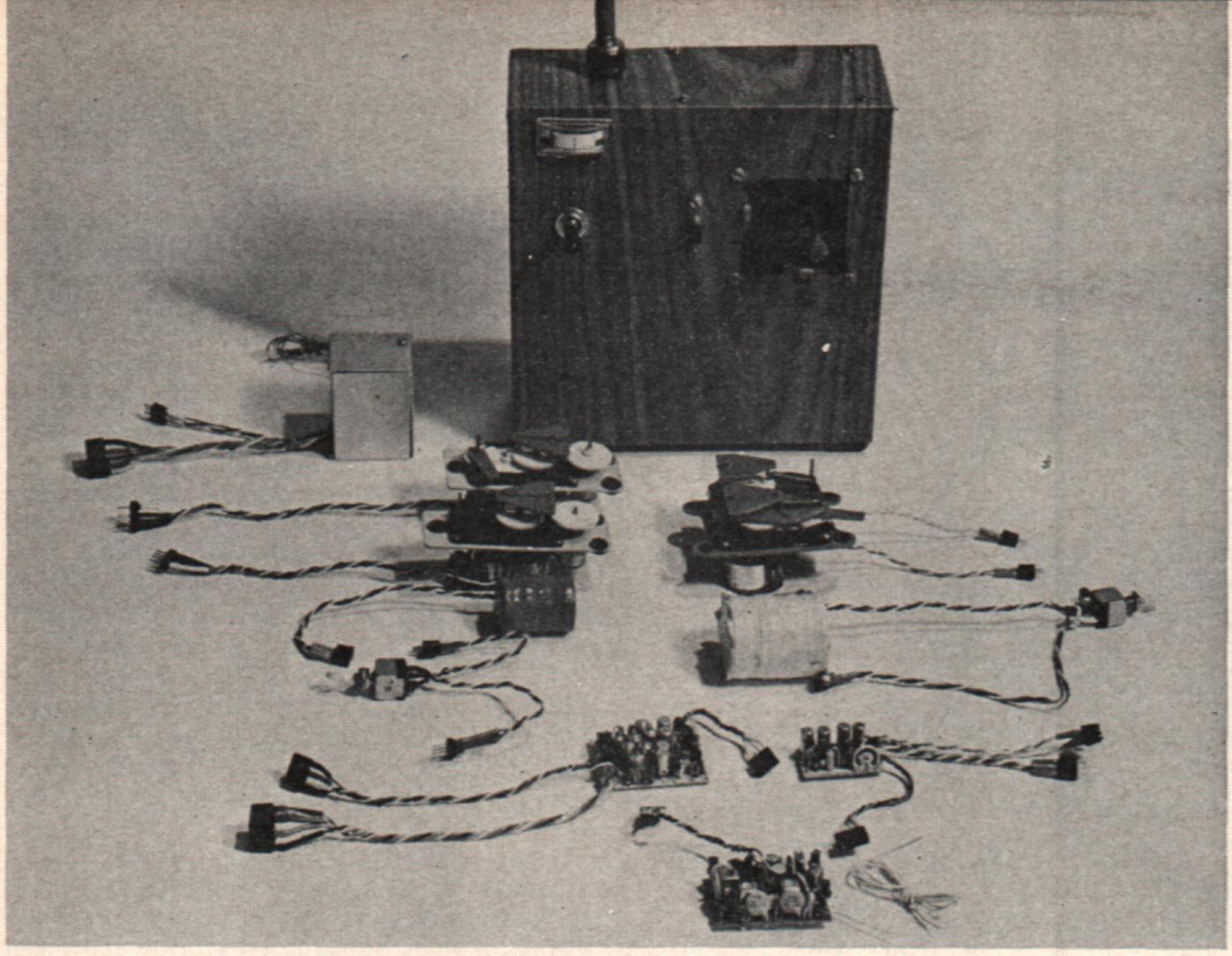
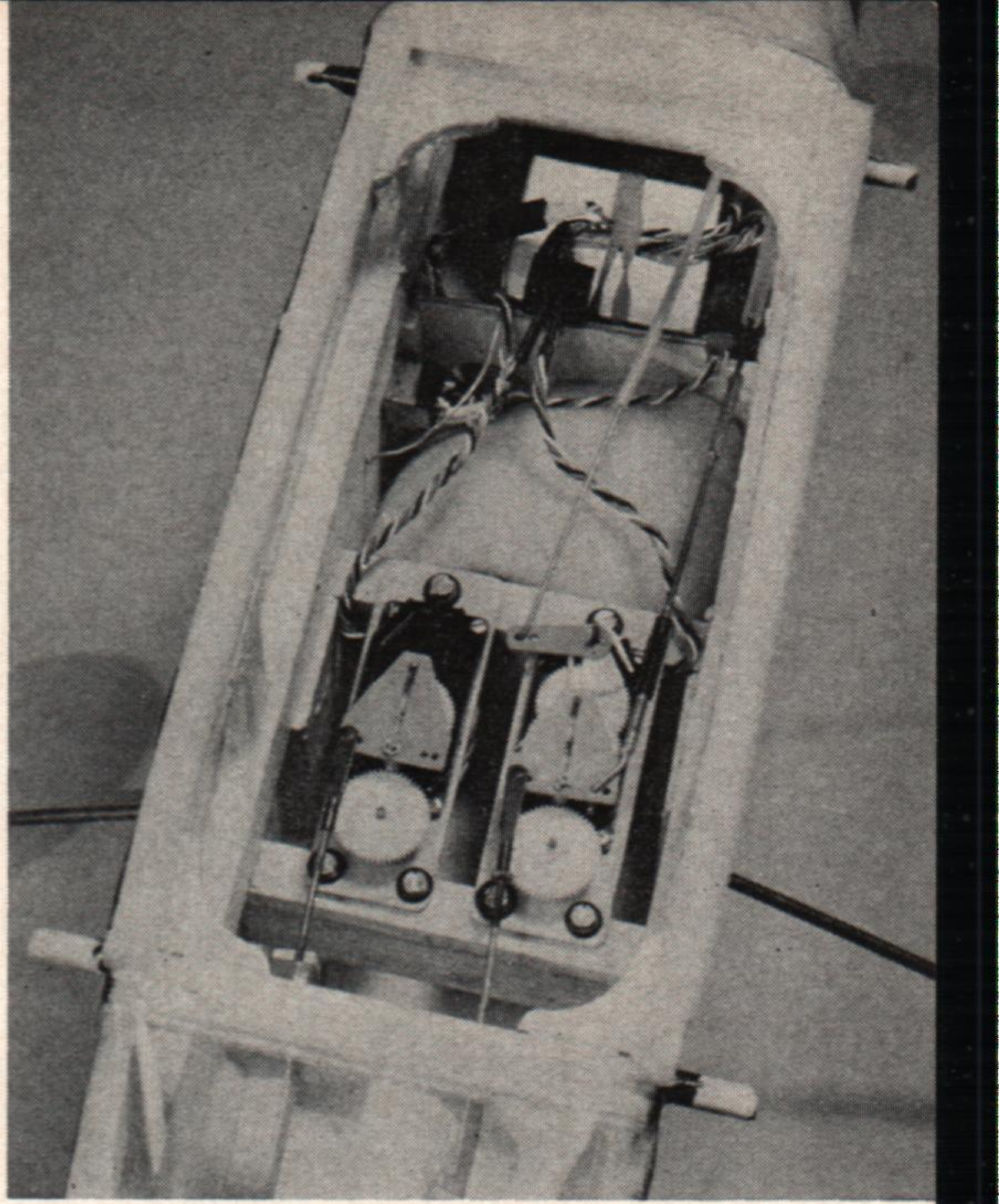




Two versions of Versapro dual-servo system are shown with Versapulse transmitter. The compact, inexpensive, pulsing set on right; lighter, powerful, feedback set on left.

Equipment installation shows use of one servo for steering, rudder, and throttle!

VERSAPRO SS-2

Two-function decoder/filter gives dual-proportional and one trimmable function with either pulse or feedback servos.

FRED M. MARKS

VERSAPRO SS-2 is a pulse-width, pulse-rate decoder followed by filters which provide two independent analog signals for control of existing analog servos — or the feedback conversion of the Rand servo presented in the March '69 issue. Lock-out is applied to both of the feedback servo signals to provide for neutral position during throttle changes, or in the event of signal loss.

Features: In keeping with the versatility promised for the Versapro system in the March issue, a number of modes of operation are possible. They are presented in order of complexity, and might well represent an evolutionary approach to construction of the system by the builder.

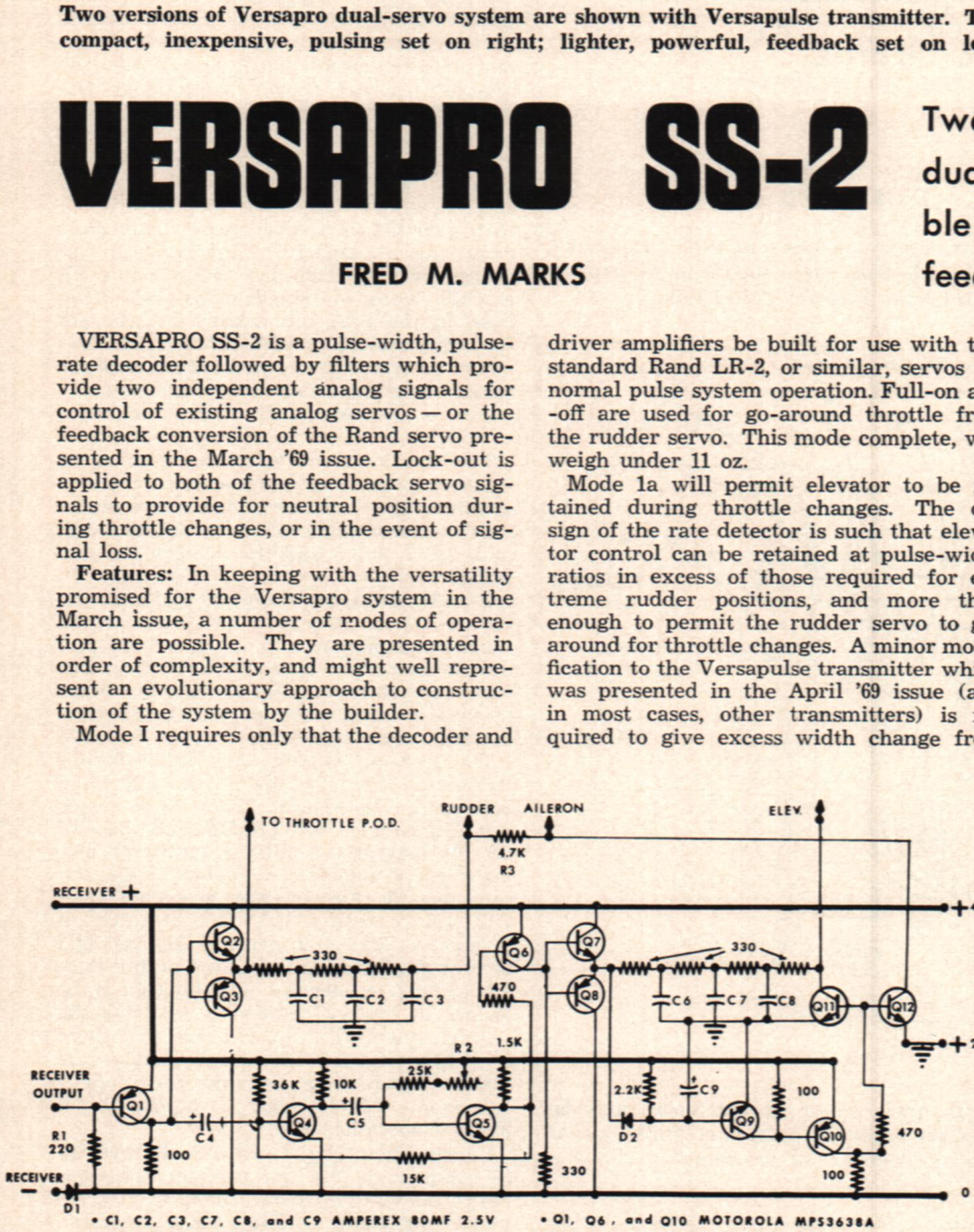
Mode I requires only that the decoder and driver amplifiers be built for use with two standard Rand LR-2, or similar, servos for normal pulse system operation. Full-on and -off are used for go-around throttle from the rudder servo. This mode complete, will weigh under 11 oz.

Mode 1a will permit elevator to be retained during throttle changes. The design of the rate detector is such that elevator control can be retained at pulse-width ratios in excess of those required for extreme rudder positions, and more than enough to permit the rudder servo to go-around for throttle changes. A minor modification to the Versapulse transmitter which was presented in the April '69 issue (and in most cases, other transmitters) is required to give excess width change from the throttle control lever-switch instead of on-off. In this mode, throttle movement is slower than in Mode 1.

Mode 2 requires that one Rand servo be converted to feedback with go-around for rudder and throttle. The second Rand servo is converted to the standard feedback configuration. These conversions were presented in the March '69 issue. The remainder of the decoder is needed for Mode 2. Full on-off is used for throttle control. Elevator servo stops at neutral until pulsing resumes. This mode complete will weigh under 10 oz. with 250 mah batteries.

Mode 2a will permit elevator control to be retained as for Mode 1a, so that we now have proportional elevator at all times, and proportional rudder with go-around throttle.

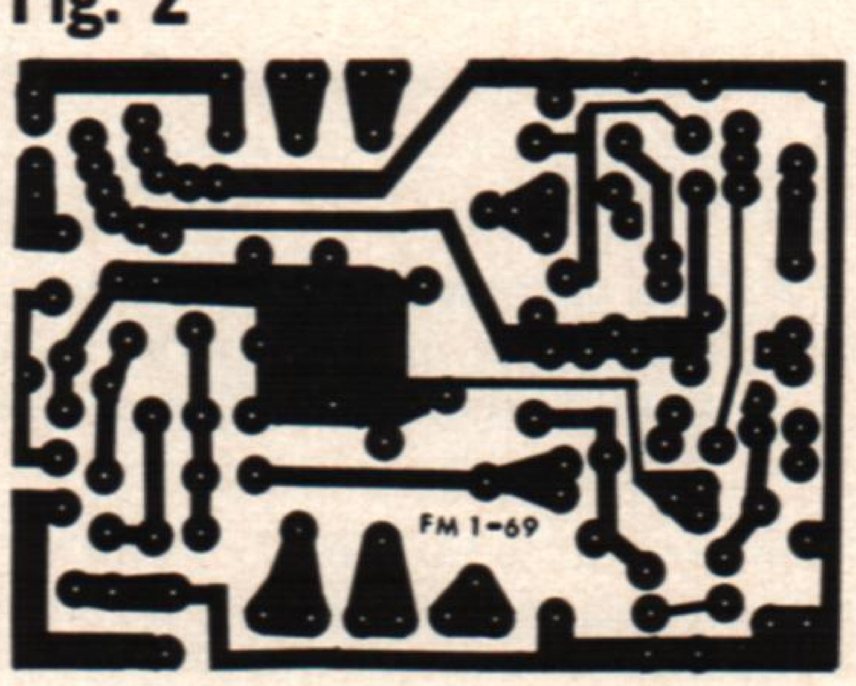
Mode 3 adds a servo to the Mode 2 configuration to give proportional elevator and coupled proportional rudder and aileron, with go-around rudder during throttle changes. The aileron and elevator neutralize during throttle change. Full on-off must be



- C1, C2, C3, C7, C8, and C9 AMPEREX 80MF 2.5V
- C4 0.15MF TANTALUM- C6 AMPEREX 40MF 2.5V
- C5 1.2 MF TANTALUM (SCM 6605-65)
- R1 SEE TEXT – R2 25K TRIM POT
- D1 IN 914 – D2 IN 34A
- Q1, Q6, and Q10 MOTOROLA MPS3638A
- Q2 and Q7 2N2430 – Q3and Q8 2N2431
- Q4 Q5 Q9 Q11, andQ12 MOTOROLA MPS2924

Fig. 1 Schematic uses readily available non-critical components. Operates up to four servos. Rate decoder has broad adjustability and no pulse-width interaction.

Fig. 2



Copper-side full-size PC board. For photographic-process, PC-board reproduction make film positive. Holes by #64 drill.

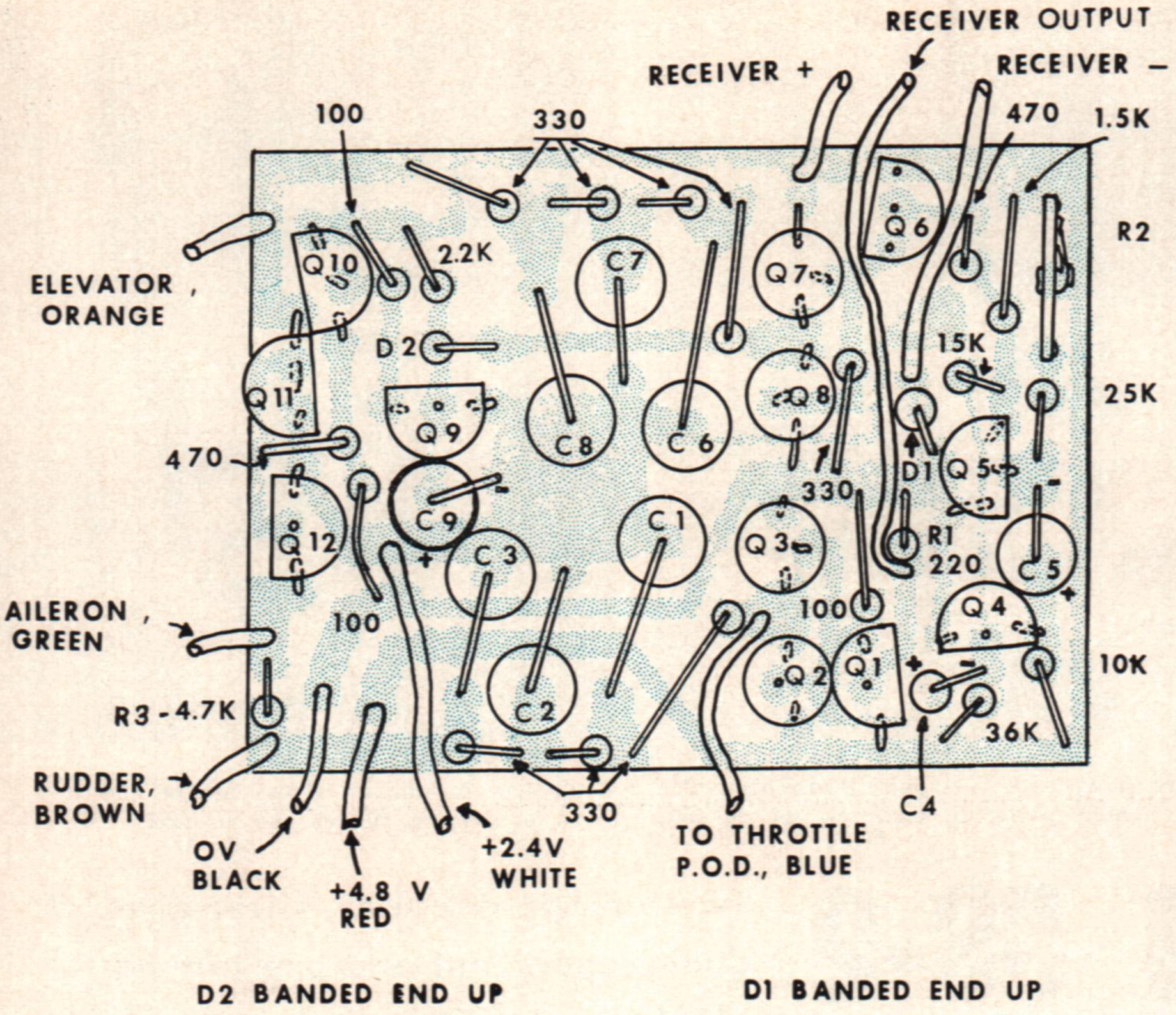


Fig. 3 Parts placement diagram for decoder with filters and lock-out POD. Mount all capacitors with positive end toward PC board. Each piece should be as close to PC board as possible; be especially careful with Amperex transistors.

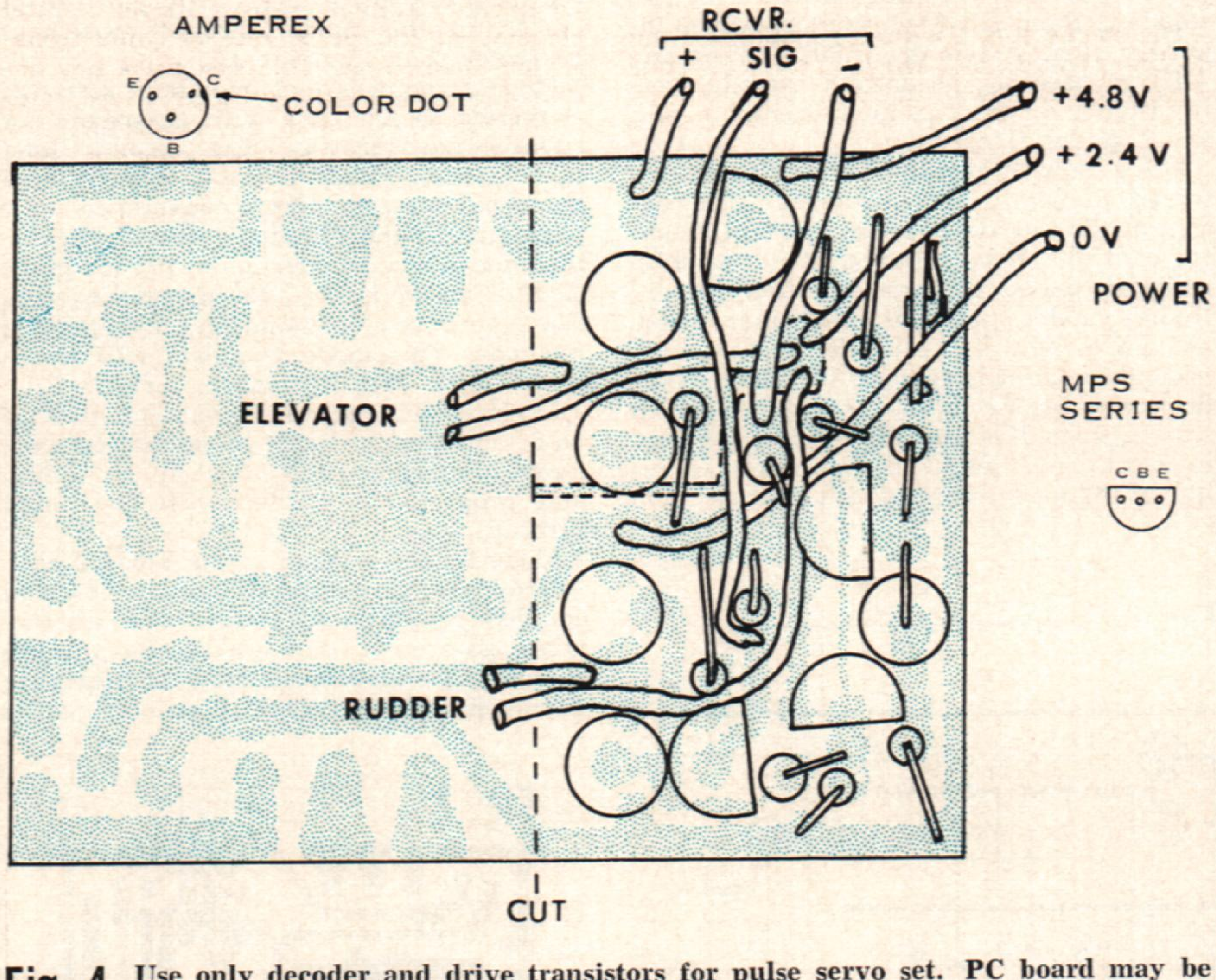


Fig. 4 Use only decoder and drive transistors for pulse servo set. PC board may be cut but, if not, parts can be added later for feedback operation. Pulse servos should oscillate 1/32″ at neutral; set rate and decoder pot accordingly.

used for throttle to provide lock-out of the ailerons. (Full aileron would be experienced if the Mode 2a throttle arrangement were used.)

Mode 4 will be known as the SS-3 (next month's article) and will incorporate a dual pulse-omission detector for a trimmable throttle servo. The aileron and rudder are coupled and all surfaces neutralize during the fraction of a second required for throttle changes. Even the aerobatic Kwik-Fli may be flown with this four-servo single-channel system.

Limitations: This system was designed to meet two specific problems. First, it permits the flyer who has a quantity of pulse equipment to maximize the use of his investment, while learning, quite pleasantly, something about simple electronics. Second, those who build digital kit systems generally will have a good system but, if there is a problem anywhere in the system, it can be found only by using at least an oscilloscope, which the average tinkerer may not have. The Versapro is limited to basically dual-proportional operation with coupled ailerons and rudder, plus trimmable throttle. The parts count is not significantly less than for a comparable digital. But, you can use your existing equipment, and you can find anything wrong using simple test equipment.

Operation: The design is relatively straight-forward. Fig. 1 presents the schematic diagram and lists the parts required. Fig. 2 is a full-size layout for photo reproduction of the printed-circuit board. The schematic is divided into five sections as it is laid out. The first is the receiver output squaring amplifier, Q1. (Resistor R1 must be varied for use with receivers other than the Ace Commander Superhet. Values will be determined and presented in the next issue.) The output from Q1 is a positive-going square-wave used to control the rudder driver amplifier (Q2 and Q3) and its filter circuit C1, 2, and 3, plus the 330-ohm resistors, shown in the upper left-hand quadrant of the schematic.

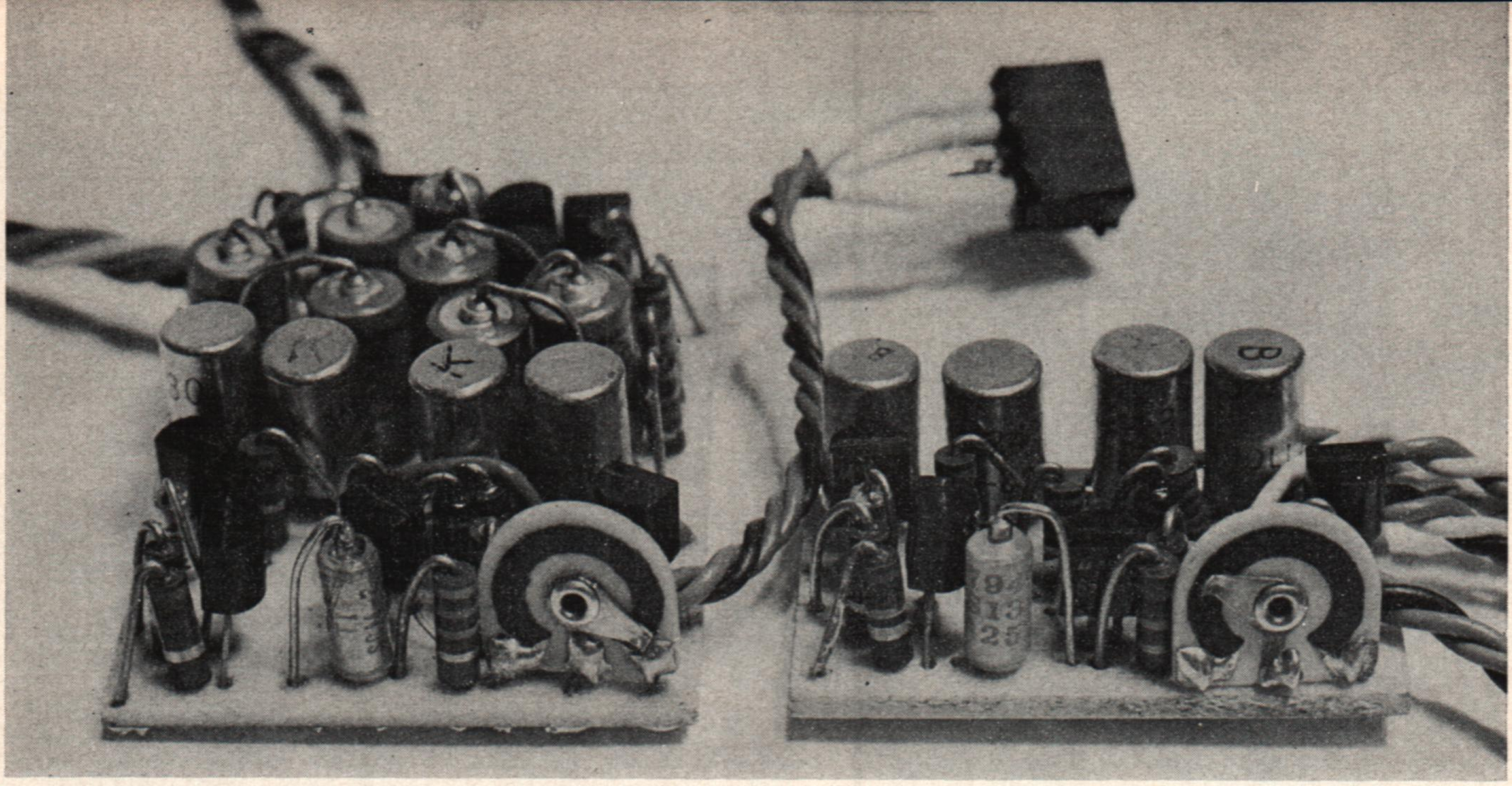
The rate decoder is shown in the lower left quadrant as Q4, Q5 and associated components. The leading edge of the squared receiver-output pulse is coupled via C4 to trigger Q4 in a short pulse. This short pulse charges capacitor C5 which can discharge only through the 25k resistor, R2, and Q5. Thus, the length of time Q5 is on, is set by the pulse rate and by the trim pot R2. Operation is feasible from pulse rates as low as 10-12 pps up to about 20. Broader ranges may be attained by changing the values of C5 and the 25k resistor in series with R2.

The output from the rate decoder is squared by Q6 to control the elevator driver amplifier and its filter in the upper right-hand quadrant, identified by Q7 and Q8, plus C6, 7 and 8 and the related 330-ohm resistors.

If only pulse operation is desired, the rudder-driver output is available at the junction of the emitters of Q2 and Q3, and the elevator drive is available at the junction of the emitters of Q7 and Q8. The other terminal of each servo motor is attached to battery center tap (+2.4V).

The lock-out detector for feedback operation is shown in the lower right-hand quadrant. The output from the elevator driver is coupled through D2 to the base of Q9. As long as the pulsing, unfiltered elevator drive signal is available to Q9 and capacitor C9, the detector keeps Q11 and Q12 solidly turned off. On cessation of pulsing, the detector permits Q11 and Q12 to turn on, thus permitting the output analog signals to elevator and aileron to be locked to battery center-tap to drive the servos to neutral. You will note that there is a 4.7k resistor (R3) which isolates the rudder signal from lock-out for Mode 3 operation. This resistor is jumpered for Mode 4 operation.

Construction: Fig. 3 presents the overlay of components for the complete decoder. Fig. 4 shows the layout changes only required for Mode 1. The changes required to obtain Modes two through four are external to the decoder with the exception of jumpering R3 when rudder lock-out is required. On Fig. 4 is a drawing of the transistor basing arrangements for Motorola and Amperex units. View is from the top



Decoders are so small that, when packaged with small, single-channel superhets, the unit is as small as a modern digital. In pulsing servo set, drive transistors will become quite warm — this is normal. Approximate pot position shown for each type of set.

with leads pointing down and away.

Decide which mode of operation is to be used and build the decoder board accordingly. The wiring diagram for the full decoder is shown in Fig. 5. A Brunner plug block was used to simplify wiring requirements. A separate aileron plug is shown and can be deleted if aileron is not used. Separate plugs can be used for all functions, if desired, and lands are provided. The receiver may be connected by a plug or wired directly.

Fig. 6 presents the layout for a simple .031 aluminum receiver-decoder case dimensioned to accept the decoder and the Commander receiver. The bent-up case is shown in the accompanying photographs. Place the leadout holes as required for your chosen plugging arrangement, but be absolutely sure to provide grommets at all points at which wires exit from the case. The receiver and decoder/filler were held in place in this case using double-sided servo-mounting tape.

If the Brunner plug block is used (on this or any other system), observe one precaution: the power plug is a male plug, i.e., the pins are exposed, and the power pack can be shorted if the plug is removed and the pins touch metal with the switch on. *Do not* lay this plug down without being absolutely certain that the switch is turned off.

The smoke test: 1) Having completed the decoder board and wiring, connect your receiver and power pack to the decoder. The power pack may be made up of four 250 to 600 mah nickle-cadmium cells. Do not use dry cells because their voltage drifts and the servo neutral will drift with neutral voltage. Check out of the simple pulse version will require only steps 2 and 3. The feedback modes require all steps. Note: do not attempt to use coupled aileron-rudder servos in the Mode 1 or 1a configurations.

2) Plug in the rudder servo, turn on the transmitter with controls and trims centered, turn on the airborne system and adjust the broad transmitter width control for neutral rudder servo position. Plug the same servo into the aileron channel (for feedback systems only.); the servo should still be centered.

3) Plug the elevator servo into the elevator output channel. Adjust R2 for neutral elevator at the pulse rate of your transmitter. Remember, this system is not designed to operate at Galloping Ghost rates (6 pps nominal) and the repetition rate must be above 10 pps. If the elevator servo can not be centered, the repetition rate of the transmitter should be increased until the servo centers.

4) *Steps 4 and up apply to the feedback modes only.* With a servo plugged into the

Continued on page 59

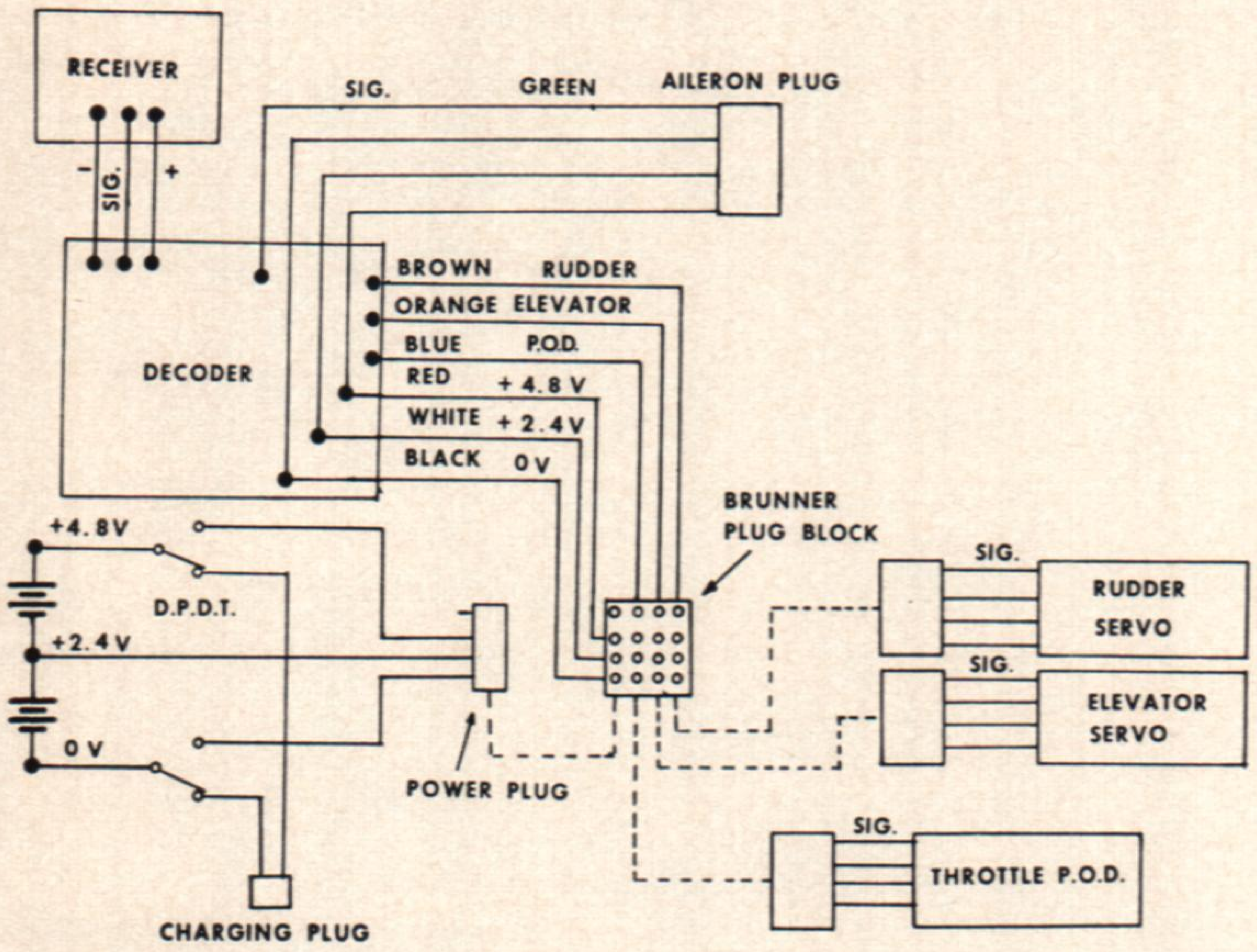


Fig. 5 **Interwiring the feedback system for four servos. Use any good superhet receiver and analog servos. Little Orbit PS-3A, converted Rand, or even older disused units.**

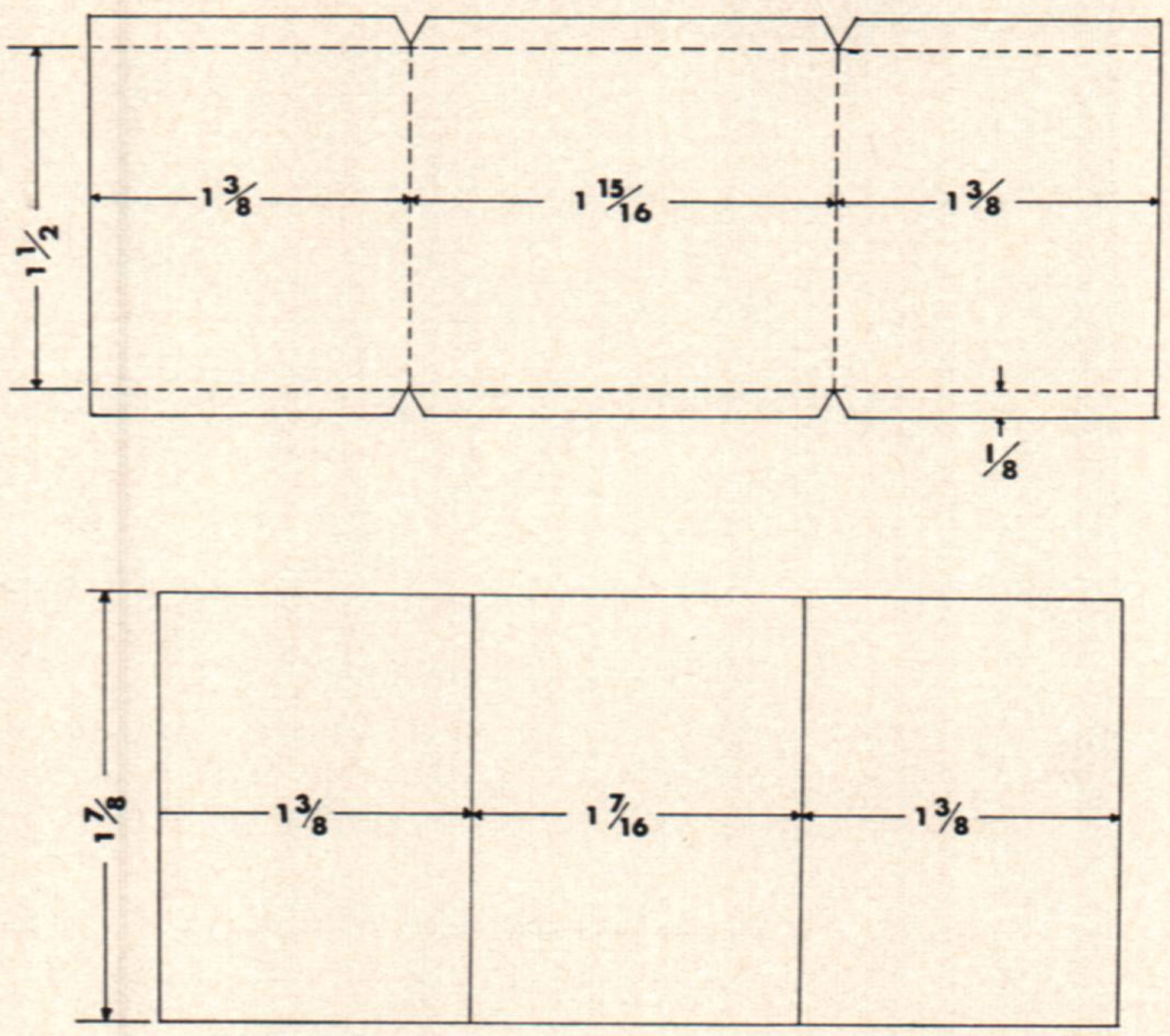


Fig. 6 **Case dimensions shown above for decoder with ACE Commander receiver. For other units, case needs to be only slightly longer on its top and bottom by 1/8″.**

or with a little down control and signal your helper to release the plane. Let the plane roll along the ground and fight the tendency to give up control. The plane will rise on its own if it is neutral and fly at shoulder height. Try to keep it in level flight about 10 feet off the ground and soon the engine will quit. As the model glides downward, give up control, and it will settle to a three-point landing and it's all over.

If this is the way your flight went you are ready for your second flight as soon as your heart stops pounding.

But, if you had problems with the first flight, here are some additional words. First, recheck the controls. If the plane flew high when you thought you were holding neutral, readjust the lines to give a little more down or readjust the top spring tension to give less up. If the plane did not take off, but rolled along the ground until it hit the grass and quit, you can give a little more up, or try another flight, without changing anything and give a little up control after it has rolled about 10 feet. But come back to neutral as soon as it is airborne. Too much up on takeoff can be disastrous and sometimes results in a wingover straight into the ground.

If you got the plane into the air, but had trouble keeping it level, this is caused by over-reaction or over-control. This is a common fault with beginners. This will clear up with more experience, but keep in mind that only a little arm movement is needed for control. Also, with this spring-loaded elevator, all you should have to do is just hang on and let the plane fly itself.

What usually happens is that you are applying control without realizing it. Remember to point your arm straight at the plane as if it were an extension of the control lines, and you should have no problems. If you should happen to crash, check over the plane before attempting another flight. Make sure everything is proper.

Now that you have earned your wings, welcome to the U-Control flying sport!

Versapro SS-2

Continued from page 31

aileron and elevator channels, command throttle changes. Both servos should "twitch" slightly then center until pulsing is resumed.

5) Check the travel of the servos. Servo throw can be reduced on any channel by connecting a variable resistor (trim pot) from the rudder or elevator signal land on the decoder board to the lands carrying +2.4V (battery C.T.). Adjust the pot until servo travel is correct at full commanded travel. Then replace with the equivalent fixed resistor. If the Versapulse transmitter presented earlier is used, the adjustment for width sensitivity is built into the pulser section and can be adjusted there.

6) The above procedure will have set up the basic control signals for the two independent channels. The set-up for each model of operation is essentially as indicated by the earlier description of the mode.

System Compatibility: The decoder was designed to operate with the Ace Commander superhet receiver and the Versapulse transmitter at repetition rates of nominally 18 pulses/second (pps) and width ratios of 30-70, 70-30. However, the decoder should be quite compatible with a number of the current high-pulse-rate transmitters and receivers such as those produced by ACE, Citizenship, Royal, Hallco, and the Bonitron.

The decoder analog outputs were originally tailored for use with the Orbit PS-3A servo. The analog output sensitivity is compatible, or can be made compatible, by means of the trimming resistor described in checkout step 6, with the Phelps, Sampey, Orbit PS-2A and PS-3A, ACL, Dickerson, and the Rand conversion. Some crosstalk will be experienced in the Controlair-Phelps servo because: a) no separate wiring is provided for reference and, b) the wire-wound pot gets dirty and must be cleaned frequently.

Operation has been satisfactory with the Citizenship SSH-P receiver and, to some extent, with the SH-100. (There are several versions of the older SH-100's; some will work, others require modification.)

A pulse-omission detector for trimmable throttle, compatible interface with a number of single-channel receivers, and a modification to the transmitter which will permit elevator to be retained during throttle changes, will be presented in the next issue of American Aircraft Modeler.

Manta

Continued from page 45

The top of the pylon should be sanded slightly concave to fit, then glued to the rear and parallel to the center-line of the pod body. A 2" piece of launch lug is glued along one side at the intersection of this pylon and pod body. Check again to insure that the pylon and launch lug are parallel to the center line. The power pop-pod is now ready for finishing and adjustment.

Finishing: Sand the wing to an airfoil shape, and the rudders to a symmetrical airfoil. The glider body is sanded round on the bottom but is flat on the top. Fine-sand nose cone and all balsa surfaces, then coat with sanding sealer or clear dope. For light weight, just fill and sand sufficiently for a smooth surface. Generally, two coats will suffice, although in some cases, three coats will be required. Of course, a beautifully done, colored finish is ideal for appearance. I have found that the added weight of pigmented paint does affect the performance somewhat.

Pre-flight adjustment: Fit the pop-pod on the glider so that the ⅛" dowel pin fits into the hole in the nose of the glider body. You should be able to "pop" the pod of the bird by hitting the nose cone lightly with the palm of your hand. If the pod fits too tight, sand inside of the alignment plates until it comes off easily but does not fall off when you hold the glider.

The CG for the glider phase is 3½" from the front of the wing where it connects to the body. Balance the bird with clay without the pod attached until the CG is correct. Hand-glide and trim as necessary. Generally, exact trim cannot be determined until the bird actually has been flown under power.

Power adjustment: Although the bird will generally lift off the pad and rise vertically with no adjustment, sometimes a little adjustment is necessary for a perfect vertical flight. Load the power pod with a ½A6-2 engine, wrapped with tape for a tight fit, for the first test flight. The nose cone should fit snugly into the body tube to get proper ejection of the power pod. Don't forget the wadding in front of the engine before you load the chute and insert the nose cone.

A piece of masking tape should be placed on the launch rod so that the power-pod weight is resting on the tape. This keeps the pod from separating from the glider before ignition. Fire the rocket and observe the flight under power. If the bird veers over on its back during the initial flight, shave the nose of the glider to tilt down the pod. This should be done only 1/32" at a time until the trim is correct.