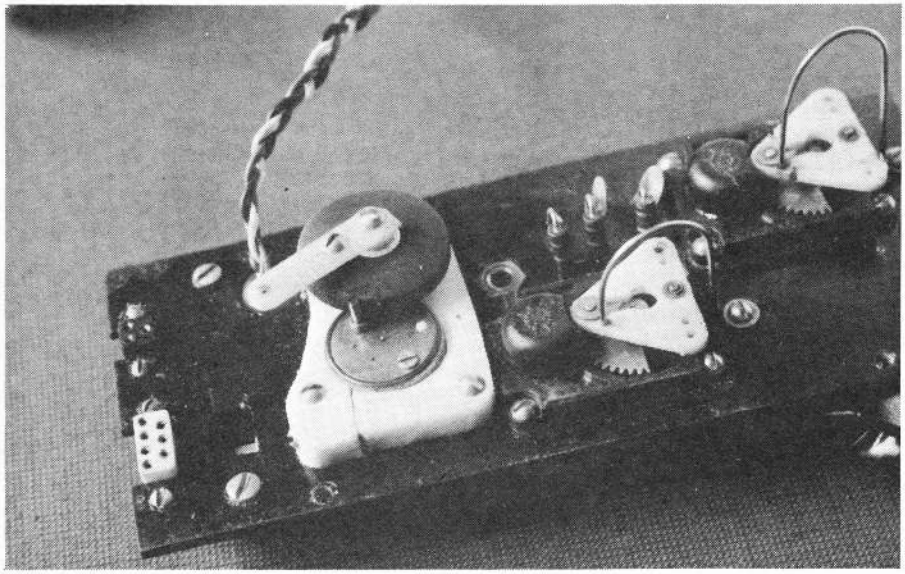
Simultaneous Motor Control

Simultaneous throttle without the extra kick or control hold during throttle control actuation. Size is apparent in this photo using a standard pencil for comparison. It's small.

for Karlsson Decoder



And still another step upward in control functions. Sterner's throttle servo incorporated in Karlsson's R.E.M. (rudder, elevator, throttle) system using motor control and decoder.

By BOB KARLSSON

Excellent addition to the Karlsson decoder published in April 1966 issue. How-to instructions make it simple to add on this extra step of electronic control for your single channel proportional system for small and large planes.

(SEE PAGE 39 FOR MOTOR CONTROL SERVO DRAWINGS)

► In most "kicking duck" pulse systems, motor control is obtained using a P.O.D. (pulse omission detector). A stepping type servo may be triggered with a short break in pulsing, or a trimmable type servo can be run in either direction by a solid tone, or lack of pulsing. There are several difficulties associated with this arrangement. By far the worst is the "glitch" caused by both elevator and rudder as pulsing is stopped, they travel very quickly towards full control position until the P.O.D. drops in, then neutralize. Also, as long as M.C. is held, no commands to flying surfaces can be made.

In our decoder, reed switches are used for switching these commands, and the breaking of contacts can give trouble to sensitive receivers, as this system uses a common power supply.

Simultaneous throttle was the most desirable improvement in the system. The requirements were

1. No changes in receiver, a S.H. 100.
2. No modification in decoder.
3. No additional battery.
4. No major change in the transmitter, a Controlaire Mark II.

The articles in M.A.N. of aileron control for the B & D system offered the first suggestion. The use of variable tone frequency was the most logical method of encoding the new function. A discriminator using stagger tuned filters and a feed-back servo was built and flown. Not to take credit away from the transmitter as it was designed for this purpose, but the tone would drift with temperature and voltage, and the filters require more stability than could be obtained without a new tone generator circuit in the transmitter.

It was decided to use a greater tone change to lessen this problem of drift, also to use a trimmable type servo already installed in two aircraft. Circuit is shown in Fig 1.

The audio is taken from the base of Q6 in the S-H 100, fig. 2. The other components shown in fig. 2 form a demodulator to eliminate any timing error in demodulation. If your rudder drifts right, with down elevator, this addition will eliminate this. Parts fit in place vacated by relay. Remove old filtering capacitor. If you had no interaction, this circuit will not help anything else.

Q1, fig. 1 is an audio amplifier. Q2 and 3 are a one shot, with Q4 being on in the quiescent state. It is turned off each audio cycle for a time determined by C2 and R6. C3 is discharged when tone is off, and will charge to a voltage determined by the frequency. Q4 is an emitter follower; the emitter will be held ½ volt positive at the lowest voltage reached by its base. C4 and R9 have a long RC time, and this voltage is maintained between pulses. In other words, Q4 is a peak voltage detector. Q5 is another emitter (*Continued on page* 45)

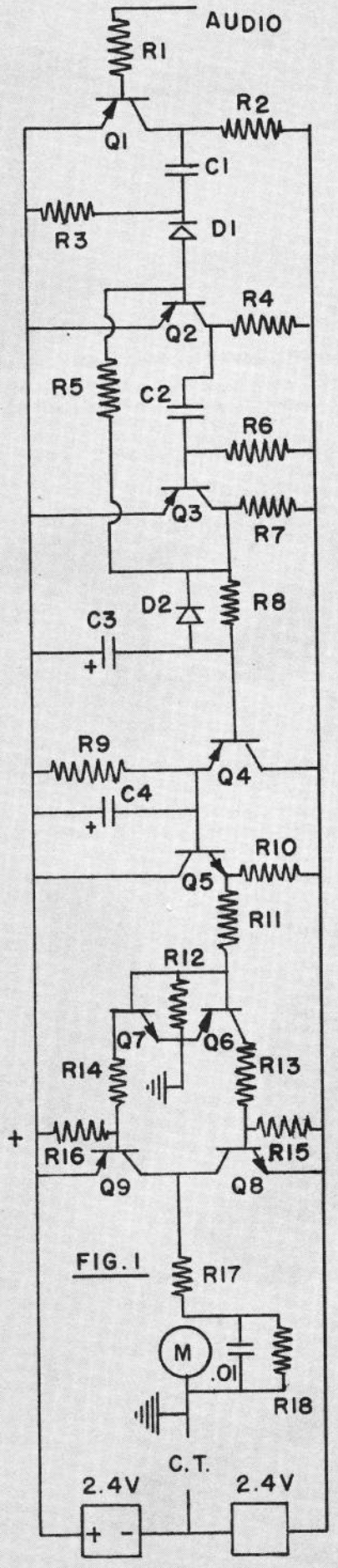
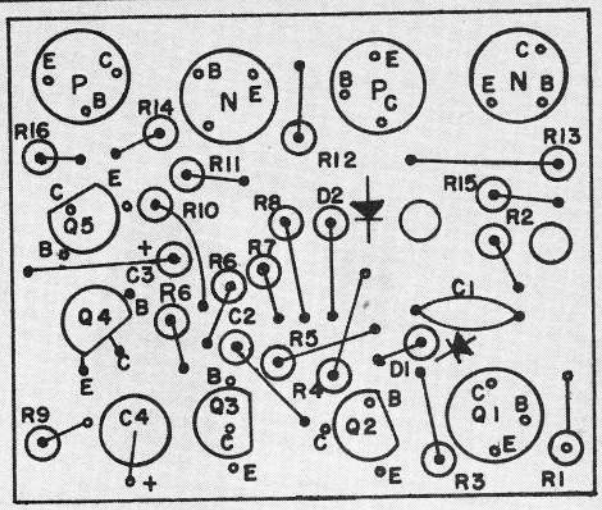
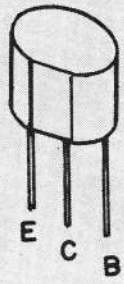


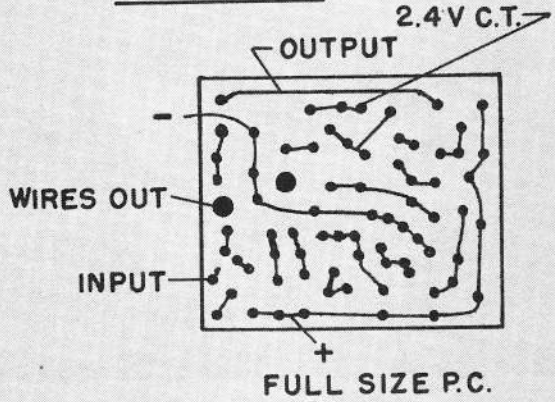
FIG. 1



PARTS LAYOUT
DOUBLE SIZE



2N3702
2N3704



FULL SIZE P.C.

KARLSSON SIMULTANEOUS MOTOR CONTROL

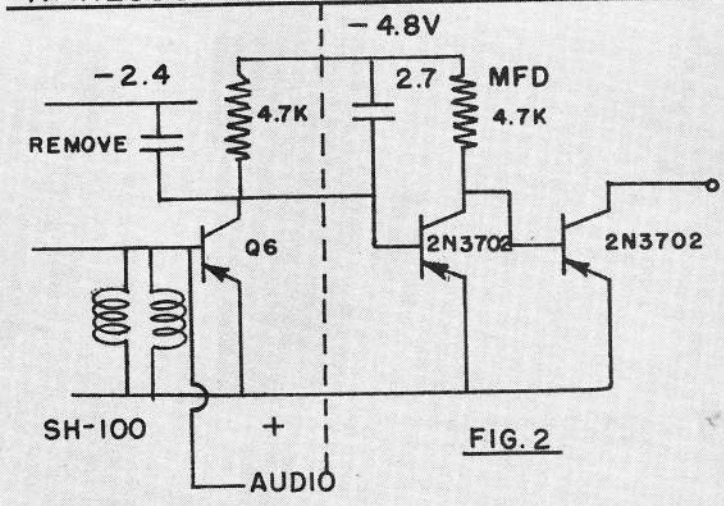
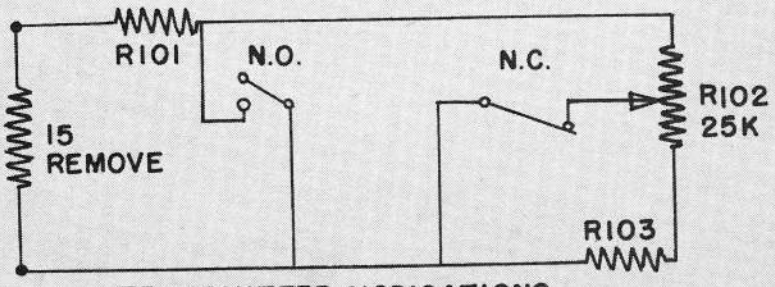


FIG. 2



TRANSMITTER MODICATIONS

C/L Flying School

(*Continued from page* 16)

plane will help alleviate this problem.

7. Do not give the student more than two or three flights in succession without a break. Trying to teach too fast can make him feel that he is slow in learning. And, as a consequence, he may get discouraged and form a mental block against everything you say from that time on.

8. The take-off and first lap of any flight is the most critical for any beginner. Stay with him during this period and compliment him on his progress.

9. Avoid giving flying instructions in windy weather if possible. The extra complications of correcting for going into the wind and downwind are too confusing for most beginners to grasp right away.

10. If at all possible, the engine should be equipped with a muffler. A screaming engine indicates to the student that a lot of power is out there in the plane and he doesn't have much room for error. Experience has shown that a muffler removes this fear and hastens the learning process.

11. After the student makes his first successful solo flight, shake his hand or give him a pat on the back for a job well done.

12. Be sure to invite the new "pilot" back for another flying session and inform him where and when your club holds its regular meetings.

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follower to provide impedance matching.

Q6, 7, 8, and 9 are a complementary symmetry amplifier. If the voltage at the base of Q6 and 7 is 2.4 no output results. At 2.2 volts Q6 is turned on, switching on Q8. At 2.6 volts Q7 is on, switching on Q9.

R11 and 12 are a voltage divider that will adjust dead-band of the circuit.

The only receivers used for this have all been Controlaire SH 100; the only transmitter, the Controlaire Mark II Mule. The modification to the equipment was O.K.'d by Don Baisden of World Engines. The only servos used the micro-mo TO-5 with 141-1 gear case, or the TO-3 Micro-Mo, 60-1. A slip clutch is required.

A rubber wheel running against the output shaft acts as both a clutch and gear reduction. This arrangement proved the best, and is very worth while as a M.C. servo for many other pulse systems. If the frequency is not changed enough, insufficient drive can cause excessive dissipation of the output transistors, unless the output load is *6 ohms or more*. The 40396 from RCA is a matched pair of germanium transistors. The maximum collector current is 500 ma., dissipation 300 mw. They are in a metal case ¼ inch in diameter. If you order one 40396, you get one package containing a PNP and NPN unit. The pair is less than a buck. The ones tested were well matched, and also much more uniform than 2N 1302 and 2N 1303. The emitter collector saturation voltage is also very low.

Most likely this circuit will not work with other decoders. The system requirements are

1. Common battery supply, decoder, receiver

2. 4.8 V or more, center tapped.

3. Transmitter and present airborne equipment capable of operating satisfactorily with a variation in tone of 700-1200 hz.

4. Battery supply, 750 ma. hour nicads or larger.

The transmitter requires some additions, but first to see if these requirements can be met, try this. Remove the 15K resistor from the tone generator near the trans-

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former. Bring two wires out from the same lands to outside the transmitter. Connect them to a 50K Potentiometer (pot.). Use some tape to insulate the pot from the case, and tape it temporarily to the transmitter. With antenna removed, operate the system and locate the extreme position so that pot can be rotated with no drop in range. It is very possible that the pot can be changed from no resistance to 30K or more with no drop in range. The idea is to see how much tone frequency change you can get. The range could be as much as 700 to 1400 hz. Ideal for the system would be 750 (about F sharp) to 1100 (about C sharp), while listening to the tone on a monitor, or earphones. Disconnect pot at each extreme and measure resistance.

If your airborne equipment passed this test, permanent modification can be made to the transmitter. R102 is a 25K pot, mounted so the shaft is outside of the case, but out of the way, as this will be a neutral trim, seldom used. The N.O. switch is hi-tone or advance throttle. R101 is a fixed resistor, the value determined from the previous tests. It is the total amount of the *least* resistance that would operate the system. (Hi-tone). R103 makes up the difference so that the resistance of R101, 102, and 103 in series (with N.C. switch open) equals the most resistance in the previous tests. R103 may not be required. Two of the disk capacitors in the tone generator should be changed to mylar 100 V units. They are the .05 mfd to .05, or .047, the .02 to .015 or .02.

The P.C. base is next. Cut a piece of material to size shown in figure. Tape it under the layout, copper side up. Lightly center-punch each dot. Dope has been found to be a good resist. Cover each center punch first, making sure to get enough land for a good joint. Connect the dots. If you get things too close, the dope can easily be cut off with a sharp-pointed tool. Two coats are required. After etching and drilling, scrub board with a Brillo pad or cleanser.

All components should be installed except R6 and R12. R17 and 18 are not on P.C. board, but are installed on servo board with the .01 disk. The total resistance of the load should be 6 ohms or more, which will determine R17. The T.O. 5 requires 3.3 ohms, the T.O. 3 high resistance 2.7 ohms, and the T.O. 3 low resistance 5.6 ohms. These should be ½ watt resistors.

A 25K or 50K pot with at least a 100 ohm fixed resistor in series is substituted for R6, a 10K pot for R12. This can now be wired into the airborne system.

Turn the pot on the transmitter to highest tone, R6 to low resistance, R12 to high resistance; turn on the system—motor should run same direction with or without signal. While pulsing, increase R6. The motor will stop. Increase it until it runs in the other direction. Now decrease tone frequency until the motor stops. Use of low and high buttons should now operate the servo in each direction. Extreme stick position may cause unwanted movement. Decrease R12 until interaction is eliminated. The most likely cause of interaction is too small a battery supply, causing excessive voltage drop at various stick positions.

When satisfied, substitute fixed resistors. Note a place for two resistors for R6 in parallel. This makes it easy to get the proper value. You might keep in mind, while selecting R6, that frequency drift of the transmitter is a higher tone with higher temperatures, tone lowers as supply voltage drops. The tone pot on the transmitter will let you adjust for neutral dead band due to voltage or temperature change, but will not change the high and low extremes.

This circuit was wrapped in plastic tape and stuffed in the airplane under the servo board. This winter the circuit has been built as a part of a new decoder and packaged in one case with the SH100, total size 1¾ by 1⅜ by 2⅜, weight is slightly less than 4 oz. If you have not had sufficient drive with your decoder, the 40396 are better replacements for the output transistors. The PNP unit is marked with a P, the NPN with a N. These are new and may not be readily available yet.

Another problem that has given trouble with the decoder is that the elevator position is sensitive to temperature. Most of this drift can be eliminated by substituting a thermistor for the elevator trim pot in the decoder. Center the system at room temperature; remove the pot from the decoder and measure resistance. Be sure to measure correct pair of leads! A Fenwell disk thermistor of the closest higher value is substituted for the pot. These can be obtained from Allied for one dollar.

Resistance	Mfr's Type
1K	JB 31 J1
3K	JB 33 J1
5K	JB 35 J1
8K	JB 38 J1

Elevator can be centered by finding correct value for R16, from base to emitter of Q6.

This type of throttle control has been used through one season in two of my planes and in one more built by Tom Sterner. After the first adjusting, no trouble was encountered, but due to the limited testing, I considered this still experimental, and not recommended for those not familiar with the circuitry.

PARTS LIST

Q1 2N 217 or SK 3003 RCA
Q2, 3, 4 2N 3702 T. I.

Q5 2N 3704 T. I.
Q6, 7, 8, 9 40396 RCA (2 pairs)
C1 .005 miniature disk
C2 .1 MFD tantalum
C3 2.2 MFD tantalum
C4 22 MFD tantalum
D1, 2 1N 4009 GE

All capacitors should be 6 Volts or more.

Tantalums are Kemet C series or Sprague 162D series to fit this P.C. layout.

Resistors, ¼ watt

R1	1K	R10	10K
R2	1K	R11	470 ohms
R3	4.7K	R12	See text
R4	1K	R13	47 ohms
R5	15K	R14	47 ohms
R6	See text (about 9K)	R15	680 ohms
R7	820 ohms	R16	680 ohms
R8	470 ohms	R17	See text
R9	56K	R18	470 ohms

Printed circuit boards, undrilled, avail., from Ed Heyman, 122 Delview Drive, Windybush, Wilmington, Del., 19803 for $2 Note: Kit will be available from World Engines shortly.

Foreign Notes

(*Continued from page* 4)

highly complex scale multi R/C jobs that some fellows spend months in building and which then end up spread all over the runway.

Yes, we know that quite a lot of models actually get retired from old age, but we are trying to make a point, to wit: are we all so fatalistic that we have grown to accept certain risks to models and equipment that are totally unnecessary? For example, why, at model meets, do so many modelers leave their airplanes sitting around unattended where spectators or even other modelers can fall over them? This seems to have originated with the advent of U-control and the practice of leaving model and lines laid out between flying sessions. Many an innocent onlooker has, quite unjustifiably, been made to feel all kinds of a fool for being effectively booby-trapped by some nitwit's control-lines, the existence of which could scarcely have been known without the aid of a mine detector anyway.

Then there are the lapses by manufacturers which occasionally seem to go unchanged by the modeler. Examples here are receiver plugs and sockets that have no provision for being locked together and battery-boxes that have to be lashed with rubber to maintain effective contact. Transmitter cases that can fall apart, if picked up wrongly are not unknown. We are thinking, in particular, of one type of multi transmitter which, if picked up by gripping the sides of the case from the rear, can immediately result in the complete chassis