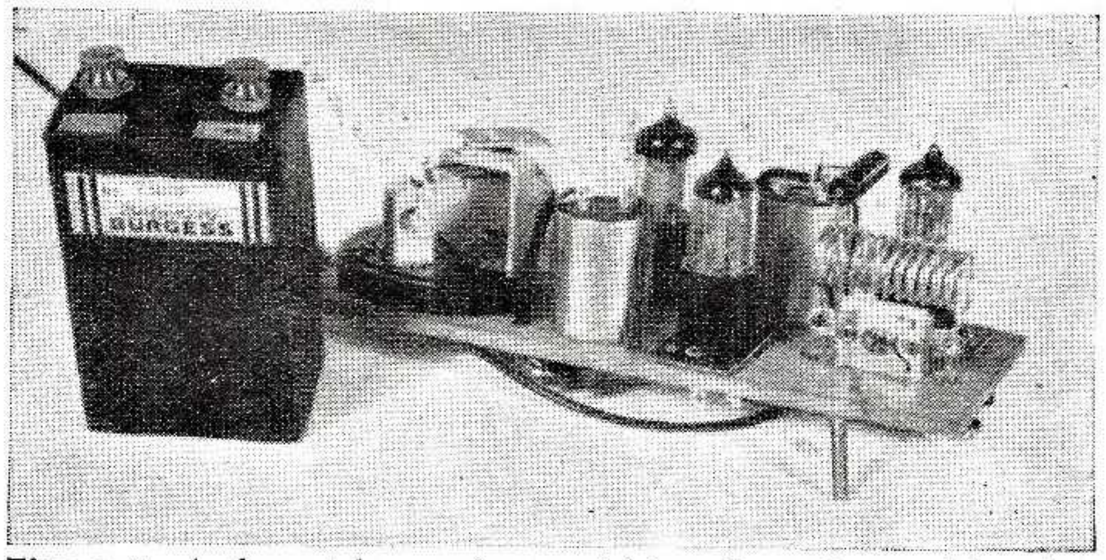

Figure 2. A three tube receiver weighing about 8 oz. with relay. The battery is the new 5-1/2 oz. Burgess V30BP 45 V. battery

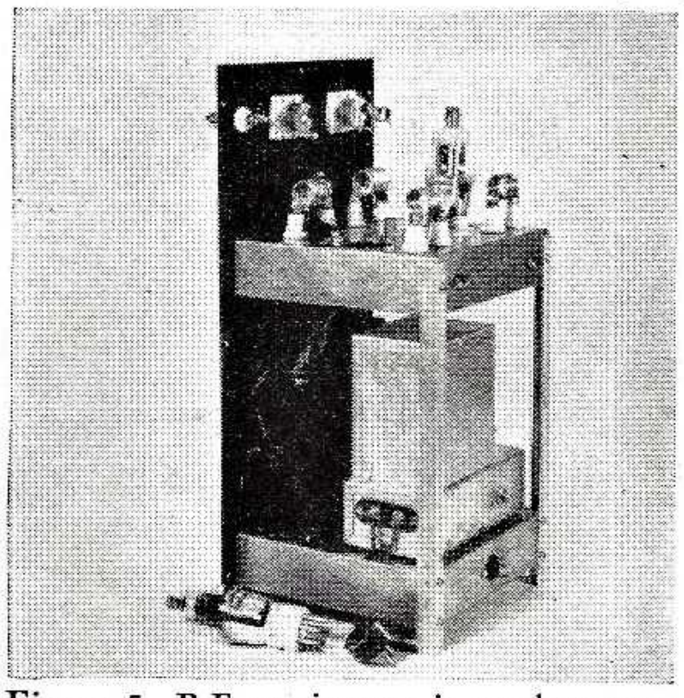

Figure 5. R.F. equipment is on the upper deck; audio oscillator and power supply on lower.

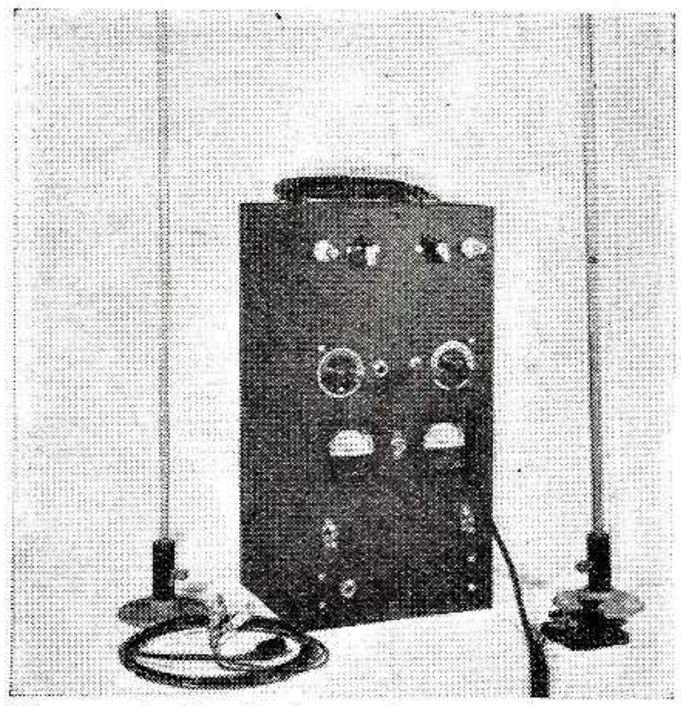

Figure 4. Dual channel transmitter, battery cable at lower left.

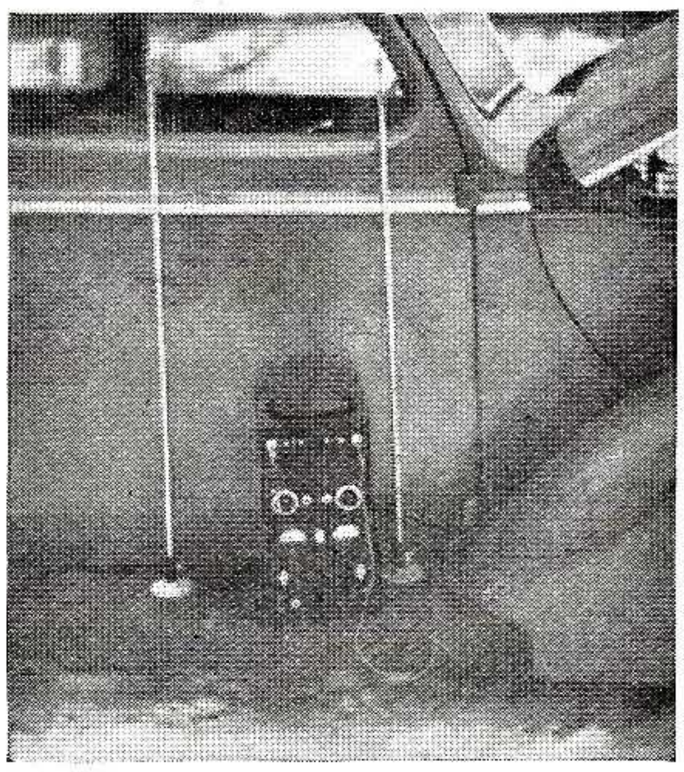

Figure 6. The transmitter ready for use. The antennas shown must, of course, be set out away from the car body and from each other.

Elements of Model Plane Radio Control

Suggestions on Radio Control Equipment That Will Enable You to Make Your Radio Control Sets More Efficient and Practical

PART 2

By HOWARD McENTEE

THIS second article on model airplane radio control will furnish details of further equipment that may be built and used by the average constructor. It should be emphasized that the idea behind this series is not necessarily to enable the constructor to make exact copies of the equipment shown, but to adapt it to his own needs. A subject as highly individual and experimental as model plane radio control makes it practically a certainty that each constructor or each group of constructors will have a "pet" idea that is thought to be better than all others. This is as it should be, for it is only in this way that the science will advance. However certain basic types of equipment are indicated, and it is hoped that these articles will furnish the needed "dope" on such equipment.

With this thought in mind, a transmitter for use with battery power will now be described. This unit is of the dual-channel type; that is, there are two separate transmitting frequencies, either or both of which may be used as required. And either singly or together. The rig has been made as flexible as possible so as to cover all types of control work. Thus an audio frequency modulator tube has been incorporated for the more advanced experimenter who wishes to work with audio frequency tone control. The modulator tube is made to produce its own A.F. oscillation by a simple feedback connection. Only one frequency is provided for in the diagram shown, but a

(Continued on page 65)

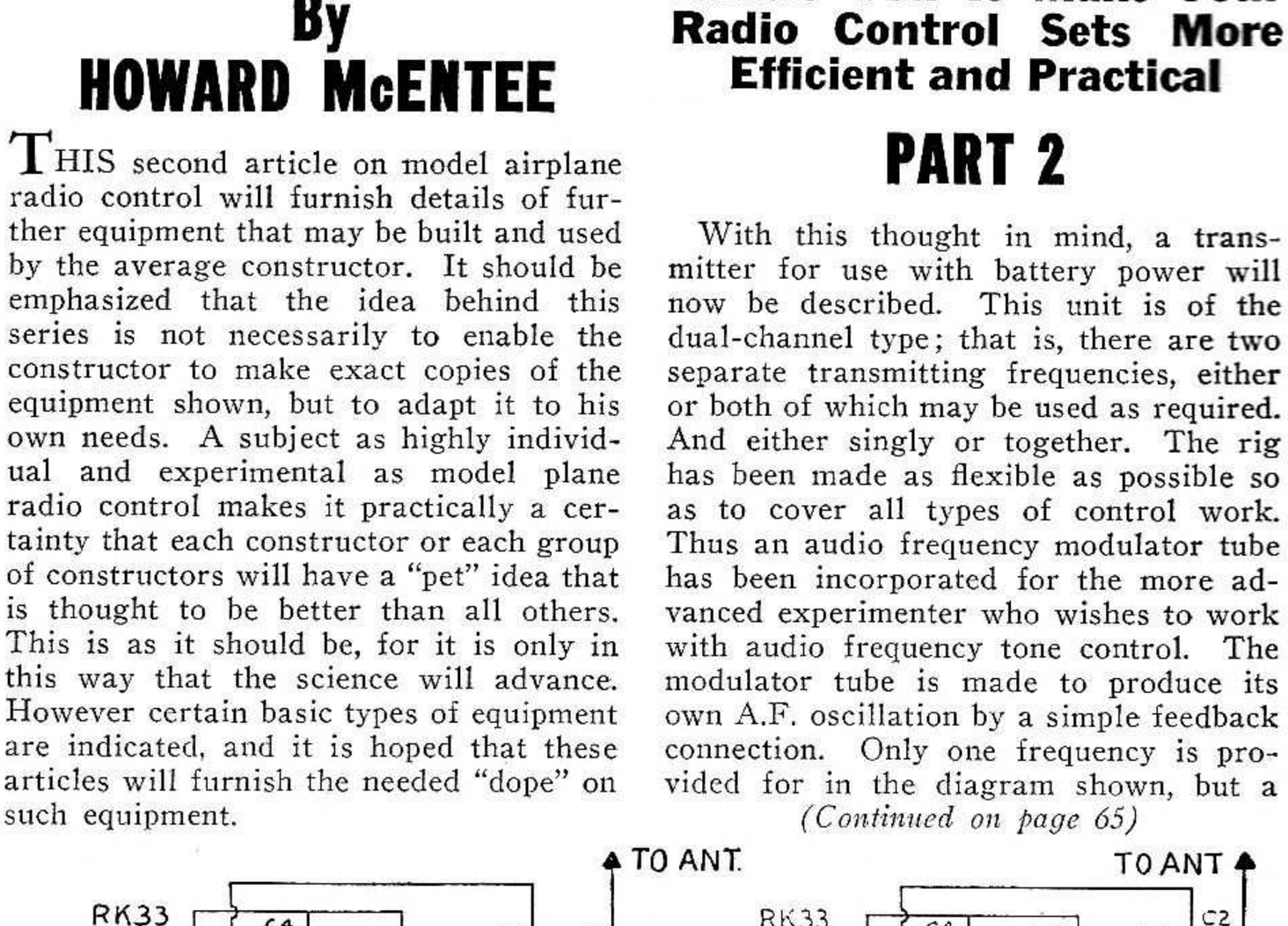

Figure 1. Parts list appears at end of article

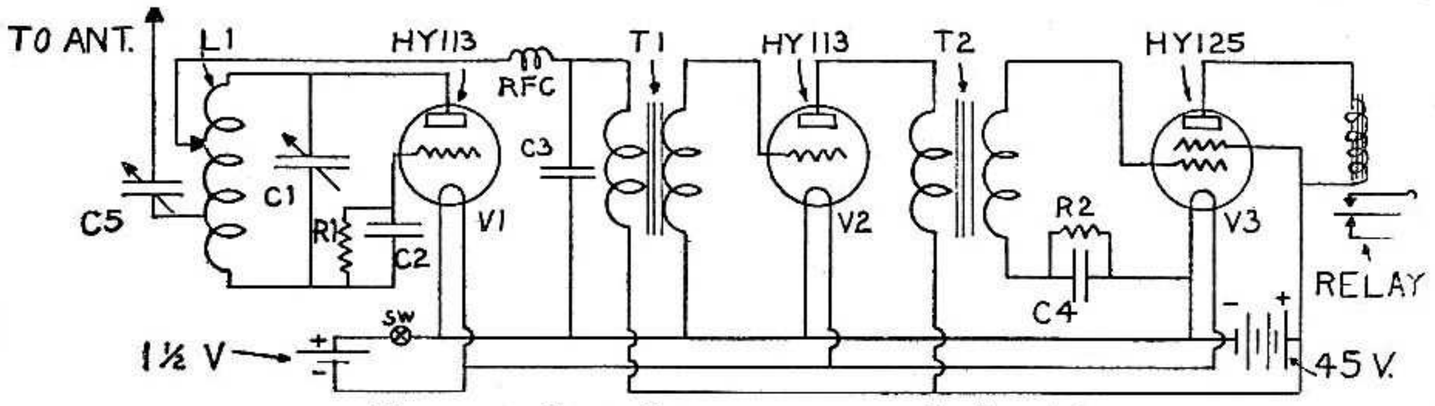

Figure 3. Parts list appears at end of article

motor for three models) and neatness (a sloppy scale model never won yet) and most important of all is one little item which you mustn't overlook . . . the valued friendships most folks form during their model building careers.

There, that ought to hold 'em!

P.S. We almost forgot! You have a comprehensive working knowledge of aeronautics to which many a pilot would doff his hat!

Elements of Model Plane Radio Control

(Continued from page 8)

selector switch or a set of keys for various frequencies may be easily arranged. A triple winding input transformer, T1, figure 1, is used so that a microphone may be connected should this be desired. Audio tones could then be provided by blowing a whistle or pitch pipe of the correct frequency. This may sound a bit far-fetched, but who knows just what the accepted system of a few years hence may call for!

A switch on the volume control (SW1) serves to cut out the modulator tube so that its current drain will not add to the already rather high battery demand. Another switch (SW2) cuts out one R.F. channel so that only a single tube is in use. Still another switch (SW3) cuts off the high voltage supply leaving only the heaters connected for use when it would be inconvenient to await the heating of a tube.

All these switches may seem to add to the complications, but they do give the unit a versatility it would lack otherwise. As noted previously, the average constructor will use only those features necessary for his particular work.

Every effort has been made to cut the battery drain as much as possible. This is a further justification for the complicated switching arrangements. Another factor along this line is the use of the Raytheon RK33 tubes. These are double triodes similar to the RK34, but of lower power requirements, and also, of course, lower output.

A further endeavor in the line of current economy is the use of synchronous rectifier in the Vibrapack high voltage supply. This supply is complete except for D.C. filter, which is taken care of by a small choke and two miniature condensers. A convenience of this unit is the power switch which makes available four output voltages from 225 to 300 V. The lower range is convenient for tuning up and for nearby control work and should be used when possible to conserve battery power.

The R.F. circuits are quite similar to that of the transmitter described in Part One. Only the final amplifier tuning condensers (C1) and the antenna condenser of each channel (C2) are on the front panel. The oscillator condenser (C3) of each is at the rear of the chassis and is set by means of an insulated screwdriver. Once properly set, this condenser rarely needs to be changed.

It is necessary to use short, heavy leads from the transmitter to the power source,

and they should preferably be connected directly to the battery terminals. The leads may be of the heavy stranded wire sold by auto supply houses. This large size is required in view of the fact that the current drain may run as high as 10 A. with both channels and the modulator in operation. Under such conditions a drop of 1/2 to 1 V. or more through the supply cable is possible if a small size wire is used, and such a drop will seriously affect the output of the transmitter.

Nothing need be said of actual construction, as individual preference and equipment at hand are controlling factors. Also details of layout may be seen from the photos.

Tuning and testing procedure are subjects which we need not dwell upon. Since this equipment *must* be operated by a licensed amateur, the operator will undoubtedly know the proper methods to follow.

A few words as to operating values may be helpful, however. The RK33 is designed to operate on 250 V. with one section *only* drawing a current of 20 ma. The oscillator will run at about 10 ma. when properly adjusted. The amplifier may be loaded up to 25 ma. or so at 275 V. for short periods of time without harm. When running at rated values, the power output will be around 2 watts, which, when connected to an efficient antenna system, will provide quite a good control range. If more power is required the RK34 should be used, but this of course means much higher battery drain.

In connection with the latter it should be noted that the Vibrapack used in this transmitter may be installed in the single channel transmitter described last month, in place of the A.C. power equipment. It will furnish sufficient power to operate the single RK34 at full output.

When used on dual channel work, two antennas are required. These should be separated by a fair distance, no less than ten feet or so. Data on antennas suitable for five meter control work is now being assembled for presentation in Part Three.

It is perhaps well to emphasize again that an amateur radio license (any class) is absolutely necessary to work this equipment. Failure to heed this warning will mean an unpleasant tangle with Uncle Sam, with the possibility of a stiff fine or imprisonment.

The next item to be taken up is an ultra lightweight receiver which is similar in circuit to that using an RK42 and an RK43 shown in Part One. The very latest in small tubes are the tiny Hytron "Bantam Jrs." which have 1.5 V. filaments for use on a single cell. Three of these, two triodes and a pentode, are used in the receiver shown in figure 2. A further contribution to lightweight is the U.T.C. "Ouncer" transformers which actually weigh about an ounce apiece. Use of these tiny lightweight components makes possible a three tube receiver weighing only eight ounces complete with the Sigma 3A sensitive relay. As shown in figure 3, the circuit is arranged to operate on short pulses from the transmitter. When a pulse is received the normal hiss of the super-regenerative detector is stopped, allowing an increase in

plate current of the audio tube, V3, and so operating the relay.

This tube is made to work somewhat similar to a grid leak detector, such operation being brought about by the condenser (C4) and resistor (R2) connected in the secondary circuit of T2. Removal of R2 and C4 cause V3 to function as an ordinary class A audio amplifier, and the receiver may then be used for control by means of selective A.F. relays.

This receiver is reasonably easy to get into operation, provided the parts are made and mounted as shown in figure 2. The tap on L1 may have to be varied for best results, and should be tried on different turns. The idea is to get the strongest possible oscillation which will produce the loudest hiss output. It is therefore advisable to put a pair of headphones across the primary of T2 while making adjustments. In any case, a milliammeter of low range, such as O-5 ma., should be placed in series with the plate lead of V3 and the circuit adjusted so that the current change is greatest when the transmitter is turned on and off.

An antenna for this receiver may consist of a four foot length of wire in series with a 3-30 mmf. midget trimmer and connected one or two turns away from the tap on L1. Adjustment of the condenser will enable the point for greatest plate current change to be arrived at. These adjustments should be made at some distance from the transmitter, preferably at least several hundred yards, as they are much too broad for careful tuning if the transmitter is too close.

Alongside the receiver, in figure 2, is shown a new Burgess battery, the V30BP. This weighs only 5-1/2 oz., about half of that of the popular W30BP and similar types. The small size is naturally obtained at a sacrifice in useful life, and furthermore, the shelf-life is somewhat limited. However, it is thought that the V30BP offers a useful middle step between the Everready X180 and the 10 oz. class, particularly for those who require light weight with a better life than that afforded by the X180. The latter, of course, was designed for a class of service in which shelf-life is of no particular consequence, so its use in model work is practical only when every possible ounce must be saved.

Mention was made in Part One of the possibility of employing the sequence reverse relays used in model railroad trains for our control work. The writer has had occasion to examine one of these made by the A. C. Gilbert Co., and used in their HO gauge locomotive. This unit seems to be a "natural" for our purposes, since it operates very positively on 3 V. with a current drain of about 450 ma., and operating position has very little effect on it.

Best of all, the weight is only 2-1/2 oz. and even this might be cut a bit by judicious trimming of the frame. It is possible that the operating current might be cut even more by re-winding, although the above values were obtained with the original winding. Experimenters who are interested in the sequence type of control are advised to look into such units as this and possibly those designed by other manufacturers for similar purposes.

This little relay, incidentally, is far superior to the experimental job shown in figure 3, part No. 1, as it is lighter, less affected by position of operation and draws less current.

We have now covered the construction of two complete transmitters as well as several different types of receivers, and it is felt that sufficient types of each have been presented to meet every need. Unless some specific need arises later, we shall turn to other phases of control work in later articles.

Part III will describe a simple system of motor speed control that can be attached to practically any motor.

Figure 1. Parts for transmitter are: V1, V2, Raytheon type RK33; V3, 6V6; X tal, Bliley 10 meter crystals; Vibrapack, Mallory type VP552; M1, Triplett 50 ma. type 227 milliammeter; T1, U.T.C. type UPMG; T2, type UTG; CH1, type R19; C1, Hammarlund HF35; C2, HF50; C3, APC75, RFC, type CHX Radio frequency chokes, 2.5 mh.; C4, Solar 100 mmf. mica; C5, .005 mica; C6, 50 mmf.; C7, 8 mf., 450 V. Minicaps; C8, .05 paper; C9, 10 mf., 25 V. electrolytic; R1, I.R.C. 50,000 ohm type BT 1/2; R2, 2,000 ohm BT1; R3, 1,000 ohm BT1; R4, 10,000 ohm BT 1/2; R5, 1/2 megohm variable with attached switch SW1; R6, 400 ohms BT2. Sockets are Hammarlund type S; case Par-Metal type PC1576 with 2 type 15760 chasses. L1, 6 turns No. 14 bare copper, 1-1/8" long; L2, 8T same wire 2-1/8" long, all 3/4" diameter.

Figure 3. Parts for receiver: V1, V2, Hytron type HY113; V3, type HY125; relay, Sigma type 3A (or 2A) 8,000 ohms; tube sockets, Cinch 5 prong; T1, T2, U.T.C. type O-4; C1, C5, Hammarlund MEX trimmers, 3-30 mmf.; C2, Solar 100 mmf. mica; C3, .005 mica; C4, .001 mica; R1, I.R.C. 5 megohms type BT 1/2; R2, 2 megohms; RFC, 50 turn No. 28 enameled wire on 1/4" diameter bakelite rod; L1, 12T No. 14 bare copper, 3/4" OD, 1-1/4" long.

New Wings For Better Performance

(Continued from page 19)

(X-9) are given on page No. 30 of the September 1937 issue. The (X-9) section is shown on the small chart presented on the first page of this article.

The Grant (X) profile is suitable for heavy planes with small wing area or for use when slow flying speed is desired. In spite of its high camber it will provide a very high rate of climb if sufficient power is used.

The average gas model will give the best results when the (X-8) is used. This section has a high lift and an L/D ratio of about 24. A glider equipped with this