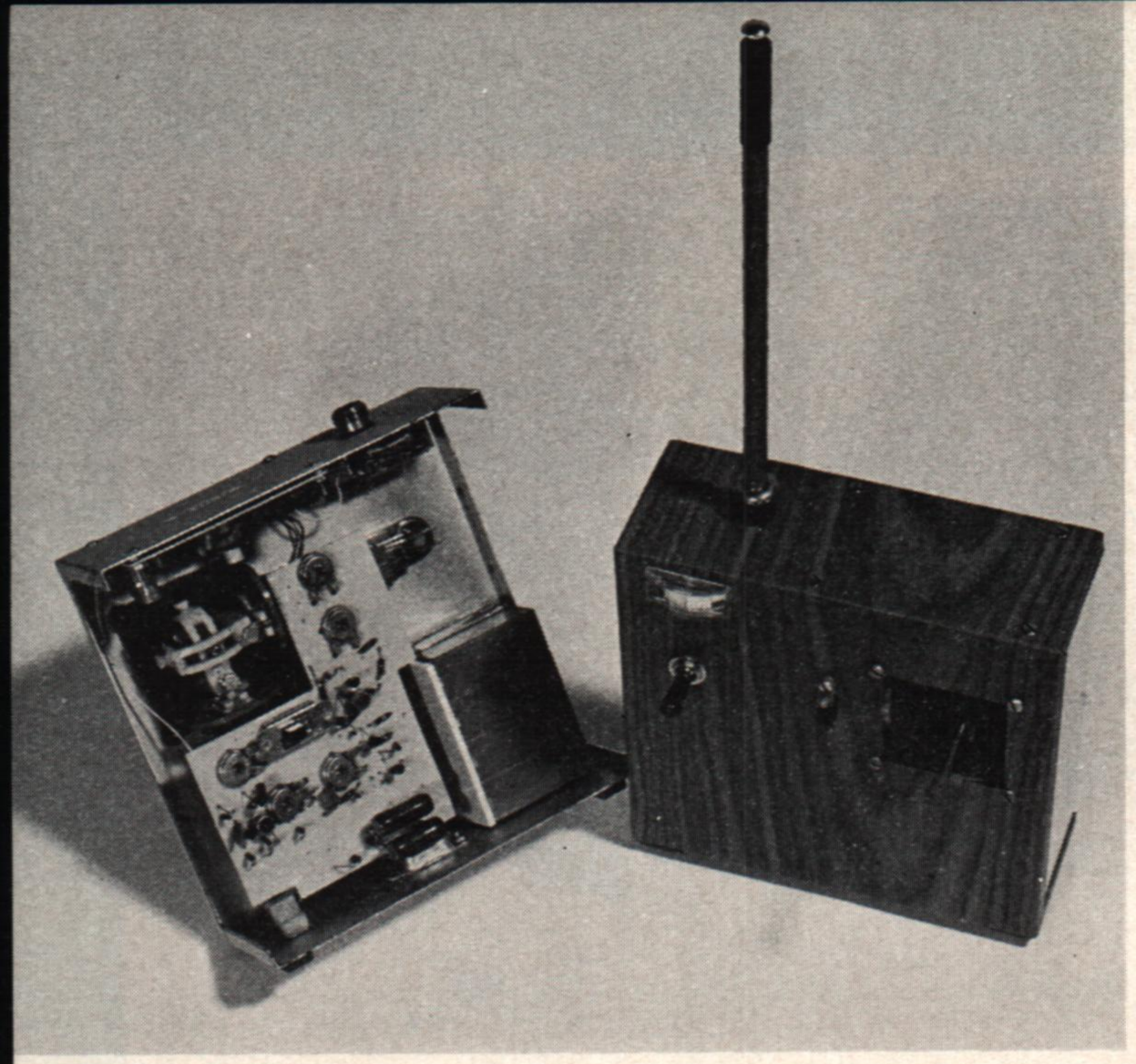
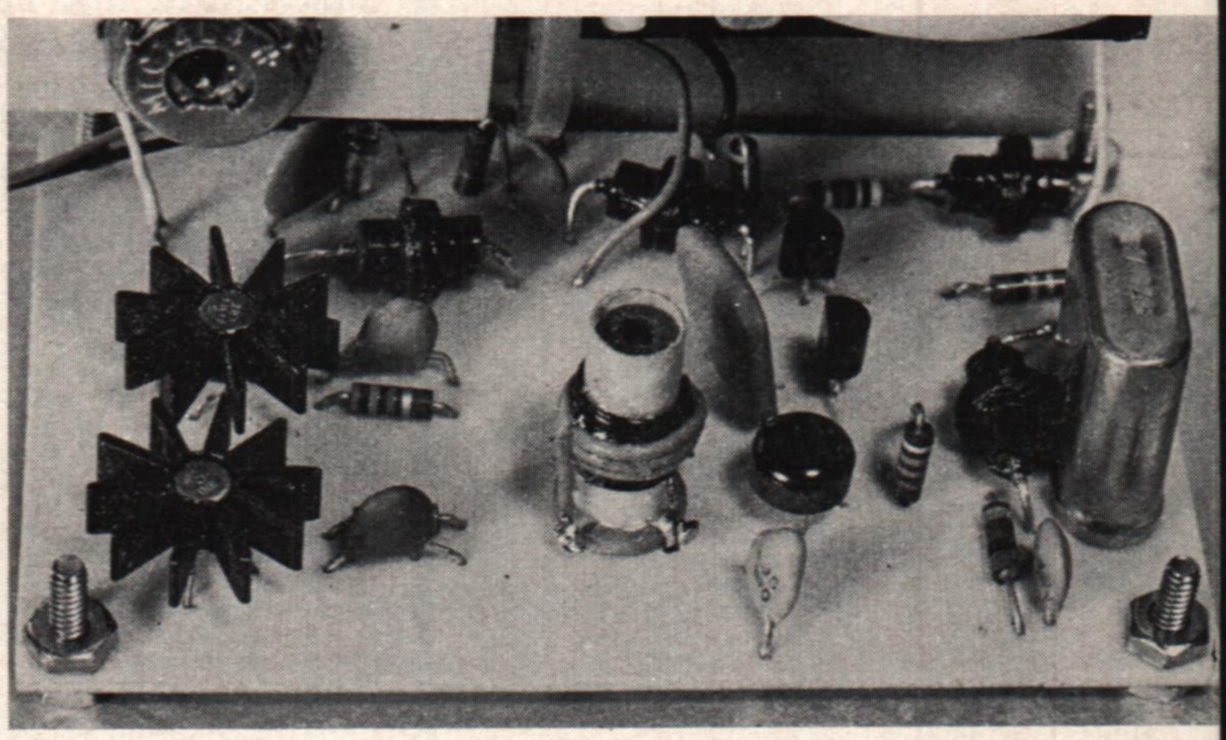


Versapro Series System



Transmitter serves any pulse application. Construction is easy, operation non-critical. Dual-output-transistor RF section is powerful, putting 750 MW into center-loaded antenna. Unit on the right is covered with vinyl wood-grained plastic contact material.

Versapulse Transmitter

Versatile single-channel pulse transmitter offers very high-power output, fully adjustable pulser/audio section, and dual charger for NiCad batteries.

FRED M. MARKS

THE Versapulse transmitter was designed to fill a specific gap in the growth of pulse-proportional control systems. The average pulse-proportional fan usually has progressed from rudder-only pulse-width control to Galloping Ghost with its limitations. The next step usually is to one of the rate-decoded systems, such as Rand Dual-Pak, Simpro III, Jaecks Decoder, etc.

Rate-decoded systems require that the repetition rate be increased from the nominal six pulses-per-second (PPS) rate used for GG to a nominal rate of 12 to 18 pps. Unless the modeler has a fairly intimate knowledge of his transmitter, he can not expect to make circuit changes which permit the higher rates and, even if he does, width interaction is usually encountered. His only alternative is to discard his present transmitter and purchase one of the few dual-rate transmitters available, or purchase a matched system.

The Versapulse transmitter was developed to help modelers overcome this problem and permit the optimum use of pulse capability. Versapulse is: a) modular, in that the RF section, pulser/audio section and charger are separate entities offering an extensive set of options and b) sufficiently flexible to permit its use with any pulse technique. For example, by adjustment of rate and width, the Versapulse has been used in one flying session to operate a magnetic actuator system, a Galloping Ghost System, the SIMPRO III at 12 pps, and a rate decoded/filtered analog system operating at a nominal 30 pps. These systems represent control limits of 4 pps to about 22 pps, and width ratios 95 to 5 and 70 to 30.

In addition to the variation in pulse func-

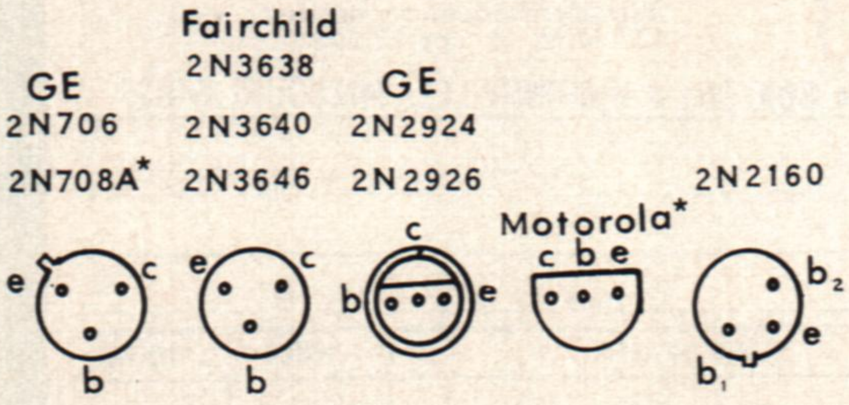
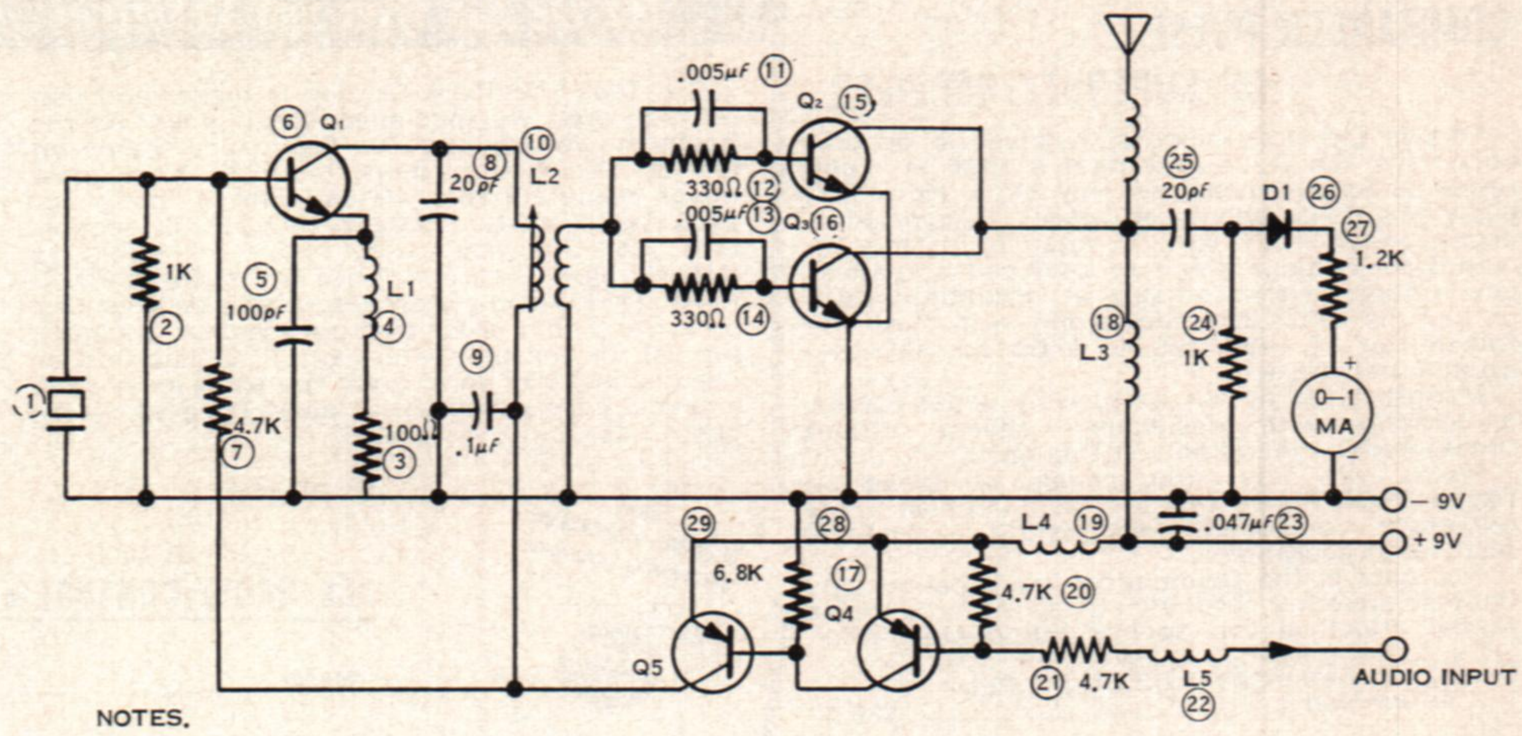


Fig. 1 Top view of transistor leads pointing down and away. Leads will have to be bent to meet PC holes marked e, b, and c for each transistor. Subs not encouraged.



NOTES.

1. TO DELETE METER CIRCUIT, DELETE METER, C , D1, R6, R7.
2. L2 – PRIMARY 12 TURNS #24 ENAMELED WIRE ON 2173–3–3 FORM
   SECONDARY 3 TURNS HOOK–UP WIRE OVER CENTER OF PRIMARY
3. L1, L3, L4, L5–36 RF CHOKES
4. Q1, Q2, Q3, – 2N706, Q4, Q5 – 2N3638, D1 – 1N4009

Fig. 2 Outstanding features of RF Circuit are: dual-output transistors giving high-power output and safe operation if either fails; meter circuit built-in; broad-tuning oscillator; simplified single-coil tuning, center-loaded antenna. Circuit is useful in other applications, such as digital.

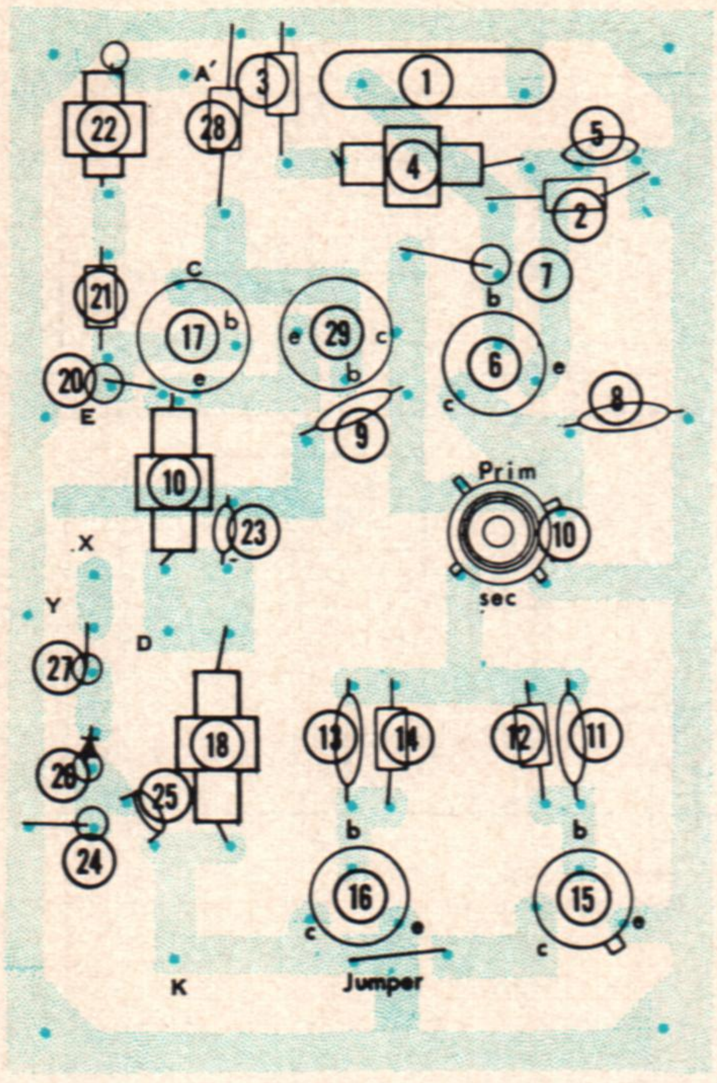


Fig. 3 **RF-section component location, top view. Assemble in order of numbers on each part. Shown full size. Heat sink on transistors #16 and #17.**

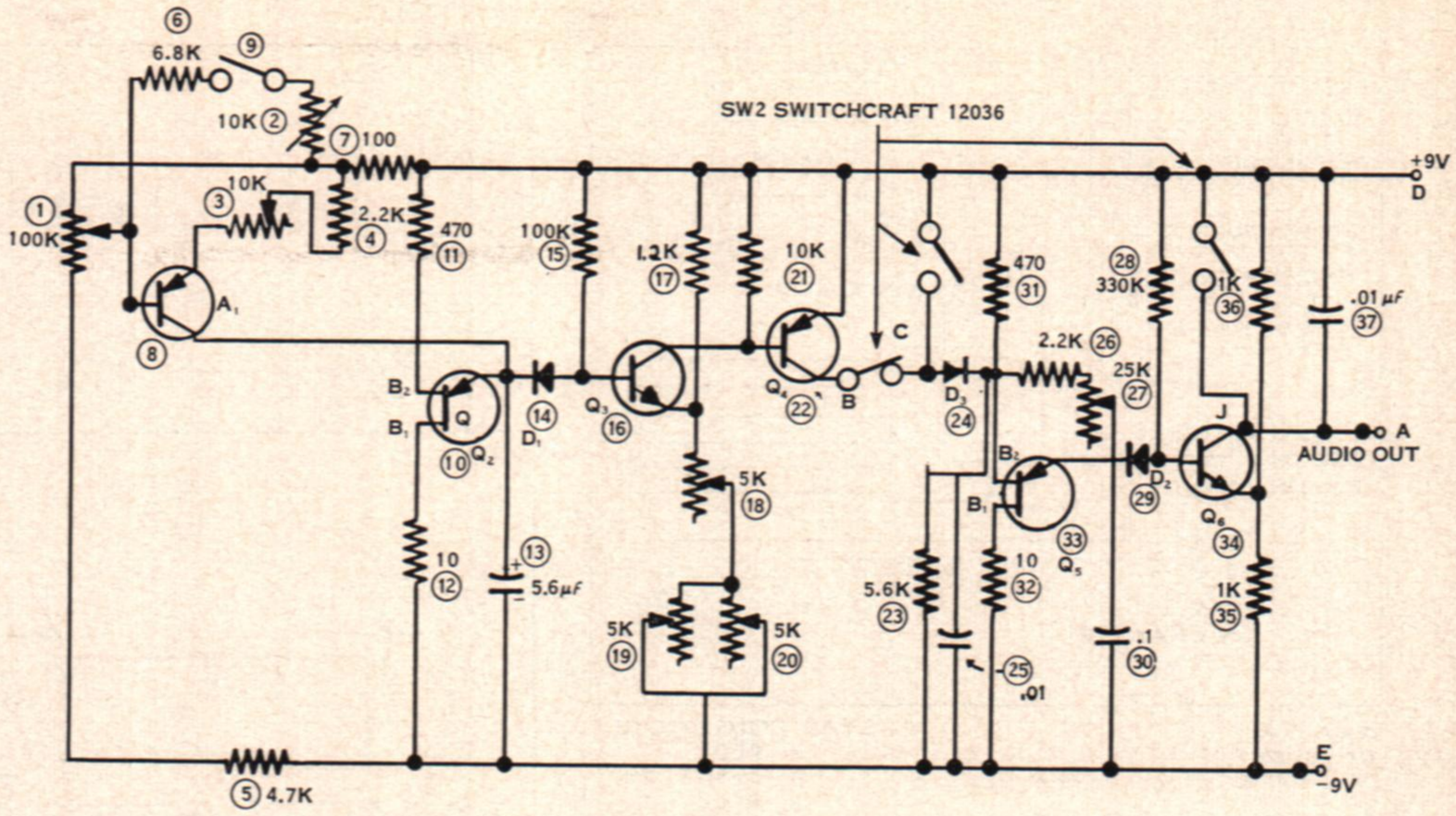


Fig. 4 **Features of Pulser/Audio circuits are use of stabilized unijunction transistor to eliminate rate-width interaction, and simple unijunction tone generator. Assemble the PC board following the numbers on the parts. Check polarity of diodes and electrolytics.**

tions the capability for variable audio frequency is included, at the option of the builder. Some receivers have been built for operation at selective audio frequencies. The audio frequency is variable from about 300 Hz for use with these units. Compatibility has been demonstrated, for example, with the Citizen-Ship AP receiver requiring 3800 Hz tone.

The RF section was kept to a simple one-tuning arrangement. Modulation is 95% and is near sinusoidal. Power output is approximately 750 milliwatts into the final RF amplifier. Efficiency is quite good, thus radiated output from the center-loaded antenna equals or betters that of most current transmitters. The RF section is not difficult. Remember, if you build the 27 MHz RF section, it must be certified by a licensed third-class operator.

The metering circuit capacitively couples some of the RF energy from the antenna output, rectifies it, and uses the resulting DC analog voltage to drive the meter. The meter circuit shows average power and reflects proper pulser operation by oscillating at the pulse rate, and by moving up and down as pulse width varies.

The charging circuits are set up to charge both the transmitter and airborne packs simultaneously or independently. The output can be varied by changing the value of the voltage dropping resistor(s) to permit whatever charging rates are required for your packs.

Construction of the transmitter is straightforward. Use the component overlays and schematics for component placement. Substitution of parts is not encouraged. This transmitter will be kitted by Ace Radio Control, Inc. Those who don't relish making their own printed-circuit boards and bending the case will find this quite welcome. Those who wish to scratch-build will probably wish to take liberty with all stages except the circuit. Individual components and detailed instructions will probably be available from Ace.

General: The PC board layout will accept either the GE encapsulated units or the

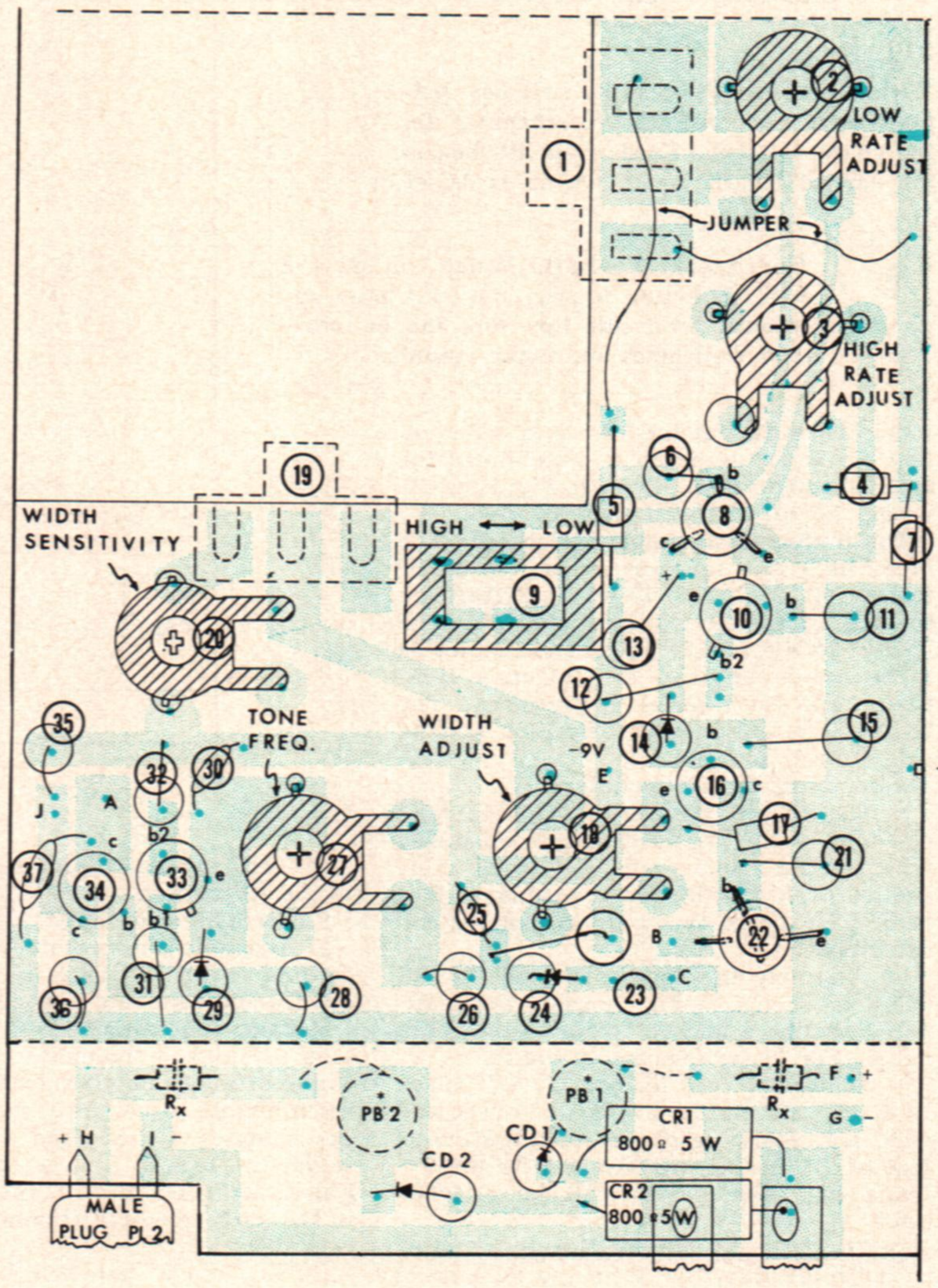


Fig. 5 **Pulser/Audio parts location, full size. PC board can be made by tracing colored lands and holes; fill in lands black, have photo shop make positive film print. Now view it from back side.**

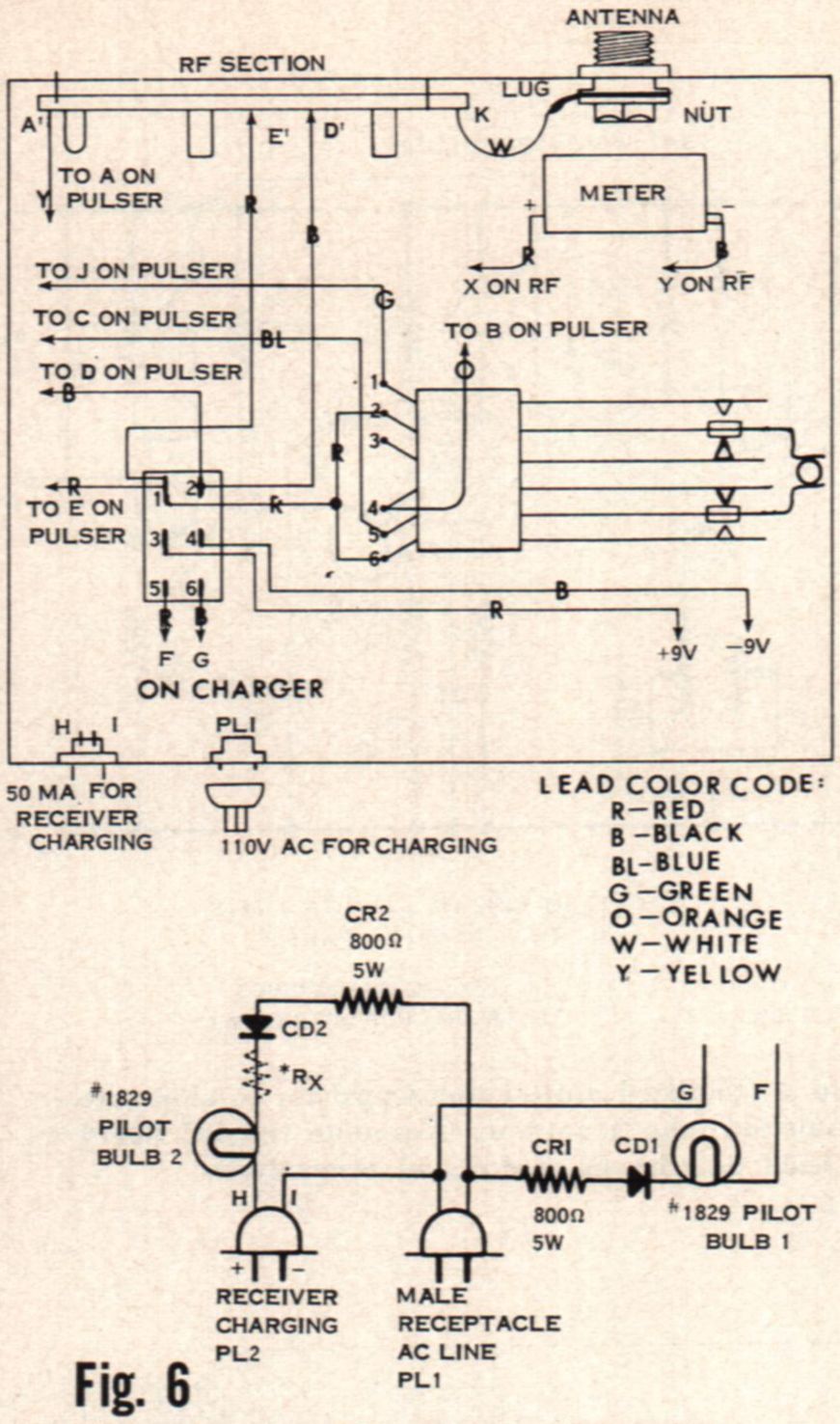


Fig. 6 **Wiring between PC boards, switches, battery, meter, etc. are above; schematic for the charger, below. Leads from PC boards are correct length, so all wiring is direct.**

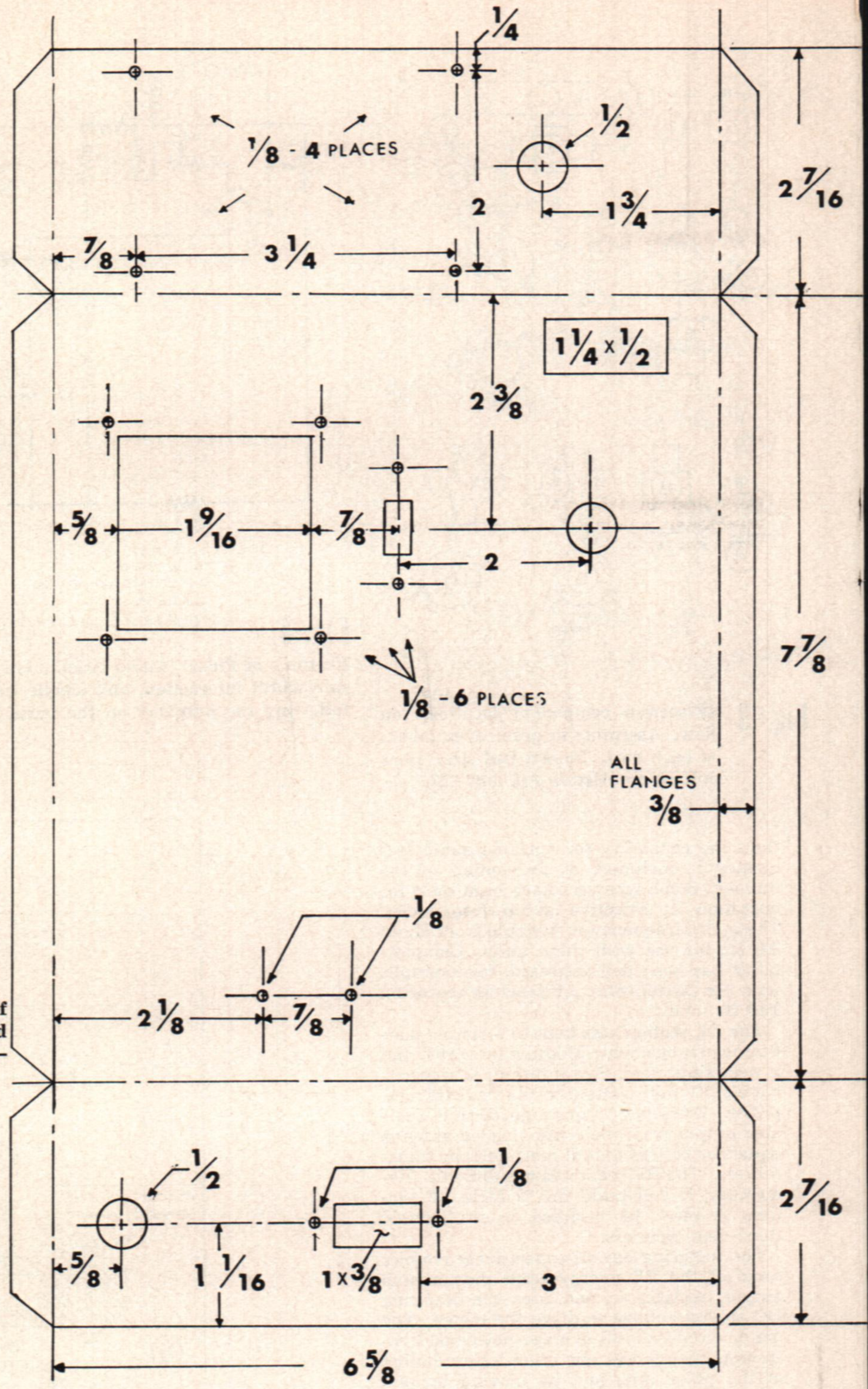


Fig. 7 **The case is made in this order: Cut sheet of .034″ aluminum to size, mark all holes and cutouts, bend side lips, top, and bottom — then drill holes and make cutouts.**

Motorola units, but the basing is different. Pay particular attention to selection of the 2N2924 configuration. Refer to Fig. 1 for the basing for all of the transistors used.

The preferred transistor is denoted. The Motorola house number is simply "MPS" instead of "2N." The 2N706 or 2N208A are the RF transistors (Q, Q2, and Q3). The 2N3638, 2N3640, and 2N3646 or their Motorola MPS counterparts are used in other locations. The MPS series is preferred. The 2N2160 is a unijunction transistor and no substitute is advisable.

Assembling the RF module:

a) The RF coil, Item 10, is a CTC 2173-3-3 coil form with 12¼ turns of #24 enameled wire for the primary and 3¼ turns of insulated hook up wire for a secondary. Picture of RF board shows the completed coil assembly.

b) Assemble the components on the RF board as shown in Fig. 3, using the numbered sequence and referring to the schematic (Fig. 2) for component values.

c) Solder a 5″ red lead at D′, a 5″ black lead at E′, a 3″ red lead at X, a 4″ black lead at Y, a 6″ yellow lead at A′, and a 3″ white lead at K. Solder this last lead to the antenna lug. The others will be attached later.

d) Clip all leads on the RF board to within not more than 1/16″ from the PC side of the board. (A toenail clipper is ideal for this purpose and no filing is required.) Remove excess solder resin with dope thinner and toothbrush, check for possible shorts.

e) This completes preliminary assembly of the RF section.

Pulser/audio assembly:

a) Assemble pulser/audio components according to Fig. 5, using the numbered sequence and referring to the schematic (Fig. 4) for component values. (Note: if you intend to build in the charger shown in Fig. 6, do not solder pots 1 and 19 with the stick assembly in place until so indicated.) If the charger is not going to be included, solder the lugs of the pots 1 and 19 to the pulser/audio board with the pots mounted in the stick assembly (Bonner Stick assembly shown).

b) Solder a 5″ red lead at Point D, a 5″ black lead at Point E, a 5″ orange lead at Point B, a 6″ green lead to Point J, and a 5″ blue lead to Point C. These leads will be attached later.

(Note: Leads on the pulser/audio are inserted from the bottom and soldered to the land. About 1/16″ of this tinned lead should extend above the PC board to serve as a test point. The other end of the preceding leads will be attached later.)

Dual charger:

a) Mount components as shown at the lower edge of the pulser/audio board except for plugs PL1 and PL2. The two pilot bulbs are soldered upright onto the PC side of the board with a short resistor lead scrap from the brass collar to lands F and H as shown by the dotted lines. They will be visible through the holes to be drilled in the case.

b) Solder a 5″ red lead from F, and a 5″ black lead from G, to be attached later.

If one or the other charging outputs is to

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Versapulse Transmitter

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be deleted, simply delete the associated components. CR1, CD1, pilot bulb 1, and the leads from F and G are required for transmitter charging. CR2, CD2, pilot bulb 2, and PL2 are required for receiver charging.

The following precaution is very important: Before charging either your airborne or transmitter pack, check the charging rate by inserting a millimeter in the positive lead to the individual pack. If the charge rate exceeds the recommended rate, cut land F (for the transmitter pack) or land H (for the receiver pack) and install a potentiometer across the cut point temporarily. Adjust this potentiometer for the correct charge rate, measure resistance setting, and replace with the nearest-size fixed resistor. These resistors are shown in Fig. 6 as Rx.

Charge rate for the 9V transmitter pack without Rx will be about 45 milliamperes. Receiver pack charging rate will be about 50 ma for a 4.8V NiCad battery pack. Remember, this circuit involves 110 volts so don't put your fingers in the transmitter at any time the line cord is attached.

Final assembly:

a) Strip ¼" from the end of the leads soldered to the PC boards earlier, tin, and solder the leads using the wiring and layout, Fig. 9. The battery leads go to lugs 3 and 4 of the DPDT on-off switch and the location and color coding of the leads are identified in Fig. 6 and on the PC boards. The lever switch shown is identified as SW-2 on Fig. 4. The transmitter case, upon which the components will be mounted, is bent from light gauge sheet aluminum. The front case layout is shown in Fig. 7. The back cover is simply a U-shape, 7¾ x 6½ with 2⅜ flanges.

b) Mount the RF section with four 4-40 binder head screws as follows: Insert each screw through the case, put a washer over it, and run a 4-40 nut down tight. When all four screws are in place, slip the RF board over the exposed ends of the screws and run nuts down at each corner. Check to be sure no solder joints are touching the case.

If in doubt, apply a layer of vinyl tape to the transmitter case behind the RF board. Mount the 0-1 ma meter. Solder the leads from X and Y to the meter with the red lead from X going to the plus pole of the meter. Mount the antenna connector (don't forget to insulate from the case with fiber washers provided) with antenna lug attached. The antenna used was a center-loaded antenna from Ace Radio Control. Lafayette radio also markets a suitable center-loaded antenna which has been used.

c) Mount the stick assembly. This will position the pulser/audio board as it should be if the chargers are not included. If the chargers are used, the following procedure applies:

Mount the stick assembly on the transmitter case with pots in place. Mount PL1 and PL2 at the bottom of the case as shown. Carefully bend 90 and solder *all three* of each pot lugs to the proper lands and the pins on PL1 and PL2 to their respective lands. The assembly now may be removed from the case and each joint "heavied up" a bit, then the assembly can be placed permanently.

Checkout:

a) Connect a 9v battery to the leads from lugs 3 (+9v) and 4 (—9v) of the on-off switch. Position the control and adjustment pots at the following initial settings:

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model rocketeer

NATIONAL ASSOCIATION OF ROCKETRY

1239 Vermont Avenue NW, Washington, DC 20005

NAR

ANOTHER TENTH ANNIVERSARY

Ten years ago this month, the then newly formed NAR was officially represented at the First World Congress of Flight, Las Vegas, Nev., held April 12-18. It was there that NAR officials made their initial contact with the National Aeronautic Association. NAR became affiliated with NAA on April 3, 1961.

EDUCATION MATERIALS AVAILABLE

If you are an educator with a school or NAR Section, you'll be interested in obtaining the special kits made up by two model rocket manufacturers. We were privileged to review these kits assembled by specialists working with Estes and Centuri companies; both seem prepared for the educator who would add model rocketry to the classroom for science projects or use certain technical reports and related materials in NAR Section classes/workshops. Write to Estes Industries, P. O. Box 227, Penrose, Colo. 81240 or Centuri Engineering, P. O. Box 1988, Phoenix, Ariz. 85001, attention of the public relations director, for your copy. Note: Educator kits are not designed for the average person to use individually; we suggest you present some background information on your class/section and how you plan to use the kit.

SOMETIMES THE GOING'S ROUGH

According to NAR senior members in the Houston, Tex. area, the going can get rough. A recent example is that three sections in that area draw on NASA's Manned Spacecraft Center for senior help, namely the Apollo-NASA, Bellaire, and Spacers sections. When NASA was cut in both the funds-personnel areas, and also geared up for Apollo missions, work was increased and NAR senior help became scarce. But this is the time when senior advisors (not necessarily NAR members-parents) and NAR leader members have to tackle leadership positions.

Mark Evans, of course, was the spark plug in the Houston area who got the first section off the ground. Other help came from college-man Ronald Fink, who organized the Bellaire Section in the Southwest part of town.

The fact is that all three sections, including the Apollo-NASA group in NW Memorial suburb, and the SE Clear Lake group, have full NAR sanction and charters which only have to be renewed. So, with some extra effort in organization, planning, etc., these sections can continue their meetings, schedule local and area-region competition in Texas, and start now to qualify for the '69 Nats.

Rocketeers in the Houston area can call Bob Jones at 946-7078 or Chuck Biggs at HU-3-4241, who are with NASA and have agreed to locate the closest NAR Section for persons who want to join.

The above information was presented as an example of actions that happen within certain sections, indicating the need for

Continued on page 56

Members of the Annapolis Assn. of Rocketry (AAR) demonstrated how to sell the NAR by manning a booth at the Greater Annapolis Science and Technology Exposition in November 1968. Show is sponsored annually by the local Chamber of Commerce and draws thousands of visitors. As a result: AAR membership has grown from about 15 to 40 in one month!

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Pot #	Designation	Initial Position	Effect of Clockwise Motion*
1	Rate control pot	30 from full CCW	Decreases rate
2	Broad rate trim — lo rate	Mid	Increases rate
3	Broad rate trim — hi rate	Mid	Increases rate
18	Broad width trim	Mid	Gives right trim
19	Width control	75 from full CW	Gives left width control
20	Width sensitivity	Full CCW	Decreases sensitivity
27	Tone frequency	Not critical	Increases frequency

*Viewed from back of transmitter, switch #9 is hi-lo pulse-rate selection. For initial tests, select low rate.

b) Turn transmitter on. Key the hi-lo-motor lever switch to low. Adjust the slug of L2 (Item #10) on the RF board for maximum meter reading.

c) Release the lever switch and observe the meter. If the pulser is functioning, the meter will swing slightly at the pulse rate and average up or down with width change. High motor (full signal on) will give a lower than average meter reading, and low motor (full signal off) will give a higher meter reading. This is because the meter indicates RF output and RF output gives an apparent higher reading when there is no modulation.

d) Operate the system with your airborne system. Adjust for desired neutrals and sensitivity without disturbing control pots 1 and 19. Note that there will be a slight change in neutral as sensitivity (20) is changed, which may be nulled by adjusting 18. Switch 9 will give rate selection appropriate for Galloping Ghost and magnetic actuators at "Low" setting and Simpro, Rand Pak, etc., at "High" setting. Minor adjustments of rate and width in going from one system to another are made with 2, 3 and 18.

Model Rocketeer

Continued from page 53

back-up assistance such as member-parent help so programs may continue. Also, be sure and send in your section calendar of events three months in advance so the Rocketeer can publicize launchings/demonstrations, etc., in your area.

NEW SECTIONS FROM COAST TO COAST

Several new sections have been added to the NAR rolls. California has reported two new groups; Texas has one, and on the East Coast, one each in Maryland, New York and Maine. Our next issue will have a complete listing of the 34 sections active in Aug. '68 plus the new sections.

The most recent chartered sections are:

Titan Section (WCMRS)
(West Covina Model Rocket Society)
1444 W. Garvey Ave., West Covina, Calif. 91790

Loma Valley Rocket Pioneers
P. O. Box 26
Browns Valley, Calif. 95918

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