OCTOBER . . . 1963

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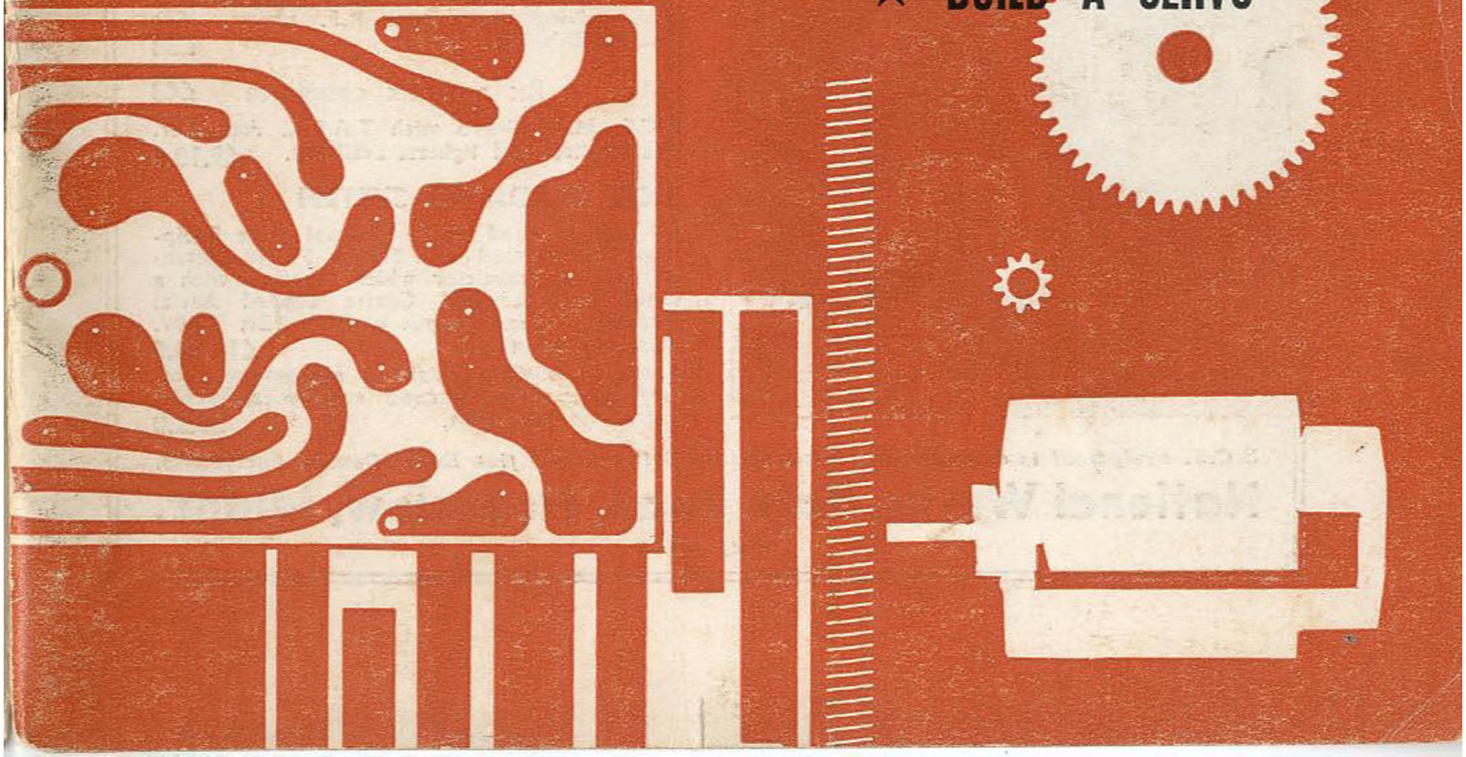

RADIO CONTROL MODELS & ELECTRONICS

OCTOBER
1963

VOLUME 4 NUMBER 10

CONTENTS

Editorial Director
D. J. LAIDLAW-DICKSON

Editor
W. P. HOLLAND

Editorial and Advertisement Offices :

38 CLARENDON ROAD
WATFORD, HERTS

Telephone :
WATFORD 32351/2
(Monday to Friday)

NEXT MONTH . . .

Highlights of the issue include :

WORLD R/C CHAMPIONSHIPS REPORT
SUPERHET FOR BOATS
NEW PROPORTIONAL SYSTEM
NEW SERIES FOR BEGINNERS
LATEST EQUIPMENT ON TEST
COMMERCIAL DEVELOPMENTS
GADGET PAGE

Plus the usual favourites

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robbe — telecont

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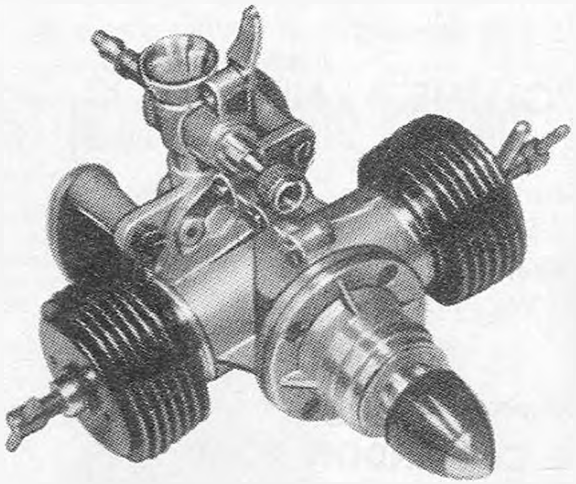


OUR RANGE OF PRODUCTS INCLUDES : KITS FOR SCALE AND FUNCTIONAL AIRCRAFT - GLIDERS - BOATS - YACHTS SCALE SHIPS - ACCESSORIES - ENGINES—SINGLE AND TWIN CYLINDER - BOTH TRADITIONAL CONSTRUCTION AND LATEST EXPANDED POLYSTYRENE FEATURED.

5 & 9 channel Transmitters shown here.

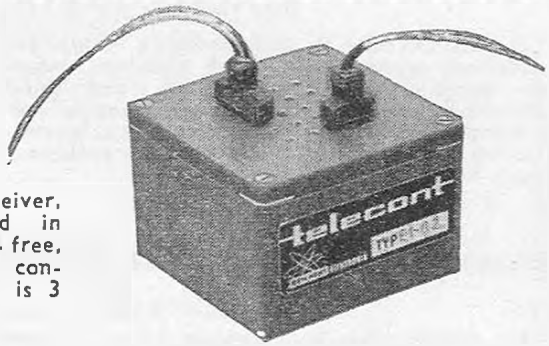
Bottom left : Transmitter in its neat camera-like leather case, the handiest ever.

A SPECIAL THANK YOU !

To modellers everywhere who have borne patiently with us during the past few months whilst we have been testing the market strength. We are now more than ever confident in the great future of robbe and telecont. We already stock a good selection of products and these are being stepped up enormously in both quantity and variety, so that we look forward to supplying your every need quickly and efficiently !

RADIO CONTROL EQUIPMENT

Tone Modulation - No Tuning - Crystal Controlled Reliable, Proved and Field Tested for Two Years Very Convenient and Easy to Use - Almost Foolproof



A typical Receiver, cleverly cased in and trouble - free, with plug-in connections. This is 3 channel type.

ABOUT TELECONT.—Fully transistorised, economical transmitter using only 7mA standing current. Accumulators rechargeable without removal via special sockets. Tx housed in miniature leather case like a camera—and is about the smallest and lightest you will find. Receiver—also fully transistorised—has sensitive relay that is nevertheless unaffected by vibration : the whole unit is stable, crash resistant and thoroughly reliable. Any Telecont Rx will work with any Telecont Tx. Well planned plug-in system makes installation a pleasure. Workmanship and material is high class throughout. You will really enjoy yours !

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WATCH the output of your transmitter go up with a Teleradio centre loaded whip aerial, Type CL/V.54.

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HEAVILY chrome plated. closed 8", fully extended 54".

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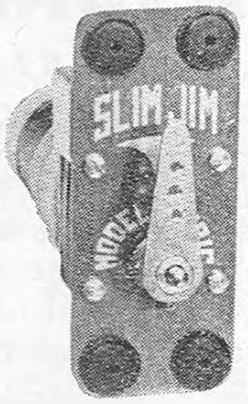
MODELECTRIC

A new motorised selective compound servo to operate from

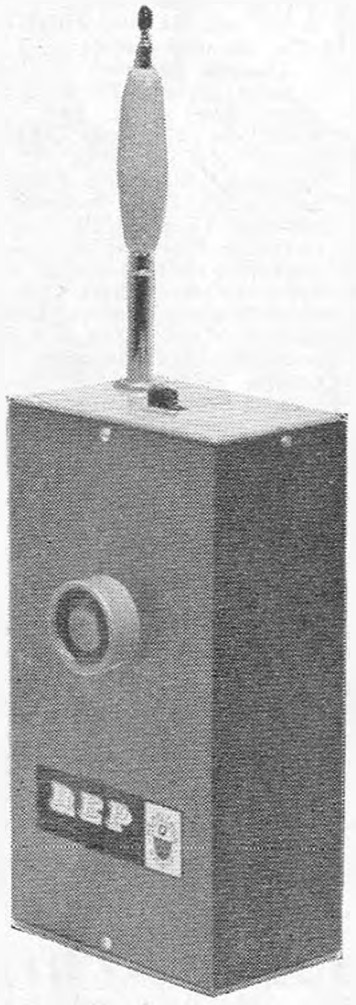
RELAYLESS RECEIVERS



- This servo incorporates a transistorised circuit which enables it to operate from relayless receiverr.
- Only a single battery is required to operate both servo, and the secondary unit, which may be rubber driven or motorised.
- No current passes through servo in, left, right or neutral positions.
- Completely enclosed contact surfaces.
- Operates from 4.8-6 volts, wt. 1½ ozs. PRICE **£4.15.0d.**
- Used with Modelectric receiver and motorised actuator will give low consumption, lightweight system.

MODELECTRIC, 2 Hanover Gardens, London, S.E.11

GEMINI



The new GEMINI is a single channel system enabling two models to operate at the same time

- **6 Transistor Transmitter**
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THE A.B.C. TONE RECEIVER KIT

RELAY ! RELAYLESS ! MULTI-CHANNEL!

Like the versatile A.B.C. Transmitter, the A.B.C. Tone Receiver can be used in various ways ; proportional operation with its relay, relayless for actuators etc., or multi-channel using a low resistance reed bank.

The 12 page instruction booklet containing stage by stage diagrams, the three methods of operation and connection to battery supplies, make it, as its name implies, as simple as A.B.C. to build.

The receiver is not all transistorised but employs a valve at the 'front end' which gives maximum stability, ease of tuning, greater sensitivity and selectivity and is also non susceptible to impulse interference from electric motors, etc.

The tuning coil is supplied pre-wound with self-fluxing wire making scraping clean unnecessary. The dust core has been treated with a non-locking core compound to prevent its detuning when subjected to vibration. The core can be rotated in the normal way however by means of the special trimmer provided.

TONE RECEIVER KIT (with plastic case 2½" x 1⅝" x 1¼")	£5 5 0d.
COMPLETE C.W. TRANSMITTER KIT (pulse prop.)	£4 19 6d.
PULSE UNIT ONLY	£2 17 6d.
TRANSMITTER ONLY (C.W.)	£2 7 6d.
TONE MODULATOR UNIT (transistorised)	£1 14 6d.
DE-LUXE ALUMINIUM CASE 8" x 6" x 2¾" (Pre-drilled, silver/grey stove enamelled, mounting shelf and complete with all hardware parts)	£1 12 6d.
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AERIAL MOUNTING SET	5 8d.

Please include stamped addressed envelope with all queries, always include enough for post and packing (min. 1/6d.), any excess will be refunded.

ALAN NICHOLLS (Radio & Model Engineers), 151-153 Lees Rd., Oldham, Lancs

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Manufacturers of the "CLIMAX" range of Actuators are pleased to announce a new After Sales Service for their range of Actuators. If the one you have requires repair or a seasonal check, send it to us, with a P.O./Cheque for the appropriate amount listed below. It will be returned to you within seven days from receipt.

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NOTE : If a new motor or complete amplifier is required we will advise. The additional charge will be 7/6d. *and* £1.12.6d. *respectively.*

ARE YOU THINKING OF CHANGING OVER TO A RELAY-LESS RECEIVER?

Why not have your Servomite or Musclemite transistorised? The charge is £4.17.6d. each and the time taken approximately one to two weeks from receipt.

COMING SOON —

A printed circuit for mounting up to four standard or four transistorised Servomites, fitted with special rubber mounts to insulate against vibration. Built in sockets for power supplies and ailerons.

C & L DEVELOPMENTS LTD., 47 Queens Road, Weybridge, Surrey

Here, There & Everywhere

May The Best Man Etc.

Whilst this issue was with the printers, the World Championships were in full swing, and once again the judges will have decided which combination of equipment is proved most reliable, airframe design the most adaptable to the contest flight pattern and pilot whose skill and consistancy of performance demonstrates the best of both the foregoing.

With the increasing number of multi proportional outfits around these days we can forsee a little rethinking in terms of airframe design and an increased demand for skill on the part of the pilot to provide a polished presentation of his whole performance for, with the sections of flight between the manoeuvres smoothed out by the use of proportional, it would seem that he has a greater advantage over the standard system. Judges always we hope, aware of the difficulties involved in producing the ideal flight pattern whether they are watching genuinely difficult (some say well nigh impossible) manoeuvres like a tailslide or a slickly performed relatively easy part of the schedule. Great stuff these championships. An inspiration whether sports or contest minded, serving to improve the reliability of equipment, produce practical models and develop a pilot's skill.

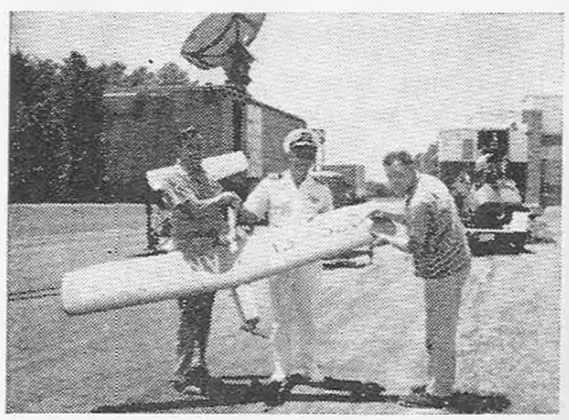
Xtal Gazing

There has, of recent weeks, been considerable discussion between manufacturers and ourselves in respect of the spot frequencies now used for superhets. Read on Mr. Average Modeller, in a very short time this could mean YOU.

Already there are several strongly held opinions on the matter, and we felt that a number of people were either working a little in the dark, or determined to "go it alone." We therefore circularised all the information we have among the manufacturers whom we knew were interested in superhets in order to A. Clarify the situation, B. Arrive at a mutually agreeable solution, C. Provide better facilities for our ever increasing contest programmes.

As we see it, something must be done to enable more models to be operated on the same airfield or lake at the same time, so that given a reasonable amount of liaison between the organisers of each section of the day's events, it would be possible to operate what would be free flight aircraft or free running boats with ultra-simple and extremely lightweight radio as a means of preventing fly-aways in the aircraft world, obviating a certain amount of bow bending with boats. Such measures as may be taken to bring about what may at this stage seem to be just a pipe dream, must of course be practical, consistent and light on the cheque book. Gentlemen, the discussion is now open; three proposals and several comments have so far been received. We do not in any way commit ourselves as to the priority or policy plugging of any manufacturer, it is hoped that by publishing information and comments we can achieve the best results for our mutual benefit. This is in turn the best reward a manufacturer could wish for, a great easing of the contest directors burdens, and who knows, there may even be a chance of the modeller flying three or four times in a whole days' contest.

Is this glorious situation likely to come about? Would it be practical for Mr. Average, or does one have to be a boffin to get results? Write to us, carry out experiments, we will pass the gen on.



Maynard L. Hill, Capt. Sellars (Naval Weapons Lab. Commanding Officer), John Worth, celebrate the record breaking flight. Worth has just crayoned the numbers "13.320" to record the altitude reached. In left background is the Navy Radar trailer with antenna. Right background NASA optical tracker, used as backup for the primary tracker.

Tranny Trainers

We hear from the "Ikarus" Harsewinkle e.v. Model Aero Club that they use a number of Telecont Radio Control outfits which are quite interchangeable. This says a lot for the stability and close adherence to specification. This is an invaluable asset as they train their young pilots so that an old hand is always available with a transmitter which matches the receiver in the pupil's model and can, in an emergency take over without the usual snatching to and fro of one transmitter as experienced over here in some clubs.

The equipment, incidentally, was placed first, second and third in class four and first in class three at the Austrian Nationals for model aircraft at Klagenfurt in June.

Thank you

Our thanks to Mr. A. White of Heston who was instrumental in establishing contact between the lad who found the transmitter mentioned last month, and its owner.

On The Cover

Just to prevent Deltas becoming a less unusual subject, Jack Bone, Victoria, Australia, built this twin engined (two K & B 45's) model. It is a somewhat stretched out "Hustler" with a lethal looking snout, the model carries O.S. 10 Channel Equipment.

Quite a lot of wing area, with 66 in. span and adequate to carry its 12 lb. weight. The controls are elevator and trim, ailerons are connected to a steerable nosewheel, motor control, spoilers (!) and wheel brakes operating on down trim. Apparently, when the photograph was taken by Jim Fullaton, the ground was very marshy, and a higher angle of attack would have been more desirable when taxying.

The standard "Hustler" kit is reviewed in this issue.

* * *

The various bits and pieces scattered around the cover represent the simplicity of the lead screw servo described on page 485.

Stop Press!

THIRD WORLD RADIO CONTROL CHAMPIONSHIPS

RESULTS

	Competitor	*Country*	*Total Points*
1.	Brooke, R.	U.S.A.	3,730
2.	Bosch, F.	Germany	3,780
3.	Kazmirski, E.	U.S.A.	3,430
4.	Louis, P.	Belgium	3,391
5.	Nelson, G.	U.S.A.	3,356
6.	Culverwell, C.	S. Africa	3,328
7.	Van-den-Bergh, F.	G. Britain	3,278
8.	Teuwen, Ch.	Belgium	3,071
9.	Marot, P.	France	3,040
10.	Tom, H.	Canada	3,022
11.	Gobeaux, J. P.	Belgium	2,997
12.	Stephansen, P.	Norway	2,956
13.	Chercover, M.	Canada	2,954
14.	Connacher, J.	S. Africa	2,896
15.	Schumacher, H.	Germany	2,851
16.	Malherbe, M.	S. Africa	2,795
17.	Hitchcox, W.	Canada	2,780
18.	Bignon, P.	France	2,568
19.	Corghi, E.	Italy	2,446
20.	Plessier, F.	France	2,261
21.	Dilot, R.	Sweden	2,205
22.	Eliasson, P.	Sweden	2,202
23.	Tonnesen, V.	Norway	2,152
24.	Van Vliet, T.	Netherlands	2,142
25.	Kramer, N.	Netherlands	2,087
26.	Mantelli, D.	Italy	1,961
27.	Gast, H.	Germany	1,943
28.	Brooks, H.	G. Britain	1,739
29.	Sauthier, C.	Switzerland	1,738
30.	Olsen, C.	G. Britain	1,734
31.	Hormann, G.	Austria	1,690
32.	Aebi, A.	Switzerland	1,603
33.	Levenstam, J.	Sweden	1,499
34.	De Mulder, W.	Netherlands	1,486
35.	Reinas, P.	Finland	1,378
36.	Mortensen, F.	Denmark	1,206
37.	Matthey, A.	Switzerland	666
38.	Miliani, V.	Italy	665
39.	Sederholm, J.	Finland	240
40.	Bardou	Monaco	0

Fly Off

Competitor	*Country*	*Points*
Brooke, R.	U.S.A.	1,928
Bosch, F.	Germany	1,856

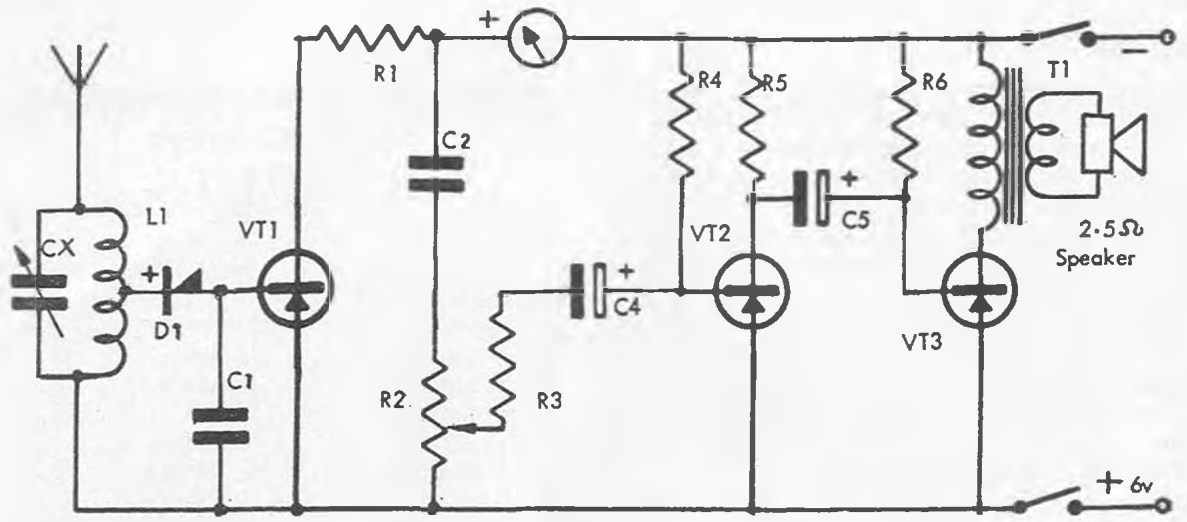
(Joint champions, Brooke holds trophy.)

Team Places

Country	*Pts.*	*Country*	*Pts.*
1. U.S.A.	10,516	6. France	7,869
2. Belgium	9,459	7. G. Britain	6,751
3. S. Africa	9,019	8. Sweden	5,906
4. Canada	8,756	9. Netherlands	5,715
5. Germany	8,574	10. Italy	5,072
	11. Sweden	4,007	

Concours D'Elegance

1. Kazmirski, E. U.S.A. 469 points.



FOR THE FIELD OR WORKSHOP . . .

A Simple Monitor/Field Strength Meter

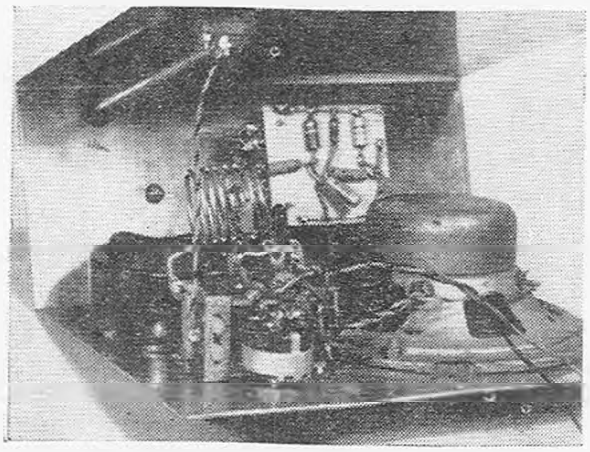
DESIGNED BY PETER WATERS . . . USING JUNK BOX PARTS

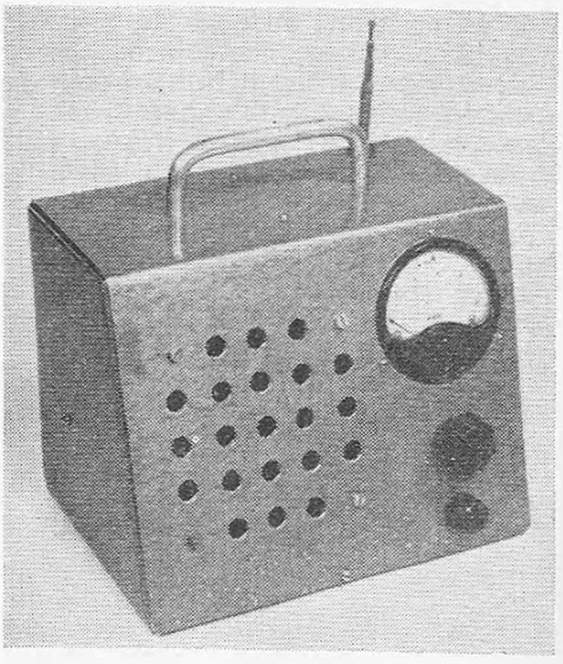
WHEN building a field strength meter, very little extra effort is needed to add an amplifier stage and a speaker so that it becomes a monitor. The advantage of using this type of instrument for monitoring transmitters on the flying field is that it does not create any radiation of its own to interfere with other receivers.

It has been found that super-regen receivers, the heart of some monitors, do produce sufficient interference to affect some other super-regen receivers in the models. Rather a pity, we use a monitor to insure that we fly in safety!

The circuit and components

No claim is made for originality, it is as simple as you can find and not at all critical as to the choice of components. In fact, a good stir round the junk box produced some OC72s and 71s, these were slightly down on gain, so surplus types would be adequate for the job. The speaker came from an old television set together with a matching transformer. The speech coil of the speaker had a resistance of 2½ ohms, but here again it is not particularly important. The old transformer is used, simply because it was thought an unnecessary expense to buy a transistor class A transformer. More cannibalising of the chassis provided the resistors and a 50K switch pot (actually any value





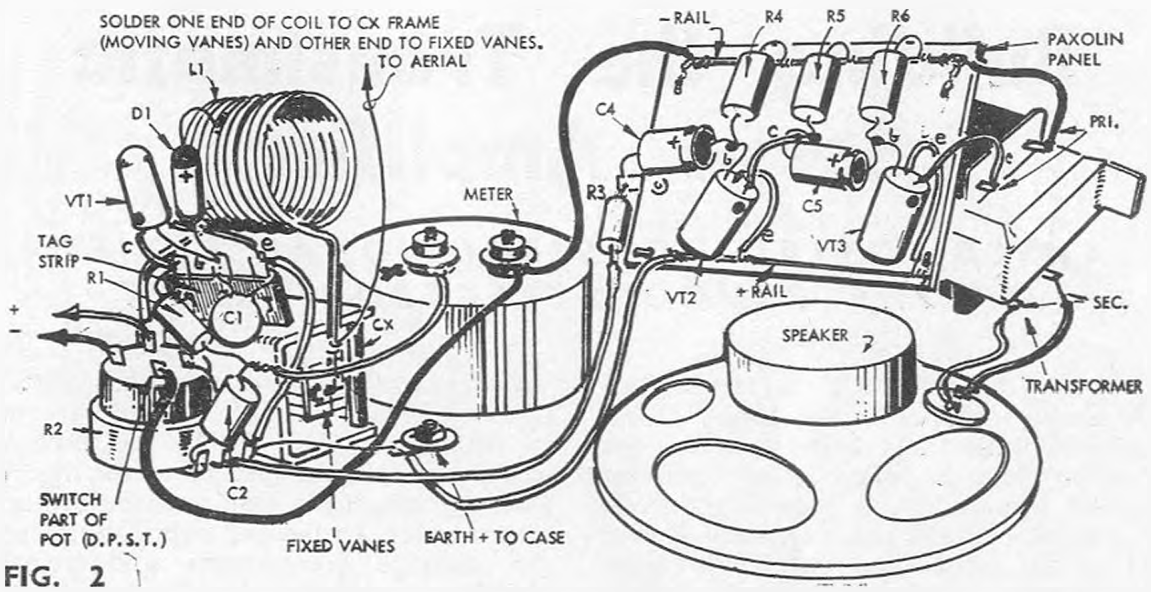


FIG. 2

from 50K to 1 Meg, linear or log will do). A GD3 diode was used, but here again any type will do providing the back resistance is high, one of the **Macpack** types would be ideal.

Some further searching revealed a variable capacitor of about 50 pf, a larger capacitor will still tune but would be more critical and require a smaller amount of movement to cover the model band. The aerial is a cut down piece of a portable T.V. antenna, a 14 in. telescopic type from Henry's Radio will be just right.

Construction

The original version was built on a couple of tag boards, one fixed to the transformer carrying the amplifier, and the other to the tuning capacitor and used for the monitor circuit components. The whole arrangement may be modified to suit the case available, and one of the H.L. Smith types would be sure to fit, depending on the size of the speaker available and the battery selected. Choose a fairly large surplus meter, the original had a 10 mA. movement.

Having assembled all the "bits and pieces" on the front panel of the case the tagboards may be bolted in place or soldered directly to the tuning capacitor if this is a stoutly constructed type, and the amplifier tag board soldered to spare tags on the transformer.

It was not thought necessary to resort to printed circuit construction, as the components are few and easily accommodated on the tag connections. The general arrangement is shown in Fig. 2 and whilst it appears rather like a spaghetti pie is quite adequate for this type of instrument and should stand up to the usual amount of ill treatment it receives on the flying field.

The photograph shows the somewhat large case used on the original, but such a bulky item is unlikely to be left behind when departing from the flying field. There is plenty of room for a loudspeaker, and more volume could be obtained by using a different audio amplifier in class B circuit configuration. The range when used as a monitor, is not as great as a super-regen type, but it is nice to be safe, and the meter gives a valuable indication when playing about with mark/space systems.

Components List

R1: 680 ohm
R2: 100K variable
R3: 8.2K
R4: 270K
R5: 4.7K
R6: 47K
Cx: 20-50 pf variable
C1: .001 μf
C2: .01 μf
C4: 10 mfd. electrolytic
C5: 10 mfd. electrolytic

D1: GD3
VT1-3: OC71 or OC72
Speaker: 2½ ohm speech coil.
Aerial: 14 in.
Meter: 0-10 mA.
Coil L1: 7 turns 1 in. dia. 16 s.w.g. (e.c.w.). Stretch to 1¼ in. long. Centre tapped.
Transformer: T1 60.1 approx.
Note: *There is no* C3.

Building the Transimatic Servo Amplifier

AN EDITORIAL CONSTRUCTIONAL REVIEW OF THE REMCON ELECTRONICS KIT

REMCON ELECTRONICS' "Transimatic" servo amplifier for the Bonner Duramite servo definitely helps to solve the price problem. Supplied in kit form for only £3, it considerably reduces the overall cost of a multi channel radio system and at the same time puts real enjoyment into equipment construction. Printed circuit panel is commendably neat and all components except transistors lay flat on the panel, virtually eliminating the risk of lead failure in a prang. We put one together and have enjoyed perfect airborne results for a couple of months now and here's how to build it.

Group all the resistors into their respective values and attach to a piece of card, numbering the 2.2K's (Colour code RED–RED–RED) 1-5, the 4.7K's (YELLOW–PURPLE–RED) 6 and 7, the 100 ohm's (BROWN–BLACK–BROWN) 8 and 9, the 47 ohm (YELLOW–PURPLE–BLACK) 10, and the 1.5K (BROWN–GREEN–RED) 11.

Also group and attach the 10 μF electrolytic capacitors numbering them 12 and 13, the four Newmarket 751 transistors (with skirt round bottom edge) 14, 15, 16, and 17, and the two Newmarket 218 transistors (plain cases) 18 and 19. Grouping and numbering of components on a card makes them immediately identifiable during assembly.

Construction Procedure

A. Clean down the printed circuit copper with an ink eraser, rubbing until the copper shines.

B. Cut black, red, green, brown and orange "SHORT" wires 7 in. long, plus 12 in. black, red, green, orange and yellow "LONG" wires. Bare $\frac{1}{8}$ in. at end of each and tin. Make a point of using 22 s.w.g. Core Solder, 60/40 grade throughout construction. This is very thin and requires only a touch from a soldering iron to make it run. Excess heat can ruin components and can also lift copper printed circuit lands clear for board.

C. Tin all soldering points around holes in printed circuit, taking care not to fill holes. This helps the flow of solder around components reducing the time for which the iron must be brought into contact. Prolonged exposure to heat can damage components and printed circuit as outlined in (B). Leads to components may now be cleaned prior to soldering into circuit by passing through a split in the end of an ink eraser.

D. Solder into circuit all LONG and SHORT wires.

E. Solder in 2.2K resistors (RED–RED–RED) 1-5. Resistors should be placed in position and excess leads cut off with a pair of wire nippers. Be very careful when bending resistor leads through 90 degrees as they can be easily fractured. A crocodile clip may be used to hold these components in place while soldering.

F. Solder in 4.7K resistors (YELLOW–PURPLE–RED) 6 and 7.

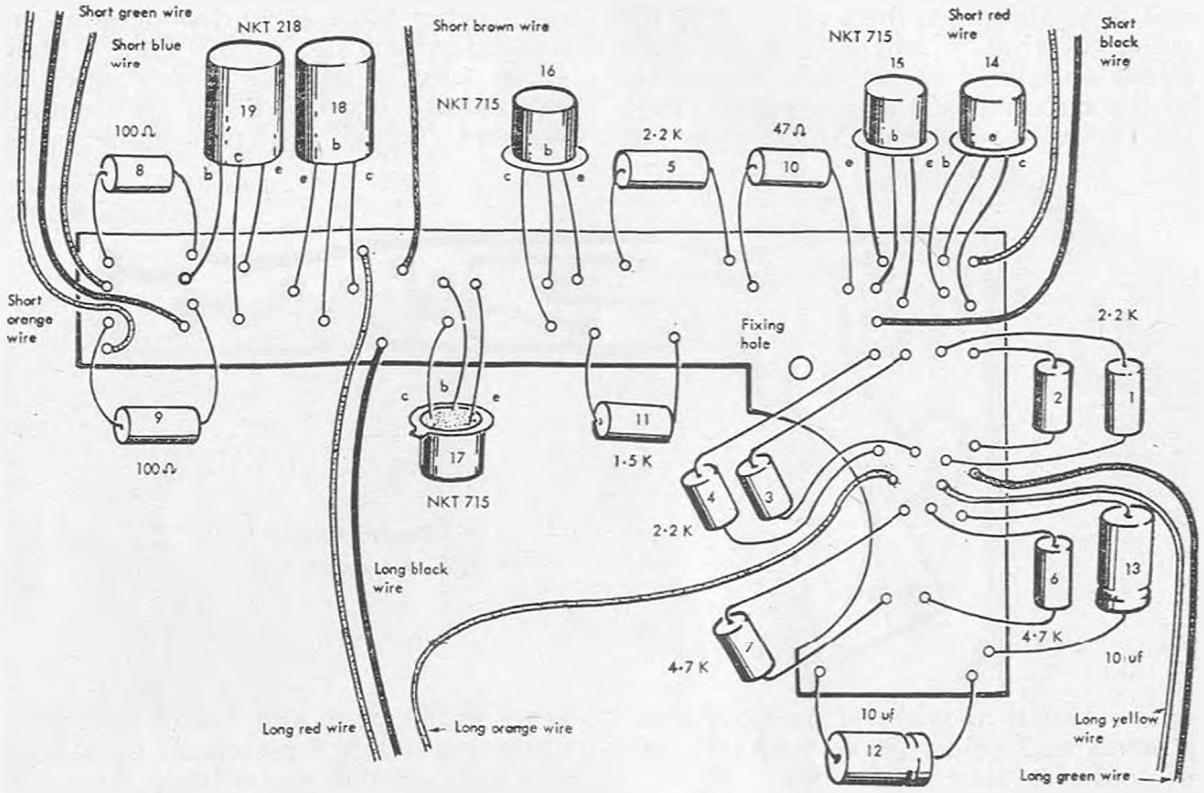
G. Solder in 100 ohm resistors (BROWN–BLACK–BROWN) 8 and 9.

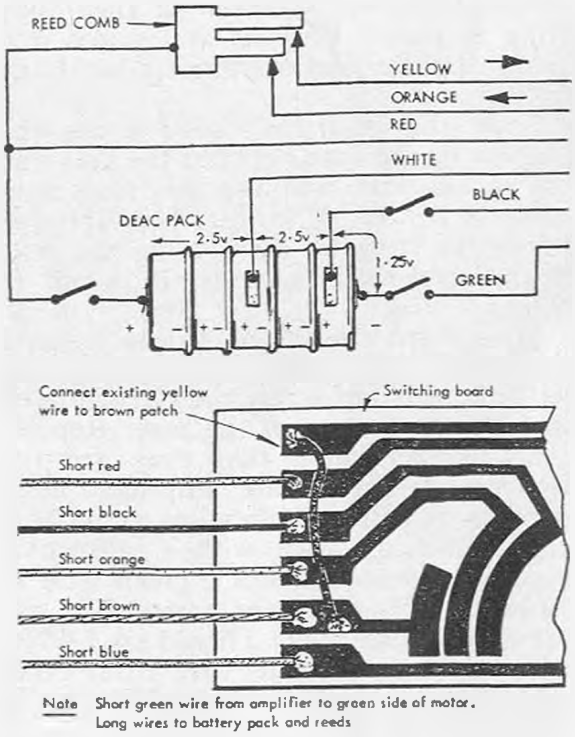
H. Solder in 47 ohm resistor (YELLOW–PURPLE–BLACK) 10.

J. Solder in 1.5K resistor (BROWN–GREEN–RED) 11.

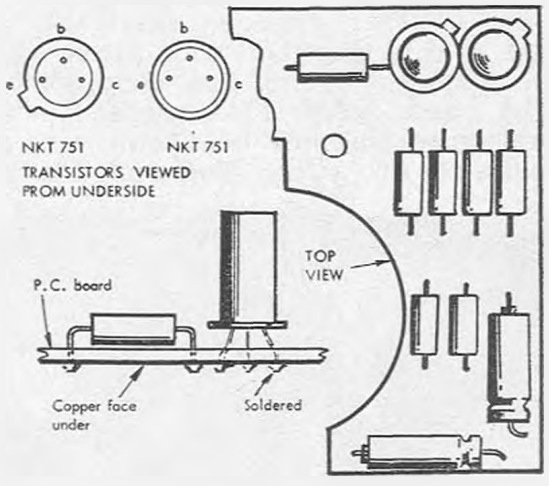
K. Solder in 10 μF electrolytic capacitors 12 and 13, observing correct polarity. Positive end has ridge round it.

L. Push LONG orange, yellow and green wires down between four adjacent 2.2K resistors, prising back together again to lock in place, thus removing load from soldered joints of coloured wires. Place leads of Newmarket 751 transistors loosely in respective holes on circuit panel, referring to the transistor lead identification diagram. Thread LONG orange, yellow, green and SHORT red and black wires between the transistor leads, pushing the transistors down tight and soldering to clamp coloured wires in position. This also





Above, components placement on circuit board. Note numbering of components. Left, wiring diagram to servo and two reeds, using 5 cell (6.25v.) DEAC battery pack. Bottom left, wiring to servo switching board. Below, typical component placement and transistor lead identification. Note that transistor second from left (without tag) is NKT 218, not NKT 751.



eliminates load from the soldered joints of the latter which might otherwise fracture. Be sure however that there are no bare points along the coloured wires.

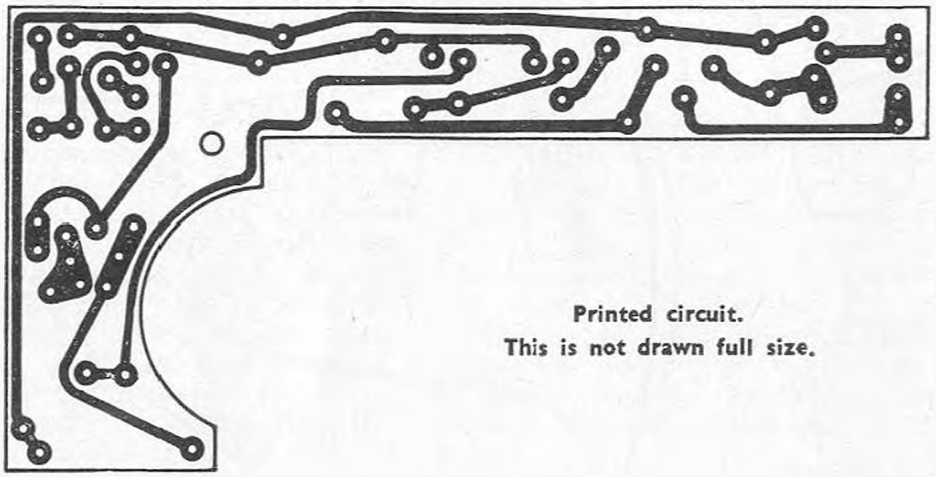
M. Thread same five wires between the leads of transistor 16 (Newmarket 751) and solder transistor as in previous stage.

N. Solder in transistor 17 (Newmarket 751), threading the LONG red and black wire adjacent between the leads. Group all five LONG wires together.

P. Thread leads of transistors 18 and 19 (Newmarket 218) through respective holes in circuit board (referring to the

transistor lead identification diagram) and thread between them all six SHORT coloured wires to emerge grouped from under transistor 18 on the inside edge of the circuit board as illustrated. Push the transistors down firmly, nip off

six short amplifier wires and solder five to switcher plate as wiring diagram indicates, observing colour code. Short green wire is left for later connection to motor brush. Carefully remove washers, sector and two combination



Printed circuit.
This is not drawn full size.

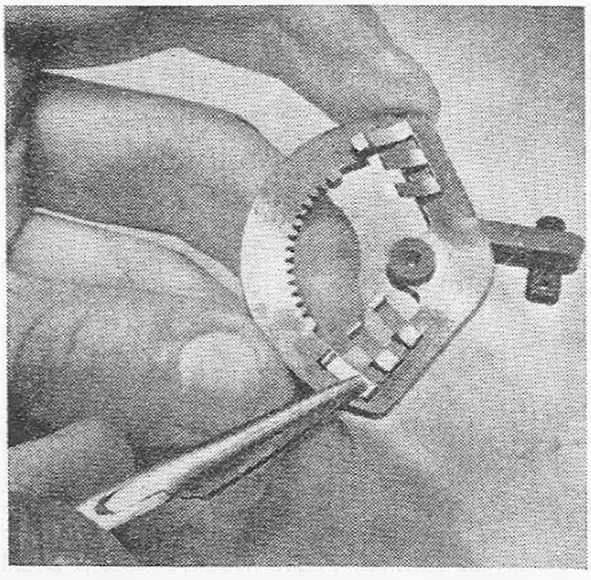
excess length as with all previous components and solder in with quick dabs of soldering iron and solder.

Q. Carefully file away or clip off any excessively protruding wires from the land side of the PC board.

R. Check all wiring and re-solder any suspect joints.

Installation

Remove lid of Bonner Duramite servo. Unsolder all except yellow wire from switcher plate on inside of lid and discard together with green wire from motor. Trim and strip yellow wire and solder to copper patch previously occupied by brown wire as indicated on wiring diagram. Tin all



gears from base and motor assembly, observing order of placement of washers to ensure correct re-assembly later. Do not remove motor or crown gear. Account for all washers as they may cling to motor magnets and shake into gears or short out amplifier if left loose in servo.

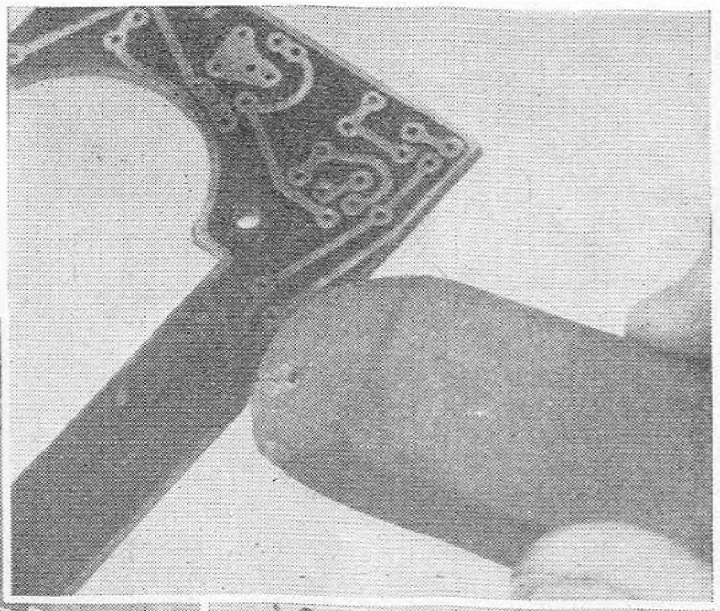
Slide the insulator board along the bottom of the case between the side and the sector post, and use this as a template to drill a $\frac{3}{32}$ in. dia. hole through the bottom of the case, using the hole in the insulator as a guide. Blow out all chips.

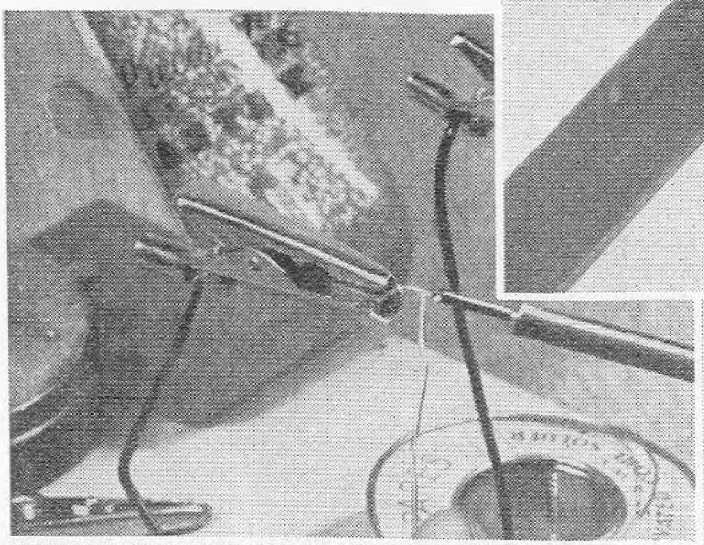
Slide servo amplifier into place above insulator board and fasten in position with the self tap screw provided, driven in from the bottom of the case. Replace gears to determine that they are not fouled by any servo amplifier components or wires. Dress wires away from gears, holding down with Evo-Stick if necessary. Solder SHORT green wire to motor brush tag where green wire was previously discarded. Thread six LONG wires, including white wire from other motor brush tag, through grommet in end of lid.

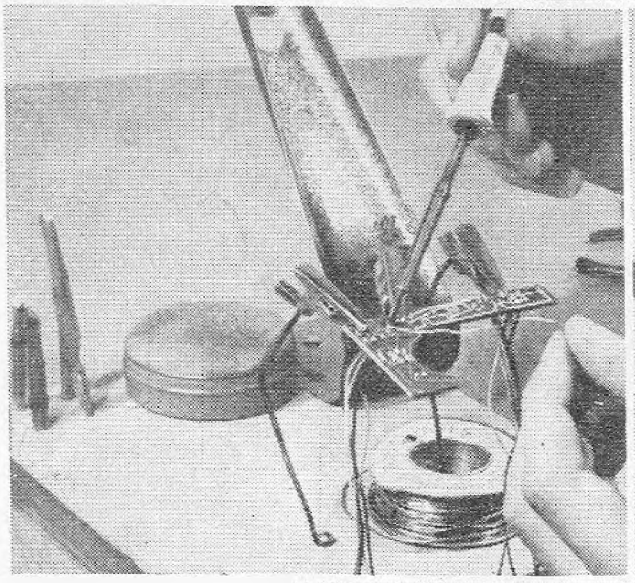
Support all soldered joints to switcher board and motor brush tags with a

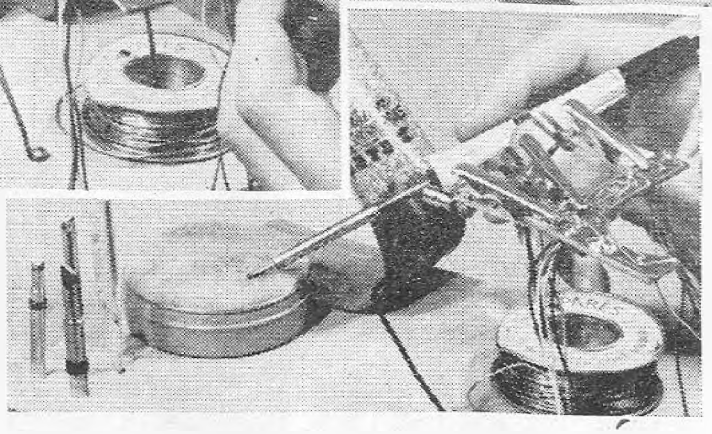
To convert self neutralising action to non-self centring (trim) without altering amplifier circuit, simply bend down the outer wiper on either side of the Bonner final drive sector.

Right, rub printed circuit panel with ink eraser to clean off dirt. Below, tinning of components is helpful to flow of solder, if not absolutely essential. Second down, soldering components in position, using crocodile clip as clamp.









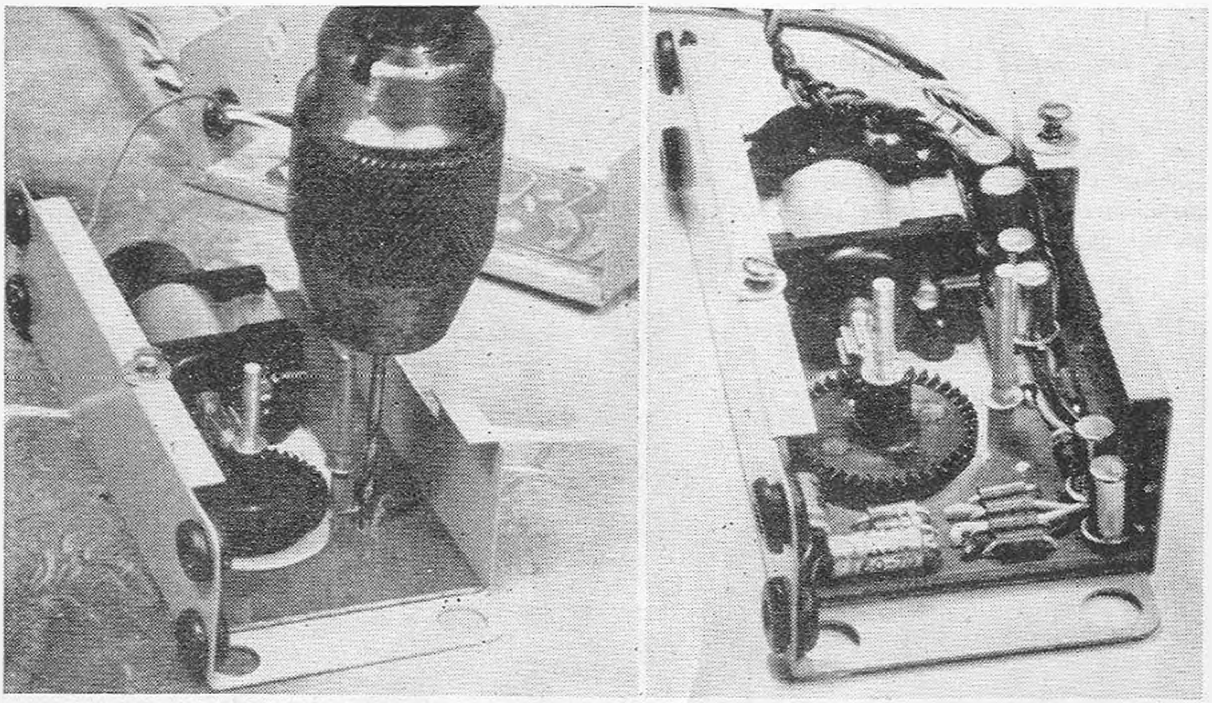
Foam plastic cleaning pad should be wet.

Above, complete work board. Copper wire mounted crocodile clips grip work while soldering is done.

coating of Evo-Stick. Replace servo lid carefully and bind servo case with insulating tape or Sellotape.

To convert the "Transimatic" to trim operation, simply bend the two outer contacts of the sector away from the switcher plate, thus disconnecting the neutralising circuitry.

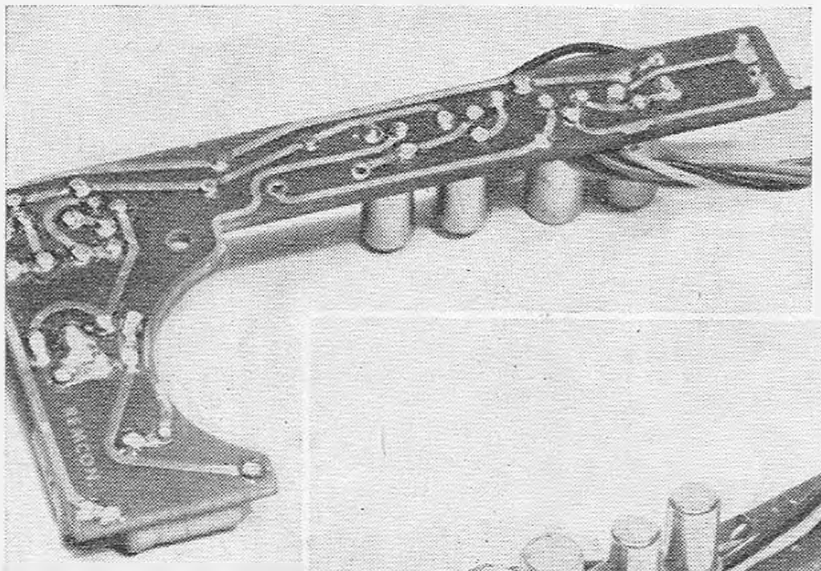
Common power source for servos is a pack of DEAC cells, in fact this is very much standard practice nowadays. 500 DKZ cells are recommended in a



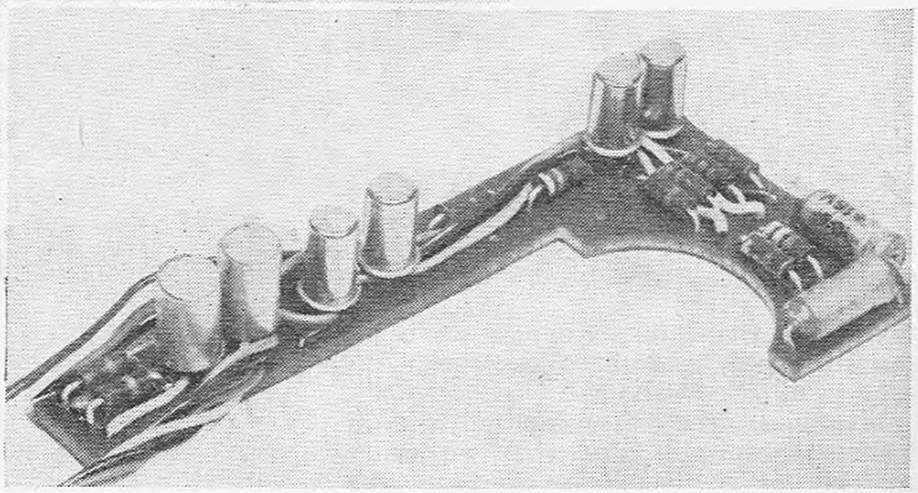
Above, drilling bottom of Duramite case for self tapping screw. Position template carefully before drilling. Above right, completed Remcon Amplifier mounted in servo.

five (6.25 volt) cell pack. Wire to servo as shown in the wiring diagram and do make a point of inserting a switch in each wire where indicated, including the green bias. Failure to break the circuit of the latter together with the others will result in running down of the DEAC pack on the bias side of the white centre tap. This was a point learned by experience.

A complete kit of parts may be obtained, price £3.0.0d.. from: Remcon Electronics, 4 Lowden Road, Southall, Middx.



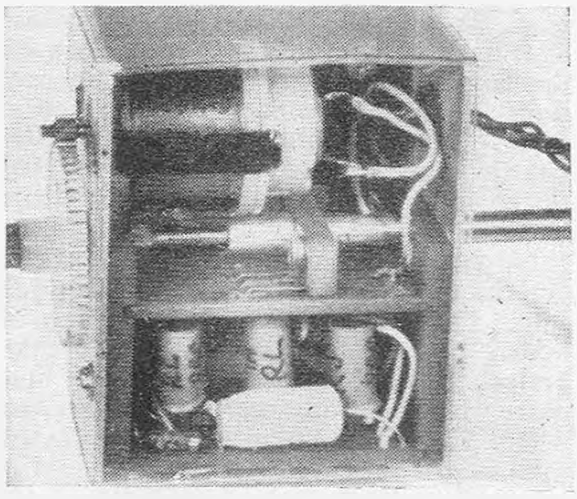
Completed servo amplifier, all components except transistors laying flat. Note dressing of wires, to avoid gears.



Underside of completed amplifier.

Build a Servo

M. L. BEACH SHOWS HOW TO MAKE A SIMPLE, POWERFUL RELAYLESS SINGLE BATTERY SERVO



RELAYLESS servos are a tremendous aid to the multi enthusiast, the simple wiring and lack of relays really contribute to ease of installation. The only (!) snag is the £40 to £50 needed. As it is very satisfying to make your own, this servo was built—it is certainly not original but is as simple as possible. The circuit is a copy of the Servomite/ Musclemite and has the great advantage of having only four wires with a single battery. The lead screw output was used to cut gearing to a minimum because it is very easy to ruin a servo with badly meshed gears. It will be noticed that this servo has adjustable mesh so you can set the gears to run smoothly. Another good point is that the circuit boards just slide out for assembly and repair.

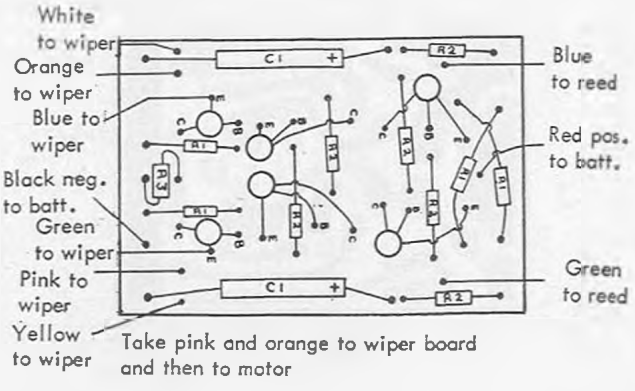
The first step is to cut out the aluminium base and bend to shape. It is simpler to bend up the front first, cut out the mounting hole for the motor and the slits for its lugs. Then bend up the other end of the base. Drill all the holes and elongate these on the front end to slots $\frac{3}{16}$ in. long. This allows the gears to mesh correctly. Incidentally, the prototype servos shown, mount flat as they were designed for a delta. To stand them on their sides, add two bent metal feet to the base (similar to a Bonner servo) and omit the mounting bolts.

Make up the output shafts using brass tubes, plug the ends and tap 6 BA. Check that the 6 BA steel screw rod used for a lead screw runs as smoothly as possible down the brass output shaft. Cut the lead screw rod to length and solder on short lengths of brass tube to make a bearing. Make up the $\frac{1}{8}$ in. paxolin plates forming the bearings and support the circuit boards. In case of slight errors in the base it is best to proceed carefully here so cut a 1 in. strip of paxolin and slide it into position, marking the appropriate holes and then continue. Drill the bearing holes making them a good fit for the lead screw bearing and for the output shaft. I do not advise cutting the slits that the circuit boards slide into at this stage. Drill and tap the plates 8 BA.

Now try a tentative assembly, put the motor in and lightly bend the mounting lugs to hold it in place. Screw the paxolin plates and shafts into place, solder a brass pinion gear on the motor, tap a nylon gear 6 BA and screw it onto the lead screw. I used Mighty Midget nylon gears and brass pinion, a couple of mine were not round but boiling them in water for 20 minutes cured this. I recommend using C & L gears.

Now check that everything lines up and try adjusting the front paxolin plate so that the gears run as smoothly as possible. If you feel everything is alright, cover the inside bottom of the

COMPONENT PLACEMENT



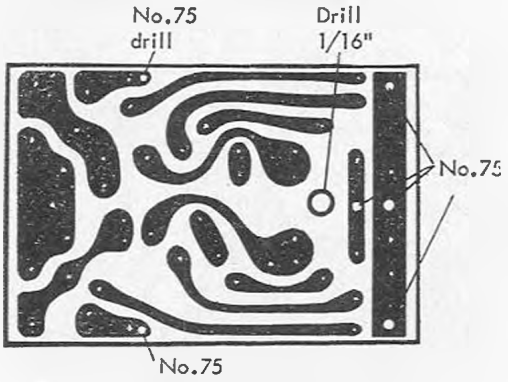
base with wide Sellotape as a guard against electrical shorts, then screw in the servo mounting bolts with locknuts underneath and fasten in the Milliperm firmly—I used Araldite as an extra safeguard. Make the paxolin wiper bars that fasten on the output shaft and Araldite in place.

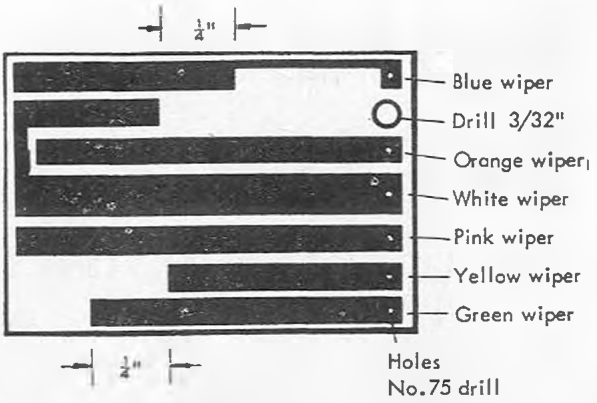
Now assemble the servo and carefully cut the slits that the circuit boards slide into. The best way is to use a scrap of board that just squeezes between the plates. Experiment until it is in the best place, then carefully mark with a scriber where the plates are to be. The idea of this is to get the wiper bar running smoothly against the circuit board, if the board is not parallel with the output shaft it can easily jam at one end. The slits are then simply cut with a hacksaw. The circuit boards can now be made, refer to back issues of R.C.M. & E. for details of printed circuit etching (January, 1963).

Now make the wipers, fit them and check they are running smoothly on the circuit board and are pressing on the right place. Incidentally, use only 0.006 spring phosphor bronze sheet—a very important point giving best results.

Having reached this stage, only the wiring remains. It is important to check that the servo runs smoothly, so take a little time here, as the quality and performance relies on adjusting the necessary clearances. Connect up a $4\frac{1}{2}$ volt battery direct to the motor tags through a reversing switch using only $4\frac{1}{2}$ volts at this stage as faults show better. Adjust the lead screw and play on the bearing by a little file work on the brass. When the 6 BA nut is tight there should be just noticeable back and forward movement. Check that there is not excessive side play in the bearings and make sure the wiper bar is running

AMPLIFIER P.C. BOARD





SWITCHER P.C. BOARD

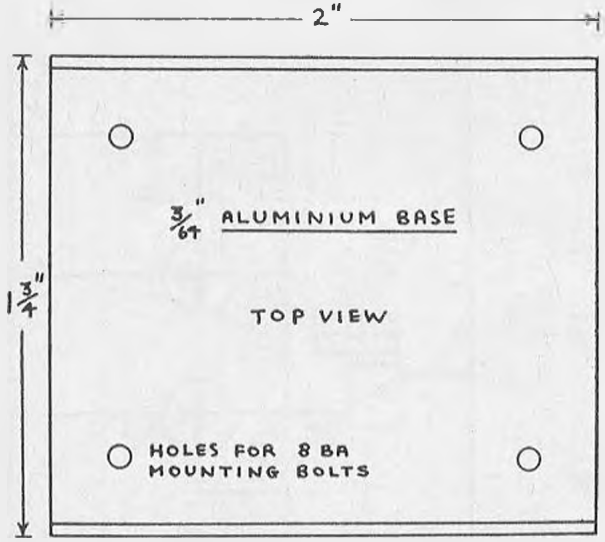
smoothly along the circuit board. If the bar rocks unduly, a shim of paper can be glued on its underside to take up the gap between it and the circuit board. If you find that the threaded bush in the output shaft is too loose, cut it carefully for a short distance down the middle with a fine piercing saw, then gently squeeze it together with pliers to take up the slap.

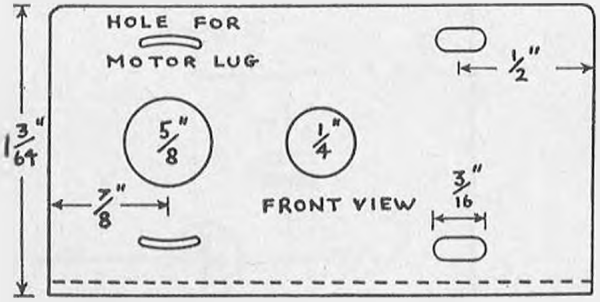
Careful attention to *all* these little points is the making of a good or indifferent servo and it is amazing the difference it makes.

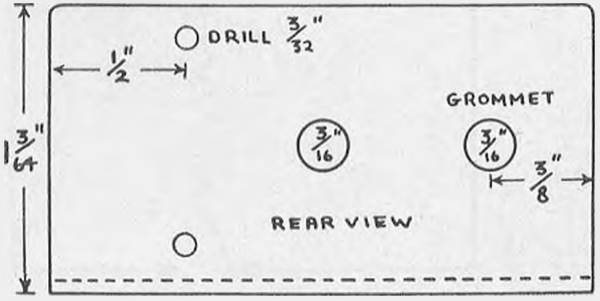
The wiring should present no problems, but a few tips might help. A neater job results by fitting all the resistors on the amplifier board first and soldering them in place. Incidentally the leads of the 47 ohm need a little careful bending to get it in. Fit and solder the smoothing condensers making sure the polarity is correct. Put in the transistors. If you are quick with the soldering iron there is no need to use heat shunts, but if in doubt however do use them as it will save trouble later. Wire the wiper and amplifier boards together. Note that the blue and green wires from the amplifier board to wiper board pass through the $\frac{1}{16}$ in. hole in the amplifier board and solder onto the appropriate copper lands. The blue, green, red and black wires that power and control the servo, pass through the $\frac{3}{32}$ in. hole in the wiper board, under the output shaft and out through a rubber grommet in the alluminium base.

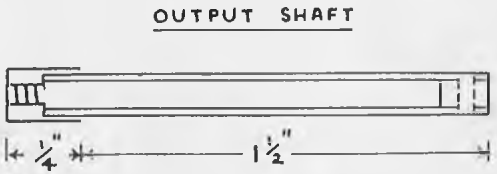
To avoid pitfalls note the following points. Avoid excess solder on the wiper board or amplifier board, otherwise the wiper bar will jam when moving to its limit, or the boards will not slide easily into their slits. Do not have too much wire connecting the two boards, otherwise it will be difficult to

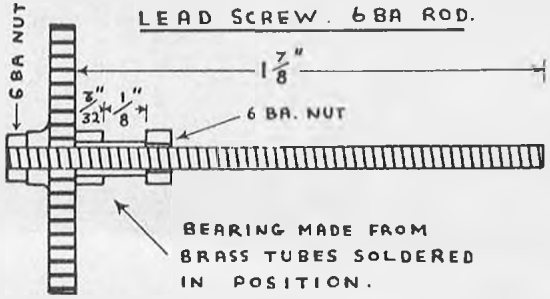
(*Continued from page* 489)

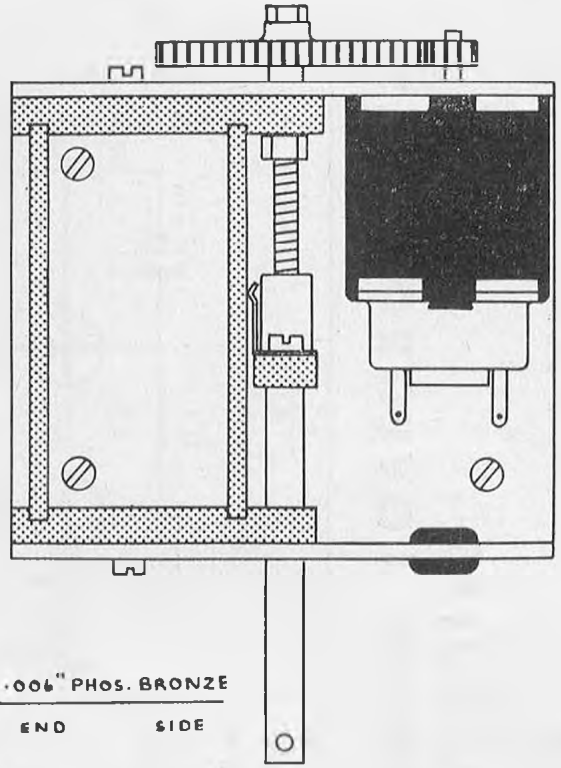


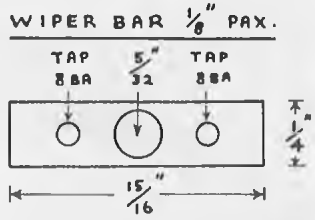


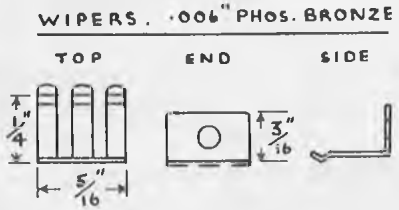


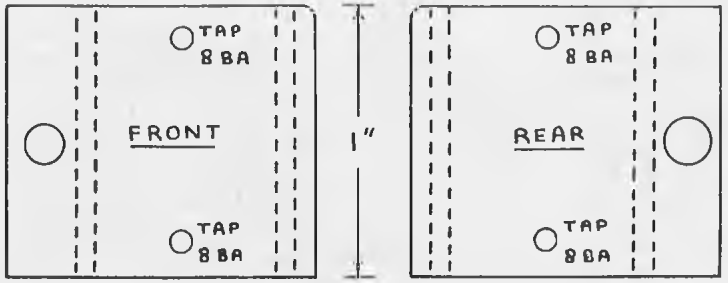












PAXOLIN PLATES 1/8"

FOR BEST RESULTS HAND FIT THESE TO EACH SERVO AFTER MAKING ALLOY BASE — CHECK WITH ARTICLE.

Bi-Simpl PART 3

FAIL-SAFE CIRCUITS

By PETER LOVEGROVE B.Sc.

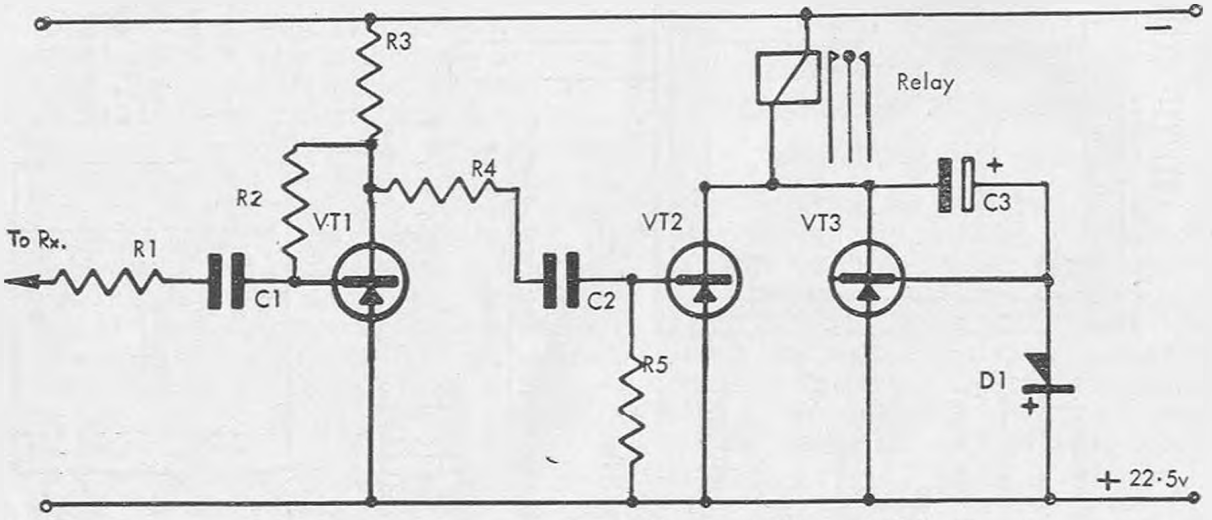


FIG. 1

THERE are two ways of obtaining fail-safe on this simple system, depending on whether you wish to load the HT (22½ volt) battery or the DEACs a little more. By fail-safe we mean surfaces sprung back to neutral and engine slow.

The first system is that working off the H.T. battery. It is identical with the engine filter unit but has no filter (Fig. 1).

R1 = 220 — 1MΩ
R2 = 4.7 — 6.8MΩ
R3 = 4.7KΩ
R4 = 4.7 — 100KΩ
R5 = 2.2KΩ
C1 = 0.01 — 0.1
C2 = 0.001 — 0.005 μF
C3 = 0.1 — 1.0 μF
Relay = 3 — 5.8KΩ
D = OA81 diode
VT 1, 2, 3 = OC44

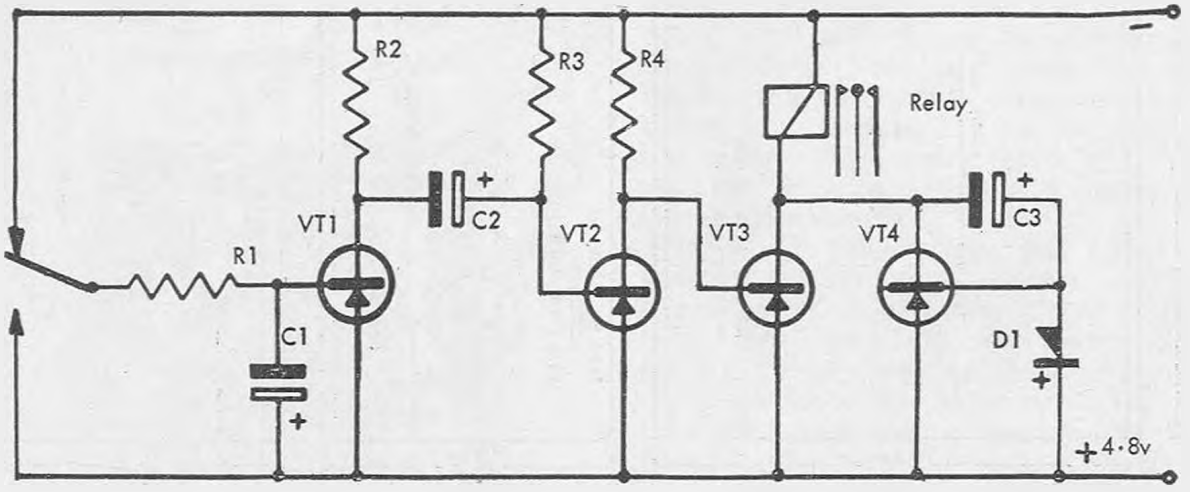
If you already have the engine control working. copy it identically, remembering to try and keep R1 as high as possible in both cases.

The second method of fail-safe is a duplicate of the Bi-Simpl itself and functions off the DEACs (Fig. 2).

as in Bi-Simpl Unit.	R1	C1
	R2	C2
	R3	VT 1, 2, 3, 4.
	R4	D

Relay — 3 — 5.8KΩ
C3 — see text.

FIG. 2



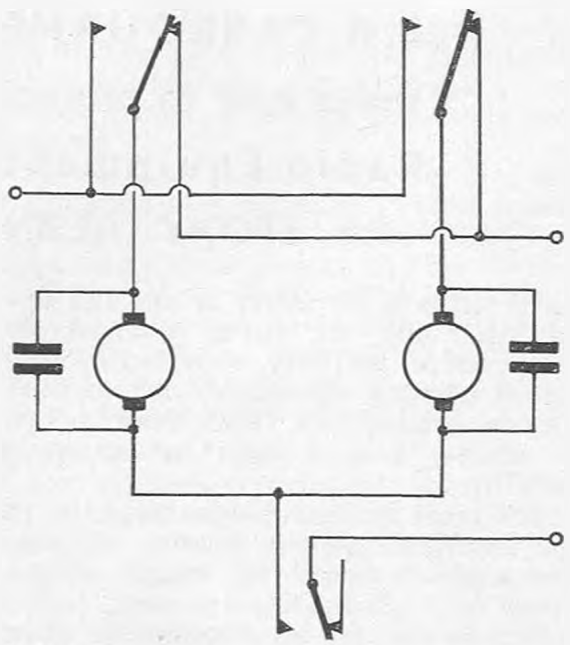


FIG. 3
Upper R.H. connection to +2.5v.
Lower R.H. connection to centre tap of DEAC.

In both Fig. 1 and Fig. 2 the capacitor C3 should be chosen to hold the relay in with all conditions of pulsing. Loss of pulsing then results in relay out, and fail-safe. But in Fig. 1 C3 will be 0.1 to 1mfd whereas in Fig. 2 it will more likely be 10 mfd. — 50 mfd.

The servo motors must be connected to the centre-tap on the DEACs through the relay leaf, and must be arranged so that when failure occurs the relay con-

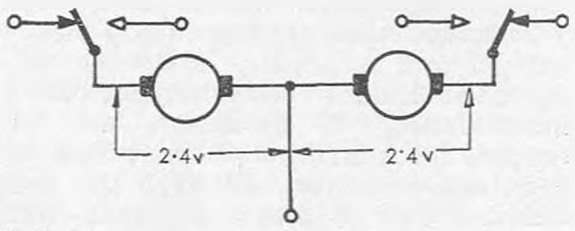


FIG. 4

tacts (on the receiver relay, and the Bi-Simpl Rate decoder relay) on which they stop, are the same polarity, otherwise both the motors get 2.4v. each and stall full over (see Fig. 4).

BEACH SERVO

(*Continued from page* 486)

get them in. Make sure that when the servo is centred, both wipers are clear of the copper lands—this is important, so widen the centring gap if necessary.

Before feeding any power to the amplifier, check the whole mechanism for smooth running. If the servo jams under power this could possibly burn out the transistors. Now connect the red wire to 6 volts positive and the black to the negative if all is well the servo will centre itself—touch the blue wire to the battery negative and it should push, touch the green wire to negative and it will pull.

If it just runs one way to its limits, reverse the pink and orange to the motor. In practice use 9 volts in the model but 6 volts is suitable for testing.

If you are now satisfied that all works correctly, put a drop of Araldite on the lead screw nut to prevent it working loose. Celluloid covers are made to keep the dust out. These are just bent out of a thick sheet and retained by the mounting bolts underneath.

For shock absorbing, fit a $\frac{5}{16}$ in. grommet on each mounting bolt. For trim arrangement and not self centring, just bend the middle wiper on each side clear of the wiper board.

All the materials needed and finished printed circuit boards can be purchased from: C & L Developments, 47 Queens Road, Weybridge. Surrey, and who have been most co-operative by their assistance in this report.

Materials list for one servo :—

$\frac{3}{64}$ in. aluminium sheet.
Milliperm 1500 motor.
Mighty Midget brass pinion and 57T nylon gear or C & L gears.
Four 150 ohm 0.1 watt 10% resistor (R1) subminiature.
Six 330 ohm 0.1 watt 10% resistor (R2) subminiature.
One 47 ohm $\frac{1}{2}$ watt 10% resistor (R3).
Two 32 μF 15 volt condensors (C1).
Six transistors GET113 or Texas 2G381.
$\frac{1}{16}$ in. printed circuit board.
5 $\frac{5}{16}$ in. O.D. rubber grommets.
6 BA steel screwed rod (studding).
$\frac{1}{8}$ in. paxolin for wiper bar and plates.
0.006 spring phosphor bronze sheet.
$\frac{5}{32}$ in. O.D. brass tube.
Assorted 8 BA bolts, 6 BA nuts, small pieces scrap brass and tube.
Multi strand coloured hook-up wire.
Acetate sheet for cover if needed.

Potting

B. R. CASBOURNE

shows how to protect Radio Equipment with EPOXY RESIN

THE first thing to assess before venturing into total encapsulation of electronic gear, is the reliability of any sub-assembly or component, and the soldering technique. Good quality components or those which have been thoroughly tested, are essential to ensure 100 per cent reliability. Thorough testing of the circuit should take place before encapsulation. If oscillators are envisaged, check and double check that the frequency is correct, although the unit described in this article (adapted from the W. Kreulen Multi Transmitter published in September, 1962 *R.C.M. & E.*) has provision for varying the frequency by means of external shunts. It will be noticed that the transistors have been mounted external to the encapsulation. This is merely a matter of personal economy, in that transistors are moved from unit to unit as required. There is no reason whatsoever why the transistors cannot be potted along with the main unit, providing the question of heat is kept below that recommended for the transistors, but once encapsulated they are in for good!

Scope of Encapsulation

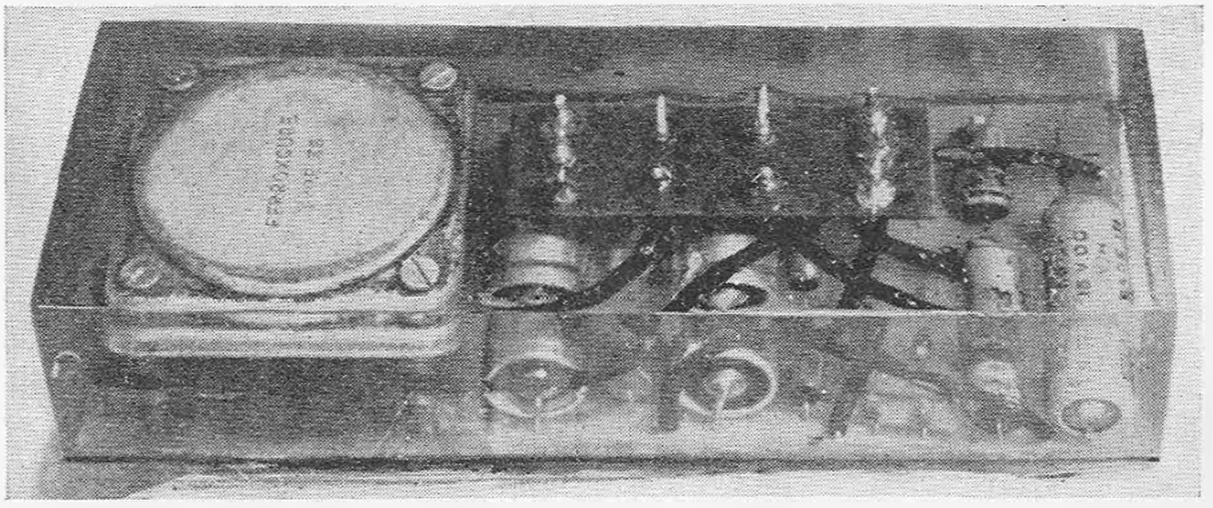
The main advantage of total encapsulation, lies in the complete freedom from contamination of any sort likely to be experienced in models. The epoxy resin used is impervious to oil, fuel and water. Vibration and crash landings have virtually no affect at all, and due to the bulk of resin, changes in temperature are very slow acting and minor changes eliminated, due to poor thermal conductivity. With these factors, of course, goes a built in frequency stability.

The most obvious disadvantage lies in the increased weight factor. An approximate increase in weight for a board of 3 x 1 x 1 in. is 4 ozs.

Parameters to be considered when choosing an epoxy resin, are the viscosity, exothermic heat and curing heats. Low viscosity is preferred to ensure that the resin flows around all components and allows air bubbles to escape easier. Exothermic heat (produced due to the reaction between resin and hardener) must be kept low, as well as curing heat, if temperature sensitive components such as transistors, diodes, or wax impregnated capacitors are used.

The particular resin-hardener combination used for the purposes of this article, results in a semi-transparent block such that all components can be seen and identified. See Fig. 1.

It is a fact that slight contraction and/or distortion takes place during curing. This is acceptable and if care is taken in mixing it will be negligible. To obviate this, a filter can be mixed into



the resin with the disadvantage of causing the casting to be opaque. A suitable filter is powdered chalk or mica, the former being very cheap and easily obtainable.

A word of warning concerns the encapsulation of RF circuits. Epoxy resins have a dielectric constant of about 3.5, depending on the brand, and the manufacturers should be consulted for correct values. This could cause frequency variations in the unit as a result of potting, and controls should be accessible to correct the variation.

Design of the Unit

The obvious choice for a basis is a P.C. board. Components should be mounted as close as possible, and all circuits should be double checked for correct functioning. Consideration must be given to mounting the unit after encapsulation. This can easily be achieved by Araldite two $\frac{3}{16}$ in. tapped brass pillars to the base of the P.C. board. By filling the tapped hole with a release agent, ingress of the resin can be avoided (wax is ideal and can be melted out afterwards).

Facilities for connecting to external circuits should be made by tags, or better still moulding a *Plessey* type plug in with the main unit. This latter method results in a unit easily removed for checking and testing. It does involve extra weight usually acceptable for marine or land work.

If variable controls are to be fitted, the spindle and its bush should protrude from the casting and in light weight units can also be used as the mounting point. At this stage it is worth considering whether test points should be fitted. These can be very useful in determining the state of the potted unit and assistance in fault finding. Tinned copper wire extensions to suitable junctions should be taken to extra soldering tags or pins on a plug.

It is not good practice to use flying leads emerging from the potted unit. These are very likely to fracture and are consequently difficult to reconnect.

Design of Mould

Before encapsulation can commence, a suitable container should be constructed. This is most easily made from aluminium, tin plate or acrylic sheet, in fact any material which is reasonably rigid and will withstand the curing temperature. On completion, check that the mould is completely "resin" tight by using water.

Prior to mounting the circuitry in the mould, a release agent must be smeared over the internal walls. Without this, the resin mix will adhere securely to the mould. A suitable cheap substance obtainable from mail order radio specialists, is a silicone compound known as "core retaining compound" (retaining dust iron cores in formers). This should be used sparingly to cover every face likely to make contact with the resin mix.

The unit should be mounted so that there is about $\frac{3}{16}$ in. clearance between the underside of the P.C. board and the base of the mould. In this instance, the brass inserts were used to hold the unit away from the base. Other methods are to either cast a base slab of resin first and then stand the unit on it in the mould, or suspend the unit by very thin wires which can be broken off after curing.

Resins

Epoxy resins used during these experiments were as follows (supplied by CIBA Ltd., Duxford—minimum order £1).

Resin	MY752
Hardener	HY219
Accelerator	DY219

Proportions for mixing were 100 parts by weight resin, approximately nine parts by weight hardener and one part by weight accelerator. Mixing should be thorough and yet not so vigorous as to cause excessive air bubbles to be trapped in the mix. It should then be allowed to stand for a few minutes to allow the bubbles to disperse. The usable life of the mix is about one hour at room temperature, this will be shortened if over 1 lb. is allowed to stand in one mass, due to exothermic heat. Curing is best achieved at low temperatures over a long period, say 20-25° C. over 24-30 hrs., but this will depend entirely on the type of resin hardener used.

To remove excess resin prior to curing, chloroform tricoethylene or acetone can be used. Excess hardener should be stored in full stoppered bottles, as it is hygroscopic (imbibes moisture).

The resin mix should be poured slowly over the unit in the mould. Avoid trapping air beneath components etc, by tilting the mould occasionally to allow the bubbles to rise. Fill to cover the

(*Continued on page* 503)

HOW TO WIRE A MODEL CORRECTLY: L. R. TANSWELL EXPLAINS

VERY often a model which may have an impeccable exterior, is spoilt by the jumble of wires that wander from point to point inside. This may occur after modifications to the inter-gear have taken place, but usually it is because the various plugs and sockets etc. are connected together one wire at a time, with the result that in cases of multi connections the wires are of slightly different lengths, and the general wiring looks a mess.

Tidy It Up

Untidy wiring is a liability. If a wire breaks away it is difficult to see immediately, where it belongs. If wires trail indiscriminately about a model, they are just inviting damage.

It should be remembered that the shortest distance between units may be the one of least resistance, but not the most reliable path for the wire to follow.

Draw It Out

Before commencing to wire a model draw out the full circuit showing each item, however trivial. Leave nothing out which you will "Join up when I get to it". Include all pin connections on the various plugs and sockets, and any detail that will be of assistance in the form of notes.

Fig. 1 shows a circuit typical of those for boats with four channel reed-relay system, for Rudder and Throttle control with the rudder gear using limit switches and the throttle a slipping clutch. If you don't do this, it is surprising the number of times you need an extra wire somewhere when the first test fails. From this drawing and the relative positions of the gear in the model, the number of wires necessary between the various points of connection can be determined. If you want to be sure, a further sketch showing the physical lay-out of the items and the wires between them can be made. Whichever sketch you prefer to work from, it is a good idea to put a small pencilled tick against the wires in the drawing as you put them in the model, and in this way any omitted can be seen easily.

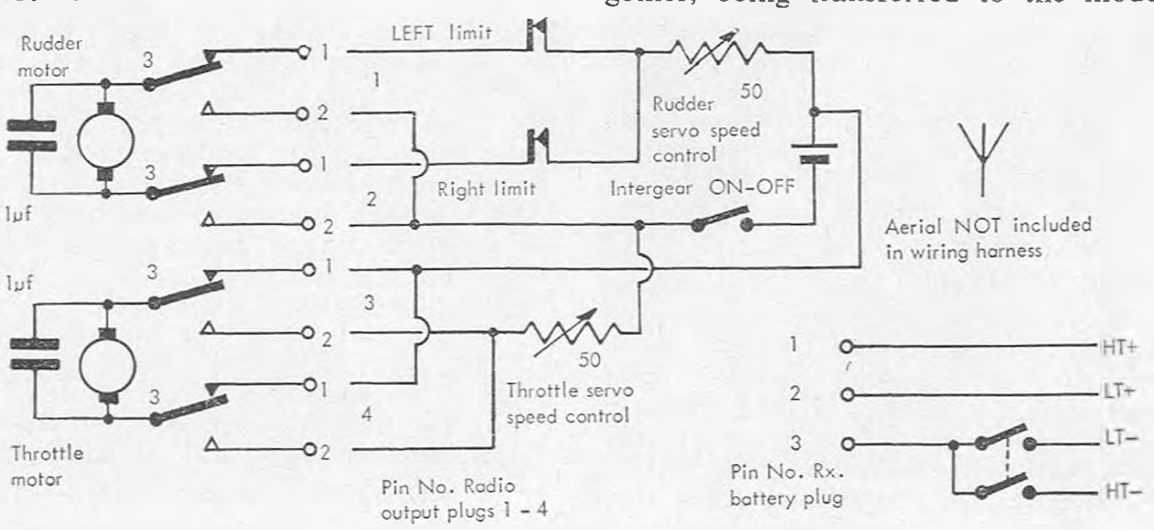
Wiring

Obtain some plastic covered flexible wire sufficiently heavy for the current it has to pass, using assorted colours and of adequate length. In estimating the length, it pays to be generous. It is no fun to drag wires out of a model on the end of a starting cord because they were too short to be clipped out of the way on the sides of the model, and believe me I've seen it happen!

The Harness

The ideal way to make up a wiring harness for a model is to find a piece of board as long as the model, and to knock in 1 in. pins at the places where the leads to the items of intergear will leave the main form of wiring that will be clipped to the side of the model. Then, when the harness is made up, all the wires can be laid out neatly on the board, and can be firmly stitched together, being transferred to the model,

FIG. 1



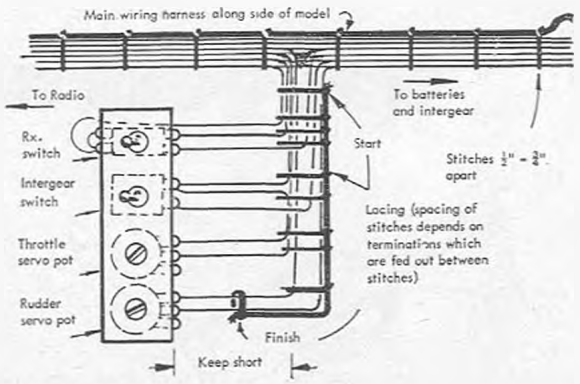


FIG. 2

all ready for termination. Alternatively, the wires can be laid directly into the model and stitched "in situ", though this may be difficult if many bulkheads are to be encountered, and the time taken to prepare a suitable board is anyway negligible, and will result in a better looking job.

A properly stitched harness has the advantage that it is in many cases self supporting, it is not affected by vibration to the same extent as individual wires. and can easily be tucked away out of sight and away from fuel. With the main form of wires running down the side of the model, any number of wires which leave it for a particular piece of gear or a control panel, should be stitched into a smaller form, and the stitching continued right to the end. Therefore, whenever a wire is taken out, it does so between stitches. In this way, a broken termination can be identified quickly. Fig. 2 shows a form leaving the main form to feed a control panel to suit the circuit in Fig. 1.

The Lacing or Stitching

With small forms of up to say, a dozen wires, a useful material to use for the lacing is waxed thread. If you cannot get this, try a reel of black carpet thread and a piece of beeswax. Having cut off about a yard of thread, draw it over the beeswax under the pressure of a thumb a couple of times. The wax will stop one stitch coming loose while you tie the next. One important point; try not to cross wires in the various forms more than necessary. Apart from making lumps in the harness, it weakens the insulation to press them together, though where wires leave the main form crosses are inevitable. To improve the look of the finished job, arrange for crosses where they have to take place, to be underneath, and keep the running stitch in a straight line.

Fig. 3 shows a suitable starting knot which brings the long end of the thread out in the direction of lacing. Fig. 4 shows the running stitch to go along the forms at about $\frac{1}{2}$-$\frac{3}{4}$ in. spacing. Note that the running end of the thread always leaves the stitch from beneath the knot and not (sorry about the pun) from the top. Fig. 5 shows a finishing knot made by lifting the thread leading to the last stitch and tying another stitch back on this part of the last stitch.

This lacing is easier than it sounds, and a harness for the average model can be made up and installed easily in an evening. With a ready made harness, the termination of wires is quicker and easier. There is less risk of wiring errors, for in the preparation of the drawing the making of the harness and in the termination of the wires, you have checked the circuit three times.

FIG. 3

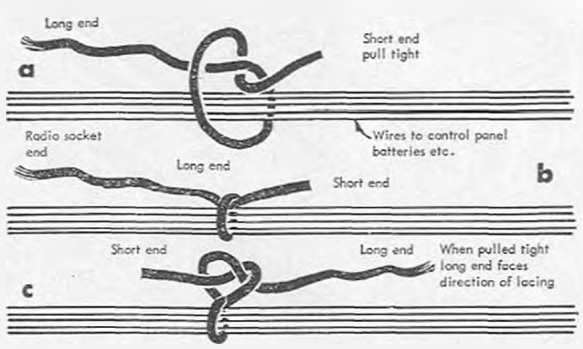


FIG. 4 above

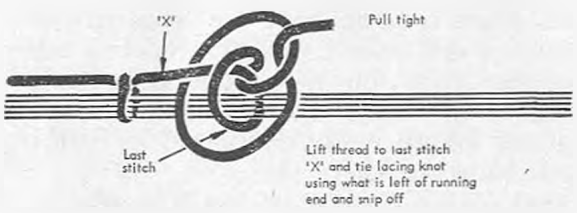


FIG. 5 below

Gadgets and

STARTING with a couple of aerial ideas, the first is provided by T. V. Chytil.

Simple Socket (Sketch **A**)

A Belling-Lee fuse holder makes a very good socket for a transmitter aerial. Mount this in the top of the transmitter case and discard the plastic cap. The aerial should be a nice push fit in the socket, and the "O" ring makes a waterproof joint against the case. The author used a 55 in. telescopic aerial from Henry's Radio, cut it at the halfway point and forced the ends into a piece of drilled hardwood dowel around which the loading coil was wound and soldered to each piece of aerial (check yours for tuning before finalising the number of turns).

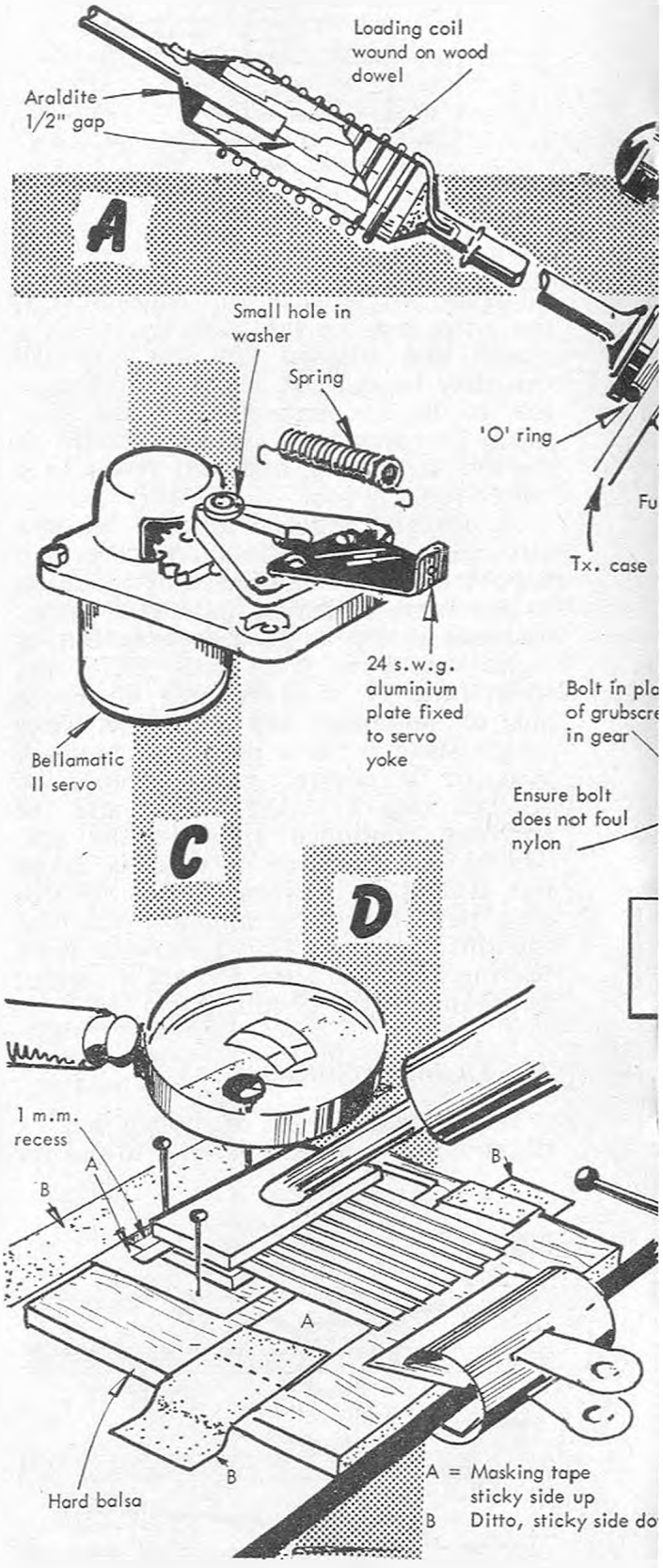
Eye Saver (Sketch **B**)

M. Scibor-Rylski found that home made aerials present a problem in that the top end is usually a plain sawn off piece of wire upon which, if one is not careful, various bystanders are likely to become impaled. A solution shown here is to bend the end at right angles and then kink it as shown so that when heated it may be pushed into a plastic button or "Tiddleywink", thereby giving some protection against injury and providing the correct colour is chosen, an indication of one's channel when using a superhet. Alternatively, a ball of foam plastic may be secured to a looped end with Evostick. In both cases, ensure that the top piece of aerial is longer than required, so that the effective aerial length is not decreased in forming the loop or kink.

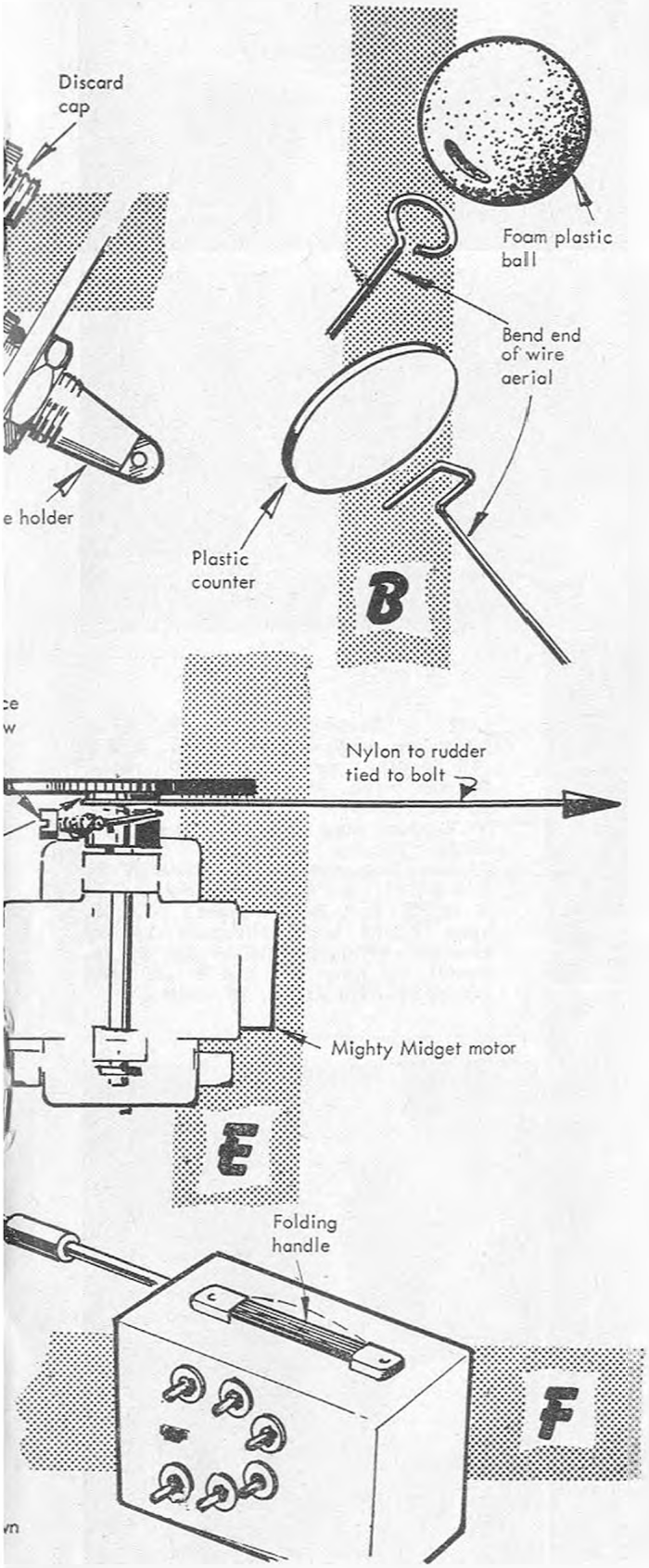
Shakeproof Two Position Throttle (Sketch **C**)

E. Lyche of Rotterdam used a Bellamatic II servo with the centering spring removed, so that it became a progressive servo for throttle control. However, the motor of the servo is so free that in this case it would vibrate off its settings, changing the throttle speed on is own.

Its little tricks were brought to an end by using it as a straightforward two position control, fitting a spring as shown in the sketch, so that it is held at either of two positions. To do this, drill a small hole in the yoke driving pin and fix a bracket to the yoke with self tapping screws. A fairly stiff spring connects the end of the bracket and the driving pin, so that it needs the power supplied to the motor to overcome it when in extreme position.



Gimmickry



Soldering Reed Combs (Sketch **D**)

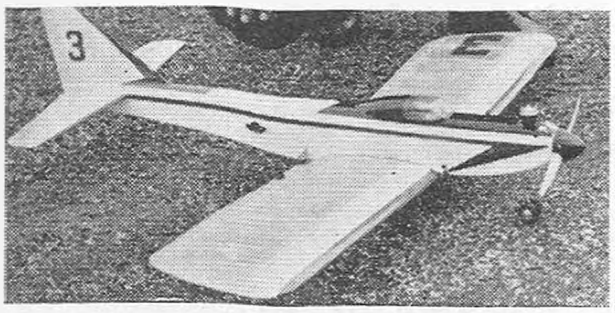
D. Sugden uses a simple jig, illustrated, for soldering strips of watch spring into their clamping plates for small reed units such as that described in the June, 1963 issue. A piece of hard balsa has a 1 mm. deep recess cut in it for the lower clamping plate. All the reeds are carefully laid on a piece of masking tape (sticky side up), this is fixed with two other pieces of masking tape with the sticky side downwards, and holds the reeds firmly whilst placing them between the plates. Soldering may then be done by running the iron along the top plate until the solder flows. Pins prevent the plate moving about in the process, and both hands are free for holding the soldering iron and, if necessary, a magnifying glass. "Fryolux" solder paint was used. Apparently 1 mm. x 0.1 mm. spring is available over here, 5 thou. as original specified as the nearest, but by no means near enough, need not now be used.

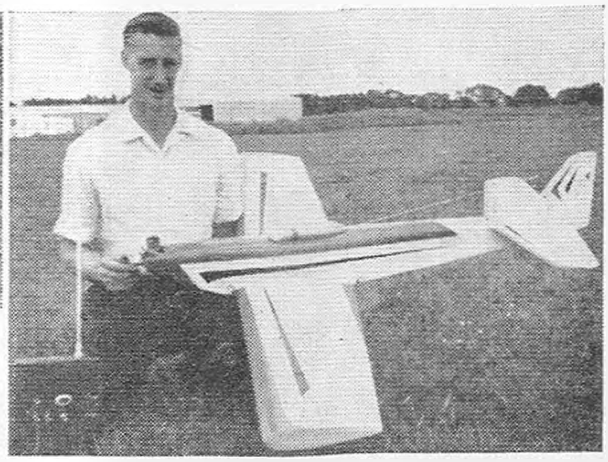
Quick Hook-Up For Manual Pulse (Sketch **E**)

J. A. Davey uses a Mighty Midget for a servo in his manually pulsed model. Smooth action is provided by the use of a piece of nylon monofilament wound rund the bush of the layshaft gear. The grub screw, which normally attaches the gear to the shaft, is replaced by an 8 BA bolt about $\frac{1}{2}$ in. long. This acts as a stop and serves as an attachment point for the nylon. The servo should be positioned so that neither the screw nor the rear face of the gear foul the nylon. The usual rubber band on the twin rudder horn should be of sufficient length to cause the motor to run back as the nylon thread is unwound: it is just a matter of trial and error. It will be seen that with the bolt serving as a stop fully only makes about 270° rotary movement so the rudder throw must be arranged to give the appropriate rudder deflection with this amount of servo movement.

Don't Drop It (Sketch **F**)

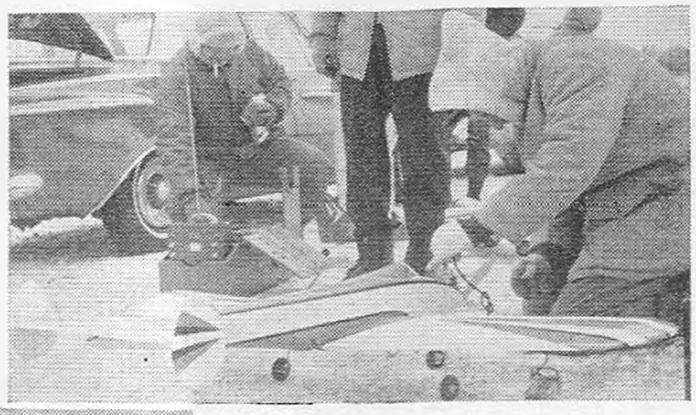
Back to M. Scibor-Rylski for a quick safety device for the greasy handed ones. A collapsible carrying handle such as may be seen fitted to portable radios, is screwed (or bolted) to the side of his transmitter, so that it may be carried like a suitcase with no fear of it slipping from the fuel covered grasp. The handle, when collapsed, does not interfere with one's grip on the transmitter.

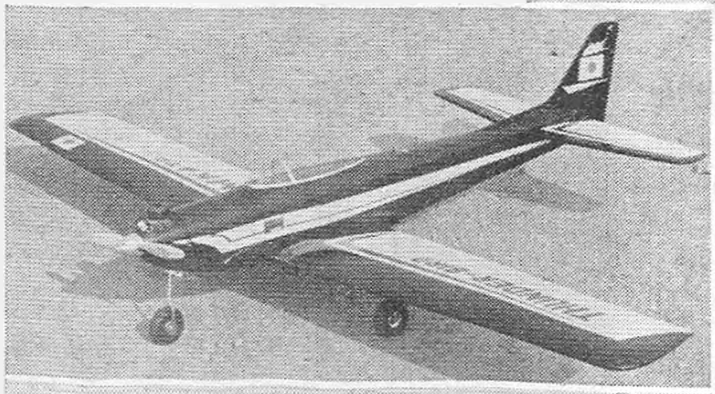


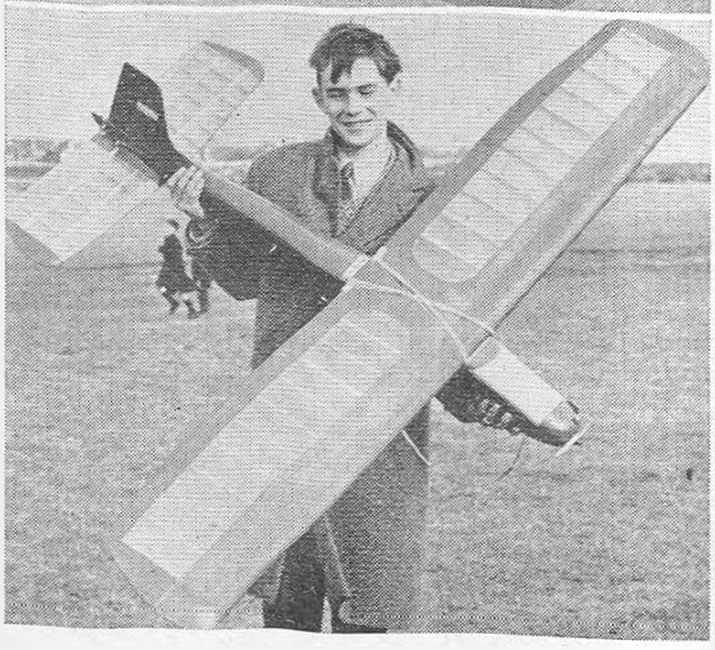


Pic Page

Top left : 40 in. span "Pylon Duster", freelance pylon racer by G. Franklin, Leicester, controlled by ailerons and elevator only. Engine Cox T.D. .15, Orbit 10 superhet receiver, Bonner Transmite servos. Top right : Australian Nationals winner Ed. Hartley with Orion, equipped with Johnson 10 relayless super-regen receiver switching Bonner Duramite servos with Johnson Amplifiers. Right : Ken Schmuldt, Wanconda, Illinois, with original multi model. Merco .49 engine, Orbit 10 radio. Temperature 10 degrees F.







Left : "Thunderbird" by M. Kato, Japan, is original low winger. K & B .45 engine and Orbit 10 radio. Bottom left : Model for rough fields by A. S. W. Winkworth, London, W.9, has plug in, 10 s.w.g. wire skids. Radio is R.E.P. Sextone, Climax Servomites and powered by K & B .45. 6½ ft span model weighs 5 lb. 2 oz. Below right : 53 in. span 1/6th scale Nieuport 28 by Granger Williams, California. 5½ lb. model is powered K & B .35 and equipped with Orbit 10 radio.

"ELSIE"

PART 2

By JIM DARKE

TWO MORE CIRCUITS: A SELF NEUTRALISING SERVO AMPLIFIER AND A FAIL-SAFE THROTTLE VERSION

LAST month's article dealt with the complete receiver and filter stages for Transmites or similar amplified servos. We now present two additional pieces of circuitry complete with slightly larger printed circuit boards and placement diagrams. This widens the scope of the receiver; the first dealing with a self neutralising servo amplifier complete with a complimentary tuned filter. In this way, it is possible to split the installation so that the amplifier is actually on the

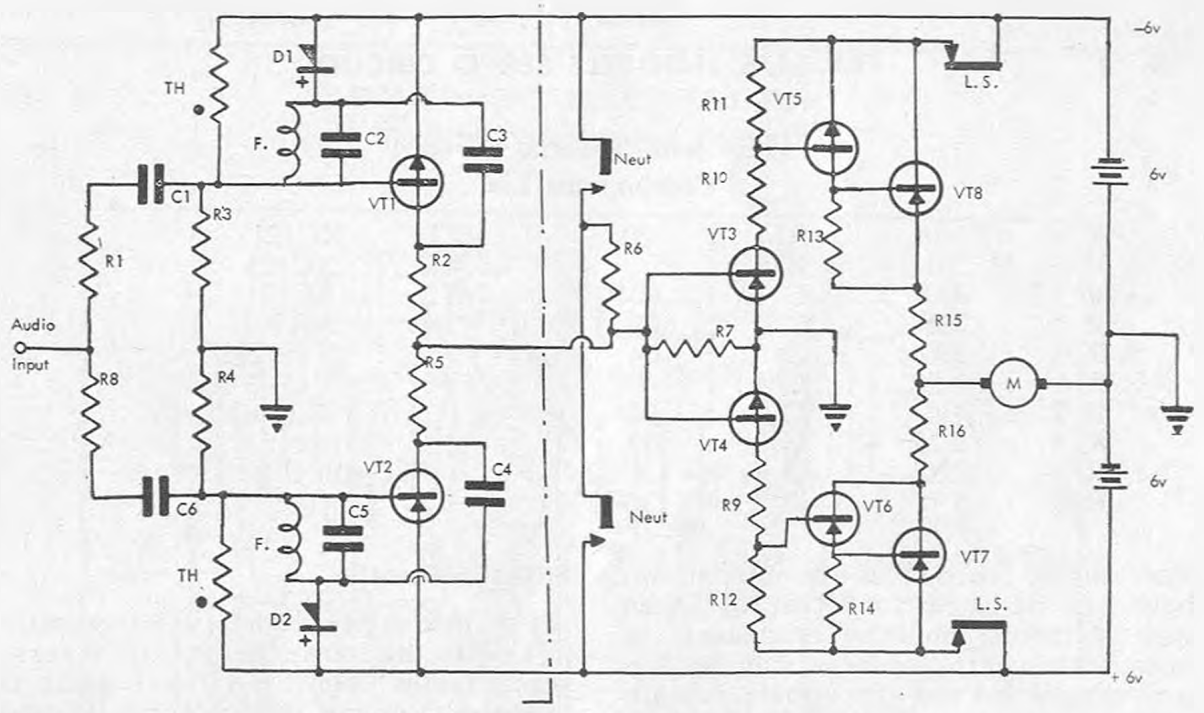


FIG. 1 SELF NEUTRALISING SERVO CIRCUIT

Self Neutralising Servo Components List

R 1	:	33K	R13	:	220	VT1	:	XA702 Transistor
R 2	:	2.2K	R14	:	220	VT2	:	XC121 "
R 3	:	390K	R15	:	5	VT3	:	XC121 "
R 4	:	390K	R16	:	5	VT4	:	XA702 "
R 5	:	2.2K	C 1	:	.02 μf	VT5	:	XA702 "
R 6	:	10K	C 2	:	*	VT6	:	XC121 "
R 7	:	1K	C 3	:	.04 μf	VT7	:	V15/20IP "
R 8	:	33K	C 4	:	.04 μf	VT8	:	V15/20IP "
R 9	:	1K	C 5	:	*	TH	:	Thermistor
R10	:	1K	C 6	:	.02 μf	F	:	Tuned Filter
R11	:	2.2K	D 1	:	CG42			
R12	:	2.2K	D 2	:	CG42			

*To suit filter.

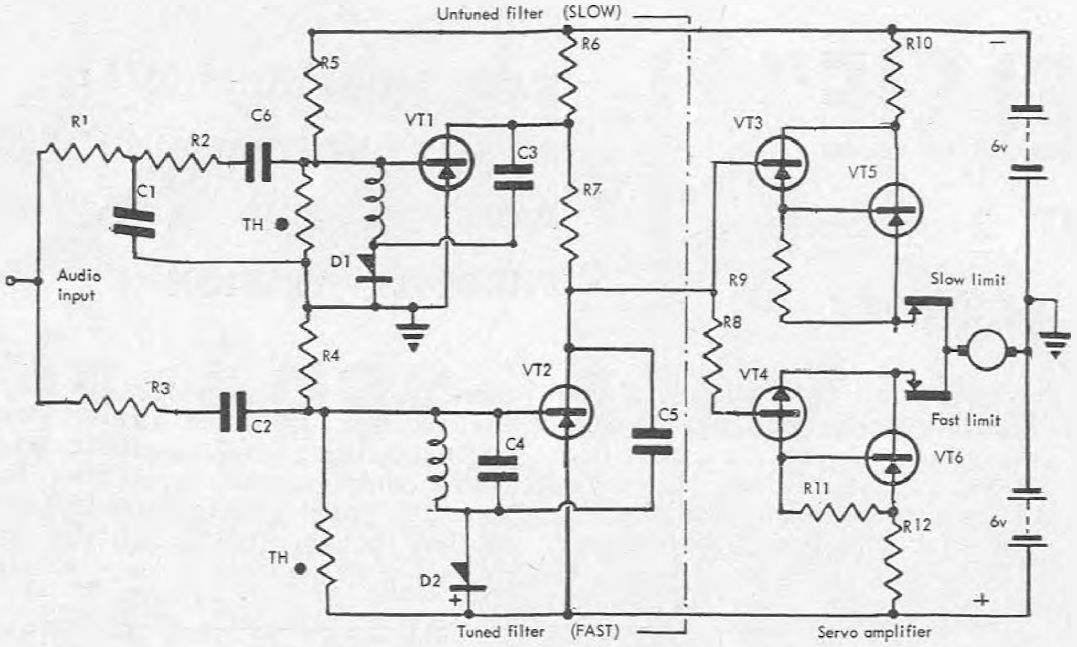


FIG. 2 FAIL-SAFE THROTTLE SERVO CIRCUIT

Fail Safe Throttle Servo Components List

R 1	:	10K	R11	:	220	VT1	: XC121
R 2	:	15K	R12	:	5	VT2	: XC121
R 3	:	33K	C 1	:	.001	VT3	: XC121
R 4	:	330K	C 2	:	.02	VT4	: XA702
R 5	:	390K	C 3	:	.04	VT5	: V15/20IP
R 6	:	1.5K	C 4	:	*	VT6	: V15/20IP
R 7	:	1K	C 5	:	.04	TH	: Thermistors
R 8	:	2.2K	C 6	:	.02		
R 9	:	220	D 1	:	CG42	*To suit filter.	
R10	:	5	D 2	:	CG42		

filter circuit board. The examples shown here are designed for Remtrol Olsen type actuators, but any mechanism to operate the control surfaces may be used providing it has the appropriate neutralising contact tracks and limit switches and the power is supplied by a Mighty Midget or similarly low consumption motor. The complete theoretical circuit is shown in Fig. 1 and operates as follows.

Operation

When one of the tuned filters is turned on by the appropriate audio tone. it drives the servo amplifier hard over in one direction. The opposing signal mixed in when a neutralising contact closes, is insufficient to stop the drive, but when neither tuned filter is on, the neutralising signal alone returns the servo to the centre position. Figs. 3 and 5 are full size placement and P.C. diagrams.

Failsafe Throttle

For this safety device, it is necessary to modify the transmitter so that it sends a continuous note, the tone of which is changed to one of the ten normally used for control operation. It is quite simple to arrange as it would normally be a high tone.

Operation

It would be seen that one filter is untuned, and is therefore operative as long as there is any tone present. This means that we have the following conditions. (See Fig. 2).

No Tone — Actuator driven to "slow speed" position.

"Fast" Tone — Actuator driven to "fast speed" position.

Any tone except "Fast" — Actuator held wherever it is.

The upper untuned filter is held "On"

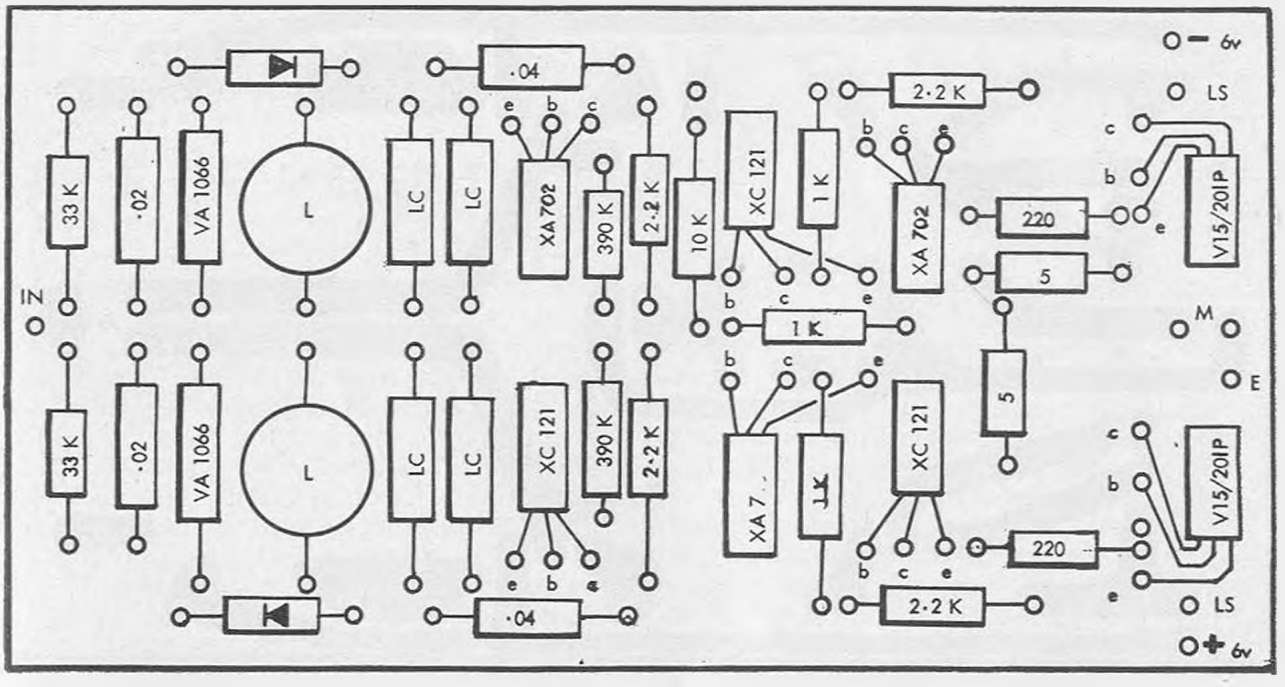


FIG. 3 COMPONENT PLACEMENT FOR SELF NEUTRALISING SERVO

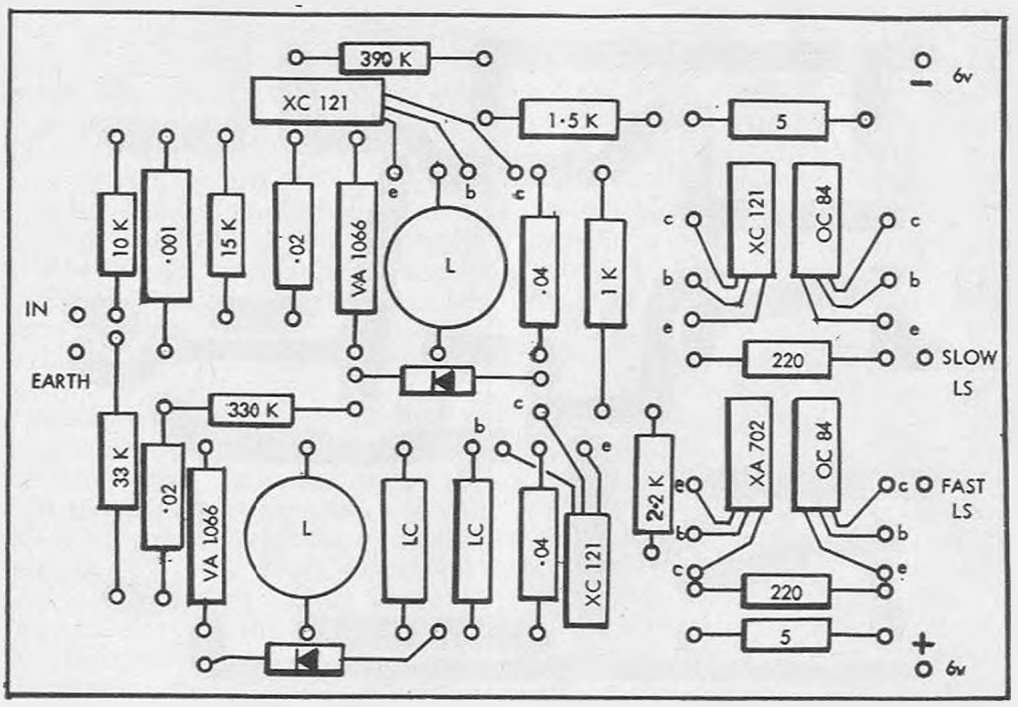


FIG. 4 COMPONENT PLACEMENT FOR FAIL-SAFE THROTTLE SERVO

Hold page up to the light to identify component connections on printed circuits overleaf.

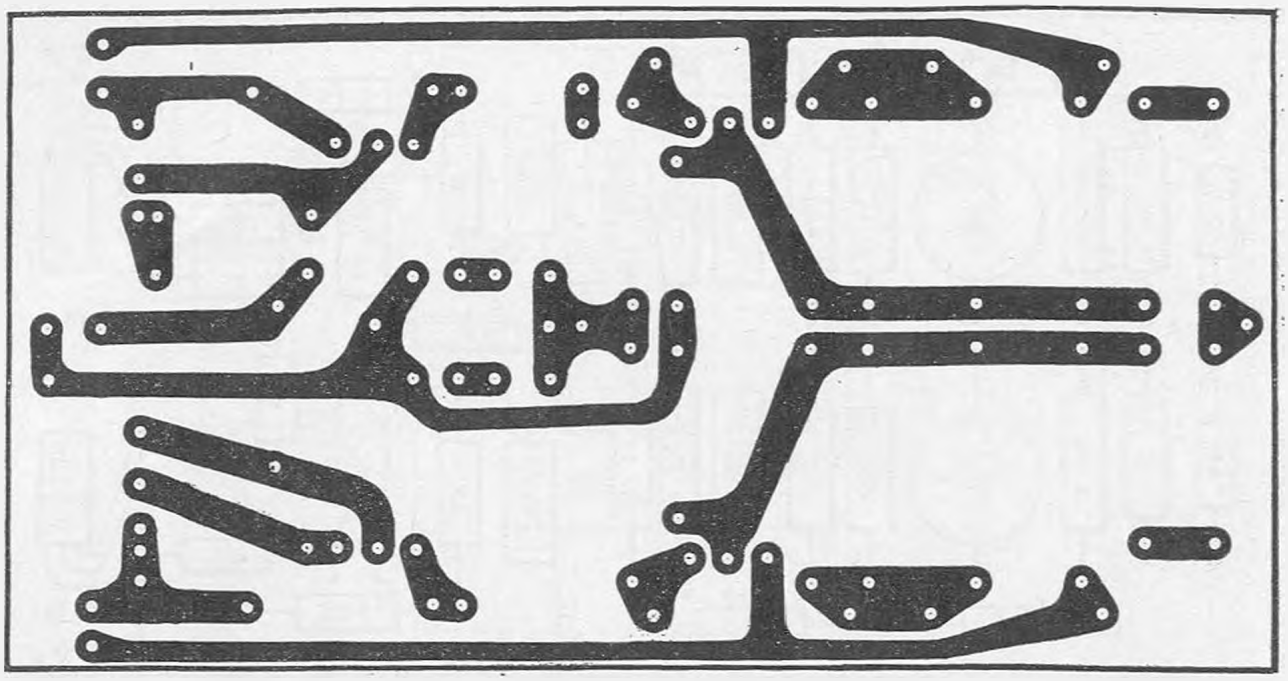


FIG. 5 FULL SIZE PRINTED CIRCUIT FOR SELF NEUTRALISING SERVO

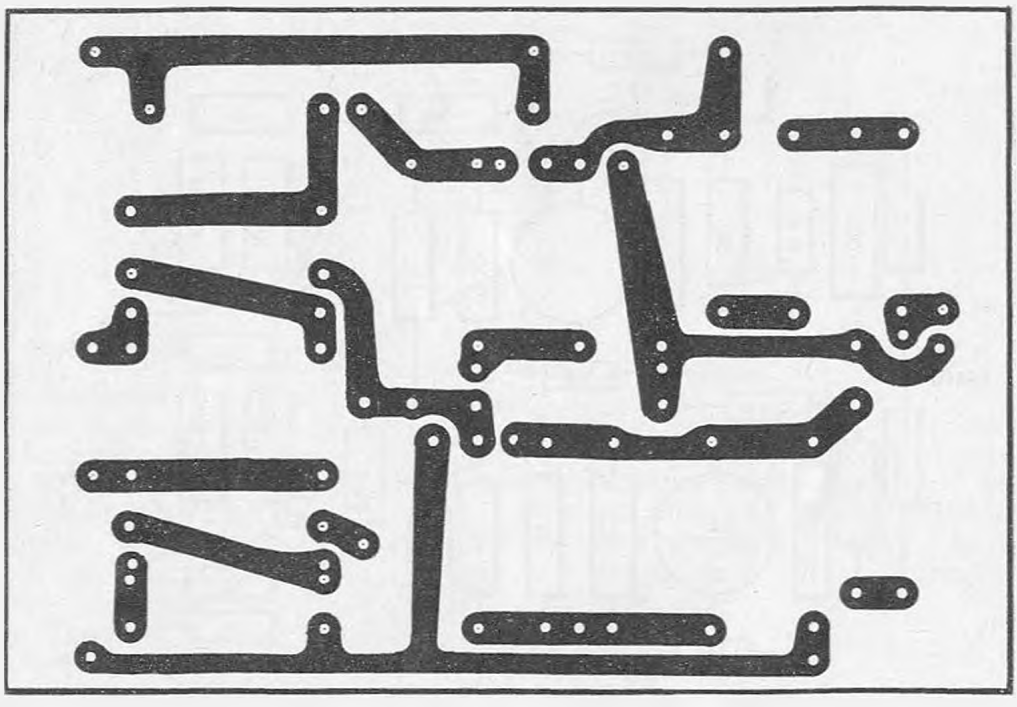


FIG. 6 FULL SIZE PRINTED CIRCUIT FOR FAIL-SAFE THROTTLE SERVO

normally by a continuous tone. If the tone is removed or radio contact lost, the actuator drives to the "Slow Speed" position. Fig. 2 shows the theoretical circuit. Figs. 4 and 6 the placement and circuit board respectively.

Actuator — Remtrol/Olsen

(TH) Thermistors — Mullard VA1066

Alternative Transistors

XA702 — OC139/140 (NPN)

XC121 — OC72, OC83/84 (PNP)

V15/20IP — OC83/84 (PNP)

Starting with R/C Boats

By R. P. MEREDITH PART 4

In past issues I have not dealt at any length on individual items, so let us look at servos for a moment. It is folly to expect a servo which may be highly efficient in an aircraft to be likewise in a powered boat, where spray gets in via the cooling vents and collects in the bottom of the hull. It doesn't take much imagination to appreciate that this can really gum up the works.

A clutch servo will be rendered useless by a smear of oil or water inside the clutch housing so protect accordingly. Wiper contacts and bearings have a lot to cope with in a boat. Some screwed rod and jockey servos eliminate all contacts by the use of override onto plain extremities with springs to restart the jockey on the thread. Very good, but not all can cope with the vibration created by a powerful engine above 5 c.c. There are spring centered servos which if properly designed are capable of all which is desired of them.

It is also extremely important to suppress all servo motors or electric motors of any kind used in radio control. Granted, all manufacturers are keen on keeping cost to a minimum, but would it be asking too much for the additional cost to receive servos already correctly suppressed?

Home made gear is sometimes better than commercial counterparts, but it isn't everyone who has the time or patience to make it to such a high standard although modellers constructing their own should note that discarded children's toys contain many useful mechanisms. Some of the units, made with the ingenuity and cunning of foreign manufacturers, save the kitchen table modellers, valuable time and expense. In many cases they only need removal of the old cogwheel and spring to become (coupled to a suitable electric motor) steering or throttle units of high performance.

So to those of you (like myself) retained by matrimonial responsibility, I would say; think twice before you consign that toy to the dustbin.

Here is an example; two years ago a relative purchased a Japanese toy bear for my young daughter. The bear carried a book with tin pages, the book was supported at the waist, one paw containing a small magnet lifted the pages. After turning over five pages, the other paw came into action and closed the whole book, from whence the cycle of operations was repeated. I removed the mechanism to find two arms, actuated from a central five spur cam one of these arms snapped back and forth four times with some force. When the fifth spur came round the second arm traversed from left to right across the plane of operation of the first arm. There was no doubt as to how it could be used.

For a long time I have thought much about the idea of a repeating shipborne gun, firing .22 rim fired blanks, here was a unit which fulfilled all requirements. I proved its ability to fire a blank cartridge, a gravity fed magazine was made consisting of four units each containing four separate blanks the striker arm fires four blanks in rotation, the second arm ejects the empty magazine, the next magazine falls into place, and so on.

Two years ago I constructed the *Annabel e* river cruiser for my young son. Sails were fitted and a "Sextone" receiver used to control an auxiliary propulsion motor, and the tiller. All went well and I had the laugh on the Bourneville club members, tacking hard to make progress in the wind while *Annabelle* close hailed was making steady progress to windward. Unfortunately, my ruse was discovered, when turning the boat to reach she capsized throwing the gear into the water, but it was the sight of the screw spinning round which gave the game away!

I learned a lot from *Annabelle* most important thing being to fit a sheeting control. It's a jolly queer feeling when you want to steer a course and set your tiller accordingly, then the sails take over and you may as well throw the transmitter in the water for what use it is.

Experts

What makes the expert? It's certainly not the depth of his pocket. It is, as described earlier in this series, making the most of what gear he has got, and above all practice—practice—and more practice. Although I might sound contest minded, it has not always been so, I still get a great deal of fun having the water to myself, when other folk are busy at work and my own business is going through a quiet time (small though it is).

If you are not interested in contests, fair enough, but your horizons are dimmed as a result, and you do miss that *esprit de corps* so obvious at such meetings when you can give the expert a run for his money (whether you are a pot chaser or not). You will encounter that friendly banter which is expected in any organisation.

Laying Up

During the Winter and early Spring, decide on what model or models you are going to use during the forthcoming season, get them tuned up so that as soon as the weather allows it you can be off with the rest, ensuring the absolute minimum of pondside fiddling which is never the best thing to do at any time. Check, charge, and maintain your accumulators during the winter months, squirt a drop of oil in that engine and turn it over occasionally, it pays dividends. If the model has been in use previously and, like all well used models, has superficial damage to the paintwork, the winter months are ideal as a time for renovation. After rubbing down, filling, and then rubbing down again ; give it a couple of coats of paint to spruce it up. Remove the oil or grease from the prop, and rudder shaft tubes, clean out and pump in a new supply then re-insert shafts. Check all servo motor brushes for wear and replace as necessary, clean commutators with a paper tissue dampened with "Serviceol" or any tetrachloride based contact cleaner finishing off with application in very small quantity, with a paint brush (making sure the motor brushes are well out of the way, since carbon tetrachloride will melt them). Take care not to damage the commutator, clean between the segments with a tiny fine hard bristle brush. Some people think it can be done successfully with a pin, but if you want rapid wear of the brushes to result, and erratic performance, go ahead and use the pin. It raises burrs on the commutator segments and is the easiest way to ruin the motor. Check relay and reed bank contacts for cleanliness, and all soldered points for good joints and security. The more expert invariably anchor all wires to a tag with thread as near to the joint as possible, so that any undue tension is not imposed on the joints. Often, modellers—in an attempt to be tidy, consign it to a well made (or otherwise) shed or garage shelf, pending the arrival of warmer weather. They also leave their receiver inside, together with batteries. This is a big mistake unless batteries are leak proof, because they will corrode with resultant damage to other equipment. Frankly it's better to throw dry batteries away and repurchase next season. The receiver will be subjected to various changes of temperature causing condensation and damp. So remove it to a dry place away from excessive heat, a suitable spot being a bureau drawer or similar. In the case of i.c. engines, empty the water system and clean out the fuel tank, checking supply tubing for leaks. Remove and clean out filters.

After *Annabelle* I purchased a hull of 40 in. length, superstructure and deck all in fibreglass (time was at a premium). The model had very nice lines, but was heavy compared to others. The laminate was not very even and it had a weak spot under the hull which required reinforcement. Although a kit, it still presented a great deal of work, not to mention installing aluminium stiffeners in the bottom of the hull to prevent flexing.

Many fine hulls are available for the hobby, most are very good productions and reasonably priced. In defiance of what has already been stated in the Model Press regarding the best adhesive for bonding wood and other materials to glass fibre hulls, take a tip from me, if you want the maximum strength use glass fibre, nothing else. It is not the easiest of materials to use, you have to be quick, have the right proportions to mix, and generally know what you are doing. If you don't know about the methods used, there is a very informative book available on the subject of glass fibre (from Model Aeronautical Press Ltd., price 7/6d.).

Now back to the model ; it was fitted with a Mk. 2 Taplin Twin and was very fast. The steering unit was an old American clockwork timer from which

only the spring and govenor were removed. The rudder actuating arm was attached to the winding key shaft and travelled between two minute ex W.D. limit switches, mounted on a backplate. A Microperm motor was connected via a dog and pin coupling and the power was such that it needed really excessive hand pressure to prevent the rudder turning. A printed circuit was fitted to the roof of the main cabin and eight lands were duly etched on its surface. A radar scanner was then fitted to an appropriate reduction gear, made from Rip-Max nylon gears, and powered by a Japanese motor. A hooter was fitted immediately behind and was wired to the p.c. board. Navigation lights and a searchlight (all home constructed) were added using one land as a common earth. The p.c. was wired to a set of contacts on the rear of the superstructure which made contact with (to quote a club member) a "Zebra crossing" p.c. board on the aft deck, from whence the wiring was fed into its appropriate position in the model.

The idea of the p.c. was to dispense with a lot of wires fitted to the cabin roof immediately above the engine coupling, they would not only look untidy but in the event of one coming adrift, would foul the engine coupling. The sequence of operation was throttle, navigation lights on, full ahead, radar scanner operated. This was effected with a simple slide and contact, travelling between two micro-switches in series with a master switch, so that the "Effects" could be completely switched off. The slide linked to the throttle arm, the hooter and searchlight were connected to a spare relay, and the whole outfit was operated on six channels. The model was very reliable and the receiver was the Sextone which suffered a drenching when *Annabelle* capsized.

The radio gear, in use for two years, was so reliable that a former member of the I.R.C.M.S. having no joy with his own Superhet bought it. I don't think he was aware that it had been used as a dragging anchor, but it is to the credit of the unit that it worked every time.

As a member of the club, interested in a superhet, you can appreciate my keenness when a circuit appeared of a five valve superhet of which five were made, by more knowledgeable members. Very compact, they seemed the ideal answer. But, though they worked at short range, they were hopeless at any distance, and it was valuable time and money wasted. In fairness, it must be said that the same set was operational in the North, installed in yachts, but it was extremely critical and when a founder member described the set as a lump of spaghetti it was the last straw.

Even though all components were of the highest quality, the combination proved unsuccessful. To save yourselves a similar setback, always be sure the circuit you decide to build is a proven efficient job, and the circuits you see in this magazine have been vetted and constructed by experts to work efficiently. As mentioned earlier, radio control seems to be split up into various groups. There are those whose interest, like the backroom boys, is development of radio only as a unit. On the other hand, there is the modeller (like myself) to whom a transmitter and receiver and its workings are but a means to an end in control, and between both you have the chap who is only interested in the hobby, not from the model point of view, but mainly to use the model as a test bed for comparison in the efficiency of the home made gear.

POTTING

(*Continued from page* 491)

unit to a depth of about $\frac{3}{16}$ in. Entice as many air bubbles out as possible and set to one side for about fifteen minutes, then cure at appropriate temperature for the time specified.

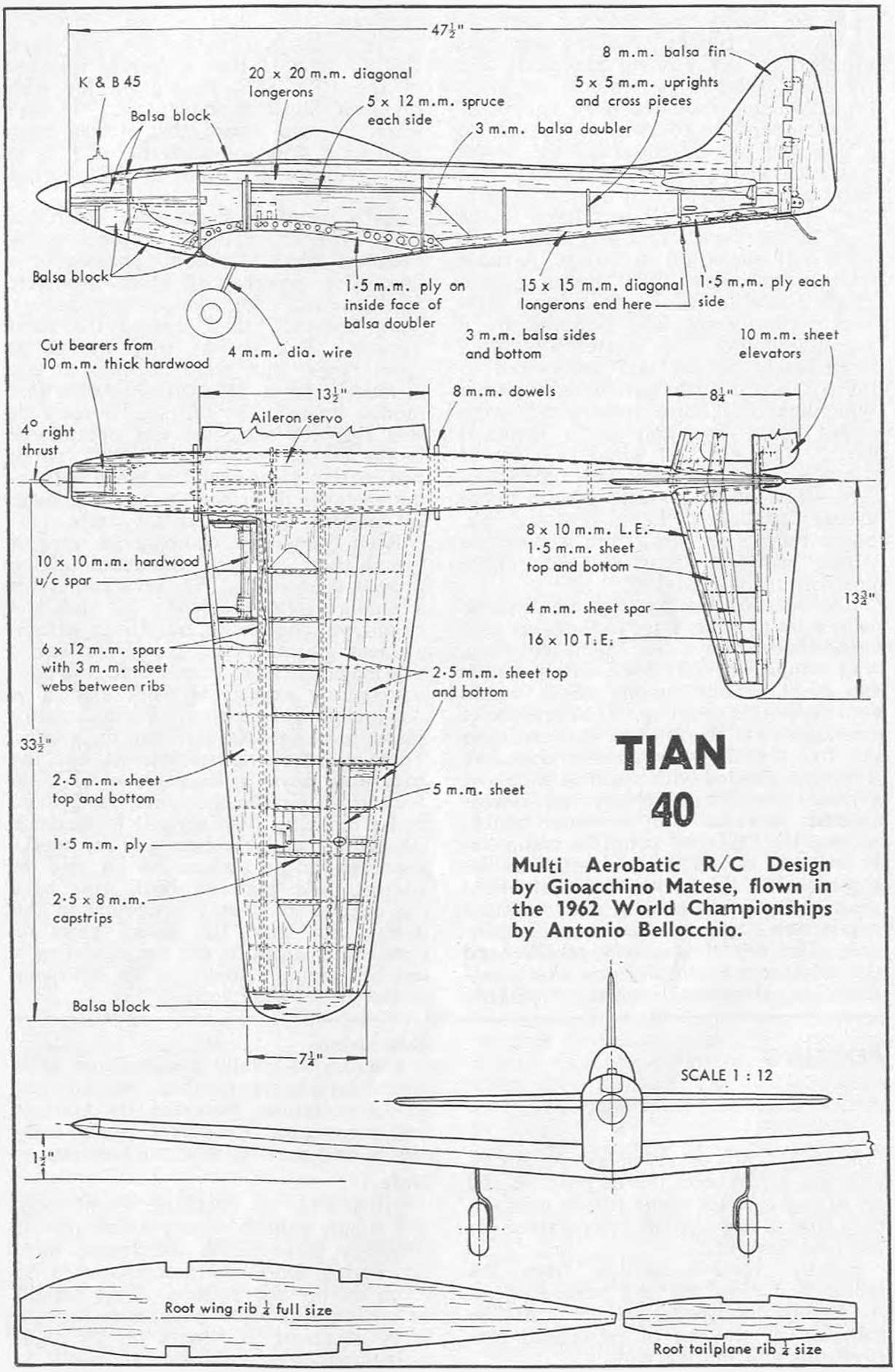
Finally, remove casting from the mould and clean off any release agent. A highly polished surface can be achieved by the use of recognised preparations and buffing pads.

Conclusion

The use of totally encapsulated units offers completely trouble free and reliable operation, provided the unit is first constructed on correct basic techniques and uses reliable components.

Note

CIBA Ltd. of Duxford, Cambridge, will supply suitable epoxy resins and all necessary information concerning mixing, curing times and precautions to be taken during the process. Care should be taken not to allow neat resin, hardener or accelator to remain on the skin, as in some cases irritation can result.



TIAN 40

Multi Aerobatic R/C Design by Gioacchino Matese, flown in the 1962 World Championships by Antonio Bellocchio.

Introduction to a modern radio component... THE TRANSFILTER

By J. H. BRUNT

This new development in the radio field helps to make superhet receivers easier to tune and more compact. J. H. Brunt has compiled the following information.

FOR short-wave communication, selectivity is just as important as sensitivity. In normal receivers crystal filter units are used in combination with the I.F. transformers to achieve a narrow bandwidth. These crystal filter circuits employ a quartz crystal, which can be likened to a series L, C & R circuit with a parallel capacity, the latter being due to the crystal holder.

The "Q" of the series circuit due to the crystal is very high, hence the high selectivity achieved using such a crystal. Quartz crystals are expensive. The raw quartz is costly, and processing to produce crystals for radio uses is likewise expensive. There are however other quartz or ceramic materials which also possess the piezo-electric effect. Amongst these is Barium Titanate which is used for crystal pick-ups and microphones. Such materials can be symmetrically produced.

In the last few years the Clevite Corporation of the U.S.A. has produced such a material called P.Z.T. This material is manufactured from LEAD OXIDE (P6 0), ZIRCONIUM OXIDE (Zr 02) & TITANIUM OXIDE (Ti 02) hence the code name P.Z.T.

This material, when clamped or placed between two electrodes and then energised with an A.C. voltage, vibrates mechanically in sympathy—further the material when similarly mounted and subjected to mechanical vibration gives out an A.C. voltage. This is called the piezo-electric effect. Now if a P.Z.T. crystal is suitably manufactured and mounted it can be made to respond to one particular frequency only. Also the crystal can be made to vibrate at this freqency by means of a suitable voltage

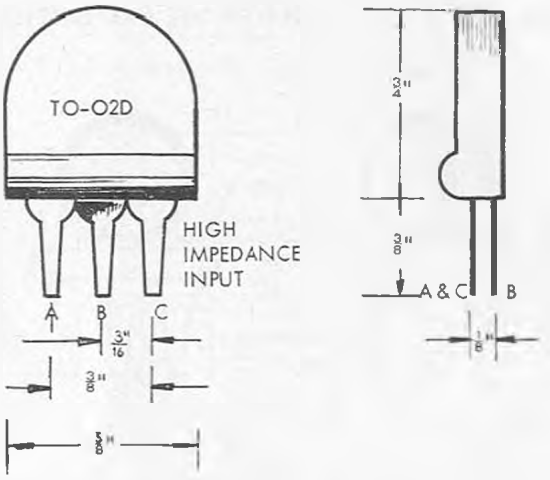


FIG. 1 3 ELECTRODE TRANSFILTER

applied to a pair of electrodes. Now if a third electrode is suitably placed on the crystal, the mechanical vibrations (caused by the voltage on the other electrodes) will cause a voltage which is in sympathy with the first voltage, to appear on this third electrode.

The "Transfilter," as the P.Z.T. crystal made by the Clevite Corporation has been named, is such a device.

Description of the 3 Electrode Transfilter

The Transfilter consists of a disc of P.Z.T. of a suitable size. On one side a circular electrode is sprayed and this is the common electrode B shown in Fig. 3b. In the centre of the reverse side, another small circular electrode is sprayed; this is the input electrode C. Also on the same side but separate and on the outer portion of the disc, a further ring electrode is sprayed; this will form the output electrode A. (see Fig. 3a). The theoretical symbol of the three electrode transfilter is shown in Fig. 4.

The input impedance of such a Transfilter is approx. 2000 ohms, and the output impedance is approx. 300 ohms.

Transfilters are being manufactured in the frequency range 450-500 Kc/s.,

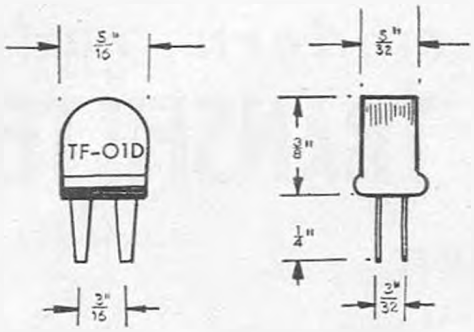


FIG. 2 2 ELECTRODE TRANSFILTER

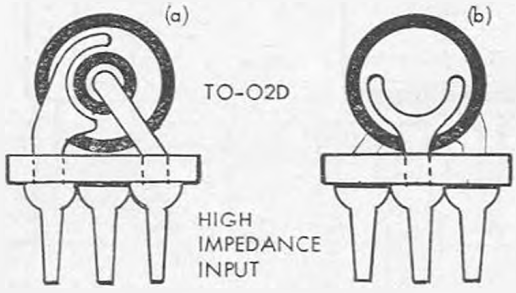


FIG. 3

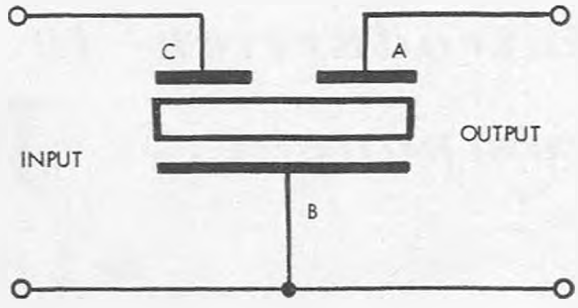


FIG. 4

and this fact coupled to their input and output impedances makes them ideal for use in transistor receivers, in particular miniature receivers as the Transfilters are very small in physical size. See Figs. 1 and 2 for dimensions. An added advantage to the home constructor lacking tuning equipment is that no tuning of I.F. circuits is required and neutralising components not necessary. Therefore with these features included in a Radio Control Receiver, only the R.F. and Oscillator circuits will need to be adjusted.

Clevite Corporation Transfilter Types

	TF-01A	TF-01B	TF-01C
Resonant Frequency	455 ± 2 Kc/s.	465 ± 2 Kc/s.	500 ± 2 Kc/s.
6dB Bandwidth	25 ± 7 Kc/s.	25.5 ± 7 Kc/s.	27.5 ± 7.5 Kc/s.
Capacity	←	500 ± 50 pf.	→
Impedance at resonance	←	<15 ohms	→
Permissable D.C. voltage at resonance V. max.	2 volts	2 volts	2 volts
Freq. drift in temp. range −20–+60° C	←	± 0.1%	→
Freq. drift in 10 years	←	<0.2%	→

	TO-01A	TO-01B	TO-01C
Resonant Frequency	455 ± 2 Kc/s.	465 ± 2 Kc/s.	500 ± 2 Kc/s.
6dB Bandwidth	25 ± 7 Kc/s.	25.5 ± 7 Kc/s.	27.5 ± 7.5 Kc/s.
Input Capacity	←	>180 pf.	→
Output Capacity	←	>800 pf.	→
Input Impedance	←	2K ohms	→
Output Impedance	←	300 ohms	→
Freq. drift in temp range −20–+60° C	←	± 0.1%	→
Freq. drift in 10 years	←	<0.2%	→

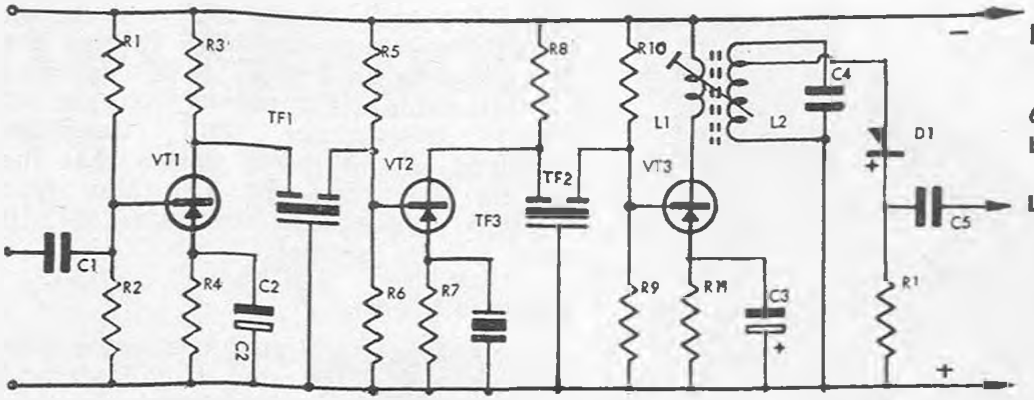


FIG. 7

6-9v. CIRCUIT
L1 20 turns 7 strand Litz
L2 100 turns 7 strand Litz Tapped 60 turns from bottom.

Coil former ¼ in. diam. with dust-core.

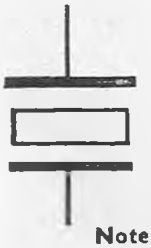


FIG. 5

Symbol for a 2 electrode Transfilter.

Note : Connect either way round.

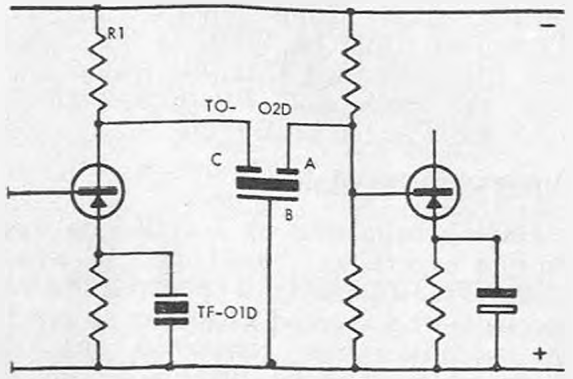
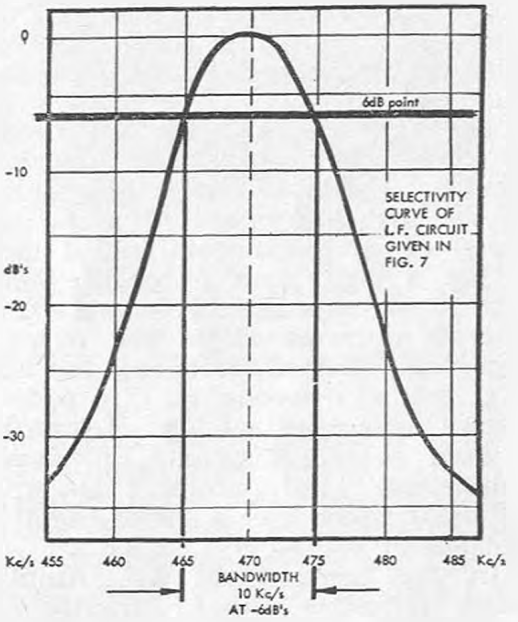


FIG. 6



Description of the 2 Electrode Transfilter

In addition to the three terminal Transfilter, a two terminal Transfilter is also produced. This unit is physically smaller than the three terminal Transfilter—see Fig. 2.

The two electrode unit possesses a very low impedance at its resonant frequency. Because of this fact it is used in I.F. circuits to replace the normal emitter resistance by-pass capacitor, (see Fig. 6) which shows the connections for Transfilters in a basic I.F. amplifier). The action of the circuit is as follows ; at the resonant frequency the emitter resistance is decoupled by the very low impedance the device offers and maximum gain of the stage results. But at other frequencies there is negative feedback due to the emitter resistor, greatly enhancing the resultant selectivity.

The impedance at resonance of the two terminal Transfilter is approx. 15 ohm. The tables opposite give the data for Transfilters for use at 455, 465 & 500 Kc/s. The types TF-01D and TO-02D types for 470 Kc/s are shown separately since at present they appear to be the only types readily available in the U.K.

The transfilters type TF-01D and TO-02D which are available from Electronic Precision Equipment Ltd., of East-

Experimentally-minded readers may find the superhet described on page 274 of the June, 1963, issue a helpful starting point for development.

bourne, are for use at 470 Kc/s. Data for these types is given below.

TO-02D

Bandwidth — 1 to 4% (see notes).
Input Impedance — 3.9 min., 3K ohms max.
Output Impedance — 680Ω min., 3KΩ max.
Insertion Loss — 3dB max.
Freq. Stability — <0.2% for 10 years ± 0.1% from −20° C. − +60° C.

TF-01D

Bandwidth — 4 to 7% at 6dB.
Impedance at resonance −<15 ohms.

The following notes "Using Transfilters" are reproduced from data supplied by Electronic Precision Equipment Ltd.

The TO-02D transfilter is a ceramic device with impedance matching characteristics. The piezo electric disc vibrates at the first overtone (470 Mc/s ± 1 Kc/s) of its fundamental radial mode. It has a high input impedance and a low output impedance. Since the transfilter is operated at its first overtone, other well damped resonances can occur (e.g., second overtone, etc.), in order to reduce these a second type of transfilter is used if more than one I.F. stage is considered. The second type is the TF-01D, which has a fundamental resonance of 470 Kc/s ± 2 Kc/s.

In the conventional I.F. Amplifier using transistors with I.F. transformers, mis-matching is generally used to avoid instability. When using transfilters the collector resistor R1 (see Fig. 6) will damp the circuit and reduce any tendency towards instability. This resistor value will also affect the bandwidth of the circuit. (End of Notes from Electronic Precision Equipment Ltd.)

Test to Check Performance of Transfilters

In order to carry out these tests, an I.F. strip was constructed. The circuit with component values is given in Fig. 7. Apart from the Transfilters and the collector lead resistors in the first two stages, this circuit is a standard one normally used with Transformer coupling, except that the I.F. transformers were removed along with the associated neutralising circuit components. In this way it was possible to check the gain of the circuit in its standard form using transformers, then to check again with Transfilters in circuit. For these tests, the RF and Oscillator coils of the mixer transistor (XF102) were disconnected leaving the first stage as in Fig. 7. Tests revealed no noticeable difference in the gain between transformer and transfilter coupling. From this it seems that the makers claim that the Transfilter type TO-02D Power loss (insertion) of 3dB max. is fully justified.

Bandwidth Test

For this test, a Signal Generator with an accurately calibrated attenuator and a fine tuning control was employed. The output being measured by the D.C. volts appearing across the diode load (47K ohms) using a valve volt-meter.

A graph being plotted of frequency against dB's (dB's being used for convenience) of the resultant I.F. response curve. See Graph. From this graph it will be seen that at the 6dB point, the bandwidth is 10 Kc/s which is equal to the normal pass-band achieved using transformers. No doubt if desired a further stage using another TO-02D Transfilter could be added to the circuit and it is estimated that this would narrow the pass-band to approximately 7.5-8 Kc/s at the 6dB point.

Effect of Vibration

Having been told by a colleague that he had experienced "microphony" when using Transfilters in a portable M.W. receiver—this seemed logical in so much as transfilters are concerned, due to their material make up being similar to an Xtal pick-up element—it was decided to deliberately subject the I.F. strip to mechanical vibration. The result was very pleasing. No trace of spurious signals was detected in the output, that could be related to the vibrations induced.

Only one thing was not tried. shock treatment. Obviously due to their nature Transfilters should be treated with care, the same care afforded to other crystals used for frequency control — and not dropped on hard floors. However, from their type of construction—in moulded plastic—it seems fairly safe to say that they will take all normal treatment likely to be received in a model aircraft, without giving trouble.

From these findings it can be seen that transfilters can be used (with a resultant saving in space) in radio control superhet receivers. June, 1963, issue contained a practical "Do It Yourself" circuit with a filter switcher output.

Test Report

The F & M ten channel transistor transmitter and superhet receiver

EDITORIAL REVIEW TEST FIGURES

By J. H. BRUNT

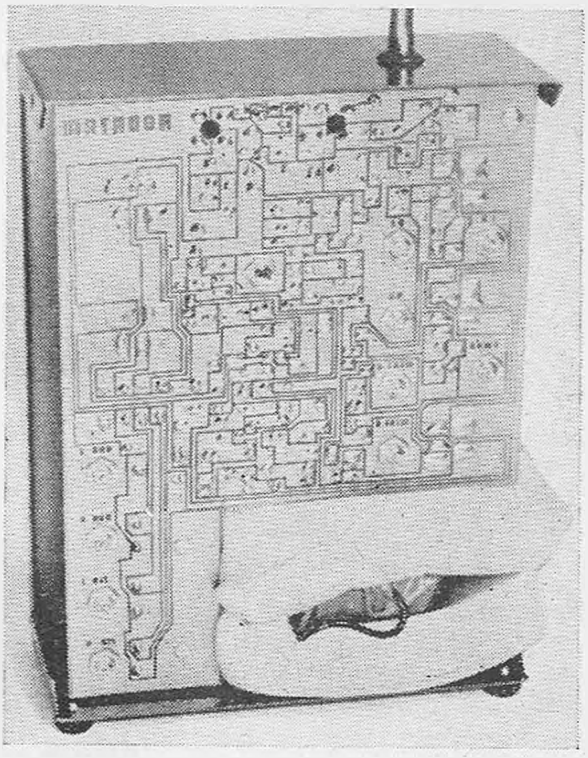
Now that F & M equipment is among those other American items readily available in this country, we thought it time to produce a test report on this equipment which now makes regular appearances in the multi contests together with the other well known manufacturers names. We will therefore deal with the "Matador" which is a ten channel, Bi-simul, all transistor transmitter and matching "Midas" Vibroloc type superhet.

MATADOR TRANSMITTER TEST

Following the trend of most transistor transmitters, a considerable lightening of weight and reduction in size was to be expected. It does in fact make a handy size box, the controls being conveniently placed, the lever switches themselves have a nice soft action permitting accurate hand pulsing to be accomplished. There is a miniature meter incorporated in the front panel to give an indication of R.F. power and a test button which, when operated, changes the function of the meter to read battery volts under a simulated operating load. The controls are positioned so that the aileron key is at the top right hand corner, this is largely a matter of preference from the pilot's point of view, and if one is used to flying with the lower right control for aileron, it is a simple matter to transpose the servo plugs in the model. An interesting point too, is that the tones are arranged in a slightly different order with elevator as the lowest note whereas we have been used to having trim in this frequency range. Providing aileron and elevator operate from reeds which have a quick response, general arrangement is unimportant.

Above, front face of Matador transmitter showing lever layout, meter, test button and switch. Below, case back removed to show printed circuit board with pot control identification etched into the copper.

The transmitter uses Measa transistors for the R.F. stage, and there is no centre loading coil in the aerial. Field strength readings carried out during the



test were very high and the mechanical construction and general layout on a wide land, one panel glass epoxy printed circuit board showed that much thought and skill had gone into the production. The crystal used in the MOPA oscillator circuit is third overtone 0.005 per cent tolerance and the transmitter complies with the American Citizens band requirements of 0.01 per cent maximum permitted R.F. drift.

The audio tone generators use toroids for tone stability. The manufacturers claim modulation in excess of 95 per cent and a stability of within 1 cycle of the reed frequency over a useful range of battery voltages and normally expected temperature changes. The tones may be tuned over 25 c.p.s. to compensate for reed bank differences.

We tested the transmitter tones to tune over 60 cycles in the high range and 70 cycles in the low range. Similarly, although the receiver specification indicated a tone range of from 200 c.p.s. to 650 c.p.s., this particular transmitter being set up to suit the "Midas," went from 640 down to 345.

Test Figures

A 6.25v. DEAC pack had been installed in place of the dry battery for which the transmitter was designed, this is quite a normal modification by modellers who do plenty of flying. The makers recommend the use of a 2½ ohm resistor in one of the DEAC leads in this case, to hold down the high surface voltage following a charge (such a resistor is supplied free) in this case. The DEAC reads six volts on load, the current was measured as follows:

Aerial Extended

Carrier 125 mA.
One tone operated between 180 and 250 mA., depending on frequency of tone.
Simultaneous between 230 and 240 mA. (up elevator and left or right rudder).

Aerial Retracted

Carrier 130 mA.
One tone operated between 215 and 255 mA., as above.
Simultaneous 250 mA.

Estimated R.F. Output

Slightly over 250 mW., field strength reading very high.
Audio frequencies, note staggering of tones.

Aileron	R	640
	L	565
Rudder	R	600
	L	530
Throttle	Hi	395
	Lo	345
Elevator	U	365
	D	425
Trim	U	460
	D	490

It should be remembered that this arrangement of frequencies requires the appropriate connections on a reed bank, and has been specially designed to suit the combination of this transmitter and Midas receiver. Needless to say, a similar reed wiring system should be used with any other reciever operated with this transmitter.

Physical Data

Size 8⅛ in. high, 6¼ in. wide, 2¾ in. deep + 1 in. for switch projections.
Weight 2¾ lb. + DEAC 3¼ lb. total.
Aerial Retracted 9 in.
Aerial Extended 58 in.
Case, folded aluminium, blue anodised with four rubber buffers on base. Back retained with four self tap screws and is removed to change battery or adjust tones.

MIDAS RECEIVER TEST

This is a ten channel all transistor superhet using a "Medco" reed bank and is designed to match the Matador Transmitter, or Hercules (earlier valve transmitter). Here again a similar glass epoxy circuit board with generously wide lands is used, and the component placement carefully arranged to avoid interaction and reduce the chances of mechanical damage. It operates on 6 volts from the servo battery pack which may be either dry batteries or more usual DEAC (6.25 volts) pack. The receiver cannot be described as *sub*-miniature, and weighs 4½ oz.

There is a really hearty drive to the reeds, which leaves no doubt whatsoever that they are making contact! Indeed this is the highest reed amplitude we have seen on test so far, yet the

selectivity of the bank was such that we could detect no tendency for the adjacent reeds to vibrate in sympathy. The fact that the reeds are wired so that ajacent reeds go to different servos is an additional safety factor. Should two adjacent reeds strike whilst tuning the tone pots it is unlikely that damage will occur to the servo amplifier under these conditions.

The receiver we tested is fitted with an additional piece of circuitry known as the "Vibro Loc." This is sensitive to *any* tone and closes the circuit to the reed comb on receipt of a tone. Should mechanical vibration transmitted from the model cause any reed to vibrate when no signal has been sent, the servos will not operate. This does not, of course, prevent mechanical vibration affectiing the reeds while a signal *is* present. We understand that the "Vibro Loc" system has largely been found unnecessary when a normal amount of care is exercised whilst installing the receiver, so on later models this facility has been omitted. resulting in what must be the smallest superhet, ½ oz. lighter and the same circuit less "Vibro Loc".

Test Figures

Rx. supply volts 6.25 from common servo and bias pack of DEAC 500 cells (makers indicate that four 1.5 volt dry cells may be used for receiver and servos, plus one or two 1.5 cells for bias).

Receiver Currents

No Signal 12 mA.
Carrier 11 mA.
One tone 38 mA.
Two tones (simul) 37 mA.
Current measured in supply lead with servos in circuit 300 mA. total while un-loaded servo operates.
Peak current with servo overloaded approximately 500 mA.

Sensitivity

Better than 2 microvolts.
Bandwidth not greater than 10 Kc (measured at I.F. frequency).

Reed Frequencies

640, 600, 565, 530, 495, 460, 425, 395, 365 and 345 (spacing extremely accurate).

Physical Data

Size 1⅛ in. high, 2⅛ in. wide, 3¼ in. deep.
Aerial length 18-36 in.
Weight 4½ oz.
Aproximate installation weight (Rx. battery, 5 oz.), plugs, sockets etc. 1¾ oz., 5 servos at 2¾ oz. each = total 25½ oz.

Midas superhet receiver has closely packed components and Medco reed block. Tuning slugs to four I.F. cans and R.F. coil are sealed with wax, to prevent movement and tampering. Manufacturers recommend that case be taped around edges to prevent entry of dust and dirt. The new "Midas" is much smaller, makers claim ; smallest R/C superhet

Case folded aluminium, blue anodised with white silk screen legend. There are six grommets in one end ; for power supplies and five sets of servo connections, aerial passed through additional grommet at opposite end of case.

Compatability

All Matador transmitters and Midas receivers are individually matched and the makers can only guarantee results when the receiver is operated by its own transmitter. This is due to the extreme sensitivity of the Midas which requires good stability at the transmitter end. It can, however, be aligned carefully to suit a number of other Txs.

Manufacturers Claims

F & M guarantee an operating temperature range from 0° F. to 130° F.. sensitivity greater than most supergen receivers, subminiature precision crystal used in the local oscillator. Extremely sharp sensitivity thanks to the four I.F. transformers producing selectivity equal to commercial (broadcast) receivers. Stable circuitry free from oscillation producing regeneration ; noise shield of mixer and I.F. stages accomplished by

(*Continued on page* 516)

Commercial Developments

By TONY DOWDESWELL

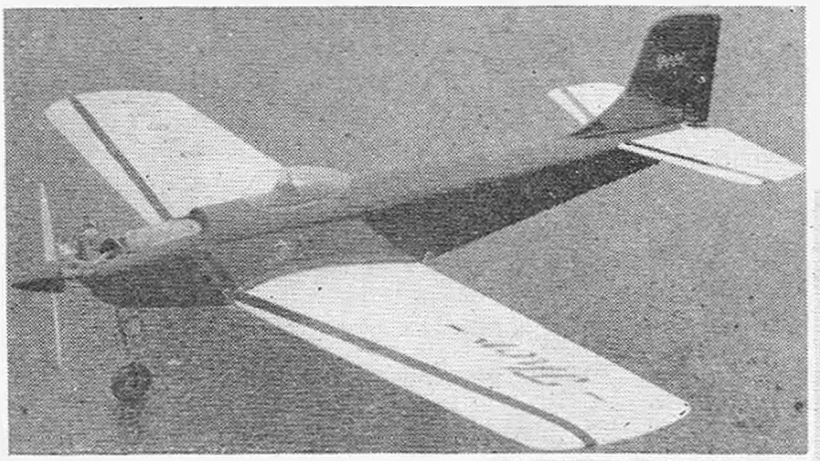
CONSUMER STAFF MEMBER SAMPLES NEW PRODUCTS AT HOME & ABROAD

OUR first items this month come from **Alan Nicholls Ltd.,** whose new **A.B.C. Tone Receiver** is the latest addition to their range of equipment. This super-regenerative set supplied in kit form, features a sub-miniature value detector stage followed by two transistors, driving a Gruner 957 relay. Although the valve works off a 22½ volt (B122) H.T. battery, the transistors use a separate 4.5v. to 7.5v. supply, easing the drain on the valve H.T. and thereby contributing to greater reliability, flexibility and reduced susceptibility to interference.

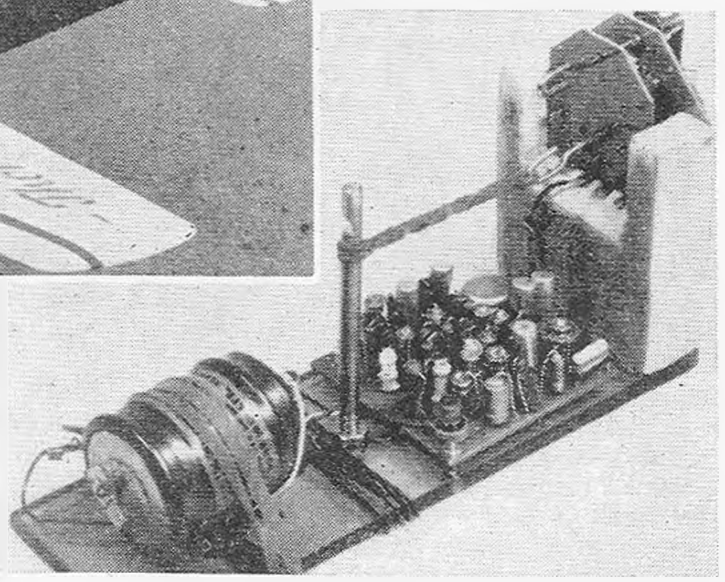
The kit of parts is very complete. All components are provided including ready wound tuning coil on former and such extras as B7G plug and socket, tuning tool, sleeved seven core wiring leads, solder and P.V.C. sleeving. Eight pages of instructions are most explicit and supplemented by four stage component placement diagrams making construction simplicity itself for anyone capable of handling a soldering iron. Size of the plastic case is 2½ in. x 1⅝ in. x 1 3/16 in. and the completed receiver would weigh about 2½ ozs. and the battery complement less escapement supply 3 ozs. This receiver is definitely to be recommended to those about to make their first try at this R/C game. One of the classic, constantly recurrent queries received at our office goes something like: "I am just starting radio control modelling and wonder if you can supply me with circuits for an all transistor receiver and transmitter". If the novice forgoes some of the advantages of the all transistor circuit we are sure he will be blessed with great success using the A.B.C. Tone Receiver which defintely gets our vote, particularly at £5.5.0d.

The receiver may also be used or converted to operate a reed unit instead of a relay for multi channel and for this purpose, the price, less relay is £3.16.0d.

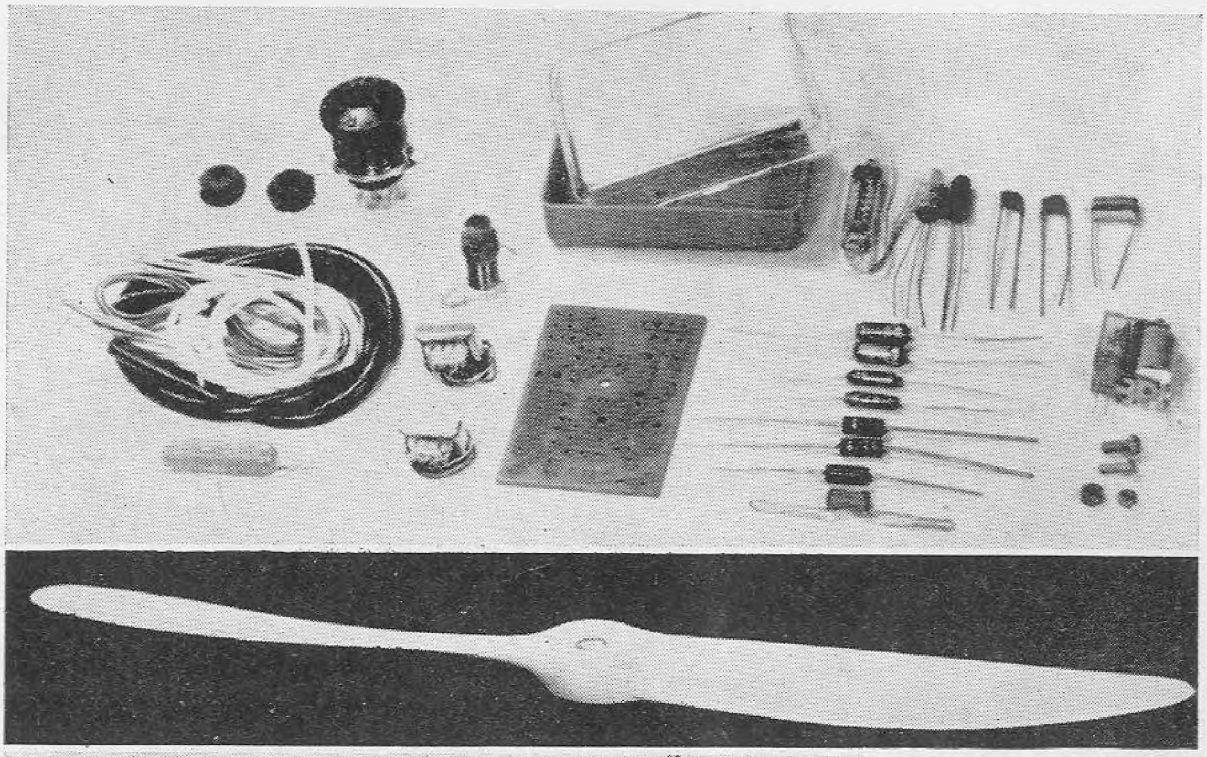
A new version of the **A.B.C. Tone Generator** of the **A.B.C. Transmitter** (*R.C.M. & E.*, April, 1963) is now avail-

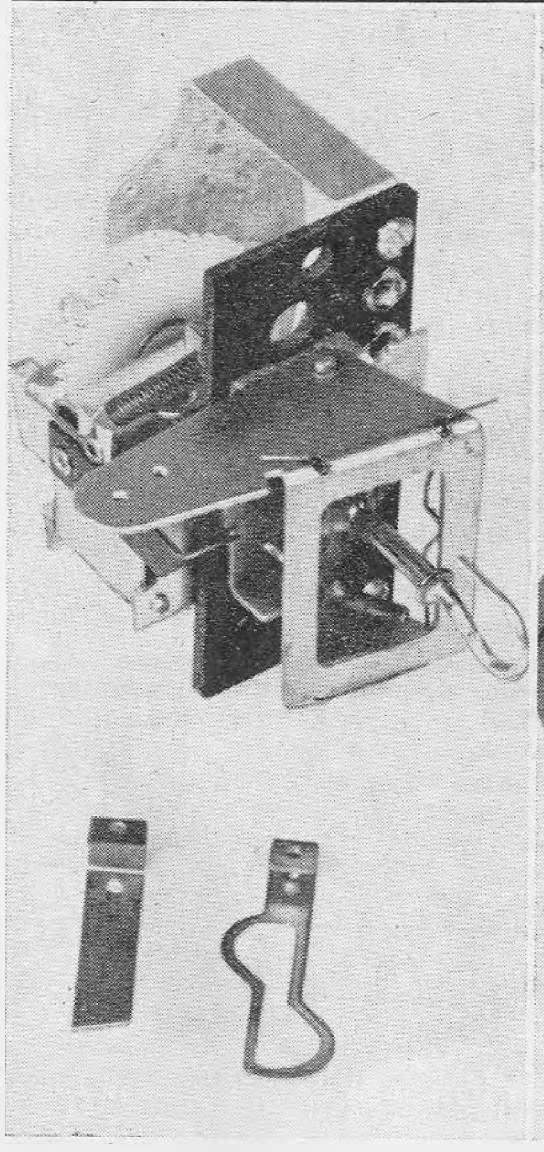


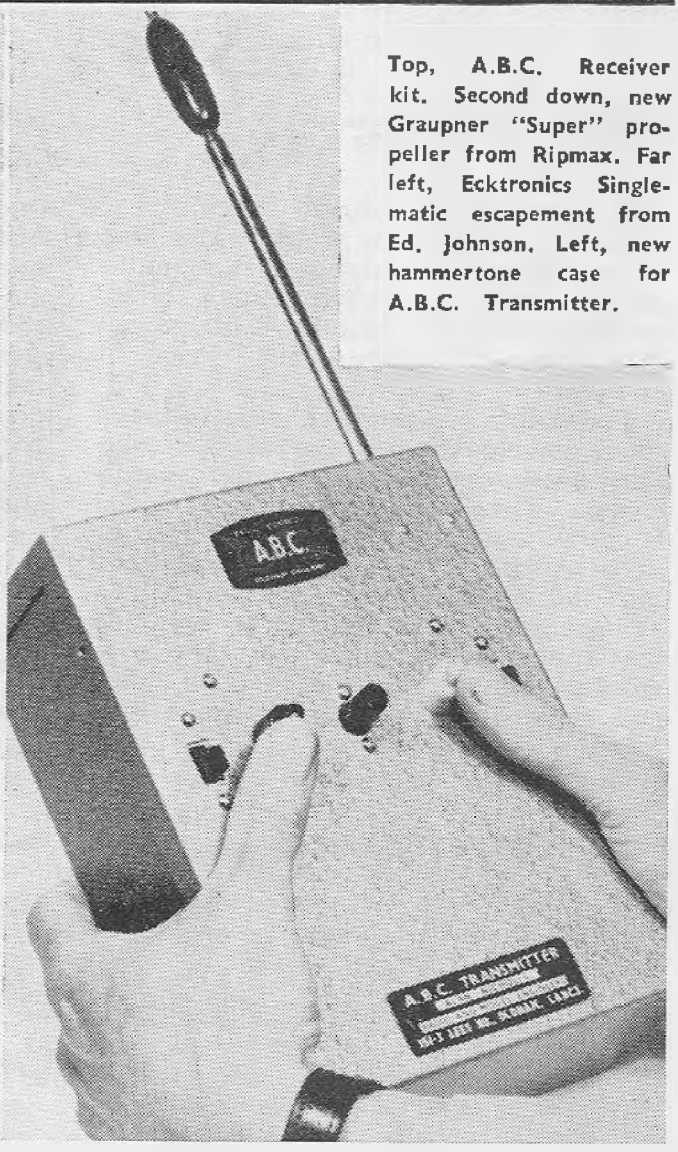
Left, our completed Robbe Thor test model, finished in navy blue, white and pink. Equipped with R.E.P. Dekatone radio and Merco .35 engine. Weighs 6 lb.



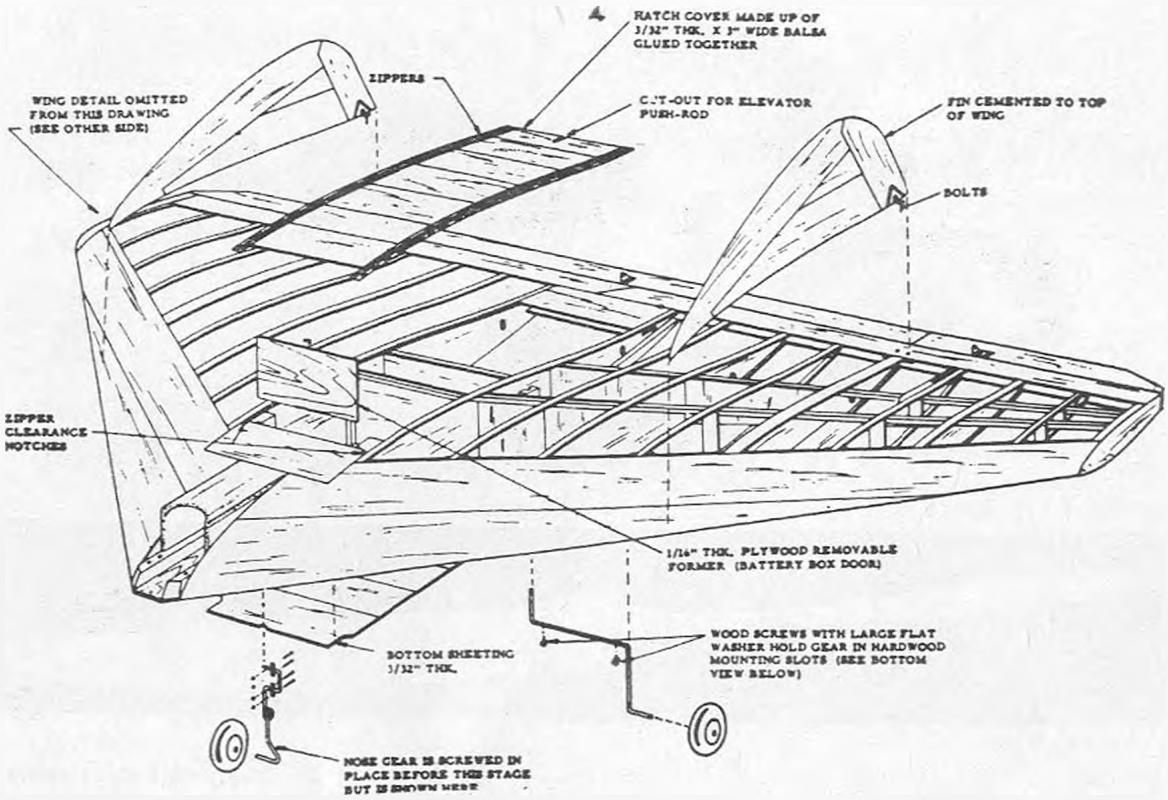
Right, Oakfield Radio's S.R.3 single channel tuned filter receiver on test rig with DEAC power pack and escapement.







Top, A.B.C. Receiver kit. Second down, new Graupner "Super" propeller from Ripmax. Far left, Ecktronics Singlematic escapement from Ed. Johnson. Left, new hammertone case for A.B.C. Transmitter.



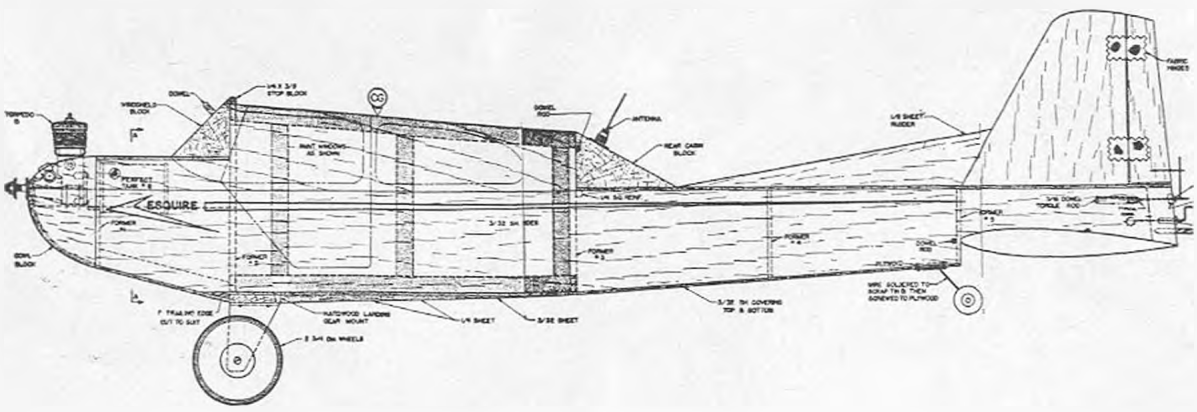
Above, structure and appearance for Midwest's Hustler XD7 delta from Roland Scott.

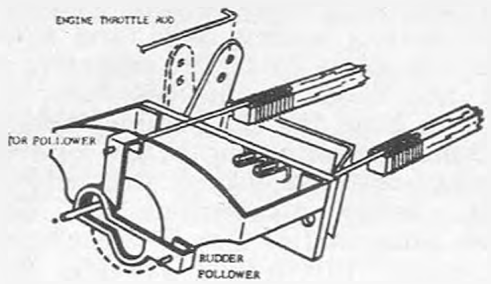
able, featuring improved circuitry to provide a better tone signal. The unit, on printed circuit baseboard is mounted on the main transmitter circuit board as illustrated in March "Commercial Developments" (page 150). Price is £1.14.6d.

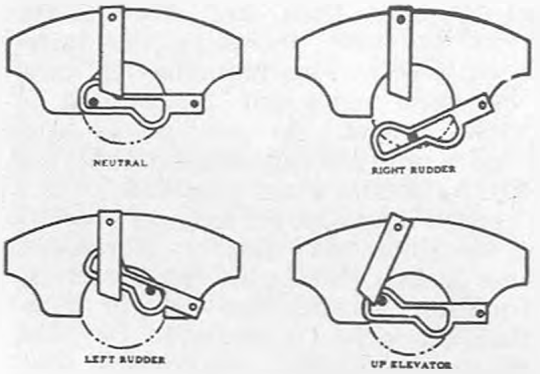
The **A.B.C. Transmitter** has also taken on a new look, with a smart hammertone finish case and trade mark escutcheons. The R.C.S. centre loaded aerial is now used, fitting the MacGregor aerial socket in the top of the case. Size and layout is unchanged and A.B.C. Transmitter owners wishing to up-grade the appearance of their set may substitute the new case for £1.12.6d. For full details of this carrier wave/tone pulse transmitter we again refer readers to April *R.C.M. & E.*

Do any R/C fliers fancy a delta model for a change? You do, well how about **Midwest's Hustler XD-7.** This is certainly a different shape to put in the air and does not require expensive eight or ten channel gear. The plan shows only elevator and aileron control surfaces indicating that this model is a genuine performer with this somewhat sparse control arrangement considered sometimes to be a little "dodgey". Just four channels are all that is required for this unusual model, but for all this originality it is a redoubtable performer as indicated by the new R/C speed record of 126.9 m.p.h. set up by one of these

Midwest Esquire trainer has spacious equipment compartment as indicated by side view below.







From Ecktronics Singlematic escapement instruction sheet, details of control positions and torque rod connections.

models with a McCoy .60 10 c.c. (not Dooling .29 as reported last month) instead of the .19 (3.5 c.c.) as indicated on the plan. Construction time is likely to be far less than for a comparably sized conventional model since the Hustler is virtually just a wing, and a simple one at that.

Parts are not numbered, but the die-cutting is crisp and the timber of extremely good quality. Undercarriage legs for the tricycle landing gear are supplied ready formed, together with moulded nylon bellcranks and control horns.

In all, it looks a good one, although the price is perhaps a little discouraging at £8 10s. 0d. Requiring less complex multi gear, it has definite appeal to a large section of the R/C fraternity, but an intending builder would require a little multi flying experience under his belt first we think. **Roland Scott** imports the Hustler from U.S.A.

Another Midwest kit which Roland sent along is the **Esquire** high wing trainer of 50½ in. span. This is a good, steady "hack", just right for introducing freshmen to the hobby with a 2.5 c.c. engine, but able to provide plenty of performance using a 3.5 c.c. motor. Though obviously intended for single channel radio equipment there is enough space in the Esquire's radio compartment for the bulkiest gear, making it ideally suited to four channel multi equipment.

Timber quality equals that of the Hustler and die cutting is also good. A spring aluminium leaf type undercarriage is provided ready formed, and also one rather surprising item, lightweight tissue. Silk or nylon will make the model much stronger. Price, at £4.5.0d. is quite competitive, particularly for an import.

Ripmax Ltd. have a new line in **Graupner "Super" nylon propellers** and we received a sample of the nicely shaped big 12 in. x 6 in. size which should suit .49 size engines well. There just is not much one can say about a propeller really except to add that the moulding is very clean with no rough edges. In the air it suited a Merco .49 well so passes our test. Price is 8/6d.

We reviewed the **Robbe Thor** low wing multi aircraft kit in July "Commercial Developments" and are pleased to report that the completed model has now finished testing successfully. The model weighs 6 lb. and the Merco .35 engine installed proved adequate power once the 11 in. x 4 in. propeller was replaced with a 10 in. x 6 in. The improvement was quite amazing. Builder G. Crossgrove reports that the Thor was deliberately flown using aileron control only and that the rudder has little effect. Price of the Thor, for those who missed the July report, is £7.8.3d.

Oakfield Radio Ltd. have announced their new range of **"S.R."** receivers. **S.R.2** and **S.R.3** and both single channel super-regenerative tuned filter selective receivers two or more of which may be operated simultaneously. Though not equal to the selectivity of the superhet receiver the use of a tuned filter to provide selectivity with a matched transmitter and receiver combination does effectively give interaction free operation. Receiver size is 2 in. x 2 in. x 1 in., and on to the 2 in. square printed circuit board, over 50 components are crammed, evidence of miniaturisation. S.R.2 has a relay and costs £9.9.0d., but S.R.3 has a relayless output and costs somewhat less at £8.19.6d. We were able to examine the latter on prototype test rig as illustrated but unfortunately time did not permit any practical tests and we will therefore say no more until we are able to play with it a little.

C & L Developments, manufacturers of **Climax Servos** inform us that they

intend to offer their fine **Musclemite** servo in kit form, including the transistor amplifier. The reduction in cost will be good news for those with a restrictive budget. As yet, prices and availability are not announced, but we will supply details when available.

A special liquid model cleanser soon to be on sale in model shops is **Aeroclens** airframe cleaner. There are two mixtures, one for diesel engines and one for glow motors. We were fortunate to be able to test samples and discovered that Aeroclens effectively removed even months' old fuel sludge and grime to give sparkling clean appearance. The diesel "D" type cleanser is blue in colour, and the glow "G" type is yellow. Each will be bottled in two sizes, the diesel cleanser costing 3/6d. and 6/6d., while the glow is more expensive at 4/3d. and 7/6d. for the two sizes.

Just in time for this month's review, **Ed. Johnson** sent along a new and interesting development in the field of single channel escapements, the Eck-tronics **Singlematic** "2 in 1" escapement. This rubber driven unit provides left/right rudder, up elevator and two speed engine control all on the one unit without resorting to a second "quick blip" triggered escapement for the engine control, hence the "2 in 1" description. For use with either relay or relayless single channel receivers, the Singlematic works off 3 volts, weighs 1 oz. and measures approximately 2 in. x 2 in. x 1¾ in. overall. Instructions provided show pictorial wiring diagrams for relay and relayless systems plus details of torque-rod attachments. Price from Ed. is £6.6.0d.

We understand from R.C.S., who must still be expanding, that Peter Lovegrove and Dave McQue are now on the staff, we await developments and new ideas from the "new boys".

F & M TEST REPORT

(*Continued from page* 511).

large "power filters"; everything possible has been done to reduce actuator noise interference. High gain transistor detector (collector mode) transformer coupled to audio stages. Exclusive A.G.C. circuit does not use diodes or complicated feedback networks, yet effectively eliminates close range blocking.

Complete Equipment Test

After a preliminary range check, the equipment has been flown in a "Tauri" with six channels used.

The gear was then given ground range check to ascertain the extreme ground to ground limit of operation with servos switched in. This proved to be 750 yds. before a servo ceased to operate.

Manufacturers: F & M Electronics Inc., 153 Vermont N.E., Albuquerque, New Mexico, U.S.A.

British prices: 10 channel £89.17.0d.; 12 channel £105.0.0d.

Obtainable from, and serviced by: "Soraco" (Harry Brooks), 32 Redhill Drive, Brighton 5.

CLASSIFIED ADVERTISEMENTS

MIN-X 10 Superhet (mod. to latest circuit by Min-X, July). 26.995 freq. matched REP 10 Tx. (latest switches). 6v. power converter with Tx. mounted accumulators. Very reliable combo., £45. P. Wilson, 50 Holly Avenue, Jesmond, Newcastle-on-Tyne.

TELERADIO will purchase that unwanted radio equipment. Details please to 18 Turnpike Lane, N.8.

CASES, chassis, panels. ANYTHING in metal; send your drawings for quote. Stove enamelled, hammertone, or plain, in any colour. — Moss Watson, 40 Mount Pleasant Street, Oldham, Lancs. (Main 9400).

SINGLE channel transmitter, 4 transistor receiver, escapement set. As new, £6.10.0d. p.p. D. Thomas, 50 Gypsy Lane, Marton, Middlesbrough.

DUOTEN Tx., completed, ready to tune to your Rx., £10. 3 Duramites, £3.10.0d. each. Hillcrest, £2. Veco clunk tank, 7/6d. (all new unused). Merco 35 Bramco throttle, perfect, £3.10.0d. Greenwood, 38 Co-Operation Street, Bacup, Lancs.

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Graupner

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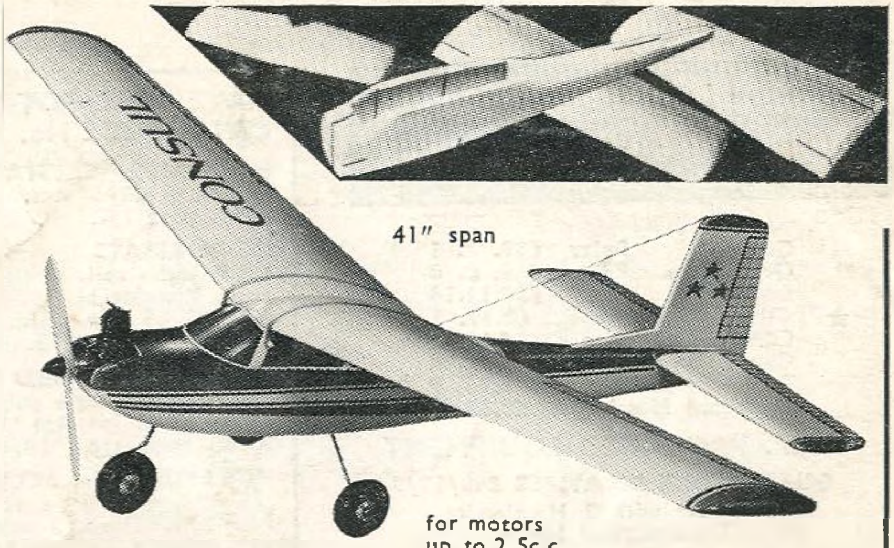


Fuselage, wings, tail COMPLETELY FINISHED ready to assemble in skin-hardened foam plastic — ready bent wire parts, wheels, transfers, etc., etc. A wonderful flyer for RUDDER ONLY (single- or two-channel radio).

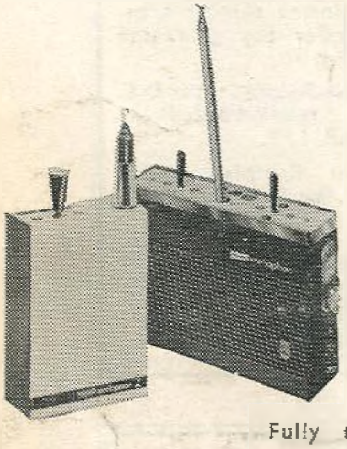
41" span

DE LUXE KIT **£4.12.0**

for motors up to 2.5c.c.

and . . . . . .

GRUNDIG RADIO SETS TO MATCH!



The very latest in radio control units, fully transistorised to use low cost batteries and featuring PLUG TOGETHER INSTALLATION — no soldering, no fuss — no wrong connections, and what a time-saver! This is the ultimate in R/C — simplicity, reliability and complete control. 2-8 Channels, plus simultaneous operation on 6 or 8 Channels.

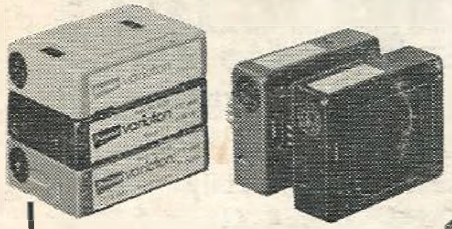
2-CHANNEL TRANSMITTER

Pre-tuned, crystal controlled. Amazing range and stability. Grundig's very latest! Size: 5½ x 3½ x 1¾" Weight: 16 ozs. Battery: 12v. (DEAC) **£19.10.0**

4- AND SIMUL 8-CHANNEL TX's

Neat in appearance and outstanding in performance! All-transistor. Size: 8 x 5¼ x 2". 50" tele. aerial. 4-Channel **£31.10.0** 8-Channel **£39.10.0** Converter (adapts 4- to Simul 8-Ch.) **£10.15.0**

2- TO 8-CHANNEL RECEIVERS



Fully transistorised tone receiver with plug-on 2-channel filter units, giving up to 8 channels. Size (each unit) 2⅛" x ½" x ½". Weight 1 ounce.

Receiver **£8.15.0**
Filter units ... **£8.15.0**
(2 channels each).

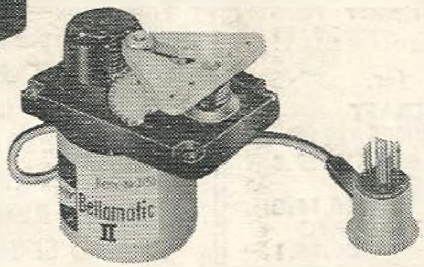
MATCHING SERVOS

Graupner servos are ready wired to plugs matching the Grundig receiver units — just plug in ready to operate!

Bellamatic II (2-4v.) **£5.12.6**
Self-centering servo for rudder, elevator, ailerons.

Duomatic (6 volts) **£5.12.6**
Very powerful, self-centering for rudder, elevator, etc.

ServoAUTOmatic (2-4v) **£3.5.0**
Progressive servo for engine speed or trim.



R/C ACCESSORIES

Your radio installation problems are made easy with specially matching accessories.

Here are just a few.

- **WIRING HARNESS** for Grundig — leads, switch ready wired with plug connections for batteries and receiver. **Price 22/6**
- **CONTROL LINKAGES** — plastic **2/11**, metal **4/3**, extension tubes **2/4**. Control horns (nylon) **2/3**.

SEE THEM AT YOUR MODEL SHOP!

KITS FOR R/C!

Here are just a few of the many wonderful COMPLETE de luxe kits in the GRAUPNER range.

CARAVELLE **£8.19.6**
71" span 'multi' aeroplane
KADETTE (46" span) 50/-
High-wing cabin monoplane
WEIHE 50 (72" span) 72/-
Scale sailplane
FILOU (50" span) 46/-
Auxiliary sailplane
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Contest type glider
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Lightweight cabin monoplane
SATELLIT (48" span) 117/6
R/C trainer

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