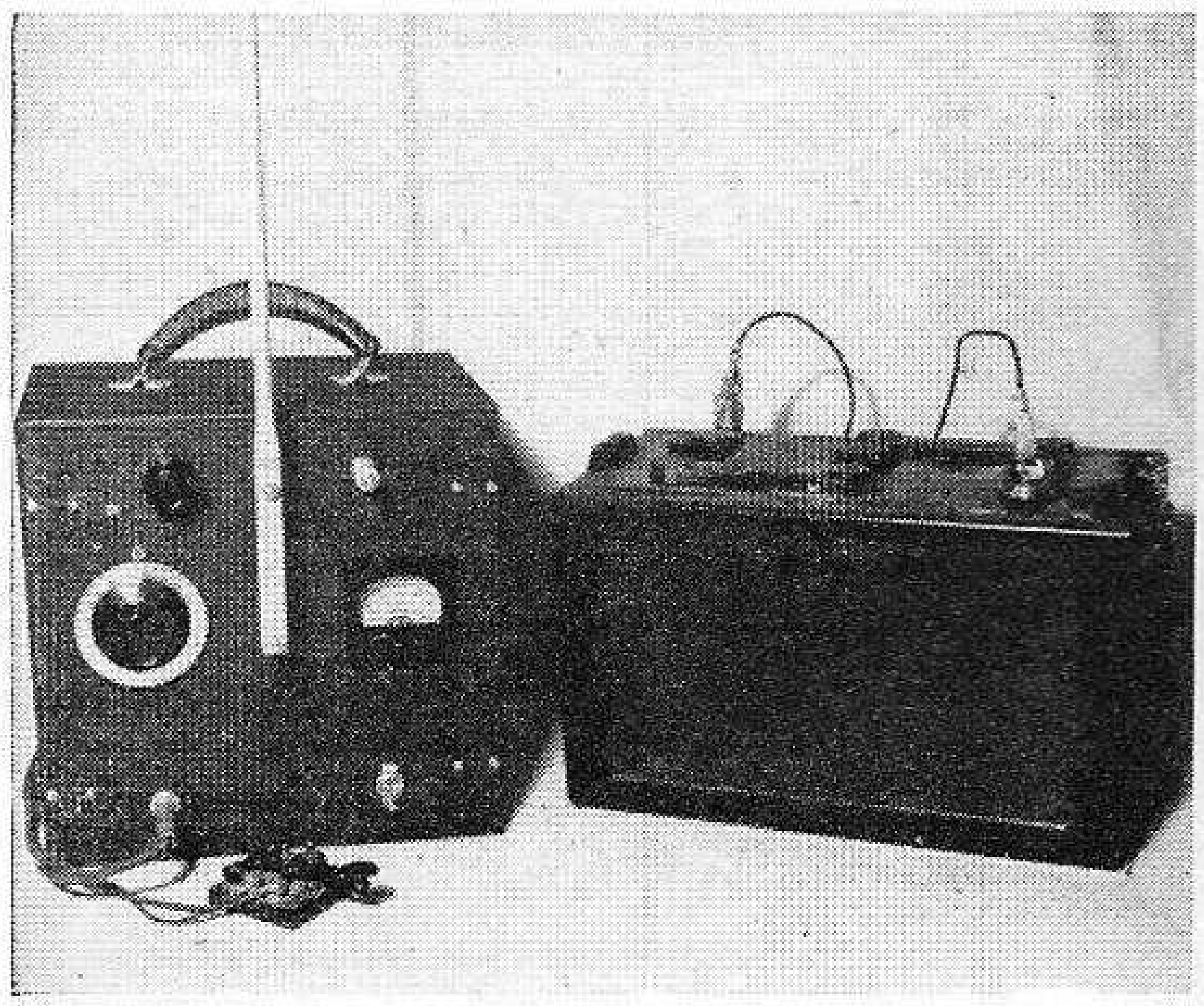


Fig. 2. Variable frequency transmitter ready for operation

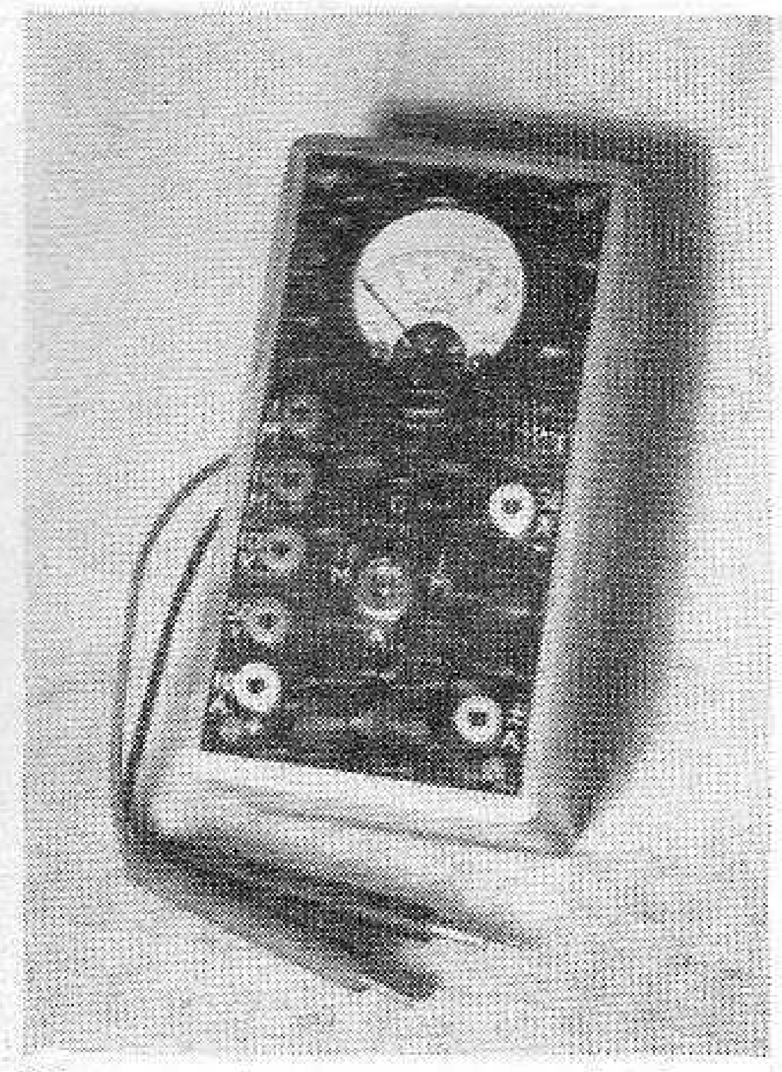
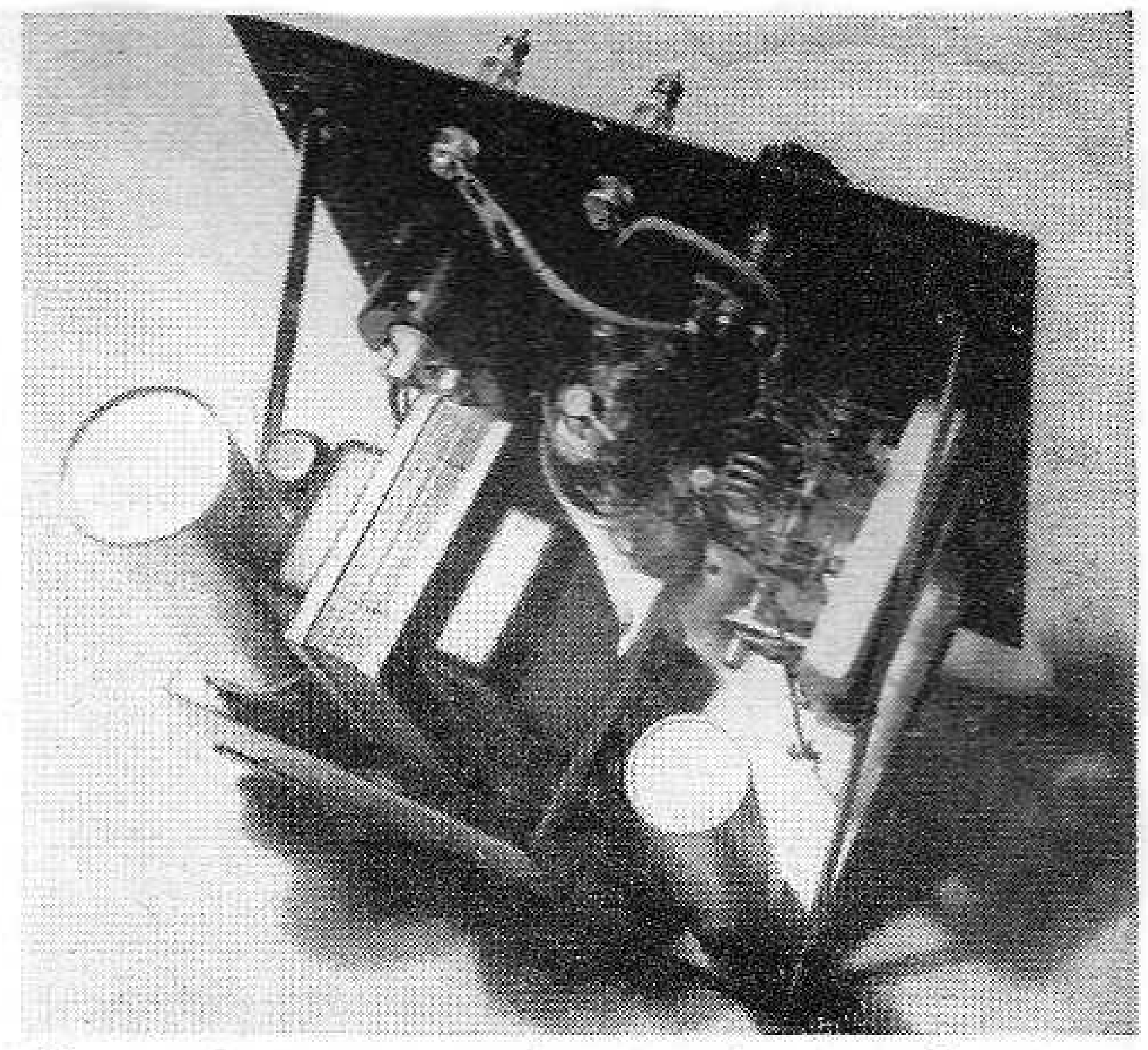


Fig. 5. A test meter designed especially for radio control experimenters



Few parts are needed to produce good power output

ELEMENTS OF RADIO CONTROL

PART 6

A Simple Transmitter for Model Plane Radio Control

By HOWARD G. McENTEE

AS IS probably evident to those who have followed this series, the writer is an advocate of stabilized, or fixed, frequency transmitters for radio control. Use of a crystal in this work has been covered in several transmitters described in the past.

A bit more flexibility can be had with crystal control by using several crystals and a simple switching means with a single tube line-up. Although only one frequency can be transmitted at a time; such an arrangement allows several receivers, each tuned to a different frequency, to be operated from a single transmitter. It has been found that the transmitter circuits need not be retuned if the various crystals cover a spread of no more than about 300 kc. This allows sufficient frequency separation for reliable operation of three receivers spaced 100 kc. apart, and even more have been used experimentally. The transmitter tuned circuits should always be set to the mean frequency and will then be found to cover those at either end of the range reasonably well. The antenna also should be cut for an intermediate point in the range to be covered. There will, of course, be a certain loss when the transmitter is operated at a frequency for which it is not exactly tuned, but the drop in output is surprisingly low.

When the transmitter itself carries the control switches, a simple SPDT switch can be used for shifting crystals. Many operators, however, have a control box connected by a length of cable to the transmitter itself, in which case relays must be used for crystal shifting as the actual R.F. leads in the circuit must be kept as short as possible.

Even so very little complication will result. For two crystals a single relay will suffice as seen in Fig. 1 A. When three or more are used a separate relay for each is best to avoid circuit complications, the arrangement then appearing as in Fig. 1 B. As pointed out before, the leads between crystals, relays and oscillator tubes must be as short as possible, but of course the relay operating circuits may be extended to any practical length.

Several correspondents have expressed a desire for a highly flexible transmitter and one that is simple and self-contained as well. This means only one thing: a simple self-controlled oscillator, and such a rig is shown herewith, Fig. 2, to give an idea of what can be accomplished along such lines. The circuit is the simplest of all, the TNT, similar to that used in the baby transmitter described in a previous issue. A dual type tube, the RK59, is em-

(Continued on page 32)

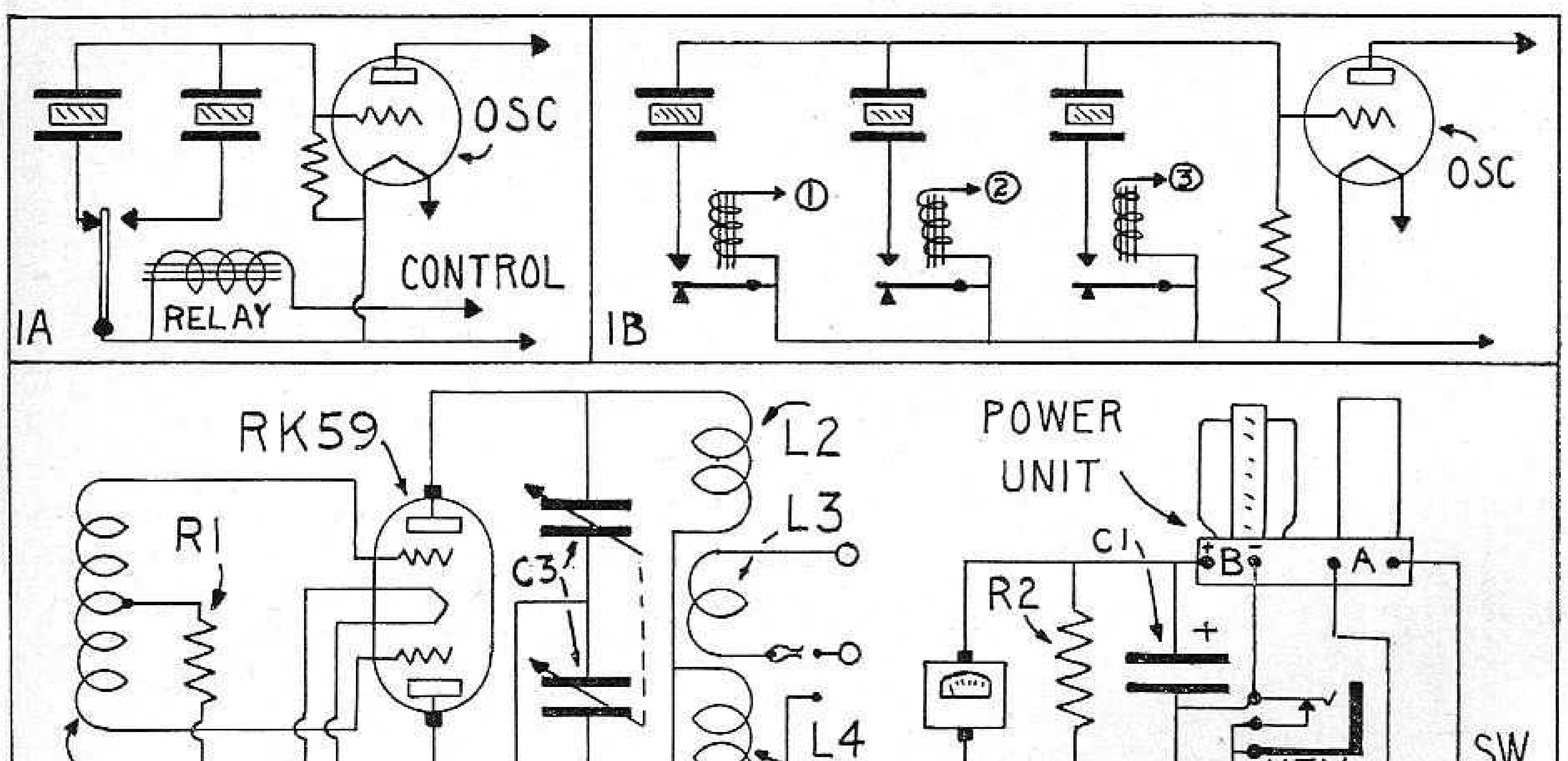


Fig. 1, 3, 6. Circuits described fully in text

Elements of Radio Control

(Continued from page 9)

ployed to give a bit more stability and also for better power output.

The circuit as seen in Fig. 3 is simplicity itself, and a prospective builder should be able to turn out such a rig in short order, particularly as the power supply comes all wired and ready for installation.

The case is 10" x 10" x 7" and comes equipped with handle, front and rear panels. The 9" x 6-1/2" x 1-1/2" chassis is bolted to the panel after the various holes are cut, and additional support is afforded by the diagonal braces of 1/2" x 1/8" brass or dural. As the frame of the variable tuning condenser is at ground potential, it may be bolted directly to the panel and also fastened to the diagonal brace at the rear for extra support.

To make the outfit as flexible as possible, a variable coupling coil controlled from the front panel has been provided. This consists of four turns of No. 16 insulated wire bunched closely together and fastened to a strip of Victron which in turn is held on the movable shaft. One end of the coil is connected by a flexible lead to the upper center terminal on the panel. The other end has a flexible lead terminated in a clip which may be snapped either on the left hand (from the rear) panel insulator or to the frame of the variable condenser for a ground connection. This lead may be clearly seen in the rear view, Fig. 4.

The lower edge of the chassis is about 1" from the bottom of the panel so that there will be plenty of room for the grid coils which are soldered directly to the grid terminals of the 4-prong isolantite socket.

An illuminated meter serves as a pilot lamp and shows the power input. A heavy duty toggle switch and a closed circuit jack are the other items on the panel. A third stand-off insulator, which is unconnected, serves as a bottom support for a vertical antenna.

Heavy wire, no smaller than No. 10, should be used for all low voltage connections beneath the chassis and to the battery, as the heavy current will cause considerable voltage drop in lighter wire.

If the coils are properly made the outfit should work at the first try. Connect a 25-watt lamp bulb to the output posts and vary the coupling until highest brilliancy is obtained. The bulb should light up almost fully with a current of 100 ma. on the meter. The output will drop slightly as the condenser plates are opened and the plate current will rise.

When a doublet antenna is employed the two upper terminal posts are used for output and the clip is naturally placed as shown in Fig. 4. With a vertical antenna as in Fig. 2, the clip is grounded. Thus, practically any type of antenna or feed system may be employed.

The power unit used here is rated at 325 V. and 125 ma. output and the tube may be operated for short periods at 100 ma.; as a general rule the plate current should be kept at 90 ma. The high voltage will run about 400 V. at 90 ma. current, giving a power input of about 36 W. The RK59 is designed for operation up to about 45 W. input using 500 V. at 90 ma., however. Other dual triodes such as the RK34 and 6E6 may be used in this transmitter, but of course at considerably lower power input and output.

It is absolutely essential to check the frequency of operation whenever the set is used since it can be shifted so easily. Mark the dial with the 52-meter band limits and *often* check the frequency with an accurate meter.

Those who work with radio control have of necessity to carry much equipment with them, including several meters for checking batteries and receivers. An effort has been made to combine all measuring equipment into one compact unit, with the result as shown in Fig. 5. The ranges are as follows: 10 V.-50V.; 10A.-50A.; 1 ma.-10 ma. There is also a simple arrangement for checking continuity of spark coils, etc. The latter is used in conjunction with a 3 V. battery, such as that used for ignition, and while the meter is not calibrated in ohms, a few tests will soon show how much reading a coil or other part should give. The circuit for this purpose is similar to that of an ordinary ohmmeter.

For the ampere readings, used to check dry cells, a special shunt is used. This came from the factory about 7" long, but in order to get it in the small case it was sawed in half at the center copper connection block. One section then runs across the bottom of the panel and the other up the right side, with tip jacks at each end and at the center.

The 10 ma. shunt and the other three resistors are mounted on a small bakelite sub-panel which is fastened to the bottom of the three-way switch and one meter mounting bolt.

The panel measures 3" x 6" x 1/4" and the wooden case is 2-3/4" deep.

Although other ranges could be used, it is felt that those chosen are adequate for most. Thus the milliampere ranges are for use in checking relay current in radio control receivers of various types. The voltage ranges cover most batteries used for ignition and receivers, while the ampere ranges are mainly for checking dry cells of various sizes.

In connection with the latter, it should be mentioned that ampere readings on all types of cells will be somewhat less than with the ordinary watch-case style of meter. This is because of the extremely low resistance of the ammeter circuit used here as compared to the internal resistance of the cheaper type of meter. It will be found that good penlite cells will read about 4-6 A; large size (type D) flashlight cells, 6-8 A and No. 6 dry cells about 20A. A few checks with cells of known quality will soon show what reading may be expected for various common sizes. As with the cheaper meter, only a single cell should be tested at a time; the leads should be held on just long enough to get a reading, not a moment longer. Quick readings are easy, however, for this type of meter swings to the proper scale position immediately and without any wiggling back and forth.

In order that reader preference may be noted, it is suggested that those who wish certain types of apparatus or systems which have not yet been covered write the author in care of this magazine.

PARTS

Fig. 3. Tube—Raytheon RK59; R1—IRC 5,000 ohms, R2—50,000 ohms, 25 Watt wired wound; C1—Cornell-Dubilier 8 mf. electrolytic No. KR608, C2—.01 mf. mica, C3—Bud dual 75 mmf. No. MC1884. Power supply—ATR No. 6A; Case—Bud No. CC1100; Chassis—No. CB37; Choke—No. CH925; Socket—No. S954; Dial—No. D1732; Jack—No. J1325; Insulators (4)—No. I1911; Meter—Triplett 200 ma. rear illuminated No. 227A; L1, 6 turns No. 14, 1-1/4" long and 3/4" OD.; L2, L4, 4 turns 1" long each, 3/4" O.D.; L3, see text.

Fig. 6. Meter—Triplett No. 223, I ma. movement; R1—10 ma. shunt; R2—10 V. series resistor; R3—50 V. resistor; R4—3000 ohm 1/2 W. resistor; R5, R6—10-50 A. shunt; SW1—3-position switch.