

AV AT ON ALTITUDE *by* MICRO-WAVES

RADIO NEWS

FEBRUARY
1940
25c

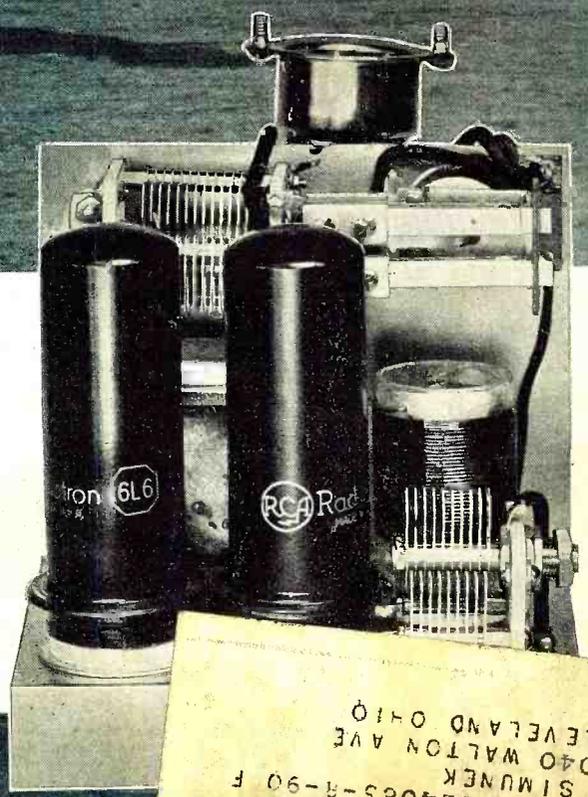


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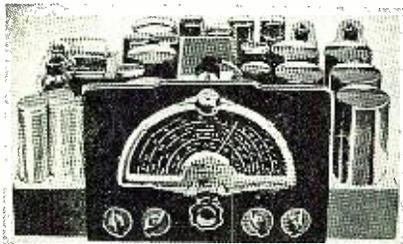
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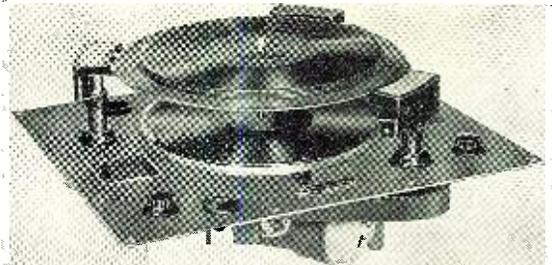
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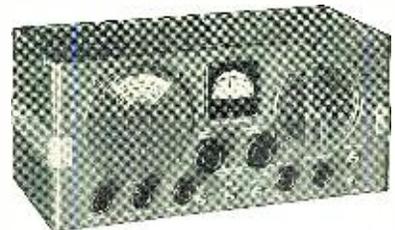


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SELECTION. An art term, used in photography to signify a subject matter based on artistic, training, or technical considerations.

SELECTIVE SENSITIZATION. The process of making a photographic emulsion sensitive to a particular wavelength of light.

A GLOSSARY FOR PHOTOGRAPHY

PHIC. also

A GLOSSARY FOR PHOTOGRAPHY

FLATTENED. A lens which has been flattened to increase its focal length.

FLEMING. A vacuum tube used in electronic circuits.

FLICKER. A rapid variation in light intensity.

FLASH. A brief, intense burst of light.

FLOODLIGHT. A light source that illuminates a large area.

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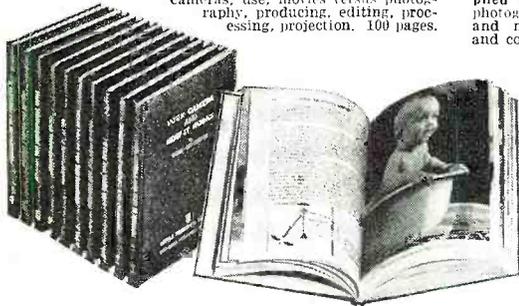
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DEALERS: ORDER FROM YOUR PHOTO SUPPLY JOBBER!

MILLIMICRON. A unit of length in the metric system equal to 10⁻³ of a meter.

MILLIPHOT. A unit of foot candles.

MILTON. See SODIUM HYDRIDE.

MINIATURE. A set of small replicas of professional objects, usually used for expensive studios, they should be built in slow motion. For the amateur, tabletop photography is limited to objects of a few inches.

light. If the pinhole diameter of the lens is small relative to the focal length, the function of a lens is to project an inverted image upon the screen. The diameter of the pinhole and the focal length of the lens determine the size of the image.

MEREA PLANE. A plane perpendicular to the optical axis of a lens.

AMERA, PLATE. A photographic plate with groundglass and usually so c film pack holder and can both be used rarely used any production of cut

CAMERA, PROCE. in photomechanical make negative; camera printing speed.

CAMERA SPEED. The number of frames per second that a camera can take through the lens. Other speeds are 8, 12, 16, 24 f.p.s.

CAMERA-STA. A camera with a stationary lens.

CAMERA, ST. A camera with a lens that can be moved to take pictures at different angles.

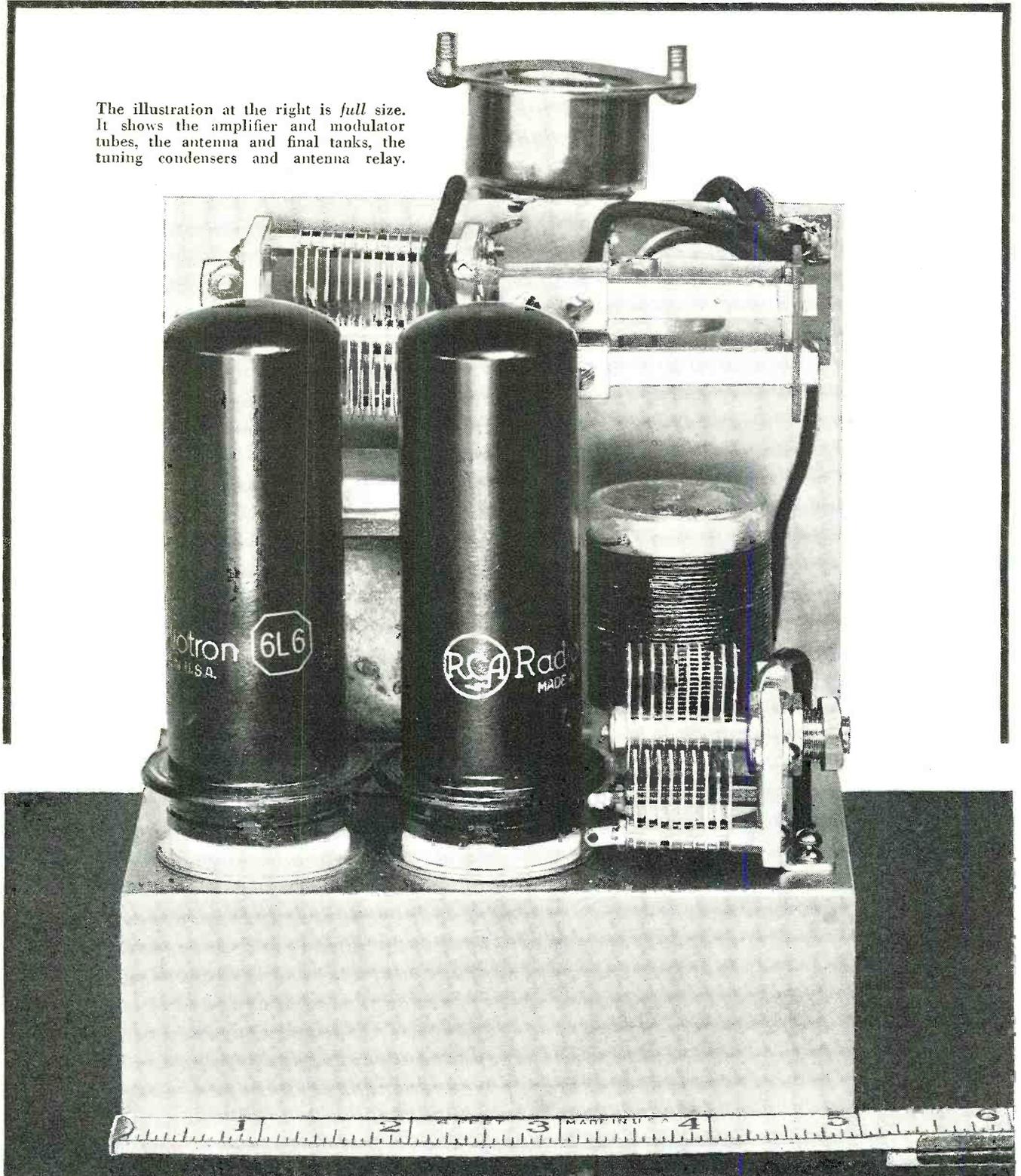
CAMERA. A device for capturing and recording light on a sensitive surface.

☆ *The Radio News* ☆

PRIVATE FLYER'S XMTR

Twelve watts carrier, 100% modulated in a space 1/8 cubic foot square was what the airplane pilot wanted. How we finally did it, is the story.

The illustration at the right is *full size*. It shows the amplifier and modulator tubes, the antenna and final tanks, the tuning condensers and antenna relay.



by
KARL A. KOPETZKY, W9QEA.
 Managing Editor
 and
OLIVER READ, W9ETI,
 Technical Editor

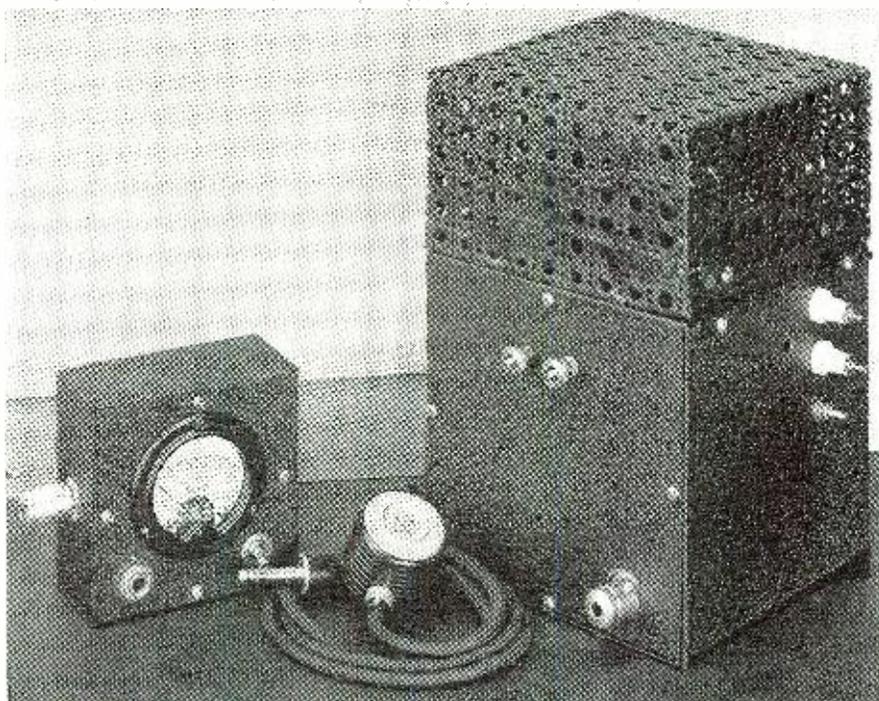
NE of the foremost thrills that any amateur experiences is the opportunity to apply his hobby and his knowledge toward designing something which has *practical* as well as commercial value. When "Doc" Hartranft, Executive Secretary of the *Aircraft Owners & Pilots Association*, came to us and asked us to design a transmitter for his plane, our joy knew no bounds. Here was the long cherished opportunity to design and build a transmitter with someone else's financial backing and, at the same time, permit us to show what our hobby was worth in the way of constructing something which would equal, if not better, commercial instruments of the same character.

What "Doc" requested was this. He wanted a small, compact radio transmitter operating on a frequency of 3105 Kilocycles. It was to be extremely light in weight and, of course, 100% reliable. This proposition of reliability weighed on us heavily because we realized that "Doc" was about to use our transmitter in an application where an occasion might arise where it would be a matter of life or death.

The first problem which was tackled dealt with choice of power. It has been our experience that power outputs as low as 0.2 watt has been successfully used from airplane to ground transmission over distances of from six to one hundred miles under ideal conditions. However, such transmissions had taken place in the 56 megacycle band and there was not any guarantee that the same conditions would allow this in the 3105 kc. band. A cursory examination of commercial airplane transmitters available to private pilots showed that the most popular power outputs lay between 8 and 15 watts.

Unfortunately, the power output is directly dependent upon the power input; and, whereas power outputs of 8 watts and less are perfectly feasible with battery supply, when one exceeds this figure and approaches that of 15 watts, the dry battery situation becomes untenable and one must resort to motor generators or vibrators and their attendant wet batteries, charging problems, weight situations, etc.

"Doc" was kind enough to furnish us with figures which led us to believe that the very best power-to-weight ratio would be in the neighborhood of 12 watts carrier and we finally decided that this was the amount to use.



The complete unit ready to install in a plane. The lefthand meter box contains microphone jack and filament switch. Mike is an aero special.

In addition, it was required that the transmitter weight be less than 20 pounds, because the average light plane permitted only this amount, together with whatever baggage the pilot is carrying. In other words, one could afford to sacrifice 20 pounds of the baggage carrying capacity of the plane for a radio. If the radio were to weigh more than 20 pounds and be bulky, it would be quite possible that the total weight of the radio baggage and parachute (if the pilot used one), would be so great that little or no baggage could be carried. This would cut down the "week-end" enjoyment, which is one of the main reasons for purchasing a plane for private use.

Before a consideration of a circuit was entered into, the tube tables were studied. Ordinarily, an excellent tube for aviation work, and one which is used in commercial practice, is the 807. In the first place, this tube requires no neutralization, and in the second place, requires little driving power. However, the 807 is large and bulky and for that reason it was rejected in favor of a 6L6 metal tube. By using the metal 6L6 we at once accomplished the shielding which is required in the circuit and, also, we were able to use a tube commensurate with the output required and at the same time reduce the bulk.

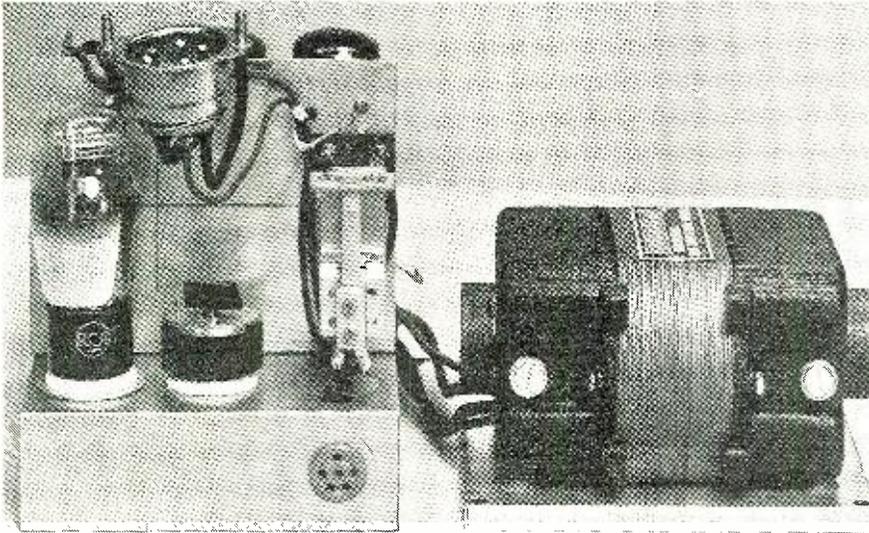
Having picked the output tube, a 6L6, we then were faced with the problem of what sort of a modulator to use. The simplest modulation problem puts forth the question of the *type* of modulation which is to be utilized. Considering that we could use either grid, screen, cathode, series, or *Heising* modulation, we rapidly eliminated the first four. We did this be-

cause in order to use grid, screen, or cathode modulation we would have to run the power input of the 6L6 at a high figure. A large motor generator would have to be used and the power drain from the battery source would be that much greater, thus shortening the operating life of the radio between battery-chargings.

In other words, to get a 12 watt carrier, which we were seeking, with grid modulation, we would have to start with a 48 watt carrier. 48 watts of input, if the power ratio of input to the generator against output from the generator were 100%, would indicate that at 6 volts input we would have to draw 8 amperes and this would not include current drawn by the necessary relays, modulator, speech, the filaments, and microphone current. Actually, of course, the efficiency of a motor generator is quite low and we probably would have to draw in the neighborhood of 16 amperes in order to accomplish grid modulation. Therefore, we discarded all except *Heising* modulation.

Considering *Heising* modulation, a quick glance was thrown towards Class B modulation and this was immediately discarded because of the large differential range in current drawn by the Class B modulator. Such range, from 1 or 2 mls to 40 or 50 mls would require a well-regulated power supply in order to keep the current to the final amplifier steady, since it would be drawing current from the same source as the modulator.

So, when everything was considered, we finally decided to use straight, orthodox *Heising* modulation. The question now was to get the maximum amount of modulation from a single



Compare the size of the transmitter with the *Genemotor* alongside of it. The unit develops 12 watts of 100% modulated carrier on 3105 kilocycles.

6L6 tube, since we had previously decided that this should be the modulator. We could, of course, use a pair of chokes separated by condensers, but there again the weight problem came into being. We finally adopted the method shown.

Having decided to use a 6L6 amplifier and a 6L6 *Heising* modulator, the net situation to be considered was the actual circuit.

Discussion of Circuit

Since the transmitter was to operate only on one frequency, namely 3105 kc., the amplifier circuit presented us with two alternatives. First, we could use a crystal oscillator in a separate stage, driving the 6L6 amplifier, and second, we could use a 6L6 as a self-excited crystal oscillator and modulate it, keeping the percentage of modulation to such a magnitude that there would be no frequency modulation.

The second of these two propositions was practical from a weight standpoint but impractical from a radio standpoint. We, therefore, were faced with the problem of selecting a simple, but stable oscillator tube to drive the 6L6. In considering the crystal oscillator circuit, we had to bear in mind that it must, under all circumstances, in any position of the crystal, be 100% sure-fire in operation.

This eliminated any harmonic type circuits as well as tritet oscillators or similar types of crystal oscillators commonly used by amateurs where a matter of life and death is not at stake. Pouring over the text books and engineering manuals, we decided finally that the best oscillator commensurate with the least amount of equipment was the *Pierce* type. After the circuit was built and tested we found that we had chosen well.

The type of tube to be used in the *Pierce* circuit, was the next consideration. Here we were solely concerned with sufficient power to drive the 6L6 and, at the same time, to use a tube which was not bulky and did not draw a great deal of plate current. Such a tube, finally chosen, is the 6J5G which meets every one of these requirements. It is one of the smallest glass tubes manufactured, extremely stable, and not subject to variations in the production line. As a *Pierce* oscillator it

works excellently with a very, very low plate current. In order to protect the unit, a condenser was inserted in series with the crystal and next to the plate of the 6J5G. Capacity coupling between the crystal stage and the amplifier stage was used.

The Amplifier Circuit

The amplifier circuit was simplified as much as possible. We used a very common orthodox screen and plate amplifier circuit where the screen and plate are *both* modulated. The coil form was wound on one of *Amphenol's Polystyrene* forms and was "nailed down" with liquid *Polystyrene*. The 6L6 is metal, and, since the oscillator is separated from the amplifier stage by a metal baffle, no feed-back of any sort was experienced.

The Modulator Section

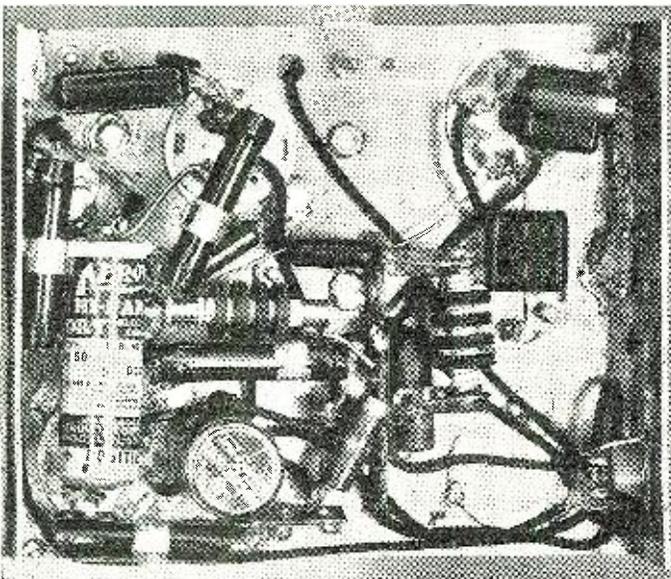
As we had previously decided to use *Heising* modulation, we were faced with the question of obtaining a proper choke. In order to pass the necessary 100 mils of plate current for the amplifier and modulator, and at the same time, present the proper impedance to the modulator tube, we decided to resort to the old system of a center tapped choke. This would mean that the 6L6 modulated stage would be pentode connected. As such, it has sufficient audio output to modulate fully 12 watts carrier. The circuit diagram of the modulator stage is conventional in every respect.

Speech Equipment

The speech equipment presented a choice of two systems. First, we could use a crystal microphone and a driver stage. Second, we could use a carbon microphone directly driving the grid of the 6L6 modulator. In view of the fact that the transmitter was to be compact, we discarded the crystal-driver stage system.

Most carbon microphones have an output of from 0.1 to 0.2 volt across 200 or 500 ohms, depending upon the impedance of the microphone. This would of itself be insufficient to swing the grid of the 6L6 modulator, so a transformer was used to get the necessary voltage gain of 40. This meant that at the grid of the 6L6 a swing of 3 or 4 volts across the grid was made available. When we came to the selection of a microphone transformer those that were submitted, were large and bulky and weighed considerable and we finally were forced to use one of the miniature types manufactured by a number of concerns.

The particular one used in the laboratory model is the *Thordarson True Fidelity Unit*, which gave excellent response and service. This unit is sufficiently small to be mounted underneath the chassis, as can be seen in the illustration. The current for the microphone is taken from the "A" battery in the standard manner. So then, our circuit consisted of a 6J5 *Pierce* crystal oscillator, followed by a 6L6 power amplifier, modulated by a 6L6 *Heising* modulator and, in turn, the



Underside the chassis. Note the tiny mike transformer next to the *Aerovox* condenser, and the heavy wiring.

AS SEEN

by **JOHN F. RIDER**

Dean of the Servicemen



John F. Rider

That Television Antenna
 YOU remember that television antenna incident? Well, with television again on the upswing here in New York City, it was quite annoying to have a perfectly operating television receiver in the home, know that good signals were floating through the air and see nothing. Did we say annoying? It was much more than that; but what to do?

It seemed pretty hopeless in view of the attitude of the landlord. So we decided to experiment. After all is said and done, radio waves do peculiar things—particularly high-frequency waves. Counsel from one individual versed in television was negative; very little if any chance of receiving NBC signals from the Empire State Building without an outdoor antenna. So we tried. The net result today is a perfectly satisfactory television signal without an outdoor antenna. In fact, we cannot rightfully call what we have connected to the receiver any form of antenna.

The receiver connections require a transmission line input. One of these terminals is connected to a piece of twisted wire similar to that used for wiring lamps in the home. This length is about four and a half feet and runs vertically from the receiver to the top of the window casing inside of the room. The other lead of the same kind of wire, is about eight feet long; it runs vertically up to the top of the window casing for about

four feet, parallel to the other wire and separated by about three feet, then horizontally for about three feet and the remaining foot of wire makes a right angle bend and protrudes outside of the window through a small opening at the top. And that is our television antenna used to pick up the NBC transmission.

Now don't ask us what signal we are receiving. We know that it is a reflected signal, bouncing off, no one knows, how many walls. We do have a slight ghost pattern, but it is by no means bothersome. No doubt some other arrangement, as yet unknown, would furnish similar signals, but we tried very many with very much less success. In fact, this arrangement is quite critical as far as pickup is concerned; that is, sufficient pickup to provide a steady pattern and strong blanking pulses. Moving the horizontal portion through a ninety-degree angle very materially decreased the signal pickup, so much so that the picture was quite dull. Moving the vertical portions likewise interfered greatly with proper signal pickup.

The fact that we can receive good television pictures with such a makeshift pickup system, gives us food for thought, particularly so when we consider the location of this receiver. It is in our so-called "den." You see, we are a cliff dweller, living in an apartment in New York City. The room is on the fourth floor of a six-story building and faces a court. It is true, that this room also faces south, which is the direction of the Empire State Building, but we are at least thirty or forty feet below the level of the roof and the building directly south of us is higher than our own and about thirty feet away. Normally we would say that the other building shields our own.

What is of interest is the fact we have heard of a number of places where the installation of a television receiver was given up as hopeless because the antenna system could not be erected properly; that is, in line of sight of the transmitter. What with these signals bouncing all over New York City, it appears possible to pick up reflected signals under the most adverse conditions and develop a good picture. Incidentally, we are about

eight miles as the chippies fly from the transmitter.

These antenna experiments consumed about two weeks' work and the only thing that gave us hope was the fact that the sound transmission, upon a higher frequency than the picture signal, was received well with a simple indoor antenna. The reception of such television signals fortifies the belief in our mind that there is much more to be learned all around about radio phenomena and that it is not right to just give up without trying. . . .

And now for the "piece de resistance." The superintendent of our building turns out to be an owner of those circuit compilations of ours, using them in connection with service work which he does. Unbeknownst to us, he has been a friend in the camp of the enemy and just this morning we were told that permission to erect the television receiver antenna will be granted as soon as the man from the Otis elevator people calls and verifies that the erection of such an antenna will not interfere with the operation of the elevator system in the building. You equal that one—we can't!

Insulation Resistance of Fixed Condensers

HERE is an interesting problem which was brought to the fore during the recent trip we made. It pertains to the replacement of fixed condensers in radio receivers being repaired. One school of thought believes that fixed condensers should be checked for insulation resistance and capacity and if the insulation resistance is less than what would be classified as normal, the unit should be replaced, otherwise it is impossible to give a guarantee without jeopardizing the shop.

The opposing school of thought is that if a fixed condenser used as a bypass condenser is operating properly, it need not be replaced even if the insulation resistance is one-tenth or even one-twentieth of what it should be, assuming a standard of say 500

(More info. on page 45)



"Aw, quit it, Mom. I'm much too tired to fix that thing. Turn on the phonograph, why don't you?"

ANY of those attempting to build a universal meter were probably surprised to find that the cost of the shunts and multipliers were almost as much as the cost of the meter itself. Amateurs, too, have meters which could be put to good use in their rigs if the ranges of the meters were increased.

By using the methods given here, accurate shunts can be made for any meter without the use of any measuring equipment, not even an ohmmeter. It is not even necessary to know the internal resistance of the meter. If made with reasonable care, they will have better than 1% accuracy.

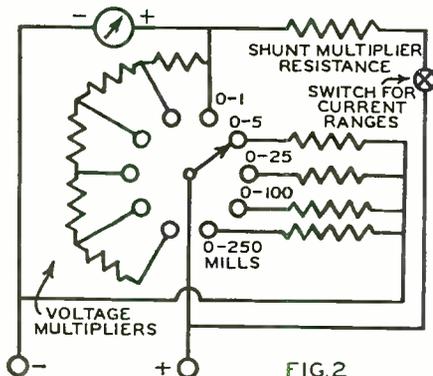
It is possible to make a set of shunts, mounted in a box and used with any low resistance meter. Each shunt would then have a factor instead of a definite current range. That is, a certain shunt having a factor of 5, when used with a 0-1 milliamperere meter would increase the range to 0-5 milliamperes. If it were used with a 0-5 milliamperere meter it would increase the range to 0-25 milliamperes.

The wire used in making these shunts is obtained from old wirewound meter multipliers. Any kind of resistance wire may be used, but the rheostat type usually has a smaller temperature coefficient.

The only equipment necessary is a fairly high voltage source, preferably a 45-volt "B" battery, and a variable resistor or volume control. The minimum size of the variable resistor may be found by the formula: $R = \text{Voltage} \times 1000 \div \text{Meter current necessary for full scale deflection}$. Thus, a 0-1 milliamperere meter used with a 45-volt "B" battery would require a 45,000-ohm resistance. A 50,000-ohm or even a 100,000-ohm volume control would be close enough.

Connect the meter, battery and resistance as shown in the diagram. Before connecting the meter to the battery, make sure the variable resistance is set for the *maximum* resistance to prevent possible damage to the meter. Let us suppose we have a 0-5 milliamperere meter which we wish to change to a 0-10 milliamperere meter. Set the meter to read 5 milliamperes or full scale by means of the variable resistance.

Now take a piece of the resistance wire and remove the insulation with steel wool or fine sandpaper. Connect about six inches of this wire across the



Make your own METER SHUNTS

by STEPHEN J. VARMECKY

Johnstown, Penn.

By making your own meter shunts you can increase the uses to which it may be put.

points marked x x in the diagram. Vary the length of this wire until the meter reads half scale or 2.5 milliamperes. When doing this, the resistance wire should make good contact with the leads x x, and the leads should be of No. 18 wire or heavier.

Measure the length of this wire between the leads as accurately as possible. The resistance of this wire is equal to the resistance of the meter. The change of resistance of the meter will have practically no effect on the current flowing in the circuit because of the large resistance already in the circuit. Now, if the total current remains the same, and only 2.5 mills flow through the meter, then the other 2.5 mills are flowing through the shunt. In order to do this, the resistance of shunt must be equal to the resistance of the meter.

Let us suppose the length of wire necessary was $\frac{1}{4}$ ". This is too small a shunt resistance to use with any degree of accuracy because the uncertain contact resistance of the switches and terminals forms a large portion of the shunt.

In order to minimize the effect of contact resistance—it is necessary to put a length of the resistance wire in series with the meter so that the shunt for the highest current range is not less than about 2" of wire with ordinary tap switches.

An explanation of this is in order. The current in two parallel resistances will divide *inversely* as the resistance of each branch. Suppose we have a 6 ohm resistor and a 3 ohm resistor connected in parallel with a current of 4 mills flowing through the 6 ohm resistor. We then have:

$$\frac{6}{3} = \frac{x}{4} \quad 3x = 24 \quad x = 8 \text{ mills}$$

through the 3 ohm resistor. That is, if one resistor has twice the resistance of the other, it will carry only half as much of the total current as the other resistor.

If we wish to convert our meter to a 0-10 milliamperere from 0-5 mills, the meter must read 5 mills when a current of 10 mills is flowing through the meter and shunt. The other 5 mills must flow through the shunt. The total current divides equally in both

branches, so their resistances must be equal.

If we use the same kind of wire entirely, we may express resistance in terms of inches of wire instead of in ohms. Expressed this way, our meter has a resistance of $\frac{1}{4}$ " of wire.

This is the highest range shunt, so we will make it 2" long. The resistance in series with the meter should then be 2" minus the internal resistance of the meter, $\frac{1}{4}$ ", or $1\frac{3}{4}$ " long.

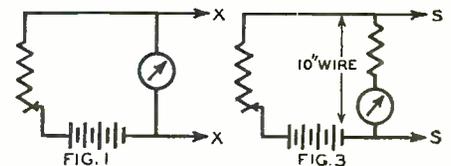
A more common application would be the different current ranges in a set tester as shown. We have a 0-1 milliamperere foundation meter with the following ranges marked on the scale: 0-1, 0-5, 0-25, 0-100, and 0-250 milliamperes. The first step, as before, is to find the internal resistance of the meter. It may require $\frac{7}{8}$ " of wire. The 0-250 mill shunt must carry the most current, so we will make it 2" long.

At full scale deflection, the meter itself will carry only 1 mill and the shunt will carry the other 249 mills. Therefore, the meter with its multiplier must have 249 times as much resistance as the shunt, that is, $249 \times 2 = 498" \div 12 = 41', 6"$ minus $\frac{7}{8}"$ (internal resistance of meter) or $41', 5\frac{1}{8}"$ of wire on the multiplier. If it were made only 41' long, the error would be about 1%.

The 0-100 scale is next. It must carry 99 mills while the remaining 1 mill goes through the meter. Since the meter and multiplier have a resistance of 498" of wire, the shunt must be $498 \div 99$ or 5.06" long.

The same procedure is followed in the 0-25 mill scale. One mill must flow through the meter to produce a full scale deflection and the other 24 mills flow through the shunt. The shunt must, therefore, have $1/24$ th the resistance of the meter and multiplier combination, or $498 \div 24 = 20.85"$ of wire.

In the 0-5 mill shunt we have 4 mills (Measure further on page 62)



A. Y. A. N. A. J. N. E.

VIA MICRO-WAVES

by **Henry W. Roberts**
Radio Editor, *Aero Digest Magazine*

Using micro-waves as a sliding ruler to measure the actual altitude of an airplane above the terrain underneath, is the latest invention.

RADIO, in its quest for new frontiers to conquer, was recently called upon to solve the most baffling problem in "blind" flying: "how high is up?"

Scientists the world over have sought for years to invent a device which would tell the airplane pilot, flying "on instruments," how high he is above the invisible ground; not above the theoretical sea level many miles away, but above the actual terrain over which he is flying.

Moreover, this information had to be made available to the pilot accurately, instantaneously and continuously. It had to be independent of the dozens of variable factors which affect the usual run of navigational instruments. Day or night, rain or shine, in storm, sleet or snow, over mountain or prairie, over jagged skyscrapers or smooth lakes, anywhere and at any time, it had to work faithfully and accurately, telling the pilot every instant how high he is over the highest point of the terrain directly below him.

It was a tough problem, but radio solved it.

Invention Without Inventor

A conscientious historian would have difficulty in crediting the inven-



Inventors Russell C. Newhouse (L) & Lloyd Espenschied of the Bell Labs.

tion of the radio altimeter to any one individual. As science advances, invention ceases to be an individual accomplishment, but becomes a cumulative process.

A dozen or more men have contributed their share of ideas which, in their aggregate, made the radio altimeter not only possible, but also practical and reliable. But the greatest contribution of all was made by a young *Bell Telephone Laboratories* engineer, Russell Conwell Newhouse, who was the first to conceive the radio altimeter in its successful present

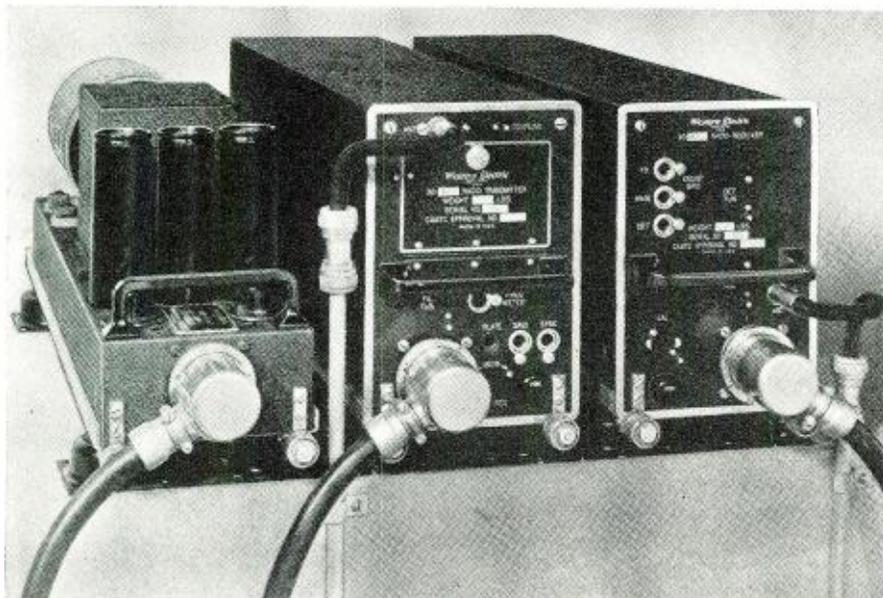
form, and who nursed its development through to its completion. For this, Newhouse received the coveted *Lawrence Sperry Award* from the *Institute of Aeronautical Sciences*, in recognition of his outstanding contribution to safety in the air.

In its essence, the radio altimeter is a simple device. It measures the time interval between a radio signal and its "echo" reflected from the ground. Its working principle is no different from that of the familiar *sonic depth meter* widely used in hydrographic surveys — except that sound waves travel at the rate of 4,938 feet per second, and that only in "standard" water, while radio waves move at the rate of 186,300 miles per second, anywhere and at any time. That is more than a billion feet per second, and the radio altimeter must consequently measure, accurately, time intervals of inconceivably small duration.

The present radio altimeter can accurately measure time intervals of $1/20,000,000$ th part of a second, corresponding to a height of 20 feet, and will soon be able to measure, just as accurately, time intervals of $1/50,000,000$ th part of a second, corresponding to a height of about 8 feet!

Strangely enough, while scientists the world over were looking for a solution to the problem, they had, all unaware, known it for years. As far back as 1915, reflected electrical waves were used for locating breaks in long-distance telephone cables. Later, similar methods were used for measuring lengths of water pipes when only one end was accessible. Railroad collision prevention devices, similarly operated, have been known for years. These methods of using reflected electrical waves was finally perfected as a radio means for measuring the height of an airplane above the ground. Their basic mathematics are the same!

In 1929, Newhouse was studying electrical engineering and doing graduate work under Prof. Everitt, at *Ohio State University*. That year Everitt and Newhouse were working on the development of a radio altimeter, substantially along the lines of the present device, under a \$1500 grant from the *Guggenheim Foundation*. Patents



Western Electric's Commercial Unit as it appears installed in the plane. The instrument is fool-proof and light in weight, but costly.

were applied for, but the applications were allowed to lapse: there was no radio tube then in existence to generate sufficiently high radio frequencies.

At the same time, Lloyd Espenschied, of *Bell Telephone Laboratories*, independently developed a similar device, and applied for patents in 1930. Espenschied, too, was unable to build the actual device because of the lack of a suitable radio tube.

That year, Newhouse went to work for *Bell Telephone Laboratories* and, with his roommate, Peter C. Sandretto, lived and breathed his radio altimeter. But it was not until 1936, with its series of airplane disasters, that the radio altimeter at last was launched in earnest. Sandretto, now a radio engineer with *United Air Lines* obtained his company's cooperation; Newhouse, still with *Bell*, was put in charge of the project. In another department of *Bell Telephone Laboratories*, another young man, A. L. Samuel, developed a new ultra-high frequency radio tube capable of producing a stable frequency of 500 mcs. That tube made the radio altimeter possible.

Over Laramie Range

Last summer, two travelers met at the airport at Cheyenne, Wyoming. One was Pete Sandretto, coming in from the West Coast with his big twin-engined "flying laboratory," the *Boeing* flight research ship of *United Air Lines*. From the East Coast, aboard a transcontinental airliner, came Newhouse—and the new radio altimeter. In the big hangars of *United's* overhaul base, skillful mechanics carefully installed the new radio magic, tested its simple controls.

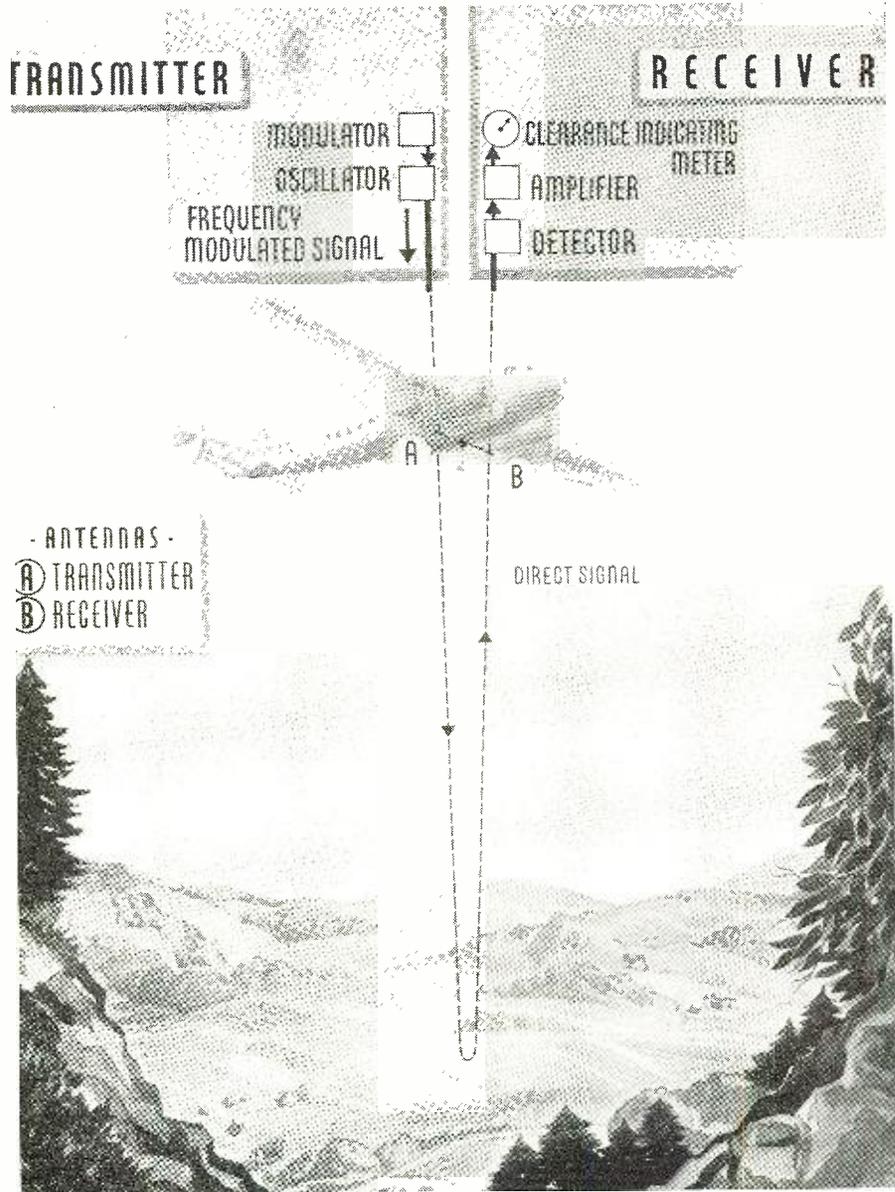
Then came the fulfillment of nine years of planning, working, waiting. The big ship roared down the runway, climbed in a graceful turn, leveled off. The old-fashioned aneroid altimeter showed 8500 feet—above sea level. In the cabin, Newhouse and Sandretto simultaneously reached for the switch which puts the radio altimeter in operation. The radio altimeter showed 2355 feet—above the airport!

The airport at Cheyenne is 6145 feet above sea level. But the sea level lies 1034 miles away to the West, 1599 miles away to the East. Of course, every pilot knows that the Cheyenne Airport lies at 6145 feet above sea level, but . . . Forty miles westward, in the Laramie Range, towers the snow-capped 8013-foot Sherman Hill. The "flying laboratory" wheeled about and headed for it.

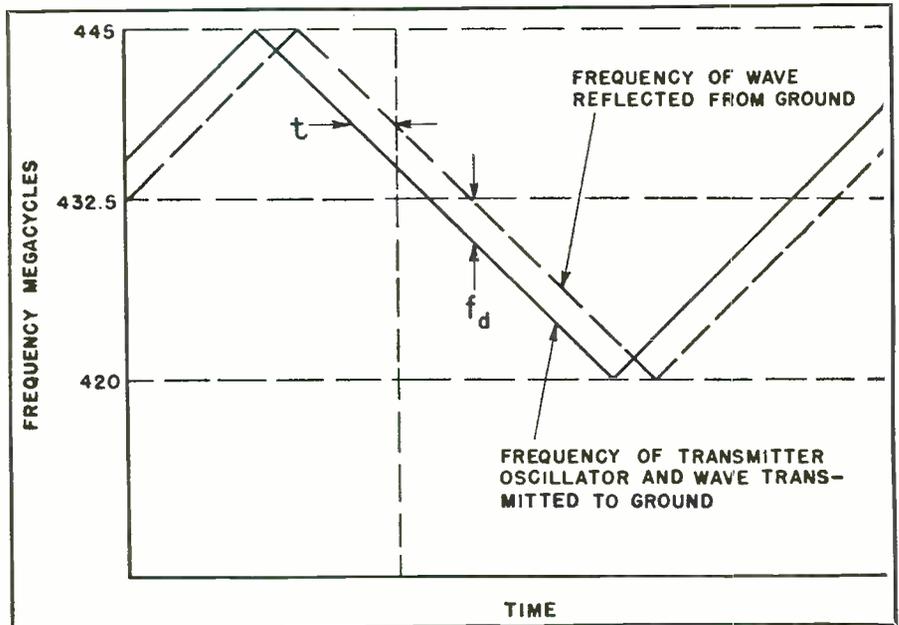
In the foothills the pointer of the radio altimeter began crawling towards zero, flashed a red warning light when it dropped below 1000 feet, and, as the forbidding peak slid beneath the wings of the big *Boeing*, the pointer read: 487 feet. The aneroid altimeter still read 8500 feet. And that was that!

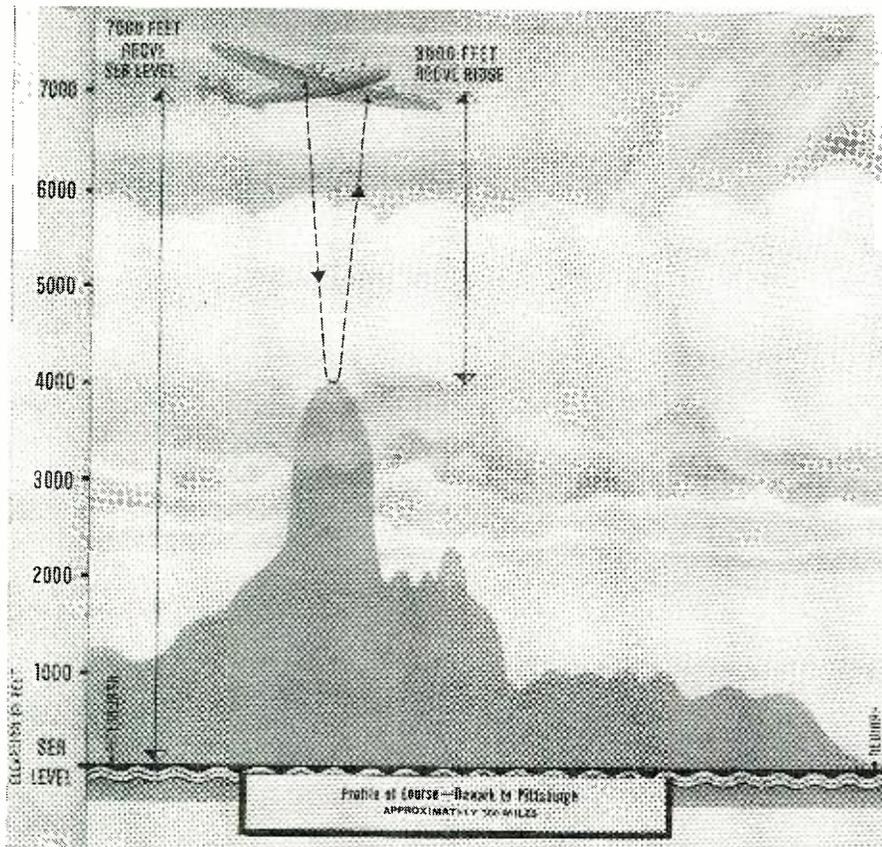
The Radio Echo

The radio altimeter, soon to become standard equipment on most airliners,



Above is a pictorial diagram of what takes place when the micro-wave altimeter is being used aboard the airplane. Below is a time-frequency diagram showing how the displacement of frequency against time is converted to feet.





A cross-section of the Newark, N. J.-Pittsburgh, Pa. airtrack showing how the regular altimeter does not give the accurate height above ground.

is now manufactured commercially by *Western Electric Co.* The first production lot is destined for *United Air Lines*, who have contributed so much to this development.

Physically, the apparatus consists of a simple UHF oscillator, a corresponding receiver, and a common power unit, installed out of the way in the radio compartment and remotely controlled by the pilot. Underneath the airplane are two small T-shaped antennae, each in a streamlined dielectric housing: one transmitting, the other receiving. The antennae, centering dipoles, are each just a foot long, set about six inches away from the wing. In front of the pilot, housed in a standard 3/4-inch diameter aircraft instrument case, is the indicator, calibrated in feet, with a range from 0 to 5000 feet. A small toggle switch on the instrument board puts the altimeter in operation; its operation is automatic, continuous and instantaneous—if you will neglect that infinitesimal fraction of a second that it takes for the radio signal to travel from the airplane to the ground and back again. Complete and installed, the altimeter weighs just about forty pounds.

Now, this is the way it works. The frequency of the transmitter is being rapidly "wobbled," up and down, 60 times per second, by a motor-driven modulator consisting of a small rotating variable condenser. The modulator is so arranged that the frequency change which it produces is *linear*. If we plot the frequency variation on a

graph, we will get a straight-line sawtooth pattern, as shown in the diagram, in solid line. Each complete "tooth" represents the change of frequency from 420 to 445 and back to 420 mcs., taking place in 1/60 sec.

That signal is directed towards the ground by one of the two antennae underneath the wing, with the wing acting as a reflector. When it reaches the ground, it is reflected back into space, and is picked up by the other antenna and fed to the receiver. Now, if we will plot the received signal on the same graph as the transmitted signal, it will obviously have the same straight-line sawtooth pattern, but will take place a little later. In other

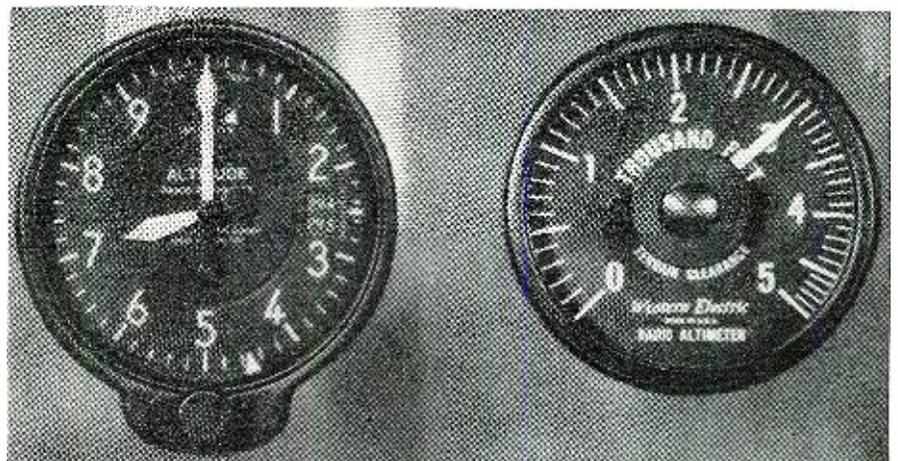
words, the pattern of the received signal will be shifted in time.

The amount of that shift shows how long it took the radio waves to travel from the airplane to the ground and back again. If we can measure the amount of the shift, we will know our altitude: because radio waves propagate at a constant speed. We can measure the amount of the shift, at any instant, by measuring the instantaneous difference between the transmitted and the received frequencies.

The amount of the shift is measured electrically, and the measuring process is automatic and continuous. A portion of the transmitted signal is fed to a special radio tube, where it is mixed with the received wave; in other words, we "beat" the received wave with the transmitted wave. The instantaneous difference between the two frequencies, constant for a given height, sets up an interference in the radio tube; and the greater the frequency difference, the greater is the interference. The electrical current thus produced, proportional to the amount of interference, moves the pointer of the radio altimeter indicator—an ordinary milliammeter calibrated in feet.

And that's how the radio altimeter works. The greater the height above ground, the longer is the distance that the radio waves must travel; the longer the distance, the greater is the pattern shift; the greater the pattern shift, the greater is the instantaneous difference between the transmitted and received frequencies; the greater the frequency difference, the greater is the resultant current; and the greater resultant current, the farther along the scale the pointer moves. And that scale is calibrated in feet of altitude.

Now we see why the radio altimeter is so phenomenally accurate: there is nothing that can interfere with it. It depends for its indication *solely* on the instantaneous difference between the frequencies of the transmitted and received waves. That, in turn, depends
(Clear to page 57, please)



These joint instruments tell the pilot his altitude above sea-level (L.), and,—with micro-waves (R.)—his height above the immediate ground below.

BENCH NOISES



by **LEE WARD**

Service Manager, San Francisco, California

Repairman's Riddle No. 3 was so successful, that we present number 4 of the series. Try your luck; you may win a prize!

THE CASE OF THE ANGRY PROSPECT

IS there any situation in a serviceman's daily routine that calls more on his mental agility and diplomacy than one in which he is faced by an enraged prospect? Is anything more valuable during the conduct of business than the right remark at the right time—when a contract hangs in the balance?

The story below is intended to test your business acumen. You are put into a quandary, and asked to tell us how you would get out. There have been many times when work and customers have been sacrificed by radio repairmen simply because they lacked satisfying comment.

NO BOX-TOPS!

Here's how to compete for the prizes listed below: Tell us, briefly, what you would have said if you were Cliff at the point in the story where the blank line appears. Entries will be judged for appropriateness, ingenuity, and pleasing import. You must add your reasons why you think your sentence is the correct one for customer use, but please don't be too elaborate, and *don't extend the narrative*. The space on the back of a postcard should be ample, although the size or shape of your entry will play no part in its appraisal.

Address all entries to REPAIRMAN'S RIDDLE NO. 4, RADIO NEWS, 608 S. DEARBORN STREET, CHICAGO, ILL.

Duplicate prizes to tie winners. Entries must be received at RADIO NEWS on or before February 15, 1940, to qualify.

PRIZES

First Prize: Your choice of either a *Triplet* Model 426 0-1 d-c milliammeter 4" square, or a *Simpson* Model 29 0-1 d-c milliammeter $4\frac{3}{8}'' \times 4\frac{1}{8}''$, or any other meter of your choice of the same retail value.

Second Prize: Chirardi's famous grief-eliminator, the *Radio Trouble-Shooter's Handbook*.

Third, Fourth, and Fifth Prizes: A year's subscription to RADIO NEWS. (If you are a subscriber, a twelve months' extension.)

Lights! Action! Camera!
And may the best man win!

WHILE Pete — the *Signal-Chaser*—might be king of the test bench, he sometimes falls down badly in problems of customer analysis. Cliff, the "outside" man, frequently smarts under Pete's technical lashing when a chassis is brought into the shop; but Cliff is no fool when he deals with our customers, and he occasionally repays Pete in a manner that makes his suffering worthwhile.

I don't actually encourage arguments among the hired help, but since they are so interesting and reflect the average serviceman's daily encounters so well, I try to be present whenever the balance of power swings from Cliffside Pete-ward.

Last week, for instance, Cliff made a single remark to a peeved prospect that turned him into a satisfied customer. Just like that. Pete doesn't yet know what that one remark was, but he's spending his spare time over a crystal ball in order to learn.

It started when Cliff brought in a *Majestic 100-B* chassis and speaker. The *Signal-Chaser* went to work immediately—on Cliff.

"Hello, there, old man," he said, with false cordiality. "Whatcha got for me this trip?"

"Lo," Cliff grunted.

"Poor lil feller," Pete consoled, "did he stub his technical toe on a bad ol' receiver?"

"Not this time—power trans-

former is burned up. I have to give the customer a price and delivery time before we start work. Check it to find if anything but the transformer is shot. Meanwhile—no more cracks about my alleged inability to handle my job! You're here to find faults in *sets*, not in *colleagues!*"

"Just the same," Pete replied, "I notice that every time you come across any real receiver trouble, you come running back to your good old papa!"

"Some day," Cliff answered, "I'm going to ram your soldering iron down your throat—that should melt the acid sore out of your system!"

I thought it was time to interfere, so—as if I hadn't been listening—I walked in on them, and asked what the trouble was.

"Nothing," they both said, to let me know it was a private argument. Pete hooked up the chassis for test, and Cliff fanned through the customer file.

Later that day, the storm broke out again.

"Here's the dope on that *Majestic*," Pete said. "Only the power transformer. Charge \$9 for the part, and \$1 for the work."

"Since when are *you* setting prices?" Cliff challenged. "I'll charge ten bucks, all right—but it will read 'Parts, \$5, Labor, \$5!'"

"That's no way to figure," the *Signal-Chaser* said. "The customer will certainly squawk at the high labor quotation. But I'm not going to argue—this is an important question of policy. Call in M.H.T. and let *him* decide."

"Here I am," I announced. "By the way, why have you two been calling me 'M.H.T.' lately?"

"On account of your writing," Cliff explained. "It's short for 'Master of the Heavy Touch.' Do you follow me?"
(Follow RR No. 4 to page 64)



"Hey, fellers, Hedy Lamarr says her radio won't work!"

THE FUNDAMENTALS OF RECORDING

by **OLIVER READ, W9ETI**
Technical Editor, RADIO NEWS



The author's complete set-up for recording from radio programs, from a microphone, and playing records or transcriptions.

THE following of these fundamentals will enable the recordist to get the most from both his equipment and his hobby. The rules are very complete.



THE art of home recording has moved at a fast pace ever since - so-called "electrical cut records" made their appearance several years ago. At that time, the record companies began to consider the *quality* of the record rather than how much *noise* could be reproduced. The broadcasters began to make use of recordings on their programs, chiefly as an economy measure and the recording companies threw up their hands in disgust. All their labors had been done in vain, they thought, and a decided drop in record sales was immediately forecast.

Were they right in their predictions? Definitely not! Today more records are sold every week than even the most optimistic sales manager ever dreamed could be. And what improvement has been made in all types of records to bring this about, was it the adoption of better recording procedure, the use of electrical instead of mechanical recording or the unforeseen ability of the broadcaster actually to create the demand for new discs?

We think it was a combination of all. At any rate, increasing interest has been shown in recent years in home recording as well as the purchasing of commercial records and today the home recordist has at his fingertips a means of transcribing his favorite program, artist, commentator, skit, or what have you, right in his own home.

The first recorders were somewhat of a novelty, and these made records of the "Jones Family" that actually sounded more like "Amos 'n' Andy" when played-back to the spell-bound listener. These were very crude in comparison to the methods used today.

Semi-professional recording is nothing more or less than an intelligent application of certain fundamental rules of sound and motion. The manufacturers have given the public recorders which are capable of producing records of a high degree of perfection, *providing* the operator uses his equipment in the manner for which it was designed.

We may delve into the art of recording in two ways to make records in a hit-or-miss fashion, or really to study the proper procedure and then apply our findings to the making of true



The recording turntable must be absolutely level and the leads to it should be shielded so as to avoid any AC pickup from the light lines.

high-fidelity discs. It is the purpose of this article to bring out some of the points we have encountered in this new and fascinating hobby and to pass it along.

Equipment Needed

First of all, we must decide on whether or not we are to record high fidelity programs or use our equipment solely as a means for voice study or on average types of music or entertainment. This is important and requires an analysis of various recorders before we may decide on any one in particular. Recorders may be divided into three groups—the home portable, the semi-professional (portable or stationary), and the professional studio type. The latter is used only by the better recording studios and will not be discussed in this article.

The home recorder is either permanently mounted within a radio cabinet as part of a combination radio, or is of the type which may be carried about without too much effort and set up at any location where power for its operation is available. It records at a speed of 78 rpm, although some include that speed with an alternate choice of 33 $\frac{1}{3}$ rpm. Most recorders cut from the outside of the disc to the inside, while a few give a choice of either outside-in or inside-out.

Home recorders include a suitable amplifier, pickup, volume level indicator, and playback facilities. A twelve inch turntable is used in nearly all models and record blanks up to twelve inches in diameter are available. The prices range from \$75.00 to \$185.00 for these units and they are entirely satisfactory for *general* recording where the recordist is satisfied with all but highest quality records. These are comparable to many of the commer-

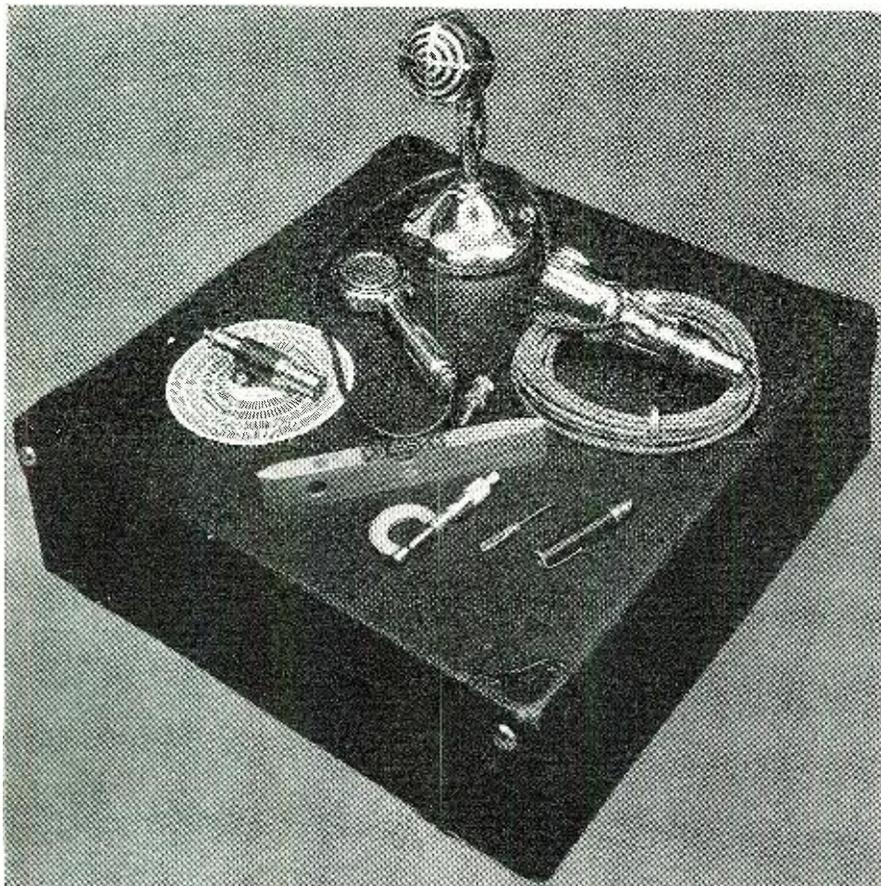
cial records sold on the open market and possess a surface noise level even lower than duplicate pressings sold.

The second classification deals with the semi-professional type of recorder. These are used in much the same manner as the home portables but are capable of much better fidelity and accuracy. The units include more costly cutting heads and playback pickup, a heavier motor and drive mechanism, and have the amplifier equipment separate from the table assembly in most cases. The price of this type of unit is considerably higher than the portable home type, and is based on the fact that the parts used and the care in manufacture needed for mechanical perfection is greater.

The third type is used only in the professional recording studio. This recording turntable and cutting head is mounted on a concrete block foundation to prevent any vibration transfer to the table. It looks like a combination lathe and turntable. The table itself weighs some 120 pounds. This is driven by a pulley-belt combination for smooth drive. The professional type is used largely for the making of so-called "electrical transcriptions." These records are 16" in diameter and are able to give 15 minutes of recorded material. The professional recorder was fully discussed in the Sept. 1938 issue of *RADIO NEWS*.

We shall confine our discussion to the second, or semi-professional type, inasmuch as all of the important points apply to the portables as well.

Suppose that we wish to use our equipment in as much a versatile manner as possible for *all* types of recording: music off the air, or direct microphone pickup (either at a permanent location or in portable service). We



Aside from the recorder and amplifier, these are the various accessories which are needed to get the most out of your new hobby.

must then be able to record all sizes of blanks up to 16" so that, when the occasion presents itself, we can record for a quarter hour on one side. Next, we should choose between the two methods of cutting—outside-in, or, inside-out. The latter method is most satisfactory for all types of discs as the "scrap" winds itself automatically around the hub and clears away from the needle. If, on the other hand, the

scrap material were to entangle around the needle, there would be a good chance of the needle jumping a groove and ruining the record.

The above precaution should be observed on acetate discs in particular, as the cut material leaves the disc immediately after cutting. On the plastic discs, the static electricity charge generated by the friction holds this material in place in the groove as it is

cut and the record can be cut from the outside-in with no danger of the scrap fouling the needle.

Both the portable and semi-professional types are available with two distinct methods of cutting drive arrangement. One is the overhead screw type. This consists of the hub assembly and worm gear, a special threaded drive rod, and a rigid carriage for the support of the cutting mechanism. The threaded rod must be accurately machined to provide an even number of lines per inch, free from backlash or play, burrs or imperfections, and positioned in a horizontal plane with respect to the turntable surface.

The second type makes use of a cam arrangement that is located under the table board. Most of these are designed to cut from the outside-in. In appearance, they represent a conventional playback pickup. This type of recording mechanism is widely used on portable units and is entirely satisfactory where a high degree of fine cutting is not required.

High-Fidelity Recording at Home

A complete permanent recording setup is shown which is the *Presto Model 6-D*. This equipment has been chosen after making several hundred records from radio broadcasts and from studio pickup; and been designed around a portable transcription table of comparable quality to obtain the results had on this unit. The turntable itself is of sufficient weight to be rim-driven with maximum steadiness and torque and this assures freedom from "wows" caused by any variation in speed as the recording is done or when it is played back.

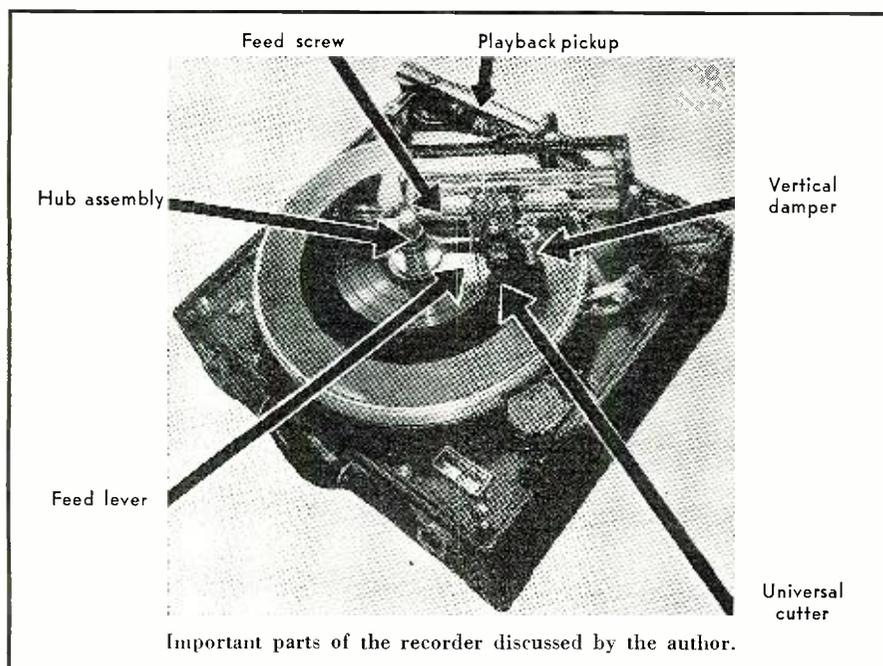
The motor is synchronous, and operates from a 110-120 volt, 60 cycle source. It is heavy enough to allow sufficient reserve so that when a heavy bass passage is encountered in recording, the increased drag on the motor will not affect the running speed. The motor requires oiling and cleaning the assembly to remove all excessive grease and oil which has accumulated dust at least once a year.

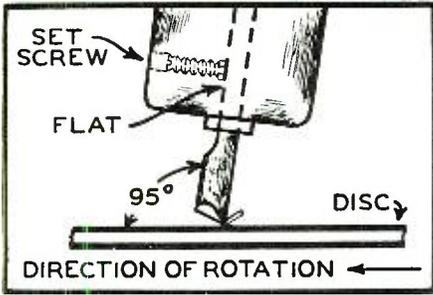
The turntable is of aluminum, and turned to perfect balance on a lathe. The "table" must run absolutely smoothly and be carefully tested for balance before it meets the requirements of a good recording "table." It is of sufficient weight to be used for high-fidelity work. Rubber drive wheels are used to transmit power to the rim as well as to afford vibration freedom from the motor.

Cutting is done from the inside-out, either at 33 $\frac{1}{3}$ or 78 rpm. A thin rubber mat should be used under the record to prevent scratching of the disc and to offer a slight amount of shock-proofing. Guide screws are provided so that the cutting drive will not slip at the hub assembly.

The Cutting Head

Of greatest importance is the selection of a cutting head which will fulfill all of the requirements of high-fidelity recording. On the "Head" rests





Position of the cutting head.

the ability to transit *all audio frequencies* onto the disc *without* audio peaks and it should do this most efficiently and precisely. Such is the *Universal Full-Frequency Cutting Head* shown and used on this equipment. Built and adjusted to the precision of a fine watch, this cutter will respond to all frequencies from 30 to 10,000 cycles and over with excellent fidelity. The earlier types of magnetic heads made use of rubber dampers. These rotted after two or three years and the balance of the armature was upset and distortion resulted. The only remedy was to install new ones and this required expert adjustment. The head shown has *no* such rubber dampers, and the initial adjustment will hold for many years. The impedance of the cutting head coil is 15 ohms and this is accurately matched to the amplifier by means of a line-to-voice-coil transformer.

Inasmuch as a standard level indicator is used "calibrated for a 500 ohm line," this method was adopted as the most satisfactory. An average recording level of plus 14 db. (0-db. equal to 6 milliwatts across 500 ohms) was found to be the best for all types of discs and the head will handle considerably more power on peaks without any distortion.

Cutting heads are available in many varieties. Most of them are of the magnetic type, and operate in much the same manner as a magnetic pickup. The crystal type has now found its way to the market. These are rather expensive and the range capability is about the same as a high grade magnetic type. Greater care is required in the use of these, and, like all crystal devices, are subject to changes in temperature. They should not be used in direct sunlight or exposed to any high temperatures or the adjustments will suffer and a possible cracking of the crystal take place.

One thing is certain for true high-fidelity we cannot be satisfied with any cutting head which is incapable of reproducing all frequencies of a large symphony orchestra and its abundance of overtones and rich harmonics. Cutting heads range in price from \$15.00 for the speech-frequency type, to as high as \$400.00 for the best grade of precision equipment used by the large recording companies. High-fidelity heads may be had for a cost of approximately \$90.00.

"Giving It the Needle"

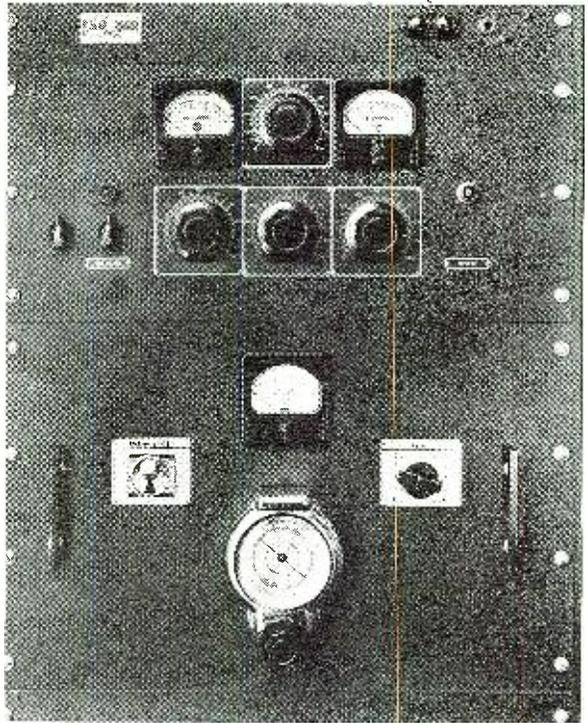
The best cutting head in the world

cannot do its job if the recording needle is in any way responsible for inaccurate cutting of the material on the disc. Two general types of needles are used in recording—the steel and the sapphire pointed. The first type are of high-grade steel, ground and polished to a razor-edged chisel point. Any imperfection on the cutting edge of the needle will be transmitted to the disc in the form of surface noise and must be avoided. If a burr is present, the needle will actually dig-in to the surface and ruin the record.

Steel needles are suitable for recording on soft surfaces such as acetate or any of the soft plastic kinds now widely used for recording. They are good for up to 15 twelve inch records before they require re-sharpening. Their quality may be tested by cutting on a blank (without audio) and then plying the record back to observe whether or not any noise is present on the disc, which will be very evident if all is not well at the needle.

For best results, we recommend the use of the *sapphire* needle. This type is more enduring and possesses a harder material that may be used for some 15 hours of recording before it is necessary to return them to the manufacturer for re-sharpening. These are rather costly to purchase, but are well worth the investment when it is realized that the recordist has a needle which is not likely to chip during a recording on some particular selection.

Sapphire needles are fragile to shock, and should be protected when not in use. Our own is covered with a small cork slipped over the needle so that in case the carriage accidentally drops to the record, or if struck, the point will be protected. Care must be



The author's panel-mounted Full-Range Amplifier & radio tuner which was used in the experiments.

used in placing the needle in position on the record.

Choice of Disc

Many excellent makes of blank discs are now on the market to choose from. The portables which cut from the outside-in may use the new plastic blanks to good advantage. For best all-around recording, the acetate type is recommended. These are also widely used (16") for transcriptions and for broadcast purposes. The acetate type of disc has an aluminum base which is covered with a coating of cellulose acetate (some authorities claim it similar to the duco we have on our cars). This material is soft in texture and is flowed or sprayed onto the aluminum in an even coat.

The thickness of this coating usually determines the cost of the record. The BC stations generally use a heavy
(Record further on page 48)

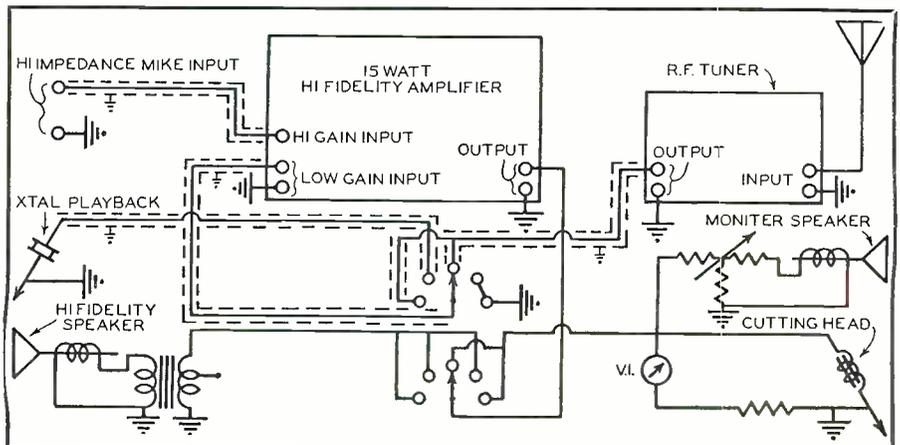


Diagram of a full recording set-up

Serviceman's Experiences

by LEE SHELDON

Chicago, Illinois

A little civic pride and a helpful spirit, not contaminated by monetary ideas, can sometimes be very profitable when needed most.

L doesn't usually take time off when there's a marriage in his family; but this particular time, after a spinster cousin had been single for so long, my partner said he wouldn't believe the ceremony had taken place unless he watched it.

It felt good to be alone in the store. I walked to and fro possessively, enjoying the unusual acoustical and spiritual calm. I paused before the washroom mirror, squinted my eyes, jutted my chin. For no other reason than it fitted my mood, I clenched my fist and shouted: "Success!" Ambition welled up within me, followed closely by inspiration.

Good advertising, I thought to myself, *that's* what we need. I'll write a sales letter; the Muse seems especially mobile today!

I went out and bought stationery to carry my moving message. The crackley kind—you know, the expensive sort, bordering on hardware, that a bank uses when they let you know your three \$500 bonds have become worthless.

For three hours I worked feverishly. When Al came in, I handed him the final sheet. He read:



"I want to repair a radio," said the scout, "I need it for a badge."

Dear Set Owner:

If your set isn't working properly, don't tune it *Crosley*. Have *Sparton* fortitude against your troubles, for *Delco* away when we start to work.

Have you a *Sonora* daughter who is a *Roamer*? Our *Peerless* repairs will help you keep them at home. Call us—*Philco* over the set thoroughly.

Can we make a *Dayton* your house *Erla* some *Knight*?

Yours truly,

Salutary Sales & Service.

"What do you think of it?" I asked, bristling with modesty.

"*Bosch!*" Al replied, dropping it into the waste-paper basket.

"You don't think it's good advertising?" I asked incredulously.

"Radio is out of its infancy," Al said, "but some radio men aren't. You know as well as I that one person's good will is better than the best copy in the world. Why didn't you spend the morning meeting prospects?"

"Fine comment," I said bitterly, "—and after I've given the best years of my literary life to you!"

"A well-earned beef," Al admitted, "but don't forget I'm the one who made those years good. It was I, my budding businessman, who hot-housed you during your protracted financial sprouting!"

So fares genius. I stalked angrily out to the front counter—just as a fifteen-year-old Boy Scout entered.

"Good morning," he announced. "I am Arnold Lewand, Star Scout and Patrol Leader of Troop 836, the oldest in Chicago—organized twenty-five years ago. I live at 2104 Eastwood Avenue."

"I enjoy your statistics," I said, knowing young fellows are notoriously small spenders, "but before you break into a Gallup, would you mind telling me what you want?"

"Of course not," he said, smiling, "I wish to repair a radio."

"Don't we all?" I snapped.

The lad looked at me wonderingly for a moment, and then, before I could show the counter-irritant to the door, Al came out and put his arm over the boy's shoulders.

"Don't mind him, fella," my partner-in-name-only said, "let me help you."

"Thank you, sir! You see, Whitey and I are studying for a Radio Merit Badge. We're stuck on the requirement which reads: 'Submit satisfac-

tory evidence that you have located and repaired a fault in a receiving set.' Our fathers have promised us two weeks at Camp Owasippe if we pass."

Know what Al did? Hooked up an old *Freshman*, jimmied it, supplied tools, and let him work on the bench until he got it to play. Then he wrote and signed a statement—on our bill-head!—to the effect the boy had diagnosed and repaired it.

Lewand read the statement proudly. "Boy!" he shouted, "wait until I get over to North Maplewood Avenue and tell Whitey about *this!* Many thanks."

"You're welcome," Al said genially, "—and send Whitey over if he needs help. Give my regards to the Sioux Patrol!"

"How did you know 836 was—" the boy began.

"Been a Scout myself," Al laughed.

I jumped on Al as soon as the door closed.

"You," I said, "helping a competitor take work out of the profession!"

"Too bad no one ever helped *you* while you were learning radio," Al said. "And he's no competitor, either."

(More experiences on page 60)



... I was sure that this scout had an idea that I had had many times.

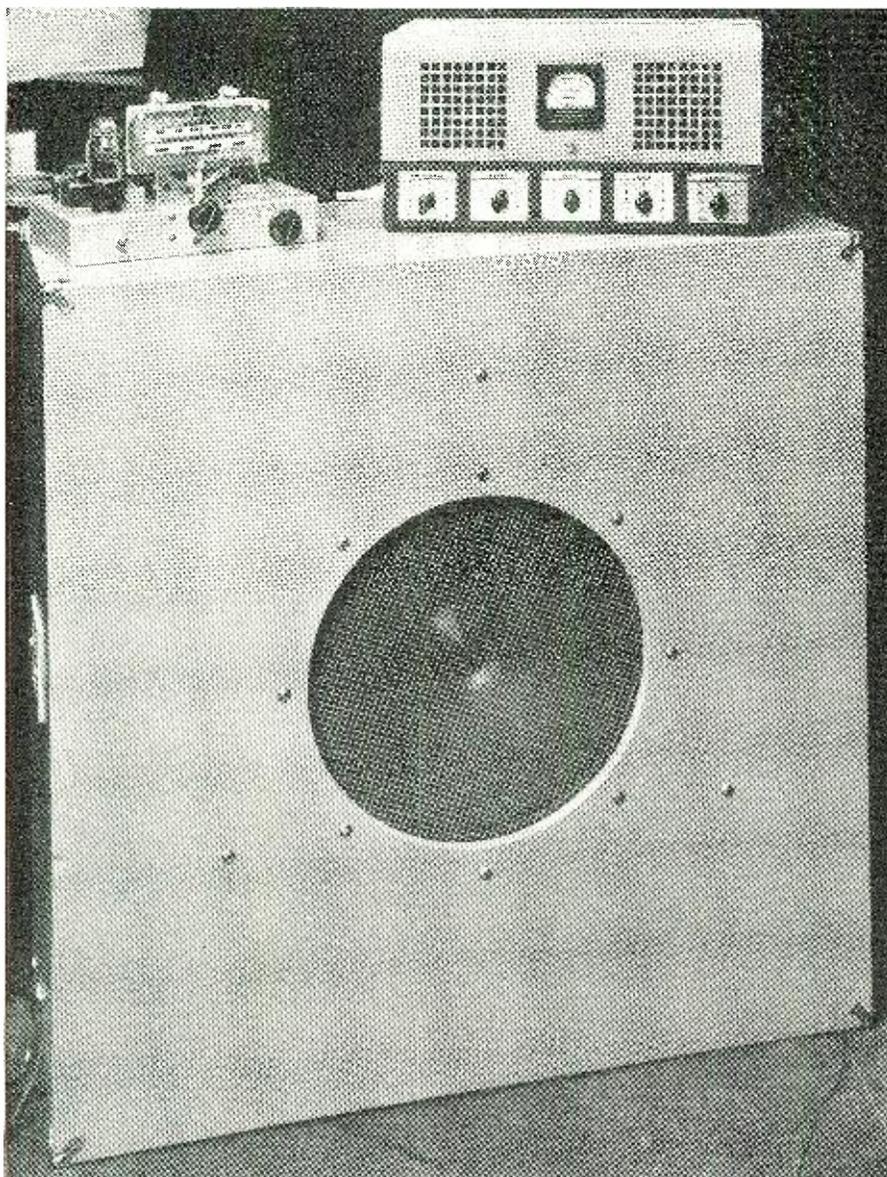
The Radio News

HIGH-FIDELITY TUNER

by A. B. CAVENDISH

Savannah, Georgia

By adding a suitable radio tuner to the amplifier previously described here, the author has succeeded in developing a superb receiver.



This is the complete set-up necessary to receive high-fidelity programs from nearby broadcasting stations. Note the big speaker.

ONE of the main reasons why the average commercial communications superheterodyne does not give high fidelity reproduction of music broadcasts is that the i.f. stages are peaked to maximum efficiency and to the sharpest possible point. Such peaking of i.f. stages cuts off a great deal of the sidebands and it is in these sidebands that the overtones and the beauty of broadcast music is to be found.

Having previously built the beautiful amplifier described in the December, 1939 and January, 1940 issues of RADIO NEWS including the variable expansion and variable selection of the expansion circuit, I felt that this unit could be well utilized with some sort of radio frequency tuner so that full range, high fidelity, broadcasts could be enjoyed. Not only was the impetus there for the all-enjoyment of such programs, but the recording of such programs from the air [Covered in an article by Oliver Read in this issue—Ed.] would also be made possible.

At first I was determined to use a simple t.r.f. radio receiver, but t.r.f.'s are notoriously broad in tuning and such broadness might result in cross-band interference where used in close proximity to two or more powerful broadcast stations.

After locking the field over, I finally picked the *Aladdin Permeability Tuner* with variable control as being the answer to the type of radio tuner which was required.

Tuning in this particular unit is of a unique and different type. It is accomplished by varying the inductances instead of the capacity in the tuned circuit by insertion of *Polyiron* cores within the respective fields. A novel and ingenious mechanical movement enables the receiver to be tuned in a conventional manner by rotation of a knob. The tubes used were a 6Q7 detector and a 6A8 i.f. input mixer. The circuit is quite conventional in every manner with the exception of the tuning unit itself, and the elimination of the i.f. stage.

Using a conventional 9" x 6" x 3" chassis, the unit was mounted through a hole cut in the top of the chassis dead center in the front. To the right of the tuning unit was mounted the gain control with the AC input line switch mounted on it, and to the left of the tuning control was mounted the change-over switch which would enable the tuner to be alternated with a phonograph pick-up input to the amplifier.

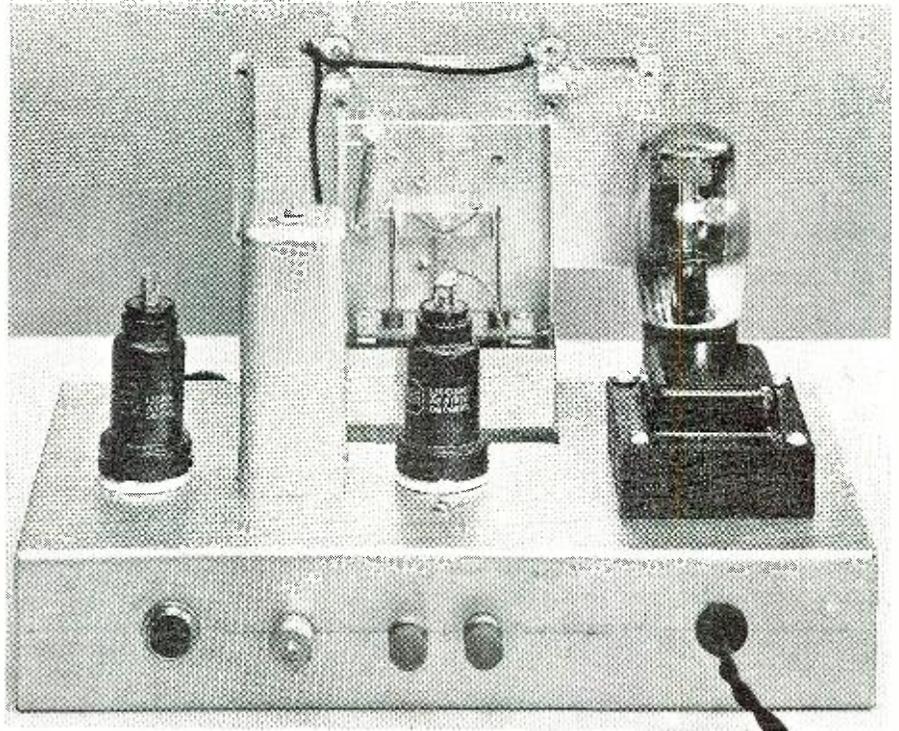
The power supply is taken care of by an 80 rectifier tube and a small power transformer. The i.f. tuner is mounted directly between the 6Q7 and 6A8 tubes while the power transformer is mounted on a line with these and to the extreme right of the chassis looking from the rear. The power tube itself is mounted directly in front of the power transformer. All other units are mounted and soldered di-

rectly under the chassis using the shortest possible leads.

The soldering of the connections is an extremely important matter in hooking up a tuner, and more than ordinary care was taken to see that each connection was completely soldered and that no "rosin-core" joints resulted. Condenser input was used in the power supply and a single filter took care of smoothing the power from the rectifier. A bleeder of 25000 ohms was placed across the power supply to provide for even voltage regulation.

Provision is made in the back of the chassis for a line cord which connects to the 110 volt a.c. cord, two binding posts to be connected, respectively, to antenna and ground, a phonograph pick-up input plug for the microphone, should one be desired with the amplifier, and an output plug from the tuner itself to the amplifier. By hooking the phonograph pick-up into the tuning chassis and using it and its change-over switch, the pick-up leads are thereby shortened, and the phonograph unit may be kept together with the tuner while the amplifier may be located in some remote portion of the room.

The connections are all conventional and fully explained in the diagram. Beyond the usual care in making the connections no trouble or difficulty was experienced. Once the tuner was fin-



Rear view of the RN tuner chassis showing the simplicity of construction. The tuner unit is commercial, and comes ready-to-wire-in.

ished, it is hooked to the amplifier from its proper output circuit and the amplifier and the tuner turned on, antenna and ground connection having been made.

Tuning to a program at the high frequency end of the band, the small padding condensers on the i.f. coil are varied until the signal comes in the loudest. Then the tuner is tuned to a signal on the low frequency end of the band and the procedure is repeated until both signals, the one on the high frequency end and the one on the low frequency end, come in as loud as possible. Under ordinary circumstances, the tuner is now tuned and ready for operation.

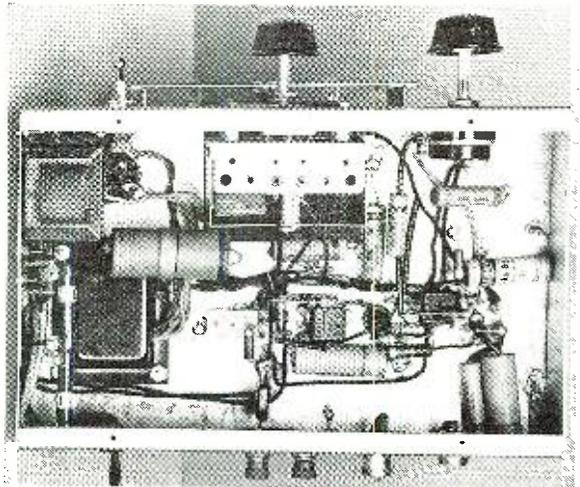
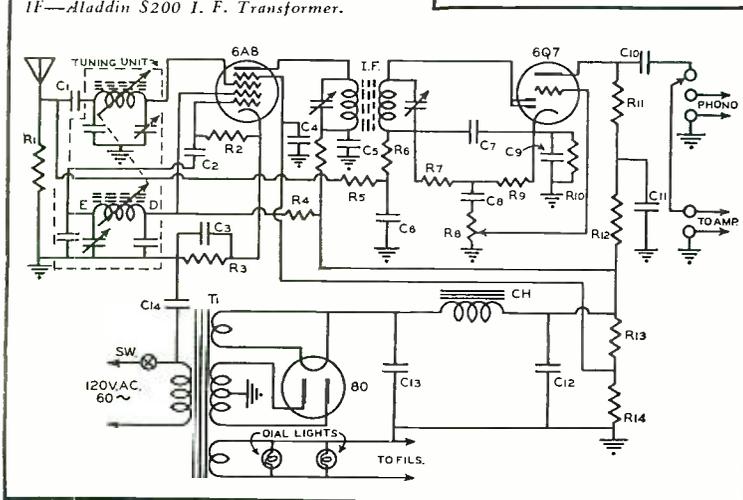
In using the tuner with the amplifier, it is best to allow the tuner to be used at the lowest possible volume range and to pick up the power in the amplifier itself. In other words, one

tunes the high fidelity radio tuner with as little volume as possible and at the same time one adds "expansion" and "gain" in the amplifier. If a suitable antenna is connected (and any piece of wire normally used for receiving may be used), and a small amount of "expansion" both in the treble and bass sections of the P. A. system, the resultant signal will far surpass the average broadcast receiver which one can buy in any store.

Especially this is true if a large, well-mounted speaker, such as is described in original issues of RADIO NEWS, is used. With expansion in the amplifier the radio tuner combination will enable the receiver to replace in the received signal so much of it as has been quashed or quenched at the broadcast station with the automatic modulation control generally in use

(Tune in on page 63, please)

- R₁—25,000 ohms, 1/2 w. Aerovox.
- R₂—50,000 ohms, 1/4 w. Aerovox.
- R₃—300 ohms, 1 w. Aerovox.
- R₄—20,000 ohms, 1 w. Aerovox.
- R₅—100,000 ohms, 1/2 w. Aerovox.
- R₆—100,000 ohms, 1/2 w. Aerovox.
- R₇—50,000 ohms, 1/2 w. Aerovox.
- R₈—500,000 ohms, Potentiometer, Yaxley.
- R₉—250,000 ohms, 1/2 w. Aerovox.
- R₁₀—2500 ohms, 1/2 w. Aerovox.
- R₁₁—250,000 ohms, 1/2 w. Aerovox.
- R₁₂—30,000 ohms, 1 w. Aerovox.
- R₁₃—15,000 ohms, 10 w. Ohmite.
- R₁₄—15,000 ohms, 10 w. Ohmite.
- C₁—.002 mf. mica Sprague.
- C₂—.0001 mf. mica Sprague.
- C₃—.05 mf. tubular Sprague.
- C₄—.1 mf. tubular Sprague.
- C₅—.05 mf. tubular Sprague.
- C₆—.05 mf. tubular Sprague.
- C₇—.0001 mf. mica Sprague.
- C₈—.02 mf. tubular Sprague.
- C₉—.20 mf. 25 v. electro. Sprague.
- C₁₀—.05 mf. tubular Sprague.
- C₁₁—.1 mf. tubular Sprague.
- C₁₂—C₁₃—8 mf. 450 v. electro. Sprague.
- C₁₄—.05 mf. tubular Sprague.
- Tuning unit—Aladdin 46-211.
- T—T13R19 Thordarson.
- CH—40 ma. 20 hy. filter choke.
- IF—Aladdin S200 I. F. Transformer.



Underside the tuner chassis.

Latest Revisions on the R. N. Full-Range Amplifier

VERY once in a while a new version of *conventional* equipment appears in print that intrigues the reader and causes him to investigate the possibilities thereof. Such has been the case after first presenting the RADIO NEWS FULL RANGE AMPLIFIER. So much interest has been shown in this unit that design was carried out long after a satisfactory degree of performance was attained. Musicians from all ranks have listened to its ability to discriminate between different audio ranges, and to expand these in the manner most pleasing to his own taste.

The first two models were most excellent from an audio viewpoint, but lacked a "certain something" as far as expansion was concerned. So we kept on making changes in the characteristics of expansion until we, and the musician, were completely satisfied from all angles of performance. Reference to the diagram will show how we have designed the expansion action to take place in *not one, but two separate channels*, after the tone equalizers are set to the desired audio response of the amplifier.

Following through the circuit, we

find that the signal appears at the input grid to the 1612 control tube. The gain of this tube is controlled by a variable bias in the cathode circuit. Part of this is set by the position of the slider on R19, and the rest by the rectified audio entering the 6H6 tube. So far we have a *conventional* audio expander. Now the signal feeds into the 6F8G discriminator tube with *all* of the audio frequencies present. They are fed in *parallel* to both grids, not in push-pull. The tone compensators are divided into two separate channels—the high-frequency, and the low-frequency.

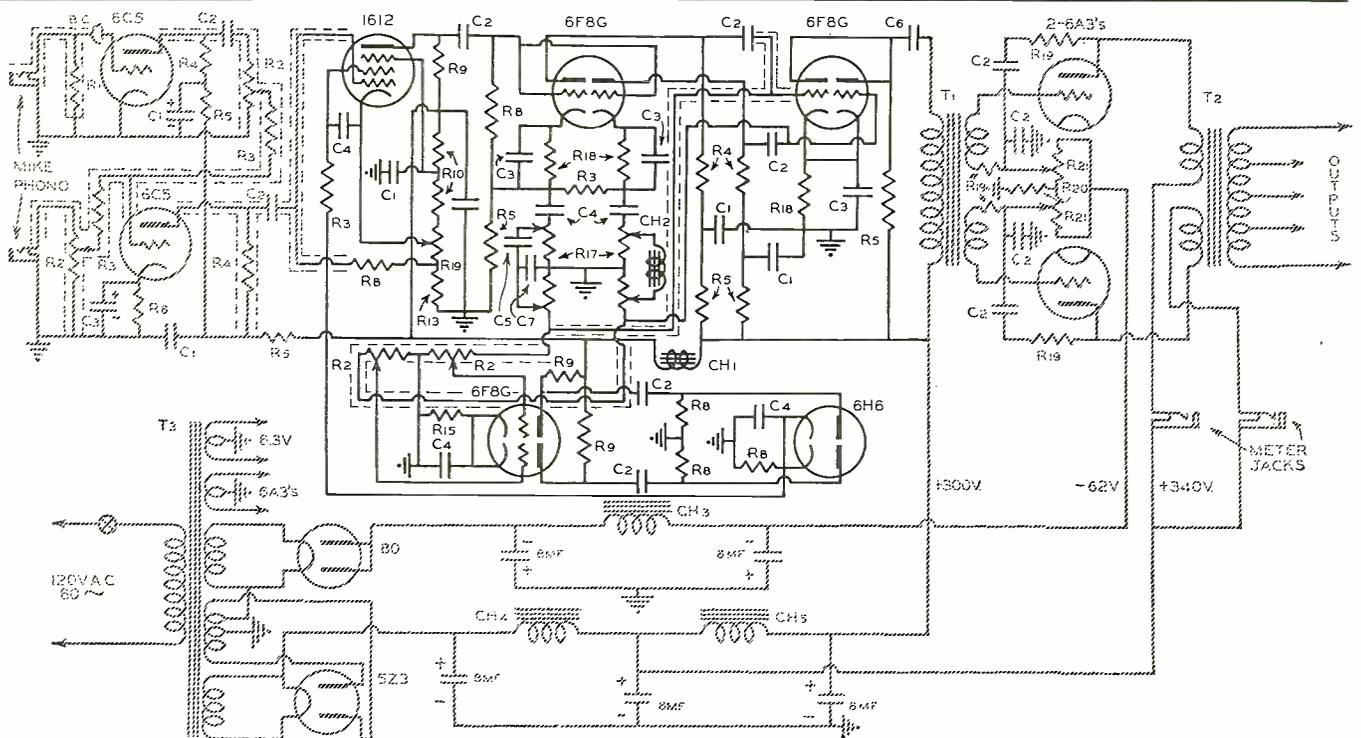
It is from this point on that the range is controlled for expansion. One channel, the high, is capable of either treble *boost* or *attenuation*, depending upon the setting of potentiometer R17. The bass, or low-frequency channel, does the same thing, but does this without affecting the response appearing in the "high" channel. Now we have audio available from *two channels* to work on, and it simply becomes a matter of applying these selected audio ranges, part to the driver tube and part to the 6F8G and 6H6 combination for automatic control of the entire amplifier.

The first models had the two channels from the discriminator tube appear at the 6F8G rectifier amplifier as two individual channels, but all this was not practical inasmuch as the two plates were connected in *parallel*. This was realized after a careful study had been made, and measurements taken to locate a peculiar form of audio distortion that was present in this stage. Connecting the circuit in *push-pull* right in to the 6H6 overcame this trouble and all distortion disappeared.

This means that the audio range that we have selected for each channel does not in any way become mixed with each other and thereby cause distortion, phase-shift, or unbalance. The output plates of the 6H6 rectifier connect in parallel, and as long as this rectified audio appears as dc., we are no longer concerned with distortion.

The net result of the above changes permits *any proportion of audio in either channel to be fed to the rectifier*. If an abundance of highs are fed to the 6H6, these will be passed on to the 1612 as bias control, with the result that expansion take place as the high notes come through. The bass will not be expanded, but will be pres-

(Concluded on page 61)

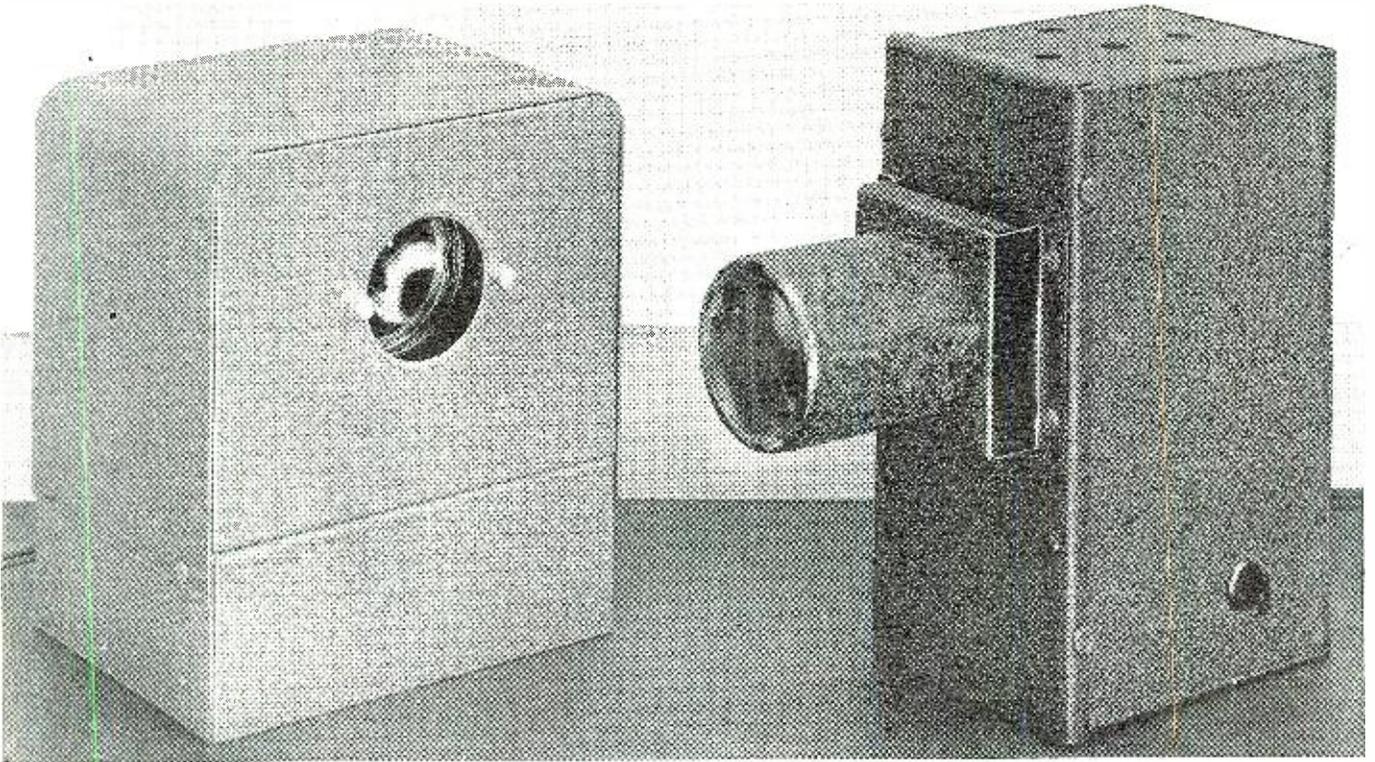


Circuit diagram of the final laboratory model. Only the solid part was changed from last month.

- R₁—5 megohms ½ w. Aerovox
- R₂—1 megohm pot. Centralab
- R₃—500,000 ohms, ½ w. Aerovox
- R₄—25,000 ohms, 1 w. Aerovox
- R₅—50,000 ohms, 1 w. Aerovox
- R₆—2,000 ohms, 1 w. Aerovox
- R₇—500,000 ohms, 1 w. Aerovox
- R₈—250,000 ohms, 1 w. Aerovox
- R₉—100,000 ohms, 1 w. Aerovox
- R₁₀—10,000 ohms, 1 w. Aerovox
- R₁₁—10,000 ohms, 1 w. Aerovox
- R₁₂—800 ohms, 1 w. Aerovox

- R₁₃—200 ohms, 1 w. Aerovox
- R₁₄—50,000 ohms, 1 w. Aerovox
- R₁₅—5,000 ohms, 1 w. Aerovox
- R₁₆—3,000 ohms, 1 w. Aerovox
- R₁₇—Dual 40 M-500 M. pot. Thordarson R1068
- R₁₈—500 ohms, 1 w. Aerovox
- R₁₉—1,500 ohms, 1 w. Aerovox
- R₂₀—5,000 ohms, 10 w. Ohmite
- R₂₁—3,500 ohms, 10 w. Ohmite
- C₁—8 mf. 450 v. Sprague
- C₂—1 mfd. 400 v. tubular Sprague
- C₃—10 mf. 25 v. electro. Sprague

- C₄—.5 mf. 400 v. tubular Sprague
- C₅—.03 mf. 200 v. tubular Sprague
- C₆—.25 mf. 600 v. tubular Sprague
- C₇—.01 mf. 200 v. tubular Sprague
- CH₁—Thordarson 67C46 choke
- CH₂—Thordarson 14C70 choke
- T₁—Thordarson T-90A04
- T₂—Thordarson T-90S13
- T₃—Thordarson T-15R05
- CH₃—Thordarson T-18C92
- CH₄—Thordarson T-15C54
- CH₅—Thordarson T-74C30



The unit on the right throws a beam of light into the photo cell on the left. By using the relay activated by the photo cell unit to cut the high voltage, the operator may so "safety" his transmitter as to save a life.

The Photo-Cell "Ham-Save."

by **ARTHUR EIDAM**

Chief Engineer Worner Products Corp., Chicago, Illinois

***Building an extremely easy photo cell device,
useful in protecting the ham from high power.***

WHEN photocell-relay devices are referred to in everyday terms, we immediately think of certain definite applications for the equipment such as, burglar alarms, door openers, counters, and signal devices. We overlook one of the most versatile uses for this electric servant—the protection of human life.

Past years have taken their death toll from the amateur ranks, due to electrocution, and in recent months, we have seen a decided trend to provide safety measures in amateur transmitting equipment. Many methods have been suggested and some of these adopted by many stations. The best methods still fail to give complete protection in some cases. Why not utilize a photocell operated relay and light source as a protection to the operator?

We have found this method most satisfactory, and complete protection is had on all types of equipment by locating the light beam so that it passes in front of the cabinet door or in any manner that will permit its interruption when the equipment is approached by the operator or visitor. Mirrors may be used in order that more surface be covered. These are placed in corners or on the walls so that a "criss-cross" pattern is formed by the light beam.

The relay contacts in the photocell

assembly are heavy enough to make-and-break the current drawn by the plate relay coil in practically any transmitter. If the light beam is interrupted by an object, the relay will open and the contacts open the series connection to the transmitter relay. The kit is supplied with all parts and tubes so that the builder may duplicate the excellent results that the unit is able to give.

To assemble the photocell life-saver the only tools needed are soldering iron, screwdriver, and cutters. First study the diagrams, figures No. 1 and No. 2, so as to become familiar with the component parts of the unit.

Using Fig. No. 1 as a guide, mount the parts in the following order:

1. Mount the sockets, being sure to have the terminals in the same position as shown.
2. Mount the two terminal strips, using self tapping screws.
3. Mount transformer, using machine screws and nuts.

4. Mount potentiometer.

5. Mount relay on top side of chassis using self tapping screw, lock washer and fiber washers to insulate relay frame from the chassis.

6. Insert rubber grommets in two holes in rear.

7. Insert line cord and tie a knot in cord to take strain if cord is pulled.

One wire of the line cord goes to terminal No. 2 on the 8 pin socket. The yellow wire from the transformer also goes to this terminal. The other wire of the line cord connects to the black wire on the transformer. Connect red-black wire from transformer to terminal No. 7 on 8 pin socket.

The red-white wire and the yellow wire on the transformer is grounded to the transformer frame. Solder a piece of bare wire from terminal No. 5 on 8 pin socket across to terminal No. 4 on 4 pin socket. Solder the pad with ground end on the No. 2 lug terminal strip and other end on bare wire connecting the two sockets. Run wire

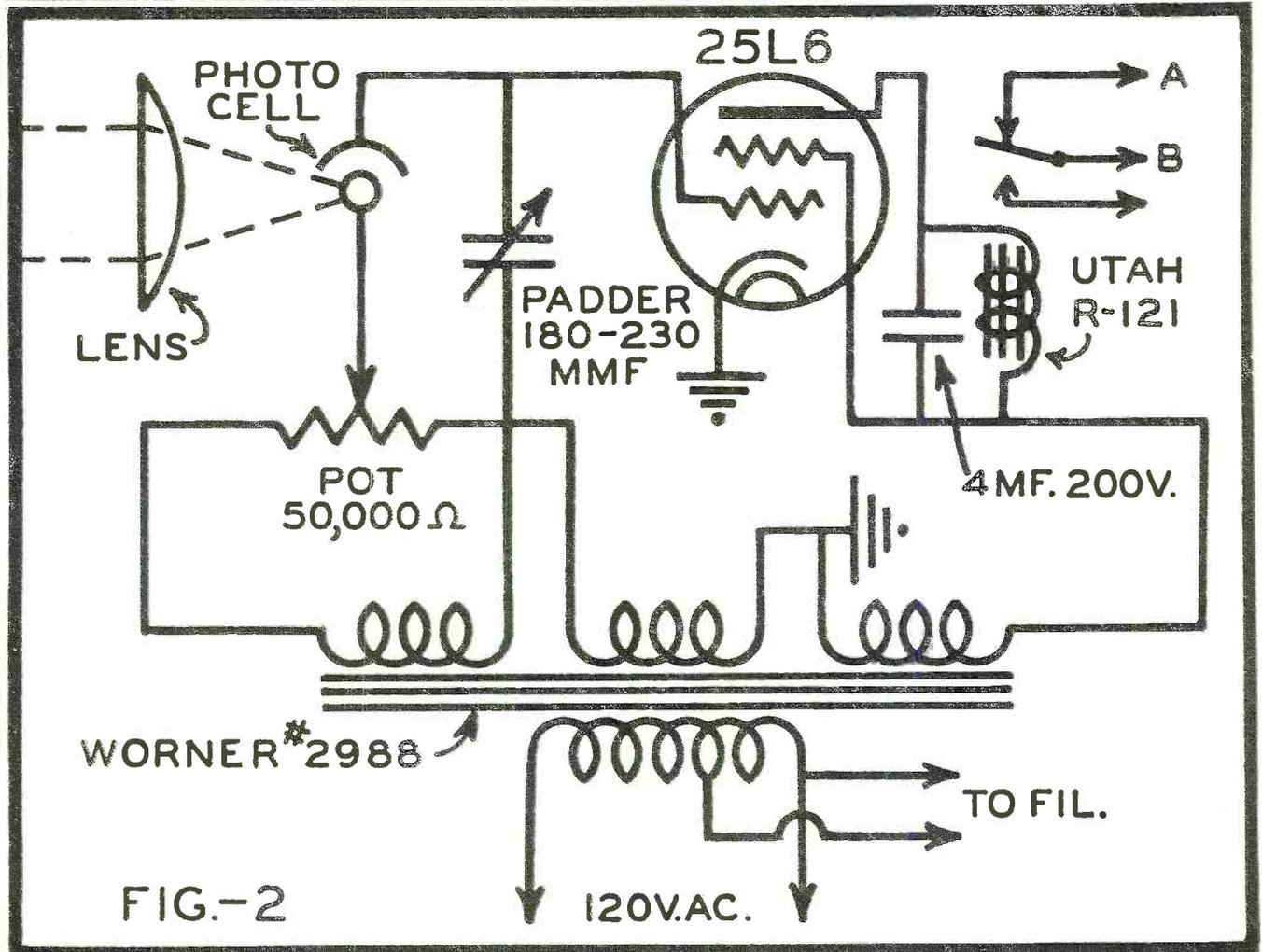
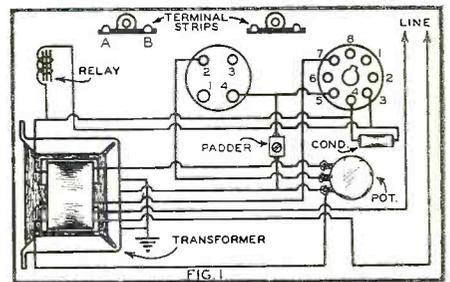
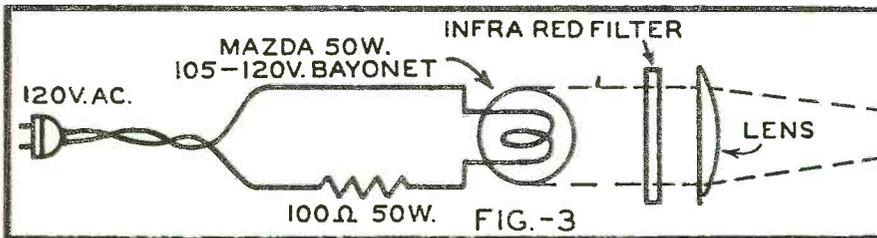


The "works" of the ham-saver photo-cell. The gadget next to the photo-cell tube is a sensitive relay which is the unit's heart.

from center terminal of potentiometer to No. 2 pin on 4 pin socket. Connect the red wire to terminal No. 4 on 8 pin socket. Connect both the brown and the green wires to one side of potentiometer as shown and continue on to the pad. Connect the blue wire to the other side of the potentiometer.

Connect the wires from the relay coil to terminals 3 and 4 on the 8 pin socket. Also connect 4 mfd. condenser to these same points, observing that the positive end goes to No. 4 pin. Run 1 wire from relay frame to the 2 lug terminal strip that is mounted underneath the relay. Connect either of the relay spring contacts to the other lug on the terminal strip. Note, you can operate as either a closed or open circuit relay depending upon which contact is used.

Testing and Adjusting for Operation
Place the 25L6G tube in the 8 pin
(Build further on page 63)



TECHNICAL BOOK & BULLETIN REVIEW

SERVICING by SIGNAL TRACING, written and published by John F. Rider, 404 Fourth Ave., New York City, is now available. During the past decade the technical problems of the radio serviceman have been increasing in direct ratio to the progress which has been made in receiver and tube design. It was with the primary idea of giving the service fraternity a technique that would be universal in application and as useful when applied to tomorrow's sets as to those of yesterday that we started laboratory research for a testing method that eventually developed into the one shown in this book.

It is essential that the serviceman who successfully employs this system be thoroughly familiar with the behavior of the signal from the instant it enters the antenna post of a set until it energizes the loudspeaker. He must know its characteristics at every point in every circuit, what part the different components play as the signal passes through them, what effect control voltages have on them and this is all explained in the first seven chapters.

The remaining chapters deal with the signal-tracing method of locating the defect that has caused the signal to depart from normal. Every step in the procedure is carefully explained. This book will answer all questions pertaining to this new means of radio servicing.

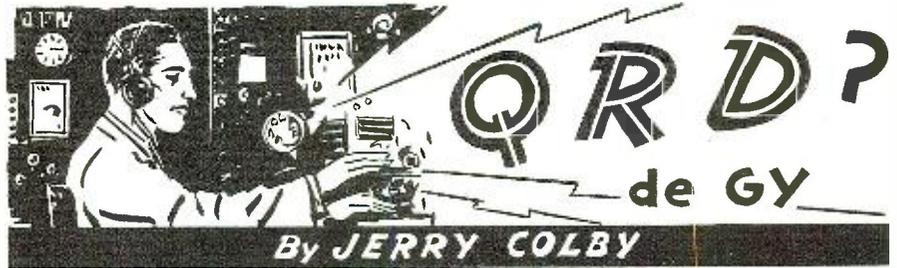
PRACTICAL DYNAMIC TESTING and **VISUAL ALIGNMENT**, by Arthur G. Mohaupt, B.A., M.S., is an excellent treatise on the fundamentals of Dynamic Testing with the oscilloscope. Dynamic testing is the process of analyzing a radio receiver and checking its performance while a suitable signal is sent through the successive stages as they come up for test and observation. That is, the receiver is checked under dynamic conditions while in action, rather than in a static state, under power but with no signal excitation.

The signal is traced from stage to stage until the indicator, a cathode ray oscilloscope, reveals either a complete absence of the signal, distortion in the form of a deformed signal wave, or some other adverse signal action. The defect in the receiver is thus isolated to a certain stage or circuit branch, and from this point on local tests in the form of point-to-point voltage and resistance measurements are made until the actual seat of the trouble is located.

Essentially dynamic testing is a modernized version of what formerly was known as stage-by-stage analysis, and has now become especially prominent on account of the more involved circuit systems that are employed in radio receivers and the elaborate test equipment that has been made available, particularly the oscilloscope by means of which the signal can be traced visually through a receiver.

Not only is dynamic testing a time-saving method of locating trouble in a failing radio receiver, but it also checks general performance as well.

-30-



THERE'S an old saying that the same old stuff in a new package can be easily sold. This was true when a radiop with a Norwegian accent suddenly bethought himself that the news published in this country of his native Norway was a trifle askew—cockeyed, to you. So he arranged a schedule with a Norwegian radiop and sold the resultant, direct, uncensored news to 34 Norwegian language papers published here, averaging better than \$100 per week. Foreign news correspondents would give their eyeteeth, we believe, to send their dope into the U.S. without first having it blue-penciled by some foreign official. If this wouldn't be breaking any international laws, couldn't some bright radio lad create himself a nice shore billet?

A CORRESPONDENT asks: "I have purchased a marine receiver—tuned rf. regenerative detector and pentode output. I would like to convert it to a.c. operation. This will not be difficult because the tubes used are 6C6, 6D6 and 43. The difficulty is that I have not been able to get a wiring diagram of the set. The manufacturer, Remler Company, Ltd., states that it will not be able to grant my request for a diagram. Can any one of the boys furnish me with a copy of the wiring diagram of this receiver? ... Tnx."

ANOTHER reader wants to know whether the Bill Hathaway recently reported shipping out to Norway is the same Hathaway who was reported shot in Spain. If same guy, was death greatly exaggerated? And reader queries whereabouts of said gentleman. Sure looks like the old streamlined bloodhounds are going to do yeoman work today!

BROTHER BOLVIN contributes this from the Great Lakes: "Ann Arbor has been having lil difficulty getting a relief op. Three in last six weeks . . . one was here three days breaking in and then snagged a job with Chicago and Southern Airlines. Second never even reached here . . . got a job with an ore boat day he was supposed to go to work here. Third stayed to break in . . . I left for a two week vacation during which time I took on an NYL . . . and while I was gone, he went on a three day toot. So now they have another young feller. Having a lil bit of tough time but think he will make the grade. By the way, under new agreement which this gang will offer the AARR for consideration, arrangements are being made to take care of the relief op with a guarantee of a decent minimum."

THE daily puzzle asks this question: "Why are the clocks in the KXN radio station, Hollywood outlet of CBS chain, always 15 minutes ahead of time?" Meaning, when a program signs off at supposedly 6 p.m., the clocks are pointing to 6:15.

Well, Mr. Kane, CBS Western Publicity Chief of the Chicago office wants me to solve this puzzle with the following statement. He said that the clocks are now right on the nose, but that a few days ago there was

some trouble with the mechanism, which has been repaired. It's little things like that that make big paragraphs like this.

CTU-Mardiv thru Brother Kleinkaus tells us that quote . . . We can report that we shall be very little affected by any change in the neutrality act as most of our ships ply to places removed from belligerent areas, and along the coast and intercoastal . . . We have also brought pressure to bear so that the African lines can continue to run, and also Eastern's service to Yarmouth. This solved our problems . . . There is an unmistakable pickup for the past few months in coastwise and intercoastal cargoes. A number of lines are putting tonnage in the far east services, while a few have started South American routes, all entirely new to them, and caused through restriction of their European services . . . We have closed 6 coastwise agreements after revising them with wage increases of from \$5 to \$15 per man . . . the highest wages ever paid in these lines. They include the *Bull*, *Baltimore Insular*, *Clyde*, *Eastern* and *Savannah* . . .

SOS . . . SOS . . . Quote . . . "After eight years of radio work, doing everything from servicing midgets and installing one KW Ham Xmtrs, I thought that I really had something when I passed the exam and got a ticket. Out of the 700 broadcasting stations in this country, I think that I have been refused a job by 699 of them. [Ed. note: *At least this lad was trying.*] The same old thing: 'Have you had any experience? If not, why not?' Howinell is a man to get experience if he can't get a job? The airports and the police produced the same results. There are many men now working in well paid billets who don't seem to know the score: yet they are drawing down their monthly stipend. Recently a certain police station radiop couldn't even tell me the freq of the rig. . . . Unlike the majority of radiops, I didn't start radio as a hobby. I started and fully intended it as a profession. . . . So what and what to do? Does anybody know the answer?"

[Ed. Note: *This is situation that has been prevailing for years and years, and yet nothing has been done about it by anyone. It seems to us that the Unions would make themselves just that more powerful and at the same time that much more well-loved if they were to take up this situation and do something. We think that the same situation which applies to the plumber's, bricklayer's and carpenter's Unions might be a guide. In these unions, the newcomer is forced to spend a year or more as a "helper" before he can get his "card." "Helpers" are "placed" by the Union in jobs to assist the regular Union man. Their salary is very small, but there is the chance of getting the experience. It's just an idea, but at least it is a step in the right direction. There will be a hoard of protest over this, but obviously, something must be done, not only to break the monopoly of the present gilded few who seem to get all the jobs by one means or another, but to encourage the youngsters to get into the field. While there may be many ops on the beach, there has always been room for a good man at the "top." As long as "experi-*

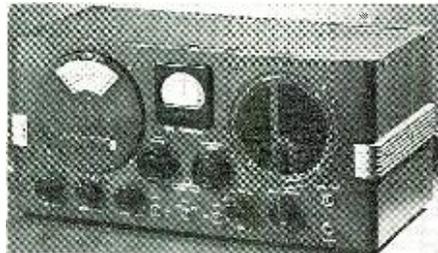
(More QRD? on page 64)

What's NEW in Radio

The Hallicrafters "Sky Champion" was introduced nearly two years ago.

Now they announce a new model of this receiver in which all of the old features have been retained and a number of new and important ones added. It is the opinion of the manufacturer that this new receiver "represents high value in the communications field."

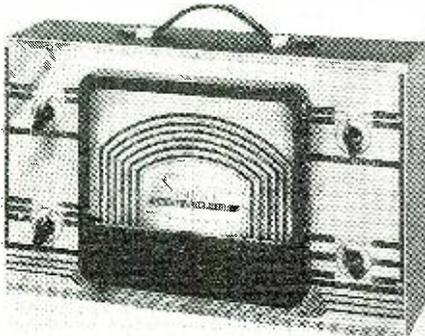
This new model provides continuous coverage of the range from 540 kc. to 44 mc. in four bands of: 540-1770 kc., 1.72-5.4 mc., 5.3-15.7 mc. and 15.2-44 mc. Thus it includes the full broadcast band, all ham bands from 10 to 160 meters inclusive, all short-wave international broadcast bands and



the ultra-high frequency television sound and high-fidelity broadcasters, not to mention the wide variety of commercial services falling within this wide coverage.

The newest types of tubes are well represented in its complement of nine. The tubes and functions of each are: 6SK7-r. f. amplifier; 6K8-first detector, mixer, high-frequency oscillator; 6SK7-first i. f. amplifier; 6SK7-second i. f. amplifier; 6SQ7-second detector, a. v. c. and first audio stage; 6F6G-audio output stage; 6H6-automatic noise limiter; 6J5GT-beat-frequency oscillator; 80-rectifier.

Simpson Electric Company, Chicago, announce a new signal generator having several outstanding features. The model 310 is designed for easy reading, greater accuracy, lasting accuracy, maximum stability, minimum leakage, and trouble-free performance. The circuit is of the electron-coupled type, which possesses a high degree of stability



under varying conditions. Three tubes are used in the circuit—full wave rectifier-modulator and oscillator. Standard 30% modulation is used.

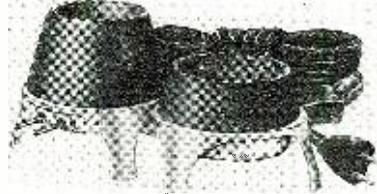
Shielding is most complete and has been carried out to afford complete protection to the instrument from stray pickup and similar conditions. Calibration is by ceramic type paddlers, carefully adjusted by means of quartz crystal oscillators. The overall size is 16"x10"x6" and weighs 15 lbs. Form No. 11939, available from the Simpson Electric Co., 5216 Kinzie St., Chicago, Ill., is available.

Two electrically heated solder pots for tinning small electric wires and leads have been developed by Lectrohm, Inc., 5133 West 25th Place, Cicero, Ill. They were designed for individual operator's use in services where only a pound or

less of solder need be melted as requirements demand.

The chief advantages claimed for these solder pots are the greater convenience they promote in tinning wires, and the savings they effect not only in a low initial cost but also in reduced solder bills.

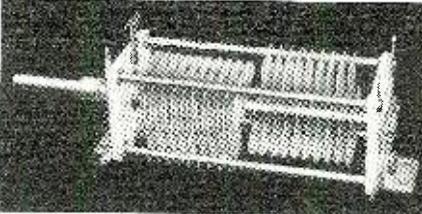
These pots are single heat units designed for



continuous operation. They may be plugged into any 110-volt a.c. or d.c. outlet. Each unit has a cast iron pot of 1 3/4" or 2 pound solder capacity mounted on a cadmium plated steel stand. The heating element is an inexpensive, quickly replaced Nichrome element. A 6-ft. approved cord and attachment plug is regularly supplied.

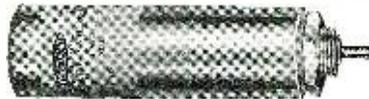
This new Hammarlund "HFB" condenser has Isolantite end plates which insulate the mounting feet. The danger of shock has been overcome by an insulated control shaft. In other words, the entire rotor assembly is electrically isolated.

Soldered brass plate construction is used in order to reduce series contact resistance. After assembly, the entire unit is cadmium plated to reduce corrosion and present a pleasing appearance. The result of the many improvements incorporated in the new Hammarlund "HFB" is a smaller, more efficient unit with higher effective voltage rating. The condenser illustrated is a



65 mmf. dual with .100" plate spacing. The overall length between Isolantite panels is 7 3/8" and the width and height are 1 3/16". The "HFB-65-F" can be used in circuits with 2,000 volts 100% plate modulated. Small physical size of the new "HFB" condenser fits right into the new mode of transmitter design. Its sturdy construction permits its use in mobile units with complete satisfaction. The opposed rotors and stators result in perfect balancing. Hand-fitted front bearing and single rear bearing offer perfectly smooth operation. Complete hardware is supplied with the unit for either panel or base mounting.

A new and improved method of sealing both dry-electrolytic and by-pass units is now employed on all Consolidated condensers according to a recent announcement made by Consolidated Wire & Associated Corps., 526 So. Peoria St., Chicago.



III. All Consolidated condensers are now end sealed with a specially developed material which the manufacturer states offers greater resistance to moisture and assures longer life, trouble-free performance of these units.

An "industrial stethoscope" for the use of acoustic engineers engaged in the diagnosis and checking of running machinery has been announced by Electrical Research Products, Inc. Just as a doctor listens to the heart beats of his patient and then charts his condition, so the Recording Frequency Analyzer (as the new device is called) discloses the "sound" condition of motors undergoing test, and records the results on a graph automatically.

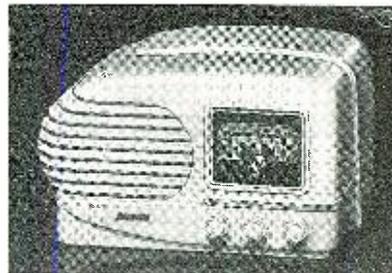
The equipment employs frequency analysis by the sweep method, using a small drive motor to actuate the frequency dial which sweeps the whole range of frequencies from 30 to 10,000 cycles per second. With this motor is synchronized another motor driving a band of graph paper on which a stylus traces the sound level at each frequency passed. Sharpness of frequency selection from the great variety of sound that the microphone picks up from a whirling machine is assured by the finest available crystal filters.

Thus the acoustic engineer has a completely plotted and permanent chart of the sound levels at various frequencies. Having tested both good

and defective machines in this manner, the engineer knows the eccentric sound peaks at certain frequencies which are symptoms of the defects most chronic to the type of machine tested. He may then recommend that the manufacturer install one of the recently announced Industrial Noise Analyzers (or electrical "tin ears") which, set to the particular frequency which betrays the defect, becomes a watch-dog against its recurrence.

The amazing advance in performance capability, and in the installation and operating simplicity of the modern a.c.-d.c. midget receiver, is strikingly exemplified in the brand-new Lafayette Model D-73 superheterodyne presented by Radio Wire Television Inc. (formerly Wholesale Radio Service Co.), 100 Sixth Avenue, New York City.

In this model the streamlined plastic cabinet in ivory or walnut, efficient dynamic loudspeaker driven by a "beam-power" output tube, and the built-in loop antenna all combine to provide both eye and ear appeal. Six tubes (6SA7GT,

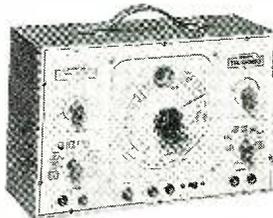


6SK7GT, 6P5GT, 6SQ7GT, 25L6GT and 25Z6GT rectifier) provide ample sensitivity and volume for excellent reception of standard broadcast stations with the built-in antenna, and terminals are provided for an external antenna for short-wave and distant reception. Other terminals provide for phono and television sound connections.

Tuning coverage is from 540 to 1650 kc. and 5.7 to 18 megacycles with both bands fully calibrated on the illuminated dial.

Tel-Ohmike, a compact new condenser and resistor analyzer just announced by the Sprague Products Company, North Adams, Mass., sets a new vogue in economical instrument design in that it permits the serviceman to utilize his own milliammeter and voltmeter.

Differing radically from conventional analyzers, Tel-Ohmike has a number of new features. According to the maker it includes the widest range of capacity and resistance available in any commercial analyzer; it measures the characteristics of condensers under exact working voltages;



has direct-reading scales which give quick, visual indication of all factors measured and permits direct measurement of insulation resistance up to 10,000 megohms of such components as Oil Condensers under high voltage up to 1,000 volts.

Tel-Ohmike also permits capacity measurements from .00010 mfd. to 2,000 mfd. and resistance measurements from 5 ohm to 5 megohms. Power factor of electrolytic condensers may be measured on direct-reading scales up to 50% power factor. Tel-Ohmike also measures leakage current of electrolytic condensers, using the serviceman's own milliammeter for which pin-jacks are provided.

Pin-jacks are also provided for connecting the serviceman's own voltmeter, to set the working voltage of the condenser under which all measurements are made. This is the first time this has been possible and means making tests under the exact working voltage of the condenser. Thus leakage current, insulation resistance, power factor and capacity are determined under actual working conditions.

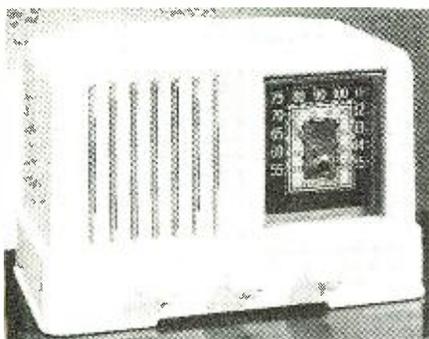
Eleven new a.c.-d.c. "Nipper" table model radios housed in smart plastic and wood cabinets, and arranged in four individually styled series, have been announced by RCA Victor as additions to the 1940 line. Each series is distinguished by separate cabinet, dial and knob design, and different chassis features. Suggested list prices range from \$9.95 to \$24.95, F.O.B. Camden, N. J.

Each series provides a selection of instruments in its price class. There is a "family" resemblance in all the models, although different styling is employed in each series. Unusual performance capabilities, built-in antennas and in-

proved electro-dynamic loudspeakers are features of all the instruments.

All eleven models have superheterodyne chassis, together with beam power output which provides undistorted tone quality remarkable for receivers of their size and price. Two identical plastic models are included in each series, one in brown mahogany finish, and the other in natural antique ivory (unpainted). Knobs match the plastic finish.

The lowest priced series includes two 5-tube plastic models of simple horizontal design, with new style features, including a three-color dial more than a third larger than on previous Nipper



receivers of this type. They have super-sensitive 4-inch electro-dynamic loudspeakers, efficient hank antennas (no ground connection required) and, like the other nine models, a back cover finished to match the cabinet. Each model is 5 inches high, 8½ inches wide and ¾ inches deep. Model shown is No. 46X12.

The new Amperite Kontax microphone, model KKH with hand volume control, is streamline in design and smooth in action.

Any number up to four can be paralleled into one input. The volume of each instrument can be varied without affecting the others. It is



easy to attach to any string instrument such as the violin, bull fiddle, guitar, piano—and can also be used with the harmonica or accordion.

It will give excellent results with any standard amplifier including the electric guitar amplifier.

RCA Mfg. Co., Harrison, N. J., has recently announced to equipment manufacturers a new series of 1.4-volt miniature tubes as follows: RCA-1R5 Pentagrid Converter, RCA-1S1 Power Amplifier Pentode, RCA-1S5 Diode-Pentode, RCA-1T4 Super-Control R-F Amplifier Pentode.

These new tubes provide a complete complement for the design of compact, light-weight, portable equipment. They are small in size (only about 2" in length by ¾" in diameter) and highly efficient in operation with 45-volt B



supply. The high operating efficiency of these new types has been attained by a new design which provides compactness without decreasing the size of essential electrode parts. Compactness has been achieved by replacing the conventional base with a new glass "button 7-pin" base sealed to the glass envelope and by mounting the electrodes directly on the glass button.

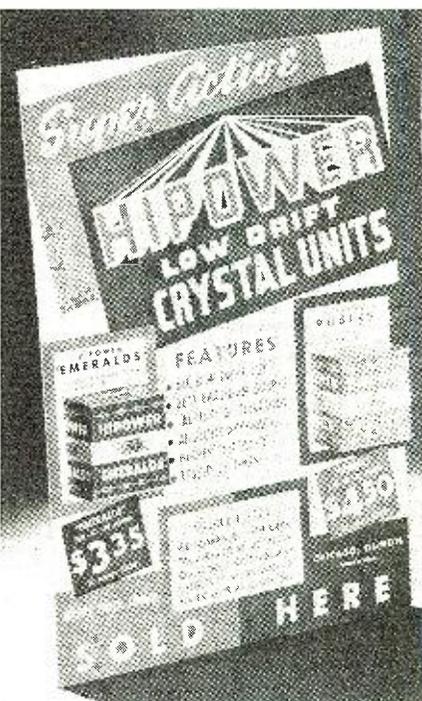
Any receiver, whether new or old, can now be arranged so that the moment it is plugged into an electric outlet it receives local and distant programs alike. Also, the set can be moved from room to room, after the manner of a portable set, which makes this new feature most attractive. The necessity of hooking up the receiver to external antenna and ground wires is now eliminated by the use of the new Power Antenna developed by Technical Appliance Corp., 17 E. 16th St., New York City.

Applicable to any set, the TACO Power Antenna, utilizes the electric wiring of the building and even the power lines beyond, for an efficient antenna. This does away with radio dead spots, where loop sets cannot give satisfactory results, without sacrificing the portable feature of the

small set. This antenna substitute is especially desirable in apartment houses where outside aerials are often prohibited. The Power Antenna is non-directional. It is small enough to mount inside the set cabinet. A red wire connects with antenna terminal of set, and a black wire connects with ground terminal or directly to chassis. Set line cord plugs into receptacle of Power Antenna, while plug of latter goes to usual electric outlet.

Hipower Crystal Company, Chicago, announces two new series of crystal units. Ground to fit amateur frequencies and priced to meet amateur requirements, these two series are known as "Rubies" and "Emeralds."

Hipower "Rubies" combine all the excellent features of commercial ground crystals, yet they are offered to the amateur at true amateur prices. Hipower "Rubies" boast a temperature coefficient of but 4 cycles or less per M C per °C. These crystal units are checked and calibrated at



least 22 times before shipping and are truly Super Active units.

Hipower "Emeralds" fill the amateur's need for true Low Drift Cut crystals at "X" Cut prices selling at \$3.35 each for the 160-80 and 40 meter bands and \$5.50 for the 20 meter band. Hipower "Emeralds," like Hipower "Rubies," are precision ground from best quality Brazilian Quartz. Temperature coefficient of but 10 cycles or less per M C per °C. All Hipower Crystal units are covered by an inviolate guarantee of satisfaction.

A new and compact design of "Ohiohm" ceramic-insulated wire-wound resistors is now being manufactured by The Ohio Carbon Company, 12508 Berea Road, Cleveland, Ohio, in addition to their line of carbon resistors. The wire-wound units are applicable to a wide range of uses such as original and replacement equipment for radio sets, broadcasting station apparatus, railroad block signaling systems and general industrial plant uses such as motor-starters and relays and on electronic safety and counting devices. Standard units are from 5 watts to 20 watts in a range of resistance values; all being guaranteed accurate to plus or minus 5%.

Compactness is obtained by the use of axial terminal wires instead of the usual projecting side-lugs; the elimination of the end-bands otherwise necessary thus permitting greater effective winding space for a given length of core. This core, of specially developed tough porcelain, has a large radiating surface on inside and outside. The terminal wires, of specially tough alloy and flared for easy soldering, are of "U" or hairpin shape and are passed through holes in the core so that the silver alloy joints between them and ends of the resistance wire are relieved from all strain. After winding, the wire (which has a very low resistance-temperature variation) is covered with a tough baked-on ceramic coating which resists heat, moisture and vibration.

An instrument which combines the functions of a tube tester, set tester and multi-meter, and which therefore constitutes the backbone of a shop's service equipment and a complete diagnostic meter for trouble shooting in the field, is the Model 801 offered by Radio City Products Co., Inc., 88 Park Place, New York City.

This model, with its power supply, is built into a carrying case 12"x12½"x6" with removable hinged cover. The heart of the instrument is a 4½" D'Arsonval, square-case meter with multiple scales in three colors. Indication of its quality is found in the use of a magnet of Alnico. Accuracy is 2%, voltage sensitivity 1000 ohms-per-volt. A unique feature is that a.c. voltages

are read on linear scales.

Tube tests include all tubes old and new at standard RMA voltages and loads and with filament or heater voltages available up to the full line value. Line voltage is controllable from 103 to 135 volts and provision is made for "hot" interelement short and leakage tests, testing individual sections of multi-purpose tubes, noise tests, etc.

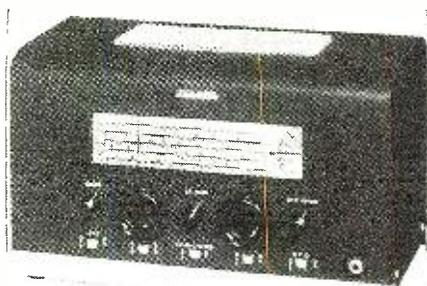
Meter ranges include: d.c. voltmeter, 0-10/50/500/1000; a.c. voltmeter, 0-10/50/500/1000;



d.c. milliammeter, 0-1/10/100/1000; d.c. ammeter, 0-10; ohmmeter, 0-500/5000/1 meg./10 megs.; db. meter, minus 8 to plus 15/15-20/20-40/32-55; output, same as a.c. volts.

This model is available in two types, one for 115 v. a.c. lines, the other for 220 v. a.c. Multitester Model 801 described in Catalog No. 121 free on application at the main office of the Radio City Products Co., Inc., 88 Park Place, New York City.

The new HOWARD 436 just announced is a seven tube amateur and commercial receiver. Frequency coverage 540 kc. to 43 mc. (355-7 meters). Also available for 150-400 kc. (750-



2000 meters). Features: noise limiter, inertia knobs, and new type electrical band spread with scale over eight inches in length.

A safe, convenient tester and polarity indicator for electrical and radio circuits from 80-v. to 550 v., a.c.-d.c., called "Safest" has just been introduced by M. M. Fleron & Son, Inc., of Trenton, N. J. This device is used for testing motors, fuses, spark plugs, as well as electrical and radio circuits. It makes obsolete the pigtail socket and lamp method of finding open or dead circuits. With "Safest" there is no need to change to higher voltage bulbs when testing up



to 550-Volts. The Neon indicator bulb is fully enclosed and protected with a Bakelite polystyrene housing, water-white in color... clearer than glass, and non-fragile. The test lead tips are fully insulated and the indicator bulb is protected against higher voltages with a special resistor. Boonton Molding Company molds the protective housing.

The Transformer Corporation of America announces the release of its latest contribution to the Institutional Sound System field—the CLEARION Model S-468 T All-Purpose School System.

Designed for program distribution and inter-communication in schools, hospitals, hotels and similar large buildings, the system serves twenty rooms, with provision for an additional twenty speakers if desired.

The unit comprises a High-Fidelity Super-Het Radio Tuner with both manual and automatic push-button tuning; Master Control Panel con-

taining a 2.5 watt amplifier; Speaker-Microphone, Intercommunication Amplifier; Input switching and Volume Level Meter; and Room Selector Panel for either 20 or 40 speakers to permit instant selection and distribution of programs to any room. Six inputs for Radio, Phono, Built-in



Microphone; Standard Microphone, Room Return and Reserve Input are provided.

Further information available by writing TRANSFORMER CORPORATION OF AMERICA, 69 Wooster Street, New York, N. Y.

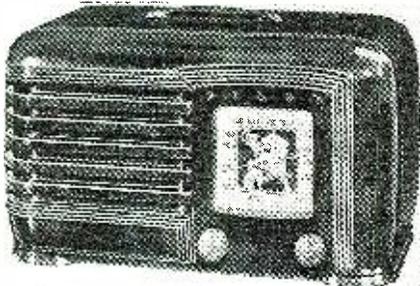
Two new auto radio cowl aerials, which greatly improve the performance of auto radio and make for a neater installation, have just been announced by Robert F. Herr, manager of parts and service division, Philco Radio & Television Corp.

These new Philco auto radio aerials are the standard 3-section cowl and the super de luxe 93" aerial.

In order to give them the appearance of being an integral part of the automobile, a newly-designed streamlined stranchion has been devised. The mounting is made of ceramic, a new departure in the manufacture of auto radio aerials, which insures complete susceptibility to moisture.

Pilot now announces the new Lone Ranger radio. It's not a toy, but a big, handsome, beautifully performing portable a.c.-d.c. set in walnut bakelite and ivory. The price is the lowest ever offered by Pilot, but you may be sure it's Pilot quality. It lists for \$19.95 in walnut, \$24.95 in ivory and is being offered to all Pilot dealers.

It features the famous Lone Ranger on his favorite mount. Silver, in beautiful colors illuminated on the dial. But it's a set that will attract adults and youngsters alike because of its



outstanding performance and quality of tone in the small-set field. It requires no aerial or ground.

It's a large handsome set, and it is a quality set from the standpoint of performance. The cabinet dimensions are 15" long, 8 3/4" high, 6 3/4" wide. Its attractive size makes it a definite factor in the "extra-set" field in addition to its exceptional Lone Ranger appeal to all youngsters.

The Lone Ranger set has the following specifications: Table model—5 tubes—1 band—super-heterodyne circuit—tuning range from 535-1650 kc—manual tuning—square dial—5" speaker—built-in antenna—automatic volume control—walnut bakelite or ivory cabinet—RMA guarantee.

A new "high" in utility and economy has been reached by Cornell-Dubilier in their BR series of tiny, tubular electrolytic capacitors. Only about one-fifth the size and weight of the older "can" type electrolytics for equivalent capacity and voltage ratings, these new units simplify set design and production by eliminating complicated mounting arrangements. They are likewise a boon to servicemen in that they cost less, permit more speedy replacement of older types, and are available in a wide variety of capacity and voltage ratings—from 4 to 40 mfd., 25 to 500 volts, working.

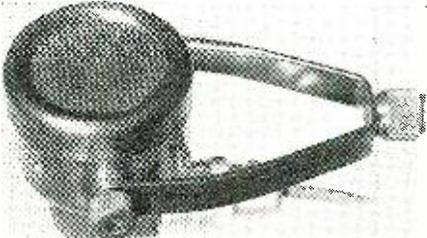
Each BR capacitor is hermetically sealed, in-

closed within an aluminum container over which is fitted a varnished cardboard sleeve. Bare wire leads are riveted to rubber-capped bakelite ends for complete security. In most applications the capacitors can be supported by their own



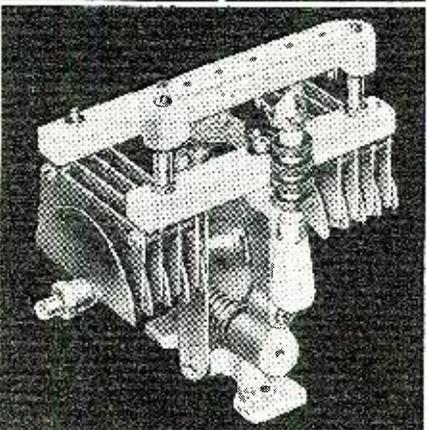
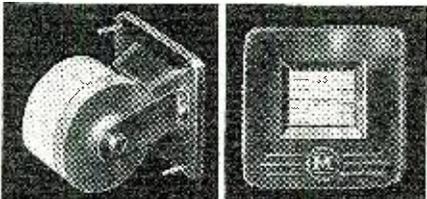
leads but where this is not desirable, as in some instances where the largest sizes are employed, they can be supplied with metal mounting straps for chassis mounting.

The Carrier Microphone Co., 15 East 26th St., New York, N. Y., announces their new model 702-D which, it is claimed, represents great advancement in microphone design. It is also said that never before has a microphone been presented which incorporates all of the features of the 702-D. Whether for close talking or distant pickup the 702-D retains its distinct natural



quality, free from sharp resonant peaks. Features include the new "Acoustic Equalizer," wide range performance, magnetic shielding, sealed construction, extreme ruggedness, response: Plus or Minus 2 db. 30 to 10,000 cycles. Output level 60 db. Additional technical data is available from the manufacturer whose address is given above.

Among the many new items shown in the James Millen catalog are the type 13035 variable condenser and the type 10001 drum dial. These two items go hand-in-hand to make an excellent combination tank tuning assembly. The right angle worm drive assembly as used on 11000 series condensers is also available for separate sale. Cast aluminum frame may be panel or base

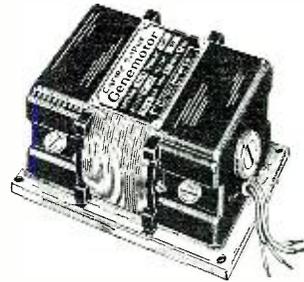


mounted, Ratio 16-1. Spring-loaded split gears eliminate backlash.

The small drum dial is designed to match in appearance the popular two and three-eighths inch type meters now used on many of the newer amateur gear. Illuminator comprises bayonet type socket and mounting clip complete with 6 volt bulb.

"A new Super Hi-Power Lightweight Generator for use on Aircraft, Marine, and Police Radio has just been announced by the Carter Motor Company of 1608 Milwaukee Avenue, Chicago, Illinois.

The exceptional Hi-Efficiency, small size, and light weight is due to a new type one piece field ring and armature design, eliminating many parts. This new one piece construction provides a more rigid and lighter weight Dynamotor. The



unit is built for long, hard use; it is provided with double sealed grease packed ball bearings that require no oiling or attention; double enamel and silk wire is used on the armature; end covers are removable in order that brushes and commutators may be easily inspected. Available in two sizes, 150 and 250 watts, output up to 1000 volts, input from 5.5 volts up. Weight of 150 watt size, only 13 1/2 lbs.

Hygrade Sylvania Corporation announces a utility shop coat for servicemen which is being offered at a price of \$1.95. It is made out of double strength, herringbone weave dungaree cloth, green and white mixed giving a tweed effect. Roomy pockets at arm's length provide for tools, pieces of wire, nuts, bolts and miscellaneous servicing knick knacks.

Of particular interest to servicemen who do a lot of auto radio work is the extra trouser



protection afforded by bringing the long coat tails around the legs, buttoning them on the front and producing a pants effect. Thus, when kneeling, stooping or when struggling under dashboards the coat serves where protection is needed. The garments are available in five popular sizes 36, 38, 40, 42 and 44.

The new Model 44X Crystal Microphone of The Turner Co., Cedar Rapids, Iowa, gives selective-directional pick-up of sound, and allows the operator to choose the sound he wishes to amplify. It has a 13-15DB differential between front and rear pick-up, so that the microphone may be considered dead at the back. This eliminates audience noises and background disturbances, and helps eliminate reflections, as well as reduces feedback problems. It allows microphone operation under bad acoustical conditions. The 44X has a 90 degree tilting head, for semi- and non-directional operation. The level is unusually high, —38DB with 25 foot lines. Fifty foot lines are possible without frequency discrimination, and with minimum loss of level. Response is exceptionally smooth, from 30-10,000 cycles. It is finished in full satin-chrome, and fits any 5/8-27 stand. Model 44X has a moisture-proofed crystal, automatic barometric compensator, and is free from blast, as well as mechanical shock proof.

Most of the worthwhile advances made recently in cathode-ray oscillography are incorporated in the new Type 175 oscillograph just introduced and described in literature available from Allen B. DuMont Labs., Inc., Passaic, N. J. This popular-priced instrument intended for laboratory, shop and field uses, combines convenient operation with remarkable flexibility, and opens up many applications heretofore barred to those unable to purchase the higher priced laboratory oscillographs.

The extended frequency response of the amplifiers incorporated in this instrument makes it

(Continued on page 65)

UR telephone rang one recent morning. It was CBS calling. "You've been asking when CBS would start sending out images," a voice said, "Hurry down! We're putting on a test pattern today."

So down we hied to the network's Madison Avenue building where a receiver was tuned to the video signal from the Chrysler Building transmitter. We found a small group of writers and CBS engineers huddled about a receiver all staring at the test pattern and the network's own photographer rigged up a trick tripod arrangement to photograph the still image on the receiver screen.

There wasn't much to see. The test pattern was the standard one we had seen in earlier transmissions. But we did gather reports from disinterested observers around New York that the CBS video signal packs a tremendous wallop and one television set-owner in Westchester County thought the signal strength indicated exceptional coverage when regular program service is started.

Test programs cannot be far off now. There really is every indication that a skeleton schedule will be on the air by the time these lines reach print. Columbia's video plans have been postponed so many times that guessing at a definite program date is no easy task. But it now seems that the early weeks of 1940 will see the sight- and-sound station getting a practical workout.

WHEN CBS launches a regular program service over W2XAX, a new and more sensitive type of icono-



TELEVISION TERMS MADE EASY!
"Vertical Polarization."

The VIDEO Reporter

by SAMUEL KAUFMAN

scope camera will be utilized. Details of the new picture pickup device were not available at the time this information reached us from a reliable Columbia spokesman. However, it is claimed that marked improvements will be noted.

Other Columbia television plans now include a mobile unit for the picking up of news and sports events. Not so long ago, the network wasn't so sure this would be essential, but it's likely that NBC's success with a television relay station-on-wheels proved that the idea is a "must" for every telecasting transmitter.

Inter-city television program tie-ins are also in CBS video plans, we were told. A network representative declared that an interchange is anticipated between W2XAX and a unit to be operated by WCAU, the chain's Philadelphia affiliate.

THERE is a tendency among television workers to compare present video images with old-time movies. How anyone could make that comparison we cannot understand, unless they've forgotten how poor the old-time movies really were.

Just to check up on what the movies of yesterday were like, we visited the Museum of Modern Art and viewed some of the films in its library. We saw Sarah Bernhardt and Lou Tellegen in *Camille* and Douglas Fairbanks in *Robin Hood*, among other films. And our conclusion is that television as it is today is not only *better* in quality than old-time movies but is almost as good as the films Hollywood is turning out this very season!

Mind you, however, *we are discussing image quality and not production*. Television cannot yet afford—and may never will—the "colossal, stupendous, gigantic" spectacles put out by the movie studios. But I've already seen some television productions which, despite technical handicaps, could give stellar Hollywood directors a

pointer or two on visual drama technique.

Of course, a big drawback is the small-size television screen. But the quality is there!

Television is not and we venture to add never will be the underdog insofar as the talkies are concerned. It is an independent medium and the aloofness of the talkies is caused by priority and not superiority. Give television time. It's the *Video Reporter's* guess that talkie producers will soon be looking for television affiliations on a mass scale.

WE think it's about time to add a few comments on NBC telecasts in recent weeks. This is the formative stage of the new art and the New York programs will have an effect on schedules of video stations in all parts of the country. Hence, the New York transmissions carry national significance.

Dramatic programs are good. Mystery plays have been particularly impressive and exceptional results were noted in operetta and musical comedy. Variety has sort of fallen off, probably due to lack for good iconoscope material.

Sports are the smash hits of W2XBS. Every assignment under this heading wins new recruits to the look-and-listening audience and dealers are cleverly using the prize-fights, football games and other scheduled athletic events as choice promotional and demonstration material.

News and special events usually score favorably but there aren't enough of them. This is largely due to the bulkiness of the mobile television unit. This program heading should come to the fore when NBC adds some new lightweight portable video pickup units at an early date.

Fashion shows and other attempts to show new apparel seem boring as television program fare. But maybe they don't seem that way to women! After all, television, like radio, must cater to all persons.

Educational programs seemed to lack a vital "something" to this viewer. An educational telecast can be entertaining as well as informative. Radio proved that with many outstanding series and television should do likewise. Actually, with the facility of providing a visual aid, television
(*More Video Reported on page 59*)

Ring the Bell

Keeping books of account, is this month's subject. It will be useful.

by **SAMUEL C. MILBOURNE**
Expert Serviceman, Greenwood, Miss.

THIS month we will start an explanation of a bookkeeping system for small radio service shops and radio dealers. You will notice that we did not say "a simple bookkeeping system," because there is none. However, the method we recommend is as easy to keep and will give you as much information as any

end of the day, the difference between the previous night's total and the present night's total is determined by a little lightning mental calculating and—*presto*—the sum represents the profit or the loss resulting from that day's business.

The "two-column note-book" system is a somewhat more refined but futile

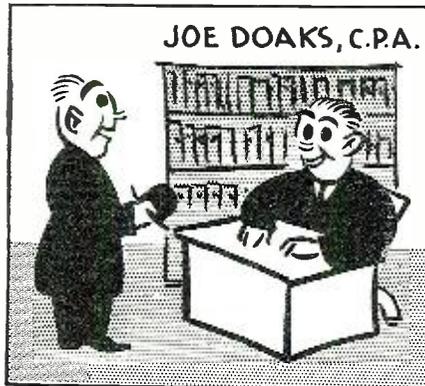
tools, books, etc., as well as the shop car (Equipment, Furniture and Fixtures), (5) notes which are payable on money previously borrowed (Notes Payable), (6) notes on money the business has loaned others (Notes Receivable), (7) Salary for you and any other serviceman you hire, (8) any sales tax, social-security or other pay-



Your account books are a history of your radio business down the years.

other system, whether "simple" or not. First, we want to "debunk" the "pants-pocket" and the "two-column note-book" system of keeping books.

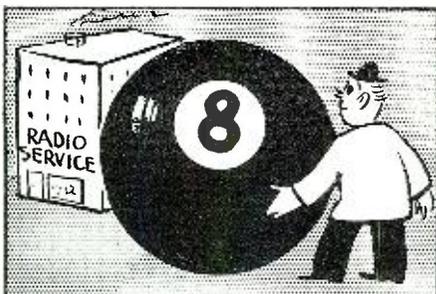
With the "pants-pocket" method, the usual procedure is to keep all the liquid funds of the shop in either the left or the right hand pocket (whichever hand is considered the most honest). All money received is dumped into the pocket. All money disbursed is paid out of the pocket. At the



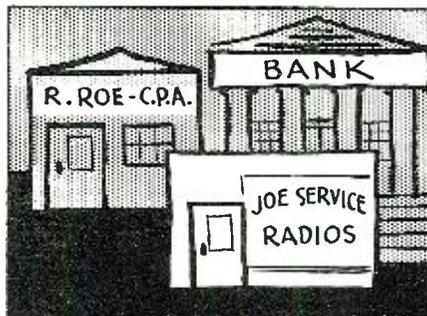
Consult a good Certified Public Accountant, and you have no worries.

attempt at keeping books. It operates on the "pants-pocket" depository system, but instead of mental calculations, everything coming in and going out is written down and a daily or weekly "profit and loss" statement prepared by subtracting the "In's" from the "Out's" or vice-versa, in the mistaken idea that this will give some idea of net worth or profit.

It seems unnecessary to point out that such matters as (1) bills owed others (Accounts Payable), (2) bills owed us by others (Accounts Receivable), (3) the value of salable items in our store (Inventory), (4) the true value of shop equipment, benches,



Without good account books you will find yourself behind the old 8-ball.



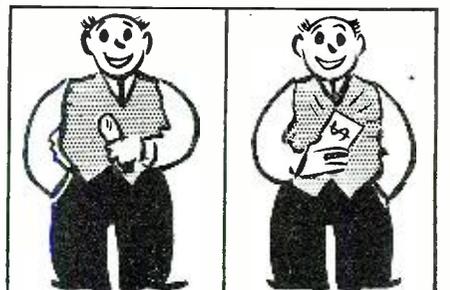
A service shop is only as strong as the bank and the C.P.A. behind it.



"Credit" is what is yours, while the "Debit" is what you must pay out to the other fellow. Get that straight!

ments you make to your local, state or national government, should be included in any honest attempt to keep books.

Now, you must make up your mind to the one fact that if you expect to get anywhere in business, *you must keep books*—and they must be kept



There is no advantage to the 2-pocket system of keeping your books.



Account books, well balanced, can be your means to conquer the world.

according to a standard system. Don't make the mistake so many servicemen make by saying, "I'm too small an operator to keep a set of books," "I haven't the time," "I can't afford it," etc.

There is no time like the present to start keeping books in a small way, paving the way for the day when, with increased business, you will find them an indispensable asset. *Bookkeeping records are the history of your business.* With them you can tell whether you are doing better or worse than you were a month or a year ago. You have a tangible record to show your banker, should you need financial assistance in your business (and who doesn't at times?) They furnish you with a set of *financial stop and go signals* so that you will not suddenly find yourself behind the financial "eight-ball" because you didn't know what was going on in your own business!

Next, after you have made up your mind to the facts that (1) you have hopes of enlarging your business in the future, and (2) you will start a bonafide set of books *now*, you should consult a *local accountant* to help you set up your books. Don't be cheap about this matter of bookkeeping. He won't charge you an exorbitant fee, and he will probably save you a good deal of worry and possibly some actual money if you take his advice. Also, don't get a cheap set of books! A satisfactory set to start will cost about \$10 to \$15 and they are well worth it! Remember that these books will be "pawed over" for the better part of

five years. Also remember that a good quality of paper will hold the ink better and, with care, will result in a fine looking set of books. After all, if you are going to do anything,

resolve to do it *right*—or not at all! In every line of work, the satisfaction comes from a *job well done*—and bookkeeping is no exception.

(Figure further on page 55)

Cash	Repair Sales
\$5.00	\$5.00

Fig. 3. Showing the proper entry for a cash sale and radio service.

Cash	Parts
\$3.00	\$3.00

Fig. 4. Showing the proper entry for a cash purchase of parts.

A Customer	Repair Sales
(1)\$6.00 (2)\$6.00	(1)\$6.00
CASH	
(2)\$6.00	

Fig. 5. Showing both phases of a Credit Sale. (1) shows the entry when the customer obtains repairs on credit. (2) shows the entry when the customer pays his bill.

A Supplier	Parts
(2)\$10.00 (1)\$10.00	(1)\$10.00
Cash	
(2)\$10.00	

Fig. 6. Showing both phases of a credit purchase. (1) shows the entry when you buy the parts on credit. (2) shows the entry when you pay your bill.

A Supplier	Parts
(2)\$5.00 (3)\$5.00	(1)\$10.00 (1)\$10.00
Cash	
(2)\$5.00 (3)\$5.00	

Fig. 7. In this case, the transaction is the same as Fig. 6, except that the amount due is shown in *two* payments. (1) shows the original entry. (2) show \$5.00 on account and (3) shows the account balanced.

A Serviceman's Pers. A/C	Cash A/C
1/5 —\$ 5.00 1/31—\$35.00	
1/10— 2.00	
1/15— 10.00	
2/1 — 18.00	

Fig. 13. Showing the operation of the "Personal" account. Each pair of entries are dated so that a clear understanding of these items can be obtained.

Cash	Parts	Transportation
\$7.54	\$7.40	\$0.14

Fig. 8. Shows the distribution of the money spent into two accounts, "Parts" and "Transportation." Note that the total of these two balance the credit "Cash" account entry.

Cash Acct.	Parts Acct.
\$7.54	\$3.40
Tube Acct.	Transportation Acct.
\$4.00	\$0.14

Fig. 9. Shows distribution of money spent into three accounts, "Parts," "Tubes" and "Transportation." Note once more that the total of the debit entries always equals the credit entry.

A Serviceman Pers. A/C	Cash
\$3.00	\$3.00

Fig. 10. When the serviceman-owner obtains money from the business for his own personal use, the entry is to debit his personal account and credit the cash account from which he obtained the money.

A Serviceman Pers. A/C	Parts
\$2.00	\$2.00

Fig. 11. When the serviceman-owner spends his personal money for parts he can *credit* his personal account with the amount and *charge* the parts account.

A Serviceman Pers. A/C	Labor A/C
\$35.00	\$35.00

Fig. 12. Showing the proper salary entry for the serviceman-owner's weekly salary. You will note that a "Labor" account is charged with the salary and his account is credited.

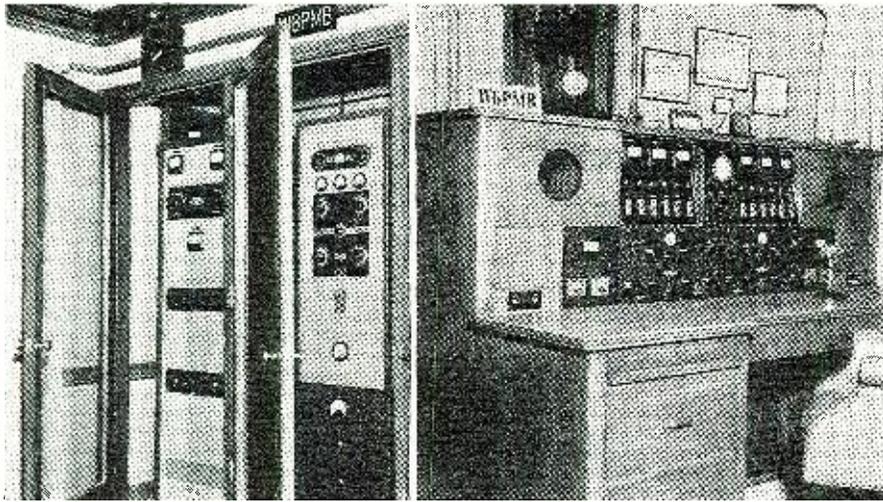
Dr.	Cr.
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Fig. 1. The basic form of a "T" account.

Cash Account	
In \$5.00	Out \$3.00

Fig. 2. The cash account showing a \$5.00 "In" entry and a \$3.00 "Out" entry.

Above are correct bookkeeping examples.



This extensive layout belongs to W6PMB.



A rare one, J5CC.

H A M C H A T T E R

HA VE YOU HAD YOUR IRONY TODAY??? whose sigs were QSA 5 R 9 in every state In the big city of ***** lived a ham of the Union and in some of the more distant parts of the World as well. He had a swell job in a newspaper office where he spent many hours over the typewriter pouring out sob stuff under the pen-name of "Soulful Suzy—Tell me your Love Troubles, etc." His pay was good, and his home life was graced with a beautiful XYL and two gorgeous junior ops. Things were indeed looking up.

Then it all happened. Came 77B and the paper folded and our ham was "at liberty" as they say in the trade. He couldn't get a job anywheres, and then his XYL took sick. He sold all his equipment using the do-re-me to pay doctor and hospital bills. His clothes wore out and he looked like a bum . . . and felt like one. But he didn't give in, he "kept pitching," turning his hand to this and that.

Finally he sold everything that could be used to raise money. . . . He even had the phone taken out. He was on his last legs.

Walking the streets one day he came across an old pal of his from his former newspaper days, drunk as a king and staggering around. It seems that the pal was to "cover" the local ham convention and had "gotten a few aboard" before going to the hotel where the shindig was to take place. Our down-&-outer offered to "cover" for the drunk and the drunk gave him a convention ticket and also paid him two bucks for the job. Our hero attended the convention and walked off with the first prize which was a \$275 ham receiver. The drunk for whom he was "covering" demanded the set, and since he couldn't get it willingly, he went to court about it.

The judge decided that the set belonged to the drunk and ordered it turned over to him. But during the trial the whole situation came out in the newspapers and one of the city editors gave him a job. Funny thing, too, it was the same paper on which the drunk had worked; and funnier, too, our hero got the drunk's job, because the editor figured that perhaps while our hero might be a drinking man, he might not be a too drinking one.

So now things are again looking up, and the XYL is well again, and our hero's sigs pound in QSA 5 R 9 in every state of our Union and in some of the more distant parts of the World as well. . . . Silly, ain't it?

THEN, of course, you have heard about the stupid ham who wanted to monitor his 'phone sigs and so he connected his receiver to the output of his transmitter and threw the switch. Well, after the fire-engines left, he suddenly realized that this was no way to hear yourself talk!

When you happen to see Rex (Taylor Tube) Munser, W9LIP, ask him to explain what is meant by "biased to twice out-off"! You'll simply be amazed. . . .

And ask Ollie (W9ETT) Read his explanation of "horizontal polarization"!

And ask Gene (W9FXK) Gleason how come his QSL's have no QRA on them. . . .

And ask W3FWU how it feels to monitor his own sigs for FCC violations and then report himself to himself if he's outta da band. . . .

W2JWX has changed his QTH from 676 Saratoga Avonius, Brooklyn, to 203 Heryll Street. He advises that he is building an HF100 final for 10, 20, 40 meter operation and a badly needed super is in production. He closes with, "73 to the OM's es 88 to the YL's." Hi! As don't we all?

Born to Mr. & Mrs. J. A. Wemer, W3CZN, an 8 lb. 3 oz. Jr. Op. W3CZN is instructor of two code classes, one in Camden and another at the Philadelphia Electric Co. He is also doing some checking up on bootleggers. W3CZN is Secretary of the Greater Camden Amateur Radio Ass'n.

W3DJR is busy at the Philadelphia Navy Yard. W3AYZ QSY to Philadelphia.

W6LYZ "Doc" QSY'd to Camden and is a member of the GARA.

W8OHT underwent an operation. Best of luck now, Harry.

FROM the 7th District, via W7FHC:

W7FXO, W7DAC, W7HLJ, W7TV, W7HIZ, W7HMS, W7PTF, W7FFW, W7FFX and W7FHC now belong to the Army Amateur 160 Meter Phone Net, Division W, which operated on 1945 kc.

W7HIG is getting a 160 doublet ready to go on the air.

W7FFW and his XYL, W7FFX, have a brand new station transmitter, receiver, frequency meter, modulation indicator, etc., and are going to give 10 a whirl.

W7FDL at Rosalia, Washington, is on 160 phone breakfast club just about every morning.

W7HPE is a new ham at Cody, Wyoming, using a vibrator power supply and cathode modulation, and has worked a California Station with only 17 watts.

W7AAT of Powell, Wyoming, is on 80 c. w. most of the time and 160 some.

W7GBY is on 20 phone and W7GFB is on 75 meter phone. W7DAJ is not on the air must on account of ECL troubles.

W7FTV has his own home now in Billings, Montana and is active on 160.

W7FHC of Luther, Montana, worked W9HZF of Natoma, Kansas, Thanksgiving morning (November 23) on 160, and signed off at 8:25 A.M. with the sun up on both ends. How is that?

R.N.'s Doughty Reporter, Keith C. Mathis, from Montezuma, Ga., scribbles in the following 4th District Ramblings:

The original menace to Amateur radio The Chicken Thief network is on the loose again in the mighty fourth district on 160. It seems that the only qualification one needs to have a helping in this net is to be a good provider of chickens by fair means or foul. Hi! ERS is chief rooster with the following stations: ERS, FCW, GFF, GHW, FCZ, FNY, EQB, DXW, FBM, FCD, and yours truly.

W4GHC formerly of Tennessee, is now at Seminole, Florida, near St. Petersburg. He says that Florida climate is great inducement to Amateur radio operative.

W4FDP is on 160 phone at Fairfield, Ala. Also operates on 40 c. w.

W4BKN formerly of Dinsmore, Florida, is now at St. Petersburg, Florida, and expects to be active there shortly. John says that South Florida is so fulla hams that you have to move them over so that you can go anywhere Hi. Trx Om fer Fb dope.

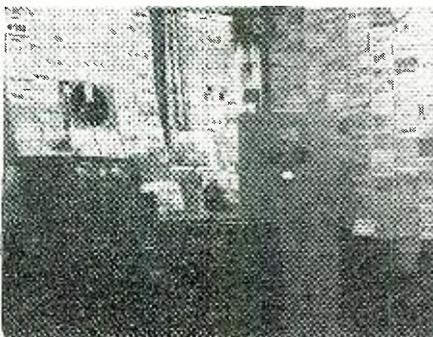
PM—you wuz turble wrong in your letter. We wuz in Dec. issue.

W4FVO of Cottonwood, Ala., says in case anybody misses them that he has left the south and gone to Gary, Ind., to finish his education and will have a new QTH there.

Knowles Roberts, W4GHK, at Savannah, Georgia, is now very active on 160 phone with a pair of 6 L 6's. His QTH by the way is: 1135 Park Ave., in the coast City.

W4FBZ at Washington, Georgia, is rebuilding and advises us that he will be very active shortly. Cicero is well known in the Fourth District.

Get Hot Willie (W4GHW) says that Damascus, Georgia, has been neglected in RN. Ok, Willie, here it is and we betcha that you being



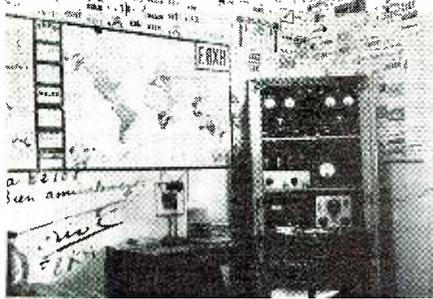
Hamstation W8HPZ.



G5FA's QTH during the present war.



Hamstation & op, TI2LC.



The well-known hamstation, F8XH.

a school teacher may be able to read this. They say up 100 watts percolates on 160 phone.

W4DXK, Savannah, Ga., says that fishing is very good over his way and invites the visiting fireman over any time. Hi!

We will swap our two-bit modulation meter for a view of Television.

W4CXD is on 160 phone at Greenville, S. C.

Another letter from Savannah tells us that W4GIA is active there on phone and c. w. Ditto W4GAP.

W4GTW is another new ham in Atlanta.

W4EZT portable at Gainesville, Florida, says that we have left him out also. O. K. Oh here it is and thanks for FB dope. He is another c. w. ham converted to phone operation.

Had a nice personal rag chew with W4DCC in Atlanta recently, discussing various matters pertaining to Hamming. He is still on 75 meter phone.

W4GDU and his XYL W4GOV are active in Montgomery, Ala., on 160 phone. Mattie Lu, the xyl, says that she can really keep up with the OM now.

We hereby give our Title of Winchell to the Guy who headed the Dec. issue of chatter. We can tattle but swear that we won't gossip so you can cheerfully have the title OM. (Who said u were a Winchell? Hi!)

Band conditions in our neck of the South at present are very good with only ten being erratic. 20, 40, and 80 are open all the time and even 160 meter stations are being heard through the day time.

All the following stations are in Atlanta, Georgia: W4ELR on 10, 20, 30 c. w., and phone wtd 100 watts to T40. W4FOB on same bands with 6L6's—and on 40 meter Ce. W4ELO, W4GBX, W4FJP, W4GAK, W4FXK. All are members of Atlanta Amateur Radio Club.

In Athens, Georgia, W4DYYK, W4AZK are on 20 and 40 c. w. W4DYX is building new kilowatt phone rig. W4AZK, an ole timer is on 10 and 20 meter phone. W4EEZ on phone. These fellows have a nice club going great guns in Athens, and are helping several prepare for licenses. Thanx gang for information.

W4FNL at Milledgeville, Georgia, says that he will be active on phone very shortly. Has been on 80 c. w.

The Cordele gang report a broadcast station on the way there.

W4EZU at Evans, Ga., says that YLS are more attractive than hamming is to him right now. Take our advice buddy—gi SLOW. Thers danger in those eyes Hi.

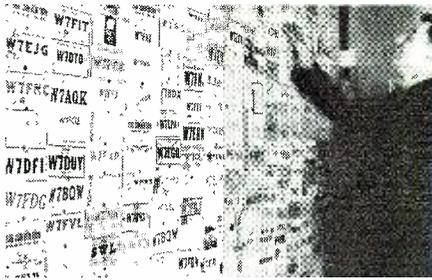
W4FJM, Panama City, Fla., is building new kilowatt fone rig according to W4EZY.

W4GJR wants to know if RN would print pic of his rig. We betch so OM send it in.

ONE of our contemporary magazines which features prominently the slogan "Safety for Hams," recently ran a short article on a tubeless



Old "Dog Eat Dog," W8DED.



An editor checks his QSL's. W7FDL.

modulation monitor. It was proposed that a certain amount of the modulation voltage be taken from the center tap of the final amplifier tube, dropped through a resistor and a condenser, through a transformer and then to a pair of earphones. We just thought it would be interesting to call attention to the circuit, that if the resistor should short out or the condenser should break down, or the windings of the small audio transformer they recommend should become shorted, that the operator who is monitoring his modulation will take the full final voltage across his headphones. It is hard to reconcile such a



"Say, Jeeves, the guy that gave me these plans must have been drunk (hic!) as a loon! (Hic!)"

circuit in a campaign for "Safety for Hams."

Don't forget the First Annual Chicago Area Amateur Radio Dance. With Pinky Aarsteth in charge of the music department and \$500.00 in door prizes being given away, we expect to see a large turn-out of hams and their YL's, XYL's and Sweethearts on February 3rd in the *Tabarin Room of the Sherman Hotel* in the city of Chicago. Let's get together, fellows, and make this First Annual Chicago Area Amateur Radio Dance the biggest thing in Chicago. Proceeds from the dance will go into the treasury of the Greater Chicago Area Amateur Radio Council for their very necessary and useful amateur work.

GENE GLEESON, doughty draughtsman of RADIO NEWS staff is now W9FXK. Gene boasts that he has a crystal and one headphone but no transmitter or receiver. All contributions will be gratefully received. Hi!

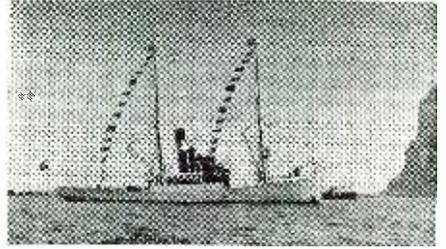
Things we didn't know 'til now: W9JU holds 1st Class Telephone and 1st Class Telegraph Commercial Operator's Licenses. Ray said the examinations were not too "hard for me." If anybody needs a good radio operator who wants to receive high pay with small hours, call Ray at Harrison 7300, Chicago.

W9ETI, Good "Ole" Technical Editor Read, is back on the air again with a vertical antenna and 500 watts of well-modulated signal in the 20 meter band. W9QEA, the Managing Ed, is working to get his rig back on the air again. What with Gene now being a licensed ham, one may expect that RADIO NEWS headquarters staff will be heard almost nightly on the air from their respective QRA's.

HOT tip! Something serious and sensational is brewing between three YL licensed hams on the East Coast!

Add Wonderful QRA's:—W2JND lives on Static Avenue in Syosset, L. I. Hi!

Soto roce Dept: What well known RI has degenerated to W9FWU? You're right, it's Mr. Gallaher of the Chicago R.I.'s office who recently broke down, took his ham exams and be-



OXVC in Gibraltar

lieve it or not, passed, and is now on the air on 40 Meters C. W. You 40 Meter hams had better watch out!

Under Cover Dept: What Plymouth or Ford Car, with Ham Coil letters on the back and a nice transmitting antenna installed is actually a police squad car operated legitimately by a cop. During his time off duty, said cop is a well-known ham.

W9CHD, whose picture graced the RADIO NEWS cover last December has recently purchased a bug key. Lenore told us that the caption on the front cover has caused her to receive an excessive amount of ham-fan mail. All had only one thought. They could not understand why Lenore would want to build herself an exciter when they were foot-loose, fancy-free, willing, and thought themselves so-o-o-o handsome. But Lenore knows,—don't you Lenore?

W4EFD, Montgomery, Ala., has had little trouble with rig but is again active. Thanks Ed for nice words about amateur activity in RN. We can't quit when we get encouragement like that.

W4KB at Valpariso, and everybody knows Jimmie, invited us to his 1940 hamfest long time in advance. Jimmie is on 75 and 160 (one as is ditto his XYL Myrtle. Jimmie as you fellows know has done his operating from Bod being crippled and is a prince of a fellow. Nice going fella.

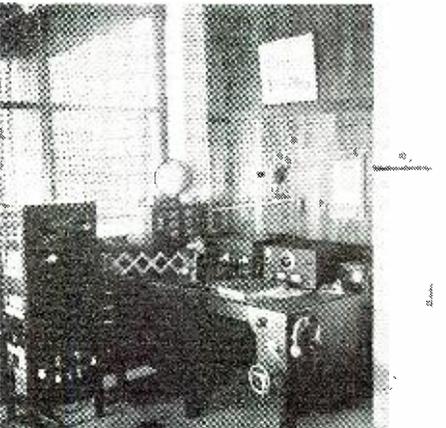
If PZ6ZK isn't a bootlegger he is entitled to the award for really putting Surinam on the air. (Quick, Henry, the Atlas) Pounding through in the DX contest with a note that varied between T9 and CX2AJF. PZ6ZK gave plenty of fellows a new country.

Another eye opener was VU2XX on 14380 T6. He said to QSL via W4KHE —we hope Stuart knows about it. In the morning LX1SS has been panicking the band. He is genuine and does QSL so there's a good reason for going after him. So many LX'S have turned out to be phooneys that LX1SS almost got treated like the Shepherd in Aesop's famous tale of the Sheep Herder who almost hollered wotie once too often.

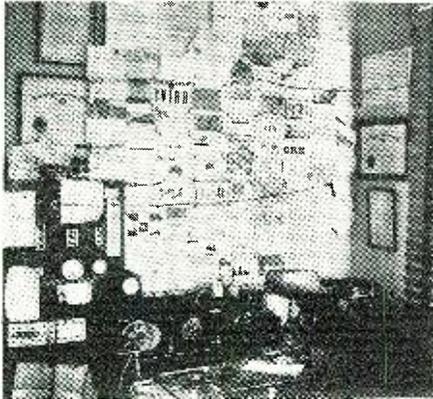
Some of the DX being heard on the bands K4KD; K4DTH; K4FCV; K4FKC; K5AA; K5AV; K5AZ; K6PAH; K6QYI; K6RWZ; K7BAQ; K7GOM; EA7AV; EA5A; U5AH; PY1LD; EK1AF; K4ILB; HA5T; PZ6ZK; LX1SS; J9CA; XU6W; XU6K; CT1OE; OQ5AM; KA1PO; FYSAD; J2NH; J3FZ; J3DF; J3EF; CP4CD; J2KN; KA1JK; KA1HR; HH2MC; LU6DR; LU2CW; P3CO; P37B; P3EE; P3EXX; CX2AJ; CX1GX; CX1BC; CE3AJ; CR6AI; CR7AF; J8PG.

FROM the mailbag: Writes W8QZV: "Writing this letter giving you the dope on the hams in and around NE Michigan. None of the Bay City, Michigan, fellows have ever been mentioned in Hamchatter column.

There are 14 hams in Bay City and all are active except one. Bay City is represented on



'Nuthur Maylayan, VS2AE.



SWL Lee Mead Williams, Balto., Md.

every band except 5 and other uhf frequencies.
 "WSAA first call in W8 district works plenty of dx on 14 mc. c. w.
 "W8ECZ, an old timer just got his ticket back after being off for 8 years and works all dx possible on 160 meter phone. He has a fine business transmitter running 400 watters.
 "W8TNN, active on 40 and 20 c. w. rebuilds a new piece of equipment each week.
 "W8SDA, a old timer, is qrt temporarily, while building a new house.
 "WSAA, W8TNN, W8SDA, are all operators at W8CGM.
 "The rest of the boys W8LAK, W8PXL, W8HCV, W8TK, are all active on sum band and are hard to keep track of.
 "And for myself, I work 14 mc. c. w., running 60 watts to a 807."

J. W. HUDSON, of Chattanooga, Tenn., busts right in with this cab-ute story on de war: For years Carroll Stegall longed for a radio transmitter in his mission field in the Belgian Congo.

Last spring his friends in Chattanooga and in other large cities of the south gave him one. Overjoyed, he received the gift on a visit here, took it back to Africa with him.

And now he can't use it.
 Mr. Stegall has fallen under the ban which the Belgian government has placed on all amateur radio transmission, according to a letter from him to Mr. W. C. Johnson of the laymen's club of the first Presbyterian church, who was the prime mover in the presentation of the gift to the Chattanooga missionary.

The ban fell, Mr. Johnson said, on Nov. 4th, just as Mr. Stegall and friends here were planning to have a radio chat across the 8,000 miles that lie between Chattanooga and Lubondai, Belgian Congo.

The ban on amateur radio transmission in Belgium and its possessions is one of the actions taken by the Belgian government to maintain its neutrality in the European war, it was said.

W9YTV left North Central, and is at Fort Sheridan as Op.

W9BYB is building a new rig for 10, es got married. Congrats, Doug!

Hrd on 160 'other nite? W9RHZ working a W3! Wat happened, Mark?

W9YXQ is planning to move to Naperville, es is on 160 fer a change.

Whose got dope on cathode modulation? W9EOT wants to know.

W9FDA is going to town on 40; once in a while on 160 fone. 6L6-T20 going up for W9EOT.

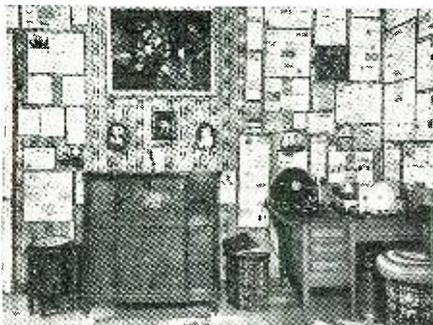
W9EJZ, new Ham in Aurora, thinks he'll get a new receiver in December.

W9ZSB is in Palatine, sometimes at W9Zhu's QTH.

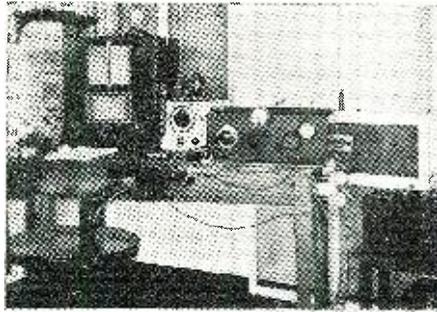
If W9EJC's modulator ever works for more than 15 min. at a time, he'll be on the air. Hi!

FROM Boston, "the home of the Bean and the Cod, where the Cabot's only talk to the Lodge's, and the Lodge's only to God," Harold W1JOM Miller puts forth the following:

W1CIB is having BCL trouble even after changing from his vertical "y" to a beam. He's



SWL station HB9RBX, Switzerland.



Malayan hamstation VS2AL.

dreaming about a place in the woods, far away from BCL's where all he would have to do is cut off the top of a tree and put up an antenna. He worked K6MUV for his 1st K.

1AFZ is looking for a new receiver.
 1DBE has dropped out of radio. He says he lost all interest. I think I've heard that one before.

1CZV is building some portable equipment for his new boat. He calls it a yacht!!
 1DNL has been trying out a *Meissner Signal Shifter* and has decided to get the *deluxe model*. He says its the "nuts" and it goes swell with his 30 watts. (He's the fellow that works the ZS's when the KW's are having a tough time.)
 1JTG is building a new 6 element rotary, to go with his new 500 watt outfit.

All the boys in Boston are wishing that the old five meter band regulations could be repealed. As one of the boys put it "they repealed the 18th amendment, didn't they?" Since the new regulations went into effect, activity has been at a standstill. We'd like to hear what the fellows in other parts of the country think of the idea.

[Ed. Note: *If the reason that you-all want the 50 mc. regs. changed is to use self-excited modulators or to get away from xtal control, you're just wasting yer time. Had a conference with the local R. I. and that worthy says that there is nothing in the regs making the use of xtal control or an MOPA mandatory. U can modulate in the antenna lead if you wantta, BUT (and it's a BIG but) you must NOT have any freq. modulation. So go ahead with the modulated oscillators, but see that they are so adjusted that the sig stays in any superhet receiver. There's no charge for this dope which is the real McCoy.*]

1AK has put up his new 60 ft. steel mast and is building a 3 el to put on top of the mast.
 1AFV has an HT-1 and is looking for some good antenna dope.

1SS is very active on 2 1/2 and is working out fine, but he has no luck on ten.

The local ten meter gang have organized a "windbag" net. The main purpose being to bring together the fellows to help pass away the long winter evenings. In order to stimulate activity there is a prize to be awarded to the station that works and verifies the most states and U. S. possessions, to date 1GOU is ahead. At the last meeting of the net 16 stations participated.

1GEJ acted as net control and 1GOU was alternate control. The meeting went over without a flaw, and a fine time was had by all.

1JGN the "Mighty Mariner" has recently returned on the air after being off for about eight months. He has changed his QTH and also now holds a higher office at the *Boston Elevated Inc.* (Keep up the good work Tommy, and get on the air more often.)

Sorry to hear that 1JJS at Rockland has been layed up with a paralysis. Hurry up and get better Harry, we're all pulling for you!

1GOU recently worked a submarine on the Pacific coast. The station said he was sixty feet under the ocean, and was using 700 watts to 3 element rotary antenna. (Believe that one or not, but Ernie is patiently awaiting a QSL which the marine station offered) Ernie runs 80 watts to vertical "y" and an HQ-120X and has worked practically any DX station on ten that you can name.

1HXK has a new portable mobile unit which he is using in his 1940 Ford.
 1RD is a new ham on ten.

1WV, the "G" man has one of those new Mims 10 and 20 beams, and wonders how he ever got along without it before. (Miles is a member of the *Century Club* and has worked over a thousand G's.)

1FH also using a new Mims on 20 meters can work as much DX on his harmonic on 10 as he can on 20. Charlie has a swell signal and has over 124 countries to his credit.

1AJA and 1DNL better known as the "photography twins" have given up pictures and are in ham radio again, they sold all their equipment and are building a KW. They say it uses less power than a 100 watt outfit in the long run. (??) It was only last year when they left radio for good. Hi-hi.

If you want to hear some stories about the navy, get ahold of 1LXR, and ask him to tell you about the time that he was on watch and stopped the captain and his wife. On Bill's first day on water he was sent up to the "crow's nest," he tells, and was to report any thing that he saw. The first thing Bill saw was smoke and in a proud voice yelled "Smoke!" Bill spent the rest of the voyage in the brig. Hi! hi! Bill has an *Harvey* rig and works on 10



Beth Rosenberg, YL op of W8NCJ.

and 160. [You couldn't mean Ole, "one sissie?" Ed.]

1LEU is waiting for his new kw *Collins* outfit to come through. Pete is now using a 1/2 kw rig at present (*Collins*). He hopes to get the rig by Christmas to use with the rotary that is laying idle in the cellar.

1MGQ located in Medford is a new ham on ten.

6NWP is back in town. He is attending *Harvard Business School* which is occupying most of his time.

1DRL has a new and first harmonic. (Congratulations Woody and Lillian.) Woody is already teaching him to call "CQ DX."

Sorry to hear that W1CLE is selling out. Hope to see you on the bands soon.

1KZD decided to try out 20 meter phone, after three days absence he turned up on ten again and said that the automobile QRN sounded like music compared to the Qrm on 20. Pat has been experimenting with cathode modulation and is getting some fine results, even with about a 4300-ohm mis-match!

When over five meters is mentioned around, you can usually expect a tear or two to be shed while discussing "The good old days." Herbie, 1GEJ one of the five meter pioneers was overheard the other night saying that if the Indians ever gave the band back he'd never squawk about the radiating receivers. We share the same feelings Herb, as many others do.

1LPX is attending *M.I.T.* Cy received the Hayden scholarship. Good luck Cy! He operates on 40 and 80 using a 2A5 e.c.o., into a 6L6 and is having a lot of fun.

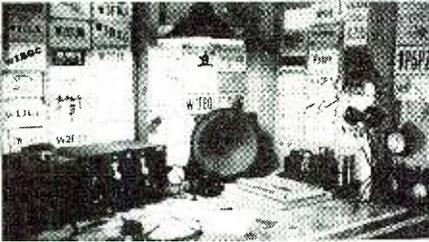
Paul Bour, F8SAB, the internationally famous DX'er from Tananive, Madagascar, went on an expedition some time ago. The expedition ran into trouble, but by means of F8SAB operating portable, help was obtained. Their weak SOS, relayed by means of a W7 to the French consulate, brought a vessel to their aid. Fortunately none of the expedition's personnel were injured, but F8SAB's equipment was entirely destroyed by moisture. Paul sent seventy-five dollars to a prominent eighth district DX man for replacements. It's time for the second SOS. The "eight" must have figured he (the "eight") needed the stuff or the money more than Paul, because F8SAB has heard nothing further about his equipment. It's bad enough that war has put so many of our brethren off the air, now this guy has to lend 'em a hand. [Quick, Henry, the flit.] So writes W2IOP.

[Ed. Note: *If W2IOP will have F8SAB substantiate the whole story above in affidavit form, properly consulted. RADIO NEWS will undertake to call the situation to the attention of the proper authorities in the location where the "eight" has his QRA.*]

It seems to us, that in this Land of the Free, that you can't be too free with other persons money and get away with it.]



SWL Ingvar Gullberg of Sweden.



SWL J. W. Huson, Cristobal, C. Z.

From the Ham-Mags

HAMGAB (Chicago).

THINGS AND STUFF

W9CQV has a new three element verticle beam on five meters.

Uncle Zeke, W9ZKQ, isn't growing old, he uses that cane as a safety measure while tuning the old beam.

Among recent new members of the club are: Walter J. Balcom, W9MFP; Rutland W. Barber, W9EZF; William Biese; Romo S. Douglas, W9HXS; and L. G. Morey, W9KBO.

As per forecast in the November issue, W9TLB again got his man.

XUCMC and KA1ER are two nice pieces of DX that have been pounding through on 10 meters.

Don't forget the Big Open House meeting of the HAMFESTERS in February, 1940. Rumor has it that there will be free dancing and everything. W9ZYL is the Chairman in charge of details.

W9SXZ has, from all appearances, been doing a little much needed carpenter work on the rear window of his trusty (?) puddle jumper.

The new QTH of W9ORH is 9034 Commercial. He was a visitor at the last meeting.

W9KBO has promised that the club would have a new eraser for its black-board before the next meeting rolls around.

W7HUV ex W0RKH seems to have a mania for collecting calls. Every time he goes west he comes back with a new W7 call and we understand that if the YL's would leave him alone that he would get a rig on the air.

W9DZY has been transferred to Rockford, and expects to again be transferred, this time to Milwaukee. He is with the CAA. Bet we will see him at the QSO party next May.

W9ENX is rather chesty after working W3GNI and W4EWP with his 50 watts on 160.

W9JOO is said to be in the market for a dog team. Seems to us that he takes these winter field days too darn serious.

W9IMB is now modulating on 20 meters.

Davey Day, W9TIC, now spends his extra checkles collecting rare coins.

Bill Ward, W9TLB, Membership Chairman, sat beside W9OVJ at the November 3rd meeting, and now W9OVJ is a member of the Hamfeters Radio Club. Seems that Bill just never fails.

Ralph Dickson, W9GJO, is recovering from his recent auto smash-up. Ralph sez it takes more than five fractures to kill a good ham.

W9LWZ is back on 160 with cathode modulation. His daughter, Dorothy, is attending Radio Classes at Englishwood High, and has a lot in common with W9UZK.

W9MFL's YF finally let him come to club. How about some of you other newbies speaking up for your rights?

W9JU is listening to your sigs through a new SX-24.

W9WJU, Old Doc, is having the time of his life making new friends on 160. Doc has just designed a new ECO and can be heard most any nite on most any freq.

W9KP reports that there is plenty of interest being shown in the new system of cathode modulation, and that he is rebuilding his entire rig. We thought it was about tops the way it was, Nick.

W9UEJ, Harry Vogel, is off the air because of a little trip to the Roseland Community Hospital for an operation.



SWL Station Alfred G. King, NYC.

One leg of the tower supporting the beam of W9PEQ collapsed when an attempt was made to take it down. Result—one Bassett beam in the junk pile, and another Ham that should count to ten twice.

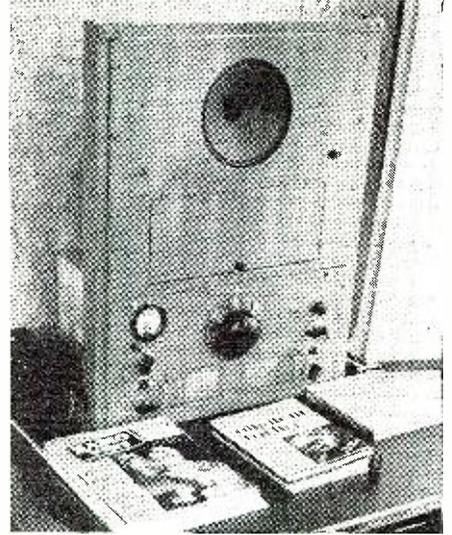
Once upon a time a key-hole snooper, by the name of Dot, sent some stuff in for this column, and Ye Editors certainly wish that W9FDW would see that she does it again.

The new piece of man-made static at the N9IMV's is a girl.

W9HNO sez that the BCL's and YL's just won't let him have a minute's peace.

W9CML is on ten meters and is interested in antennas.

Several members that have been losing sleep worrying about the YL that W9DBE has been escorting around can cease to worry. It's his sister, Gladys.



SWL YL Jane Guertin, Needham, Mass.

Safety Advice; per W1HXE. Keep your eyes wide open. When you have thrown the main AC switch; For your hands and your pet Xmitter. When they meet, Flash-Crack. Darkness black as pitch.

Joe, W1KMY, is resigning as Emergency Coordinator for Lowell and vicinity—leaving position open for a good active ham in that vicinity. He must be level headed and live wire. No shirk wanted, as E.C. he must have his town all lined up when the emergency arises.

Ed, W1JED, has his eyes glued to Radio Mag, on this new system of cathode modulation. He is due to break out again soon.

Talking of QSL's, your club gossip has a record (he thinks). He has 9 qsl's from SWL's who have actually copied him on CW, now he wants to know if any of the gang can beat that record. Qsl's from SWL's on any CW bans! It proves we must be careful on our code language also.

Archie, W1JNU, officially appointed ARRL code practice station on 160 meters. His frequency is 1978 Kc. Time—6.00 to 7.00 P.M. Nights—Monday, Tuesday, Thursday and Friday.

Dick, W1FCU is back in Florida. He has terminated his engineer connection with WLAW, and is now working with some airway company in Fla. Kilburn E. Culley, W1KCB, now operating as engineer in W1FCU's place at WLAW.

Paul, W1HXE now has a picture recording of Herb W1KBP's camp and radio shack. Paul sez in time he will have a recording of all the MVARC.

And when the great scorer comes To write against your name, He'll ask not if you won or lost But how you played the game.

THE (Asheville, N. C.) A R C Mag: by "Tex"

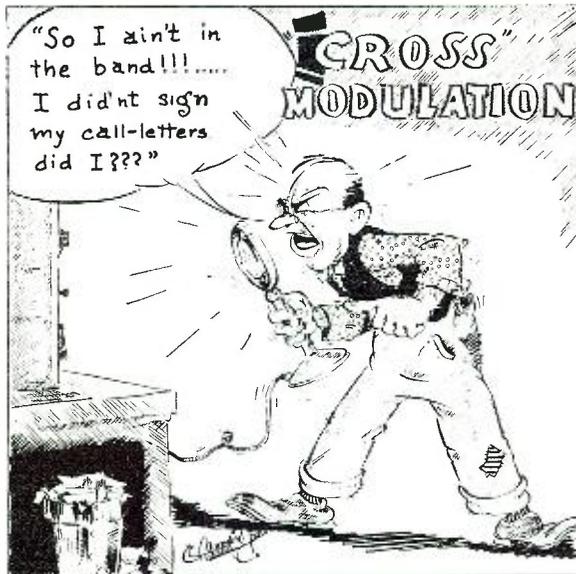
It's a YL for the John Shaw's (W4EYF). She put out her first CQ on November 7 and congrats are in order.

For Sale: To any lid an A21 second harmonic of 75 meters fone. Apply direct to W4BCU, Anniston, Ala.

W4DSY and W1JFG are sad because DX don't QSL like they used to.

W4CAY has been working EK1AF (Northern Africa) with low power on 20 fone.

November "ARC" had DST with new 2 ele. (More HC on page 53)



The HAMFESTERS have had the rep of being a social club and yet it's like looking for hens teeth to get a bowling team organized, according to W9RBD; sez the gang are interested in radio. . . . We enjoyed the little debate on Neutrality that W9OVJ, W9SXZ, W9MRQ, W9HWN, and W9NLP engaged in, and W9NLP certainly spoke words of great truth when he said that "We amateurs are endowed with a great privilege—and one bad apple in a barrel of apples is all that it will take to have us lose that privilege."

W9EJ, W9JU, W9MUZ, W9LUS, W9SXZ, W9IMN, W9ZHR, W7HUW, Hank Woods, Joe Haenle, and Ed Wollenhaupt helped engineer the job of getting the W9VXS rotary beam up. And we do mean "up."

W9JU sets a new record for the number of hamburgers a man can eat, the same day.

M. V. A. R. C. (Lawrence, Mass.) News:

It is learned that W9ZJB, George V. Dawson, Jr., of Kansas City, Mo? Has successfully worked all districts in the United States, on 5 Meters. Which all proves that we up here are making a serious mistake in giving up our struggle to get going on 5 meters again. This W9ZJB deserves a vote of congratulation from the MVARC, for his fine piece of work, and are only sorry that his W1 contact could not have been one of our club members. But from our past efforts to get established on 5 since the change in regulations took place, we are evidently made of jelly and give up too easily. Congrats, George.

Harris, W1JMW, reports in that the gang from Reading, Wakefield and Stoneham, Mass., and thereabouts are eager to cooperate with us on 2 1/2 mtr. experimentation. So wid all their fb cooperation we should get somewhere on this band. So let's go you fellows who have agreed on 2 1/2 mtr. operation.

ALGERIE FA-3HC

ORA: R. PLEIBER - 43, Rue Fontaine-Bleue - ALGER

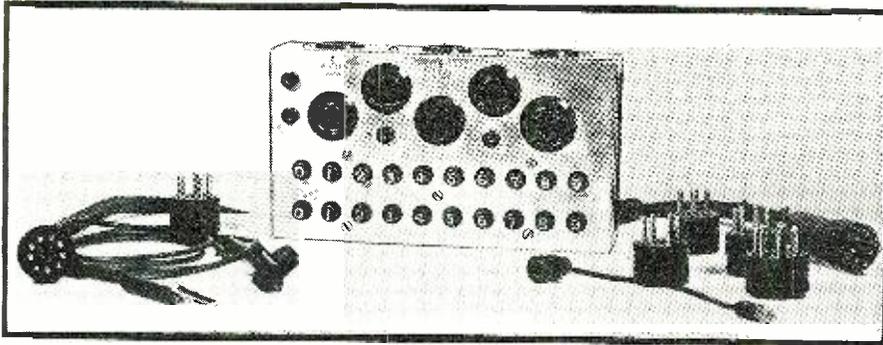
VISITEZ L'ALGERIE



Algerian FA3HC QSL of Ouled Nails.



QSL of YL op VE4AHZ & APA(OM).



SERVICEMAN'S TESTER

by **ARTHUR CARLIN**
Chicago, Illinois

This is an extremely neat point-to-point and tube tester for the serviceman to build. It will find many uses in the shop and the home.

BEING in need of an Analyzer to read voltage, current, and resistance in Radio Receivers, and desiring an instrument that would conform to my own ideas, I set about designing my own.

These ideas can be summed up as follows: It must be modern and sim-

ple of operation. It must provide for special as well as future needs. It must read in the standard (R.M.A.) system of pin numbering, and still use only the heavy wires of cable for the filaments.

This goal was attained and the result is an instrument that is both com-

The entire unit with all its accessories takes up very little room in the serviceman's kit; does a fine job.

compact, pleasing to look at, and efficient.

To meet the first condition, home-made push-button switches are used. These are not hard to construct, consisting of brass screws and fiber tubing of two sizes, a coil spring, flat contact strips of Phosphor Bronze and, for the end buttons, tubing of a third size.

The second condition is met by providing an extra pair of buttons, and an extra tip jack, the circuit of which leads to one of the 9 prong plug-in sockets. Also a plug consisting of an octal base with all pins except No. 8, removed. This pin connects to a spring clip attached to base.

The third requirement is attained by changing our 9 wire cable.

This is done by attaching a length of test lead wire to the hemp center core, and tying wires of the same end to some solid object. Then the core can be pulled out and the wire in, later connecting this wire in parallel with pin No. 8 wire.

This makes 3 heavy filament conductors which are connected to pins No. 2, 7 and 8, on the octal plug. With the socket adapter wires as shown, and the 9 pin plug inserted at the proper place, the tube circuits will now appear at the buttons corresponding to (R.M.A.) pin numbers of tubes.

In hooking up, the soldering of the test socket is done first, leaving a lead wire for each switch of ample length. Then the rear sockets are mounted temporarily on a piece of cardboard and then wired, leaving leads of about 10 inches. The cardboard is then torn away and the assembly mounted, using four $\frac{3}{8}$ screws and two of the socket hole cutouts between sockets.

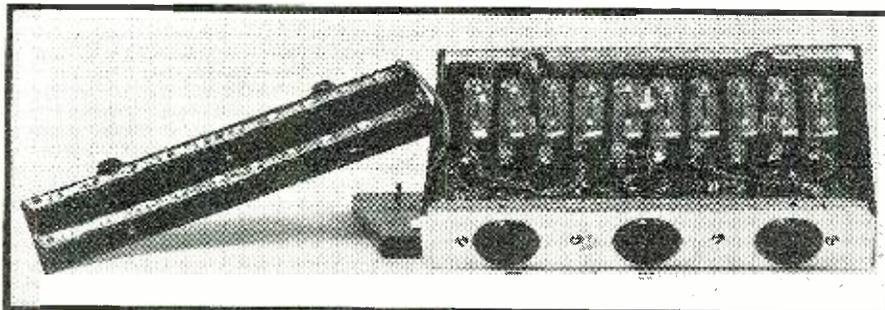
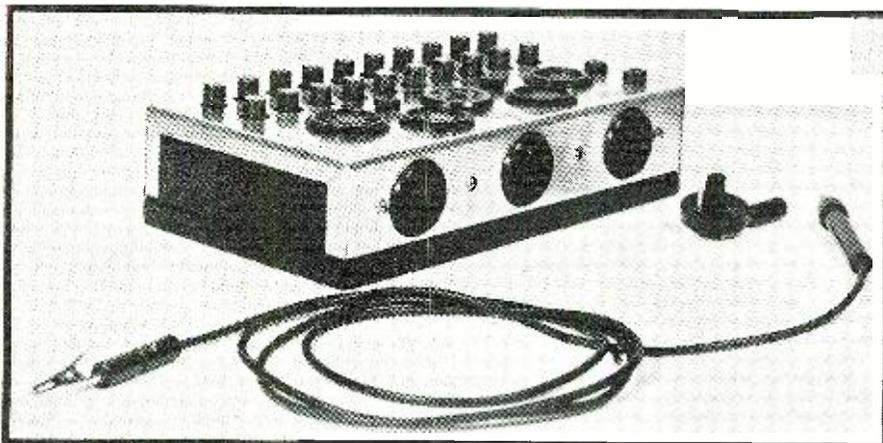
The leads are then formed to pass corners and around to the front, five going each way, then cut to lengths and then soldered to the button assembly before placing same on final position. The mounting screws are then inserted from the front, pushing out the four screws inserted from the rear during assembly of switches.

Finally Bus bars are wired to output jacks and the other switch connections completed. The bottom deck is then put in place and held by nuts or mounting screws. It is important that the correct plug-in socket is used; this is apparent upon a study of circuit diagram.

Parts List

1. Chassis Base, $8\frac{1}{2}'' \times 4\frac{3}{4}''$.
2. Wood baseboard, $8\frac{1}{2}'' \times 4\frac{3}{4}'' \times \frac{1}{2}''$.
3. Two Bakelite end pieces $4\frac{5}{8}'' \times 1\frac{1}{2}'' \times \frac{1}{8}''$.
4. Bakelite upper deck $8\frac{1}{8}'' \times 2\frac{1}{4}'' \times \frac{3}{16}''$.
5. Bakelite lower deck $8\frac{1}{8}'' \times 2\frac{1}{4}'' \times \frac{1}{8}''$ drilled and trimmed as shown on dotted line.

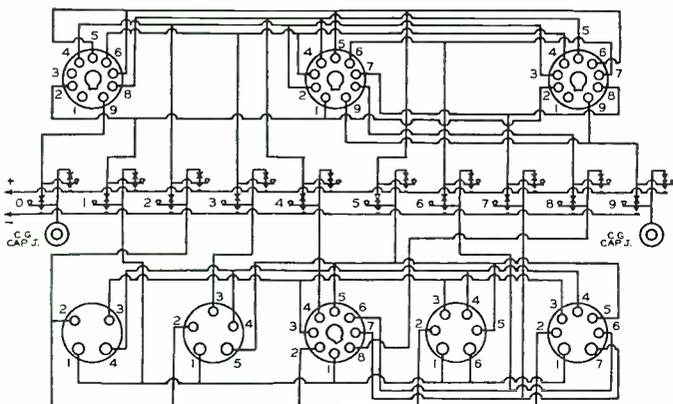
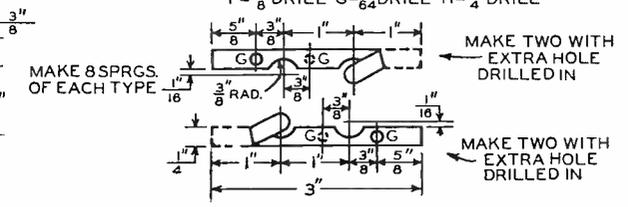
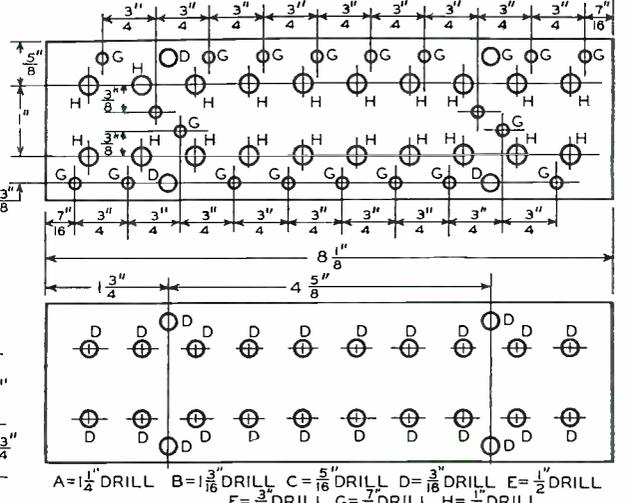
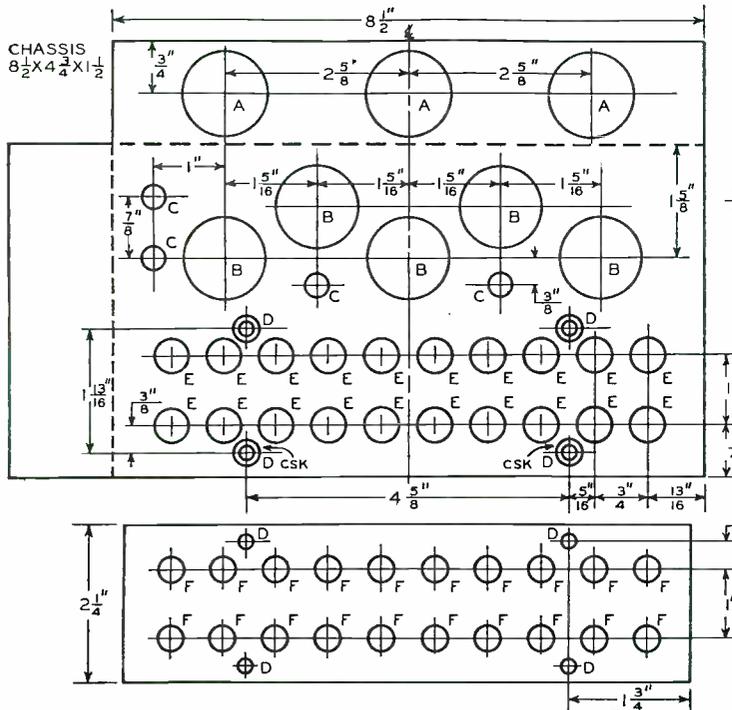
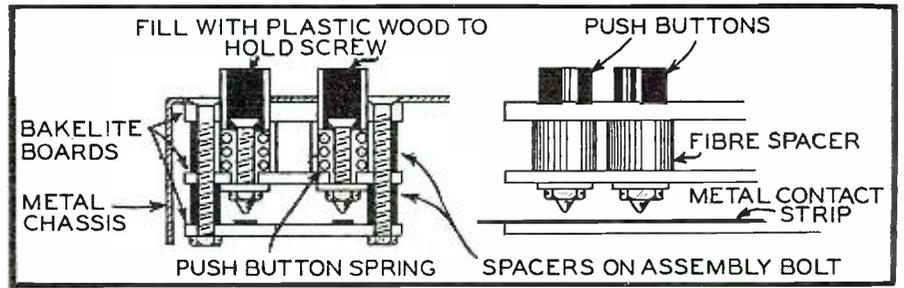
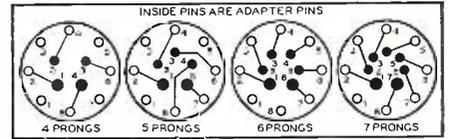
Inside and outside views of the serviceman's tester. Note clean wiring.



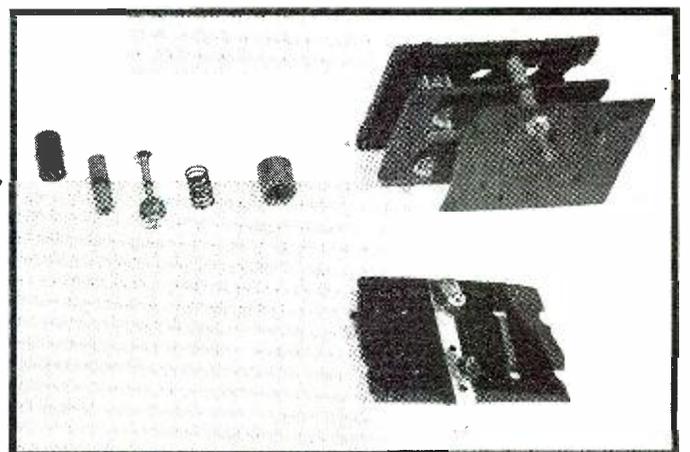
6. Twenty-six tubular rivets $\frac{7}{64} \times \frac{1}{4}$ " for bus and switches.
7. Two bus bars, 22 gauge copper $8\frac{1}{4} \times \frac{3}{16}$ " drilled for rivets at middle and ends to fit lower deck.
8. Sixteen contact springs of 22 gauge Phospor Bronze drilled with rivet holes like type A in drawing.
9. Four contact springs with holes like type B.
10. Ten pieces of red fiber tubing $\frac{3}{8}$ " O.S. Dia. x $\frac{5}{8}$ " long for red push-buttons.
11. Ten pieces of black fiber tubing $\frac{3}{8}$ " O.S. Dia. x $\frac{5}{8}$ " long for black buttons.
12. Twenty pieces of hollow Phenolic rod $\frac{1}{4}$ " diameter x $\frac{7}{8}$ " long tapped for $\frac{1}{32}$ screws.
13. Twenty brass screws, flat head size $\frac{3}{32} \times 1\frac{1}{4}$ " long with brass nuts for same.
14. Twenty No. 8 brass washers.
15. Twenty coil springs, compression type $\frac{5}{16}$ " dia. x $\frac{5}{8}$ " long.
16. Five insulated spacers $\frac{1}{2}$ " long.
17. Four insulated spacers $\frac{7}{16}$ " long.
18. One insulated spacer $\frac{5}{16}$ " long.
19. Four pieces of fiber tubing $\frac{1}{2}$ " dia. x $\frac{1}{2}$ " long, reamed for loose fit of push-buttons, used at end buttons.
20. Three Amphenol Clip-tite sockets, 9 pin type with mounting plates.
21. One set of Amphenol Clip-tite tube sockets, consisting of 1-4 pin, 1-5 pin and 1-6 pin, 1-7 pin combination small and medium and 1-Octal.
22. Two insulated tip jacks in black.
23. One insulated tip plug.
24. One dual grid cap with 8 inch wire head.
25. Two insulated combination tip and

- banana plug jacks in red and black.
26. One Amphenol socket plug, 9 pin type.
27. One "Bud" Octal test plug.
28. One wire cable 5 feet long.
29. One test lead wire 5 feet long.
30. One 4 pin adapter wired to (2-4-6-8) of Octal top.

(Build further on page 61)



Constructional details of the unit. Follow the diagrams and illustrations carefully.



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SERVICEMEN'S CASE HISTORIES

by **ALFRED A. GHIRARDI, B.S., E.E.**

Author of "The Radio Physics Course," "Modern Radio Servicing"; member Radio Servicemen of America, New York Electrical Society, Institute of Radio Engineers.

CROSLEY 168

- Hiss in back-ground on all stations, even when correctly tuned . . . 1) replace the dual 8-mfd. 25-volt condensers in the cathode circuit of the second detector and output tubes, with 75-volt units
- Lack of AVC 2) try several 2A6's, 56's and 2A5's. If this does not help, connect from 400,000 to 100,000 ohms across the primary of the first i-f transformer (use the highest permissible value)
- 000 ohms across transformer (use the highest permissible value) 3) remove the 300,000-ohm 1/2-watt resistor between the i-f trimmer and the 8-mfd. cathode biasing resistor. Insert a 100,000-ohm 1-watt resistor from the i-f trimmer directly to ground
- Inoperative . . . 1) "open" section in filter condensers **No. 23-24**

CROSLEY 169

- Inoperative (voltages O.K.) . . . 1) see remedy listed for this same trouble in the Crosley 148 receiver
- Fading 1) make sure to use 6-8-volt pilot lights, as 2.5-volt pilots will cause fading
- Oscillation 1) connect a 0.02-mfd. 600-volt condenser from power-transformer side of line-switch to ground

CROSLEY 170 DUAL TEN

- See also Case Histories listed for Crosley 171
- Intermittent reception (noisy and squealing when reception stops) . . . 1) faulty 8-mfd. condenser across the 25,000-ohm bleeder resistor. This condenser is one of a 3-unit condenser
- '80 rectifier burns out repeatedly . . . 1) electrolytic 8-mfd. condenser (Part 29097) "shorts" and then "heals" itself. Replace it with improved condenser 29097-A
- Weak reception (tubes and voltages check O.K.) . . . 1) check grid cap lead to first r-1058 tube for a break inside the tape
- Poor tone 2) tone and volume can be improved by connecting a 2- to 4-mfd. by-pass condenser across the first a-f bias resistor. Also, reduce the value of the diode load resistor from 500,000 ohms to 400,000 or 350,000 ohms—whichever gives best results
- Weak, noisy, reception . . . 1) check the 0.0005-mfd. tubular condenser in series with the antenna coil
- Oscillation (ceases when the finger is placed on the cap of the first type '58 tube) . . . 1) open-circuited r-f oscillator coil located behind the band switch
- Background "hiss" over entire dial . . . 1) shunt a 300,000-ohm resistor from the primary of the second i-f coil to the chassis
- 2) connect a 2-4-mfd. by-pass condenser across the first a-f bias resistor

CROSLEY 171

- Noisy reception, Loss of volume 1) faulty 0.0005-mfd. tubular condenser in series with antenna coil
- Inoperative . . . 2) faulty triple 8-mfd. filter condenser unit (part No. W-29097). Replace with the improved part No. W-29097-A
- 2) faulty 8,500-25,000-ohm "Candohm" resistor (part No. W-28471). Replace with new unit
- 3) faulty rectifier tube as a result of the above condition. Replace with new tube
- No QAVC action. 1) faulty section in "Candohm" resistor. Replace with new unit (part No. 28471)
- Poor volume

CROSLEY 173

- Intermittent operation . . . 1) "open" 16-mfd. section of filter condenser
- 2) if receiver uses tapped primary on power transformer, look for broken wire in tap lead

CROSLEY 175

- Inoperative on lower frequencies 1) replace 7,000-ohm cathode resistor in the oscillator circuit with a 5,000-ohm unit. Realign the i-f amplifier

CROSLEY 178

- Tubes burn out 1) short-circuited resistor between one side of the filament circuit and ground
- when the set is switched off 2) short-circuited "safety" resistor connected between the movable arm of the volume control potentiometer and the ground
- The above condition causes the "C" battery to be connected across the filaments when the switch is turned off
- No control of volume . . . 1) "shorted" condenser from filament of '32 tube

CROSLEY 305 CHASSIS

- Noisy reception, Unstable operation 1) change in value of the 11,000-ohm stabilizing resistors connected in parallel from the B-plus terminal of the audio transformer to ground. Replace
- Intermittent reception 1) intermittently open-circuiting heater in the type '27 first audio tube. Replace with new tube
- 2) intermittently short-circuiting 0.5-mfd. detector cathode resistor by-pass condenser, resulting in no bias on the type '27 detector tube. Replace
- 3) decrease in value of 55,000-ohm first detector plate supply resistor. Replace
- 4) leaky 0.001-mfd. r-f by-pass condenser connected between plate and cathode of the first detector tube. Replace
- 5) leaky a-f coupling condenser between the first detector plate choke and the control grid of the first audio tube
- 6) leaky electrolytic condensers. Replace with new units

CROSLEY 401

- Variable condenser "freeze" . . . 1) the tuning condensers sometime "freeze" up so they turn hard. Drill a 1/4-inch hole through the die-cast bearing of each condenser section to the shaft. Drop a little oil and graphite in each hole. Now turn the condensers back and forth to work in the lubricant

CROSLEY 425

- Intermittent reception . . . 1) internal "shorting" of the untuned r-f transformers (one terminal of which is connected to plate terminal of last r-f tube
- Noisy 1) noisy sensitivity-control switch. Solder flexible wire from the moving contact to ground to eliminate this trouble
- Speaker rattle 1) remove cone from speaker. Paint the joints inside and out where the voice coil fastened to the cone (use good grade of glue or thin shellac). If voice coil wires are loose, shellac the entire coil

CROSLEY 515

- Inoperative . . . 1) "open" in 2-section Candohm resistor at rear of chassis sub-base (overall resistance 33,500 ohms; long section 25,000 ohms; short section 8,500 ohms). If any one section opens a 5-watt resistor of corresponding resistance may be used as a replacement for that section
- 2) if set does not turn "on" install an "on-off" switch separate from the volume control dirty contact points and "shorts" in electrolytic condenser. Unsolder and test for "shorts" or opens
- Intermittent operation with strong hum 1) defective dual 0.02-mfd., 200-volt type 6D6 tube cathode by-pass tubular condenser (even though it may test O.K.). Replace with a new unit
- Fading 1) faulty or "open" "Litz"-wire r-f coil

CROSLEY 516

- Intermittent operation, 1) check speaker voice coil for continuity—especially broken leads to voice coil
- Sputtering and chattering 2) voltage-divider resistance values changed. Correct values are: feeder 8,500 ohms. 2-

watts; bleeder 25,000 ohms 1-watt

CROSLEY 517T

- Distortion 1) 16-mfd. filter can is insulated from chassis by two fibre washers. As the can is located in the rear of the chassis and is handy for lifting the chassis when handling the set it may slip just enough to throw it off center and short to the chassis. Re-center the can in the hole and tighten securely in place

CROSLEY 601 (BAND-BOX)

- Inoperative (voltages check O.K.) . . . 1) "shorted" neutralizing condenser. Locate and repair the short. Neutralize the receiver
- Filament rheostat burns out 1) install new rheostat—being careful that its shaft does not "ground" against metal panel
- Tuning control cord "frozen" 1) free the cord and rinse out carefully. Otherwise, install new cord
- Squealing, Howling . . . 1) variable condenser rotor sections slipping on the shaft. Trouble often is difficult to find, as the condensers are mounted upside down in the receiver. Tighten and align the tuning condenser rotor sections
- Variable condenser "freeze" . . . 1) see the Case History listed for this trouble under Crosley #01 receiver
- Improving selectivity . . . 1) "short" out the first-stage balancing condenser. Make sure that the plates of the tuning condensers mesh properly

CROSLEY 602

- Variable condenser "freeze" . . . 1) see the Case History listed for this trouble under Crosley 401 receiver

CROSLEY 608 (GEMBOX)

- Reception cuts off near 100 on dial 1) check tuning condensers for burrs which "short" the plates when half meshed. Also check them for spacing and "tracking"
- Regeneration control "freezes" . . . 1) replace the control
- Tuning control "freezes" 1) repair by smoothing the burrs on the gear and holes where it turns. Otherwise, replace the drive gear
- Hum 1) loose power transformer laminations. Loosen lockbolts and hit laminations gently with hammer to "set" them. Tighten bolts carefully
- Volume control noisy 1) clean with 0000 sandpaper gently and rub with vaseline—or replace

CROSLEY 609 (GEMCHEST)

- Sensitivity poor . . . 1) shift the positions of the r-f coils until best sensitivity is obtained. Fasten them in these positions
- Oscillation . . . 1) Readjust angles or positions of r-f coils
- Noisy tuning . . . 1) corroded condenser gang rotor shaft tension spring. Connect a flexible pigtail between the condenser rotor and chassis
- Distorted reproduction 1) open-circuited 10,000-ohm resistor in secondary return circuit of output tube

CROSLEY 610 (GEMBOX)

- Oscillation . . . 1) readjust angles or positions of r-f coils
- Lack of sensitivity or selectivity 1) loose rivets on the center-tap filament resistor. Remove resistor and squeeze the rivets securely in a small vise
- Fading, Increased hum level . . . 1) corroded condenser gang rotor shaft tension spring. Connect a flexible pigtail between the condenser rotor and chassis
- Noisy tuning . . . 1) open-circuited 10,000-ohm resistor in secondary return circuit of output tube
- the condenser rotor 1) Distorted reproduction

CROSLEY 635

- Inoperative, Oscillation . . . 1) check condenser No. 17B in the schematic, connected be-

tween the cathode and screen of the 6A7 tube

CROSLEY 645 (32-volt d-c receiver)

- Intermittent distortion (accompanied by varying output) 1) broken lug in the '48 tube socket
2) check all other tube socket lugs for defects

CROSLEY 655

- Distortion (especially at high-volume) 1) weak 6F6 power tube
2) poor 5Z4 rectifier tube
3) check output voltage of filter. If below normal it is likely that one of the filter condensers has excessive leakage. This additional current drain would cause the output voltage to drop and the power transformer to heat excessively

CROSLEY 704, 706 (SHOWBOX)

- Inoperative (no plate voltage on r-f tubes) 1) 0.5-mfd. r-f by-pass condenser "shorted"
2) check 3,250-ohm r-f resistor
- Inoperative (no plate voltage on first a-f tube) 1) loose spring-contact at "plate" prong of first a-f tube socket. Repair, or replace with a new socket
- Inoperative, (filter choke leads "shorting" to chassis) 1) speaker field pin-jacks "shorting" to chassis
- High-voltage output shorted 2) loose 1.5-v. filament winding riveted-lug on the terminal strip of the power unit. Check all other riveted lugs on this strip also, and tighten securely
- Intermittent reception (26 tubes light up intermittently) 1) screw on aerial terminal works loose due to worn or faulty threads. Solder a small length of wire to lug under screw and attach aerial to other end of wire instead of terminal
- Fading 1) solder one end of a piece of wire to the bottom of the aerial lug. Fasten the other end under the screw at the top of the aerial and ground strip
- Noisy tuning 1) corroded condenser gang rotor shaft tension spring. Connect a flexible piston between the condenser rotor and chassis

- 2) burrs on stator tuning plates. Can be cleaned off with a long sharp knife blade

- Noisy reception 1) clean the volume-control resistance element and contact arm

- Oscillation, (General instability) 1) open-circuited type '226 tube filament by-pass condenser readjust balancing condenser take out washer located between the condenser housing and the pinion gear. Sand-paper it and the points with which it makes contact. Bend it so that firm connection is made when it is put back

- Hum (steady) 1) faulty Mershon electrolytic filter cond.

- Howling during "warm-up" period (stops if first audio tube is removed) 1) shunt grid circuit of first audio tube with a 500,000-ohm resistor. Also change the detector grid resistor to 1 megohm

- Fuse blows 1) replace fibre bushings on field supply

- Voltage divider gets extremely hot 1) replace 0.5 mfd. condenser from center arm

- Dial light flickers, Noisy 1) replace the a-c line switch

- Poor tone 1) if volume increases when one of the output tubes is removed, check the small wires on the "E" type speaker unit for a "break"

- Raspy tone, Harsh, Fuzzy 1) check rubber damping blocks at the ends of the loud-speaker armature unit for hardened condition. Replace with new ones of thin "live" rubber. Re-assemble unit, adjust properly

CROSLEY 706-60

- Excessive hum (circuits check O.K.) 1) replace the '27 detector tube with a '56, and connect a 0.1-mfd. 200-volt condenser from chassis to detector heater at the fourth terminal from front of chassis on brass strip which connects power pack with chassis

- Distortion 1) replace the 1,100-ohm bias resistor. A standard 1,000-ohm 10-watt resistor will do for replacement

CROSLEY 714

- Inoperative (no r-f plate voltage) 1) "shorted" 0.5-mfd. by-pass condenser
2) foregoing condition generally causes the 3,250-ohm wire-wound plate resistor to become excessively hot—or burn out. Check both these possibilities and make necessary replacements

CROSLEY 715

- Intermittent reception, Oscillation 1) if normal operation is resumed when finger is placed on the grid cap of the 2B7 tube at the rear of the chassis, replace the faulty 3-section filter condenser (part W-36056)

sis, replace the faulty 3-section filter condenser (part W-36056)

CROSLEY 716

- Inoperative on broadcast band 1) loose connection on the frequency series-adjustment
- Noisy when tuned to resonance 1) faulty 6A8 oscil.-mixer tube—even though it tests O.K. Try several tubes

CROSLEY 718

- See Case History listed for Crosley 714 receiver

CROSLEY 725

- Inoperative (set smoking, no voltages on plates, condensers O.K., two 10,000-ohm resistors heated) 1) tuning meter "shorted." Replace tuning meter and both 10,000-ohm resistors

CROSLEY 801 (JEWELBOX)

- Distortion (about 20 minutes after receiver is switched on) 1) "leaky" 0.25-mfd., 400-volt by-pass condenser connected from the B-plus cathode of the first type '27 a-f tube

CROSLEY 814

- Distortion, Low volume, Inoperative 1) open-circuited section in 10,000-ohm "Candohm" resistor section connected between the screen circuits and ground

CROSLEY 1117

- "Fuzzy" tone 1) install special shielded lead (No. 4123-34403) between center arm of volume control and the coupling condenser
- Loud hum 1) tighten the mounting nut on the grounded filter condenser so as to make better electrical contact
- Poor tuning-eye action 1) remove the cathode lead (black wire) from ground and connect it to the lower end of the diode load resistor

CROSLEY 1127

- Poor tuning-eye action 1) remove the cathode lead (black wire) from ground and connect it to the lower end of the diode load resistor

CROSLEY 1516

- Neon tuning indicator fails to operate 1) "open" 30,000-ohm resistor No. 68

CROSLEY 5515

- Inoperative 1) "open" in 2-section Candohm resistor at rear of chassis sub-base (overall resistance 33,500 ohms; short section 8,500 ohms; long section 25,000 ohms). In event of an "open" occurring in any one section, a 5-watt resistor of corresponding resistance may be used to replace that section

CROSLEY 5666

- Intermittent reception, Noisy 1) replace the volume control

DAY-FAN 5005-A

- Oscillation between 1400- and 1500-ke 1) connect a 0.01-mfd. condenser between the screen-grid on the first r-f tube and the ground post, insulating the ground post from the chassis. Make sure that the ground wire goes directly to the condenser and not to the post

DAYFAN 5066

- Inoperative, Weak reception 1) check for faulty speaker condenser

DAYTON A.C. "NAVIGATOR"

- Inoperative 1) defective a-c switch. Replace

DE CHAMPE RECEIVERS

- Loss of volume 1) magnetic speaker armature off center

De FOREST-CROSLEY 707

- Intermittent reception 1) open-circuiting detector plate choke. Replace with a 17-mhy. unit

De FOREST-CROSLEY "ARIA" 740, "TROUBADOR" 750

- Loud hum 1) faulty 3-section "Mershon" filter condenser. Replace with a new unit or drill a hole in the hard rubber top and fill the can to within about 1/2-inch of the top with distilled water. Then seal up

De FOREST-CROSLEY (CANADIAN) "ARIA," "MELODY," "TROUBADOR"

- Distortion at low volume 1) decrease in resistance of 20,000-ohm, 2-watt carbon bleeder resistor connected between the r-f plate supply and the cathode of the audio tube. This causes over-biasing of the a-f tube. Discard the bleeder resistor and self-bias the tube with a 2,000-ohm, 1-watt unit
- Low volume, Poor tone 1) faulty speaker voice coil
2) open-circuited field coil in speaker

- Squealing (when set is first turned on) 1) gassy '45 power tube. Test the tube, and replace if necessary

De FOREST-CROSLEY 762

- Weak reception, Distortion, Gradual rise and fall of volume 1) if plate voltages and currents are low on all but the power tubes, check the 0.5-mfd. r-f plate by-pass condenser for leakage. Use a 500-volt unit for replacement

De FOREST-CROSLEY "MINSTREL" 810

- Loud hum 1) faulty 3-section "Mershon" filter condenser. Replace with a new unit or drill a hole in the hard rubber top and fill the can to within about 1/2-inch of the top with distilled water. Seal the hole with sealing wax

DELCO R-1119 Auto Radio

- Line fuse blows while set is warming up 1) replace 3-mfd. 250-volt electrolytic condenser with a 400-volt unit

DELCO R-1129

- Distortion and hum when signals are tuned in 1) 6P5 tube not operating. Replace it

DELCO 500, 630 Auto Radios

- Insensitive, No distant reception, Blocking of near-by stations 1) blocking of weak signals by noise suppression circuit. Disconnect the volume control "grounding" wire from the chassis grounding lug. Connect this end of the wire to the cathode terminal of the '6D6 tube instead. If this causes resulting audible vibrator noise, connect a 100-ohm resistor in series with the 275-ohm common bias resistor for the '6D6 and '6B7 tubes. Put it between the cathode and the old resistor, re-connecting the by-pass condenser across both the old and new resistors. Connect the lead from the volume control to the junction between the resistors

DELCO 1936 Auto Radios

- Hum (loud & intermittent) 1) rivets which hold the electrolytic condenser bracket to the chassis "loose." Bond the bracket directly to the chassis with copper bonding braid soldered in place
- Difficult to align correctly without squealing or uncontrollable oscillation 1) particularly common on models using 6A7 and 6B7 tubes. Grid and plate prong on 6A7 are very close together, causing feedback. To remedy, cut lead to plate prong to absolute minimum, and shield it. Also insert an insulated piece of braid between the grid and plate prongs to act as a shield. Ground braid

DELCO 1937 Auto Radios

- Difficult to align properly without squealing or uncontrollable oscillation 1) see the Case History for this same trouble listed under Delco 1936 Auto Radios

DETROLA "MIDGETS"

- Distortion 1) replace the 0.5-meg. plate resistor of 6C6 detector with a 0.25-meg. unit

DETROLA "WARWICK" MODEL

- Inoperative over part of broadcast band 1) replace the 50,000-ohm voltage-dropping resistor for the screen grid of the '57 detector-oscillator tube, with one of lower value (about 40,000 ohms)

- Weak reception 1) the 50,000-ohm screen-supply resistor usually increases in value, thereby reducing the voltage available for screen supply. Replace with a 2-watt resistor

DETROLA 6P2, 6V

- Weak reception, Distortion 1) voltage checkup shows '42 tube to be underbiased and '75 tube to be overbiased. Caused by leaky 0.01-mfd. 400-volt coupling condenser

DETROLA 1116

- Inoperative 1) "shorted" condenser in plate circuit of output tube

- Oscillation all over dial 1) add 1,500-ohm 1-watt carbon resistor from the screen-grid terminal of the 6K7 tube to chassis

- Distortion 1) replace "leaky" coupling condensers

- Hum 1) replace faulty 8-mfd. electrolytic condenser unit

De WALD "BAG"

- Inoperative 1) open-circuited ballast lamp. Replace with new lamp

De WALD "DYNETTE"

- Inoperative 1) faulty line resistor. Replace with new unit

De WALD 61

- Distortion, Hum 1) cathode of '41 tube shorted to positive filament of '37 tube socket.

MANUFACTURERS' LITERATURE

"Replacement Motor Starting Capacitors" is the title of a new catalog just published — 1939-40 edition — by Cornell-Dubilier Electric Corporation. The book lists exact duplicate replacement capacitors "for all types of a.c. motor driven equipment" from Air Conditioning down to Water Systems. Included in the catalog listing are the Type and Catalog Number of each C-D unit, together with its capacity, a.c. voltage rating, dimensions and list price. Manufacturers are listed alphabetically, with the proper C-D replacement capacitor arranged to correspond with the manufacturer's Part number.

Catalog No. 162 can be obtained free on request at the main office of the Cornell-Dubilier Electric Corporation, in South Plainfield, New Jersey, or (RADIO NEWS No. 2-100).

Tube Base Data Connections and Chart, issued by Weston Electrical Instrument Corporation, Newark, N. J., assembles in one convenient folder the element connection and base layout of over 500 different types of radio tubes. Originally designed for use with the Weston methods of selective analysis, but now used with all methods of servicing, this folder permits rapid socket selection for practically any tube now in commercial use.

Tube base connections are illustrated by diagrammatic sketches of the bottom view of socket or base of tubes. Occupying the inside spread of the folder, these sketches constitute valuable reference material on tube circuits for the serviceman or dealer. A tube base chart on the back page indicates the proper base to use for any of the various tubes listed. Copies of this folder may be obtained by writing Weston Electrical Instrument Corporation, Newark, N. J., or (RADIO NEWS No. 2-101).

The new 8-page *Turner Microphone Catalog* is now off the press and offered free to anyone requesting it of The Turner Co., Cedar Rapids, Ia.

This New Turner Catalog No. 60 shows and explains all the microphones and equipment in the complete Turner line, with list prices.

Included are microphones for every amateur, commercial broadcast, recording and public address purpose. The new Crystal and Dynamic microphones recently designed by Arthur Charles Haggstrom, world-famous industrial designer, are shown on the opening pages, while the back page of the catalog is devoted to the new Turner U-9 Multi-Flex Microphone. This latter unit is designed to fill all four impedance requirements, and allows the operator to be ready for any job without duplicating his equipment. Model U-9 works at 50 ohms on long

lines; at 200 or 500 ohms for the particular job; with balanced line connections; or on high impedance on regular shorter lines, all at low cost.

The new Turner Catalog also depicts hand, desk and lapel microphones, as well as microphone equipment, such as floor and desk stands, cable, cable guides and racks, positive contact connections and transformers.

The new Turner 44X Crystal Selective Directional Microphone is one of the outstanding models featured in the new catalog. The 13-15 db. differential between front and rear pickup permits the rear to be considered dead, and allows the operator to amplify the sound he chooses. (RADIO NEWS No. 2-102.)

Just off the presses and free to servicemen through their jobbers is the Cornell-Dubilier "Capacitor Manual for Radio Servicing," a book of over 240 pages which constitutes a speedy guide to the selection of standard Cornell-Dubilier capacitors for use as replacements in all existing types of receivers.

Many months were spent in compiling, checking and rechecking all standard set data in order to provide complete replacement information in concise and simplified form. Set manufacturers' names appear alphabetically, and under each are listed the models of that make. For each model the data given include capacitor values in each circuit, working voltages, C-D standard capacitor types recommended for replacement, references to basic filter and bypass circuits (over 165 of which are given in the rear section of the Manual), manufacturer's original parts numbers, and the volume and page of Rider's Manuals in which the complete schematic circuit is to be found for checking complete circuit of the receiver.

The variety of recommended replacement capacitor types has been reduced to an absolute minimum, requiring smaller stocks with rapid investment turnover for the serviceman. Moreover, inasmuch as all recommended types are standard, stocks can be replenished speedily from local jobbers with assurance of fresh stock. All capacitors recommended are the correct and most economical types for each particular job.

The new book is bound in a handsome, embossed paper cover printed in two colors, and will withstand constant handling. It is of pocket size (5 3/8" x 7 3/8") for maximum convenience. (RADIO NEWS No. 2-103.)

The new 1940 *RADOLEK Radio Profit Guide*, just released, is richer than ever before by some 5,000 new items. If you have not already sent

for your copy we suggest you do so in order to get acquainted with the many new items listed. (RADIO NEWS No. 2-104.)

The Hammarlund "40" Catalog is off the press. This has been brought up to date and includes several new items of interest to the amateur operator. Several popular items shown are: The "PA-300" amplifier kit, the "BD40" kit, the "PA500 kit" and others. These compact units find application in transmitting equipment where space is at a premium and where ease of assembly is desired. A complete description of the new Hammarlund HQ-120X is also given, which is one of the most popular communications receivers on the market today. Included also is a new line of small compact transmitting condensers known as models "HFA" and "HFB." Many types are shown which fill all low-voltage requirements in amateur rigs. There are 39 sizes to choose from, and both single and dual models are listed. (RADIO NEWS No. 2-105.)

The E. F. Johnson Co., Waseca, Minn., have issued a new "Radio Transmitting Equipment" catalog for distribution to the amateur. This is No. 966. The new "HI-Q" inductors are of special interest, and include both plain and linked models. The links are substantially mounted on ceramic forms within the coil form of the tank. Full rotation is provided so that proper match may be had to all conventional feed systems. These inductors are made in the following sizes: 100 watts, 350 watts, and 1000 watts. Specially designed bar mountings are listed to accommodate these, and the jacks are so arranged that self-centering will take place to the pin jacks on the form without the danger of cracking the ceramic. The famous Johnson "Q" and "Q" Beams are described in detail and features of their use discussed. (RADIO NEWS No. 2-106.)

Hygrade Sylvania Corporation announces a new *Sylvania Technical Manual*, the fifth edition of this well known Sylvania book compiled for servicemen, radio technicians, engineers and amateurs, and are offering it to the trade at a price of 35c. The coat pocket size of 4 1/2 x 9 1/4, which has identified Sylvania Technical Manuals in the past, has been retained as well as the convenient wire-o type binding.

This new edition has 264 pages of complete data and tube diagrams, prepared from RMA standards, for 344 types of tubes. Operating conditions, ratings, characteristics and circuit applications for standard glass tubes, "G" types, Loktal, Metal, Majestic and special types are fully and accurately

covered, in addition to information on Sylvania's complete line of panel lamps. Also included are data on special tubes for particular applications in television amplifiers, Cathode-Ray tubes, etc., with new circuit information and diagrams covering the latest type tubes.

Considerable space is devoted to new typical receiver circuits, complete bias resistor charts, data on interchangeable tubes, separate pages of bulb outlines and dimensions and a wealth of indispensable service data. Obtainable from Hygrade Sylvania Corp., 500 Fifth Ave., New York City, at 35 cents. (RADIO NEWS No. 2-107.)

National Union Radio Corporation is providing for use by N. U. radio service dealers a new form known as "Official Radio Service Analysis and Test Report." The form is patterned after shop check-up and service report sheets used so successfully in the automotive industry. It is 5½" wide by 13¼" long and provides a guide for complete radio analysis and testing under thirteen separate headings and more than forty sub-heads.

The form may be used by a serviceman for either estimating or billing service work and should impress the customer with the complexity and thoroughness involved in intelligent radio analysis and testing operations.

This new National Union form is available to dealers unimprinted without charge on requisition through local National Union distributors. (RADIO NEWS No. 2-108.)

The Radio Amateur's Handbook, Seventeenth (1940) Edition, by the Headquarters staff of the A.R.R.L. Published by the American Radio Relay League, Inc., West Hartford, Conn. 576 pages, including 8-page topical index and 120-page catalog section of amateur radio equipment. Approximately 830 illustrations and 86 charts and tables. Price, paper bound, \$1.00 in continental U.S.A., \$1.25 elsewhere; buckram bound, \$2.50. Spanish edition, \$1.50.

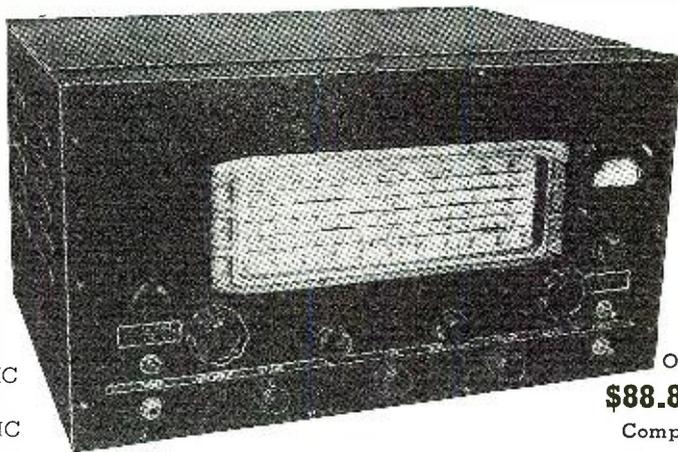
The 1940 edition continues the long record of comprehensive coverage of its field—amateur short-wave radio—established by its sixteen predecessors. It does this by meeting change with change, by keeping pace with the progress of its art. The amateur radio of today is quite a different thing from that of ten, or five, or even two years ago. In consequence this new volume is itself entirely different—written from the new, fresh point of view of 1940.

The entire table of contents has been rebuilt. There are 32 chapters in the new HANDBOOK—a complete exposition of practical amateur operating and constructional data. There are two introductory chapters, intended for the newcomer first learning about amateur radio. There are four chapters on principles and design, covering the essential elements of ra-
(Please turn the page)

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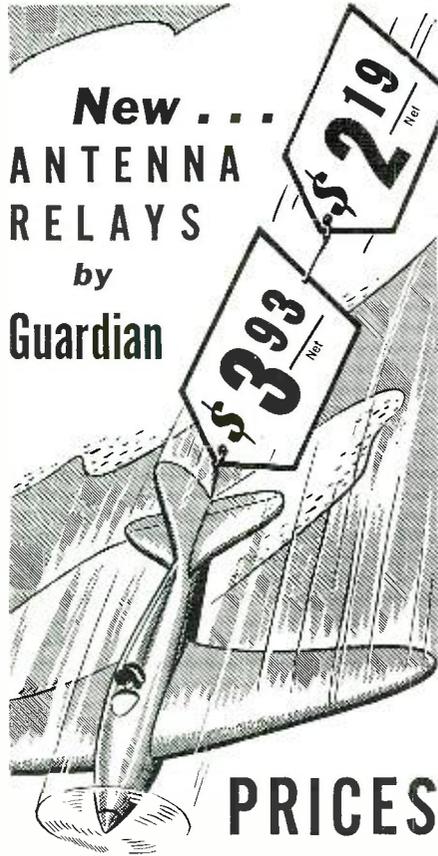
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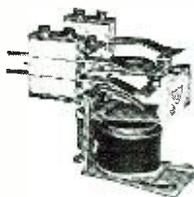
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Private Flyers' Xmtr.
(Continued from page 9)

C10 and C7 for maximum output is, of course, familiar to every amateur. The set was now ready to be tested for modulation. At this time we disconnected the a.c. power supply entirely since to have used it would put a.c. on the microphone. This might not only destroy the microphone transformer but also the microphone. The set was, therefore, hooked up in final operating position with the motor generator being used as a source of supply with the wet battery of 6 volts necessary. The microphone was plugged in and we switched on the filaments. When everything had warmed up we pushed a button and spoke into the microphone. A test with an oscilloscope showed modulation to be pretty close to 95%, and, in the right direction.

We then determined to find the amount of ripple that might be present on the carrier. In trying out the motor generator hook-up and disconnecting the modulator completely, we discovered that the carrier was 100% clean although there was not any filtering in the motor generator circuit, but when we put the modulator and speech supply into the circuit, there was a considerable motor generator commutator ripple.

A call to the local radio inspector's office revealed that there were not any regulations pertaining to airplane transmitters outlining the amount of ripple permitted, and all of the information we could get was that as long as the ripple was not objectionable and as long as voice frequencies would override, it was not necessary that we

include any filter beyond possibly a condenser. In order to eliminate this ripple, we actually installed two condensers, one of 4 microfarads across the battery terminals themselves. This rid the microphone circuit of a great deal of hash, another condenser across the motor generator output took out the remainder. This also served to cut the ripple in half. There is some ripple on the carrier when used on phone, but it is not objectionable. The set was now ready for installation and test in the airplane.

Installation and Test

It so happened that the plane which this transmitter was tested is known as a "Monocoupe." We found out from "Doc" Hartranft that the transmitter should be located as close to the center of gravity of the plane as possible. If this were done it would be unnecessary to run another series of "weight tests" on the plane in order to obtain the necessary licenses. We installed the motor generator directly behind the pilot's seat in a compartment usually reserved for baggage. Since the antenna to be used was of the trailing kind we determined that the proper coupling could be of the Marconi type. The antenna was connected directly to the transmitter and run through a feed-through insulator outside the plane and trailed under the belly. From there the antenna ran through an insulator behind the tail so that in taxiing the tail wheel would not cross over and pull the antenna from its socket. Beyond the tail, of course, the antenna floated free some 20 or 30 feet behind. On top of the plane, and from wing-to-tail, is a small antenna used for communicating with control towers at airports while the plane is on the ground

and this antenna, together with the trailing antenna were hooked in parallel to the antenna posts and the Marconi system resonated so that both together drew power. Once everything was shipshape, "Doc" took us aloft for a very pleasant trip, during which we had the opportunity to test the transmitter. We found it to be efficient in every respect and that its range was commensurate with commercial transmitters of equal power. This range varies from 30 to 100 miles, depending upon flying and atmospheric conditions.

Other Uses

There will, of course, be many amateurs who are totally uninterested in building airplane transmitters and who have absolutely no use for such a unit. It is to be pointed out to these gentlemen that the 1/8 cubic foot flyer's transmitter herein described makes an extremely flexible and easily portable QRR rig which can be slung across the shoulder. When we weighed the instrument complete with motor generator, we found it tipped the scales at slightly under 15 pounds.

In using it for QRR work an ordinary strap was bolted to the side of the cabinet and the transmitter slung over the shoulder in the same manner as a pair of field glasses. With an ordinary \$3.00 single button microphone, QRR work was undertaken in a field test conducted immediately after the flight test. Contacts with a little transmitter operating at 12 watts in the 80 meter phone band were established with points in Michigan and Montana from Chicago.

One of the greatest advantages of the Private Flyers' rig is that it may be operated either from batteries by discarding the generator and thereby lightening it by seven pounds, or from the generator, or a filtered a.c. 110 volt power pack may be used. This makes a rig of extreme flexibility, easily transportable, and one which is subject to only one failing as a QRR rig. The frequency of the transmitter is fixed and not easily changeable. To a certain extent this is overcome in the laboratory model by using a variable Bliley crystal cut for the 80 Meter band. In airplane work, of course, the MC5 Bliley new airplane crystal was utilized.

Strictly speaking, it is hard to choose whether this transmitter is better for QRR work or for airplane work. However, we did have a great feeling of pride when we saw "Doc" take off for New York City, knowing that his communications would be carried on by means of a transmitter built by hams, designed by hams and engineered by hams. —30—

As I See It!

(Continued from page 10)

megohms per microfarad, or even one-half of that amount.

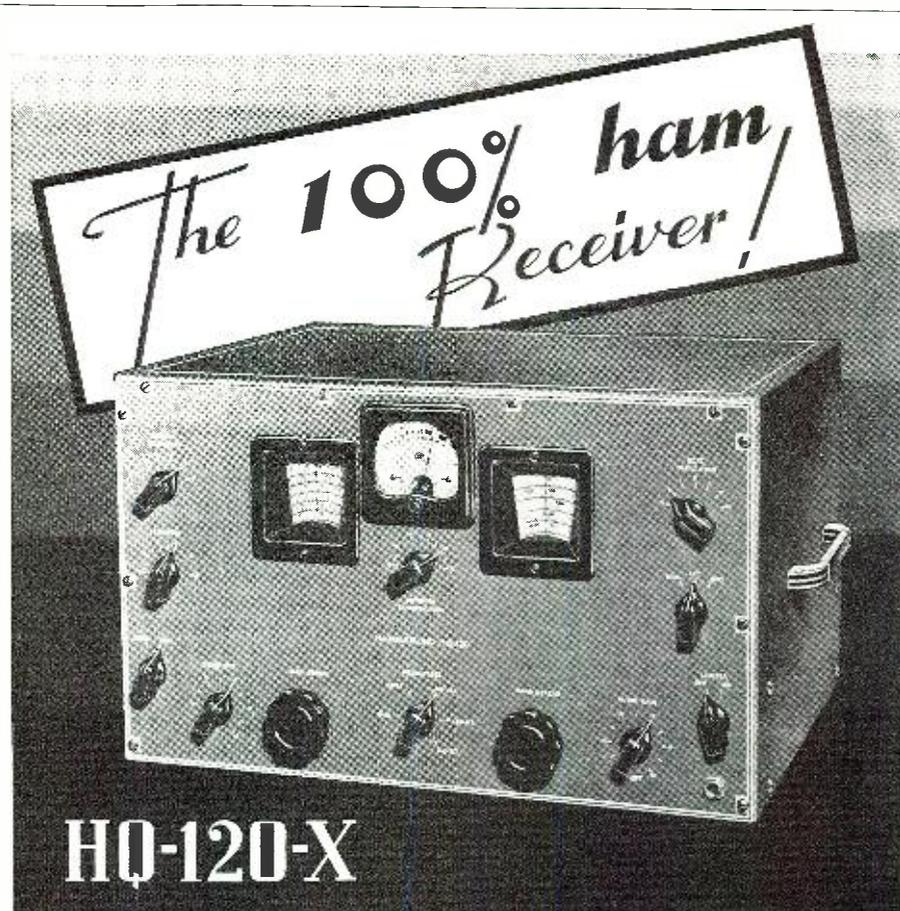
Looking at the subject from an impartial angle, it seems to us that about the only place we are concerned

with insulation resistance of fixed condensers in the conventional broadcast receiver is in the case of coupling or blocking capacities, particularly in those circuits where high-resistance grid leaks are used in conjunction with high- μ tubes operated at comparatively low bias voltage values. In circuits such as these, small fractions of a microampere of leakage current flowing through the grid leak will interfere with operation—hence the insulation resistance of the coupling or blocking condenser is of importance. Because of the plate voltages involved, the high value of grid leak used and the low value of bias voltages which must exist for normal operation, insulation resistance must be

high, therefore is critical. Hence, this is one type of condenser which should be checked, and, incidentally, with the modern methods of voltage measurement with very high resistance voltmeters they can be checked without removing from the set.

Another possible place where insulation resistance is of importance with respect to the circuit components, is in *avc* systems. But in these circuits, the insulation resistance must get down into the low megohm values before it begins to become a major influence. In fact, if the insulation resistance becomes low enough to be of significant interest, it affects operation.

Speaking about becoming low



EVERY receiving problem confronting the amateur and short wave listener was carefully analyzed during the design of the "HQ-120-X." Three very important features were the result of this analysis. Variable crystal filter selectivity for phone, as well as CW reception, has had the effect of more than doubling the width of the amateur and short wave bands. This high degree of selectivity cuts down background noise and hiss as well as QRM. The next important feature is the calibrated band spread dials making it easy to spot stations with remarkable accuracy. The third feature is the antenna compensator. With this control, peak efficiency is assured at all times, even with the simplest form of antenna. Your local Hammarlund dealer will be pleased to demonstrate these as well as other outstanding features of the "HQ-120-X."

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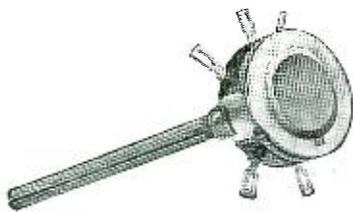
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enough to be of significant interest, we find it extremely difficult to establish what is representative of a reduction in insulation resistance to an extent which can be utilized as an indicator of approaching failure. People who make condensers cannot state definitely that a reduction in insulation resistance is a sign of approaching failure, particularly so in the case of units which are employed by bypass condensers across comparatively low impedance circuits such as grid bias resistors, plate circuits, diode demodulator loads, plate load impedances, etc.

In circuits of this character we cannot see the justification for a check upon the insulation resistance. It is not economically sound. If the condenser is operating satisfactorily, that is the signal conditions are correct and freedom from noise prevails, it seems far better to leave the unit intact and not check its insulation resistance because if it is found to be less than normal, it is not a sign of impending failure; it is difficult to charge for the time elapsed to remove, check and replace the unit and there is no known range of insulation resistance limits which can be used as a basis of comparison. If and when a receiver is repaired and some circuit shows signs of a defect, low signal level, distortion, noise, etc. and it can be traced to the bypass condenser, constants of that capacity are of no consequence. The need is for replacement.

Therefore, as an unbiased observer, we cannot concur with the unqualified statement that a guarantee cannot be given with a reasonable assurance of safety unless the condensers are checked. The age of a receiver is to be borne in mind. In such receivers greater attention must be paid to the operation of condensers, but once again, if the condensers appear to be functioning properly as bypass units as far as the signal is concerned, we would be prone to leave sleeping dogs lie and figure on the ten per cent protection fund applied to all jobs to cover the guarantee, take care of repeat calls—particularly when there is no guarantee furnished by the radio parts manufacturers that a new part just installed is going to function properly for a specified period of time. What do you think about this entire matter?

A Few Turns of Wire

ANOTHER year is passing and most certainly it has been hectic in many ways. A comment we heard just the other day makes us pause and consider the far-reaching effects of a few turns of wire—the control grid—inserted into a vacuum tube in 1907 by Lee DeForest. Forgetting daily radio broadcasting for a moment, we see that commercial transport flying in the United States would be a virtual impossibility without the radio beam and operation upon this beam would be impossible without the operating capabilities of the vacuum tube, which capabilities are due pri-

marily to the insertion of these few turns of wire. For further safeguarding of lives, we hear about a new terrain clearance indicator system which shows the absolute height above ground instead of sea level and this equipment operates on a frequency-modulated wave of from 420 megacycles to 445 megacycles.

That which is used on one hand to save lives is also used to destroy and maim the human being. Radio on ships or during a flood can direct a rescue. The same signal can also direct a fleet of bombing ships to destroy the lives of the inhabitants during a war—examples of which we hear every day.

Right in our laboratory we witnessed a demonstration which some day will contribute to the elimination of accidents at traffic crossings. We are speaking about the Halstead micro-wave traffic control. This is the system wherein sound waves, actual speech is transmitted from traffic towers to guide motorists and these warnings and directions are picked up by the car. Also the elimination of audible horn noises in automobile traffic by the transmission of a warning signal between cars by radio.

All of this is possible only because of a few turns of wire placed between the plate and the electron emitter of a vacuum tube. Each time that you pick up the telephone and talk to anyone at a distance, those few turns of wire come into play. Without it the tremendous advancement of the world in commerce and industry made possible because of instantaneous communication between the different parts of the world would have been greatly curtailed.

In medicine those few turns of wire are becoming of greater and greater import each day. Not only for the diagnosis of ailments of various kinds, by the measurement of potentials generated in the human body, the study of the heart and the brain, but for the cure of various types of sicknesses by means of artificial fevers created by the use of high-frequency oscillators.

Today we are told that Europe is in the midst of a war of nerves as well as bombings, nerves tensed almost to the breaking point by the dinning of radio propaganda each time a radio set is turned on. The dissemination of such propaganda of international scope is made possibly only because of these few turns of wire.

Television now in its embryonic stage with respect to applications is another development which would be impossible without those few turns of wire. Today it is a form of entertainment. Tomorrow it will be a form of advertising and the next day a military device for the scouting of enemy terrain, the observation of military objectives and the visual means of noting the success with which the enemy have been annihilated.

War or peace—commerce and industry—medicine or art—those few turns

of wire are playing an important rôle. Doubtful it is if any other invention of man finds application in such a diversified field and is of equal merit in all as those few turns of wire!

Frequency Modulation

THIS frequency modulation business is moving ahead at a rapid rate. A number of stations in different parts of the country already have received licenses and about two dozen more are pending. This was so about four weeks ago. Maybe by this time the number has increased.

From what is evident upon the surface, those manufacturers who are producing f.m. receivers (and more than likely others in the future will follow the same policy), are manufacturing a combination receiver embracing f.m. and a.m. types of transmission, wherein separate r.f., mixer, i.f. and demodulator systems are provided for the two types of transmission and a common audio amplifying system is used for both types of receivers. Also they are producing what a separate and distinct f.m. receiver embracing the usual r.f., mixer, i.f. and demodulator and audio system.

The idea of using a separate f.m. channel of r.f., mixer, i.f. and demodulator feeding into the common audio system no doubt will lead to the sale of separate f.m. converters which will be used with the audio system now in use in the a.m. receiver possessed by the customer. The frequency bands used in the f.m. receivers now in production range between 40 and 44 mc. for the carriers and between 2 and 3 mc. for the i.f.

Speaking in generalities and recognizing the advantages of frequency modulation, we still feel that many years will elapse before the conventional a.m. type of receiver will become obsolete and be replaced by the f.m. type of receiver. Operating upon the high frequencies, f.m. type of transmission is still subject to the vagaries and limitations of such transmission, hence in those sections of the country where the reception of stations several hundred miles distant is the required thing for radio broadcast operation, a.m. types of transmitters will be in use for a long time. And there are many places in these United States where transmitters are more than 100 miles from receiving centers.

Under the circumstances, it seems to us that the frequency modulation form of transmission is another one of those developments which the service industry must take in its stride without feeling any alarm that it will inject new requirements of radical nature into the testing procedure, cause revolutionary changes in the design of test equipment, etc. Incidentally the signal-tracing process of servicing takes frequency modulated receivers right in stride, for after all, it is just another type of receiver which operates upon a signal, a signal which is different than an a.m. signal, *but a signal just the same*. In fact, the f.m. receiver does not differ so very radically from the conventional a.m. type of receiver. If you were to glance at two schematics, one of a f.m. receiver and another of an a.m. receiver, you would not notice a number of differences.

True, the demodulator in the f.m. receiver is of the discriminator variety utilized in a.f.c. receivers, but we have seen such discriminators used in a.f.c. receivers, hence the tube circuit structure is not a radical departure. It is also true that a carrier voltage limiter is used in the f.m. receiver so as to maintain the carrier amplitude fed into the demodulator at a constant level, but once again we saw a similar arrangement used in one commercial type of a.f.c. double superheterodyne. Hence this tube circuit is not absolutely new.

We hear about the broad band pass used in the f.m. type of receiver, but upon closer analysis we find that the band pass used in the i.f. system, for example in a f.m. type of receiver, is not so very much greater in proportion to the peak frequency than the normal band pass used in the conventional superheterodyne operated at say 465 kc. For example 7.5-kc. sideband in a 465-kc. amplifier amounts to a band pass of about 4 percent of the peak frequency. In a f.m. receiver with 2-mc. i.f. peaks, side bands of from 75-kc. to about 100-kc. each side, amount to a total band pass of about 7 to 10 percent of the peak, so that what appears to be a very wide band pass actually is in line with that would be expected considering the basic frequency and circuit type.

Now, all of the comments made are not to be disparaging

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the f.m. form of transmission or reception or an attempt to belittle the significance of the development. All we are concerned with is conveying to the servicing industry the thought that frequency-modulation receivers will not upset the industry nor develop obstacles of insurmountable nature. Of course the servicing industry will have to acquaint itself with the basis underlying frequency modulation form of operation, but this can be done, just as other things have been accomplished in the servicing industry.

An Open Letter to Radio Magazine Editors

DEAR Gentlemen: What with the business data which is appearing every so often in radio periodicals there is room for some technical material along certain specific lines. For example very little if anything has been written about the amount of regeneration which is permitted to exist or is definitely introduced in some of the smaller receivers. Very often servicemen when repairing these receivers (and they are being repaired) remove the regeneration because they think it to be a defect. With the regeneration removed, the sensitivity is much less than should exist. How much should exist? Where should it be introduced? Where does the manufacturer introduce it?

"Now that experience shows that these cheaper jobs can be serviced at a profit because of the increased speed in servicing offered by signal tracing, the servicing industry is interested in more of the details concerning the operation and characteristics of these receivers. Granting that there is a limit to the sale of receivers within a certain price class, we doubt after an analysis of the market, that these cheaper receivers will ever disappear. As supplementary receivers for the household, they do serve a purpose. Hence we might just as well acquire all possible information about them so as to expedite the service procedure. Sincerely yours, John F. Rider." —30—

Fundamentals of Recording

(Continued from page 19)

disc, supplied with more than the usual amount of coating. The depth of cut is important and the scrap should be approximately the thickness of a human hair. Too deep a cut will result in cutting through the coating and on to the aluminum base and is to be avoided. Chances are that the needle would be ruined as well as the recording.

Aluminum blanks are sometimes used. These have a much higher surface noise than the acetates or plastic types. A diamond cutting needle is required when the grooves are not pre-cut. This needle actually drags along the record in application.

Choice of Amplifier

Here again, we must be careful to choose an amplifier which has the ability to pass all frequencies that are

to be fed into the cutting head. This amplifier must be versatile in its discriminator channel so that full advantage of tone correction may be used. Such an amplifier is the **RADIO NEWS FULL-RANGE AMPLIFIER** described in detail in the Dec., Jan., Feb. issues just past.

This unit has a power output of 10 watts undistorted or 15 watts peak and this is more than sufficient for full modulation of the cutting head. This amplifier may be seen mounted on the relay rack in the accompanying photos directly under the cathode ray oscilloscope. The circuit is the one contained in this issue. Reference to that article will show that provision has been made for both high and low-gain inputs. The output transformer will match any standard line or voice-coil combination.

Complete tone compensation is provided. Both the highs and the lows may be either *attenuated* or *accentuated* at will. This is exactly what we want when recording music at a recording speed of 33½ rpm. as will be explained later. We also can add further to the effect of played back recordings by including volume expansion for both the high and low frequencies. This applies mostly to commercial records which are sold on the open market. These are recorded within definite volume-range-limits, and do not represent a true picture to the listener as far as hi-fidelity is concerned.

A symphony orchestra has an overall range of about 52 db. This range is compressed in the studio to much narrower limits to prevent overcutting of the wax groove. The home recordist, on the other hand, does not have to be concerned about this condition as long as precautions are taken "not to overdo it," and to watch the depth of cut intelligently. So we can see from the explanation that in the home, a wider range is permissible and then the record may be played back without any expansion and be an original transcription in this respect.

The amplifier must possess a frequency range of from 30 to 10,000 cycles, both in fairness to the cutting head and to the sound source, such as a symphony orchestra. The amplifier must also be capable of rather flat characteristics in order to be capable of high-fidelity. The hum level must be extremely low so that no trace will appear on the record. This model of the **RADIO NEWS** amplifier has its power supply mounted on the lowest panel in the rack. This may be seen in the illustration.

Two plate current meters are provided instead of one on this model so that individual tube currents may be observed simultaneously. This is important and high-fidelity recording just will not permit any distortion in the amplifier. Shielding is most complete, from the input circuits all the way through to the output.

Playback Pickup

A much easier unit to choose is the pickup. This must be of good grade

and fully capable of reproducing all frequencies from the record. Many excellent makes are now sold which are able to accomplish this. First, we must consider the weight of the needle as it rests on the disc. This should not exceed two ounces. Next comes the type of pickup we will purchase. There are magnetic units, dynamic units, and crystal types to choose from. The fidelity will be in proportion to the cost of the pickup, in general. The magnetic units are the most durable and are less subject to temperature changes than the crystals. Either may be used for playback with about equal results.

The pickup should be free in its motion, both vertical as well as horizontal, so that the amount of wear on the record be kept to a low degree. The needle should always be tight in the armature when in use or the playback will lack true reproduction, particularly of the high notes. One of the latest types of pickups makes use of a miniature dynamic unit. These are now being used in many broadcast studios for transcription work. They possess a high degree of ruggedness found only in some of the best magnetic types.

Volume Indicators

Several types of indicators are used on recorders but the purpose of each is the same. Some of the low priced units make use of an a.c. voltmeter across the output line to the cutting

head. The better portables use a copper-oxide type of rectified instrument known as the DB meter. If high-fidelity recordings are to be made on acetate discs, we can highly recommend the instrument shown. This meter, a *Simpson model 47* has an especially designed solid bar magnet and is known as a "Slow speed" meter.

There are many sound passages which contain an abundance of instantaneous peaks that show on a fast reading meter in such a manner as to mislead the operator. We have found that it is far more satisfactory to have an accurate *average level* reading for best results and this instrument was chosen in preference to the high-speed types. The meter needle rises rapidly on peaks, but has a slow return downward across the scale. This gives enough time to observe the level which is not the case in some of the more commonly used methods of volume indicators. Suitable multipliers are provided to increase the range of the instrument to a maximum of plus 18 db. The meter comes in the standard range.

Radio Tuner

We must have a suitable tuner if we are to record programs from "off-the-air." The main requirement in the selection of this unit is to be sure that the full modulated carrier of the broadcast transmitter can be received. This is needed, of course, for maximum results. Most super-het receiv-

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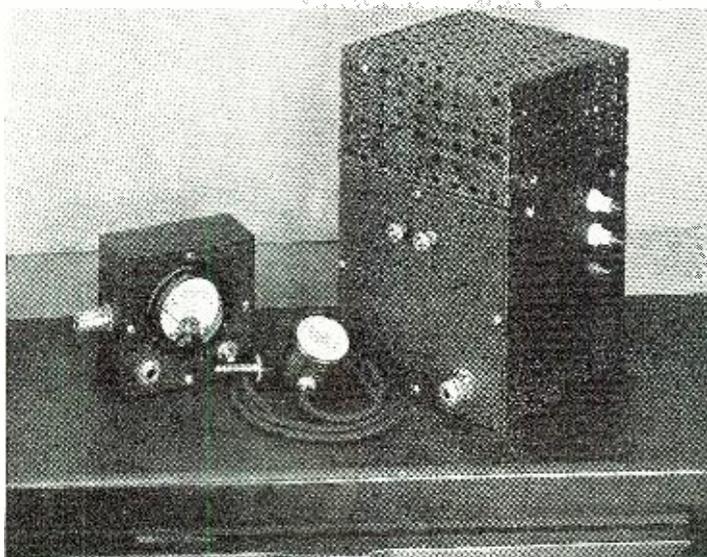
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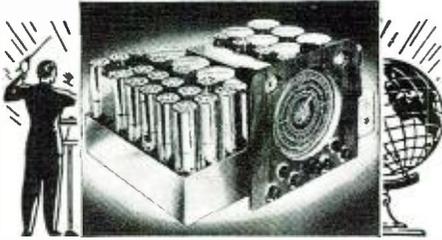
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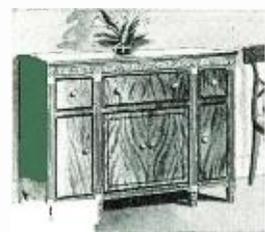
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ers on the market today possess a high degree of selectivity and are unsuited for high-fidelity as the side-bands of the carrier usually suffer unless the receiver is peaked to have flat-top characteristics.

It is better to design a tuner for any given recording setup and this will permit us to take full advantage of the full range of audio. Present regulations permit the broadcast station to transmit on a channel that is 10 kc. in width. In other words, frequencies as high as 5000 cycles appear on each side of the carrier frequency of the transmitter. When frequency modulation is adopted we may hear a much more complete audio range than is now possible from a conventional transmitter.

To meet present conditions we are using the tuner shown in this issue of RADIO NEWS. Note that this has been stripped to the bare essentials of an oscillator, first detector, and a second detector. The combination allows complete coverage of local stations with maximum fidelity. The selectivity is good enough to permit only one station at a time to be heard, and this without any side-band splatter from adjacent channels. The receiving antenna should be just long enough for all local stations to be heard at good volume through the amplifier.

Another type of tuner may follow design of the tuned radio-frequency type. At any rate, the one point to consider is that we must have "all of the station" appear at the amplifier or we cannot expect good results. The detector should operate as a rectifier on the best possible portion of the plate curve for linear detection so that no distortion will be caused by the tuner itself. Coupling is done to the low-gain input of the amplifier in conventional manner. It is best to establish a volume level at the tuner, and once set, not changed. Volume may be controlled at the amplifier with more accurate results.

Choice of Microphones

Here again, we find plenty of good microphones to choose from. What type is best suited to recording? The answer to that question will depend on what applications are to be covered most. For home recording of the family voices, the crystal, capacity, carbon, velocity, dynamic, or inductor may be used. If the microphone is to be passed around to various members of the family, we may choose one of the hand units. Probably the best will be the crystal. This unit is rugged and will operate in any position. If price is an obstacle, we may use a carbon mike with suitable handle, as shown.

If the recorder is one of the portables, we suggest one of the following: crystal, dynamic, or capacity (Velotron). A suitable collapsible floor stand may be carried about with the equipment and set up wherever the occasion presents itself.

For the professional or where the requirements are more exact, we have

found that not one, but two or three microphones may be used to good advantage. Such types as a dynamic, a directional crystal, and a velocity all find application for good recording. The dynamic type shown, *Electro-Voice 620C* is of high impedance type, performs well both inside as well as out-of-doors, and is not effected by wind, moisture, or temperature. This is ideal where sound-effect records are to be made. In the studio, the dynamic possesses characteristics which make it ideal for both voice and all types of music. By tilting the head to a vertical position, it responds to all direction with equal effectiveness. In a solo position, it permits either distant or close pickup with excellent quality.

The directional crystal type of microphone, *Shure Bros. Uniplex*, shown, is ideal where recordings are made in a hall or ballroom that has a PA system in operation at the same time as a record is being made. This mike is highly sensitive in the direction to which it is aimed and permits pickup in difficult situations that many types are not able to handle.

We have always had a soft spot in our heart for the velocity mike for pickup of a soloist. It seems to possess all of the qualities for this application in the studio. This microphone is particularly suited to a permanent setup in a room or studio. It features pickup from both front and rear with equal sensitivity, and is, therefore an ideal type to use for recording two or more people at one time, such as when reading script in a presentation of a play. It is not as well suited to outdoor pickup as the other types, as noisy operation will result when wind passes through the screen and moves the ribbon.

Many makes of microphones are available, and if one chooses with care, he may be assured of excellent response in connection with the high-fidelity amplifier used.

Recording Technique

Now that we know just what equipment we will need, we may go into the finer points of recording. We shall use the setup as shown as being representative of nearly all types, whether permanently located or set up at a portable location. There are definite steps that should be taken when using the equipment for the first time. First, the moving parts should be inspected for proper lubrication and cleanliness. Second, the recorder should be assembled (if necessary) following the manufacturer's specifications which accompany the recorder.

Third, the table must be absolutely flat. This may be adjusted with the aid of a small carpenter's level placed on top of the table. Undue wear on the record will result if this precaution is neglected. Fourth, the cutting needle should be inserted into the head in such a position that when it rests on the record, the angle should be 85 degrees. In other words—the needle should follow the record at an angle of 5 degrees from the vertical.

If too great an angle is used—chattering and echo will result in recording. The needle must be tightened securely before making a record. Some heads are provided with a conventional means of needle screw, while the *Universal* head is furnished with a small screwdriver and the needle is held firmly in place by tightening the set-screw. This method offsets possible chance of damaging the adjustment from accidental shock or impact, and also reduces the weight of the armature.

A flat is provided on one side of the needle shank and this side must face the front of the head and is on the opposite side of cutting edge. Turning of the needle is thus avoided. Never drop the needle onto the record but lower it gently *after the table is turning*. Failure to observe this rule will result in a gouged disc and possibly a chipped needle.

A test record should be run to determine whether or not there are any defects in the needle. Run off a few grooves and then play back for observation. If any noise is present, it will be heard as a scratch or hissing. Later you will find that a good needle will cut quietly and this may be judged by the ear without playing back. The needle should not be heard in a quiet room as it is cutting.

The depth of cut is extremely important. This, as mentioned in earlier paragraphs, should be adjusted so that the scrap is of the same consistency as *one* human hair. This adjustment is made with the spring tension on the right hand side. The cutting may also be observed by microscopic inspection. The microscope is a handy attachment to have when recording orchestra music or the like.

The scrap is highly inflammable and should be disposed of in a metal can with tight fitting lid. This scrap should be continuous thread if properly cut and should be shiny in appearance. If the scrap appears as a dull grey, it indicates that the cut is not great enough and the tension spring must be slightly loosened for deeper cut.

Some recorders cut at 98 lines, or grooves, to the inch, others at 102 and 110 grooves per inch. In the first case, the error of overcutting is far easier to prevent than in the other two, but in any case, the operator has to observe the precautions set forth in earlier paragraphs.

The first record should be made with microphone on voice from some member of the family in order to check the recording against the normal speaking voice of the subject. This recording should be a faithful reproduction and it is easy to compare the two for accuracy. The position of the subject with respect to the microphone is important for best results. By having the subject speak at different distances from the mike, the operator will soon find the best placement and this should be noted for any particular mike.

After the recordist has become entirely familiar with the fundamentals

in this type of procedure he may attempt the more difficult types of microphone pickup. It is best to progress in small steps as blank discs are expensive and are not to be wasted. Set up the microphone in the living room at home. This room is usually provided with enough carpets, rugs, and drapes to relieve any bad reverberation effects. If some member of the family plays, and a piano is available a test record may be run and then studied for comparison.

The manufacturer specifies how much volume is required for correct operation of the head. An average level of 14 db. is usually sufficient for nearly all magnetic heads. Too high level will result in distortion, overcutting, and unsatisfactory overall per-

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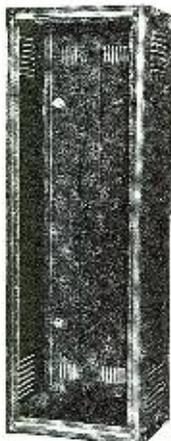
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formance. Too low a level will result in improper modulation of the recording head and the surface noise will be near the lower passage levels.

After each record has been made, the selector switch should be turned to the "playback" position and the recording studied for response, level, surface noise and any irregularities. Correction may then be made before attempting another run. Only by careful study can we expect to achieve good results. Make notes whenever possible on the label—such as the level used, microphone placement, etc. Then when an unusually fine recording turns out, we can tell at a glance just what conditions were used at the time.

Recording Broadcast Programs

The serious minded recordist will wish to record certain programs "off-the-air." Our own particular fancy in this respect is to record the *Sunday Evening Hour*. It so happens that this program enjoys a beauty of microphone pickup that is hard to beat.

When the selector switch is placed in the "record-tuner" position, all connections of the various units are automatically made and we are ready to proceed with the recording. Volume is adjusted at the amplifier so that a level of 14 db. reads on the meter. It is very important that the tuner be precisely tuned to the station or distortion will result. If the tuner has a tendency to drift in frequency, we must allow sufficient time for it to reach operating temperature before recording.

A form of aural monitor must be used in order to follow the program. The regular speaker provided in some recorders may be used to good advantage for this purpose, although this does not apply when microphone pickup is used. To do this, would result in feed-back from speaker to mike and the disc would be ruined. Headphones should be used for the latter.

Excellent recordings are made with good equipment, of orchestras which contain a wider range of frequency than do the commercial records or pressings in most cases. The surface noise is so low that one cannot detect needle noise unless the room is absolutely quiet. It is best not to "ride gain" when recording unless the music is of such a type that extremely low passages predominate. In such cases, the volume may be increased for the duration of this passage, and later returned to normal.

After a few records have been run, the operator will know just how much maximum and minimum range may be tolerated with his particular equipment.

Recording at Slow Speed

Many recorders are designed for both 78 and 33 $\frac{1}{3}$ rpm. In no case should the user attempt to record music at 33 $\frac{1}{3}$ until he is entirely satisfied with results on 78 rpm. This type of recording requires more elaborate treatment than does the standard speed and certain precautions must be taken in order that all frequencies will cut with equal ampli-

tude on the disc. The actual speed of the traveling disc near the inside is very slow and the high notes will suffer greatly if some correction is not made.

This requires that the high notes be boosted at the amplifier to overcome the losses. Trial will determine how much boost is needed. As the speed increases, these high notes will take-hold in normal fashion and the amount of boost may be reduced.

A good investment for the recordist is in the purchase of a *Universal* test frequency record. By using it as a standard of comparison, this record will be valuable and we can learn much about the characteristics of our equipment. This record may be played on an extra phono turntable and fed into the amplifier in the recording position. The test is then run and a recording made during the process. When played back, one may observe what changes have taken place from the original and studied for correction of the tone compensators.

The 16" transcription discs require even greater care in recording as the inside-to-out ratio of speed is greater than that encountered with the 10 or 12" sizes. These are most suitable for music when recordings are made at the higher speed and this is recommended where a 15-minute playing time is not wanted.

Frequency Response Recording

A cathode ray oscilloscope is a valuable addition to the recording setup. With it we may check the response of the amplifier in terms of voltage to frequency, study the harmonic content of the recording amplifier, and observe waveform under various conditions. The response of the cutting head may be determined by feeding the output of a beat-frequency audio oscillator into the amplifier and then on to the cutting head. The oscilloscope may be used as a no-current voltmeter so that the input voltage be kept constant at all frequencies. This is important, as we want to determine just what is taking place in the amplifier and cutting head.

If we know that the response of the amplifier is flat we may be reasonably sure that the head will be modulated at the same response as actually comes from the oscillator-amplifier combination. After the recording has been made, the disc is substituted for the audio oscillator and we may proceed in making a curve on the response of the head at various frequencies.

The decibel meter is used as an output indicator across the line. The volume at the amplifier is set to read 0 db. at the meter. The record is started and the first frequency, say 30 cycles from the record is read for level (frequency should be jotted down on the disc at each setting of the audio oscillator) prior to the test. This reading may be -10 db. The next reading, say at 50 cycles may read as -8 db. These are noted on a piece of logarithmic graph paper.

When we hit 200 cycles, the reading

may change to 0 db. and so on up the frequency range. Each frequency is marked on the graph and later, when complete, will give a true picture of the ability of the cutting head to respond to various frequencies. The gain at the amplifier *must not be changed* after the run is started. The response curve of the *Universal* head is shown in the accompanying illustration as an example of excellent characteristics.

Conclusion

We have attempted to give the reader a complete story on home recording without going into highly technical explanations regarding recording technique as it is known in the large commercial studios. Wax recording, etc., requires a treatise that, although similar to instantaneous recording, involves closer adherence to fundamentals and details and we feel this field is limited to only a very few and will not be discussed in this manuscript.

The reader may be assured of excellent results if he will but observe the fundamentals set forth. Purchase equipment with care, don't be too hasty to turn out the first records, study the individual parts of the recorder and the accessories, place microphones intelligently, watch the db. meter when recording, don't use excessive audio to the head, balance the audio at the amplifier to give pleasing proportion to the type of recording being played, keep new and finished blanks in a metal container to preserve their surface and to prevent undue hardening of the material, use only the best needles—both for cutting as well as for play-back.

By following these simple rules, you will produce the best recordings.

-50-

Hamchatter

(Continued from page 37)

ment rotary. Should have been DIS buying it from DSY.

BMR entertains WSJK last week in October, taking him around to various shacks for bull sessions. BMR also had VP3THE visit him November 4th, BMR receiving effusive thanks from VP3THE for BMR handling traffic for him. (Should be VP3THE, ed.)

I guess they call it "Piggy Back." It's the latest in Charlotte. FUA with EJE aboard worked W9ZLO. AYP worked T12FG with FUU in the hole. That didn't work. Experts at this game DSY with BME in the hole.

"Another young fellow," AYP has new 4 element rotary and *Deluxe Signal Splitter*. BMR's new rotary is in and in the air 67 or so feet. Don't miss an opportunity to visit Dave's shack while in Charlotte. That boy will be glad to show you around. He's a prolific worker and has the stuff which makes for efficient operating.

CLB and DIS relax after work by getting on 20. (I don't know how you call it relaxing.) CAY checking hum with ADG. FUA has new super-ultra speech amplifier, also 275' each leg of his V Beam. FVR pounding brass in the SS.

THE Toledo (Toledo, Ohio) Official Bulletin of the Toledo Radio Club. Joe Scott, who wargoned with Bill Johnson as to who would be the first to get veries from the 48 states, informs us he no longer has an all-wave receiver and the present BC receiver is on the fritz. Perhaps some fortunate member who has more receivers than he needs will help our little (?) Joe out.

When WSTLB heard of the failure of Paul Lent—W9TKS—and Bob Cook—WSTWJ—to obtain some ham news, he promised to put out a page or two on such items himself. However, before Larry could get really started, he was in the accident mentioned previously. When Larry comes back we feel positive he will do a bang-up job.

George Hemminger, who replaced W9ESN in the radio section of the Civilian Air Reserve, had a swell article on the air show in which this

section participated with very favorable comments from all.

Paul Luckman—W8KPH—and Lee have a splendid habit of dropping in little notes whenever things of interest happen. We wish more of you could be placed in the same category.

Have any of you either heard or worked W8HWF of Perrysburg while he was touring the west during the month of September? We understand he was fully equipped for portable operation.

W8RUU in a ham-gab with PNK talked for about five minutes before it occurred to him that his speech amplifier was shut off. Maybe PNK thought RRU's transmitter was suffering from laryngitis.

Thanks to Larry Scott, we read an article, accompanied with a picture which appeared in the Mansfield newspaper about a disaster preparedness test conducted by the Richland County Chapter of the American Red Cross and Boy Scouts in which the Mansfield hams played an important role of dispatching communications. In the work-out 25 scouts were drilled in sending and taking emergency messages. Fifty-two messages were handled seven times by radio, telephone and messenger.

Larry Gilsdorf—W8SCC—had some trouble with his transmitter because his crystal wouldn't stay in. According to our sleuth, he is on the lookout for a rubber mallet so he can keep tapping the crystal holder and thereby remain on the air.

W8TLB received a report on a signal of his of QSA-1, R-1. Some may call it a distinction, but others may not be so vociferous in their praise.

W8AVB, along with a couple of W8QUL's family, has had an appendicitis operation and should by now be back on his feet ready for revenge. (He's an M.D.) In a recent conversation with Doc, he informed your reporter of his working a South African ham on the latters last day of operation. Five minutes after concluding the QSO he heard that station go off the air for good. The war has taken a lot of joy from Doc because he is an ardent DX man.

W8LKP worked EA7AV on 20 meter CW, October 31st, with a signal report of 5-9-9 plus. Lkp had an input of 456.7 watts, and his frequency was 14,388 kc. It looks as if Spain is back on the air.

W8TKS has been put on record as having said that a three-way QSO was OK, providing it was out of town. Is he turning out to be a DX hound? Seems the BCL's have been getting under Paul's skin of late, because they have the audacity to call him up after getting him on their receivers. Well, Paul, all we can say is that you aren't a ham unless you get under the BCL's skin, only don't let it get under yours.

(Continued on next page)

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FEBRUARY ISSUE

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WSRZO es TZO are being called the E.C.O. twins.

Charlie Peters, our Michigan associate member, entered a five-meter hunt and walked away with a prize. He used the same set with which he took first prize in our own hunt over a year ago. In case some of you members would care to know, this set was designed and built by Ray Nantais.

W8PNX is called the Casanova of the air, the Romeo of the kilocycles, and the Don Juan of the ether waves. Maybe 'tis so, but we do know of one YL, he's "kinda took" on. KPH, his rival gave up the hunt, and today can be seen mulling over another femme's snapshot, and keep it under your hat, she's a T. U. co-ed!

Amid bushes and stammering George Hemminger failed to conceal the fact that his foot was too large for the bucket in WSPD's corridor last month while we were participating in the DX broadcast. Perhaps he was trying to kick the bucket!

W8OTR has been off the air because there has been no space in which to erect an antenna. Wonder if he ever thought about going down on 5 meters.

ESN es TLB, accompanied by Hemminger and Felix attended the Michigan Division of the Radiophone Association on November 14th and came back loaded to the gills with information on cathode modulation, which was the subject given by Don Armstrong. A lucky day for ESN because he walked away with a prize of \$7.50. Lee claims the idea of cathode modulation is not so new and has proof in some old radio books dating back to 1914, he says the idea popped up before loop modulation.

In a very mysterious way, from a very mysterious person, we were informed that Bill Golding—W8GJS—is going to be on the air again, so let's give him 3 rousing cheers and best of wishes for 100% QSO's.

ESN and Jr. constructed a two-tube receiver using a 58 into a 56, he used an 18-inch length of wire for an antenna, and the signals were picked through a loud speaker. With the receiver heterodyning he carried on a QSO with a ham a couple of miles away. On November 20th, Lee transmitted a special message to his son at the Science Room in DeVilbiss High School to which the rest of the class were invited and it was so interesting that the class remained in the room after the period was over and heard ESN through to the end of his subject.

HENRY POOLE, W6PJT, left Transradio for a position as announcer with KWAL, Wallace, Idaho. It is expected the W6 call will give way to a W7 shortly. Wondering, too, if he shouldn't put his Private Pilot License in cold storage until he gets out of the mountains. Will blossom out with a brand new rig on 20 and 40 in a few weeks.

FROM W2IOP we get the following interesting info:

That stupendous, colossal, conglomeration of signals attributed to the *Sweepstake Contest* is gone for another year, although lots of the boys still end up their calls with "SS BK." It's a good thing we're not bookies or odd makers because we predicted no new records would be set with seven Canadian sections missing.

At the present time it looks as if we're five liars anyway, because W2IOP, W9FS, W3BES, W3DUK, and W8OFN have all reached new heights. There may be other super-scores, and, if so, you'll probably find W3ARO, W1EZ, W7CMB, W6QLL, W8OKC, W3EDP, W3GZL, W8QDU, W1ICA, and W1TS on the list. The unofficial scores of the present six leaders are:

Call, Contacts, Sections, Approximate Score			
W2IOP	653	63	101,500
W9FS	652	61	98,303
W3BES	625	62	96,875
W8OFN	626	62	96,797
W3DUK	610	63	96,075
W9VES	632	62	85,000

None of the leaders are believed to have worked the full forty hour time limit. From the looks of things we can hold our breath and predicate the following section winners. However, this is by no means official and in many states where it is close we will very likely see some changes. Alaska, K7GOM; Eastern Pennsylvania, W3BES; Maryland-Delaware, d.c., W3DUK; Illinois, W9VES; Kentucky, W9FS; Ohio, W8OFN; North Dakota, W9ZOU; South Dakota, W9SEB; South New Jersey, W3EDP; Northern Minnesota, W9YCR; Southern Minnesota, W9VKF; Wisconsin, W9VYD; Arkansas, W5EIJ; Indiana, W9YB; Louisiana, W5KC; Mississippi, W5AYF; Tennessee, W4FCU; East New York, W2EWD; New York City-Long Island, W2IOP; Northern New Jersey, W2GSA; Missouri, W9RSO; Nebraska, W9ZAR; Vermont, W1EZ; Idaho, W7JC; Oregon, W7GPP; Washington, W7GMB; Nevada, W6QLL; Philippines, K4ILB; Colorado, W9WTW; Western Florida, W4BSJ; Georgia, W4DIA; West Indies, K4FCV; Arizona, W6KFC; Oklahoma, W5CEZ; New Mexico, W5HAG; Los Angeles, W6GRL; Kansas, W9QXG; Sacramento Valley, W6PAR; West Virginia, W8OXO; Iowa, W9QW; Virginia, W3BZE; Michigan, W8QDU; Maine, W1ASG; New Hampshire, W1BTT; East Massachusetts, W1KHE; Connecticut, W1TS; South Carolina, W4FNS.

Those are all we dare guess on, but it should give you some idea of the big scores. No doubt there is bound to be some mistakes in that list, but you can rest assured that everyone mentioned did very well. In some sections there are so many high scores you just can't start to predicate.

Philadelphia, as usual, was more than well represented in the SS. It looks like the *Frankford Radio Club* has the trophy again, but the

Columbia University Radio Club of New York will stand watching. W6QQL of Boulder City, Nevada, made many a ham happy. Not only coming through with a fb signal, 6QQL was accurate enough to give everyone a crack at the highly prized state. He probably completed more W4's and section lists than any station in the history of the contest. South Carolina is never over populated with amateurs, so 14-year-old W4FNS was welcome. K7GOM filled in that section for many of the gangs.

K7BAQ in Juneau was on but he just couldn't break through the QRM. Poster said that he called hundreds of the boys, but his thirty watts didn't create enough noise.

W2IOP missed Hawaii; W9FS lost out on Hawaii, Alaska, and the Philippines; W3DUK couldn't work Alaska; W1TS and W6RLL QSO'd all active sections; W9VES didn't get KA on the West Indies; and W3BES fell short on two sections. W3EJU, an old holdout for phone limbered up the arm to the tune of 282 QSO's in 59 sections. W8NLO turned in a tidy 76,065 points. W8JIN had 514 contacts and W9WFS had 439 in 55 sections. W9ZRP had 44 contacts in 61 sections got around 63,000 points. W6GRL's 635 contacts in 64 sections were worth 81,000 tallies. The fact he ran high power cost Dave the 1.25 multiplier and one of the big six scores. W2IOP had his best hours on eighty. W9FS did his best work on 40, and from the sound of it W6GRL really went to town on 20 meters.

We don't have a great deal of information on the phone contest, but W6OCH, W3DQ, W3GWQ, and W2HXQ are four likely section winners. The usual repercussions of the SS are dire threats by many big scorers "never to enter again in that % contest again." This year we quote a number of the boys. Doc, W8OFN is "THROUGH." He claims that doctoring just doesn't mix with contests. Seems that the patients were all getting sick just during the best hours of the SS. Besides that it seems a bleary eyed gentleman who has gone without sleep for 24 hours just doesn't look encouraging to worried people. You know we always get a kick out of the explanation in front of the various contests which explain they are so arranged that you can get your eight hours rest, meals, etc. But they never tried it, and we should know. W9FS who did so fine for a man in the SS for the first time said, "It's the last time, gents." W2HJM let NYCLI down, but he didn't let her down. As Auggie put it, "when a feller gets my age," ah yes, yes indeed.

Herb, W6QD has proceeded with his DX contest as per schedule. I guess everyone knows the Cubans are back on to help. Unfortunately it appears that it will be a rather one-sided affair in favor of the West Coast. The majority of the competing DX seems to be Asians and South Americans, both of which are better picking from W5, 6, and 7. *RADIO'S* contest is so worked out that it is possible to run a score up into the millions. But aside from the arithmetic heights some of the gang are likely to hit 200 QSO's, which in times like these is very FB.

We've done so much forecasting that we might as well extend the old neck a little further. East Coast high scorer looks like W2UK; West Coast leader and probable national high is gonna be W6GRL. DX has perked up somewhat and we're ready to award this month's pair of burnt out Eimac 500TH's to a DX station.

W2JB, who finally completed his W4C with VU7BR, tells us that if by any chance 7BR owes you a card a letter will bring a new one in reply. After all what else is 7BR going to do with his time?

ZB4UC on 14385, T9 claims he's on Ascension Island and says he will send a list to the *ARRL*. He says *NOT to QSL to him or he will get in a lot of trouble*. He is on frequently between 9 and midnight, so says W2GT.

Reviving cathode modulation has greatly lessened the cost of phone. With a slight variation series modulation has brought down the price even a bit more, in as much as no audio power supplies are necessary. Which all brings us to the point that some of the phone men should watch their step a bit more carefully. The great American public can listen in on most amateur bands and since they don't copy CW its phone that holds the stage. Some of the nonsense that traverses the ether is almost an insult to the thousands of fine phone operators all over the country. Besides that, the general quality of many signals is not only annoying to phone men, but downright selfishness. Splashing over the phone band, and often into CW channels it is a wonder nobody wises them up. *ARRL* official observers, who have a thankless job if ever there was one, deserve the applause of everyone for at least trying to eliminate this trouble. However, it isn't on OO's job alone—it is the duty of every ham to keep the bands in good shape. We just brought this up now because we were wondering what might happen if somebody develops a system of modulation where you just yell at the final amplifier. A constructive suggestion that will probably alleviate a lot of the trouble is give honest reports. If a signal is T4 don't be ashamed to tell the other fellow; after all it isn't *your* signal. Seriously though a T7 isn't so bad, and there are far few less T9 signals on the air than the average log would indicate.

No doubt all of us are put to wondering about amateurs abroad and how they are faring in the present crisis. A long letter from G5FA will at least give you some idea. Bill is an employee of a marine insurance company. Fortunately he hasn't been called to active duty, but he was forced to leave his family in London and move to company headquarters in the sub-

urbs. All amateur gear was confiscated by the Post Office Department; in this case a transmitter, all tubes including an HK24 sent as a gift from the U. S. A., four crystals, and a rack & panel for a new transmitter which had never been out of the carton. As Bill put it, "It was like being a fish out of water after spending every day on the air for the last two years talking to my many friends."

The Radio Society of Great Britain has decided to keep going in an attempt to hold together the unity of the British amateur, and so that when the terrible affair is over and done with they will stand less chance of losing their rights on the ham bands.

An appeal which is likely to be heard often, this time from G5FA: "I hope the fellows over there will make the fullest possible use of the ham bands so that none of the commercial people wiggle their way in on this side of the pond and cause us to lose our DX bands."

G5FA reports that W's have been roaring in on all bands. The ten meter band is reported in fine shape with W's coming in R9.

G2PL, who has come to live in London since the war stated that 40 has been excellent with W6's coming through well in the early morning. There are so many restrictions on that the gang are not holding their district meeting like they used to. However, on Sunday they intend to hold meetings in the afternoon. The idea of the "fireside" chats in the afternoon is to give the boys ample time to reach home before the blackouts. Bill was recently elected district representative of the RSGB for North London and Hertford.

W2120, secretary-treasurer of the Columbia University Radio Club promises that W3BES and the Frankford monopolists are due for a sudden shock.

The officers of the Peninsula Amateur Radio Club in Virginia are: President, A. C. Jones, W3NE; V. President, V. C. Grubbs, W3HW; Treasurer, W. H. Penny, W3GSV; Secretary, G. W. Hodday, W3IQ. The club has just purchased 16 new crystals on 1830 KCS, for an emergency net.

A regular hamfest took place at W3IFL's when W8SKD; W3FOU; W3IHV; W3GCZ; W3HBO; W3GDK; W8IHU; W0LST; W3FKW; and several SWLS dropped in. All the amateurs in South Norfolk, Virginia, work for the utilities company.

The Norfolk Amateur Radio Club is rapidly becoming one of the outstanding outfits in the country. They having been holding joint meetings with nearby clubs, as well as putting on some of the liveliest programs attempted by any group. Among their rosters are W3EMM; W3BWA; W3HRC; and just about every live wire in that part of Virginia.

From the *RADIO FLASHES* published by W3FBF and the Arnold Company in Richmond, "Down Where the South Begins," we quote a poem dedicated to a newcomer, W3IKV, Jimmy Dickinson:

"Now, Jimmy-boy, just a word of advice—
Unless you cool the plate with a cake
of ice,
You'll never get to see that 'East Side
of Heaven.'"

When you run a kilowatt to that 807!"

The Richmond Radio Club isn't letting any grass grow under their feet. W3ALP; W3BZE; W3EQQ; W3BKG; W3PMY; W3GRU; W3GKI; W3GWQ; W3HAO; and W3FBL are the most active of the gang. The club meets every other Friday at the YMCA. A new Y is under construction in Richmond and the club hopes to secure a permanent radio room in it. The live wire club has both CW and phone winner of the 1939 SS among its members in W3BZE and W3GWQ.

W3GWQ is not Acting SCM of Virginia, so there isn't much they haven't got.

W2HAP of Far Rockaway is putting out a healthy signal of 160.

W21UQ is now signing W1MIJ at Dorchester, Mass.

The American Emergency Net may be heard on 160 at 10 P.M. Wednesdays.

W21OP is spending most of his time handling traffic.

W2OB is another 40 meter steady, and is probably on more than any other ham in the second district. His R9 signal on 7000 KC, almost runs WWV competition.

Brooklyn Tech is continuing their ambitious program with the construction of a new television receiver.

The D.A.S.D. is attempting to keep organized during the European trouble. (For what?)

The R.E.F. has completely disbanded and will do nothing until amateur radio is permitted again.

We are pleased to report that the W's are handling the phone situation of 40 in fine style.

In case you hear KC1USA, KC4UB, or KC4USC don't be surprised. It is the *Byrd Arctic Expedition* which is expected to get on the air sometime early next year.

A little something happened on 20 meters that is mighty interesting. LU2CW was heard calling CQ DX with "Don't call LU2CW, call CX2AJ" tacked on the end of each sign. In the meantime W7AYO was heard calling QST. When he finished with his QST CX2AJ broke through with another QST and repeated W7AYO's QST about the SS contest. It sounds complicated, it is complicated, and we surely would like to know what the boys were up to.

AND that about winds up the HC column after this month. Watsa matta wid you fellers? Stipping? There's do-re-me in sending in

your info to this dept. We pay 'n pay 'n pay! Will want to keep this dept. the tops for the type it is in these here United States. But we can't do it without your support. Make notes in your logs, and then send them in—in long hand if you haven't a will—and get extra for the dope to buy yourself that new thingamajig you've been wanting since Hector was a pup. Some of the Checks that go outta here are this BIG!!! Anyhow, thanks for past favors and we hope we'll BCNU. Ed. -50-

Ringing the Bell (Continued from page 33)

Of course, there are the "hold-outs" among you who say, "I don't know anything about bookkeeping." "It's too hard to learn." "It doesn't make sense," etc. For those of you who feel that way, and for the vast majority of radio dealers and servicemen who sincerely want to know more about a relatively simple system of bookkeeping, we will explain the basic fundamentals, without getting too involved in theory, and then apply them to a working, practical system which we are using in our business.

Now, before you can understand any bookkeeping system, you must understand the use of two terms—*Debit* and *Credit*.

A "*Debit*" is a charge against a person or an account.

A "*Credit*" is an entry in favor of a person or an account.

For instance, let us start with the "Cash" account, as bookkeeping is based upon the receipt and disbursement of money and the "Cash" account is the temporary depository for this money. Let's assume for a min-

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ute that the account is an individual—Mr. Cash. He holds the money you take in until you desire to pay it out again. If you give him \$5.00 to hold for you, naturally you must *charge* him with that amount. Therefore, as a "charge" is a "debit," this would be a *debit* entry on the books. If you then took \$3.00 away from him to pay someone else, you would make a *credit* entry on the books to off-set \$3.00 of the \$5.00 he originally held for you so that the *difference* between the two entries would be \$2.00, the *balance* he now holds for you.

In bookkeeping, when a *debit* and a *credit* column are side-by-side the *debit* column is always to the *left* of the *credit* column. Likewise, when separate accounts are used with *Debit* entries on one side of the page and *Credit* entries on the other side, the *debit* is *always on the left side*.

To illustrate the entries we are going to talk about, we will use what are called "T" accounts as shown in Fig. 1. These are called "T" accounts because the two basic lines form a letter "T." Above the horizontal line is placed the name of the account. To the *left* of the vertical line are placed all *debit* entries. To the *right* of the vertical line are placed all *credit* entries. Thus, as shown in Fig. 2, the "Cash" account which we spoke of earlier would have a \$5.00 entry on the left and a \$3.00 entry on the right side.

So far, we have spoken about only *one side* of the entry. In *double-entry* bookkeeping (the type now considered standard for all types of business) there must be *both a debit and a credit entry* for each transaction. This is where the "pants-pocket" and the "two-column note-book" systems fall down. They tell you but half the story.

For instance, let us say that you made a radio repair for which you received \$5.00. You receive the \$5.00 and give it to "Mr. Cash." You, therefore, *debit* or *charge* the "cash" account with \$5.00, and *at the same time credit* "Repair Sales" (or whatever name you use for the account) with the \$5.00, as shown in Fig. 3.

Let us now suppose that you purchased *parts* to the amount of \$3.00, paying cash for these items. In this case, you would *credit* the "cash" account. You have now taken away \$3.00 of the original \$5.00 and you *debit* "Parts" (or whatever name you desire to use for the account which shows the cost of the parts you buy) with the same amount. Fig. 4 shows the proper entries.

With these two examples in mind, you can now begin to see the value of *real bookkeeping*, for you now have a record of cash receipts and disbursements *plus their origin*.

Next, let us assume that you repair a radio on credit. The bill is \$6.00 and you desire to make an entry on the books showing the customer owes you \$6.00 for the repair. To do this, you would *debit* the customer's account

with \$6.00 and, once more, *credit* "Repair Sales" with the amount. Then, when the customer pays the \$6.00, you would *credit* the *customer's* account with \$6.00 (closing it out) and *debit* *Petty Cash* with this amount. Fig. 5 shows these two transactions, with the first two entries shown as (1) and the second two entries shown as (2).

Now, let us assume that you buy \$10.00 worth of parts on credit. You must *credit* your supplier with \$10.00 and *debit* the "*parts*" account with \$10.00. When you pay for the parts, you *credit* "Cash" with the \$10.00 obtained from it and *debit* the supplier's account, balancing it out. These two transactions are shown in Fig. 6, with the first two entries marked (1) and the second two entries marked (2).

You can see that if you had paid the account in two payments, of \$5.00 each, you would have made two entries in the Cash account and two in the supplier's account. Before the second entry was made, the supplier's account would show that you bought \$10.00 worth of goods from him and had paid him \$5.00 on account, leaving a balance of \$5.00 owing. The second \$5.00 entry would show you as "even" with the supplier. Fig. 7 shows these entries.

Now let us assume that you received a \$7.54 C.O.D. package of parts on which there was due (1) a bill for the parts (\$7.40) and (2) postage and C.O.D. fees (\$0.14). Most servicemen want to keep their transportation

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MARCH ISSUE

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separate from the direct cost of their parts, thus, you would *credit Cash* with \$7.54, the total amount spent and debit "*Parts*" with \$7.40 and debit *Transportation* with \$0.14 as shown in Fig. 8. Likewise, if you desired to keep the cost of your tubes separate from the cost of other parts, and the \$7.40 was made up of \$3.40 worth of parts and \$4.00 worth of tubes, you could *debit* them on *separate accounts* (see Fig. 9).

Remember there is *no end* to the breaking-down of items into separate accounts. You could even have a separate account for each type of tube or part, but this would be ridiculous. It is always best to start with a *minimum* number of accounts so that you will not make the system a burden on you instead of a *profitable help to you!*

Every serviceman should have a checking account at the bank. Here, again, is a permanent record of your major disbursements. If you also have a "Petty Cash" box which you can use to receive all money and either pay it out (when in small quantities) or make your bank deposit from it, you will be very nicely set up to handle your flow of cash.

Many servicemen feel that when they need money for their *personal* or *family* use, they can merely lift it out of the same pocket. This should not be done, unless a "Personal" account is kept on the books and in the serviceman's name. Thus, when he "borrows" \$3.00 to buy the hamburger meat, etc., for the next week, he *debits* his "*Personal*" account and *credits* his "Cash" account as usual. See Fig. 10. If he spends some of *his own* money, temporarily, for business expenses, he should *credit* his "Personal"

account and *debit* the correct account or accounts. ("Expense," "Parts," "Tubes," etc.) as shown in Fig. 11.

Against these debit personal account entries, he should make a *credit* entry in his personal account every week, or twice a month for *salary* which he should draw the same as if he were working for someone else. The *debit* entry would be made in the "*Labor*" account. This set of entries is shown in Fig. 12. He can now draw on his account up to the amount of the entry.

Suppose that during the week you drew \$5.00, \$2.00 and \$10.00 for personal use. There would be three *credit* entries in the "Cash" account and three *debit* entries in your "*Personal*" account. Now, you feel that the business can pay you a salary of \$35.00 per week. At the end of the week you *Credit* your account with \$35.00, *debiting* the "*Labor*" account with the same amount. You have spent \$17.00 of this \$35.00, thus you can now draw \$18.00 more out of your cash drawer or the bank, *crediting* "Cash" for this amount and *debiting* your account. This is shown in Fig. 13.

Now, we shan't trouble you with any more "debits" and "credits."

Please read over the information in this issue so that you can get it clearly in mind. Next month we will continue this bookkeeping discussion. In the meantime, keep the two budget accounts growing — *Advertising* and *Shop Modernization*. After this series on a practical bookkeeping system, we will bring you some ideas on Shop Modernization. If you find these series of articles of worth to you, drop a letter through RADIO NEWS giving us your reactions. We can also use photographs of modern—but *modern*—radio shops, unusual shop decoration or display work, new advertising ideas that have worked in your territory, etc.

For every business-getting idea that "rings the bell" and is accepted for publication, the author will award a copy of that swell "Radio serviceman's bible," Gharardi's "Modern Radio Servicing"! For every picture of a modern radio shop used for publication, the author will award Gharardi's twin pocket gadgets, "Home-Radio Trouble Shooter," and "Auto-Radio Trouble Shooter." So, come on you business tycoons, exercise your brains—ring the bell!

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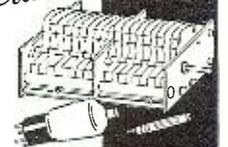
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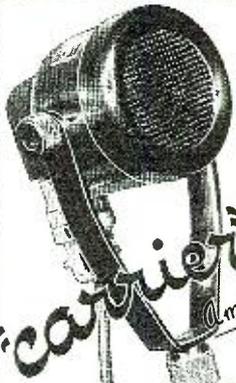
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Aviation Altimeter
(Continued from page 14)

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(Continued on next page)



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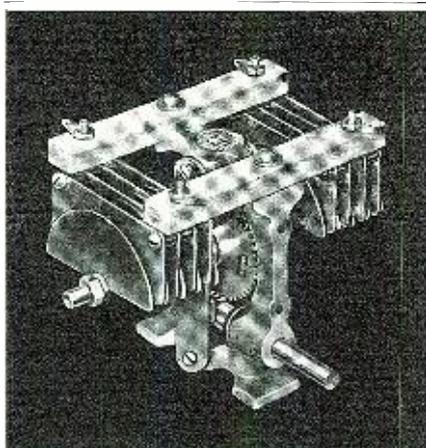
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But before the radio altimeter becomes as commonplace as two-way radio communication apparatus is today, there is much more yet to be discovered about its utmost potentialities.

For example, the signal which it now projects from the airplane spreads downward cone-like pattern over an angle of about 40°, giving the pilot his height over the highest point in that area, extending slightly ahead of the airplane. Work is now in progress on adapting the same principle as is used for the radio altimeter to the development of a radio collision prevention device, which would warn the pilot of obstructions in his path.

Still other possibilities even more fascinating, even more far-reaching in their implications, are also in the offing, taking shape under the imaginative pencils of many engineers. —30—

Power Supply (Continued from page 21)

between the 6A3 grid and its filament (center tap grounded) is due to the difference between the negative voltage with respect to ground developed across R_2 and the positive voltage developed across the 6SJ7.

When the E.C.O. is keyed, the action which tends to maintain the voltage constant at 500 volts is due to two effects. First, any decrease in current in R_2 results in a less negative bias on the 6A3 causing it to draw more current and hence to compensate for the decrease in current due to removal of the E.C.O. tube from the supply. Second, any increase in voltage which does occur results in a greater bias applied to the 6SJ7 so that it draws less plate current. This causes the plate to become more positive since the drop in R_2 is less. The bias on the 6A3 is thus made less negative so that this tube draws more current with the resulting compensating action. By proportioning the resistors correctly, the 6A3 may be made to draw sufficient current so that when a 75 ma. load (this is the load taken by the E.C.O. oscillator tube) is removed, the voltage developed between the filament and the plate of the 6A3 remains practically constant. The value of R_2 should always be chosen so as to give approximately a 100 volt drop. As the total load current flows through this resistance, it should be capable of handling at least 30 watts. If the power supply is to deliver 300 volts to a speech amplifier which draws approximately 100 ma., the value of resistor R_2 should be reduced to about 200 ohms, while R_1 should be increased to 3000 ohms. The 110 a.c. switch is positioned in the primary of the transformer and a pilot light with a green jewel is connected across one of the 6.3 volt filament windings. A second switch of the high voltage snap type is positioned in the negative lead of the power supply in series with a 500 ma. pilot light. With this latter switch

open, the 110 volt switch may be closed, lighting the filaments of all the tubes, including the two 5Z3 rectifier tubes, after which the B supply switch may be closed, lighting the red pilot light and placing B voltage on the plates of the tubes. The pilot light in the negative end of the B supply has the further advantage of acting as a fuse on the high voltage circuit.

Construction

The whole power supply is placed on a standard chassis 7" x 17". The rack panel may be chosen any height desired to fit into the rack panel mounting. The minimum height for clearance of tubes, filter condensers, and transformers is 8". An 8 $\frac{3}{4}$ " panel was used on the power supply shown. The positioning of parts is shown in the illustration. It will be noticed that the supply has been made as compact as possible. All high voltage leads are positioned below the chassis and a 6-prong socket is used to terminate the proper voltage for the suppressor grid, the voltage for the screen, and the high voltage for the plate of the oscillator tube, plus the 500 volts for the amplifier tube plate.

Performance of Power Supply

The performance of the power supply under varying load conditions is as follows: With the load of the oscillator removed, that is, key up when keying the oscillator, the voltage at the 300 volt tap is 307 volts; when the key is down, the voltage is 300 volts.

—30—

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... a valley buried deep in the wilds of South America ... hemmed in by radio-active cliffs ... a land where there is no night ... where a life is Utopia! THERE you can give your frayed nerves the kind of relaxation they deserve! Let *Orlin Tremaine* take you into a new world of imagination ... read his fascinating story, "JAU OF RADIANT VALLEY" ... one of the six great stories that will bring relief from the European war, politics, or "problems" at the end of a hard day's work. Plunge into the

MARCH ISSUE

fantastic
ADVENTURES

ON SALE JANUARY 16

Video Reporter

(Continued from page 31)

can do a better job with instructive programs than radio has done to date.

ONCE again—and this time with little ballyhoo—NBC used telephone lines to convey a sporting event from Madison Square Garden to the Radio City television studio. The Tony Canzoneri-Al Davis prizefight was the event and NBC holds the pick-up was good, showing marked improvement over a bike race telecast employing the same wire relay method a few months earlier.

This event was very significant. It showed that the bike race program was not of the stunt variety and that continued use of the wire plan may lead to a wide-spread permanent use of telephone relays for video presentations.

Prize-fights seem to be ideal for television. It's a pity that fight promoters seem to fear the use of television as a threat to their business. We're told that they are not worried by the fact that persons can look-in at home. There are too few sets in private use to let that point disturb them. But it's said that they are annoyed by large groups of persons flocking to video-equipped public and semi-public spots—such as stores and theatres—to view the fight.

IT didn't take long after the start of regular television programs in New York for several entertainers' unions to attempt to gain jurisdiction over the newest performing medium. A truce was effected with the arrange-

ment last November to establish a committee to negotiate talent contracts for a half-year. The committee includes representatives of the Actors Equity Association, the Screen Actors Guild and the American Federation of Radio Artists.

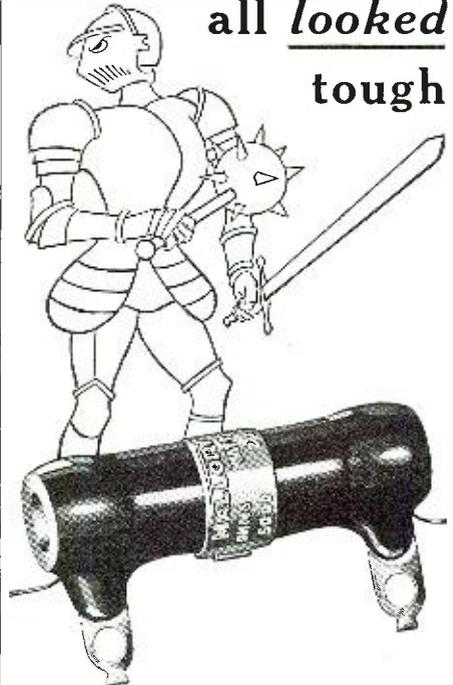
ELLSWORTH C. DENT, educational director of the RCA Manufacturing Company, recently predicted a wide field for television as an educational aid when network programs become available on a national scale, according to word reaching us from Camden. We didn't receive the full text of Mr. Dent's talk which was delivered at the third annual Southern Conference on Audio-Visual Education, but we will comment, however, on the brief summary sent out of his firm's headquarters. That a wide field exists for television as an educational adjunct is certain. But we don't think it has to wait for national networking. There's no reason why the topic must be neglected in single video service areas before the establishment of a television network. Education can be a major program heading right at the start of individual station's schedules.

WE'VE been hearing a lot about television networks lately. Of course, such a development as linking stations in various parts of the country together is an important step. Particularly impressive are the plans under way to relay NBC's New York programs to the General Electric video station in Schenectady. This link, as well as the contemplated New York-Philadelphia relays, may be the wedge for nation-wide networking. But we think it's more important at this time to start local program services in as many areas as possible. A network cannot exist until enough local stations are in operation. The immediate industry trend should be to promote telecasting in all important population centers.

WE hear of a spurt in activity at several experimental stations in various parts of the country. The fact that unscheduled test programs are going out at frequent intervals shows there's still life in some of the old licensees. The experimental licenses don't call for a definite amount of "on the air" hours. Commercial licenses probably will. And being obligated to a regular schedule—and a costly one at that—is something to consider carefully in advance. It's likely that when the FCC says the word "Go!" on commercial telecasting, several of the present experimental stations will drop from the field entirely.

WHEN we consider what's happened to television in England since the start of the new European War we can't help but think that perhaps the FCC is doing the right thing about not letting television run away with itself in this country. Of course, trade conditions are drastically differ-

**Knights in armor
all looked
tough**



In ye olden days, knights in armor all looked tough. Their appearance in boiler plate suits depended on the skill and artistry of the blacksmith. But beneath these coverings of steel, fought the knight that rescued the fair lady, and the blackguard who plotted the downfall of a throne.

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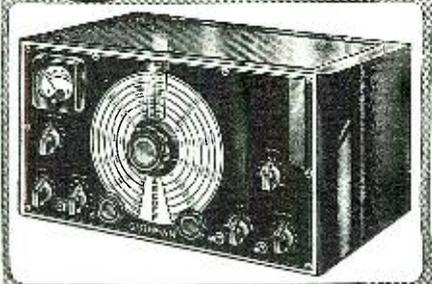
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- 100 watt use 1107-13
- 250 watt use 1108-10
- 400 watt use 1108-8
- 500 watt use 1108-7

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ent in a neutral nation, but when we hear of the disappointments brought about in the London area due to the suspension of television programs after more than 20,000 receivers were in use, we think it is essential for a substantial program service guarantee to be made in every area where sets are sold.

It was recently mentioned in a London plea for resumption of video service, that the Postmaster-General once gave an assurance of continuation of television programs until 1941. But it seems that the service period could not practically be continued after war was declared.

The result: Millions of dollars are tied up in equipment that cannot be used. Even this might be unimportant as compared with the huge task that awaits the British television industry in re-selling Londoners on television when the war ends. The abrupt ending of the initial television service—even though the action may have been an obvious necessity—will call for supersalesmanship in the reintroduction of the product. —30—

Serviceman's Experiences
(Continued from page 20)

I've been active as a registered volunteer Scouter, and I know my deeds contribute to a worthy cause."

"He could have repaired his own set, instead of bothering us, couldn't he?" I asked. "By the way—what's this extra work get you?"

"The satisfaction of seeing boys grow into better men," Al replied, "but I wouldn't expect you to see any value in that sort of thing."

"I work for five years in a radio store with you, and what am I?" I asked the ceiling. The boy friend of the whirling dervish—with a partner gone dizzy doing good turns!"

"You needn't be so cynical," Al came back. "If you want to be over-practical, don't forget the good will in the boy's family isn't exactly bad advertising."

"I thought so," I said. "After all that high-sounding talk, you've got your hand out!"

"The good will is incidental," Al said, using a tone that made me end the session. But the argument wasn't over.

As I stepped out of the truck the next morning, I spotted Lewand coming toward the store carrying two table models. That, I decided, was the occasion for a show-down with Al—before we were saddled with a double load of the repair requirement.

I picked up the tool-bag, ran into the store, and called Al to the counter.

"That Scout is coming here again," I said, "and I warn you I'll stop work the minute you begin to waste any more time with him." I threw down my tool-bag as an accent against youth. "What's more," I continued, wagging my finger under Al's nose, "If you don't get rid of him quickly, you and I are permanently through!"

Al wanted to answer, but I didn't give him a chance. Instead, I turned and strode sedately out the door. That is, I would have strode sedately if I hadn't tripped over the tool-bag.

What a fall!—all over the place! I couldn't get up; one ankle seemed to be full of hot solder. I was sitting on the floor, leaning back on my elbows, when Lewand entered. He laid the two sets on the counter.

"These belong to my father and my uncle," he explained. "If you finish work in time, please deliver them tomorrow night."

Then he saw me on the floor. "Why—what's the matter?" he asked, kneeling and putting one arm behind me.

"He just failed in an acceptance test for power diving," Al explained, "and came to rest in a position of siesta."

"Ohhh!—my ankle," I groaned.

Lewand removed his neckerchief and bound it tightly around the top of my shoe. "Might be a bad sprain," he announced, "so you'd better get a doctor. This bandage will act as a temporary support till you get to bed. Here—put your left arm across my shoulders and stand on your right leg."

My feelings had changed completely while I watched him care for me. "Where did you learn that first aid?" I asked.

"A Scout is always prepared," the boy replied, pulling out his Scout Manual. "The temporary treatment

IF STALIN WERE A STREETCAR MOTORMAN

... he would not be listed on the company payroll as a dictator! If repairman John Doe improves the operation of Mrs. Jones' receiver, should he be labeled a "radio engineer"? The title "radio engineer" has often been seriously abused, and has therefore fallen into disrepute among the men most deserving of its use. What, then, are the requirements necessary to justify the title "radio engineer"? You should know! Don't fail to read "WHAT IS A RADIO ENGINEER?" ... in the

March Issue



ON SALE FEBRUARY 9

for your trouble is described under First Class Requirement number Six."

He turned to Al. "Shall I drive him home?" he asked.

"Might as well," my partner agreed. "A person in his mental and physical condition isn't of much value in a radio store."

I hobbled to the door.

"When you get him home," Al added, "tell him that unless he watches his step, he's going to have trouble under another classification."

"Whick one?" Lewand asked, reopening the Manual.

"Seventy-seven B!" Al laughed. "Take him away!"

-30-

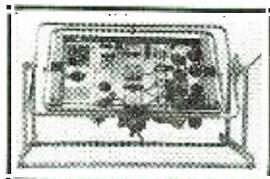
Analyzer

(Continued from page 39)

- 31. One 5 pin adapter wired to (2-4-6-8-7) of Octal top.
- 32. One 6 pin adapter wired to (2-3-4-5-6-7) of Octal top.
- 33. Two 7 pin adapters wired to (2-3-4-5-6-7-8) of Octal top, one small and one medium base.
- 34. One special plug made from Octal

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- base by removing all pins except No. 8.
- 35. One Fahstock connector for above.
- 36. Four cadmium plated screws for mounting switch assembly size $\frac{1}{2}$ x $1\frac{3}{4}$ ".
- 37. One small amount of black lacquer for finishing base-board and making plastic fill-in push buttons.
- 38. One small amount of red lacquer for fill-in red buttons.
- 39. One small amount of Plaster of Paris for mixing with lacquer to make plastic.
- 40. Hook-up wire of No. 18 solid Push-back in at least 3 colors.

-30-

Revision of R.N. Amplifier

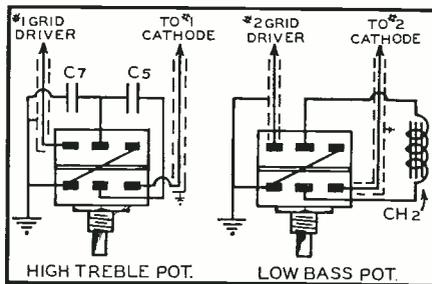
(Continued from page 24)

ent only at the driver tube in regular form. The reverse is the same in application, that is, we may select only bass for expansion by setting the potentiometer R2 in the bass channel to pass this audio to the 6F8G.

Any combination of highs are thus possible to expand simply by setting these two R2 pots to proper proportions.

Notable musicians agree, that herein lies the solution to wide range expansion that has been lacking for so long.

The only changes needed from the diagram discussed last month are shown in heavy lines. Inasmuch as standard parts are used throughout



Tone compensator connections.

this entire unit, no trouble will be experienced by the builder in duplicating the results that this amplifier is able to give.

Summarizing; we caution the reader to use the parts specified in the parts list or to select substitutions with care. The values shown are critical in some cases, and for this reason, any substitution is not recommended. Shielding of all wires as shown is important if a minimum of hum level is to be attained, and care should be taken that no short exist between these shields and the wire itself.

In order to connect the two-tone compensators in the proper manner, we have shown a pictorial drawing of the top view, facing the lugs. Be sure to wire these exactly as shown or the entire system will not work as intended. Reasonable care will give the constructor an amplifier he will be proud to display and demonstrate to his friends.

-30-

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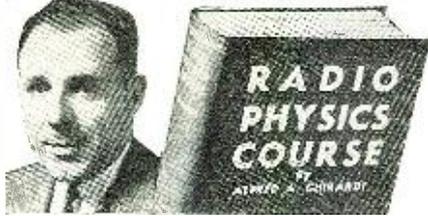
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RADIO PHYSICS COURSE

by Alfred A. Ghirardi

(Continued from January issue)

Magnetism in radio: Magnetic fields, permanent magnets and electromagnets perform very important functions in radio and television transmitting and receiving apparatus. Radio and audio transformers, magnetic types of loud speakers, phonograph pickups, B eliminators and power packs, battery chargers, etc., all depend for their operation on the proper use of magnetism and magnets. In fact, the transmission of radio signals themselves is partly due to the actions of the electromagnetic fields sent out through space by the transmitting aerials of the broadcasting stations.

The proper use of magnetism also plays a very important part in our everyday lives. There could be no dynamos for generating e. m. f. commercially on a large scale, and no electric motors to turn the wheels of industry, if it were not for the action of magnets. The telegraph, telephone, and thousands of other common necessities of life depend upon magnetic action. Like electricity, we cannot actually see magnetism, but that does not prevent us from learning a great deal about it by studying its many effects which can be seen and measured.

Natural magnets: We probably all first come in contact with magnetism during our childhood days when we "discover" that the common small steel horseshoe magnet, (painted bright red) will pick up nails, needles and other iron objects. Some of us also find that a straight bar magnet consisting of a magnetized piece of hard steel will point north and south when suspended in a horizontal plane by a piece of thread.

Magnetism first became known to our world many years ago, (probably independently in different places and at different times) when it was discovered that lumps of a certain kind of iron ore found in the ground would always point approximately to the north star (direction of the north pole) when suspended so that they could move freely. This ore was used as a compass by the early Norse navigators and for land navigation by the Chinese as early as 218 A. D. This ore (iron oxide, Fe₂O₃) was called **lodestone** or **leading stone**. It is now called **magnetite**. Not all magnetite is found already magnetized.

(To be continued)

Meter Shunts (Continued from page 11)

through the shunt and 1 mill through the meter. Figuring it out, the shunt is $498 \div 4$ or $124\frac{1}{2}$ " long.

However, there is still one more factor to be considered. It is not good practice to have more than about 25 mills go through a single strand of this wire because of heating effects. The 250 mill shunt carries about 250 mills, so it will be necessary to use 10 strands of wire, each 10 times as long. This means the shunt will be made of 10 strands of wire each 20".

The 100 mill shunt will need only 4 strands of wire, each 4 times as long. It can be seen that a small error in measuring the lengths of wire, say 1/16" in the 250 mill shunt, means an error of only 1/3 of 1%. This is considerably more accurate than the meter itself, as most meters are only accurate to 2%. With other shunts, a similar error would affect the accuracy even less.

If such accuracy is not so important, the highest current shunt can be made equivalent to only one inch of wire. In this way, only half as much wire will be required and the shunts can be made more compact. Their accuracy will still be within 2%. As you probably noticed, the internal resistance of the meter is only a small part of the total circuit resistance, and the error would be slight if it were disregarded altogether.

If only a limited quantity of several different kinds of wire are available, it is a simple matter to find their relative resistances. Refer to Diagram 3. Connect 10" of our standard wire minus the internal resistance of the meter, 10"—7/8" or 9 3/8" in this case, at S. Set the meter to read full scale and then connect the unknown wire at the points x x, varying the length until the meter reads only half scale. The resistance of the unknown wire is then equal to the resistance of 10" of the standard wire. Suppose it required 12" of wire. It would then be necessary to use 12/10 as much of this wire as was necessary with the standard wire. Thus the 250 mill shunt would be 20" x 12/10" or 24" long if made of this wire.

The constructor may use any form of mounting the shunts he desires. Two methods are shown in the accompanying photograph. A wooden dowel was slotted and the wire wound in the slot, with two small holes drilled near the ends of the dowel for the No. 18 wire leads.

The other methods shown is more compact. Two pieces of hook-up wire are twisted together, insulation and all, and the resistance wire wound around the twisted part. The ends of the resistance wire are soldered to the ends of the hook-up wire.

If the shunts are to be used with a.c. the resistance wire should be doubled before winding on the form in order to make them non-inductive.

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RADIO NEWS Tuner
(Continued from page 23)

throughout the entire United States. The resultant program comes to you then much in the exact manner in which it is being played in the studio.

While there is not any particular radio engineering problem involved in building the tuner, nor in tuning it to peak performance, the results of the combination of this radio tuner and the RADIO NEWS Full-Range Amplifier will afford the user something most unusual in broadcast receiving sets.

Mostly the tuner is designed for use in the cities of the first class where the local broadcast stations of high power are available, but I have been reliably informed that this tuner is being used in outlying districts where only small broadcast station signals come in, and yet the tuner operates with excellent reception results.

No cabinet work was included in my model of the r.f. tuner since it is understood that each reader will, for himself, want to mount the tuner in a cabinet of his choice. It is suggested, however, that tuner and amplifier be mounted together in a walnut cabinet. This would make indeed a fine looking unit which would grace any living room.

Photo-Cell
(Continued from page 26)

socket and the photocell in the 4 pin socket. Turn the potentiometer to the extreme left. Connect a milliammeter (0-25) ma. range with the positive terminal on No. 8 pin of 25L6G, and negative terminal to ground. Cover the photocell so that light cannot enter. Plug the line cord into a 110 volt a.c. outlet and allow the unit to heat for several minutes. Now adjust the pad until the meter shows approximately .2 ma.

Now remove the cover from the photocell, and with a moderate light falling on the cell, advance the potentiometer until the relay closes. Place the cover over the cell again and the relay should fall out. Recheck the meter current and if necessary readjust the pad to get .2 ma.

Remove the meter from the circuit and solder a wire from pin No. 8 on the 8 pin socket to ground. The photocell is now ready for operation. **CAUTION.** Never advance the potentiometer further than is necessary to close the relay. This potentiometer controls the voltage applied to the photocell and should never exceed 60 v. a.c.

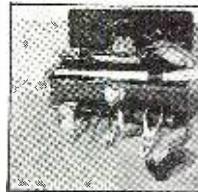
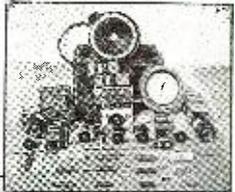
Many other uses for this unit will be seen around the ham shack. It also offers a means for experimental work. The light source shown consists of an auto head-lamp, a resistor, and a special lens to concentrate the light so that it may be transmitted to the photocell with maximum efficiency.

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Bench Notes

(Continued from page 15)

"Master of—?" I began puzzled.

Pete explained: "It's because your words carry so much weight."

"Oh, thanks, fellows," I said, greatly pleased. After all, I enjoy a compliment as well as the next fellow. "About that method of charging," I said, assuming the air of an experienced arbiter, "I'd say both of you were right. It would depend on the customer."

Cliff was exasperated. "Look," he said, "I can get a fair price from any customer. This particular job represents about three hours' labor. How can we be honest with ourselves by quoting a dollar thirty-three cents per hour? I'm going to charge Mr. Duke five dollars for labor, and he's going to be satisfied when he pays it!"

"Go ahead—make a fool of yourself," Pete said. "I still think it's better to charge more for parts, and let the set owner think he's getting a bargain. How are we to know you won't charge nine and one, and then tell us you charged five and five?"

"Simple," Cliff replied, "I'll take M.H.T. along as witness."

I rode with Cliff, pretending to be his assistant. Pete had been right. Man, was that prospect mad!

"Five dollars for labor?" he yelled. "That's 50% You must have a deluxe shop, with two screwdrivers! Or are you one of those fellows who demands to be paid for what he knows, not what he does?"

"Mr. Duke," Cliff said, "I believe you are employed as a mechanic by Finn & Haddie."

"I am," Duke replied. "But what's that got to do with a broken-down radio?"

"Well," Cliff remarked, "—"

The customer stared blankly for a moment, and then laughed.

"Boy," he said, "ya got me! How soon can you deliver the set?"

What would you have said to satisfy the customer and cinch the job? —30—

QRD? de Gy

(Continued from page 27)

ence" is at a premium, there is little if any chance of developing those "top" men since the ones further down will never have the chance to move up without there being someone to take their places at the bottom.]

THE FCC isn't foolin'. They recently released the following: "Robert P. Herzig suspended 1st class radiop for a period of 15 days because licensee, while employed as a radiop aboard SS. Charles R. McCormick, on July 24, 1939, failed to obey orders of the Master by leaving ship for an extended period of time without permission and failing to report at the scheduled sailing time for radio watch as directed during navigation of said vessel from Chester, Pa., to Baltimore, Md., in violation of Sec. 358 of the Communications Act of 1934, as amended." Yousah, me hearties, there ain't no more regaling the gang 'bout the time you went AWOL in some port. (Page 65, please)

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CITY & STATE.....

HERE'S one for the books: "There's a lot of the old *IP 501's* in use yet and a lot of the boys like to work break in but it means an extra skywire. But the jiloppy blocks when the Xmtr is keyed. Top this off with a flock of microphonic *201A's* and the Break-in is a headache. We have one of those squeak boxes left. . . . So I get around the above mess and get FB bk-in as follows: *201A's* are first replaced with *37's* and there are no more microphonics. A couple of hours with a soldering iron and a new set of sockets well worth the trouble. Use a short skywire of about three or four feet hung parallel to Xmtr lead-in with about three inches spacing between them. Everything but the blocking detector taken care of now! Hang a half watt neon bulb across the ANT-GND posts after removing the internal resistor and gluing the base back in place. No more blocked detectors . . . and watch the visitors stand with their mouths open as the bulb does a hula." [Ed.: If youse chappies can top this, shoot the works in.]

WELL, as we go to press we hear that fifteen to twenty vessels are due to be launched under the supervision of the *Martime Commission*. These are in addition to those twenty-two vessels which had been built and launched a few months ago with the aid of the *Commish's* rehabilitation program of \$350,000,000 which was appropriated to build 137 ships. Now we're wondering if radiops will have to be built according to specifications to man these iron monsters. So it would seem that there are untold berths going begging for some capable men to sleep in and work in, if this log-jam of war-seared tie-ups stop our boats from leaving U.S. coastal harbors. But you can always have the consolation that you're not on one of the warring nation's battlewagons, waiting for your turn. 73 . . . ge de GY. —50—

What's New in Radio
(Continued from page 30)

especially adaptable to television development requirements. It is available in two models: Type 175, for study of high- and low-frequency recurrent phenomena; and Type 175-A, in which control circuits have been added to the saw-tooth oscillator, permitting single-sweep control of the horizontal deflection.

New high capacity, high voltage condensers in working voltages of 600 volts and 800 volts and in both round and square can and square cardboard types have been introduced by the Sprague Products Company, North Adams, Mass. They are specifically designed for public address and theatre applications where working voltages are high and where surges run over 600 volts.

The high capacities and high voltages are obtained by the use of dry electrolytics connected in series and designed for long, trouble-free service. Full capacity, full working voltage, low leakage and low power factor are assured by exclusive Sprague design and construction features.

Finch Mobile Facsimile Unit Type DM is a complete, self-contained dual (send-receive) facsimile station, ready to operate over existing radiophone, telephone, telegraph, intercommunicating system, factory call system, or wired radio circuit.

Weight: 40 lbs. for fixed, 25 lbs. for mobile station use (approx.).
Dimensions: 15x14x9 in. high (approx.).
Power Supply: Operates on 6, 12, 24, 32 volt battery; or on 110 or 220 volt 60 cycle a.c. or d.c. Also available for 25, 50 and 52 cycles.
Output: Takes place of any microphone and feeds zero db. level at 500 ohms. into radiophone or wire line.
Input: Will operate of radio receiver of 5-watt rated output, or from wire line.
Blanks: Same as usual telegram—8½ wide by 7 inches. Maximum copy space, 8x5½ inches.

Save Money!
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EVERYTHING IN RADIO AT LOWEST PRICES!

In the Radolek catalog you will find the MOST for your money! Lowest Prices! Best Quality! Biggest values! Most complete Stock! Fastest Service! Send for your FREE copy NOW!

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The world's most complete stock of radio repair parts and exact duplicate replacements. All leading brands at lowest prices!

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All types. RCA, Sylvania, Raytheon, Philco, etc. Includes Kellogg, special Majestic and transmitting tubes. Complete selection.

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The most complete line ever displayed in any catalog. All leading makes. Includes latest improved 1940 models at lowest prices.

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A Huge selection of money-saving set bargains! New Phono-Radio combinations. Automatic tuning sets. Beautiful cabinets. New "Ham" receivers and equipment.

EVERYTHING FOR AUTO RADIO
Complete new auto radio section. Includes vibrator replacement guide, new auto aerials, custom panel control plates for all autos.

COMPLETE P. A. SELECTION
New 1940 public address amplifiers from 5 to 100 watts. Complete P. A. Systems for permanent, Mobile and Portable use.

NEW ELECTRICAL APPLIANCES
Extra profits for you! Standard Brand Electric Irons, Stoves, Heaters, Percolators, Waffle Irons, Vacuum Cleaners, Trains, Clocks, Mixers, etc., at lowest prices!

FREE Mail Coupon

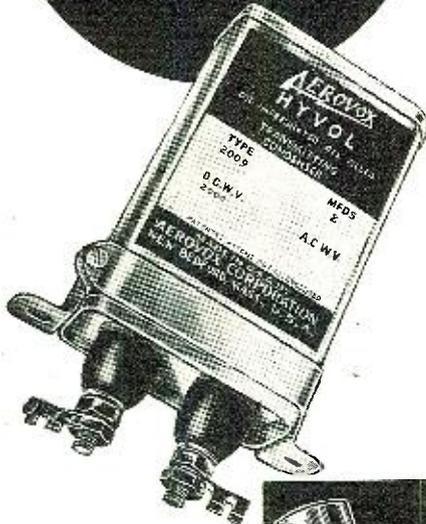
The RADOLEK Co.
601 W. Randolph, Chicago, Dept. T-38

Send the 1940 Radolek Radio Profit Guide FREE.

Name

Address

Service man? Dealer? Experimenter?



By providing still greater choice of working voltages, the 1940 AEROVOX line of condensers is definitely aimed at longer-life assemblies.



In oil-filled paper capacitors you now have the popular rectangular type in voltages up to 5000 D.C.W. In round-can, up to 3000.



In molded bakelite mica, you can have the mica bakelite (yellow finish) in any standard type at slight price increase, for exceptionally low-loss performance.



In electrolytics, AEROVOX still insists on generous-proportioned sections for longest service life, even though space-saving units are also available where compactness is the No. 1 requirement.

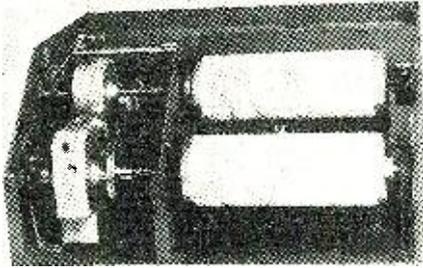


New CATALOG, 1939-40 Edition, now available, tells the story. More pages, more items, more choice. Ask local supplier for catalog—or write us direct.



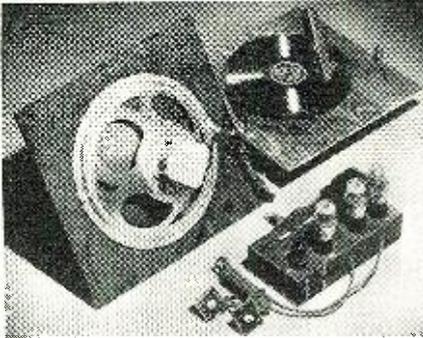
Plain paper for transmitting, special for receiving.

Speed: 8 sq. in. per minute.
Loading: Blanks clip on respective drums.
Drums loaded and unloaded without removing drums.
Synchronization: Exclusive Finch synchronization.



No external synchronization means required. Receiving drum lockstepped with transmitting drum. Synchronization maintained regardless of power source.

Montgomery Ward now makes it possible for anyone to have a new modern phonograph, or phono-radio outfit, both combined in one kit. The amplifier gives the outfit power enough for



any ordinary hall, while the volume control makes it ideal for home use. It comes complete, ready for operation, merely by inserting in any cabinet or bookcase and plugging in the cord. The outfit consists of a Motor Board Assembly, including offset-Crystal pickup, self-starting phonomotor, off-on switch and volume control, 9-inch turntable, needlecup, and 6 foot a.c. line cord. Motor board is 24x24x1/2 inches.

The powerful 12-watt Amplifier has convenient external volume and tone controls connected with 3 foot shielded leads. Mounts anywhere in your present cabinet. Size: 15x9x4 inches high. Uses one 6SC8, two 6V6G and one 5U4G rectifier tube. 12-inch P.M. Dumatic Speaker mounted on heavy baffle board. May be sawed to fit. Entire outfit draws only 120 watts from any 105 to 125 volts.

Within Earshot of the Editor
(Concluded from page 4)

market for replacement batteries of portable radios purchased during the previous year. In addition to this, figures will become available which will indicate to what extent tubes will have to be replaced and to what extent the entire radio market has become saturated.

THE aviation transmitter which is a leading article of this month's issue is a result of careful study in collaboration with Joseph Hartranft, Jr., Executive Secretary of the *Aircraft Owners' & Pilots' Association*. The problems presented in airplane transmitters are radically different from those which the ham has to face. In the first place, there is a problem of weight and then there is also the problem of power. The ratio of weight to power is in direct proportion the measure of the adaptability of the instrument to aviation work. In addition to this, there is the matter of compactness, since an aviation trans-

mitter should be located as close as possible to the center of gravity of an airplane.

After many months of paper work, and numerous conferences, the *RADIO NEWS Private Flyers' Airplane Transmitter* was designed. The original laboratory model was tested by "Doc" Hartranft in his "Monocoupe" with surprisingly fine results. Don't fail to read the article. In reading it, if you do not happen to own a plane, or are not interested in aviation, the *Private Flyers' Transmitter* makes an excellent *QRR* rig, which may be slung over the shoulder on a strap and carried to the most inaccessible places. Occupying slightly more than an eighth cubic foot of space, we believe it to be the smallest transmitter of its power ever constructed.

THE article by Oliver Read on recording is unique in that it is a symposium on the subject. Much has been written about each one of the phases in the matter of recording, but we have been unable to find, under one single cover all of the subjects so cogently enumerated by Mr. Read. Recording, especially home recording, is becoming an increasingly popular hobby, and the fundamentals which Mr. Read has laid down in his article should be memorized by every hobbyist in order that he may obtain the maximum results from his equipment. We recommend this article highly to those who wish to make their own records with more than the ordinary success.

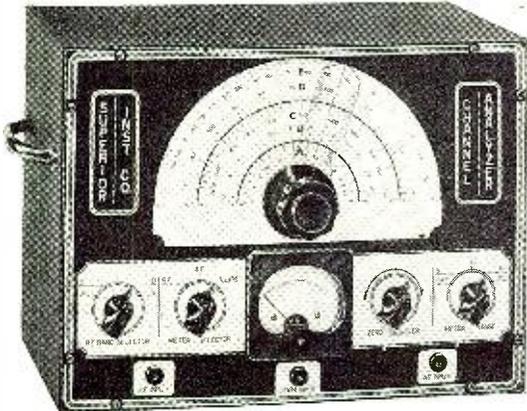
REPLYING to the numerous requests of readers for a radio tuner to be a companion piece to the *RADIO NEWS Full-Range Amplifier*, we had A. B. Cavendish of Savannah, Ga. "go to town" with the design of such an instrument. When we received the unit in our office we were anxious to try it out, and, hooking a small piece of wire to it for an antenna, we listened to superb tone quality as it came from the *Full-Range Amplifier*.

Using the *selective expansion* for which the Amplifier is famous, we were delighted to find that we had here, in effect, a high-fidelity receiver. For those who have already built the *Full-Range Amplifier* and who would like to have a tuner to go with this unit, we recommend the very simple two-tube (and power supply) instrument designed by Mr. Cavendish. If the hobbyist will acquire a tuner, amplifier and a recording unit, he will be completely set up to take recordings from the air in a manner which will delight the most exacting.

THAT about winds up another paragraph and also the column for this month. Although we are writing this late in the month of December, by the time it reaches you Winter will be with us in full swing. . . . Anyway, enough of this, and so until next month—
Best 73. KAK.

THE NEW CHANNEL-ANALYZER

Follows the SIGNAL from Antenna to Speaker



The well-established and authentic SIGNAL TRACING METHOD of locating the very circuit in which there is trouble, and the very component that causes the trouble, is now for the first time available at a price any radio serviceman can afford.

THE CHANNEL-ANALYZER will

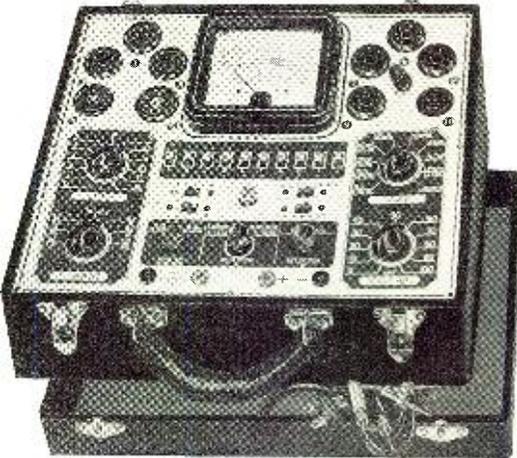
- ★ Follow signal from antenna to speaker through all stages of any receiver ever made.
 - ★ Instantly track down exact cause of intermittent operation.
 - ★ Measure both Automatic-Volume-Control and Automatic-Frequency-Control voltages and circuits without appreciably loading the circuit, using built-in highly sensitive Vacuum-Tube Voltmeter.
 - ★ Check exact gain of every individual stage in receiver.
 - ★ Track down and locate cause of distortion in R.F., I.F., and A.F. amplifier.
 - ★ Check exact operating voltage of each tube.
 - ★ Locate leaky condensers and all high-resistance shorts, also show opens.
 - ★ Measure exact frequencies, amount of drift and comparative output of oscillators in superhets.
 - ★ Track down exact cause of noise.
- The Superior Channel-Analyzer comes housed in shielded cabinet and features an attractive etched aluminum panel. Supplied complete with tubes, three specially engineered shielded input cables, each identified as to its purpose. Also full operating instructions. Size 13"x10"x6". Shipping weight 19 pounds. Only **\$19⁷⁵**

THE NEW MODEL 1280 SET-TESTER

Combines Models 1240 and 1250

A complete testing laboratory in one unit, the Model 1280 combines the Models 1250 Multitester and 1240 Tube Tester. (See specifications of each below.)

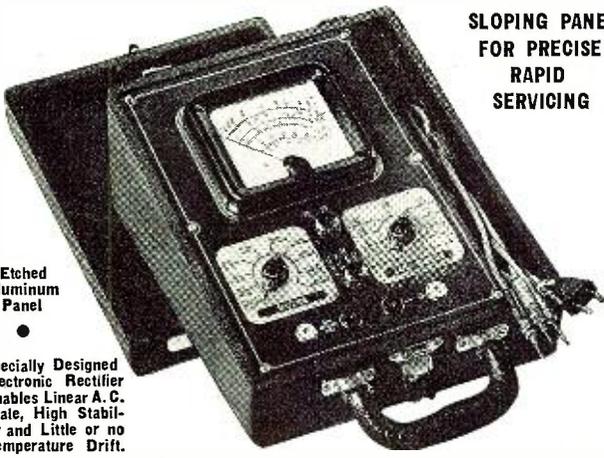
- ★ Instantaneous Snap Switches Reduce Actual Testing Time to Absolute Minimum.
- ★ Spare Socket and Filament Voltages Up to 120 Volts. Make the Model 1280 Obsolescence Proof.
- ★ Latest Design 4 1/2" D'Arsonval Type Meter.
- ★ Works on 90 to 125 Volts 60 Cycles A.C.



Even those servicemen who through past purchases know they can always get SUPER-VALUES from Superior, will be amazed and delighted when they read the specifications of this all-purpose instrument and then note the unbelievably low price. The Model 1280 features a 4 1/2" D'Arsonval type meter for easy reading of the various scales, and in line with our new policy of stressing appearance as well as serviceability in our new 1200 line of test equipment, our Model 1280 utilizes an aluminum etched panel, designed for beauty as well as ruggedness. The primary function of an instrument is, of course, to make measurements accurately and when designing test equipment this is our first thought. However, we also appreciate the important part the appearance of an instrument plays in the impression a serviceman makes on his customers, especially on home calls. We have, therefore, paid special attention to the outward design of all of our new instruments. For instance, the panel of this Model 1280 is made of heavy-gauge aluminum and etched by a radically new process which results in a beautiful, confidence-inspiring appearance. Model 1280 comes complete with test leads, tabular data and instructions. Shipping weight 18 pounds. Size 13"x11"x6 1/2". Our net price **\$19⁹⁵**

Portable cover \$1.00 additional

THE NEW MODEL 1250 MULTITESTER



SLOPING PANEL FOR PRECISE RAPID SERVICING

Etched Aluminum Panel

Specially Designed Electronic Rectifier Enables Linear A.C. Scale, High Stability and Little or no Temperature Drift.

Here is an opportunity to acquire a Multi-Service, Precision Engineered Instrument, for less than you would have to pay for an ordinary Volt-Ohm Milliammeter. Besides making the usual volt, resistance and current measurements (both A.C. and D.C.) this unit accurately measures the CAPACITIES of mica, paper and electrolytic condensers, INDUCTANCE of coils, chokes and transformers, DECIBEL gain or loss, of power amplifiers and public address systems, WATTS output of amplifiers, receivers, etc.

SPECIFICATIONS

Complete A.C. and D.C. Voltage and Current Ranges	High and Low Capacity Scales
D.C. Voltage: — 0-15, 0-150, 0-750 volts	.0005 to 1 mfd. and .05 to 50 mfd.
A.C. Voltage: — 0-15, 0-150, 0-750 volts	3 Decibel Ranges
D.C. Current: — 0.1, 0-15, 0-150, 0-750 ma.	—10 to +19, —10 to +38, —10 to +53
A.C. Current: —0-15, 0-150, 0-750 ma.	Inductance: 1 to 700 Henries
2 Resistance Ranges	Watts: Based on 6 mw. at 0 D.B.
0-500 ohms, 500-5 megohms	in 500 ohms .006000 to 600 Watts

Model 1250 works on 90-120 volts 60 cycles A.C. Comes complete with test leads, tabular charts and instructions. Shipping weight 9 lbs. Size 9 1/2"x11"x6 1/2". Our net price..... **\$11⁸⁵**
Portable Cover \$1.00 Additional

THE NEW MODEL 1240 TUBE TESTER

Instantaneous Snap Switches Reduce Actual Testing Time to Absolute Minimum

Tests All Tubes 1.4 to 117 Volts

Sockets for All Tubes—No Adapters

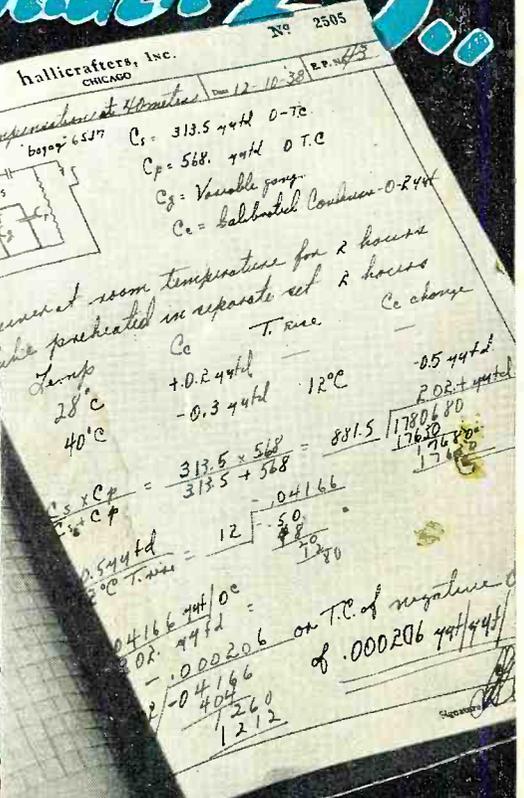
Superior is proud to offer the newest and most practical tube tester ever designed. Unbelievably low in price—unbelievably high in performance.

- ★ Tests all tubes, 1.4 to 117 Volts, including 4, 5, 6, 7, 7L, octals, loctals, Bantam Jr., Peanut, single ended, floating filament, Mercury Vapor Rectifiers, the new S series, in fact, every tube designed to date.
- ★ Spare socket included on front panel for any future tubes.
- ★ Tests by the well-established emission method for tube quality directly read on the GOOD ? BAD scale of the meter.
- ★ Jewel protected neon.
- ★ Tests shorts and leakages up to 2 megohms in all tubes.
- ★ Tests leakages and shorts in all elements AGAINST all elements in all tubes.
- ★ Tests BOTH plates in rectifiers.
- ★ Tests individual sections such as diodes, triodes, pentodes, etc., in multi-purpose tubes.
- ★ Latest type voltage regulator.
- ★ Features an attractive etched aluminum panel.
- ★ Works on 90 to 125 volts 60 cycles A.C.

Model 1240 comes complete with instructions and tabular data for every known type of receiving tube. Shipping weight 12 pounds. Size 6"x7 1/2"x10 1/2". Our Net Price..... **\$11⁸⁵**
Portable Cover \$1.00 Additional

SUPERIOR INSTRUMENTS CO. 136 LIBERTY ST., DEPT. RN2 NEW YORK, N. Y.

Back of the Skyrider 23..



A communications receiver—no matter how well constructed—is no better than its engineering. Each function in the SKYRIDER 23 was carefully analyzed from the most scientific approach before it was incorporated into the final circuit. (This page on drift characteristics from the Laboratory Data Book is an interesting example.)

The SKYRIDER 23 has everything—*absolute reset accuracy on the main tuning dial*. The same station always comes in at the same place on the dial. All functions are under front panel control—band indicator and switch—S-DB meter—RF gain—pitch control—tone control — A.N.L. switch — selectivity switch — send-receive switch — audio gain—crystal phasing control—main tuning—phone jack. Has entirely new band switch arrangement—8 positions. Bands 1-2-3-4 cover 545 kc to 44 mc. Bands 5-6-7-8 are preset bandspread for the amateur 10, 20, 40 and 80 meter bands.

Take a SKYRIDER 23 home *tonight* from your Parts Jobber's—for a \$23.10 down payment—and listen in on history in the making all over the world!

"Here's What Other Owners Say!"

"... has been received in perfect condition and is now in operation at W9--. I am more than delighted with performance."

"The SX23 has confirmed my previous belief that it is superior to anything I have ever used."

"There is one point I would like to mention at this time: the unusual stability of the SX23. To satisfy myself as to the merits of the 'compensated coil and condenser' arrangement in the SX23, I tuned in WWV broadcasting standard frequency transmission on 5,000 KC. Room temperature 92 degrees. An electric fan was then turned on and directed against the side of the receiver, blowing through the vent grill and into the set. WWV remained as steady as a rock on the same dial setting. 30 minutes later, the same condition existed with absolutely NO CHANGE in dial setting."

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