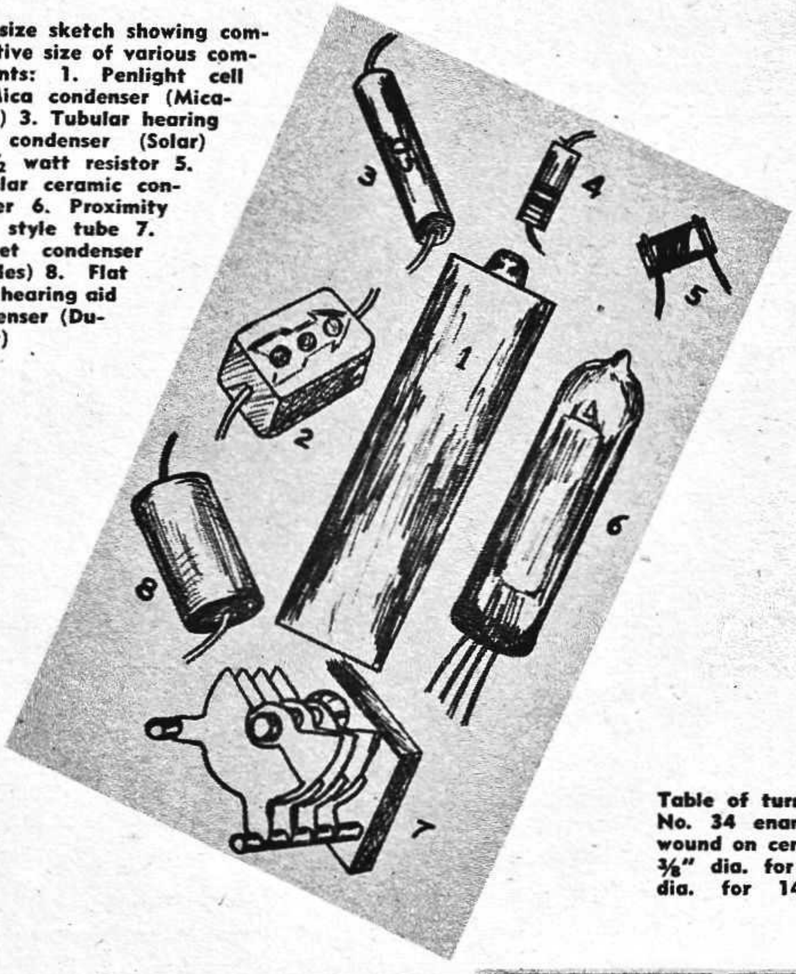
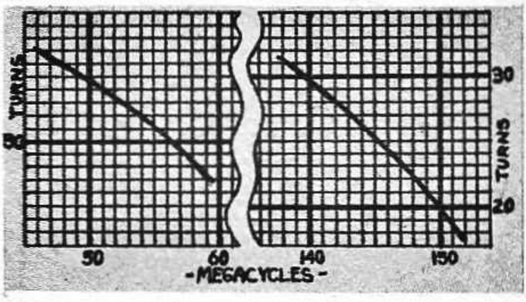
# RADIO CONTROL PARTS




**Full size sketch showing comparative size of various components: 1. Penlight cell 2. Mica condenser (Micamold) 3. Tubular hearing aid condenser (Solar) 4. ½ watt resistor 5. Tubular ceramic condenser 6. Proximity fuze style tube 7. Midget condenser (Sickles) 8. Flat type hearing aid condenser (Dumont)**

**Table of turns for R.F. chokes. No. 34 enameled copper wire wound on ceramic resistor form. 3/8" dia. for 50-54 mc, 3/16" dia. for 144-148 mc band**




**by E. J. LORENZ**

AS A beginner in the radio field you undoubtedly have wondered what tubes, relays, batteries and other accessories to use; or as an experienced builder you probably wished you could obtain some specific part to complete that special job you had started.

TOOLS NEEDED—First of all here is a list of tools required for radio control work. You can get along without some of them and then perhaps you will desire to add others:

Medium size soldering iron, about 60 watts

Pencil type soldering iron with interchangeable tips

A jeweler's saw with various size blades

A small vise and a small anvil

An assortment of small files

Several large flat, half round and round files

Diagonal cutting pliers, long nose and round nose pliers

An assortment of drills and a small hand drill (preferably drills number 1 through 80)

Several small taps and dies as needed.

Small steel rule and steel scriber

Small pin vise

Hammer and center punch

Small square and compass or dividers for metal work.

These tools should enable you to build almost any article of radio control equipment, although various special tools may be purchased from time to time.

MATERIALS—In the line of materials, several thicknesses of mycarta or bakelite insulation are needed, 1/32", 1/16" and 1/8" being the most commonly used. These can be obtained at most radio supply houses along with Polystyrene, the best insulator for VHF work. Polystyrene, while an excellent insulator for the higher frequencies, has the disadvantage of not holding up under high temperatures especially when soldering is to be done near it. Polystyrene or any of the other plastic insulations can be obtained in sheets, rods and tubes. It should not be used in thin sheets where any weight is to be supported or where it is subject to prolonged heat, over 150° F. Sheets of SO aluminum .030", .040" and .050" and 1/16" thick are an aid and necessity for building cases and small frames for mechanical parts. Brass and aluminum angles 1/4" and 1/2" on a side, along with various sizes of brass and aluminum tubing are essential. An assortment of music wire and copper wire in various sizes as needed are also essential in building the

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# Radio Control Parts

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radio set and mechanical equipment. Assorted eyelets, rivets, screws, small nuts and bolts, soldering lugs and other small items of hardware are essential but can be picked up as needed at most radio supply houses, hardware stores and model supply shops.

VACUUM TUBES—Now for information on tubes and circuit components. Choice of tubes for the transmitter and receiver is quite large, and numerous ones will work. The essential factor is to use a minimum number of tubes for a given purpose and to take into consideration the voltages and current drain of the tubes you plan to use. It would be as foolish to run a transmitting tube having a 6 volt filament with a .75 amp drain on dry cells as it would be to use a large unwieldy complicated power supply for a 1-1/2 volt tube that could be run off batteries. For the receiver the RK-62 or the miniature version, the RK-61, is the best all-round performer. This tube has low voltage and current characteristics, and being a gas thyratron eliminates using more than one stage in the receiver. These tubes may be purchased from the Raytheon Manufacturing Corp. of Newton, Mass. The price is $3.50 for both the RK-62 and RK-61. The RK-61 has wire leads and is self supporting while the larger RK-62 has a standard 4-prong socket.

The tubes in the 9000 series may be used to good advantage in certain circuits but their characteristics require several stages to operate a relay if used in a super-regenerative circuit. There are several good miniature tubes with pin leads such as the 3A5 and the 1S5 which may be used. Information on various tubes can be obtained from a radio "ham" book or manufacturers' tube manuals.

We will not go into all the tubes that can be used since the circuits vary and the tubes are used for different purposes. If you have a knowledge of radio you will pick the tubes of your choice, whereas if you are a beginner it is best to follow tried and proven plans. The choice of transmitting tubes is perhaps a little wider than those for receivers. There are quite a few twin triodes that are good up through the 144-148 mc band. The Hytron 114B and Hytron 615B are excellent triodes for VHF work, as is the new Hytron 2E30 tetrode. The RK-34, 6J6 and

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3A5 are also excellent transmitting tubes for VHF. For the 144-148 mc and higher bands, special tubes must be used. The acorn tubes are fine but are limited in their power output. The midget tubes in the 9000 series are excellent for high frequency work but like the acorn tubes these also give limited output. Perhaps one to watch for is the Raytheon 6N4 which is a high frequency tube and is claimed to reach up to the 500 mc mark. To sum it up, either follow a proven set of plans when building your set or chose tubes to meet your requirements from makers' manuals or from the Radio Amateur's Handbook. By writing to the Hytron, Raytheon, or Sylvania companies you can secure valuable information on small tubes.

RELAYS—Outside of selecting the proper tube for your receiver, the matter of what relay to use and where to obtain it is a problem. The relay acts as a switch between the radio circuit and the mechanical control of the plane. It must function with a minimum of change in plate current and must be relatively unaffected by vibration. Above all it must be lightweight and dependable. The RK-61 and RK-62 tubes require a relay with a DC resistance of 7000 to 10000 ohms. To use a relay of 3 or 4 thousand ohms and then to add a resistor in the circuit is a waste of power and is inefficient design. Sigma Instruments Inc. of Belmont, Mass., make excellent sensitive relays suitable for model radio control purposes. They are extremely sensitive, lightweight and reliable and can be obtained with almost any desired DC relay resistance. These relays have screw adjustments for the contact points and armature tension. The Kurman Electric Co. of Long Island, N.Y., produce a very small and lightweight relay but they are limited to comparatively low DC resistance and do not have screw adjustments. In some circuits, depending on the tube, these Kurman relays are very good due to their small size and light weight.

The problem of constructing your own relay lies in winding the coil which consists of No. 42 or smaller wire; having seen the size of No. 42 wire you will understand the difficulties involved. The relay given in the September issue of M.A.N. was made with a coil obtained from Sigma Instruments Inc. and is a very sensitive and reliable little relay. The chief advantage is its low weight and high contact pressure, thus keeping the worry about relay chatter or vibration to a minimum.

BATTERIES AND POWER SUPPLIES —By far of least concern regarding the receiver and transmitter is the matter of power. We will discuss the receiver first. Main consideration is the voltage required and the current consumed. There are several small batteries which can be used, but they are so small that a tube having a large current drain would deplete the battery in a short time. For the filament supply one penlight cell will take care of a current drain of 50 to 75 ma for several flights of 20 to 30 min. each. The large sizes of flashlight batteries will last proportionately longer.

The small wet cells, especially the Vitamite, are excellent for the filament supply if they are stepped down from 2.2 volts to 1.4 volts with a 16 ohm 1/2 watt resistor. These cells will last for several days' flying when used as filament supply. They are also recommended as a source of power for escapements and other mechanical means of operating the various controls.

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The much publicized mercury batteries developed during the war are suitable for filament lighting and have a remarkable life, although their cost is greater than the flashlight cells. The Mallory RMB-3 cell will operate an RK-61 for around 16 hours continuously and is 1" in diameter and .671" high; it weighs 1 oz. The RMBZ—4 cell which weighs 1-1/4 oz. will operate the tube for close to 24 hours. These cells are used in many hearing aids and are made by P. R. Mallory & Co. (Battery Div.), North Tarrytown, N.Y.

For the "B" supply there are numerous hearing aid batteries and other small units used for pocket and portable radios which are suitable for the receiver and transmitter. The Eveready Min-Max 412E (22.5v), 413E (30v), 420 (22.5v) and the 430 (30v) batteries are the smallest and lightest now obtainable and are unexcelled for use in the plane where the current drain is low. The larger Eveready 455 (45v) and the 467 (67½v) batteries are small enough for use in a plane and can also be used as power for a small low power transmitter. The Burgess hearing aid batteries XX30E (45v) and the XX45 (67½v) and the regular W30BPX are also lightweight batteries suitable for either receiver installation in the plane or low power transmitters. Numerous hearing aid manufacturers put out their own batteries and they may be purchased from hearing aid supply shops. Zenith and Sonotone are but two of the companies who have special batteries for sale. Select the battery most suitable for your purpose, considering first the weight, and the current drain second. Note however that it will not pay to save a couple ounces of weight only to have the batteries go dead, thus possibly wrecking your radio control model.

Power for the transmitter may be obtained from three sources: batteries, portable power supplies and AC power supplies. We can forget about the last one as a source of power when out on the field as it necessitates long wires and a heavy bulky case. Batteries may be used if the output of the transmitter is limited to a low power input, in the neighborhood of 2 to 4 watts. For more power there is the choice of either a dynamotor, genemotor or vibrator power supply. All of these require a storage battery to operate although a vibrator supply can be built to run off dry cells.

The Carter Motor Co. of Chicago makes very fine dynamotors for portable work. The P. R. Mallory & Co. Inc. of Indianapolis, Ind., manufacture a vibrator, supply No. VP552, which is widely used for radio control work. Electronic Laboratories of the same city make two vibrator supplies, 601 and 605, which are small, compact and have a low current drain for portable transmitting work. For experimenting with your set during construction it is suggested that an AC power supply be used, or if battery operated use the large "B" batteries.

SMALL ELECTRICAL PARTS—The problem of component parts, such as resistors, condensers, etc., is fairly well taken care of with standard parts. There are, however, small condensers used in hearing aids which are about half the size of standard parts. They can be obtained from most hearing aid repair shops. By-pass condensers are of the tubular type, 5/32" in diameter by about 3/4" long, and the flat type 1/8" x 5/16" x 3/4". Mica condensers approximately three-fourths the size of the smallest regular size are made by Micamold. Small tubular ceramic condensers manufac-

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tured by several firms (Erie, and Centralab Division of Globe Union Inc., Milwaukee, Wis., Bulletins 596 and 630) are now on the market. These are excellent for fixed condensers in tank circuits and in other parts of the circuit where mica condensers were formerly used. The smallest are approximately 5/32" in diameter by 3/8" long and have a capacity of 2 mmfd up. If a variable condenser is required the standard 3-15 mmfd mica trimmer (postage stamp size) with either a ceramic or bakelite base is available. For the tuning condenser in the transmitter a variety of midget types are available, ranging in size from a two plate 4 mmfd up to 150 mmfd. Due to war surplus, practically every radio supply store has them on hand at a price far below the prewar price. Hammerlund Co. now makes special condensers for VHF circuits as well as any other type you may need. Any of the large condenser manufacturers will be able to meet your needs with various types of condensers.

Resistors of the 1/2 or 1/3 watt size are only 1/8" in diameter and less than 1/2" long. Hearing aids contain midget variable resistances but in most cases are built into the plastic cases and cannot easily be removed.

RF CHOKES—RF chokes are best when made specifically for the desired frequency. The small chart on page 40 gives the optimum size and winding for the 50-54 mc and 144-148 mc band. Use ceramic coated resistors of 10 megohms or higher as the form for winding these chokes. No. 34 copper wire should take care of about 35 ma of current through these chokes and either enameled copper wire or single silk covered wire may be used.

MISCELLANEOUS PARTS — Special components, such as midget variable inductances, are made by the Cambridge Thermionic Corp. of Cambridge, Mass. These are about the size of the end of your little finger and are useful in tone modulated or audio circuits. Small inductances or transformers can be obtained from the United Transformer Corp. of New York City. This company makes some of the smallest commercially manufactured transformers and inductances, which are lightweight and compact and very useful in multi-stage and audio circuits. Hearing aids contain one or more very small transformers but in order to obtain one you must return the old transformer. Since that is out of the question it is best that you make the acquaintance of a hearing aid repair man and have him help you out.

For those desiring to use a crystal as a means of controlling their transmitting frequency, the James Knights Co. of

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Sandwich, Ill.; Valpey Crystal Corp. of Holliston, Mass.; and the Bliley Electric Co., Erie, Pa., are but a few of the manufacturers who make crystals for the amateur bands of 50-54 mc and 144-148 mc.

## RADIO CONTROL ON 144 MC

Experience gained from use of the equipment described in detail in our October issue has shown conclusively that the RK-61 tube is not reliable on 144 mc. Experimental work on this frequency is now under way but until final results are obtained we strongly recommend that prospective builders shift operations to the 6 meter band (50-54 mc).

Changes required in the receiver are:

L—11 turns No. 16 wire 7/16" inside dia.
C2—10 mmf fixed
RF choke—85T No. 34 wire on 1/4" dia. form.

For the transmitter:

L1—increase to 6 turns
C1—*add* 10 mmf across this unit
C2—change to 100 mmf
Ant.—should be approximately 3' long with adjustable end

The transmitter antenna will, of course, have to be varied to proper length for the frequency chosen. At these frequencies the RK-61 is absolutely reliable and the entire equipment will be found to give a good account of itself.