C_8, C_9, L_5, L_6—First i.f. trans.
70453	C_{10}, C_{15}—.02 μfd., 100 v. cond.
70437	C_{11}, C_{12}, L_7, L_8—Second i.f. trans.
65405	C_{13}—82 μμfd., ceramic cond.
70454	C_{14}, C_{19}—.002 μfd., 150 v. cond.
33111	C_{16}—33 μfd., ceramic cond.
36718	C_{17}—10 μfd., 60 v. elec. cond.
70627	C_{20}—.005 μfd., 600 v. cond.
70443	L_2, L_4—Oscil. coil
70440	T_1—Output trans.
70430	S_1—Power sw.

TRUETONE—MODEL D2615

Part No.	Code and Description
A-9B1-26	R_1, R_3—150,000 ohm, ½ w. res.
A-9B1-50	R_2—100 ohm, ½ w. res.
A-9B1-70	R_4—4700 ohm, ½ w. res.
A-9B1-25	R_5—100,000 ohm, ½ w. res.
A-9B1-82	R_6—47,000 ohm, ½ w. res.
A-9B1-42	R_7—22 ohm, ½ w. res.
A-9B2-54	R_8—220 ohm, 1 w. res.
A-9B2-63	R_9—1200 ohm, 1 w. res.
A-9B1-52	R_{10}, R_{12}—150 ohm, ½ w. res.
A-9B1-34	R_{11}—3.3 megohm, ½ w. res.
A-9B1-29	R_{13}—470,000 ohm, ½ w. res.
A-9B1-27	R_{14}—220,000 ohm, ½ w. res.
101211	R_{15}, S_1—1 megohm, vol. cont. & sw.
A-9B1-23	R_{16}—47,000 ohm, ½ w. res.
A-9B1-35	R_{17}—4.7 megohm, ½ w. res.
B-8A-10212	C, C_4, C_7—2-gang var. cond.
10011	C_1—.01 μfd., 400 v. cond.
129132	C_2—.000125 μfd., mica cond.
10026	C_3, C_{14}—.02 μfd., 400 v. cond.
1001	C_5—.1 μfd., 400 v. cond.
1006	C_6—.25 μfd., 200 v. cond.
2195	C_8, C_9, C_{17}, C_{20}—.0001 μfd., mica cond.
11994	C_{10}, C_{11}, C_{12}—40/20/20 μfd. elec. cond. (for 60 cycles)
11995	C_{10}, C_{11}, C_{12}—60/40/40 μfd. elec cond. (for 25 cycles)
1009	C_{13}—.05 μfd., 200 v. cond.
100106	C_{15}—.004 μfd., 600 v. cond.
12939	C_{16}—.00005 μfd., mica cond.
10025	C_{18}—.002 μfd., 600 v. cond.
100110	C_{19}—.2 μfd., 400 v. cond.
B-13E-10213	T_1, T_2—Loop antenna, complete with back and loading coil
A-13D-10215	T_3—Osc. and coil assembly
108140G	T_4—Input i.f. coil assembly
108145G	T_5—Output i.f. coil assembly
10595B	T_6—Output trans.
114191	T_7—5-inch PM speaker

BELMONT—MODEL 6D111

Part No.	Code and Description
A-9B1-70	R_1—4700 ohm, ½ w. res.
A-9B1-31	R_2—1 megohm, ½ w. res.
A-9B1-50	R_3—100 ohm, ½ w. res.
A-9B1-26	R_4—150,000 ohm, ½ w. res.
A-9B1-42	R_5—22 ohm, ½ w. res.
A-9B1-17	R_6—4700 ohm, ½ w. res.
A-9B1-25	R_7—100,000 ohm, ½ w. res.
A-9B1-23	R_8, R_{14}—47,000 ohm, ½ w. res.
A-9B2-53	R_9—180 ohm, 1 w. res.
A-9B2-63	R_{10}—1200 ohm, 1 w. res.
A-9B1-34	R_{11}—3.3 megohm, ½ w. res.
A-9B1-57	R_{12}—390 ohm, ½ w. res.
A-9B1-52	R_{13}—150 ohm, ½ w. res.
101218	R_{15}—1 megohm, vol. cont. & sw.
A-9B1-29	R_{16}—470,000 ohm, ½ w. res.
A-9B1-27	R_{17}—220,000 ohm, ½ w. res.
A-9B1-35	R_{18}—4.7 megohm, ½ w. res.
B-8A-10211	C_2—Gang var. cond.
10025	C_1, C_{15}—.002 μfd., 600 v. cond.
1292	C_3—.0005 μfd., mica cond.
1001	C_4—.1 μfd., 400 v. cond.
1006	C_5—.25 μfd., 200 v. cond.
1295	C_6, C_8, C_{19}—.0001 μfd., mica cond.
11994	C_9, C_{10}, C_{11}—40/20/20 μfd. 150 v. cond. (60 cycles)
11995	C_9, C_{10}, C_{11}—60/40/40 μfd. cond., 150 v. (25 cycles)
1009	C_{12}—.05 μfd., 200 v. cond.
129161	C_{13}, C_{14}—.0001 μfd. dual cond.
10026	C_{16}—.02 μfd., 400 v. cond.
100110	C_{17}—.2 μfd., 400 v. cond.
100106	C_{18}—.004 μfd., 600 v. cond.
12310	L_1—Load coil
B-13E-10242	T_1—Loop ant. asembly
A-13D-10215	T_2—Osc. coil
108140	T_3—Input i.f. coil, 455 kc.
108145	T_4—Output i.f. coil, 455 kc.
105104	T_5—Output transformer for speaker
114197	T_6—5-inch PM speaker

CLARION—MODEL C100

Part No.	Code and Description
	R_1—10 megohm, ¼ w. res.
	R_2—2.2 megohm, ¼ w. res.
	R_3—470,000 ohm, ¼ w. res.
	R_4—220,000 ohm, ¼ w. res.
	R_5—22,000 ohm, ¼ w. res.
	R_6—120 ohm, ¼ w. res.
	R_7—27 ohm, ¼ w. res.
	R_8—1000 ohm, ½ w. res.
	R_9—10,000 ohm, 1 w. res.
	C_1—.00025 μfd. mica cond.
	C_2—.0001 μfd. mica cond.
	C_3—.00005 μfd. mica cond.
	C_4—.05 μfd., 400 v. cond.
	C_5—.01 μfd., 400 v. cond.
	C_6—.004 μfd., 400 v. cond.
	C_7
	C_8—.05 μfd., 200 v. cond.
18-266	C_9—30/30 μfd., 150 v. elec. cond.
19-177	C_{10}, C_{11}, C_{12}—2 gang var. cond.

New Tetrode for Fixed or Mobile Use

The New AT-340

Lewis AT-340 is a rugged and versatile 150 w. class beam tetrode to simplify transmitter circuit design and with extremely low driving power requirements. AT-340 accomplishes this at low "per-hour" cost by conservative ratings and careful manufacture.

A minimum of structural insulation support enables operation under maximum conditions to 120 mc and permits high dissipation with a relatively small bulb cooled by convection only.

Lewis builds transmitting, rectifying, industrial or special purpose vacuum tubes to your specifications.

Tubes and catalogs are now ready.

MAXIMUM RATINGS

Class "C" Radio Frequency

Power Amplifier
and Oscillator

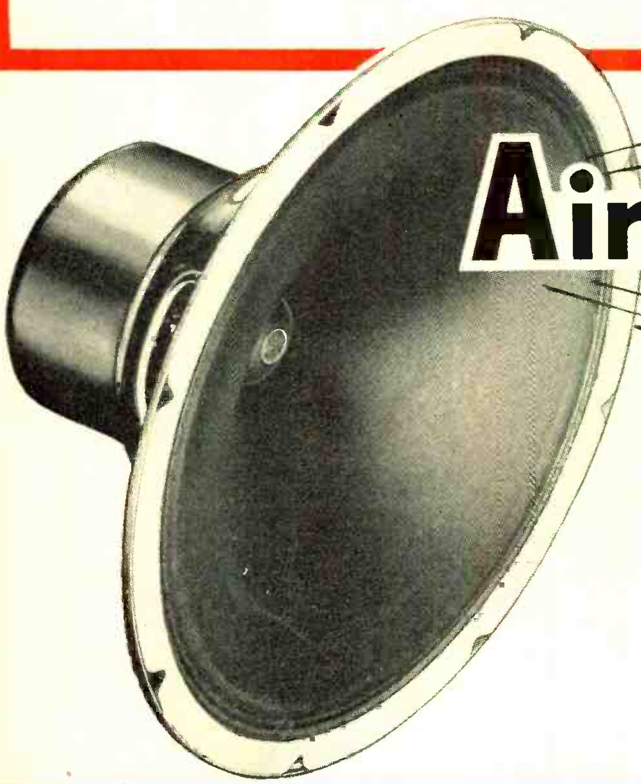
D-C Plate Voltage	4000 volts
D-C Plate Current	225 ma
Plate Input	750 watts
Plate Dissipation	150 watts

To 120 Megacycles

Filament

5.0 volts	7.5 amperes

The AT-340 has a 5-pin metal sleeve base and top plate connection. Filament is thoriated tungsten at 37.5 watts, plate is molybdenum, dark body.



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Aireon AND Cinaudagraph Speakers

The enviable reputation which Cinaudagraph Speakers have attained for high fidelity, superior performance and ruggedness will be extended through the exceptional research, engineering and production facilities of Aireon. Acceptance of Cinaudagraph Speakers by leading radio manufacturers is assurance of their high fidelity performance.

A complete line of speakers from 2-inch units for portable radios to 15-inch models for commercial phonographs and P.A. systems is available. Write us about your speaker requirements.

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Speakers, Inc.
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82-30	T_1—*Loop antenna*
10-394	T_2—*Osc. coil*
10-369	T_3—*First i.f. trans.*
10-370	T_4—*Second i.f. trans.*
8—212	T_5—*Output trans. used with 79-307a speaker*

CROSLEY—MODELS 56TA, 56TW, 56TC

Part No.	Code and Description
W-48858	*1—Dial Light, 6.3 v.*
C-132300-1	*2—Power cable & plug*
C-132300-1	*3—Ant. Loop*
AW-134994	*4—h.f. ant. coil*
AW-134993	*5A, 5B—b.c. osc. coil h.f. osc. coil*
AW-134065	*6—First i.f. trans.*
AW-134158	*7—Second i.f. trans.*
B-134995	*9A, 9B—var. cond.*
AB-135088	*10—h.f. ant. trimmer*
GC-210685-143	*11—580 μμfd., 300 v. mica cond.*
39004-5	*12—50 μμfd., mica cond.*
39001-63	*13, 19, 20, 21, 22—.022 μfd. 200 v. cond.*
39001-67	*14—.1 μfd., 200 v. cond.*
39001-65	*15—.05 μfd., 200 v. cond.*
39004-9	*16—220 μμfd. mica cond.*
39001-10	*17—.0033 μfd., 600 v. cond.*
W-134177	*18A—15 μfd., 140 v. cond.*
W-134177	*18B—15 μfd., 120 v. cond.*
Part of No. 10	*23—b.c. osc. trimmer*
39281-11	*24—470 ohm, ½ w. res.*
39281-17	*25—4700 ohm, ½ w. res.*
39281-28	*26—330,000 ohm, ½ w. res.*
39281-38	*27—15 megohm, ½ w. res.*
39281-21	*28—22,000 ohm, ½ w. res.*
39281-27	*29—220,000 ohm, ½ w. res.*
39281-34	*30—3.3 megohm, ½ w. res.*
39281-23	*31—47,000 ohm, ½ w. res.*
39281-35	*32—4.7 megohm, ½ w. res.*
39281-29	*33, 34—470,000 ohm, ½ w. res.*
39281-8	*35—150 ohm, ½ w. res.*
GC-49675-9	*36—Speaker*
49772-5	*37A, 37B, 37C—Band Change sw.*
C-46846-6	*38A, 38B—Vol. control, power sw.*
Part of No. 3	*39—b.c. ant. trimmer*

RADIOLA—MODELS 61-1, 61-2, 61-3

Part No.	Code and Description
30733	R_1—*3300 ohm, ¼ w. res.*
30492	R_2—*22,000 ohm, ¼ w. res.*
38785	R_3—*15 megohm, ¼ w. res.*
30654	R_4—*1500 ohm, ¼ w. res.*
12928	R_5—*3.3 megohms, ¼ w. res.*
30189	R_6—*120 ohm, ¼ w. res.*
30648	R_7—*470,000 ohm, ¼ w. res.*
14583	R_8, R_{10}—*220.000 ohm, ¼ w. res.*
30931	R_9—*4.7 megohm, ¼ w. res.*
6134	R_{11}—*1200 ohm, 1 w. res.*
36242	R_{12}, S_1—*Vol. cont., power sw.*
70652	C_1, C_3, C_4—*.01 μfd., 800 v. cond.*
70635	C_2—*.035 μfd., 500 v. cond.*
70412	C_5, C_6, C_{18}, C_{19}, L_5—*Second i.f. trans.*
70711	C_7, C_{11}—*.02 μfd., 700 v. cond.*
39640	C_8—*330 μμfd., mica cond.*
70627	C_9—*.005 μfd. cond.*
70712	C_{10}—*.0018 μfd., 800 v. cond.*
36226	C_{12}, C_{13}, C_{14}, C_{15}—*Var. tuning cond.*
70411	C_{16}, C_{17}, L_3, L_4—*First i.f. trans.*
39152	C_{20}, C_{21}—*30/50 μfd., 150 v. elec. cond.*
70617	C_{22}—*.1 μfd., 400 v. cond.*
70615	C_{23}—*.05 μfd., 400 v. cond.*
39821	L_1, L_2—*Antenna loop*
39824	L_7, L_8, L_9—*Osc. coil*
36800	T_1—*Output trans.*

WARDS—MODELS 54BR-1503A, 1504A

Part No.	Code and Description
C-9B1-13	R_1—*1000 ohm, ½ w. res.*
C-9B1-31	R_2—*1 megohm, ½ w. res.*
C-9B1-78	R_3—*22,000 ohm, ½ w. res.*
C-9B1-90	R_4, R_9—*220,000 ohm, ½ w. res.*
C-9B1-82	R_5—*47,000 ohm, ½ w. res.*
A-10A-10075	R_6, S_1—*500,000 ohm vol. cont. & sw.*
C-9B1-34	R_7—*3.3 megohm, ½ w. res.*
C-9B1-37	R_8—*10 megohm, ½ w. res.*
C-9B1-94	R_{10}—*470,000 ohm, ½ w. res.*
C-9B1-52	R_{11}—*150 ohm, ½ w. res.*
C-9B1-43	R_{12}—*27 ohm, ½ w. res.*
C-9B2-53	R_{13}—*180 ohm, 1 w. res.*
C-9B2-63	R_{14}—*1200 ohm, 1 w. res.*
C-9B1-5	R_{15}—*47 ohm, ½ w. res.*
B-210-10040	C, C_3, C_4—*2-gang capacitor assembly, including ant. and osc. trim.*
C-8D-10761	C_1—*.01 μfd., 400 v. cond.*
C-8F3-10	C_2, C_8, C_9—*220 μμfd., 500 v. cond.*
C-8F3-8	C_5, C_7—*100 μμfd., 500 v. mica cond.*
C-8D-10770	C_6—*.05 μfd., 200 v. cond.*
C-8D-10788	C_{10}—*.004 μfd., 600 v. cond.*
C-8D-10772	C_{11}—*.02 μfd., 600 v. cond.*
C-8D-10760	C_{12}, C_{16}—*.1 μfd., 400 v. cond.*

OL' PROF. SQUEEGEE DID THE JOB

... way back when

Professor Oswald Z. Squeegee is peeved. Extracts from a recent letter carefully typed on asbestos paper and perfumed with brimstone follow: "Listen here, you jerks. Isn't it about time I got credit as the first man, or reasonable facsimile thereof, ever to smash the Atom? Blow the dust off your files and you'll find I did the job way back in 1940 long before most folks even knew an atom from a dehydrated potato . . ."

And ol' Prof. Squeegee is right! Herewith is reprinted the Sprague advertisement of almost six years ago wherein mention was first made of his startling achievement. Credit where credit is due!

(NOTE: Sprague Atoms are even better today than when Prof. Squeegee performed the now famous experiment. Would he accept a challenge to repeat it now?)

PROFESSOR SQUEEGEE SMASHES THE ATOM

After walking to his desk, Professor Oswald Z. Squeegee, PDQ., COD, carefully wound his watch, dropped it into the cuspidor and tucked his chew into his vest pocket. Then he faced the eager, upturned faces of his class.

"Listen to me, you intolerable numbskulls," he shouted. "Today we're going to study the Atom. What's more, we're going to smash the Atom right here in this room. S'help me!"

The Professor paused, reached for a coughdrop, got an eraser by mistake and chewed it vigorously. Then he cleared his throat and continued:

"The Atom, as you ought to know but probably don't, is the unit of all matter. It is the alpha of everything—the smallest, theoretically indivisible portion into which anything can be divided and still maintain its identity. In that respect, it is a good bit like the salaries most of you will earn when you graduate—if you ever do.

"How to smash the Atom has long puzzled scientists, including myself. However, we won't go into that today. Instead, we'll deal with an entirely different type of Atom—the Sprague Atom Dry Electrolytic Condenser, appropriately named for its small size and great durability. This, however, is a type of Atom that *can* be smashed. What's more I'm gonna smash it!"

After ten minutes search, the Professor finally found an 8 mfd. 450 volt Sprague Atom in his cigar case—also a similar midget dry electrolytic of another make. These he connected into a weird electrical circuit on his desk. Then he slowly turned on the juice.

"Now," he gloated, "both condensers are rated at 450 volts and that's exactly what they're getting. As you see, nothing happens. We'll step the voltage up to 500. Now up to 525. Note that the other condenser is beginning to sizzle, although the Atom is still in good shape. Here we go to 550 volts—now to 575—now to—goodness me!"

There came an explosion not unlike that of a giant firecracker and the heads of the class suddenly disappeared beneath their desks.

"You're all wrong," shouted the Professor gleefully after order had been restored. "You thought I smashed the Atom—but I didn't. It was the other condenser that blew up—not the Atom."

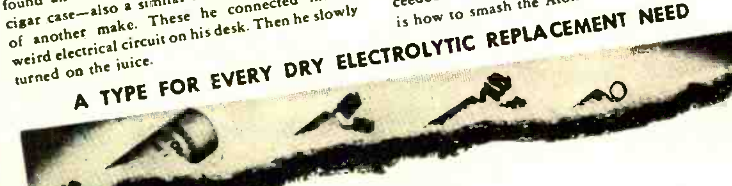
Sure enough, the Atom on the desk was still connected—now hissing a bit under the strain of over 600 volts but functioning perfectly.

"The Atom," continued the professor, "is especially protected against blow-outs—against moisture, heat and whatnot. The way to smash the Atom is not merely a matter of overloading it. The way to smash the Atom is this."

The professor grasped an axe hung over a sign "Use only in case of fire." Swinging this with the skill of a woodchopper and shouting wildly all the while he brought the blunt end down on the Atom—again and again and again.

"There!" he screeched, gleefully looking at the shattered remains. "We've done it. We've succeeded where others have failed. That, gentlemen, is how to smash the Atom. Class dismissed."

A TYPE FOR EVERY DRY ELECTROLYTIC REPLACEMENT NEED



SPRAGUE PRODUCTS COMPANY

NORTH ADAMS, MASS.

JOBBING DISTRIBUTING ORGANIZATION FOR PRODUCTS OF THE SPRAGUE ELECTRIC CO.

A-8C-10077	C_{13}, C_{14}, C_{15}—40/20/20 μfd., 150 v. elec. cond. (60 cycles)
A-8C-10946	C_{13}, C_{14} C_{15}—60/40/40 μfd., 150 v. elec. cond. (25 cycles)
C-8D-10789	C_{17}—.002 μfd., 600 v. cond.
C-8D-10771	C_{18}—.1 μfd., 200 v. cond.
A-16A-10090	L_1—Choke coil
C-212-10435	T_1—Loop ant. assembly
A-13D-10089	T_2—Osc. coil
B-13B-10091	T_3—Input i.f. trans.—range of trimmers 43-80 μμfd.
B-13B-10092	T_4—Output i.f. trans.—range of trimmers 43-80 μμfd.
B-12C-10074	T_5—Output trans. for speaker
B-18A-10094	T_6—4"x6" oval PM speaker

TEMPLETONE—MODELS E510 to E-51[illegible]

Part No.	Code and Description
605.2231	R_1—22,000 ohm, 1/2 w. res.
605.2251	R_2—2.2 megohm, 1/2 w. res.
605.4731	R_3—47,000 ohm, 1/2 w. res.
650.504E	R_4—.5 megohm with power sw.
605.1061	R_5—10 megohm, 1/2 w. res.
605.2241	R_6—220,000 ohm, 1/2 w. res.
605.4741	R_7—470,000 ohm, 1/2 w. res.
601.1511	R_8—150 ohm, 1 w. res.
602.1821	R_9—1800 ohm, 2 w. res.
164.009	C_1—.005 μfd., 600 v. cond.
165.513	C_2A, C_2B—var. tuning cap.
162.522	C_3—100μμfd., 500 v., mica cond.
162.580	C_4—10 μfd., 500 v., mica cond.
164.004	C_5—.05 μfd., 400 v. cond.
162.522	C_6, C_7—100 μμfd., 500 v. mica cond.
164.009	C_8, C_{10}—.005 μfd., 600 v. cond.
162.556	C_9—220 μμfd., 500 v. mica cond.
164.003	C_{11}—.02 μfd., 600 v. cond.
161.520	$C_{12}A$, $C_{12}B$, $C_{12}C$, $C_{12}D$—40/20 μfd., 150 v. cond.
164.004	C_{13}—.05 μfd., 400 v. cond.

DEWALD—MODELS A500, A501, A502, A503

See circuit diagram for component values

MECK—MODELS RC-5C5-A-B-C

Part No.	Code and Description
RC-32002	R_1—20,000 ohm, 1/2 w. res.
RC-31005	R_2—10 megohm, 1/2 w. res.
RC-32004	R_3—2 megohm, 1/2 w. res.
VC-10103	R_4—1 megohm, vol. cont. with sw.
RC-32503	R_5—250,000 ohm, 1/2 w. res.
RC-35003	R_6—500,000 ohm, 1/2 w. res.
RC-31500	R_7—150 ohm, 1/2 w. res.
RC-32000	R_8—200 ohm, 1/2 w. res.
RC-31001	R_9—1000 ohm, 1/2 w. res.
CV-10002	C_1, C_2—var. cond. with pulley
CP-14503	C_3, C_4, C_{10}—.05 μfd., 500 v. cond.
CM-15500	C_5—.00005 μfd. mica cond.
CM-15251	C_6, C_7—.00025 μfd. mica cond.
CP-14103	C_8, C_9—.01 μfd., 400 v. cond.
CL-10001	C_{11}—20/20/20 μfd. 150 v. elec. cond.
AL-10000	L_1—Antenna loop
TRC-10000	L_2—Coil osc.
TS-10000	T_1—First i.f. trans.
TS-10001	T_2—Second i.f. trans.
TO-10000	T_3—Output trans.
SR-10000	Spkr.—Speaker-PM 4" round, less T_3
SR-10001	Spkr.—Speaker-PM 4" round, with T_3

TRAV-LER KARENOLA—MODEL 6000

Part No.	Code and Description
IR-13	R_1—2 megohm, 1/2 w. res.
IR-11	R_2—470 megohm, 1/2 w. res.
IR-14	R_3—150 ohm, 1/2 w. res.
IR-4	R_4—47 ohm, 1/2 w. res.
IR-15	R_5—2200 ohm, 1/2 w. res.
IR-16	R_6—33,000 ohm, 1/2 w. res.
V.C.-3	R_7—1 megohm vol. cont.
PC-5	C_1—.05 μfd. 400 v. cond.
MC-2	C_2—.0001 μfd. mica cond.
PC-7	C_3—.01 μfd. 400 v. cond.
EC-3	C_4, C_5—40/20 μfd., 150 v. elec cond.
MC-5	C_6—.0005 μfd. cond.
MC-4	C_7—.000056 μfd. mica cond.
PC-9	C_8—.1 μfd., 400 v. cond.
GC-2	G_1, G_2—Gang cond.
TC-7	G_3—Ant. Trimmer cond.
TC-6	G_4—Osc. Trimmer cond.
LL-1	L_1—Loop antenna
LO-2	L_2—Osc. coil
LI-1	T_1—Input i.f.
LI-2	T_2—Output i.f.

CLARION—MODEL C104

Part No.	Code and Description
	R_1, R_8—200,000 ohm, 1/3 w. res.
	R_2—150 ohm, 1/3 w. res.
	R_3—27,000 ohm, 1 w. res.
	R_4, R_7—100,000 ohm, 1/2 w. res.
	R_5—22,000 ohm, 1/3 w. res.
	R_6—1000 ohm, 1/3 w. res.
	R_9—10 megohm, 1/3 w. res.
	R_{10}—500,000 ohm, 1/3 w. res.
	R_{11}—500 ohm, 1 w. res.
B19-186	C_{1a}, C_{1b}, C_{1c}—var. cond.
A20-139	C_2—Trimmer cond. (On loop)
	C_3, C_4, C_9, C_{15}—.05 μfd., 200 v. tub. cond.
	C_5, C_6, C_{10}—.05 μfd. 400 v. tub. cond.
	C_7, C_8—50 μμfd. mica cond.
	C_{11}, C_{13}, C_{14}—.01 μfd. 400 v. tub. cond.
	C_{12}—250 μμfd. mica cond.
	C_{16}—.005 μfd., 600 v. elec. cond.
A18-278	C_{17}—20 μfd., 25 v. elec. cond.
A18-279	C_{18}—16 μfd., 450 v. elec. cond.
A18-274	C_{19}—16 μfd., 450 v. elec. cond.

Mrs. Emily Schuette, Chicago amateur radio operator contacted the Azores one night and talked to Lt. Bruce Simpson of Dearborn, Michigan. Simpson asked Mrs. Schuette to telephone his fiancee, Alice Mae Wilhelm, for him. Mrs. Schuette did even better, she had the girl come over to her house and talk to her Lieutenant. The couple set their wedding date via ham radio.

A10-445	L_1—Ant. coil
A10-447	L_2—R.f. coil
A10-446	L_3—Osc. coil
B10-412	T_1—First i.f. trans.
B10-444	T_2—Second i.f. trans.
A80-222	T_3—Speaker output trans.
C80-223	T_4—Power trans.

TRAV-LER KARENOLA—MODEL 5000

Part No.	Code and Description
IR-13	R_1—2 megohm, 1/2 w. res.
IR-11	R_2—470 megohm, 1/2 w. res.
IR-14	R_3—150 ohm, 1/2 w. res.
IR-4	R_4—47 ohm, 1/2 w. res.
IR-15	R_5—2200 ohm, 1/2 w. res.
IR-16	R_6—33,000 ohm, 1/2 w. res.
V.C.-3	R_7—1 megohm vol. cont.
PC-5	C_1—.05 μfd., 400 v. cond.
MC-2	C_2—.0001 μfd. mica cond.
PC-7	C_3—.01 μfd., 400 v. cond.
EC-3	C_4, C_5—40/20 μfd., 150 v. elec. cond.
MC-5	C_6—.0005 μfd. cond.
MC-4	C_7—.000056 μfd. mica cond.
PC-9	C_8—.1 μfd., 400 v. cond.
GC-2	G_1, G_2—Gang cond.
TC-7	G_3—Ant. Trimmer cond.
TC-6	G_4—Osc. Trimmer cond.
LL-1	L_1—Loop antenna
LO-2	L_2—Osc. coil
LI-1	T_1—Input i.f. trans.
LI-2	T_2—Output i.f. trans.

DETROLA—MODEL 568

Part No.	Code and Description
BR17B223	R_1—22,000 ohm, 1/3 w. res.
BR17B151	R_2—150 ohm, 1/3 w. res.
BR17B156	R_3—15 meg. 1/3 w. res.
B-9051-5	R_4—500,000 ohm, vol. cont. & sw.
BR17B224	R_5—220,000 ohm, 1/3 w. res.
BR17B335	R_6—3.3 meg., 1/3 w. res.
BR17B685	R_7—6.8 meg., 1/3 w. res.
BR17B474	R_8, R_9—470,000 ohm, 1/3 w. res.
BR16C151	R_{10}—150 ohm, 1/2 w. res.
BD610202	C_1, C_{12}—.002 μfd., 600 v. cond.
A-51834	C_2, C_3, C_9—Trimmer, 3-section cond.
C-51837-1	C_4—Var. cond.
B-51839-4	C_5—2.2 μμfd. cond.
B-51428-5	C_6—Padder cond.
BC31B503	C_7—.05 μfd. cond.
B-51839-2	C_8—1 μμfd. cond.
BM58D512	C_{10}—5100 μμfd. mica cond.
BM78A101	C_{11}—100 μμfd. mica cond.
BD210503	C_{13}—.05 μfd., 200 v. cond.
BD410104	C_{14}—.1 μfd., 400 v. cond.
BD410103	C_{15}—.01 μfd., 400 v. cond.
A-8948	C_{16}—40/20 μfd. elec. cond.
BM78A221	C_{17}—220 μμfd. mica cond.
BD410203	C_{18}, C_{19}—.02 μfd., 400 v. cond.
B-51828	L_1—Bc. and sw. ant., coil assembly
B-51836	L_2—Osc., coil assembly
B-51010-1	T_1—First i.f. trans. assem.
B-51011-1	T_2—Second i.f. trans. assem.
B-51764-1	SW_1—Switch band

—30—

1000 Watt R.F. Amplifier
(*Continued from page* 30)

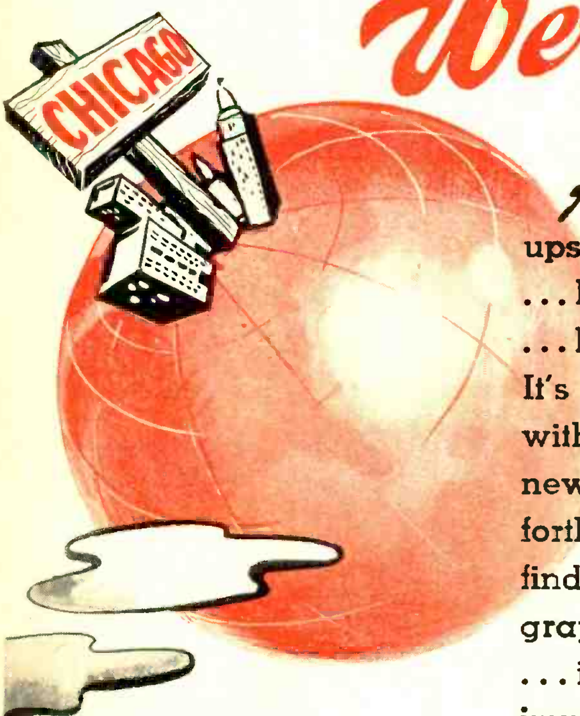
wiring between the coil socket, the grid tank tuning condenser, and the grids of the two 4-125A tubes. The metal chassis acts as a shield between the amplifier grid and plate circuits. There is no r.f. feedback from the plate to the grid circuit; the amplifier is perfectly stable. It is not necessary to go to extremes in reducing losses in the grid circuit. They should, however, be reduced to the lowest practicable degree. Generally, the r.f. driver tube, even though it is only a single 6L6 or an 807, will supply more than sufficient grid excitation for the 4-125As. A maximum of approximately 8 watts of driving power will be required for the two tubes. *This figure does not include the losses in the grid tank circuit or in the coupling device between the driver and the amplifier.* It is safe to assume that a driver capable of supplying 15 to 20 watts *output* should be available in order to have sufficient excitation with good regulation on all bands.

The amplifier, as shown in the photographs and in the schematic, is basically a c.w. telegraph unit. Class "C" telegraph operating conditions for frequencies below 120 megacycles are given in Table 1.

For radiotelephone operation the conditions are somewhat different. Plate-modulated class "C" operating conditions for frequencies below 120 megacycles are shown in Table 2.

The filament voltage, as measured directly at the filament pins, should be between 4.75 and 5.25 volts. The d.c. bias voltage should not exceed 500 volts. If grid-leak bias is employed, as we have done in this amplifier, suit-

W2BXK, 500-watt amateur radio station at the Polytechnic Institute in Brooklyn is being checked by Richard Norton and Thomas J. Potts, Jr., preparatory to going on the air. Prior to Pearl Harbor, this transmitter spanned the country and worked far out into the Atlantic and Pacific oceans. This amateur radio transmitter is operated in conjunction with the school's Electrical Communications Lab.



CHICAGO

D.C. Plate Voltage	2,000	2,500 v.
D.C. Plate Current	300	304 ma.
Plate Dissipation	150	160 w.
D.C. Screen Voltage	350	350 v.
D.C. Screen Current	66	60 ma.
Screen Dissipation	23	21 w.
Peak A-F Screen Voltage (100% Modulation)	210	210 v.
D.C. Grid Voltage	—220	—210 v.
D.C. Grid Current	20	18 ma.
Peak R-F Grid Voltage	*375	*360 v.
Driving Power (approximately)	7.6	6.6 w.
Grid Dissipation	3.2	2.8 w.
Plate Power Input	600	760 w.
Plate Power Output	450	600 w.

*Per tube measured with a suitable peak voltmeter connected between filament and grid.

Note: The above operating values are for two 4-125A tubes in push-pull connection.

Table 2. Plate modulated class "C" operating conditions for frequencies below 120 mc.

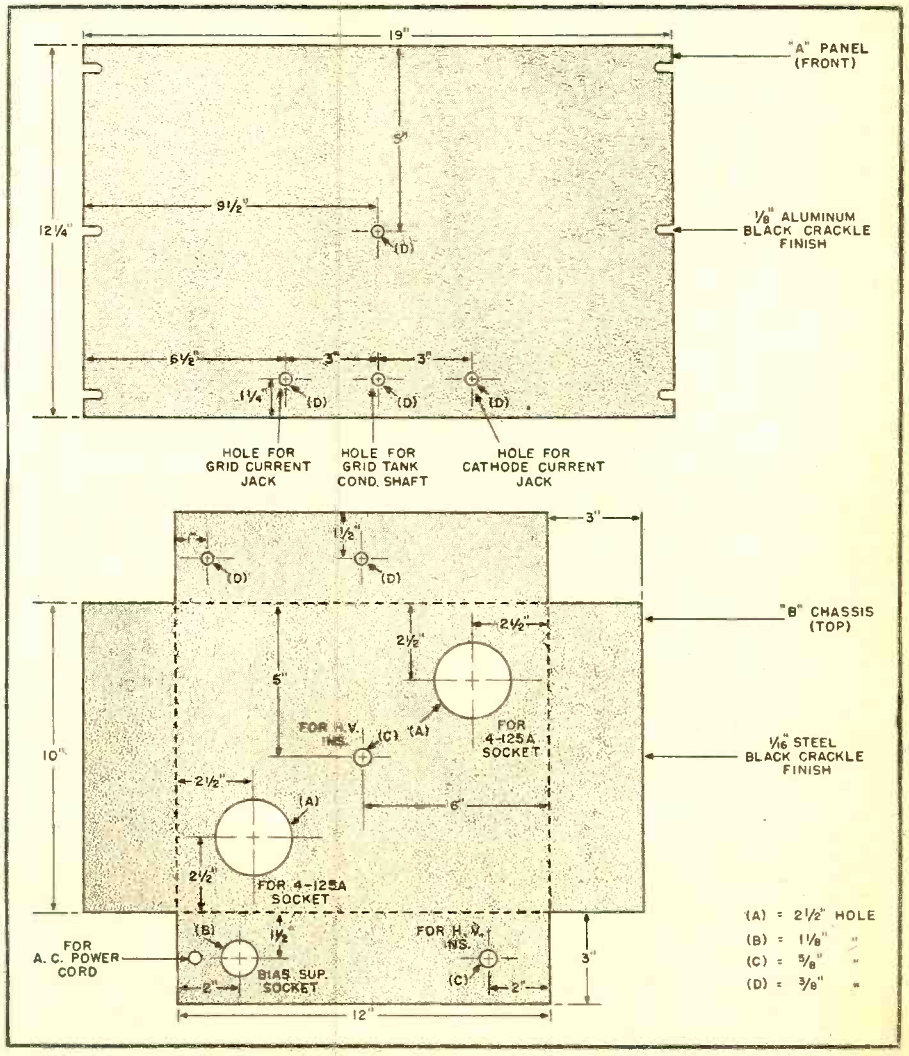
able protective means must be provided to prevent excessive plate or screen dissipation in the event that the excitation is accidentally removed. In this particular design, a 10,000 ohm, 25 watt grid-leak resistor and 90 volts of fixed negative bias was used. The fixed bias, which was supplied by two 45-volt "B" batteries connected in series, is sufficient to reduce the plate and screen currents to safe values in the event that excitation is lost. The grid dissipation for the 4-125As should not be allowed to exceed 3 watts *per tube*. Grid dissipation can be calculated from the following expression:

$$P_g = E_{cmp} I_c$$

Where P_g = Grid dissipation
E_{cmp} = Peak positive voltage
I_c = d.c. grid current

E_{cmp} may be measured by means of a suitable *peak voltmeter* connected between filament and grid. Where no means are available for measuring E_{cmp}, the maximum grid excitation must not be greater than the amount which causes the power dissipated in the bias source to be 5 watts *per tube*.

Fig. 4. Panel and chassis layout showing mechanical construction details.



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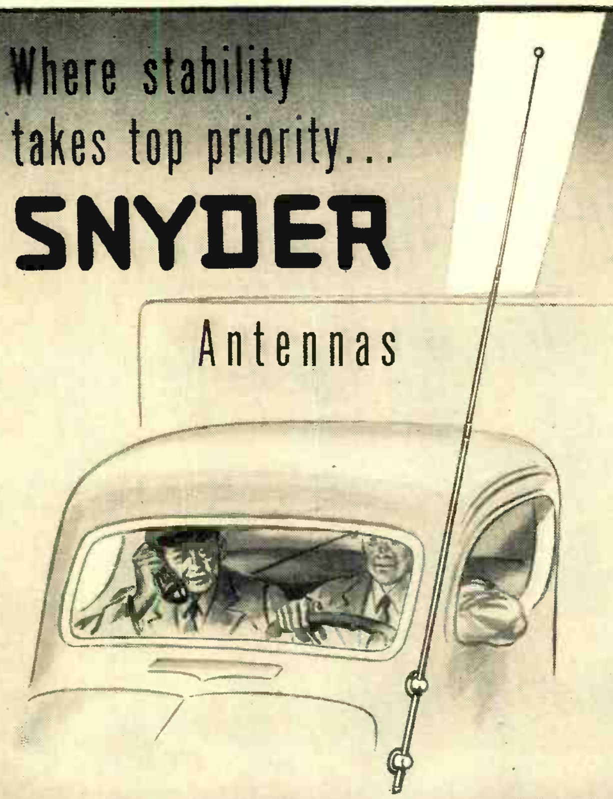

The d.c. screen voltage should not exceed 400 volts. In the c.w. telegraph amplifier it is advisable to supply the screen with voltage from a source separate from the high-voltage plate supply. In plate-modulated radiotelephone r.f. amplifiers, however, this arrangement is not practicable. In order to attain any reasonable percentage of modulation, the a.f. modulating power must be applied to both the plate and the screen. Ordinarily, the screen may be "self modulated" by supplying it with voltage from the plate supply system through a series resistance of from 25,000 to 35,000 ohms. This method does not allow 100 per-cent modulation on the positive peaks, however, and for minimum distortion the screen should be supplied with modulated voltage, either by a resistance-capacitance divider network from the modulated plate supply or through a separate winding on the modulation transformer. It should be understood that the distortion at full modulation, using the "self modulation" method is probably no more than that usually encountered in the average amateur transmitter, but it should be avoided if possible. The effect is to prevent the instantaneous plate current from doubling when the instantaneous plate voltage is doubled.

It will be noticed that the maximum allowable plate dissipation *per tube* for plate-modulated amplifiers is *85 watts*. At full modulation with a sustained sine wave, the plate dissipation reaches 125 watts. Since amateur transmitters are seldom modulated continuously at 100 per-cent, it is likely that the carrier-condition modulation could be greater than 85 watts without exceeding the maximum plate dissipation rating under normal modulation. It is difficult, however, to set a figure for the maximum plate dissipation rating for carrier conditions under these circumstances. It is suggested, therefore, that the carrier-condition plate dissipation be limited to 85 watts. With normal efficiency, the plate power input is thus limited to a little more than 700 watts *per pair* of 4-125As.

A plate voltage of from 2200 to 2500 is recommended for radiotelephone operation as the efficiency and power gain of these tubes improve rapidly as the plate voltage is increased above 2000 volts. The operating conditions for voltages between 2000 and 2500 volts may be arrived at by interpolating between the figures given on the data charts.

Adequate cooling must be provided for the seals and envelopes of the 4-125A tubes. The design of this particular amplifier allows the air to circulate freely around the bases of the tubes. The *Johnson* Type 275 sockets, used in this amplifier, have openings in the ceramic which permits air to reach the seals. A small fan or centrifugal blower directed toward the upper portion of the tube envelopes will ordinarily supply sufficient circulation for envelope and plate seal cooling. It is advisable to apply forced

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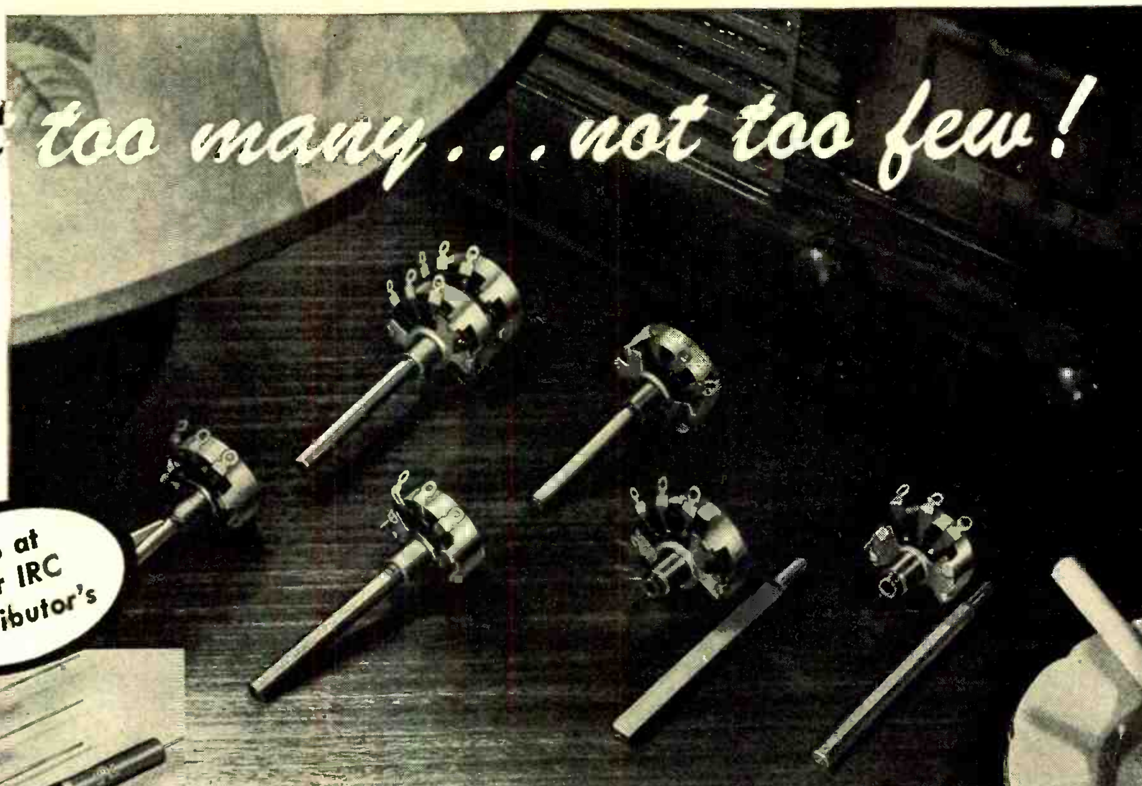

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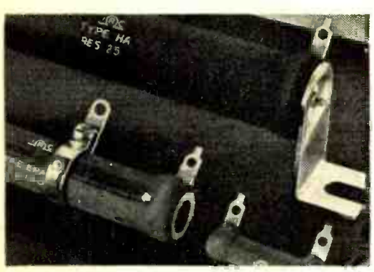

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air cooling to the stem structure by directing the air flow from a small nozzle vertically toward the hole at the center of the tube socket. An air flow on the order of approximately two cubic feet per minute will ordinarily be sufficient for stem cooling. Small complete blowers suitable for this purpose are available at an insignificant cost.

-30-

Unique Phono Amplifier

(*Continued from page 51*)

resistance load in place of the voice coil of a speaker. With a speaker connected in place of the resistor, the high frequency response of the amplifier did not fall off as rapidly, otherwise the curves remained the same.

In checking distortion through the amplifier with one volt applied to the input terminals, it was found that virtually no distortion existed with seven watts of audio power output.

The entire unit is constructed on a 7" x 13" x 2" cadmium plated chassis. Parts are placed in such a way that all controls can be located along the front edge of the chassis. The input is to tip jacks mounted along the left hand edge. The power transformer, T_3, is mounted at the right rear corner of the chassis while directly in front of it are located two of the multiple section filter condensers, the filter choke, L_1, and the 80 rectifier tube. The output transformer, T_2, is located in the center of the rear edge of the chassis. The output tube, a 6N7, is located in front of the transformer, while the driver transformer, T_1, is located near the front edge.

The 6SK7 input stage, the 6C5 expander amplifier and the 6H6 bias rectifier are located along the left hand edge of the chassis, from front to rear respectively. The four tubes in a line

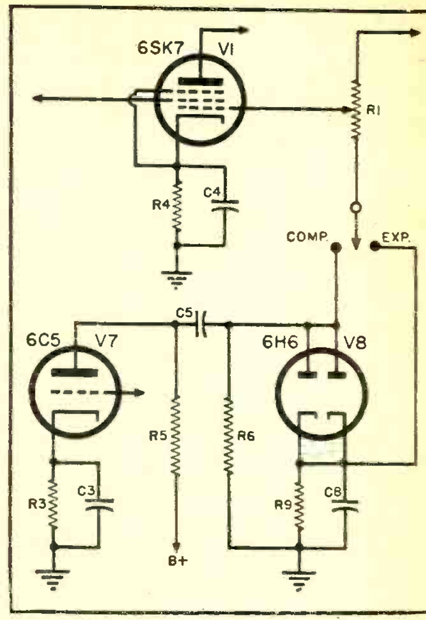

Fig. 5. Necessary change in expander circuit in order to obtain volume compression.

are, from front to rear; 6C5 driver, 6C5 straight amplifier (V_2), 6C5 bass control amplifier (V_3) and 6C5 treble control amplifier (V_4).

An additional multiple section filter condenser is mounted to the right of the center of these four tubes and close to the 6N7 output stage. Tip jacks for the speaker output are located along the rear edge of the chassis just behind the output transformer, T_2.

The controls on the front edge of the chassis, shown in Fig. 1, are from left to right; gain control, R_1; expander control, R_2; treble control, R_{17}; bass control, R_{15}; master gain control; R_{26}; and the line "on-off" switch.

All wiring in this unit is simple and direct. Parts are placed for convenience and shortest possible leads. In constructing this unit, care should be

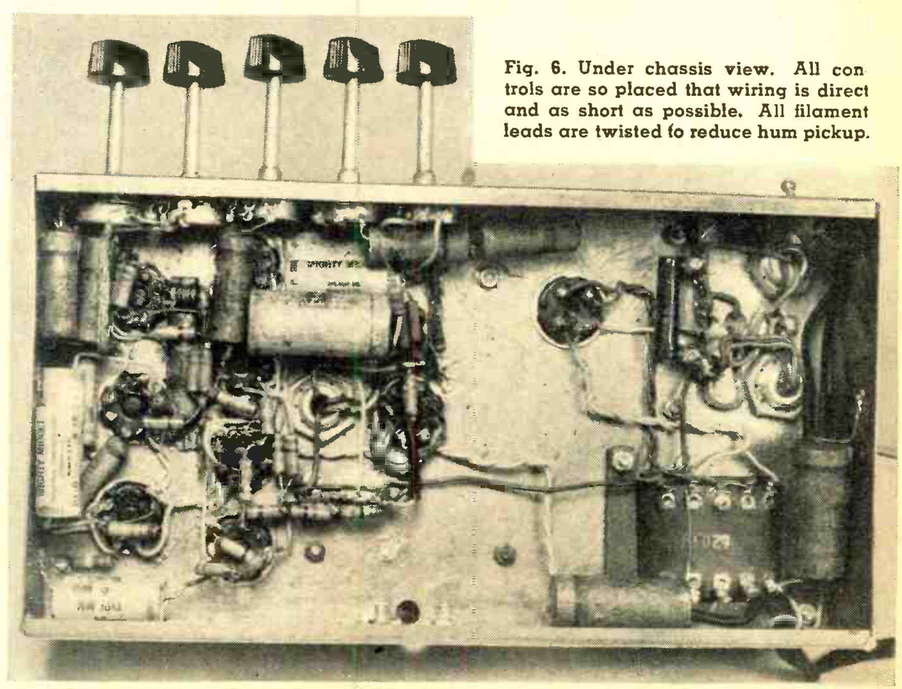

Fig. 6. Under chassis view. All controls are so placed that wiring is direct and as short as possible. All filament leads are twisted to reduce hum pickup.

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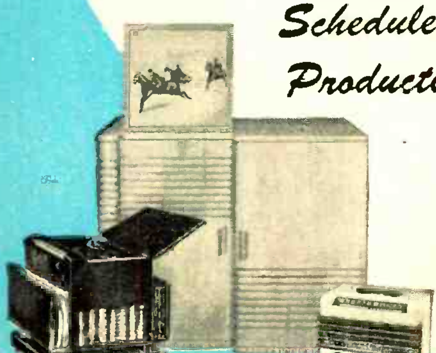

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taken to keep input circuits separated as much as possible from the balance of the unit.

After the unit has been completely constructed, the amplifier should be turned on and checked either by means of an audio oscillator applied to the input, or by actual performance tests with good recordings. Expansion will not be particularly noticeable on the popular records but should have a marked effect on the reproduction quality of symphonic recordings.

In order to secure maximum fidelity with this unit, it is suggested that a high quality speaker be used with this amplifier.

—30—

Pilotless Plane

(*Continued from page* 35)

the instruments during the plane's flight, and this information is relayed to the operator of the ground radio station. The second piece of television apparatus, installed in the cabin of the plane without a human pilot, actually scans the horizon as it would be seen if an honest-to-goodness pilot were flying the machine and this vision of the horizon as viewed by the "robot" is relayed to the operator of radio equipment in the motor truck.

This experimental aircraft, joint brain-child of the *Bell Aircraft Corporation* and the Air Technical Service Command, Wright Field, Dayton, Ohio, is a preview of an imminent period of flight of commercial airplanes through the combined factors of radio and television. More than a year ago this writer forecast the imminence of the "all electronic airplane"—a craft functioning solely by "electronic fingers" rather than by the hands of a human pilot. Although the *Bell Aircraft Corporation* is using this experimental jet-propelled plane as a sort of "flying research laboratory" in assembling data that might influence the flight behaviour of a plane, the company believes that remote control of aircraft by radio is impending, both from a commercial and military viewpoint. Furthermore, by use of this robot plane the risks of sacrificing human pilots in hazardous flights at sonic and supersonic speeds are averted.

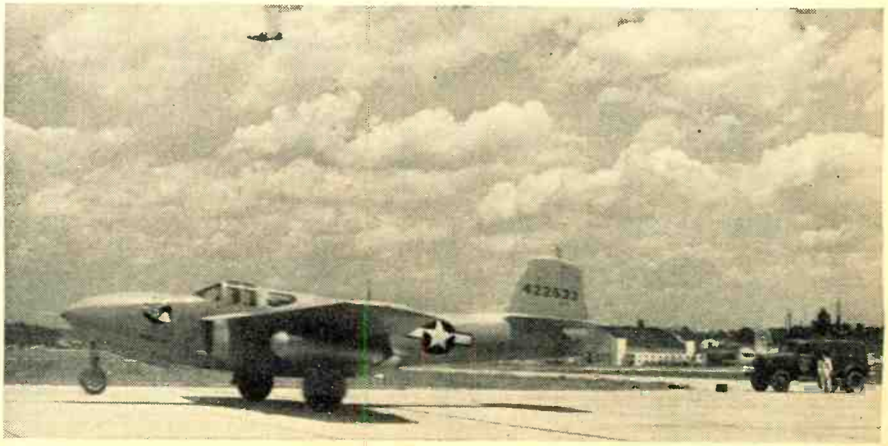
The successful flights of this radio-operated plane—since October, 1944, but until recently among the war-pigeoned secrets—are attributed largely to a new concept of the autopilot—described as the "rate" autopilot by Robert M. Stanley, chief engineer of the *Bell Aircraft Corporation.* This novel gadget, automatic in performance, assures control of a plane where the orthodox autopilot leaves off—and it can function dependably when the craft is approaching a diving altitude.

Turbo jet-powered planes were chosen for the initial tests with pilotless, radio-operated flying machines for several "down-to-earth" reasons, namely, the absence of torque and vibration; their stability even at the speed of sound; their efficiency in the stratosphere or other high altitudes; and the stability they demonstrate when landing by means of tricycle landing gear.

More about the new version of the autopilot—the "rate" autopilot—which receives the lion's share of credit in realizing the aeronautical engineer's dream of controlling aircraft solely through the means of radio and television. Instead of the standard autopilot, controlled by a gyroscope which spins about its vertical axis and is therefore subject to "spilling" in violent maneuvers, the new type of autopilot makes use of two rate-of-turn gyro instruments. One of these is so arranged that the gyroscope's spin-axis is vertical as a means of affording a way of sensing a change of pitch. The second gyro device is rotated so as to place the gyroscope fore and aft, thus providing a method for determining the rate of roll.

Then, these two sensing gadgets—the "rate" and "displacement" autopilots—are coupled in an electrical bridge, with their functions being interchangeable. The "displacement" or orthodox autopilot is answerable for maneuvers involving less than plus-or-minus 30 degrees change in pitch or plus-or-minus 45 degrees in roll. The new version of autopilot—the

Radio controlled jet plane lands at Wright Field by remote control. Either the "mother" plane, shown in flight, or the truck ground station at right can control the plane.



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"rate" mechanical pilot with its spill-proof gyroscope, is answerable for any other maneuvers to which an airplane may be subjected. The "flying radio laboratory," as well as the ground radio station, has a switch, handy on the instrument panel, which permits of easy selection of the two autopilots. Simultaneously, either or both of these mechanical pilots can be governed from both air and ground radio stations.

A diminutive "joy" stick, functioning like the conventional control stick on a standard airplane, is mounted on the usual stick in the "mother" plane and another pigmy stick, a duplicate, appears on the ground radio operator's chair. This small stick is secured to a platform built on top of the radio-equipped motor truck. The movements of these midget sticks are comparable to those of the conventional "joy" stick. Moved forward, for example, the miniature stick prompts the impulse that lowers the airplane's elevators, causing the radio-controlled plane to dive; moved backward, the undersized stick prompts a climb, and to the right or left, a turn of the airplane in either direction.

The throttle, flaps, landing gear, brakes, etc., of the radio-operated plane are actuated by the usual servo motors, deriving their electrical energy from circuits controlled by the radio receiver. Thus, by coordinating these controls, the radio operators of the flight or ground stations can put the robot through such actions as warm-up, taxiing, take-off, climb, level flight, banks or turns, dives and loops.

The operation of this radio or electronic airplane is dependent upon novel and heretofore untried apparatus, with special and secret radio parts, designed especially for Army Air Forces' Technical Service Command. This radio equipment is as vital to the functioning of the airplane television and telemetering equipment as are the heart and lungs in the functioning of the human body. The incorporation of high-frequency radio apparatus for voice communication is optional rather than a requirement, we are told.

—30—

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MANY of the iron core i.f. transformers which have only a brass rod with a saw cut in the end, stick easily. To prevent spreading or splitting the end, here is a servicing tip.

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—30—


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Bulletin 722
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Bulletins 630 and 586

International Short-wave

(*Continued from page* 54)

GVX, 11.93, 5-7 a.m.; GVO, 18.08, 6-10:45 a.m.; GSP, 15.31, 10:30 a.m.-4 p.m.; GRG, 11.68, 2-7 p.m.; GRH, 9.825, 4:15-9:45 p.m.; GVZ, 9.64, 4:14-11 p.m.; GSU, 7.26, 4:14-11 p.m.; GSL, 6.11, 7:15-11 p.m.; via Leopoldville, 8:15-9:45 p.m., on a new frequency of 9.380.

The BBC services directed to North America include General Overseas Service, 5-8 a.m.; Special Programs, 8-11 a.m.; General Overseas Service, 11 a.m.-12 noon; Special Programs, 12 noon-4 p.m.; General Overseas Service, 4-4:15 p.m.; North American Service, 4:15-9:45 p.m.; and General Overseas Service, 9:45-11 p.m. English newscasts given in the evening North American Service are now at 4:45, 5:45, 6:45, 8, and 9:30 p.m. Radio Newsreel continues to be presented at 7:30 p.m.

* * *

MEXICAN SW LISTINGS

From the office of the Director General, Department of Telecomunicaciones, Mexico City, comes this up-to-date list of Mexican short-wave transmitters:

COMMERCIAL — XEBR, 11.820 (25.38 m.), 150 w., Hermosillo, address Esquina Sardan y Rosales; XEBT, 6.000 (50 m.), 10 kw., Mexico City, D.F., address Calle del Bueon Tono No. 6; XECC, 6.185 (48.50 m.), 50 watts, Puebla, Pue., address 2 Norte No. 803; XEFT, 9.545 (31.43 m.), 250 watts, Veracruz, Ver., address Independencia No. 74; XEKW, 6.030 (49.75 m.), 500 watts, Morelia, Mich., address Aladama No. 154; XEOI. 6.010 (49.92 m.), 2,500 watts, Mexico City, D.F., address Donato Guerra No. 26; XEQQ, 9.680 (39.99 m.), 1 kw., Mexico City, D.F., address Jose Maria Marroqui No. 11; XEQR, 9.610 (31.22 m.), 5 kw., Mexico City, D.F., address Cordoba No. 48; XETT, 9.555 (31.40 m.), 500 watts, Mexico City, D.F., address Uruguay No. 37; XETW, 6.045 (49.63 m.), 100 watts, Tampico, Tams., address Madero No. 10; XEUW, 6.020 (49.83 m.), 250 watts, Veracruz, Ver., address Independencia No. 230; XEUZ, 6.139 (48.94 m.), 100 watts, Mexico City, D.F., address Paseo de la Reforma No. 18; XEWW, 9.500 (31.58 m.), 10 kw., Mexico City, D.F., address Ayuntamiente No. 54.

EDUCATIONAL — XEJG, 4.820 (62.24 m.), 200 watts, Guadalajara, Jal., address Palacio de Gobierno; XEXA, 6.175 (48.58 m.), 100 watts, Mexico City, D.F., address Calle de Bucaroli; and XEYU, 9.600 (31.25 m.), 250 watts, Mexico City, D.F., address Calle de Justo Sierra.

* * *

RADIO NATIONAL BELGE

Despite persistent American reports that Brussels is being heard irregularly, 11 a.m.-12 noon, on a frequency of 17.845, directed to Leopoldville, both Brussels and Leopoldville report that the only transmitter of Radio National Belge is located at Leopoldville, Belgian Congo. A recent letter from F. Zoete, Director, Institut National Belge de Radiodiffusion, Overseas Service, Brussels, states: "We are *not* using *any* short-wave transmitter in Belgium proper, although we expect to duplicate our Leopoldville transmitter at Brussels in a couple of years. Leopoldville is presently in an experimental period in order to find the permanent wavelength they are going to use."

From I. Le Roye, Director, Radiodiffusion Nationale Belge, Station de Leopoldville, by airmail, comes a letter confirming that "there is *no* broadcasting on short-wave by transmitters in Belgium and that *all* Belgian short-wave broadcasts are transmitted by our RCA 50-kw. transmitter. Plans for the future are, of course, elaborated in Belgium, but owing to the war and post-war difficulties, there is no solution yet."

Current schedules of the principal Leopoldville transmitters were listed as follows:

First transmission on 17.770 (16.88 m.), Dutch, 5-6:30 a.m.; French, 6:30-8:30 a.m.; English, 8:30-9:30 a.m.

Second transmission on 17.770 (16.88 m.), English, 11:30 a.m.-12:15 p.m.; musical variety program (in French), 12:15-1 p.m.; on 9.745 (30.66 m.), Dutch, 1-2 p.m.; French, 2-4:15 p.m.; Spanish, 4:15-5 p.m.; at 4:45 there is a change in antenna direction and of frequency to 9.380 (31.98 m.); continuing on 9.380, French, 5-5:45 p.m.;

Portuguese, 5:45-6:30 p.m.; Spanish, 6:30-7:15 p.m.; English to North and South America, 7:15-8:15 p.m.; relays BBC's North American Service, 8:15-9:45 p.m. sign-off.

Leopoldville is now sending out a beautiful 4-page verification card in yellow and brown, showing pictures of the antenna, transmitters, an African bugler, and a map of Africa and the Mediterranean area. Simply address Belgian National Broadcasting Service or Radiodiffusion Nationale Belge, Leopoldville, Belgian Congo.

According to a recent Bern supplement, Ruiselede (Brussels) has been assigned frequencies of 6.200, 7.300, 9.480, 11.720, 11.850, 11 893, 15.280, 15.335, 17.845, 17.860, and 21.450, to use 5 kw., later to be 100 kw.

* * *

SCHEDULE OF ZQI

The acting station manager, The Government Broadcasting Station, 2 Seaview Avenue, Half Way Tree, Jamaica, British West Indies, informs me that ZQI (with studios in Kingston) is scheduled:

Daily, 4:30-6:30 p.m.; identification in English is given at 15-minute intervals. Frequency is 4.700. Reception of ZQI is erratic in the United States.

* * *

NEWS OF U.I.R.

The Union Internationale de Radiodiffusion, Centre de Controle, Brussels, Belgium, informs me that their "laboratories" were badly damaged when the German armies fled from Brussels in August 1944, and that we have not yet resumed completely our previous work. We proceed already to daily measurements on the medium-waves broadcasting stations and we compile a monthly chart of the measured frequencies. As regards the short-wave broadcasting stations, we hope that we shall be able to resume our measurements in March (1946)." They promise to send compilations soon.

* * *

PORTUGUESE SCHEDULES

From Emissora Nacional de Radiodifusao, Lisbon, Portugal, comes this list of 1946 schedules of Portuguese transmitters:

CSW, 10 kw., 11.040, 27.17 m., 12:30-3 p.m. and 4-6 p.m.; CSW, 10 kw., 9.740, 30.84 m., *to North America,* 7-8 p.m.; CSX, 0.5 kw., 11.985, 25.01 m., 7-9 a.m.; CSX, 0.5 kw., 6.370, 47.10 m., 1:30-7 p.m.; ERA, 1 kw., 4.040, 74.65 m., 5-7 p.m.; ERA, 1 kw., 7.015, 42.76 m., 3-4 p.m.; CS2WD, 2 kw., 6.155, 48.7 m., 2:30-7 p.m.; CS2WI, 0.25 kw., 12.400, 24.19 m., Parede, 6:45-9 a.m. and 2:30-6:30 p.m., relays CT1GL (1,068 kcs.).

CR7BE, 10 kw., 9.700, 30.93 m., Radio Clube de Mocambique; CR6RA, 0.35 kw., 9.470, 31.68 m., Radio Clube de Angola, Loanda; Radio Bissau, Portuguese Guinea, 0.25 kw., 16.310, 18.39 m., and 6.300, 36.14 m., no schedules given for these.

* * *

NEW

The new Singapore frequency of 6.77 was first reported to me by Paul

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Dilg, California, late in February, and I have been hearing this signal with nice level most days since. This appears to be (as announced) "the Far Eastern Service of the SEAC calling from Singapore," with a schedule of 4:25 to 8:35 a.m. English news is usually read by a man at 6:15 and 7:15 a.m., with headline news just prior to sign-off. Generally, a woman announces. A frequency of 11.735 is announced as being in parallel. Sign-off of the 6.77 transmitter is with "Good-night, everyone!"

A station using French and English and popular records on 5.780 has been heard 9:15-9:50 a.m. by listeners in Oceania; is believed to be located at Mauritius, an island in the Indian Ocean east of Madagascar.

Radio Bissau, Portuguese Guinea, listed by Lisbon on 6.300 and 16.310, verified reception of last fall by letter which stated they were off the air during the early winter owing to technical difficulties. Returned mid-January and now is scheduled 5-5:45 p.m.; power of the Hallicrafters transmitter is only 50 watts. (Legge)

A new short-wave station at Umtali, Southern Rhodesia, broadcasts on 6.082, 3-3:30 a.m. (Sundays to 6 a.m.) and on 3.400 at 1-3 p.m. approximately and 10-11:30 a.m. on Thursday *only*. Salisbury, 6.000, operates 3-3:30 a.m. and on 3.658, 1-3 p.m. approximately, also Thursdays at 10-11:30 a.m.; Bulawayo, 3.800, carries all of the above-mentioned radiations. (Legge)

Reported heard in Australia is a 12-watt transmitter at Balikpapan, Borneo, on 7.960 (was 7.880 but moved to avoid QRM); schedule is 1-3 a.m., 4-6 a.m., and 5-? ? p.m.

From Hawaii it is reported that the new "Voice of Free Indonesia" is heard in English, 6-7:30 a.m., on 15.210 (announces 15.220).

The Far Eastern Service of Malaya, announced for 6.770 and 11.735, is reported from Oceania as coming in on 11.695 in the 25-meter band. The 9.555 frequency is now in the Blue Network and the Red Network is either off or starting much later. The 6.770 frequency is being widely heard, 4:25-8:35 a.m.

Singapore writes a correspondent in New Zealand that they are using the same Japanese 25 kw. transmitters and will increase power to 100 kw. as soon as new tubes arrive.

A station on Morotai Island is reported heard by Australian correspondents at 8:30 a.m., also at 11 a.m., on 13.710.

* * *

CHANGES

Radio Prague, 11.840, Czechoslovakia, scheduled to North America during the winter 8-8:30 p.m., has been sending an erratic transatlantic signal. By this time, it will likely have changed schedule to 7-7:30 p.m., a more favorable hour.

A recent Swedish report puts Radio San Remo, Italy, on 7.590, 1:45-5 p.m.

Radio Belgrade, 9.420, now signs on at 12:15 a.m. and is heard in various

foreign language news bulletins through the 2 a.m. French period; music between 1:15-1:30 a.m.

Leopoldville, OTC2, now signs off 9.745 at 4:45 p.m. and reopens at 5 p.m. on a new frequency of 9.380, which is vacated at 4 p.m. by OTM2. Still relays the North American Service from London at 8:15 p.m., signing off at the new time of 9:45 p.m.

Hargeisa, 7.126, British Somaliland, is heard just before sign-off at 10 a.m.; apparently does not relay BBC at 10 a.m. as before, nor run to 1 p.m. any longer; man announced twice, "This is Radio Somali," and on Thursday said they would be back Monday at same time; was heard again on Monday, but not Friday, Saturday, or Sunday; so may be off the air those days. (Dilg)

XRRA, Peiping, China, is now on 6.090, reported good between 6-10:30 a.m.; a station on 7.170 *seemed* in parallel, may be auxiliary listed for 7.380. (Dilg)

The Chinese transmitter on 6.235 now announces as "Chinese Army Radio," and mentions a province, and call letters sounding like XNTA. (Dilg) This station sometimes is heard in the East early mornings.

LRY, Radio Belgrano, Argentina, has moved to 9.453. LRX will soon increase power from 6 to 10 kw., operates 5:30 a.m.-10 p.m.

HC2AK, 4.650, Ecuador, is good again to 10:48 p.m. sign-off; had not been heard for many weeks and was apparently off the air.

Official Honduras schedules are HRN, 5.875, Tegucigalpa, 8-10 a.m., 1-3 p.m., 6-11 p.m.; also list 2.437 which has not yet been reported as heard; La Ceiba, HRD2, 6.235, operates 12 noon-2 p.m. and 7-11 p.m.; San Pedro Sula HRP1, 6.351, operates 11 a.m.-2:15 p.m. and 6-10:30 p.m.

Following Guatemala's lead, Nicaragua has cleared all broadcasters from the 40-meter amateur band. YNXW, Managua, has moved from 7.070 to 6.273 (measured, announces 6.275) and schedule is 8-10 a.m., 12 noon-3 p.m., and 5-11 p.m.; YNBH, Managua, moved from 7.008 to 6.547 (announces 6.550), and YNWW, Granada, moved from 7.020 to 7.325, where it battles London evenings. (Legge)

ZAA, 7.850, Tirana, Albania, is now reported 2-3:30 p.m., with English at 3:10 p.m.

Radio Rodina, 9.345, Sofia, Bulgaria, has moved up here from 9.330 and is reported to have much improved signals; heard from 11:30 p.m.-1 a.m. sign-off with Bulgarian Home Service.

OLR3A, 9.550, Prague, Czechoslovakia, is reported heard at 11 a.m. in Sweden.

* * *

BEST BETS FOR BEGINNERS

This month we have these Best Bets for Beginners in the Philadelphia area, as compiled by John T. Jones, Jr.:

HCJB, 9.958, 12.455, and 15.105, Quito, Ecuador, 5-6 p.m. and 9-10:30 p.m.; English news at 5 p.m. VLC5,

(*Continued on page 137*)

TECHNICAL BOOK & BULLETIN REVIEW

"RADAR—WHAT IT IS AND HOW IT WORKS" by Orrin E. Dunlap, Jr. Published by *Harper & Brothers*, New York. Price $2.50.

This is a popularly written book on the wartime miracle of radar, a book which can be read and enjoyed by everyone interested in the beginnings of this useful electronic application.

The author traces the history of radar from the early reflected wave experiments of Hertz and Marconi right through the application of the radio "echo" to push-button warfare.

The development of our wartime radar equipment is as thrilling a story as most novels and the achievements of the allied scientists make good reading.

The book is illustrated with photographs and sketches which will help the lay reader visualize radar. This book is recommended for all readers regardless of technical background and training.

* * *

"RADIO SOUND EFFECTS" by Joseph Creamer and William B. Hoffman. Published by *Ziff-Davis Publishing Company*, Chicago. 61 pages. Price $1.50.

This little book presents the first complete manual of radio sound effects and how they are created. Written by the Promotion and Research Director and a member of the sound effects department at station WOR, this book will serve as a practical handbook for the sound effects technician or as a fascinating "inside story" for the layman.

The authors have covered such subjects as the use of sound effects in radio, the mechanics of sound effects, control room signals, manual effects, recorded effects, trick effects, the turntable and supplementary sound effects. The book is illustrated with "action shots" showing various sound techniques in use.

* * *

"ELECTRON OPTICS AND THE ELECTRON MICROSCOPE" by V. K. Zworykin, G. A. Morton, E. G. Ramberg, J. Hillier, and A. W. Vance. Published by *John Wiley and Sons, Inc.*, New York. 754 pages. Price $10.00.

This is a book which fulfills a long felt need for an authoritative text on, first, the operation and techniques of electron microscopy and, second, a resume of theoretical electron optics and microscope design theories.

Of necessity this book will have a limited audience, but to those whose work is intimately connected with the operation of the electron microscope (and their number is growing daily) this text is a boon.

The book is divided roughly into two parts, each serving a distinct purpose. The first part includes descriptions of the various types of electron microscopes and a non-mathematical discussion of the electron optical theories on which the electron microscope is based and about which the operator must be aware in order to use this laboratory tool effectively.

The second part of the book deals with theoretical electron optics and design techniques and problems. This part of the text is a remarkable document, detailing as it does the mathematics of the electron microscope. The authors have included in this second part the best thinking on the subject, including work done in this country and abroad. Some of the subjects covered in this section on the theoretical basis of electron optics and the electron microscope include, determination of potential distribution, electron trajectory tracing, Gaussian dioptrics of electrostatic lenses, magnetic fields, electron motion in magnetic field and magnetic lenses, aberrations of electron lenses, magnitude and correction of electron lens defects, high voltage electron optics, ion optics and image formation in the electron microscope.

This book is *not* designed for the lay audience. This text is written at a high engineering level.

—30—

Spot Radio News

(*Continued from page* 14)

the light of isolated instances of bad taste or poor judgment—nevertheless strike at the very heart of our system of broadcasting and constitute bold steps toward government domination which may eventually deprive us of fundamental rights."

CHARLES R. DENNY, JR., new chairman of the Federal Communications Commission following Paul Porter's departure to OPA, was profiled briefly in this column (RADIO NEWS, May, 1945) when he advanced from FCC general counsel to a member of the Commission last spring. But now that he's gone on to the top job, we thought it worth while to get a few sidelights on him to complete the record. . . . Probably most important to the industry is his belief that FM broadcasting will replace the major portion of standard-wave broadcasting in urban areas, but that there will always be a place for standard waves in the broadcasting picture because of the need to reach rural areas. . . . A Democratic member of the FCC, Commissioner Denny's term will expire June 30, 1951, but even then he will be the youngest member of the Commission if it should remain unchanged. At 33, he is not only the youngest chairman in FCC history, but also the youngest man at the head of any major Federal agency. . . . He's also a wonder boy in another way—a non-voting resident of the District of Columbia, his chances for his appointment before it was made were considered not good, politics being what they are. . . . Denny likes to play golf, describes himself as a "frustrated"

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gardener, rides a bicycle, his favorite flower is the red carnation, his favorite book is James Thurber's "My Life and Hard Times," and he has a wife and three children. If Senator Wheeler of the Interstate Commerce Committee is an authority on the subject—and he is— it could be that one of the children will get the next FCC appointment. After Wheeler reported favorably on the Denny chairmanship, somebody suggested to the Montana senator that Denny is not much older than popular radio itself. "Yes," commented Wheeler, "another nomination or two like this and we will be referring to the FCC as the Quiz Kids."

PAUL PORTER, new OPA chief, has not left all his radio problems behind him. Indeed, some of the ones he now faces might be considered more knotty than most of those remaining at FCC. While production has shown monthly increases since the first of the year, it still shows signs of lagging behind the industry's prewar average output. Chief spring problem: insufficient quantity of cabinets, condensers, and speakers. . . . Early in the spring, when the Porter OPA appointment was pending, he refused to take any action until he was confirmed—a not inconsiderable blow to radio manufacturers, who had hoped for quick action even before Porter came into the picture. He did, however, put the radio problem on top of his OPA calendar. Concensus in Washington among industrial observers was that, while set manufacturers who granted wage increases since the war ended were advised that they would probably not get compensating price relief, there was a good chance that OPA might change policy to spur the output of the lagging components. And Porter was said to be not unsympathetic to the idea. . . .

A REVOLUTIONARY GERMAN MACHINE for manufacturing radio, radar and other condensers was the spring gadget featured by the War and Commerce department and is attracting widespread interest among U.S. manufacturers, to whom it is being made available for inspection. . . . The machine is covered by U.S. patents in custody of the Alien Property Custodian. War Department estimates that any manufacturer of fixed paper condensers can adopt the new process with an additional capital outlay of $25,000. . . . The machine was developed by Robert Bosch Company, Stuttgart. It replaces the usual metal foil by a thin vaporized zinc coating applied directly onto the paper dielectric. More than 50,000,000 condensers for use in both alternating and direct current circuits were turned out by the Bosch machine during the war. . . . One advantage of the condenser is that it heals automatically after an electrical breakdown, and numerous breakdowns may occur before the effective value of the condenser is reduced below the workable limit. Because of this, metallized paper capaci-

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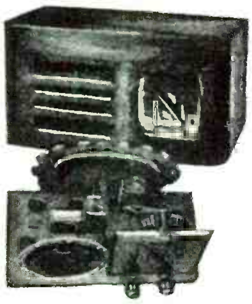

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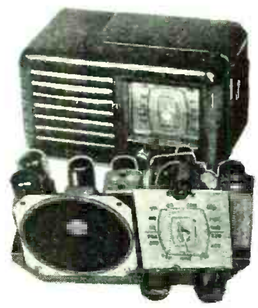

COMPLETE, INCLUDING ATTRACTIVE BROWN BAKELITE CABINET.

Diagram Furnished — All Parts Mounted APP SIZE 9x5x6 Inches

Uses one 25L6—one 25Z6—one 6SA7—one 6SQ7—one 6SK7 or one 50L6—one 35Z5—one 12SA7—one 12SQ7—one 12SK7.

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3 x .05 MFD — 300 V. D.C. .... Your Cost .19 cts.
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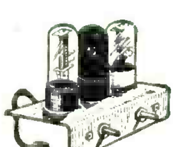

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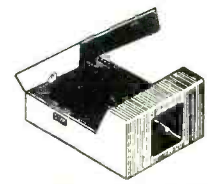

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tators may be operated at from 20 to 50 per-cent higher voltages than is possible with paper and foil capacitators. The metallized paper capacitators are about 40 per-cent smaller than the paper and foil type, and it is believed that production costs will be about 20 per-cent less. . . . Credit for investigating the machine goes to Frederic E. Henderson, superintendent of manufacturing engineering of the *Western Electric Company,* Baltimore, who was sent to Stuttgart by the U.S. government. His full report is available from the Publication Board, Department of Commerce. Cost ten cents.

AAF, MEANTIME, is busy planning experiments this summer to fight the war-famous rocket bombs with radar. Signal Corps is cooperating in the work, which will be conducted at White Sands proving ground, New Mexico. The project is under the command of Brig. Gen. William L. Richardson, chief of the guided missiles division, Air Staff, and officers and civilians from Watson laboratories, the ground radar laboratory of the Air Technical Service Command, Wright Field, will man the radar equipment. . . . It will include every known means of radar detection, not neglecting the devices used to reach the moon. If something can thus be found or devised to track the 3000 miles-per-hour missiles as they arch across the sky, it will, AAF predicts, then be possible to devise some means of exploding the V-2's in mid-air before they reach their targets.

PERSONALS

R. C. Sprague, chairman of the executive committee, Radio Manufacturers Association, led off the annual RMA spring conference, New York City, with a meeting of his committee and all section chairmen of the parts division on April 10. An even earlier date —April 9—was set for a meeting of the new Amateur Radio Activities Section, under chairman **W. J. Halligan** of Chicago. The conference was held April 9-11. . . . **Ben Abrams,** of New York City, is chairman, and **A. H. Gardner,** of Buffalo, vice-chairman, of the special RMA Excise Tax Committee working on the problem of repealing or modifying the 10 per-cent federal radio excise tax. . . . **Charles F. Gill** of *General Electric* heads an RMA committee now planning a pamphlet on approved specifications and other information regarding school sound systems. About 50,000 copies are to be published. Other committee members: **Henry F. Kuhlman,** *Western Electric Co.;* **Hal C. Sager,** *Stromberg-Carlson Co.,* and **Max U. Bildersee,** New York State Department of Education. . . . **Daniel L. Jacobs** has left as director of the Radio Unit of the OPA Durable Goods Branch. He is succeeded by his former assistant, **E. E. Smallwood,** formerly with *RCA* at the Bloomington, Ind., Plant, where he was head of the cost control department. He joined OPA in July, 1944.

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European Radio Industry

(Continued from page 27)

their surplus output principally to British Dominion and Empire countries, and neglected or paid very little attention to the possibilities of marketing in Europe, are today making a determined bid to capture a fair share of the continental market with co-operatively produced, commercially profitable, radios and a co-ordinated export merchandising policy supplemented by improved overseas marketing.

It certainly looks as if the British radio exporters mean business, because at a time when nearly every set in the country needs a repair of some kind and BBC estimates show that 1,300,000 receivers are completely out of commission and 2,500,000 partially inoperative, the British Board of Trade has announced that of the 1,367,000 radios which are scheduled to be made by the end of 1946, 878,000 will be earmarked for the home market and 489,000 exported as against the average annual output of 1,400,000 sets before the war of which 66,000 only were exported.

Presumably with an eye on this market there are now rolling off British production lines well proportioned medium-class, push-buttoned table sets with carefully arranged amplification stages, excellent tonal output and well-matched loudspeakers; more expensive cabinet type receivers with automatic recorders and record players; as well as low-priced, multi-band superhets of restricted range. Invariably, these new models contain improved tubes, components and frequency-stabilized tuned circuits and are housed in plastic cabinets.

The prices charged for these radios are at present between 25 and 30 percent above pre-war levels but decreased production costs, combined with design simplifications, are expected to bring down overhead expenses and make them available to Europe's lower income groups.

France

In spite of an almost equal population, France's listening public is way behind Britain's and her radio industry—today gradually recovering from the effects of the war—smaller and less organized.

This is due mainly to the fact that the French radio industry—apart from such Dutch, American or British controlled concerns as *La Radiotechnique, French Thomson-Houston* or *Pathé-Marconi*—consists literally of thousands of independent workshop-like factories making custom-made receivers differing in little else but scale formations and similar minor details.

In order to put this radio industry on a sound basis, a comprehensive plan has been worked out and is now being brought into operation under the patronage of the French Government's over-all industrial $800,000,000

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"Plan Council" scheme, entailing the rejuvenation of the industry within five years through the concentration of its manufacturing potential in groups of factories that will make strictly standardized sets of a limited number of types. To satisfy the taste of the French, renowned for their individuality and reluctance to uniformity, a small number of radios will continue to be imported from abroad.

It is estimated that during the five years' period, a target figure of 6,000,000 sets will be reached, and the 1938 output within two years.

The cost of these receivers will probably be, in the initial stages, higher than before the war due to higher wages, increased raw material prices and inflated overheads.

Holland

With its international ramifications in Britain, France, Germany, Italy, Hungary, Sweden, Finland and most other European countries, as well as branch factories in the U.S.A., Australia, Argentine, and elsewhere, the *Dutch Philips* concern of Eindhoven, has undeniably contrived to make Holland, in spite of its physically limited home market, one of the most important radio manufacturing countries in the world.

Still hampered by lack of essential raw materials, a depleted labor force and the destruction wrought to buildings and machinery, the Eindhoven works, the biggest of its kind in Europe, is today swinging into production at a steep pace and probably soon will have reached pre-war levels of output.

The Soviet Union

Sprawling across nearly one-sixth of the world's land surface, a sweep of the earth containing all the raw materials required for the production of radio equipment, the U.S.S.R. occupies a special position among Europe's radio manufacturing countries, due as much to her geographical location as to the fact that the Russian radio industry is conducted along strict state-monopoly lines.

At present, this relatively small industry is concentrating on the mass production of single-band, 3 tube, straight receivers, 4 tube, 3 band, t.r.f. sets and 4 tube superhets, all housed in wooden cabinets. Technically, these radios follow American construction and lay-out more than European and tubes and components are usually either direct copies produced in the country under license or else adaptations of other versions.

Measured in relative purchasing power, prices of sets are rather high just now, due to the supply lagging far behind the demand, and despite enormously increased production programs for the future, will continue to be so until more pressing needs are met and a measure of normality has returned to this Nazi-seared country.

Television in Europe Today

Complementary to manufacturing

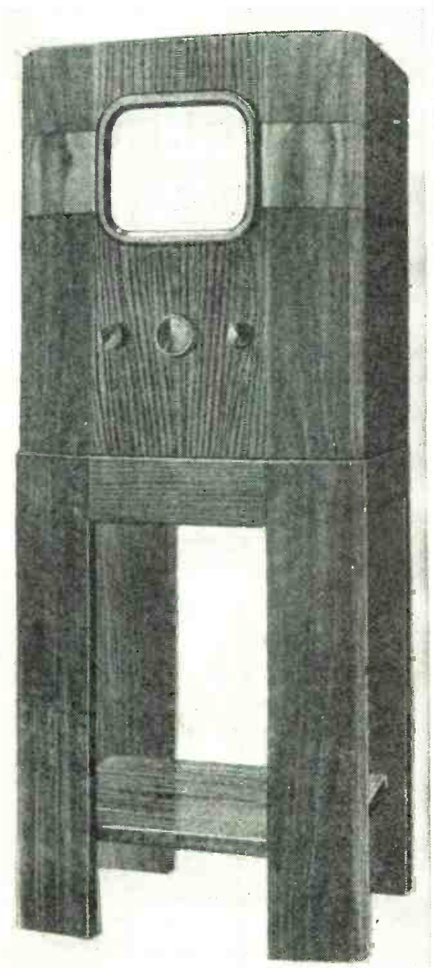
sound broadcasting equipment, the European radio industry, like the radio industry of the U.S., early embarked upon the making of domestic television receivers.

Of all European countries, however, Great Britain alone maintained regular television transmissions, relayed to some 20,000 set-owners, before the war; neither France, Germany, Russia nor Italy could claim similar services at that time and the number of sets in operation in any of these countries never rose above 10,000.

The position is not materially changed today, and Britain is still well in advance of other countries in the manufacture of television receivers as her manufacturers, fully awake to the dangers of being scooped in the international television markets by postwar competition, at an early date carried out the preliminary spade work necessary for putting into production the blue-printed prototypes of the models now coming into the market at the rate of a few dozen at a time. It has been confidentially estimated that even present acute shortage of cathode-ray tubes will not prevent the total number of telesets in operation in this country from increasing to at least 50,000 by the end of 1946.

Basically, these receivers are of a

Television adapters of the type popular in England. Ordinary broadcast receivers are used in conjunction for the sound.



similar quality as pre-war models, and are sold at prices ranging from $180 for small-sized units to about $300 for full-sized screens. The higher priced, four-in-one combination sets comprising sight and sound with phonograph and automatic recording retail at approximately $700.

France, too, has made progress in television receiver manufacture in recent years, and table models equipped with dual dials for vision/sound adjustment and synchronising/brightness control are scheduled for release shortly to the public at popular prices.

Similarly, Russia, Switzerland, Italy, Holland and Belgium—countries which have either resumed television production or else are contemplating its commencement in the near future —are today making efforts to build up markets for telesets.

Since the popularity of television is governed to a large extent by the cost of purchasing receivers, unit sales will be precluded from rising appreciably above pre-war figures by the material impoverishment of Europe, as long as prices are maintained at their present levels; a glance at the income structure of even Britain, a country still enjoying the highest standard of living in Europe, shows that 85 per cent of her net national income is in the hands of families with incomes below $2,000 per annum.

Accordingly, it can be taken for granted that the lower income groups of Europe will not be able to command the use of television unless their purchasing power is raised or prices reduced through large-scale production of low-priced sets.

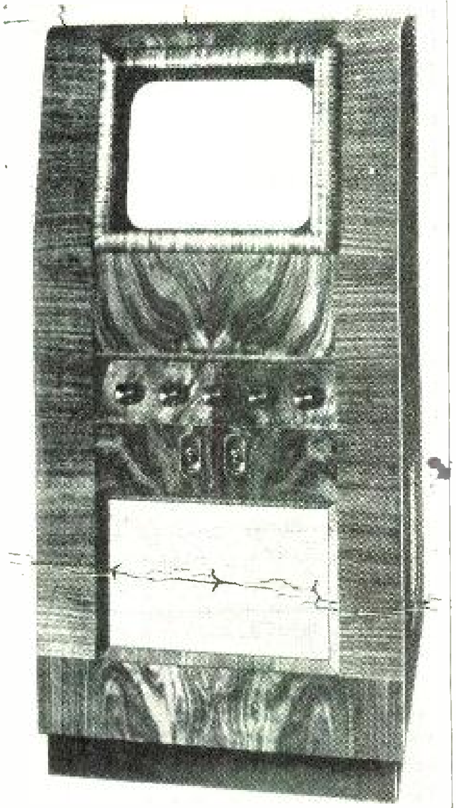
The Current Market Outlook

Europe is today bulging with customers willing to buy radio and television receivers at almost any price and no amount of stuff poured into this continent's markets can possibly exhaust its absorption capacity without leaving a wide margin for additional quantities.

Accountable for this state of affairs is, in the first place, the fact that in spite of miracles of improvisations performed in the absence of proper tubes, accessories and parts by radio engineers, technicians and manufacturers in some countries, few receivers were made in Europe between the end of 1939 and mid-1945 apart from a mere trickle of war-time civilian radios of the utility type in Britain and junked sets and crystal detectors in France, Holland, Belgium and elsewhere.

The magnitude of the existing potential market can be best gauged, perhaps, if it is realized that approximately one-third of Europe's 85 million odd radios in use at the time of the outbreak of the war are today destroyed, damaged or otherwise out of order and the number of sets of all types needed as replacements, as well as to fill the demand for new receivers, is reliably put at least 50 million.

No matter how anxious manufac-



A modern British television receiver.

turers over here may be to restore the volume of their production to pre-war levels or step up beyond it, this demand cannot be met by the European radio industry single-handed for a long time to come; nor can it be filled, of course, by unloading limited quantities of usable surplus radio equipment from military stores.

Consequently, it can be anticipated that U.S.-made radios will figure prominently in post-war European radio sales and millions of dollars' worth of sets, imported from America, will find a ready market among would-be buyers, unable to obtain other than inferior quality and second-hand models at fantastic prices.

However, any U.S. radio manufacturer who intends getting rich by pushing cheaply produced radios overseas, irrespective of whether they are aesthetically acceptable to Mr. Babbitt's opposite number across the Atlantic, will soon discover at his cost that a stable export trade can only be built up when bearing in mind that a sizable share of Europe's post-war radio market will be geographically occupied as follows:—

1. Western Europe. Full-sized performance superhets and midget superhets combining technically all the advantages of the normal superhet, including its superb acoustic reproduction facilities, as the so-called second or auxiliary set in the bedroom or kitchen.

2. Northern Europe. Economically-priced, workmanlike multi-band receivers of medium and high-class performance.

3. Southern Europe. Low-priced,

straight receivers, superhets and midgets of effective range and satisfactory output.

4. Eastern Europe. Simple type receivers of single and double band range and limited selectivity in which quality is subservient to price.

—30—

Practical Television

(*Continued from page 41*)

be considered the plate-to-ground, grid-to-ground, and the miscellaneous wiring-to-ground capacities. In a typical resistance coupled amplifier stage, the total of these capacities may amount to no more than 20 μμfd.; however, the reactance of such a capacity at 4.5 mc. is sufficiently low to cause an appreciable shunting effect on the high frequency components of the picture signal. Just how serious this shunting effect will be, is determined, to a large extent, by the value of the plate load resistance. In an ordinary resistance coupled amplifier for broadcast use, this plate load resistor may have a value of anywhere from 50,000 ohms to 200,000 ohms. In a video amplifier it is necessary to use a plate load resistor of a much lower value. The precise value required will depend on the bandwidth requirements, the aforementioned capacities and other considerations, but in general will be found to be of the order of 500 to 3000 ohms. Since the capacitive reactance of 20 μμfd. is 177 ohms at 4.5 mc., we find that the shunting effect of this capacity with a 500 ohm load resistor will cause a gain reduction at 4.5 mc. of about 4 to 1, whereas with a 50,000 ohm load resistor, the gain reduction will be 400 to 1. Quite obviously, the use of such a low value of plate load resistor will reduce the over-all gain possibilities of a given tube type much below that normally obtainable. For all practical purposes, when the value of the load resistor becomes small by comparison to the tube impedance the gain in the stage may be assumed to be the product of the transconductance of the tube multiplied by the value of the load resistance. It will be seen from this that the gain of a typical video amplifier stage may be no more than 5 to 10 times, hence a much greater number of stages will be required in order to obtain the necessary amount of amplification than would be required for an ordinary audio amplifier. Some improvement in this situation can be obtained by inserting an inductance in the circuit in such a manner as to counteract the by-passing effect of the tube and wiring capacities. The insertion of such an inductance is normally referred to as "peaking." There is quite a wide variety of peaking circuits for this purpose. Perhaps the most readily understood type is that where an inductance

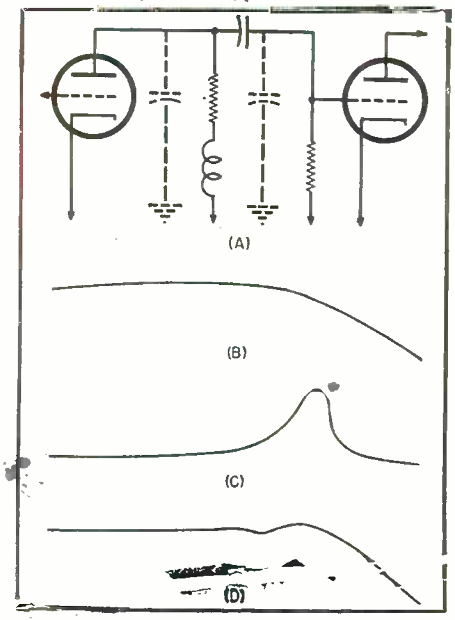
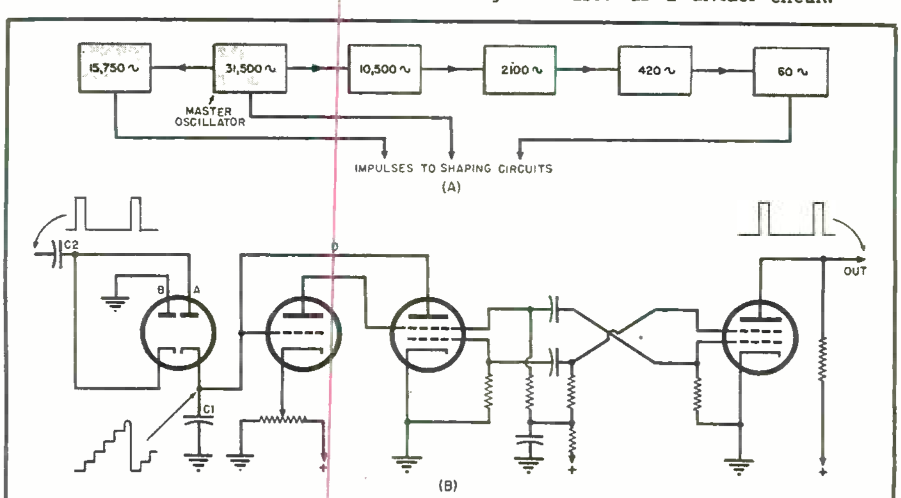


Fig. 4. (A) Shunt peaking coil in plate circuit of amplifier stage. Dotted condensers indicate tube and wiring capacities. (B) High frequency characteristic without peaking coil. (C) High frequency characteristic with peaking coil, but with load resistor shorted out. (D) High frequency characteristic with both coil and resistor in the circuit, as shown in diagram.

Fig. 5. (A) Block diagram of a typical divider chain for synchronizing generator use. Each of the squares, other than the master oscillator, represents a divider circuit. (B) Refined multivibrator arrangement used as a divider circuit.



is inserted in series with the plate load resistor, as shown in Fig. 4. If the value of this inductance is carefully chosen so that in connection with the shunt capacity of the tubes and wiring, it will resonate at a frequency slightly above the desired pass band, it will then effectively increase the load impedance into which the tube works, at the resonant frequency. The resonance curve or "Q" of such a circuit will be quite broad, due to the resistance of the load resistor, and hence will help raise the load impedance well down into the pass band. By the use of suitable peaking circuits, an over-all gain of several times can be obtained, compared to what would be possible for the same bandwidth without the use of such peaking circuits.

In general, video amplifiers that are found in television plant equipment may not necessarily have a perfectly flat gain frequency characteristic. This is due to the fact that the output from the pickup tube itself is not flat. In order to faithfully reproduce a picture, it is necessary to have a gain frequency characteristic which rises at both the low frequency and the high frequency end of the pass band.

Somewhere in the video amplifier chain there must be added the shading signals previously mentioned. In addition to these signals, there must also be added a blanking signal. This blanking signal, sometimes referred to as picture blanking, or kinescope blanking, serves a two-fold purpose: 1. It blanks out the return trace on the receiving kinescope, of which more will be said later, and 2. it provides a reference signal for controlling or determining the average brightness of the picture. The configuration of this signal is very much the same as that shown in Fig. 1B for iconoscope blanking with the exception that the impulses are slightly wider. This signal must be added to the picture signal in such a manner that the narrow side of the impulse will correspond to, or be in the same direction as the blacks in the picture. The addition of the blanking signal to the video signal may be accomplished by connecting the plates of two tubes, one of them amplifying the video signal and the other amplifying the blanking signal, to a common load resistor. The two signals will thus add algebraically. After this addition process, the signal is passed through an amplifier stage on which the grid bias is variable. When the bias is adjusted toward cut-off, the surplus blanking signal will swing beyond cut-off of the tube. In this way the amplitude of the blanking signal may be varied without causing any appreciable variation of the amplitude of the picture components. For normal operation, the amplitude of the blanking signal should be just equal to the amplitude of that portion of the picture signal which represents the blackest black of the picture. Fade-outs and fade-ins may be accomplished by biasing this so-called "clipper-stage" still further in a negative direction, thus causing the tube to stop drawing plate current during any part of the picture signal cycle.

In order to maintain picture signal amplitudes at their proper values, it is customary to use the cathode-ray oscilloscope. An oscilloscope used in this manner corresponds to the volume indicator that is used for sound broadcasting purposes. It provides an indication of the strength of the picture signal so that the average brightness on the home receiver, as determined by the amplitude of the kinescope blanking signal, will remain essentially constant. In using an oscilloscope of the ordinary variety on a television picture signal, the image on the oscilloscope may wander up and down across the face of the tube, even though the peak-to-peak amplitude of the signal remains the same. This movement is due to the fact that the a.c. axis of a signal may vary over quite a wide range, depending upon picture content. On a pure sine wave the a.c. axis is the zero point about which the voltage varies from positive to negative and is midway between the peak values of voltage in both directions. In a non-symmetrical signal, however, such as all television signals, the a.c. axis may not be, and usually is not, precisely midway between the positive and negative excursions of voltage. In a non-symmetrical signal, the a.c. axis will be at that point at which the area under the curve on the positive side is equal to the area under that portion on the negative side. Hence, it will be seen that as the ratio of blacks to whites in a picture signal varies with changes in picture content, the position of the a.c. axis may like-wise vary between the maximum positives and maximum negatives of the signal, even though the peak-to-peak amplitude remains the same.

The use of the phrase, peak-to-peak voltage or amplitude comes about due to the same effect; the fact that the a.c. axis is not always midway between the positive and negatives peaks of the signal, and that it may vary. In ordinary sound broadcasting practice, rectifier type volume indicator meters are used which read between average and r.m.s. voltage, and although the wave shape of audio signals are seldom sine waves, these meter indications are entirely adequate for the purpose. In the case of a television signal, it will be seen that the reading any such meter would give would be wholly worthless since it would depend not only on the amplitude of a signal, but also on the picture content. It is then, for this reason, that cathode-ray oscilloscopes are used for voltage measurements, and that when making such voltage measurements, the measurement is made from the maximum negative peak to the maximum positive peak or the total peak-to-peak amplitude of the signal. Thus, as far as measurements of voltage are concerned, the position of the a.c. axis is of no importance.

Thus far we have developed a video signal, complete with kinescope blanking, but as yet without any information for the receiver to use in synchronizing the movement of the scanning beam in the kinescope with the scanning beam in the iconoscope. It is necessary then, to add an additional signal which will contain such information. This information is referred to as the synchronizing signal. The synchronizing signal is made up of the following frequencies: the horizontal scanning frequency impulses, two times this frequency, and vertical scanning frequency impulses. The precise configuration of this signal will be discussed in more detail in that portion which covers receiver operation.

During the discussion of the production of a television signal, numerous references have been made to various impulses, such as those required for the deflection of the pick-up tube beam, the iconoscope and picture blanking impulses and the synchronizing impulses, without any mention of where or how these impulses originate. Synchronizing generator or pulse generator are the names usually applied to the device which originates these signals. A very high degree of accuracy is required in a synchronizing generator. The FCC requirements for a television signal, as it appears on the air, specify not only the horizontal and vertical scanning frequencies, but also the amount of time that may be consumed in blanking out the horizontal and vertical return traces; the shape, relative amplitude and position of the synchronizing signal with respect to the blanking portion of the picture signal; and the over-all stability of the device in that the regularity of occurrence of the impulses are specified, as is the rate of change of frequency of the horizontal frequency components.

The master oscillator of a synchronizing generator is usually of the tank circuit variety, operating at twice horizontal scanning frequency (31,500 cycles). If the oscillator is particularly stable, it may operate uncontrolled, or it may be controlled by the local 60 cycle power source, or by a subharmonic of a crystal oscillator which operates at a much higher frequency. There are two reasons for the particular choice of master oscillator frequency; one is the fact that there are 31,500 cycle components required in the synchronizing signal, and the other is due to the whole number plus-a-half relationship between the horizontal and vertical scanning frequencies. 15,750 cycles cannot readily be divided down to 60 cycles because of the one-half factor, but 31,500 cycles will divide, since it bears a simple whole number relationship to 60 cycles (the field or vertical scanning frequency).

In order for the interlace to be accurate and stable, the vertical or 60 cycle impulses are derived from the master oscillator through a series of divider circuits. These dividers may take one of several forms, but in general they consist of several blocking oscillators, multivibrators or some other readily controlled type of oscillator. Fig. 5A shows a block diagram of a typical divider chain for synchronizing generator use. Each of the squares, other than the master oscillator, represents a divider circuit of the type mentioned, or preferably of the counter type as shown in Fig. 5B. It will be seen that this is a refined multivibrator arrangement. The positive portion of the input impulse causes diode *A* to draw current and partially charge condenser C_1. The cathode of the triode is so set that no plate current flows, and the partial charge on condenser C_1 is insufficient to reduce the bias on the triode to the point where it will draw plate current. During the negative portion of the input signal, condenser C_2 is discharged through diode *B*, but C_1 retains its partial charge. On the next positive input peak, condenser C_1 receives another increment of charge, and so on until the charge on C_1 is sufficiently positive to cause the triode to draw plate current. The triode plate current sets off the multivibrator, which in turn discharges condenser C_1 over lead *D* and thus prepares it for another cycle. It will be seen then that the multivibrator can be made to operate at any sub-multiple of the input frequency, as determined by the cathode voltage of the triode which controls the number of successive increments of charge on condenser C_1 before recycling.

From the standpoint of picture interlace, the frequency relationship between the horizontal and vertical scanning impulses is of much greater importance than is the absolute frequency of either, hence the divider arrangement which is used, is of considerable importance.

The notation "to shaping circuits" appears in Fig. 5A. "Shaping circuits" is the name used to describe those circuits wherein the impulses are made narrower or wider, squared off and combined as required in order to produce the deflection, blanking and synchronizing signals previously referred to. In these shaping circuits, much use is made of multivibrators; differentiation and integration circuits; limiter or clipper tubes wherein the grid is biased to cut-off or beyond, often by means of grid current; octodes; and delay networks. A comprehensive treatment of these circuits is beyond the scope of this article. Suffice it to say, however, that the stability and accuracy required in synchronizing, or impulse generators for television use, place them among the most complicated units in the system.

The addition of the synchronizing signal to the video and blanking, completes the picture signal which is then ready for r.f. transmission by the transmitter. The television transmitter poses a number of problems not encountered in the ordinary broadcast transmitter. As in the camera video amplifiers, the pass band must be a minimum of 4.5 mc. wide and the phase characteristic must be linear. This pass band must be maintained throughout the r.f. stages, and the antenna system. The difficulty of amplitude modulating a transmitter with a 4.5 mc. or wider signal, and delivering any large amount of power to the antenna, at frequencies in the order of both 100 mc. and 400 mc., is attested to by the many such discussions which have appeared in print recently, as well as by testimony before the FCC in connection with the new frequency allocations for television and FM. Frequency modulation of video transmitters has been tried, but for the most part, has been found to be somewhat less satisfactory than AM. The sound channel which accompanies a television picture is, however, frequency modulation.

There are two other essential differences between a television picture transmitter and an ordinary AM sound transmitter. One of these is the so-called single side band method of transmission wherein a vestigial side band filter is used in the antenna system to suppress the lower side band and thus transmit only carrier and upper side band. By this means, more effective utilization of the 6 mc. r.f. channel is possible, in that it allows a 4.5 mc. spacing between picture and sound carriers. This is well over one-half the total channel width which, in the case of double side band transmission, would represent the maximum pass band possible even if the sound channel were to be ignored. The improvement in the picture resolution which is made possible by this arrangement is obvious and is generally recommended.

The other essential difference is the transmission of a d.c. component by the transmitter. This may be accomplished by applying a bias to the transmitter output stage, which bias varies in accordance with the picture content in such a way as to maintain the peaks of the synchronizing signal at the point of maximum carrier voltage, regardless of picture signal content. The synchronizing signal is specified by FCC as occupying 25% of the maximum carrier voltage. It will be seen that during a fade-out when nothing but synchronizing signal is being transmitted, the shift of the a.c. axis of the video signal up into the synchronizing portion of the signal, would cause an appreciable reduction in transmitter output were it not for the d.c. insertion. This reduction in transmitter output might well cause a sufficient reduction in signal strength at the receiver to allow the receiver to drop out of synchronization on each such fade-out. Therefore, the synchronizing signal is always transmitted at maximum carrier voltage and that portion of the signal having to do with picture components modulates downward, or toward a decrease in carrier voltage.

In the operation of a television system, a test pattern is used to provide a test signal which corresponds to the 1000 cycle tone used in audio work.

This test pattern is placed in front of the camera, or projected onto the mosaic of the pick-up tube. The geometric figures on the test pattern are so arranged that a great deal of information about the performance of the system can be obtained by observing the final result on a kinescope. The uses for the information contained in this signal are probably more important in receiver work than in transmitter work, since it provides a means of fairly accurately judging receiver performance without the necessity of resorting to large and expensive test equipment.

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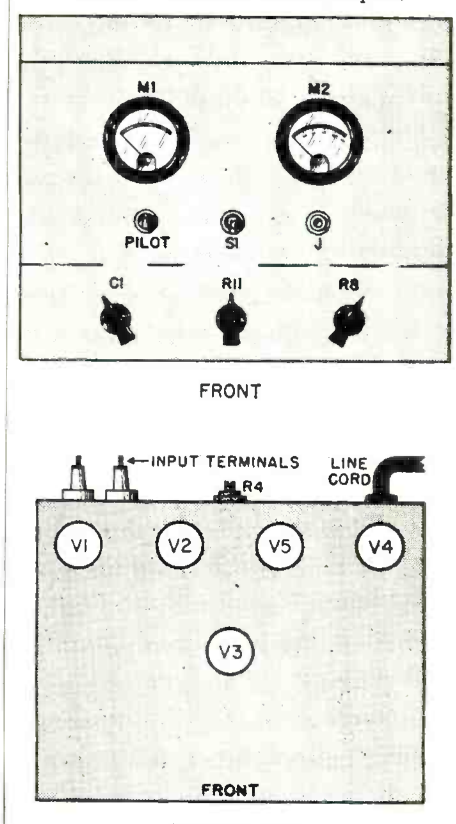
A Per-cent Modulation Meter

(*Continued from page* 45)

The following procedure is recommended when using the monitor: (1) With pick-up device disconnected from input terminals, switch on monitor and allow about 3 minutes for warm-up. (2) Set meters M_1 and M_2 to zero. (3) Connect pick-up device and couple to transmitter. (4) Set S_1 to POSITIVE. (5) Adjust setting of C_1 and coupling of pick-up device until meter M_1 is deflected to reference value. M_2 then will show automatically the modulation percentage on positive peaks. (6) Set S_1 to NEGATIVE and M_2 will show modulation percentage on negative peaks.

When monitoring an AM radiotelephone signal, meter M_1 should show no change from the carrier reference deflection during modulation. Any

Fig. 6. Panel and chassis layout.



introduced into the mixer grid-cathode circuit must be accorded the same consideration as in the previously described systems.

Use of a high i.f. in the receiver necessitates a greater frequency separation between the oscillator and tuned signal circuit. The greater the frequency separation, the greater will be the attenuating effect that the signal-tuning circuit (which is always tuned to a frequency different than that of the oscillator) has upon the oscillator voltage actually developed in the mixer grid circuit.

Fig. 3 illustrates a fairly common commercial adaptation of the cathode circuit coupling arrangement. It has been employed in such home receivers as the *RCA* 15X and 36X, *Belmont* 7D22 Series B, etc. The oscillator voltage is injected into the cathode circuit of a pentode mixer tube operated with single-electrode input, by returning the mixer cathode to ground through the oscillator-cathode coupling coil L_0.

A variation of the popular arrangements for introducing oscillator voltage into the cathode circuit of the mixer is illustrated at C of Fig. 2. Here the oscillator cathode circuit is *capacitively* coupled to the mixer cathode circuit by capacitor C_1. The small by-pass capacitor, C_2, across the cathode-bias resistor of the mixer provides a convenient method of reducing the oscillator voltage impressed at the high-frequency end of the receiving band, since its reactance will be lower at the high frequencies (where the oscillator voltage is usually greatest). If the oscillator voltage impressed at the high-frequency end of the receiving band is too high, it may be reduced to the required value by simply using a capacitor of larger capacitance value in this position.

(The action of single-electrode input type mixers and converters will be explained in the next article of this series.)

(To be Continued)

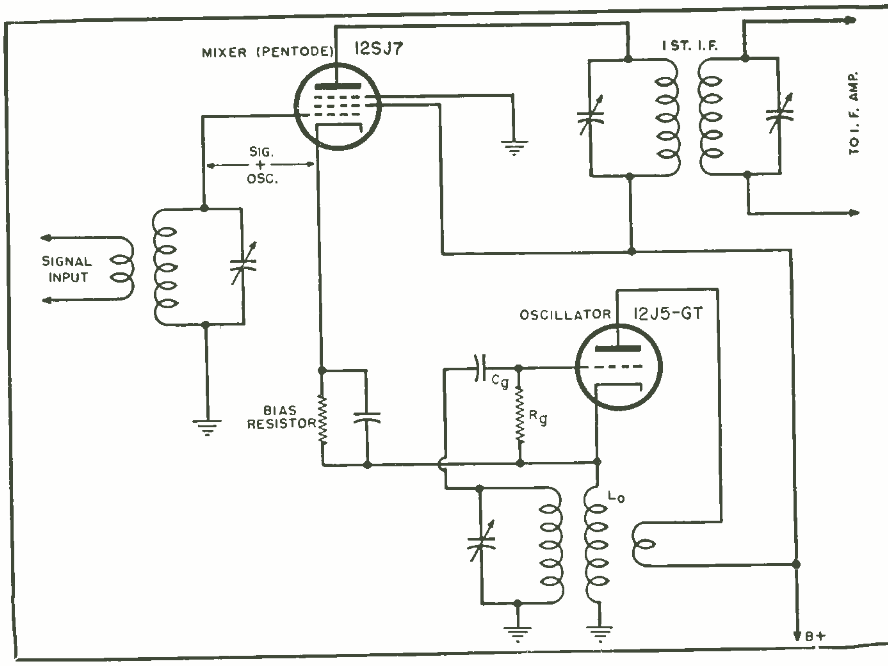


Fig. 3. How oscillator voltage is injected into cathode circuit of pentode mixer, operated with single-electrode input in such home receivers as RCA 15X and 36 X, Belmont 7D22, etc. All band switches and miscellaneous circuit elements are omitted for clarity.

Manufacturers' Literature

Readers are asked to write directly to the manufacturer for the literature. By mentioning RADIO NEWS, the issue and page, and enclosing the proper amount, when indicated, delay will be prevented.

RESISTOR CATALOGUE

The *Precision Resistor Company* has just issued a 16-page catalogue giving the electrical specifications and physical dimensions of 26 resistor types.

Included in the listing are resistors with values up to 1 megohm with either inductive or non-inductive windings. Wattage ratings from ½ to 50 watts are available.

A copy of this catalogue is available from *Precision Resistor Company*, 334 Badger Avenue, Newark 8, New Jersey.

SOLA BULLETIN

A new bulletin, "Electrical Power, Disciplined" is being offered by *Sola Electric Company.*

The booklet contains a complete discussion of the construction and operating theory of the constant voltage transformer, engineering and operating data, a survey of line conditions which make constant voltage transformers necessary and a section devoted to new developments.

The catalogue lists 31 standard types in capacities ranges from 15 va. to 10,000 va. with complete electrical and mechanical specifications.

A copy of this bulletin, 2CV-102 is available on request. Address all inquiries to *Sola Electric Company*, 2525 Clybourn Avenue, Chicago 14, Illinois.

BUYERS' GUIDE

The 1946 handbook, "Reference Book and Buyers' Guide," of interest to amateurs, radio servicemen and users of industrial electronic equipment, has just been announced by *Walker-Jimieson, Inc.*

This reference book contains listings of over 10,000 items, including complete sections devoted to public address systems, intercommunications systems, tubes, batteries, test equipment and maintenance supplies.

This 100-page booklet is free on request. Address letters to *Walker-Jimieson, Inc.*, 311 S. Western Avenue, Chicago 12, Illinois.

ANTENNA DATA

Technical Appliance Corporation has just released a new and up-to-date antenna catalogue which includes antenna systems for old and new radio receivers, FM, facsimile and television.

The catalogue describes and illustrates various noise-reducing and multiple antenna systems, a new store-demonstrating antenna system, tranmission lines, couplers and a variety of dipoles.

A copy of the TACO 1946 catalogue will be sent on request. Address the company, *Technical Appliance Corporation*, 46-06 De Long Street, Flushing, New York.

INDICATING INSTRUMENTS

The *Marion Electrical Instrument Company* of Manchester, New Hampshire, has just issued a new catalogue covering their line of electrical indicating instruments.

Included in the catalogue are milliammeters, microammeters, gauss meters, null indicators, multi-range metertesters, and direct-reading fluxmeters.

Each of these instruments is available in a variety of ranges for specific electronic applications.

Detailed information on construction procedures is also given. A copy of this 28-page book may be secured by writing to the *Marion Electrical Instrument Company*, Manchester, New Hampshire, and asking for the catalogue "Marion Electrical Indicating Instruments."

SIMPLEX DATA SHEET

A new data sheet, listing many of the standard r.f. cables, has just been released by *Simplex Wire and Cable Company.*

This four-page sheet lists the physical characteristics of the cables and gives a rather complete description of the electrical characteristics of each cable.

Copies of this data sheet will be forwarded to those requesting them from *Simplex Wire and Cable Company*, 79 Sidney Street, Cambridge 39, Mass.

V-T FUZE STORY

The story of the Proximity Fuze, and the part played by one company in the manufacture of components for this fuze has been told in an interesting eight-page booklet which is being distributed by *Cornell-Dubilier Electric Corporation.*

This booklet, which is well illustrated, gives the history of the development of the Proximity Fuze and various types of fuzes in use, complete with cross-section diagrams of the mechanism.

A copy of the booklet "The Proximity Fuze" will be forwarded upon request to *Cornell-Dubilier Electric Corporation*, South Plainfield, New Jersey.

EDUCATIONAL ELECTRONICS

A booklet describing ways in which electronics can be used in education has been issued by the Transmitter Division of the *General Electric Company's Electronics Department.*

The 8-page booklet is illustrated with charts, pictures of electronic equipment and actual scenes showing the use of electronics for educational purposes. A complete bibliography of publications which are available to educators is also included.

Copies of the booklet are available free on request to the Publicity Section, *G.E. Electronics Department,* Thompson Road Plant, Syracuse, New York. Be sure to specify booklet EBR-28.

AMPLIFIERS

The new line of audio amplifiers, pre-amplifiers and accessories, now in production at *Newcomb Audio Products Company,* is described in a 24-page booklet recently issued by the company.

Listed in the booklet are the company's new K-series, deluxe models and the H-series, standard models. Also included are portable amplifiers built around all models of both the K- and H-series. Actual response and distortion curves, based on tests of completed amplifiers are also included in this catalogue.

Inquiries for additional information, or copies of the catalogue, should be addressed to *Newcomb Audio Products Company,* 2815 S. Hill Street, Los Angeles 7, California.

PROCEDURE MANUAL

Ranger Aircraft Radio Division of *Electronic Specialty Company* has just issued a new radiotelephone procedure manual which is now available to pilots and plane owners.

The manual includes the correct phrases and procedures to use in two-way radiotelephone communications, instructions and suggestions on correct phraseology, how to contact airport control towers and CAA communication stations, the phonetic alphabet, Morse code and shortened phraseologies. A section is also devoted to flying radio ranges.

This manual is available without cost from *Ranger Aircraft Radio Division, Electronic Specialty Company,* 3456 Glendale Boulevard, Los Angeles 26, California.

INDICATOR LIGHTS

A new 26-page catalogue, listing hundreds of indicator light assemblies for various panel board and instrument signalling applications has been issued by *Gothard Manufacturing Company.*

Included in the catalogue are indicator lights with lucite caps, enclosed indicator lights, bayonet shell units, bayonet socket indicator lights with outside terminals, jewel holders, variable intensity indicator lights, etc.

Copies of Catalogue 46 may be obtained by writing *Gothard Manufacturing Company,* 2110 Clear Lake Avenue, Springfield, Illinois.

TRAINING PAMPHLET

A 36-page, illustrated pamphlet which described class-room demonstration procedures with electronic test equipment is currently available from *Radiolab Publishing Company.*

Copies of this manual will be sent to users of Precision Apparatus test instruments, Dumont oscillographs and Masco and Meissner amplifiers.

Complete circuit and demonstration set-ups are described and illustrated along with pertinent information on the equipment under test.

A copy of the booklet will be forwarded upon request to *Radiolab Publishing & Supply Company,* 652 Montgomery Street, Brooklyn 25, New York.

CANNON CONNECTORS

A revised edition of the *Cannon Electric,* Type AP, Bulletin is now available for distribution to interested persons.

This 12-page catalogue lists five plugs and three receptacle types which, with the six insert arrangements, makes possible 48 different fittings. This series which was originally designed for the Signal Corps may be used in many types of radio, telephone and sound circuit applications where a fitting, gasketed for weather resistance, is required.

Copies of the new bulletin are available free of charge from the *Cannon Electric Development Company,* 3209 Humboldt Street, Los Angeles 31, California.

MARINE EQUIPMENT BOOK

A brochure describing new electronic communication and navigational aids being manufactured by *General Electric Company* is available to those requesting it from the company.

Included in this booklet are all type of equipment for various classes of ships in maritime service; the Electronic Navigator, depth-indicating and recording equipment, radio-direction finders, high-power public address systems, shipboard announcer systems, water-proof loudspeakers, marine type broadcast receivers, radio transmitters and communications receivers.

A copy of this brochure will be forwarded to those requesting it from the Publicity Section, Thompson Road Plant, *General Electric Company,* Syracuse, New York. Please specify publication EBM-1.

CONTROLS AND RESISTORS

A catalogue covering a variety of resistors, controls and resistance devices has just been issued by *Clarostat Mfg. Company, Inc.*

Included in the listing are wire-wound power resistors, and glass insulated flexible resistors; composition-element and wire-wound rheostats and potentiometers; tapped and taper controls and switches; constant impedance input and output controls and attentuators; tube-type wire-wound resistors, automatic line voltage regulators and replacement line ballasts; power rheostats and a power resistor decade box.

A copy of Catalogue 46 may be secured from any *Clarostat* jobber, or by writing direct to *Clarostat Mfg. Com-*

pany, Inc., 285-7 North 6th Street, Brooklyn, New York.

ALLIED CATALOGUE

Allied Radio Corporation of Chicago is announcing the release of the new 1946 catalogue covering over 10,000 items for the radio serviceman, the dealer, hams, experimenters, engineers, schools and industry.

The catalogue is indexed for easy reference. An enlarged section is devoted to amateur equipment needs, including communications receivers, keys, mikes, kits, books, and many other items.

Several special kits, designed for the experimenter, beginner and, radio student, are included in the catalogue.

A copy of the 1946 catalogue will be forwarded free, upon request to *Allied Radio Corporation*, 833 West Jackson Boulevard, Chicago 7, Illinois.

TEST EQUIPMENT

Two booklets containing a listing of several new test equipment items are now available upon request to *Metropolitan Electronic & Instrument Co.*

Included in the booklets is descriptive material and prices on such items as tube testers, pocket model V-O-Ms, multitesters, vacuum-tube volt-meters, combination tube and set testers, etc.

Copies of these booklets will be forwarded to those requesting them from *Metropolitan Electronic & Instrument Co.*, 258 Broadway, New York 7, New York.

-30-

Simple FM Converter

(*Continued from page* 31)

obtain this by connection to the screen grid pin on one of the audio output tubes, but this connection should be made only if this screen voltage is not obtained through a dropping resistor in the set. A plate supply voltage for the converter, between 100 and 300 volts, will be satisfactory, and the current drain is considerably under ten milliamperes.

Basically, the converter consists of a crystal detector used as the non-linear element in a mixing system in which a received signal in the frequency range 90 to 100 megacycles is made to beat with the output of a fixed 50 megacycle oscillator to produce a signal in the 40 to 50 megacycle tuning range of a pre-war FM receiver. The circuit diagram of Fig. 1 shows the 50 megacycle oscillator stage comprising a 6J5 tube, the resistors R_1 and R_2, the coil, L_2, and the condenser, C_2. The circuit is that of a high-frequency Colpitts oscillator whose tank circuit consists of the tube interelectrode capacities and the coil L_2. The condenser C_1 and coil L_1 between the converter input terminals and crystal, function as a high-pass filter having a cut-off frequency slightly below 90 megacycles, attenuating spurious responses resulting from low-frequency signals.

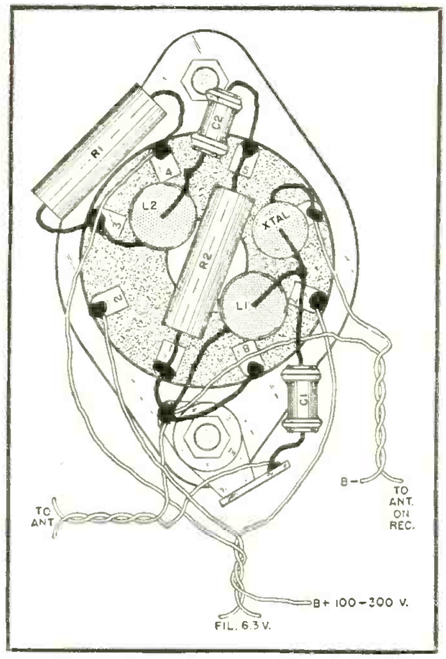
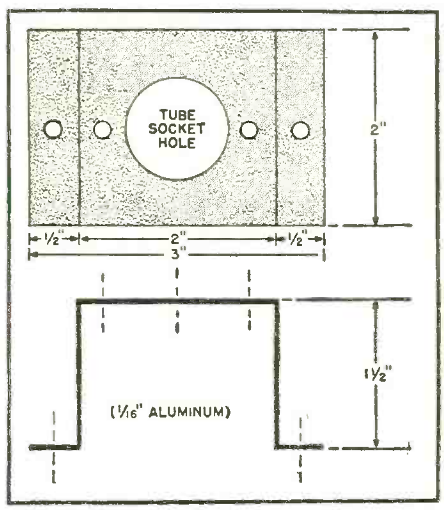


Fig. 2. Under chassis view showing component connections to 6J5 socket pins.

In service the converter is used with a suitable antenna connected to the input terminals. It has been found advisable to exercise some care in location of antenna wiring to insure proper functioning of the high-pass filter. The output terminals of the converter should be connected to the antenna input terminals of the receiver with which it is to be used. Tuning of the converted receiver is accomplished by the same means as it was previously tuned.

The only converter components which even remotely approach being critical are the coils L_1 and L_2. L_1 should have sufficient inductance to function with condenser C_1 to form a high-pass filter having a cut-off frequency between approximately 65 and 85 megacycles. The oscillator coil L_2 should be proportioned to obtain an oscillator frequency of 50 megacycles, although deviation from this figure of plus or minus one megacycle is acceptable. It has been found most con-

Fig. 3. Converter chassis.



venient, as mentioned previously, to wind both coils on resistors using *Allen-Bradley* type GB, 1 watt resistors as coil forms. The use of resistance values above 500,000 ohms is recommended.

The parts layout shown in the photographs, is a design involving a minimum of hardware. Dead pins on the 6J5 oscillator tube socket are used as tie points.

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Grid Bias Modulation

(Continued from page 74)

bias and cut-off bias. The effective excitation may be increased either by raising the r.f. excitation voltage, or by lowering the operating bias.)

To provide substantially linear modulation of the carrier at a level approaching 100 per-cent, it is necessary to adjust the effective excitation to that point which gives approximately ¼ the maximum carrier power (½ the output r.f. voltage or current) which is obtainable with the excitation at near-saturation, assuming the while a fixed value of antenna loading. If this adjustment results in the plate dissipation being less than the maximum permissible, then the antenna loading should be increased as required to bring it up to the desired value, the effective excitation being readjusted, as necessary, to maintain the modulation capability near 100 per-cent. When so adjusted, the stage is delivering the maximum safe carrier power which can be fully modulated.

The requirement for careful adjustment of the effective excitation makes a grid modulated stage a little more difficult to tune up than a plate modulated rig. An r.f. ammeter in the antenna circuit is a great help in acquiring the "feel" and facilitates a quick tune up. However, with a little practice a passable job can be done by relying on the grid and plate current meters in the modulated stage, together with a flashlight bulb coupled to the antenna or antenna feed line.

When the stage is properly adjusted, it should be possible to "whistle up" the antenna current 20 or 25 per-cent, with the plate current remaining substantially constant and the grid current kicking up considerably. When a medium-low mu tube (say a mu of 6 or 8) having a very high transconductance is run at high plate voltage, the grid current may be zero or nearly so under carrier conditions when the stage is correctly adjusted. With higher mu tubes the resting grid current will run between 2 and 6 per-cent of the plate current. After the actions of the grid current meter are observed under normal conditions, the meter will facilitate tuning up the transmitter on another frequency and then serve as an effective modulation indicator.

For maximum economy and performance, the following rules should be observed in designing a class "C" grid bias modulated transmitter:

1. Pick a final tube which has a high plate dissipation per dollar of cost, with a mu between 12 and 35, and run it at maximum permissible plate voltage.
2. Employ bridge rectification for the sake of economy when a plate transformer of sufficiently low wattage rating is not available in a full wave center tapped arrangement.
3. When using two or more tubes in the modulated stage, be sure they are closely matched.
4. Use the r.f. driver plate supply (inverted) as bias for the modulated stage.
5. Use low reactance, capacitive coupling to the modulated stage when feasible, and run maximum rated grid current on the r.f. driver stage. Use the adjustable step-up arrangement of Fig. 1 to permit optimum excitation adjustment.
6. Connect an r.f. swamping resistor across the same coil turns as the grid and cathode of the modulated stage, computing the resistance and wattage in accordance with the preceding text.
7. Use cathode injection of the audio modulating voltage, the amount of audio power and optimum coupling transformer turns ratio being determined as described in the text.

—30—

Within the INDUSTRY

ALBERT L. SCOTT, president of *Lockwood Greene Engineers, Inc.* of New York died of a heart ailment in his home at Chappaqua, New York.

Mr. Scott was 67 years of age. He started his work with the Lockwood Greene organization in 1900, holding various executive positions until he became president in 1926.

Mr. Scott achieved especial prominence in 1932 as a member of the Laymen's Foreign Missions Inquiry financed by John D. Rockefeller, Jr. and later under the same auspices he conducted a study of liquor control systems in the U. S. and Canada.

Mr. Scott was a trustee of Chicago University, Brown University and Spelman College. He was a former president of Rockefeller Center, Inc.

* * *

JOHN C. CERA, until recently a Lieutenant Colonel in the Signal Corps, has announced the opening of his own offices as Industrial Consultant and Labor Counselor.

Mr. Cera, who is well known in the electronics industry, will be located in Washington, D. C. He is an electronic engineering graduate of Carnegie Tech.

* * *

J. K. POFF has been appointed service engineer of the Jobber Sales Division of *The Astatic Corporation* of Conneaut, Ohio.

Mr. Poff who has recently returned from service with the U. S. Naval Reserve was a Chief Naval Inspector of electronic equipment.

His new duties will include providing technical information and assistance to the company's jobbers, and sales and servicing of the product.

His headquarters will be at the main plant of the company in Conneaut.

* * *

WEST COAST ELECTRONIC MANUFACTURERS ASSOCIATION recently held their annual election of officers for the Los Angeles Council at the Jonathan Club in that city.

New officers of the association are; Lew Howard, general manager of the *Peerless Electrical Company*, Chairman; D. A. Marcus, general manager of the *Electronic Specialty Company*, Vice-chairman; and James L. Fouch, president of the *Universal Microphone Company* was re-elected Treasurer.

The Los Angeles group also named the following men to serve with the officers on the executive committee; George L. Carrington *(Altec-Lansing Corp.)*; Robert Newcomb *(Newcomb Audio Products Co.)*; L. B. Brittain *(Brittain Sound Equipment Co.)* and Howard Thomas, Jr. *(Packard Bell Co.)*

* * *

O. E. SIMMS has joined the staff of *Sprague Products Company* of North Adams, Massachusetts as assistant to the sales manager, Harry Kalker.

Mr. Simms, who comes to *Sprague* from the *General Control Company*, will devote his time to contacting distributors in connection with the merchandising of new lines to be released shortly.

Mr. Simms is a radio amateur, an associate member of the I.R.E. and the A.R.R.L.

* * *

NELSON P. CASE has been promoted from the post of chief engineer of the *Hallicrafters Company's* receiver division to that of chief engineer for the entire organization.

Mr. Case came to *Hallicrafters* several months ago after serving as director of engineering design and development for the *Hamilton Radio Corporation*. Prior to that time, Mr. Case was associated with *Hazeltine Electronic Corporation* for 13 years in various capacities.

Mr. Case is vice-chairman of the committee on broadcast and shortwave home receivers of the Radio Manufacturers Association's Engineering Department and is active on several other RMA and RTPB committees. He is a senior member of the I.R.E. and a fellow of the Radio Club of America.

* * *

IRVING C. BROWN has been named sales manager of the Industrial Electronics Division of *Raytheon Manufacturing Company*.

Before joining *Raytheon*, Mr. Brown served as sales manager of the Thomson-Gibb Electric Welding Company.

He will make his headquarters at the company's Waltham, Massachusetts plant.

* * *

VERNON L. HAAG has been named vice-president of *Aerovox Corporation*, manufacturers of radio and electronic capacitors.

Mr. Haag comes to *Aerovox* with 13 years manufacturing, personnel, engineering and production control experience. He was formerly assistant general manager of the *Illinois Watch Case Company,* assistant plant manager of *Sperry Gyroscope Company,* assistant factory superintendent of *Crosley Corporation,* chief engineer of *U. S. Cartridge Company* and works manager for *Majestic Radio.* Mr. Haag is a graduate of Purdue University where he received his B.S. in E.E.

* * *

HENRI BUSIGNIES, director of Federal Telecommunication Laboratories, has been made a Fellow of the Institute of Radio Engineers.

The honor was conferred on Mr. Busignies "for his accomplishments in the field of radio direction finders, particularly pioneering work on instruments having automatic indicating features."

He is chairman of the Sub-Committee on Instrument Landing, Aeronautical Committee, RMA and was the 1926 winner of the Lakhovsky Award, conferred by the Radio Club of France.

Mr. Busignies has been associated with *Federal Telephone and Radio Corporation* and its parent company, *International Telephone and Telegraph Corporation,* since 1928.

* * *

RADIO PRODUCTS SALES COMPANY of Los Angeles, California, distributors of radios, electronic equipment and appliances, have announced that ground has been broken for a new building which will house the company's four divisions; broadcast receivers and appliances; replacement parts and equipment; amateur equipment, and industrial electronic equipment.

In addition to 25,000 feet of floor space, the new location will include ample parking space for customers. The building will be air conditioned and lighted by fluorescents.

* * *

NATIONAL ELECTRIC PRODUCTS CORPORATION has announced the removal of their company to new quarters occupying the entire 13th floor of the Chamber of Commerce Building, 411 Seventh Avenue, Pittsburgh 19, Pa.

The company formerly was located at 107 6th Street, Philadelphia, where it had maintained general offices for the past 40 years.

* * *

THE HALLICRAFTERS COMPANY has announced the purchase of the *Electronic Winding Company* of Chicago as a part of its plan for an extensive enlargement of its component parts division.

Facilities and personnel of the *Hallicrafters* component parts division will be moved from the present location at 1323 South Michigan Avenue to the *Electronic Winding Company* plant at 5031 Broadway, Chicago.

Irving Glerum will head the newly enlarged division as superintendent with J. S. Paterson and Frank Mitchell as engineers. The new division will manufacture coils, chokes, tools, dies, jigs and all types of trimmers.

* * *

GARRARD MOUNTJOY has been appointed vice-president in charge of engineering for *Electronic Corporation of America.*

Mr. Mountjoy is well-known in the electronic field as director of radio research and development for *Lear, Inc.,* head of the license consulting section of the *RCA License Laboratories* and as chief engineer of *Sparks Withington Co.*

He holds over thirty domestic patents and numerous foreign patents on radio and television. During the war he participated in development work on the Loran system of navigation.

* * *

P. B. ALGER has been named application engineer for the *Sprague Electric Company* of North Adams, Massachusetts.

Mr. Alger was formerly a Lieutenant Commander in charge of naval inspection at the *Stromberg Carlson* plant in Buffalo. Prior to his navy service, Mr. Alger served as an engineer for the *New England Power Company.*

He is a graduate of M.I.T. and did graduate work at both M.I.T. and the University of Michigan.

* * *

CARSON M. WHEELER has joined the *Amperex Electronic Corporation* as chief engineer in charge of tube development. He will take over a newly expanded laboratory.

Mr. Wheeler comes to *Amperex* from the *Federal Telephone and Radio Corporation* with whom he was associated for more than ten years. During the war he was assistant to the Director of Vacuum Tube Research for that company and contributed a number of tube developments for radar and related fields.

* * *

DANIEL WOLFRED has been appointed Works Manager for the *Aireon Manufacturing Corporation* of Kansas City, Kansas.

Mr. Wolfred joined *Aireon's* Hydraulics Division at Burbank, California in 1944 and then transferred to the Electronics Division in Kansas City, Kansas last September.

The company manufactures radio and electronic components.

* * *

POTTER & BRUMFIELD SALES COMPANY has recently been incorporated in the State of Illinois to act as distributors for all domestic and export sales of relays, process timers and electro-mechanics manufactured by *Potter & Brumfeld Mfg. Co., Inc.*, of Princeton, Indiana.

The office of this new sales organization is located in Chicago and will be in charge of Ralph T. Brengle, president of the new company. Mr. Brengle, who has just returned from the Navy with the rank of Commander, will make his headquarters at 549 West Washington Boulevard, Chicago 6, Illinois.

* * *

WALTER M. REYNOLDS, information manager of the *American Telephone and Telegraph Company* since May, 1944, has been appointed publications manager at *Western Electric*.

In his new post Mr. Reynolds will be responsible for the production of sales and instruction bulletins, manuals and booklets, and will supervise the preparation of displays, exhibits and posters.

Mr. R. I. Johannesen, editor of the "New York Telephone Review," succeeds Mr. Reynolds as information manager of A. T. & T.

* * *

RUSSELL E. KRAFT has joined *Radio Frequency Laboratories, Inc.*, Boonton, New Jersey, as Senior Electrical Engineer.

Mr. Kraft who has been with the Navy for five years and was recently discharged with the rank of Lieutenant Commander, was connected with the Design Section of the Bureau of Ships. He participated in extended combat tours in both the European and Pacific Theaters as Technical Engineering Advisor in the Anti-Submarine Warfare Section.

Before the war Mr. Kraft was a communications engineer with the *American Telephone and Telegraph Company*.

* * *

ROBERT GILBERT has been appointed sales executive in charge of the northwest area for *Electronic Corporation of America*.

Mr. Gilbert will maintain principal offices at 3524 N.E. 44 Street, Portland, Oregon and from these offices will cover Washington and Oregon on behalf of the company's line of radios and Typatunes.

Mr. Gilbert has had 15 years' experience in the radio and appliance field with Michael's Brothers Department Store in Brooklyn and one of the northwest's largest furniture houses.

* * *

W. G. H. FINCH, founder and president of *Finch Telecommunications, Inc.*, was recently awarded the Legion of Merit by President Truman.

Mr. Finch, who served in the U.S. N.R. with the rank of Captain, was cited for his outstanding service to the government as head of the Countermeasures Design Section, Electronics Division, Bureau of Ships. Mr. Finch held this post from December 1, 1941 to September 1, 1945 and during that time was directly in charge of research, development and design of countermeasure electronic systems.

* * *

DIRECTORS OF PARTS SHOW MEET

The smooth operation of the Radio Parts & Electronic Show and Conference to be held at the Stevens Hotel in Chicago from May 13-16 was virtually assured when the Directors of the

show met in session recently. Left to right in the photograph are: Kenneth C. Prince, J. J. Kahn, H. W. Clough, John W. Van Allen, Bond Geddes, Leslie F. Muter, R. P. Almy, Sam Poncher, J. A. Berman, Charles Golenpaul, and W. O. Schoning.

—30—

Electronic Air Filter

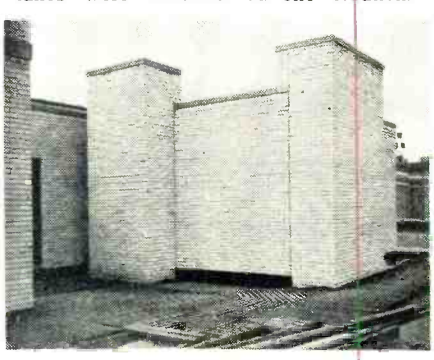
(Continued from page 53)

the last four years at WSM. It is here that the effectiveness of electronic air filters is illustrated most clearly to the building supervisor.

In some instances an air filtration problem might not justify the installation of a fully automatic self-cleaning electronic air filter. The company has recently developed a unit type electronic air filter known as the Electro-Cell. This filter has removable collector plate assemblies which has made possible a number of innovations in construction that simplify installation and insure competent maintenance.

Soon to be placed on the market is another unit type electronic air filter known as the Electro-Airmat. Radically new in design, it introduces an entirely new principle in electronic air filtration. The collector element is electrostatically charged Airmat paper, which is a cellulose product com-

In order to deaden the sound made by intake fans, these "chimney" type air intakes were installed at one location.



posed of a number of plies of porus tissue-like sheets formed of short cellulose fibres in "jack-straw" arrangement. Airmat is also a highly efficient mechanical filtering media; thus, when the power is off for any reason it affords ample protection against the infiltration of dust due to "flu" or "stack effects" which sometimes occur in air conditioning systems. The arrestance rating of this filter, when tested by the Discoloration Method, is 90% or better with atmospheric dust or smoke. Weighing 40% less than the plate type electronic filter, ease of installation and economy and convenience of maintenance are its outstanding features. When the Airmat paper has accumulated its dust load it is removed and replaced with clean material by turning a crank in a mechanical loader which automatically folds the paper into the serrated base section of the filter unit. Spare cells loaded with clean Airmat can be provided for convenience in servicing, and for small installations requiring only a few units, a manual loader answers the purpose.

Electronic air filtration is definitely coming into its own and the radio communications industry is one of the fields in which it promises to play a most significant and important role. With radio equipment becoming more highly developed and therefore more delicate, super-clean air might well become a "must" for every broadcasting station. —30—

..... LETTERS .....
FROM OUR READERS

MR. BELL RINGS THE GONG

"THE letter from Mr. Thomas Bell, North Attleboro, Massachusetts, rings the bell.

"His is the first letter which to my mind really voices a sound and sensible viewpoint.

"That is, to organize an association, national in scope and strong in numbers that can make its influence felt in correcting the evils of discrimination such as he mentions.

"There are myriad associations of various industries and sections of industries. Why not one for radio service shops, as such, united to keep the serviceman up and not down."

H. J. Wolfson
Mercury Radio
Chicago, Illinois

Does this idea meet with your approval, Readers?

* * *

BACK TO SCHOOL?

"I AM writing you to express my appreciation for the fine material contained in RADIO NEWS. I enjoy and read with interest such articles as "Saga of the Vacuum Tube," "Practical Radio Course," "Practical Radar," etc.

"The article 'As I See It' by John Rider sure hit the bull's eye. The serviceman will have to go to school again and train for television as there will be new sets for him to learn about.

"Mr. Rider is, I am sure, correct in saying that 15 out of 1000 independent repairmen are not sufficiently well versed in television.

"Keep the good news coming, for RADIO NEWS has a date with me every month. Good luck and best wishes to all RADIO NEWS readers."

W. H. Stalvey
Greensboro, N. C.

* * *

"I HAVE just been reading the article by John Rider on the outlook for the radio service and repair industry in the postwar era. He unquestionably has many sound facts in his argument. I have thought much along these lines, especially with reference to television, FM and the hundreds of developments that are coming.

"While Mr. Rider has indeed hit upon some of the more serious aspects he has overlooked some that will solve some of the serviceman's problems, provided the serviceman is capable and has a desire to get ahead. It is probably that the net effect of all these developments and gadgets will be to weed out of the field thousands of servicemen who do not wish to learn or who are not enterprising enough to meet the changes. It will also take out of the field many who never had any right to enter the field.

"There always is a human element that must enter the equation. It may be true that factory trained men will know how to shoot trouble in the products of the company who trained them but it is not true that they will be able to work with equal facility on products of other makers. It also is not true that service trained radio men will be able to do an expert job on civilian equipment. I have seen them fail even now.

"In many cities, especially the smaller ones, a serviceman who has built a reputation has nothing to fear. The people know him, his reputation and his work and if he keeps abreast of developments he should be able to get along all right. If he fails it is his own fault.

"Television may require lots of complicated circuits but essentially it is just another way to modulate a transmitter and eventually to demodulate the received signal. A little study will develop the basic knowledge and a few months of experience with the equipment should provide the practical knowledge.

"I have been an amateur since 1922 and have built and operated nearly everything, including the early scanning systems of television. I am not frightened by the outlook but rather will get more fun and pleasure from dealing with complicated apparatus and learning its innermost secrets."

H. G. Turner
Turner's Radio Shop
Petersburg, Virginia

Would any of our readers care to comment on the course of action which the radio serviceman should take to get ready for the high frequency equipment of tomorrow?

* * *

A CHIEF REPLIES

"IN THE November issue of RADIO NEWS I read the letter written by F. A. Munro of Marshfield, Mass., suggesting that he and others like him should be handed commercial tickets just because they are hams or have been in some branch of service. That argument reminds me of the prewar gripes I used to hear from fellows who wanted to operate on 5 meters without getting a ham ticket. They couldn't seem to understand why the FCC wanted them to pass a 13 w.p.m. code test and theory exam, getting a ham ticket just to operate 5 meters.

"All FCC exams are on basic theory and practice pertaining to the license desired, whether amateur or commercial, so if he has such a great knowledge of equipment that a commercial op has never seen, surely he can pass an exam on basic theory without even trying. I think the truth of the matter is that he and a lot of other fellows want to get a license which they are not qualified to hold and are only trying to dodge the effort necessary to obtain it instead of studying and preparing themselves as they should do.

"I remember when I first decided to try for a commercial ticket, I simply walked into the FCC office and stated "I am a ham and want to take exam for a commercial license," with the thought in mind that being a ham made me a superior being who was qualified for anything in radio. I took the exam, but needless to say, I failed miserably. I then really got down to business of preparing myself. I have since obtained both telephone and telegraph tickets as well as amateur class A and can truthfully say that the knowledge I was required to learn was absolutely necessary to properly start learning the special things I needed to know on each individual job. I think the FCC is doing a wonderful job in requiring every operator to be thoroughly versed in fundamentals, so that when he gets on the job, he can go on from there and be a credit to himself and the FCC. I am even in favor of having a new exam every renewal of a license, regardless of whether service is obtained or not, then a lot of older ops will brush up a bit and everyone will benefit thereby. There is no substitute for knowledge and we must keep abreast of the latest developments or be left by the wayside.

J. Victor Stout
Chief Radio Operator
S/S Freeport Seam

Any comments on the Chief's suggestions? —30—

International Short-Wave

(*Continued from page* 100)

9.540, Shepparton, Victoria, Australia, 8-8:45 a.m. to East Coast; news at 8:01, 8:35 a.m.; excellent. HEI2, 6.345, Bern, Switzerland, Monday, Wednesday, Friday, English at 8:30-9:15 p.m.; Tuesday, Thursday, Sunday, English at 8:30-10 p.m.; the 6.345 frequency parallels 7.380. HED4, 10.405, also Bern, has Short Edition, 2:20-2:50 p.m. daily *except* Saturday. HH3W, 10.105, Port-au-Prince, Haiti, heard as early as 7:30 p.m.; sign-off varies from 9:15-10:31 p.m.; relays medium-wave HHW; fine programs in Spanish; call is given in broken English. RNF, 11.845 and 9.550 (varies to 9.540), Paris, English heard 8:55-10:35 or 10:45 p.m., news in English at 9, 10:30 p.m. Leopoldville, Belgian Congo, 9.380, English program 7:15-8:15 p.m.; relays BBC's North American Service, 8:15-9:45 p.m. FZI, 11.970, 9.440, Brazzaville, French Equatorial Africa, news in English at 1:45, 3:45, 5:15, 6:30 p.m. Leopoldville, Belgian Congo, 17.770, English news at 11:30 a.m., then fine musical program with English announcements to 12:15 p.m. CFRB, 6.07, Toronto, Ontario, Canada, usually on about 9 a.m.-12 noon; also heard afternoons and early evenings; verifies with an attractive card bearing a map of Canada and picture of downtown Toronto; address is The Rogers Radio Broadcasting Co., Ltd., 37 Bloor St., West Toronto, Ontario, Canada; no International Reply Coupon is necessary; this station relays CFRB (860 kcs. with 10,000 watts), uses 1 kw. power. VONH, 5.970, St. John's, Newfoundland, heard 4:30-9:30 p.m.; verifies in about 1 month without IRC; address Broadcasting Corporation of Newfoundland, Newfoundland Hotel, St. John's, Newfoundland; power is 300 watts.

From Canandaigua, New York, Thos. D. "Red" Taylor sends these Best Bets: GRH, 9.825, London, 4:15-9:45 p.m., excellent; GVZ, 9.64, is also good to 11 p.m. HCJB, 9.958, Quito, Ecuador, good evenings, just below WWV (10.00). RNF, 9.54, Paris, good 9-9:30 p.m.; Paris on 17.847 is good at 10.30 p.m. VLC5, 9.54, Shepparton, Australia, has best daytime signal, 8-8:45 a.m. ZFY, 6.00, Georgetown, British Guiana, evenings to around 7:45 p.m., in English. KRHO, 17.80, Honolulu, Hawaii, good at 7 p.m. in English news period. HEI2, 6.345, Bern, Switzerland, with 7.380 in dual, heard with good signals, 8:30-10 p.m., *except* Saturday. GSL, 6.11, London, has an excellent signal at 7:15 p.m. in North American Service of BBC. FZI, 11.970, Brazzaville, French Equatorial Africa, is good 3:45-4 p.m. with English news; 9.440 is in parallel but is not as strong.

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REPORTS FROM ABROAD

AUSTRALIA—Rex G. Gillett, Dudley Park (Adelaide), DX editor of "Radio Call," reports that Singapore time is 7½ hours *ahead* of GMT (12½ hours *ahead* of EST). FK8AA, 6.208, Noumea, New Caledonia, closes "at any time between 5-5:15 a.m. with 'La Marseillaise'." One of his latest catches was Radio Macassar, Celebes, D.E.I., on 9.370, heard in English session of recorded music on Monday, Wednesday, Friday, between 5:30-6 a.m.; at other times, languages used are Dutch and Malay; strength is fair to good; opens at 5 a.m. VLC10 21.670 (13.85 m.), Australia, has been heard carrying the British Isles Service to closing at 2:25 a.m. Through annoying interference, Omdurman Radio, Anglo-Egyptian Sudan, is audible at 11 a.m. with a program of Egyptian-type language; this station has been heard as late as 3 p.m. with programs in English designed for the Forces; frequency is 13.335 and 9.220 is scheduled in parallel. These transmitters have an English session Thursdays *only* at 12:30 p.m.

Before sign-off at 1 p.m. with the playing of "God Save the King," ZOY, 7.300 (41.10 m.), Accra, Gold Coast, is a nice signal; talks on matters of interest concerning life in Africa are usually given just after 12:30 p.m.; this station was heard to announce several other stations in relay, just prior to sign-off. Much improved signals are noted from Durban, 6.170 (48.62 m.), South Africa, at 12:30 p.m., when they have English news; Johannesburg on 6.090 (49.26 m.), also presents a news bulletin at this time but and are only trying to dodge the effort necessary to obtain it instead of studying and preparing themselves as they should do.

"I remember when I first decided to try for a commercial ticket, I simply walked into the FCC office and stated "I am a ham and want to take exam for a commercial license," with the thought in mind that being a ham made me a superior being who was qualified for anything in radio. I took the exam, but needless to say, I failed miserably. I then really got down to business of preparing myself. I have since obtained both telephone and telegraph tickets as well as amateur class A and can truthfully say that the knowledge I was required to learn was absolutely necessary to properly start learning the special things I needed to know on each individual job. I think the FCC is doing a wonderful job in requiring every operator to be thoroughly versed in fundamentals, so that when he gets on the job, he can go on from there and be a credit to himself and the FCC. I am even in favor of having a new exam every renewal of a license, regardless of whether service is obtained or not, then a lot of older ops will brush up a bit and everyone will benefit thereby. There is no substitute for knowledge and we must keep abreast of the latest developments or be left by the wayside.

J. Victor Stout
Chief Radio Operator
S/S Freeport Seam

Any comments on the Chief's suggestions?

-30-

International Short-Wave

(*Continued from page* 100)

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A verification card from Radio Saigon, French Indo-China, gives schedules of 11 p.m.-5:45 a.m. and 7-9:15 a.m. on 4.810 (62.37 m.), 11.780 (25.47 m.), and 1050 kcs. English programs are featured between 5:15-5:45 a.m. and 8:30-9:15 a.m.

Radio Warsaw, 6.100, Poland, has a broadcast of events in Poland (in English) at 4 p.m.

Hongkong has returned to the air again on its pre-war frequency of 9.525 (31.49 m.); is heard at 5:15 a.m. in English; poorly received in Australia.

Closing at 3:30 p.m. with the Portuguese National Anthem, CR6RA, Loanda, Angola, has been heard with improved signals on 9.470 (31.68 m.). There is interference from TAP, Ankara, Turkey, on 9.465.

Gillett reports that Radio Rangoon, which he lists on 11.855 (25.30 m.), now closes at 9 a.m. (A later report from Balbi indicates this transmitter runs to 10 a.m. some weekdays; I hear it to 9:10 a.m. on Sundays *only*.)

The Forces Program from Singapore concludes at 9 p.m. on 11.860 (25.29 m.).

VIG, 15.090 (19.88 m.), Port Moresby, New Guinea, is heard irregularly calling Sydney, Australia, at 8:30 p.m.

NEW ZEALAND—Bill Milne, Invercargill, reports Singapore, 15.46, Malaya, heard testing in English at 2:40 a.m., poor; Colombo, 4 90, Ceylon, heard in English at 9:50 a.m., BBC news relay at 10 a.m., good signal; Delhi,7.21, signs off in English at 1:30 p.m.; XORA, 11.696, Shanghai, China, good in English news at 7 a.m. Radio Macau, 7.52, Portuguese China, has English news at 7:30 a.m., poor signal; SEAC, 3.395, Colombo, Ceylon, heard at 10:40 a.m., has BBC news relay at 11 a.m., moderately good; SEAC, 15.12, Colombo, Ceylon, heard signing off at 5:30 a.m. in English, good strength; Radio Saigon, 11.778, French Indo-China, heard at 6:45 p.m. in French and English; Saigon on 4.81 heard in French and English around 7 a.m. with poor signal; TAP, 9.465, Ankara, Turkey, heard at 1 p.m. with English news, good signal.

From Art Cushen, also of Invercargill, comes word that a veri received from Rangoon, Burma, includes program schedule from the Director of (English) Programs, Broadcasting Station, HQ, CAS, c/o 12th Army, SEAC, Rangoon, Burma. Power is 7500 watts. English broadcasts are scheduled for 8:45-9:30 p.m. on 6.045; 10:30-11 p.m. on 11.855; 1:45-2:30 a.m. on 6.045; 2:45-3:45 and 9-10:30 a.m. on 11.855.

A veri received by Art from Paris (11.730) indicated that power will be increased to 100 kw. in August of this year. Other SW veris recently received by this New Zealander include PCJ (15.220), Holland; British Forces Network, Delhi (7.210); HJFH; WLWS; WLWL; HCJB; XEWW; CFRX.

Singapore on 6.090 and 7.220 (now reported *off*), Malaya, sign at 10:30 a.m.; use English and Malay; English news at 9:30 a.m. (?).

AFRN, 6.015, Tokyo, signs off at 4 a.m., English, poor signal.

XMEW, 16.540, Kumming, China, heard at 5:30 a.m. in English with AFRS programs.

He reports XMHA, 11.860, Shanghai, China, as heard in Chinese and English, with English news at 5:45 a.m., fair signal.

SOUTH AFRICA—From Muckleneuk, Pretoria, Henry Eksteen reports that daytime reception there has been poor lately but night reception is improving. He recently received a verification from OTC, Leopoldville, Belgian Congo, a "local" for his region. Eksteen reports that the South African Broadcasting Corporation is using the first letter of the city of location as its call-sign; thus, the Johannesburg transmitter uses a "J" (in Morse) and Durban a "D." They already have two separate programs: "A" programs are for English listeners and "B" programs are for Afrikaans listeners. The SABC is to operate a "C" transmission for commercial programs, but at present it is not known whether medium- or short-waves will be used for this purpose.

He lists frequencies used by "Radio Clube de Mocambique," Lourenco Marques, Mozambique, as CR7AA, 5.863; CR7AB, 3.493; CR7BD, 15.243; and CR7BE, 9.71. One of these transmitters uses 10 kw. power, presumably CR7BD or CB7BE. (Most likely it is the latter.) One transmitter uses 600 watts and the two others use 300 watts. Reports to these stations are always welcome, Eksteen says. Best DX heard includes PCJ, Holland; CHOL, Canada; VLC6, Australia; Radio Saigon, French Indo-China; and Singapore, Malaya.

SWEDEN—Lennart Ekblom, Stockholm, lists schedules for Motala's SBO, 6.066, as: Sundays, 8-9 p.m., 1:30-4:20 p.m., 4:30-5 p.m.; weekdays, 8-9 p.m. and 1:30-5 p.m.

Athens, Greece, is on the air on 7.295 between 3:30-4:30 p.m.; strong signal in Sweden.

Oslo, Norway, 6.200 (also reported as 6.195), is heard 3-6 p.m.

Radio Colombo, 4.900, Ceylon, is being heard to 11:20 a.m.

VQ7LO, 4.950, Nairobi, Kenya, is heard 12 noon-2 p.m.; news from the BBC is relayed at 1 p.m.

Copenhagen, Denmark, 9.520, is heard from about 1 to 4 p.m. with good signals in Sweden. (Should be heard now in the U. S. toward the end of the transmission which may run to around 5:30 p.m.)

ZOY, 7.300, Accra, Gold Coast, is heard 12 noon-1 p.m.

CR7BU, 4.925, Lourenco Marques, Mozambique, is heard 1:30-3:30 p.m.

ZRK, 5.875, Capetown 3, South Africa, is heard best 2-4 p.m. in Sweden.

Teheran, 4.760, Iran, is heard *after* 10:45 a.m.

EA8AS (probably means EAJ43), Santa Cruz de Tenerife, Canary Islands, is scheduled 4-6 p.m.

Ekblom reports that Bangkok, Siam, 6.000, has been heard on Sundays between 9-11 a.m.; he lists the call as HSPP but may mean the pre-war call of HSP5.

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MID-WEST REPORT

Jim Johnson, Chicago, reports CE1180, 12.00, Santiago, Chile, Radio Nacional de Agricultura, heard 7-11 p.m., signal improving from fair to good; Radio Martinique, 9.705, heard at 6 p.m. in French. XEBT, 9.625, Mexico City, heard 5:30 p.m.-12 midnight with excellent signal. Brazzaville on 6.025 is heard evenings paralleling 11.97 and 9.440. SUV, 10.055, Cairo, Egypt, has been heard at 5 p.m. with excellent signal, contacting London. VUD5, 15.190, Delhi, heard with native program at 11 p.m.; woman announced "All India Radio" in English. XEOI, 6.015, Mexico City, Radio Tamoio, heard nightly *after* 10 p.m., fair to good signal. VLG3, 11.71, Melbourne, Australia, heard in Pacific transmission in English between 4-5 a.m., English news at dictation speed at 4:30 a.m.

From Butlerville, Indiana, James A. Green reports ZFY, 6.00, Georgetown, British Guiana, with BBC news relay at 5:45 p.m., fair to good signal. VLC5, 9.540, Shepparton, Australia, always has excellent signal, 8-8:45 a.m., news at 8:01, 8:35 a.m. KRHO, 6.120, Honolulu, Hawaii, has news on the hour mornings. COBQ, 9.238, Havana, Cuba, has excellent musical programs and identifies in English; off at 10:25 p.m. VLW7, 9.520, Perth, Australia, has a fair to good signal, mornings. FZI, 11.970, Brazzaville, has excellent signal at 3:45 p.m. when English news is heard. HH3W, 10.135, Port-au-Prince, Haiti, has fine musical programs; heard evenings in French except for occasional identification in English; schedule appears to be irregular. OTC, 9.380, Leopoldville, Belgian Congo, English period begins at 7:15 p.m.; according to announcement, moved to 9.380 from 9.745 to avoid interference; asks for reports on 9.380 and 17.770; address the Belgian National Broadcasting Service, Leopoldville, Belgian Congo; announced power of 50,000 watts; excellent signals. HP5K, 6.005, Colon, Panama, heard evenings, English news at 10 p.m., followed by repeat in Spanish at 10:15 p.m.; good level.

A newcomer to this department, Kenneth G. Walker, Marlow, Oklahoma, who has been DXing since 1937, sends along FZI, 11.970, Brazzaville, heard with English news at 5:30 p.m., excellent signal; KU5Q, 9.67, heard almost daily at 8:30 a.m. in contact with KES2, San Francisco; ZFY, 6.00, Georgetown, British Guiana, good at 6-6:30 p.m. CHOL, 11.720, Sackville, N.B., good 5:45 p.m. on; CKLO, 9.63, also Sackville, good from 3:45 p.m. on. CFRB, 6.070, Toronto, has good signal at 10 p.m. RNF, 9.620, Paris, good at

9:30 p.m. with English news. VLC5, 9.54, Shepparton, Australia, excellent in East Coast beam, 8-8:45 a.m.

Larry Gutter, Chicago, sends us VLA, 7.28, Australia, heard well to French Indo-China in French, Thai, and English, 7:45-9 a.m.; VLQ2, 7.215, Brisbane, Australia, heard with good signal in Home Service from about 7-8:30 a.m. LSA6, 10.365, Buenos Aires, Argentina, was heard recently at 7:45 p.m. relaying a commentator to New York. ZYC9, 15 37, Rio de Janeiro, Brazil, is heard occasionally around 7 p.m. with fair signals; uses 25,000 watts. CE1180, 12.00, Santiago, Chile, is scheduled 4-11 p.m. and is heard well. XTPA, 10.65, Canton, China, heard some mornings with fair signals, peaking at 8 a.m. Moscow on 11.63 is heard 6:40-8 a.m. to the United States (and some mornings to 8:25 a.m.); signals are much better near the end of the transmission; on 15.75, Moscow has fair signal in English period to North America, 11-11:25 a.m. HH3W, 10.135, Port-au-Prince, Haiti, heard with extremely strong signals "some evenings," uses French, peak is around 9 p.m.

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WEST COAST REPORT

August Balbi, Los Angeles, lists VLH4, 11.88, Melbourne, Australia, signs on weekdays at 1:30 a.m., fair signal. Leopoldville on the new frequency of 9.38 is heard relaying the BBC's North American Service, 8:15-9:45 p.m., has Spanish between 9-9:30 p.m. Radio Congo Belge, 9.380, heard 11 p.m.-2 a.m. paralleling 6.295.

FGY, 11.715, Dakar, French West Africa, 2:15-2:30 a.m., has replaced 7.21, strong signal.

HEI5, 11.715, and HEK3, 7.38, Bern, Switzerland, heard Saturday *only*, 10-10:40 a.m. in African beam, best on 11.715.

HH3W, 10.135, Port-au-Prince, Haiti, signs off 9:15 p.m. some days, but usually runs to 10 p.m., strong.

XGOL, 9.99, Foochow, China, signs off now at 10 a.m.; relays XGOY's English news at 9 a.m.

VUD5, 15.19, Delhi, 10:15-11:30 p.m.; news at 10:30 p.m.; also announces 15.16, 15.35, 11.87, which are not heard by Balbi.

VUD3, 6.01, and VUD7, 6.10, reported off since March 1. VUD3, 7.29, Delhi, has been heard 8:30 a.m.-12 noon, since March 1, all-native program.

Singapore on 4.82, all-native station, has been off since February 25.

Saigon, 4.81 and 11.78, French Indo-China, has English news at 5 and 8:30 a.m., the 11.78 transmitter is becoming much stronger now.

The U.S.S.R. Home Service is heard from 11 p.m. on over 12.26, 12.17, 12.115, and 11.78.

VE9AI, 9.54, Edmonton, Alberta, Canada, is now using this frequency exclusively, having dropped 6.005.

TGWA, 9.79, Guatemala, heard irregularly on this frequency to 12:15 a.m. sign-off, as usual on 9.76.

VLA6, 15.20, Shepparton, Australia, heard from 11:30 p.m. with fair signal.

Balbi reports great improvement in

reception on the 15- and 11-megacycle bands, evenings, particularly from Europe.

VLC4, 15.315, Shepparton, strong to Fiji Islands at 1 a.m.

He reports XORA, 11.696, Shanghai (listed by Chungking as on 11.780!), as heard around 10 a.m. some days with some QRM.

Paris on 11.845 is fair to good evenings and is good with light QRM on 9.54 to sign-off at 10:45 p.m. Bern is weak on 7.38, fair on 6.345 in the 8:30-10 p.m. North American beam.

ZRL.9.608, Capetown, South Africa, is good, 11-11:45 a.m.

General Forces Program from London is heard from 11 p.m. on 11.705, 9.51, 7.32, 7.26, 6.11; from 12 midnight on, GWO, 9.62, and GRS, 7.07, join the others.

Buddy Giles, Wichita Falls, Texas, reports a letter veri from YV1RX, "Ondas Del Lago," Maracaibo, Venezuela, 4.80; a nice card from TAP, Ankara, Turkey; HHBM, Port-au-Prince, Haiti, sent a letter. Recent loggings include TGOA, 6.49, Guatemala; Leopoldville on 9.38; ZNS-2, 6.09, Nassau, the Bahamas; and HJCF, 6.24, Bogota, Colombia.

Paul Dilg, California, reports Singapore on 9.555 is being heard mornings with a fairly good signal; seems to be in parallel with 4.78 and 6.165 to about 9:30 a.m. when 6.165 usually carries a different program.

XRRA, Peiping, China, appears to be on 6.09, good signal, not heard after 10:30 a.m. This leaves VUD3, 6.10, Delhi, in the clear with a good signal. Shanghai on 5.51 has been heard working KU5Q, Guam, around 9:15 a.m.; call has been reported as WLXJ but some days the call of WXJ is given. WLXJ is sometimes also heard on approximately 7.35/36, around 8-9 a.m. calling various stations.

JODK, 2.510, Korea, has been improving in quality, peaks around 7:30-8:30 a.m. on West Coast.

Foochow, China, appears to have dropped to approximately 9.99 where it has a fair signal, WWV does not heterodyne it any more. Heard around 6:25-8:15 a.m.; no English heard.

A Chinese station on approximately 9.62, heard 6:55-9:10 a.m., is *probably* Kalgan.

Radio Macau, 7.53 (or 7.525), Portuguese China, has fairly good signal now; Portuguese news is at 7:20 a.m. followed at 7:30 a.m. by English news; fades badly some mornings.

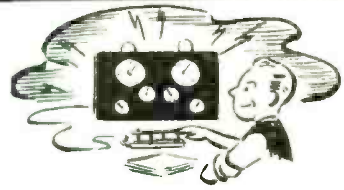
Radio Saigon, 11.778, French Indo-China, is sending an improved signal mornings, around 5-9 a.m.

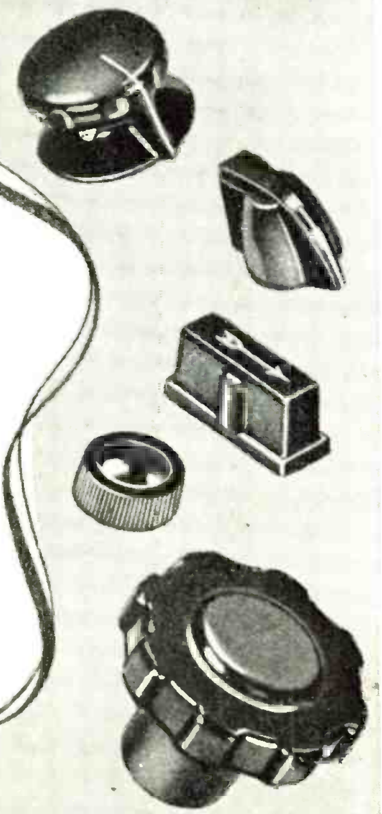
Java's PMH, 6.72, probably opens at 5 a.m. The 12.27 frequency is heard irregularly.

JGF, 7.78, Tokyo, is heard mornings, sometimes tests around 9:20 a.m.

Formosa on 6.017 (approx.) has become better than on 9.69, although the latter is fair early but weak or inaudible during the news period at 9 a.m.

XGOY's 9 a.m. news period has been heard on 6.15 (listed as 6.146 or 6.135)





and 7.152 (listed as 7.153); relayed by Formosa on 9.69 and 6.017; by Kweiyang, 7.01 (listed as 6.99); by XRRA, 6.09; and by XGOL, 9.99.

Colombo, Ceylon, on 4.90 has a fair signal around 9 a.m., with sports scores, followed by program preview, then music; at 9:30 a.m. a clock strikes eight times.

British Somaliland on 7.126 was recently picked up at 9:30 a.m. in native; at 9:59 a.m. said, "This is Radio Somali closing down until tomorrow." Songs at 10 a.m. Announces dance music for 9:30-10 a.m. Tuesday and Thursday.

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ACKNOWLEDGEMENTS

AUSTRALIA—Gillett, *Radio Call.* BELGIAN CONGO —Radiodiffusion Nationale Belge. BELGIUM—Radio National Belge de Radiodiffusion. CALIFORNIA—Balbi, Dilg, Curtiss. CANADA—Kennedy, Gauvreau, Dolber, Moss, Park. CHINA—Central Broadcasting Administration. DISTRICT OF COLUMBIA—Government of India Information Services; Legge, Havlena, Eaton. ENGLAND — Harrison. FLORIDA — Rowland. GAMBIA — Public Utilities Department. GEORGIA—Duggan. ILLINOIS—Gutter, Hester, Johnson. INDIA—Directorate General, All India Radio. INDIANA—Green. JAMAICA—The Government Broadcasting Station, ZQI. KANSAS—Seckler. MASSACHUSETTS—Kernan, Harris. MEXICO—Direccion General de Telecommunicaciones; Butcher. NEW YORK—Australian News & Information Bureau; Taylor, Barry, Meyer, Ekstein, Kentzel, BBC. NEW ZEALAND—Milne, Cushen. OHIO—Sutton, Riggle, Croston. OKLAHOMA—Walker. PENNSYLVANIA—Jones, Starry. PORTUGAL—Emissora Nacional de Radiodifusao. RHODE ISLAND—Underwood. SOUTH AFRICA—Eksteen. SWEDEN—Ekblom, Skoog. SWITZERLAND—Union Internationale de Radiodiffusion. TEXAS—Giles. VERMONT — Greenwood. VIRGINIA — Howe, URDXC. WEST VIRGINIA—Casdorph.

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Television Deflection Channels

(*Continued from page* 58)

ment of the bias on the vertical and horizontal amplifiers, by means of the vertical and horizontal linearity potentiometers. This bias is set on a non-linear portion of the tube characteristic at the proper point to compensate for the non-linearity of the sweep waveform applied to the grid. Final adjustment is best made by observation of the pattern on the picture tube screen.

The part played by the non-linear portion of the tube characteristic in straightening the waveforms is clearly demonstrated in Fig. 4. Thus, if the grid waveform is curved as shown, and the bias is adjusted to point *P*, the opposite curvature of the characteristic produces a linear change in plate current and, therefore, a linear saw-tooth output.

The deflection of the electron beam in the Model 90 picture tube is proportional to the strength of the magnetic field of the deflection coils, which is, in turn, proportional to the current flowing through the coil. To have a linear sweep, therefore, it is necessary to have a linear rise of current through the coil. In a pure inductance, a linear rise of current is produced when a squared wave of voltage is applied across the inductance; in a resistance, a linear rise of current is produced when a saw-tooth of voltage is applied across the resistance. It is apparent that in order to produce a linear rise of current through the deflection coils, which consist of both resistance and inductance, some form of modified waveform is required.

The necessity for such a waveform is shown in Fig. 5. In Fig. 5A, which represents a theoretically pure inductance, a saw-tooth of current flows through the coil when a squared wave is applied. The curves shown in Fig. 5 illustrate the relation between voltage and current with respect to time. Thus, at the instant the leading edge of the pulse is applied, the current begins to rise linearly and continues to do so for the duration of the pulse (current rise is linear only when no resistance is present; in all

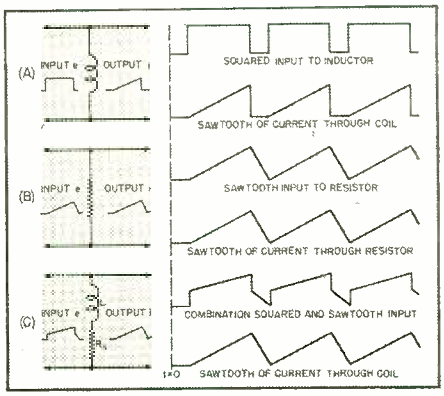


Fig. 5. The formation of a saw-tooth current wave in a deflection coil.

practical cases, resistance is present and the rise of current is exponential). When the pulse is removed, the current decays. Theoretically, the rate of decay is the same as the rate of rise; however, in practical circuits, a partial short appears across the coil, causing the field to collapse rapidly. Fig. 5B shows the saw-tooth current which follows in phase with the applied saw-tooth of voltage across a pure resistance.

To cause a saw-tooth of current to flow in the circuit of Fig. 5C, which represents the inductance and equivalent series resistance of a deflection coil, a combination of the input waves of Figs. 5A and 5B is required. This waveform and the resultant saw-tooth are the last two waveforms of Fig. 5. Thus, there is an initial sharp rise to overcome the inductive reactance and start an exponential rise of current in the inductance and, then, a gradual rise of voltage which sustains a linear rise through the combined inductance and equivalent series resistance.

It is important to note at this point that the inductive reactance of the deflection coils becomes less and less as the sweep frequency decreases, requiring a smaller and smaller amplitude initial rise. The inductive reactance is so low for the vertical sweep frequency that it is not necessary to modify the saw-tooth voltage to obtain a saw-tooth of current through the vertical deflection coils. At this frequency, the resistance exceeds the reactance and the load is largely resistive and, therefore, the current follows the voltage in shape and phase. Consequently, in the Model 90 receiver the vertical saw-tooth wave is not modified, while the higher frequency horizontal saw-tooth wave is modified before it is applied to the grid of the horizontal amplifier.

Modified Horizontal Waveform

The horizontal waveform is modified in the saw-tooth-forming plate circuit of the horizontal multivibrator by a series RC combination, resistor R_{10} and capacitor C_3, Fig. 1. It is this capacitor C_3 which charges through resistor R_1 when the second section of the multivibrator is cut off, and discharges when it conducts. Inasmuch as the time constant of R_1 and C_3 is long in comparison to the horizontal sweep cycle, the capacitor only charges over

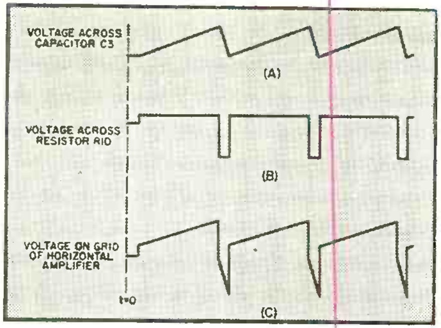


Fig. 6. The waveforms in a horizontal deflection circuit.

the linear portion of its charging cycle and rapidly discharges when tube conducts. The waveform across the capacitor is shown in Fig. 6A. Since the capacitor is charging linearly, the charging current is constant and the voltage drop across small resistor R_{10}, which is a part of the charging circuit, is low and constant. This slight voltage is shown in B of Fig. 6.

When the second section of the multivibrator conducts, the capacitor has a low resistance path to ground through the tube, and rapidly discharges. The high discharge current now passing through resistor R_{10} in the opposite direction develops a sharp negative pulse across the resistor. Since the voltage on the grid of the horizontal amplifier is the sum of these two voltages, it appears as shown in Fig. 6C, and is of the proper shape to cause a current saw-tooth through the horizontal deflection coils.

Horizontal Transients

Another defect arising in the horizontal sweep amplifier which causes distortion of the waveform is high-voltage transients. Since the horizontal sweep consists of its high fundamental frequency plus frequency components up to at least the tenth harmonic, the reactance of transformer windings and the deflection coil is very high. Consequently, high transient voltages are developed across the reactances, particularly at the start of the horizontal retrace when the change in current is very fast. These voltages often shock-excite the windings into a series of damped oscillations which modulate the sweep. To prevent high voltage transients, the secondary of the horizontal output transformer and horizontal deflection coils are shunted by a low value resistor combination which loads the inductors heavily at high frequencies. Thus the fast retrace currents are shunted off through the resistors and do not develop transients across the high inductive reactances. A second method often used is to shunt the same circuit with a diode which is so polarized that it conducts during the retrace intervals, placing a partial short across the reactances when the coil currents are changing at the fastest rates.

From the above discussions, it is clear that the horizontal deflection transformers and circuits must have

Company, 1419 West Jefferson Boulevard, Los Angeles 7, California.

HACK SAW BLADE HOLDER

Of interest to the hobbyist and home constructor is the announcement being made of an inexpensive holder which allows broken hack saw blades to be used.

A. D. McBurney of Los Angeles has developed this holder which will accommodate thin flat file sections, in addition to the hack saw blades. This unit is a single unit tool composed of a tubular handle with an extended

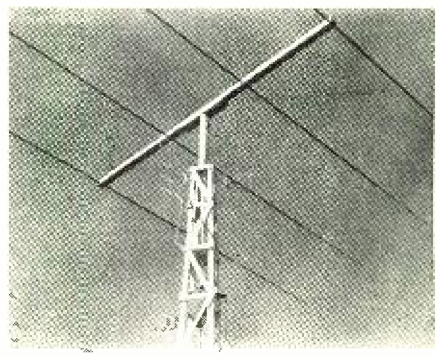
positive grip nose for securing the working point of the blade or file. The ends of the handle are slotted to receive inserted blades. The tool will handle almost any length blade securely.

Details of this tool will be sent to those requesting information from *A. D. McBurney,* 939 West Sixth Street, Los Angeles 14, California.

ROTARY BEAM ANTENNA

A new high-efficiency, four-element, rotary beam antenna, designed for the radio amateur, is being announced by *Research Manufacturing Corporation* of Chula Vista, California.

This new antenna, known as the REMACO-4, is constructed of Dural and is suitably treated to minimize effects of the atmosphere on the conductivity of the elements. The unit is supplied complete with the four elements and supporting "boom" and requires only a few minutes to assemble. It is adjustable for operation on any frequency within the 10 meter band. The 10 meter assembly weighs ap-



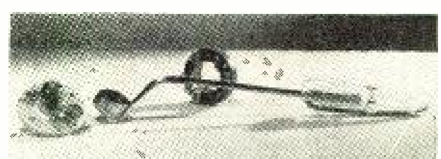
proximately 15 pounds and can be adapted to most types of rotating mechanisms. Complete instructions for assembling the unit are included, as are tuning charts.

Complete details of this unit can be obtained from *Research Manufacturing Corporation,* Department N-4, Box 757, Chula Vista, California.

AUTOMATIC TUBE INSERTER

The Oliveri Tool Company of Chicago has recently patented a new automatic tube inserter which facilitates the installation or removal of radio tubes without breakage.

This unit is designed for use on the



production line, or may be used in service shops to remove or install tubes while the unit is in operation.

This tool is completely insulated and may be used with perfect safety. Prices and further details will be furnished those requesting them from *The Oliveri Tool Company,* 4000 W. North Avenue, Chicago 39, Illinois.

AMATEUR RECEIVER

Production of a new amateur receiver is being announced by the *Pierson Electronic Corporation* of Los Angeles, California.

This receiver, the KP-81, features r.f. stages in operation on all bands, five bands, including broadcast and up a frequency response reasonably linear up to 150,000 cycles. Transformers must be carefully constructed to have such a high frequency response with a minimum of self-resonant tendencies. The vertical deflection amplifier is of much lower frequency and not so critical of design. The vertical saw-tooth is also of greater amplitude as applied to the grid of the vertical amplifier and, consequently, a low impedance triode has sufficient gain to develop the required current variation through the vertical deflection coils. An added advantage of the low impedance triode is that its plate load is essentially resistive and transient troubles are non-existent.

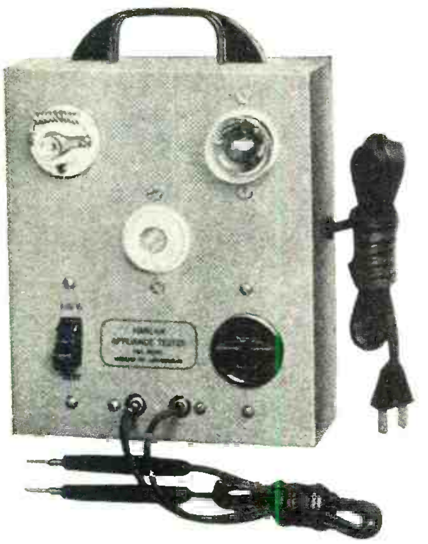
The horizontal amplifier must be a high impedance pentode which has sufficient power sensitivity to convert the relatively low amplitude horizontal waveform to a large current variation through the deflection coils. A high impedance tube, with no damping of inductive circuits, has a plate load which is reactive and, therefore, becomes a circuit vulnerable to transients, which is another reason for highly damping the horizontal output circuit. In some receivers, a small amount of inverse feedback in the last stage is used to reduce the effective impedance of the pentode.

(*To be continued*)

What's New in Radio
(*Continued from page* 64)

nounced by *Hanlan Company* of Los Angeles.

This appliances tester can be used to check thermostats under actual working conditions, controls the heat on soldering irons, checks continuity, shorts, grounds and faulty insulation. It may be used to check automatic irons, vacuum cleaners, motors, re-

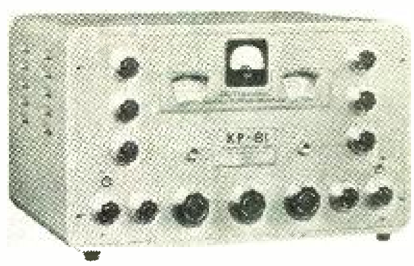


lays, bulbs, fuses and appliances with three-way switches.

The tester comes complete with full instructions.

Details of the unit and price information will be forwarded to those requesting them from the *Hanlan* to 40 megacycles, a new type of i.f. circuit, and improved type silencer, electrical bandspread with calibrated dial in the ham bands, and other circuit refinements.

Details of this receiver are available to those requesting them from



Pierson Electronic Corporation, 533 East Fifth Street, Los Angeles 13, California. Requests for information will be handled promptly.

PORTABLE MARINE RADIO

Soundview Marine Company, Inc., has announced the production of a new portable marine receiver, especially adapted for small sail or motor boats without lighting systems.

Completely battery operated, this receiver covers the entire broadcast band, 49 meter foreign range, Coast Guard weather reports, ship-to-shore marine telephone lanes and time signals. The cabinet is cadmium plated of non-corrosive metal which is moisture and drip-proof. The cabinet is finished in navy gray crackle enamel with blue escutcheon and knobs.

A removable, non-corrosive whip antenna, which is non-directional and can be extended to a height of 40", is a special feature which eliminates fading.

Over-all size of this unit is 11½" x 7" x 8¼". Full details will be fur-

nished those requesting them from *Soundview Marine Company,* City Island, New York. Ask for information about the "Sea Mate."

INDUCTION HEATER

The *Marion Electrical Instrument Company* has announced the development of a new low cost induction heater, designed for production soldering.

This new heater was designed to meet the requirements for clean soldering of small parts and for soldering of metal to metallized glass and ceramics. Power requirements are lower than for ordinary solder pots, as the unit consumes only 775 watts at full load and 100 watts on standby.

The unit is suitable for operation by inexperienced workmen as there is no danger from sparking or r.f. burns. The frequency, 450 kc., produces no harmful radiations and the unit is completely shielded for safety. FCC requirements with reference to radio interference have been met.

The induction heater is furnished in a standard relay rack cabinet and measures 15¾"x21½"x15" and weighs 150 pounds. The unit is operated at 115 volts, 60 cycles.

Details of this unit will be furnished by *Marion Electrical Instrument Company*, Manchester, New Hampshire, upon request.

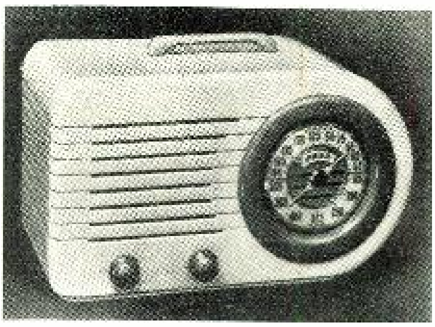
FADA HOME RECEIVERS

Six models of home radio receivers are now in production at the *Fada Radio and Electric Company* plant in Long Island City, New York.

Of these models, one, the series 1000 receiver, is illustrated. This receiver is a 6-tube a.c.-d.c. superheterodyne with 8-tube performance. The series 1000 is available in five color combinations; all alabaster, alabaster with red knobs, handle and escutcheon, maroon cabinet with alabaster knobs, handle and escutcheon, blue cabinet with alabaster knobs, handle and escutcheon and all onyx.

The receiver covers the broadcast band from 528 to 1680 kc. and features 6 tuned circuits. The cabinet is 7" x 5½" x 10½" and weighs 6 pounds.

Details of this series and other series now in production will be furnished upon request to the manufacturer, *Fada Radio and Electric Company*, Long Island City, New York.



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QTC

(Continued from page 42)

Pacific islands and the sixth on the Atlantic run. The five in the Pacific are Fra Berlanga, Limon, San Jose, Esparta and Comayagua. . . . The Junior is on the Atlantic run . . . all are reefer ships.

CHARLES MEANEY, chief aboard the Bernard Carter died this past winter aboard his ship in the Atlantic, we're sorry to hear. Jack Edwards aboard the new "Junior" of UFCO in recently from his north Atlantic run. George Edwards, R. Pardue, L. Gresham and R. Stormberg shipped recently from the Gulf. Bill Halleran is reportedly sizing up the airlines for a new shore berth. Pat O'Keefe out with the Santa Marta ran into a bit of trouble and had to put in at an unscheduled port for repairs, we understand although no sign of Pat around the big town. . . . Late Maritime Training School men shipping out include C. Fears, C. Clack, F. Fenerty, A. Daniel, K. Muegge, and Lloyd Mitchell. J. Paple has been assigned to the Cape Lopez. James Miller took out the Abraham Baldwin for Mississippi Shipping down in the Gulf.

R.O.U. has announced the opening of its office at Wilmington, Calif., which is in charge of Robert Wilson, an old timer in the marine radio field—who has been with USMS during the war and was in charge of code and typing at the Radio Training School at Huntington, New York, and Gallups Island and Hoffman's Island also as Instructor and in charge as Chief Radio Training Officer.

DONALD SPACKLER, M. G. Hawkins and Marshall Foster sailed recently from the Gulf. Robert Gisslow sailed from the West Coast aboard the Golden State, California Maritime Academy training vessel for a trip down the west coast of South America. . . . Gallups Island, U.S. Maritime Training School site in Boston Harbor, is up for sale as surplus property. . . . E. McBurney, R. Sprow, R Cox, R. Lyles O. Wingard, L. Schiff and A. R. Willis, all recent school graduates shipped out recently. . . . 73

ERRATUM

An error has appeared in the schematic diagram, page 37, Fig. 5, in the March issue. The filament lead of the rectifier tube should be connected directly to the 5 volt transformer filament winding. It should not be in series with the 2200 ohm resistor.

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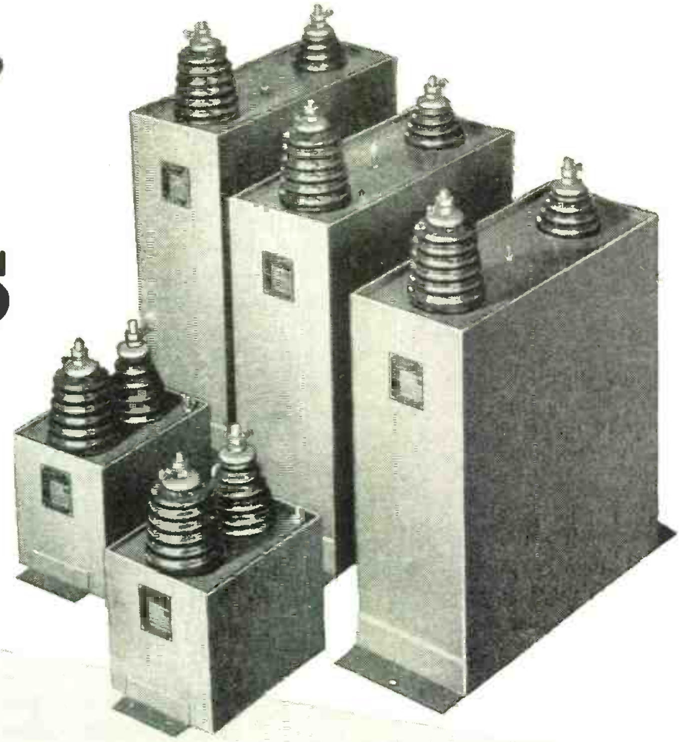

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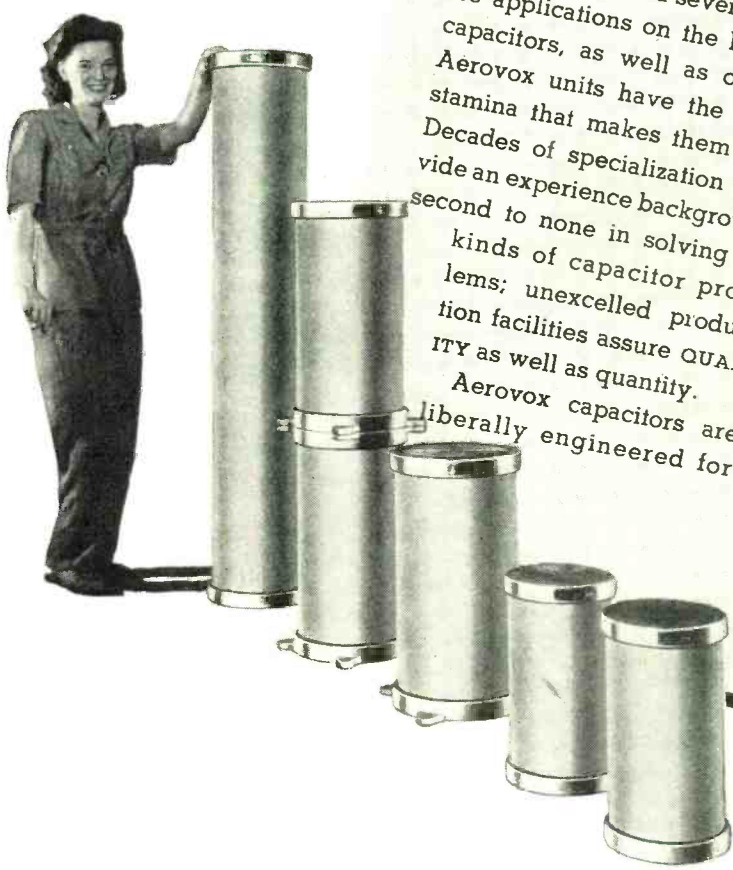

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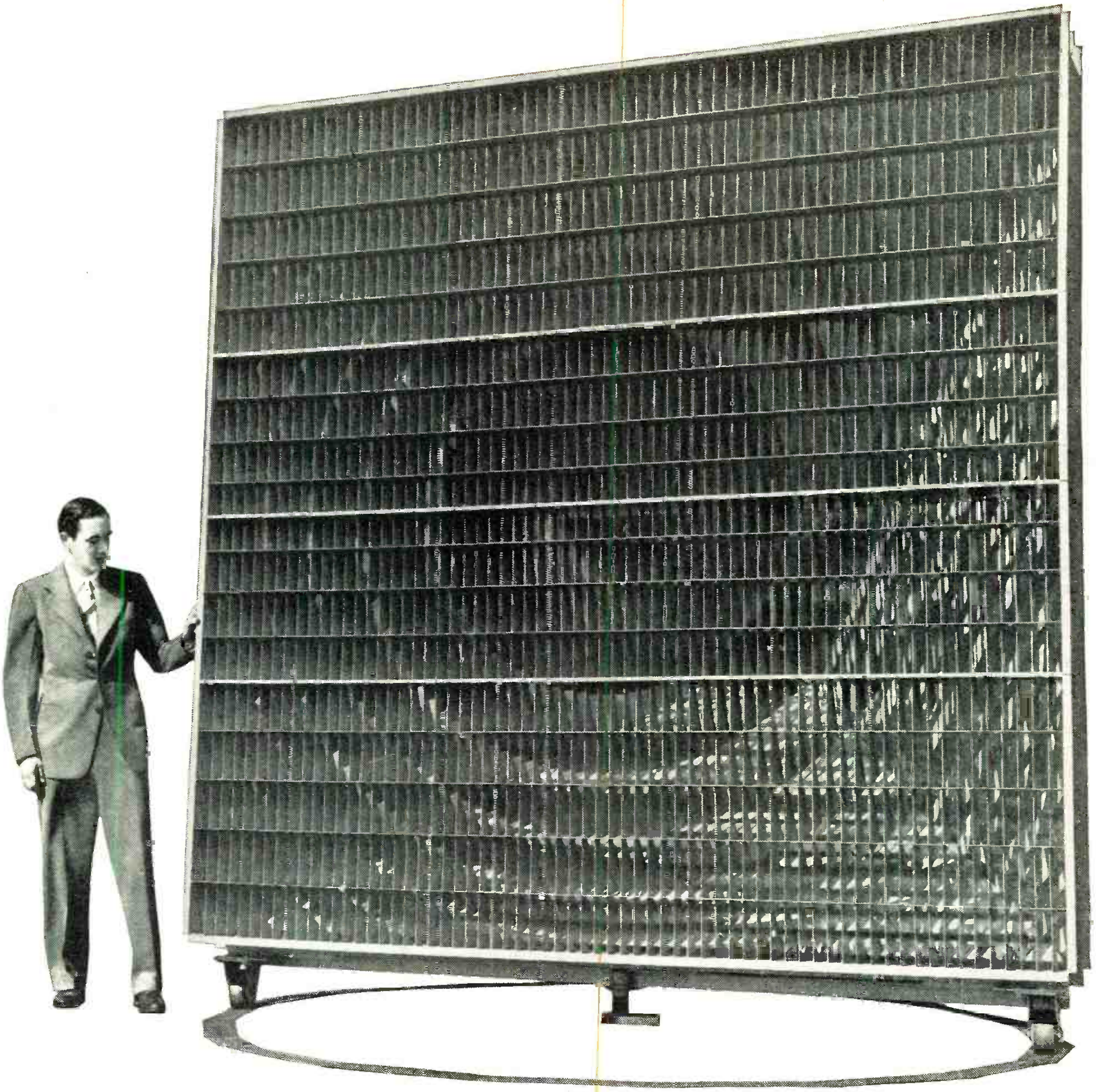

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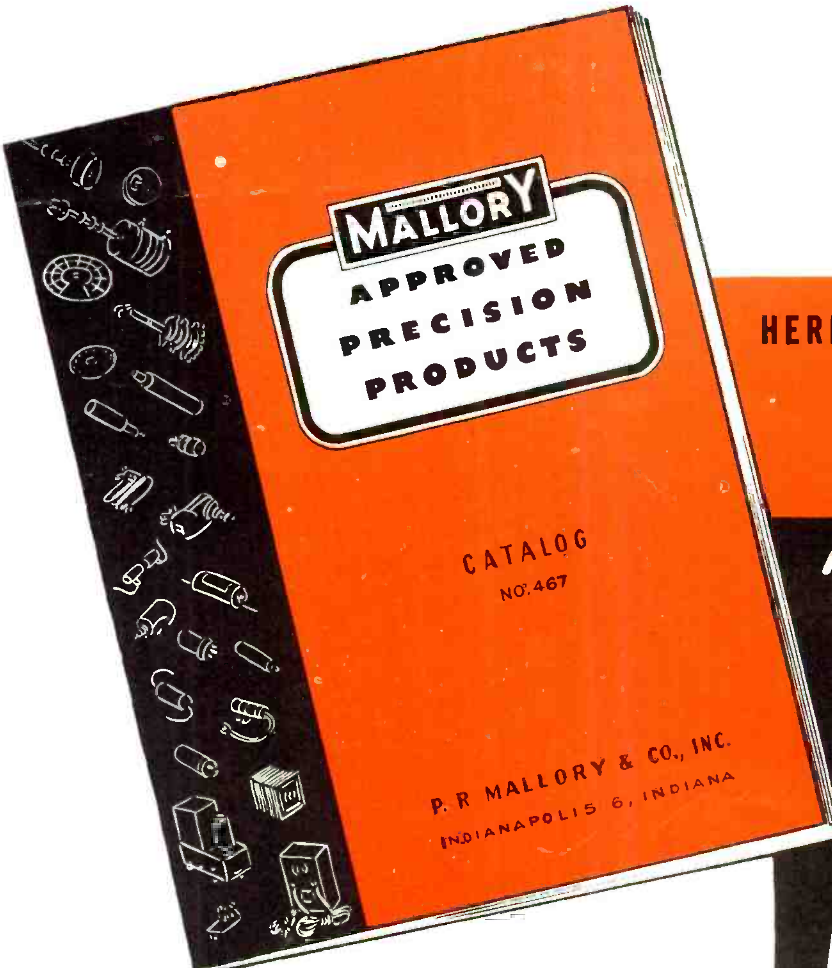

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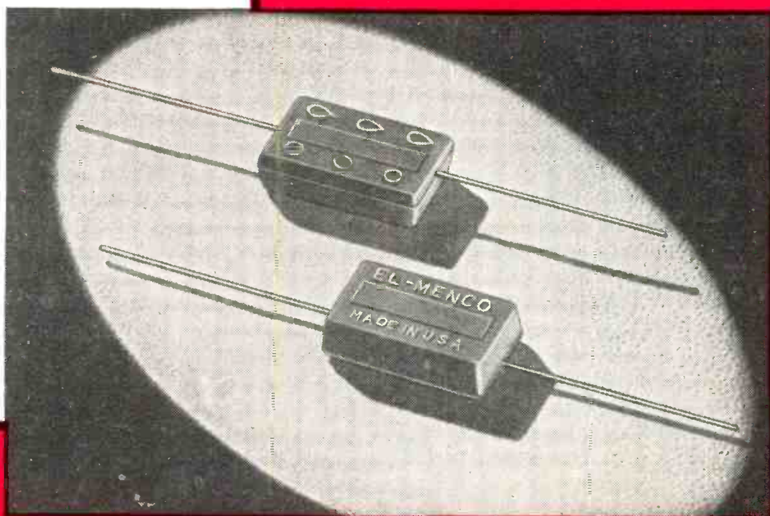

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