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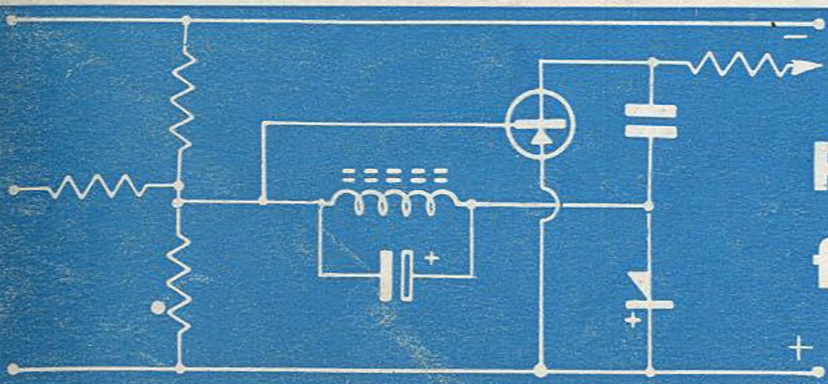

Relayless filter receiver

RADIO CONTROL MODELS & ELECTRONICS

SEPTEMBER 1963

VOLUME 4 NUMBER 9

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HARNESSING
POTTING
MONITOR
LATEST EQUIPMENT ON TEST
COMMERCIAL DEVELOPMENTS
GADGET PAGE

Plus the usual favourites

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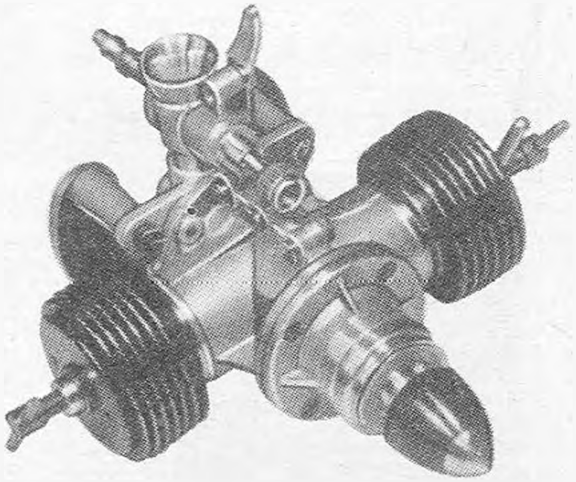

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5 & 9 channel Transmitters shown here.

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

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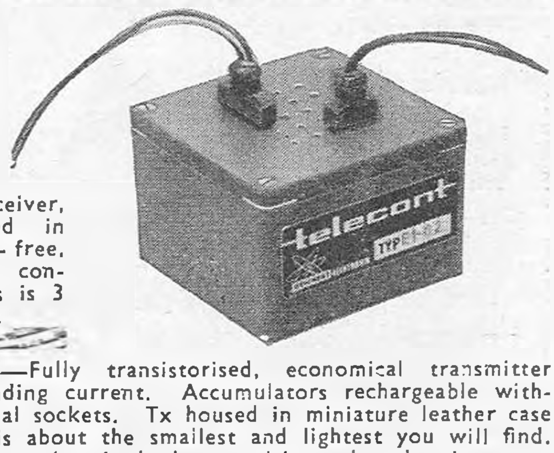

A typical Receiver, cleverly cased in and trouble - free, with plug-in connections. This is 3 channel type.

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The battery compartment accommodates standard flash lamp batteries costing a total of 5/-, giving satisfactory operation over long periods.

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Case size : 7" x 6½" x 1¾".

Weight with batteries—under 2 lbs.

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THE COMBINATION OF THIS TRANSMITTER AND

PLUS . . .

The **MINIMAC** Receiver

A 5-transistor relayless receiver which may be coupled direct to a rubber or clockwork driven actuator, servo motor, or a single channel motorised actuator via a low resistance relay.

SPECIFICATIONS :

Overall case size	2" x 1⅝" x ⅝"
Weight	1 oz.
Receiver voltage	3-4½ volts maximum
Receiver current	1-5 m/a
Actuator voltage	1½-6 volts maximum
Actuator current	500 m/a maximum

By the use of a unique 1 or 2 battery system the Minimac Receiver becomes practically immune from pulse interference by relay contacts and electric motor commutators. It is, therefore, ideal both for marine and aircraft use.

Price including Purchase Tax **£8.19.6**

New! The TERRY

The original Terrytone Receiver was designed primarily for use in model aircraft coupled to a rubber or clockwork driven actuator. Whilst an excellent receiver for the purpose intended, its use however, was restricted.
This new version, whilst similar in size and appearance, employs entire new circuitry, much easier construction, and above all is more versatile than the original.
By the use of a unique one or two-battery system the Terrytone II Receiver as before, may be coupled direct to a rubber or clockwork driven actuator but in addition will operate, without modification, a small servo motor, or with a low resistance relay, a motorised actuator designed for single-channel operation. The new receiver has the advantage of being practically immune from pulse interference by relay contacts and electric motor commutators. For marine use, where a large 12-24 volt electric motor is used for the main drive, little or no interference will be experienced providing the electric motor is suppressed as recommendd by the Manufacturer, and the receiver—together with aerial—placed away for the electric motor. The Terrytone II receiver is not subject to swamping and will operate equally where a transmitter has constant carrier wave or carrier and tone are keyed simultaneously.
Construction of the new kit is extremely simple, requiring the insertion and soldering only of the components into a printed circuit panel. The panel is clearly marked showing

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Here, There & Everywhere

That's Bob That Was !

The latest news from the U.S.A. is that Bob Scott has flown a radio controlled Delta on a straight line speed course to establish a new world record at 126.9 miles an hour. The only gen we have at the moment, relayed via Henry J. Nicholls, is that a Dooling 29 was the power plant, and the model a "Husler" delta design.

The Russian 7,380 ft. altitude record has also been beaten by a high flying group at Dahalgren, Virginia, the U.S. Navy Weapons Laboratory. Maynard Hill of Silver Springs, Maryland, is top with 13,320 ft., Walter Good made just 10,080 ft. and Bill Northrop's model still topped the previous record with a height of 7,470 ft. The accuracy of the altitude measurements were made possible by the use of the laboratories radar equipment.

Hitherto, we always thought the model had to be "accompanied" by a full size aircraft carrying an altimeter or an approved recording altimeter carried in the model.

Preparations Are Being Made . . .

Our photograph supplied by the organisers of Wereldweek Der Modelluchvaart (the World Championships to you!) shows the radio control landing area on the left and the control line circles to the right. The Airstrip in the background is the light aircraft and gliding establishment. The diameter of the radio tarmac is 120 metres (about 100 yards), big enough for the biggest miscalculation, and of course by present day standards of pilots' proficiency, the smallest possible chance of missing a spot this size! Although the next issue appears on the bookstalls almost two weeks after the competition, we regret that a report will have to be held over until November issue in order to do the event, the competitors and their models justice. We will, if we can, rush a stop press winners list into the next issue. Rest assured, with crossed fingers and we hope uncrossed telephone lines, we shall do our best.

Lost 1.

Strange as it may seem . . . a transmitter. A contributor whose work is to be published soon, informs us that his transmitter, basically an American M.C. Carrier Wave much modified and fitted with a joystick and pushbuttons, was left at Chobham Common on Sunday, June 23rd. Apparently, a young assistant who was carrying the transmitter back to the owner's car, found that the owner had departed.

May we, on behalf of the owner I. R. Francis, 79 Queens Avenue, Hanworth, Middx, make an appeal to what must be a very confused helper, whose name and address Mr. Francis would like so that he can collect the transmitter. The equipment is part of a proportional system which was designed as one unit. The receiving part of the equipment has been carefully matched to the transmitter and would entail the consumption of a considerable amount of midnight oil whilst converting it for use with a new transmitter.

Lost 2. (orthodox)

One of the many models which disappeared downwind from the Nationals was a 40 in. span shoulder wing green and yellow radio model with single channel equipment. It belongs to D. C. C Handley, whose name and address (need we say) was not on the model. Will any kind soul who comes across the model please get in touch with Mr. Handley at the "Locking Nuts" Model Club, J4 "B" Sqn. (Apps)., R.A.F. Locking, Weston-super-Mare, Somerset.

Another Breath of Southampton Air

Further to our paragraph recently in which we enquired into the whereabouts of an aeromodelling club for radio enthusiasts in the district; we are informed by Mr. B. Scott, P.R.O. of the Southampton M.A.C. that their club has been going for a considerable time, and that leaflets are distributed to local model shops. Perhaps the reader who enquired and regrettably ourselves were not, at the time, aware of this long established organisation.

For the benefit of any other radio control modellers nearby, here is the address: 48 Lyon Street, Newtown, Southampton.

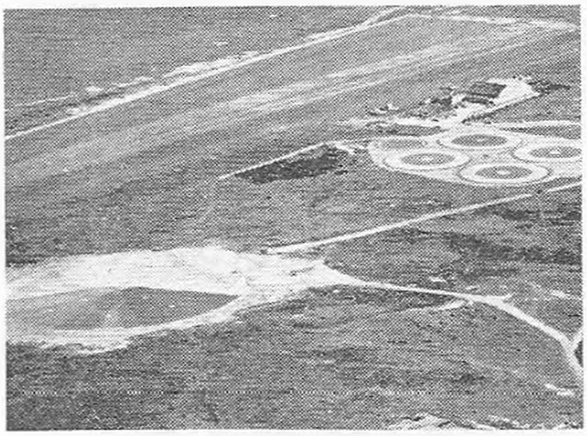
On the Cover

The tugboat on the cover belies its external simplicity, containing a wealth of interesting control equipment fully described in this issue. This is, indeed, an ingenious application of a single channel signal. John S. Handyside, the contributor, scaled the model up to twice size from Norman Taylor's plans of the "Brent" Tug.

The scrap of circuitry, immediately recognisable to most of our "Do-it-yourself" readers as part of a tuned filter configuration, described as our principle constructional feature. . . . A completely relayless filter multi receiver, to feed straight into Transmites or similar servos.

Brighter Transmitters

With the advent of transistor transmitters and the willingness of modellers to build their own comes a happily not often experienced problem; that of overheating in the brilliant (pause for laughter) summer sunshine. Some output transistors when cooked in a hot metal transmitter case, are in danger of being damaged if the transmitter is operated in this state. Dark colours absorb more heat than light reflective shades. . . . Now you home handymen, what about a few lighter and brighter boxes to house your equipment. Easily spotted in the long grass, they do not get nearly so hot as other types of equipment container, and until everybody "gets with it" adds an air of individuality. Try a white, silver grey, yellow, or dare we say, pink or pale blue for your transmitter. If you must stick to a sedate, conservative black type box of tricks, make an expanded polystyrene case in which to park it when not in use. An excellent insulator, to be highly recommended especially when gear is carried in the hot boot of a dark coloured car, or vice versa!

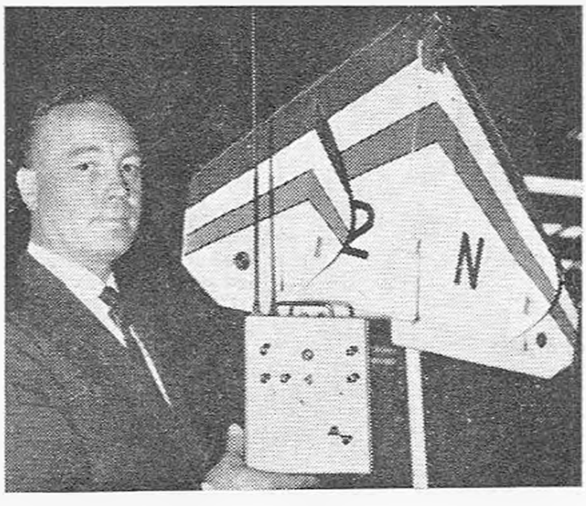


That huge area of tarmac on the left for the World R/C Championship contest shows the lengths to which our hosts have gone this year.

Cleaner Monitors

We understand that three models in the Northern Heights Gala recently held at Halton, "bit the dust" as a result of interference caused by a monitor. It may not be commonly known that some super-regen monitors can be suspect in terms of interference. This particular one was radiating quite a strong signal and with its close proximity to the launching area proved to be a hitherto unsuspected hazard. It is far safer to use a diode front end for a monitor, range may not be so good but at least it is safe.

In all probability, the owner of the monitor had no idea that he was the cause of the trouble, and we suspect was listening intently on it to find the signal which had caused the first prang! Presumably he never had occasion to use it for his own flights, or he was lucky in that his receiver was insensitive to it.



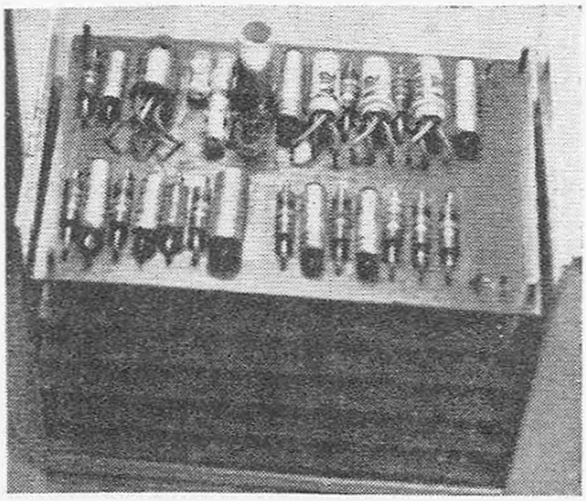
Surprise find at the International Aero show, Paris June 16th, was a new French ten channel all transistor outfit named "Radio Pilote", manufactured by Messrs. Erelec of Boulogne. President of the company, Henri Violeau, is seen with transmitter and Delta Hustler, built for air tests using Bonner servos. Erelec specialises in radio control and servos for full size application.

A RELAYLESS TUNED FILTER RECEIVER

FOR AIRCRAFT

ELSIE

OR BOATS



With L/C tuned circuits in place of a reed bank our nickname for this receiver just had to be, "Elsie" !
Photograph above shows the receiver sitting on a stack of five pairs of filters. In fact, pairs of filters may be added for the basic receiver stage by stage up to five as one purchases additional Transmites.

Designed by JIM DARKE

Described by HOWARD BOYS

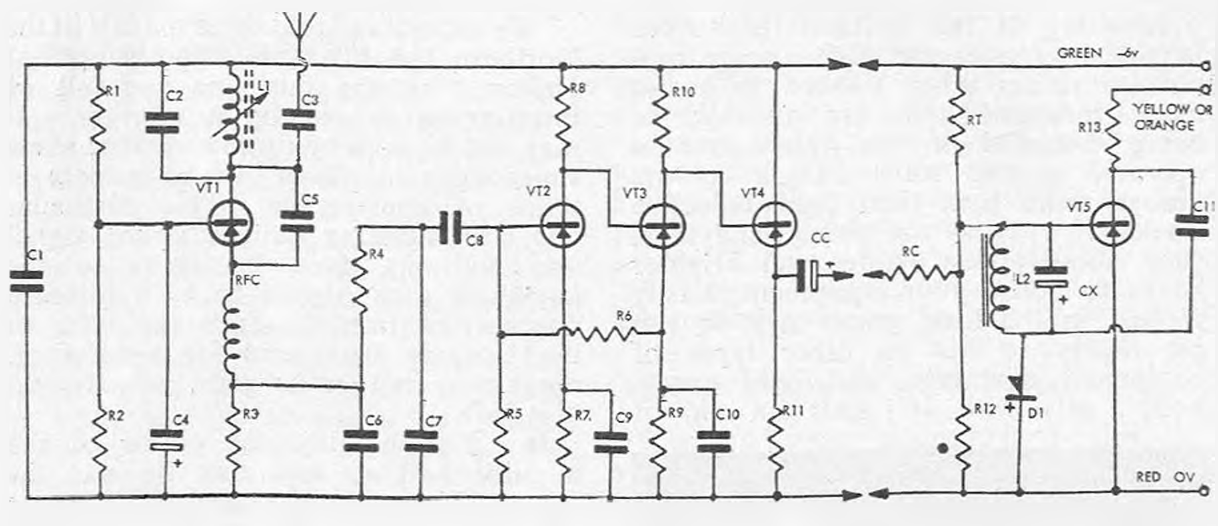


FIG. 1

COMPONENT VALUES

R1 — 10K
R2 — 6.8K
R3 — 4.7 to 10K
R4 — 10K
R5 — 10K
R6 — 10K
R7 — 1K
R8 — 6.8K
R9 — 4.7K
R10 — 4.7K
R11 — 4.7K
R12 — 4.7K
Varistor VA 1066 (26° C.)

R13 — 1K
Rt 330K–560K
RC 30K–40K — see text
C1 — .01 μF
C2 — 47 pF
C3 — 10 pF
C4 — 2 μF electrolytic
C5 — 22 pF
C6 — .001 μF
C7 — .04 μF
C8 — 2 μF
C9 — 10 μF
C10 — 10 μF

C11 — .04 μF
CC — Coupling Capacitor —approx. 2 μF
CX — See text
VT1 — OC170
VT2, VT3, VT4 — OC45 or XA112
VT5 — XC121
L1 6-7 turns .018 dia. enamel wire
L2 Mullard FX2236 pot core —see text
D1 CG 42 or CG 44

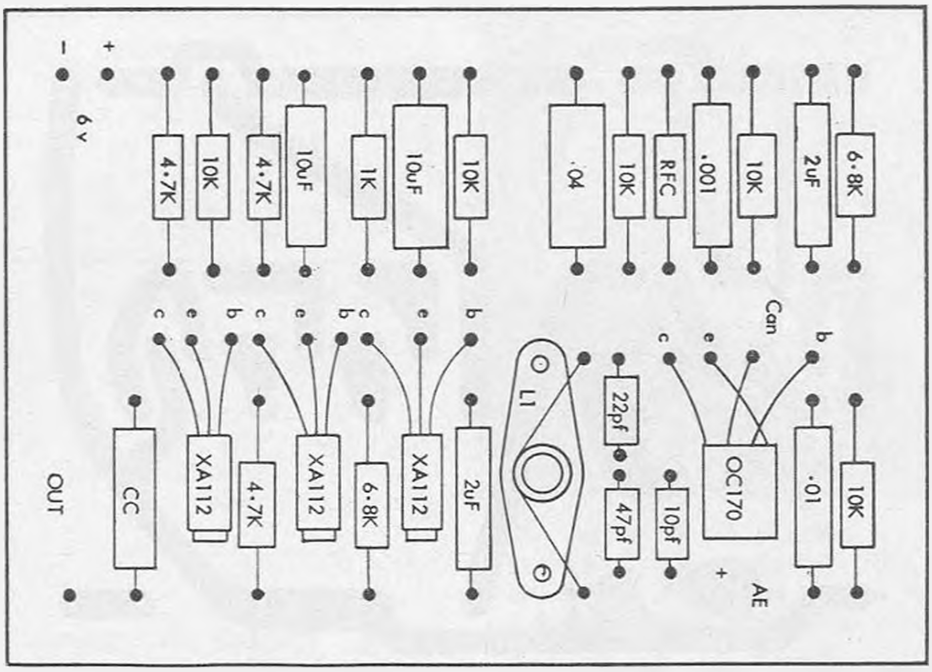


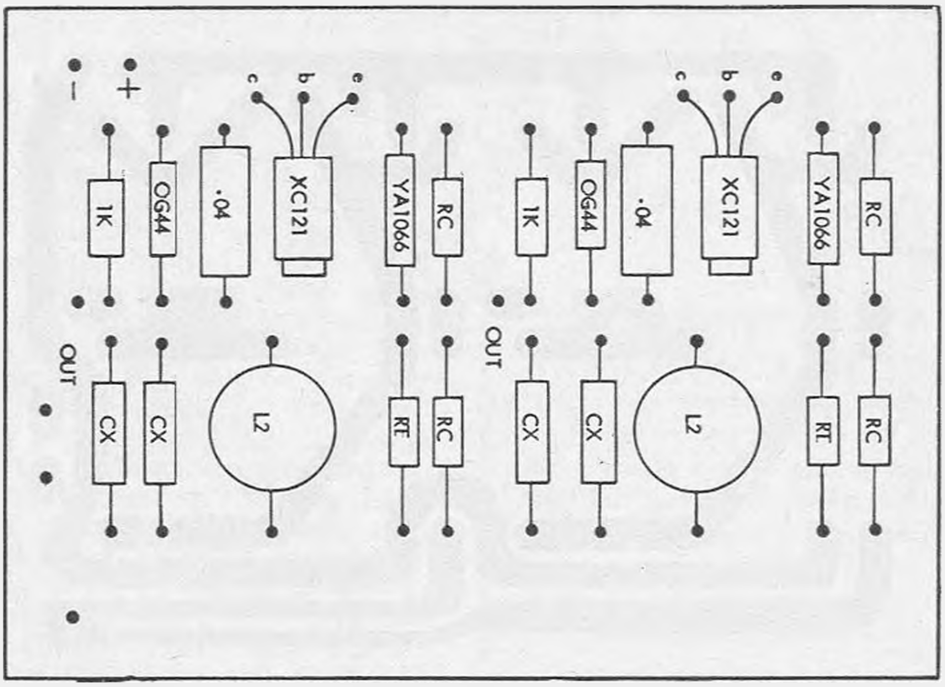
FIG. 2
Rx COMPONENT PLACEMENT

THIS receiver, together with an all transistor transmitter, has been built by John Bickerstaffe to circuits designed by Jim Darke, both personal friends of the writer. The equipment has been proved satisfactory by a season's use in an Orion. John is so pleased with it that he would not change it for anything he saw at the World Championships, though he did find the simplicity of Don Brown's proportional set attractive.

The circuit is shown in Fig. 1, and the first part is a copy of the Bellaphon while the second part is original. Only one filter circuit is shown, though ten are fitted in the model, and simultaneous operation is satisfactory. Each filter circuit feeds straight into a Transmite, thus eliminating any form of make and break contacts.

Fig. 2 shows the layout of compon-

FIG. 3
PLACEMENT FOR 2 FILTERS



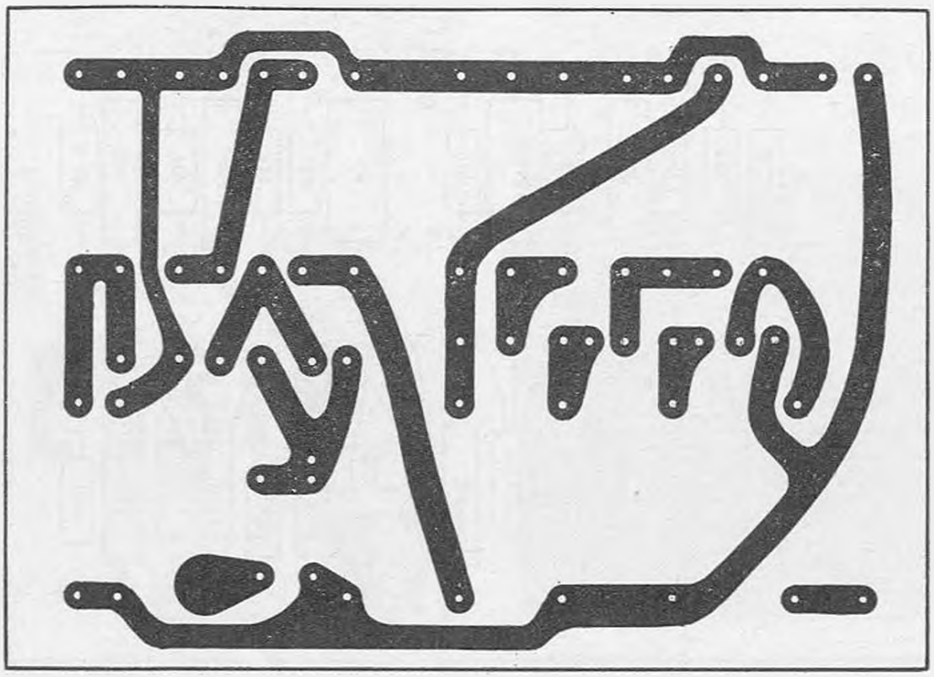


FIG. 4

Rx CIRCUIT BOARD

ents and Fig. 4 the printed circuit for the receiver section. Figs. 3 and 5 show components and printed circuit for one pair of filters. Five filter boards and a receiver board were built into a boxed stack.

In Jim Darke's receiver the tuning coil was 7 turns of .018 wire slightly spaced on an 8 mm. former. With a similar coil, John's receiver seemed to tune correctly, but the range was severely limited. Eventually the number of turns was reduced to 6 and the receiver then tuned correctly and gave very good range.

When the receiver is complete, the voltage at various points can be checked. The readings are as Table 1.

The inductance L2, uses the Mullard pot core FX 2236 with a 2 thou. paper

FIG. 5

FILTER CIRCUIT BOARD

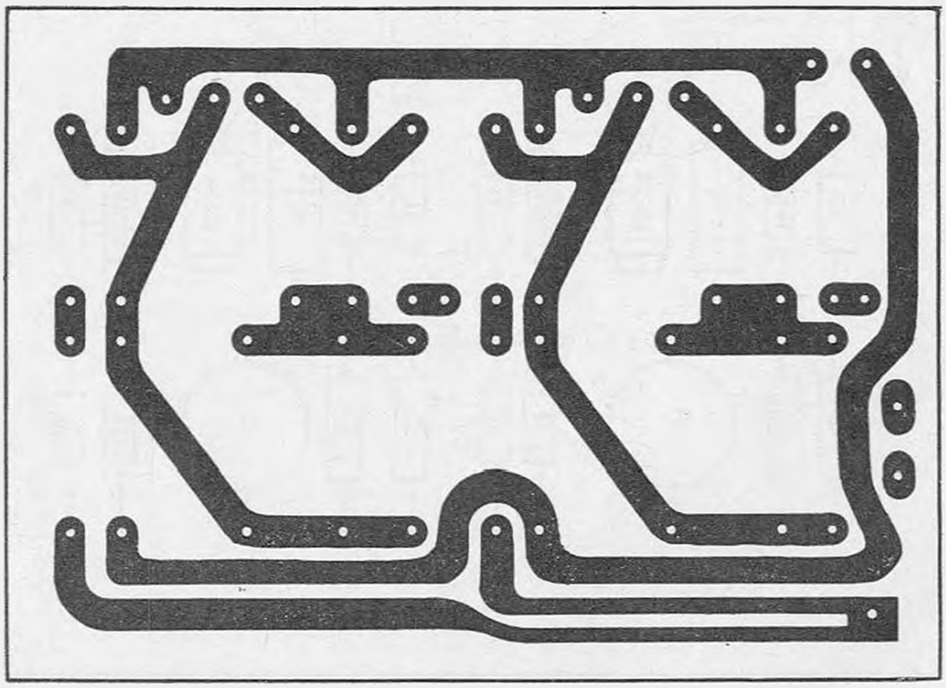
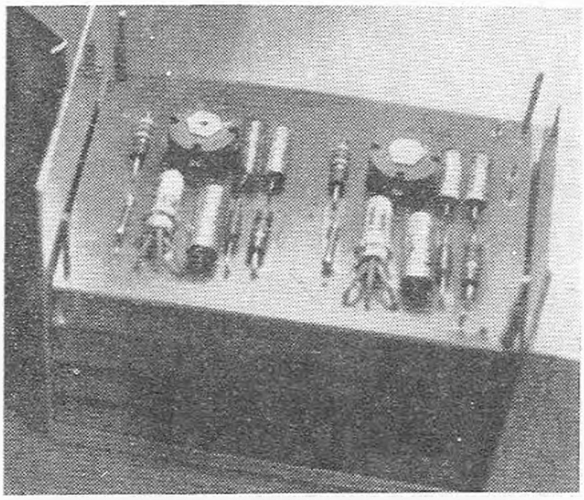


Table 1

Supply Volts	Voltage at a	b	c	d	e	f
6	1.9	3.7	.75	.6	1.7	3.7
6.5	2	4	.8	.65	1.8	4

Key

a = collector of VT2
b = ,, VT3
c = Base of VT2
d = Emitter of VT2
e = ,, VT3
f = ,, VT4



The receiver board removed to show the upper pair of filter circuits. Note the projecting wire connections carrying the supply and input between each printed circuit board.

gap to aid temperature stability. As a guide to winding these, two samples are given. 290 turns of 40 gauge Lewmex gave 28 mH and with .04 μF tuned to 4800 c/s. 410 turns of 42 gauge enamelled gave 58 mH and with .08 μF tuned to 2400 c/s. To obtain the correct value of tuning capacitors CX will usually require two in parallel, and space has been made for both on the circuit board.

The tolerance on the Mullard thermistor type VA 1066 is quite large, and this must be balanced by adjusting Rt. The value required is found by measuring the standing collector current through the transistor. This should be about 30 μA at an ambient temperature of 15 to 17 degrees C.

The same basic receiver has been followed by different filter circuits for different purposes, that in Fig. 1 being used by John Biskerstaffe. The coupling capacitor Cc was 2 μF and fixed to the receiver panel as shown. The coupling resistor Rc was separate for each filter, and fitted to the filter circuit board. the value being found by trial. To do this, one needs to have the transmitter sending out the appropriate tone, and the capacitor Cc part way down the 4.7k emitter resistor. This can be done by using a 5k potentiometer, or two fixed resistors of say 1.2k and 3.3k ohms in series with Cc connected to the junction, the 1.2k being nearest the transistor. A 50k ohm potentiometer is then put in place of Rc and adjusted to give as high resistance as possible, but with enough current to drive the Transmite motor at full speed. This value is likely to be 30k to 40k ohms, and it may be necessary to put two resistors of standard value in series to obtain the correct total value. The circuit board shows two.

Jim Darke used the receiver for a boat with the filter circuits coupled to Remtrol/Olsen actuators.

We shall follow up next month, with some interesting failsafe circuits which operate the throttle in the event of signal failure. The system in this case requires a continuous tone outside the range of the other filters. It is a simple matter to modify the transmitter to provide this facility.

(To be continued)

ARE YOU LICENCED?

Just in case newcomers to Radio Control are not aware of it — you need a licence for operating remote control equipment. No tests, just fill in a form and pay £1 for five years' cover. Application form and full particulars from Radio Branch, Radio & Accommodation Dept., G.P.O. Headquarters, London, E.C.1.

Tugboat Trickery

A SINGLE CHANNEL SYSTEM WITH A WIDE RANGE OF FUNCTIONS . . . DESIGNED AND DESCRIBED BY J. S. HANDYSIDE

The "Brent" tugboat to be described was built to twice the scale of the plans drawn by Norman Taylor in his booklet "Model Power Boats". The reason for building this larger model was so that all the electrical equipment required could be accommodated; both as regards to space and weight. Simplicity with a maximum number of functions was the goal. A natural type of steering* was designed even though it was found difficult to overcome the sluggishness of control.

*F. J. Camm, *"Radio Controlled Models"*.

Transmitter

The transmitter is the conventional push pull Hartley Oscillator chopped by a variable mark/space ratio multivibrator operating at about five c.p.s. The pulsed signal is used for steering; slow pulsed carrier for function. Fig. 1 is the general view of the transmitter and Fig. 2 shows the sequence of operations which under normal circumstances offer a minimum of delay between wanted functions. A maximum of six seconds is required under the worst circumstances, i.e., say to step from "full ahead" to "full astern" to "full ahead" again.

Each time the selector passes through "lights" the mast head lamp glows thus checking the synchronisation of the transmitter and receiver. In the event of them getting out of step, the selector is quickly turned to "lights" and then the red button is pulsed until realignment occurs. The black button is for carrying out the operation for a controlled time, such as raising the anchor, blowing the whistle, etc.

The transmitter needs no comment except to say that a transistorised multivibrator could be used for pulsing which would save space and weight if the transmitter is to be hand held. Power for the transmitter is provided by the converter shown in Fig. 3.

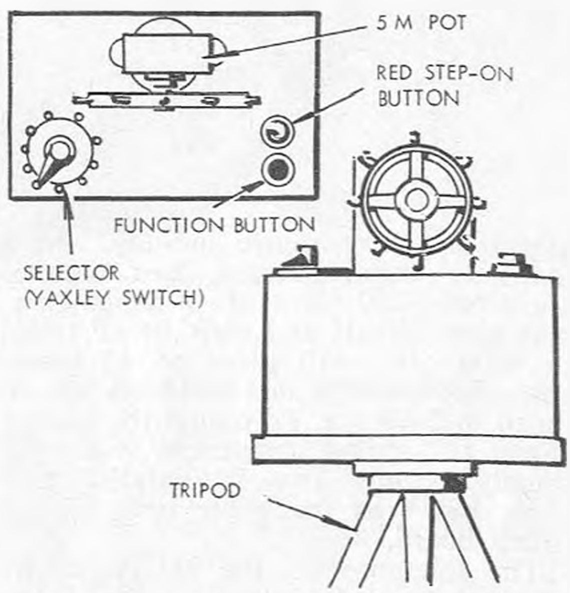
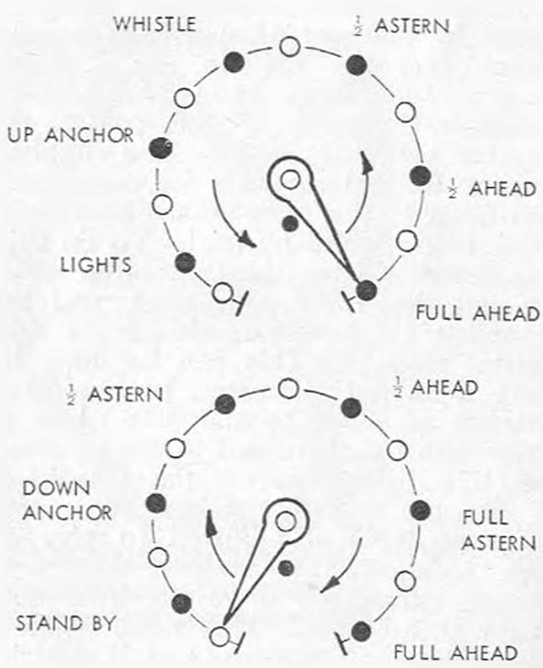


FIG. 1

FIG. 2



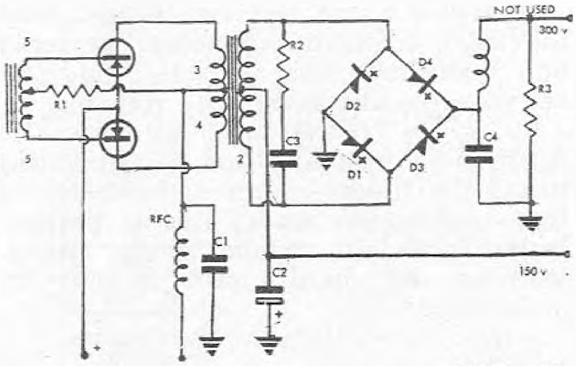


FIG. 3

Values

Transistors 3A type 2N301 or similar.

Core HCR toroid 1½ in. dia. type 5C (Felcon).

Winding 1 250 turns of 30 s.w.g. double en. on ½ core.

Winding 2 250 turns of 30 s.w.g. double en. on other ½ of core.

Winding 3 10 turns of 2 x 19 s.w.g. double en. on ½ core.

Winding 4 10 turns of 2 x 19 s.w.g. double en. on other ½ of core.

Winding 5 2 x 3 turns of 30 s.w.g. double en. on each side.

For 6v. operation parallel primary to give 10 + 10 turns.

R1:	250Ω	C2:	8 μf
R2:	200Ω	C3:	.005 μf
R3:	50K	C4:	.01 μf
C1:	.01 μf	D1-4:	SD92

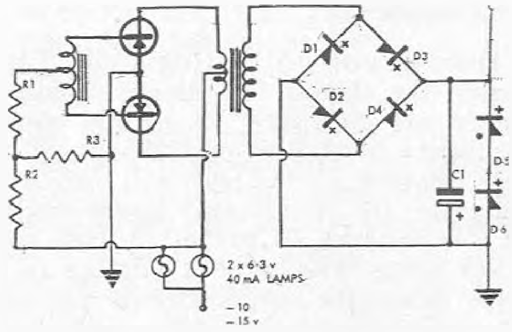


FIG. 5

Values

Transistors 40v. 250 mA. type.

Transformer core ¼ in. stack of 0.005 in. type 500T Mumetal.

½ secondary 180 turns of 34 s.w.g.

Feedback 10 + 10 turns of 34 s.w.g.

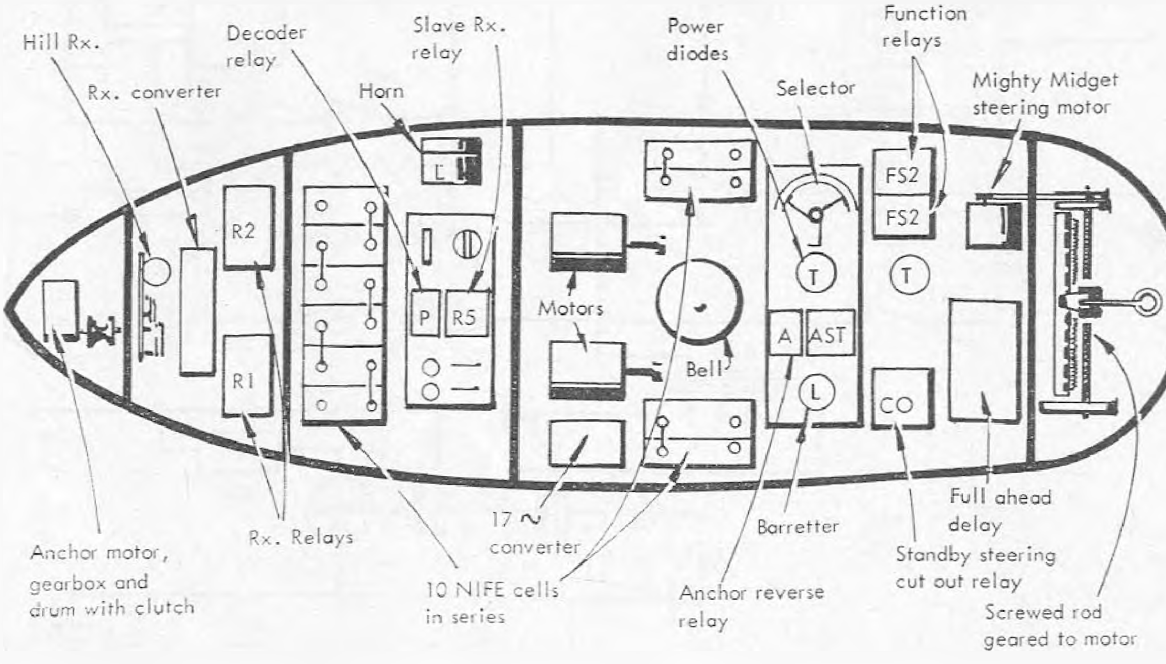
Primary 68 + 68 turns of 29 s.w.g.

½ secondary 180 turns of 34 s.w.g.

(all ECW).

R1:	100Ω	C1:	5 μf
R2:	750Ω	D1-4:	OA81
R3:	26Ω	D5-6:	18v. Zener.

FIG. 4



Installation

Turning now to the tug itself. Fig. 4 shows the layout of the components which are arranged to nicely balance the boat. With the parts as stated the boat weighs 32 lb. and will run intermittently for about two hours on one set of batteries. Current at full speed is 1.5 amps with a peak current of 2.5 amps when the uniselector is operated. The voltage range is from 14v. for a fully charged battery down to 10 volts before the slave pulsing relay becomes used, but extensive use has to be made of zener diodes and lamps used as barretters.

Values

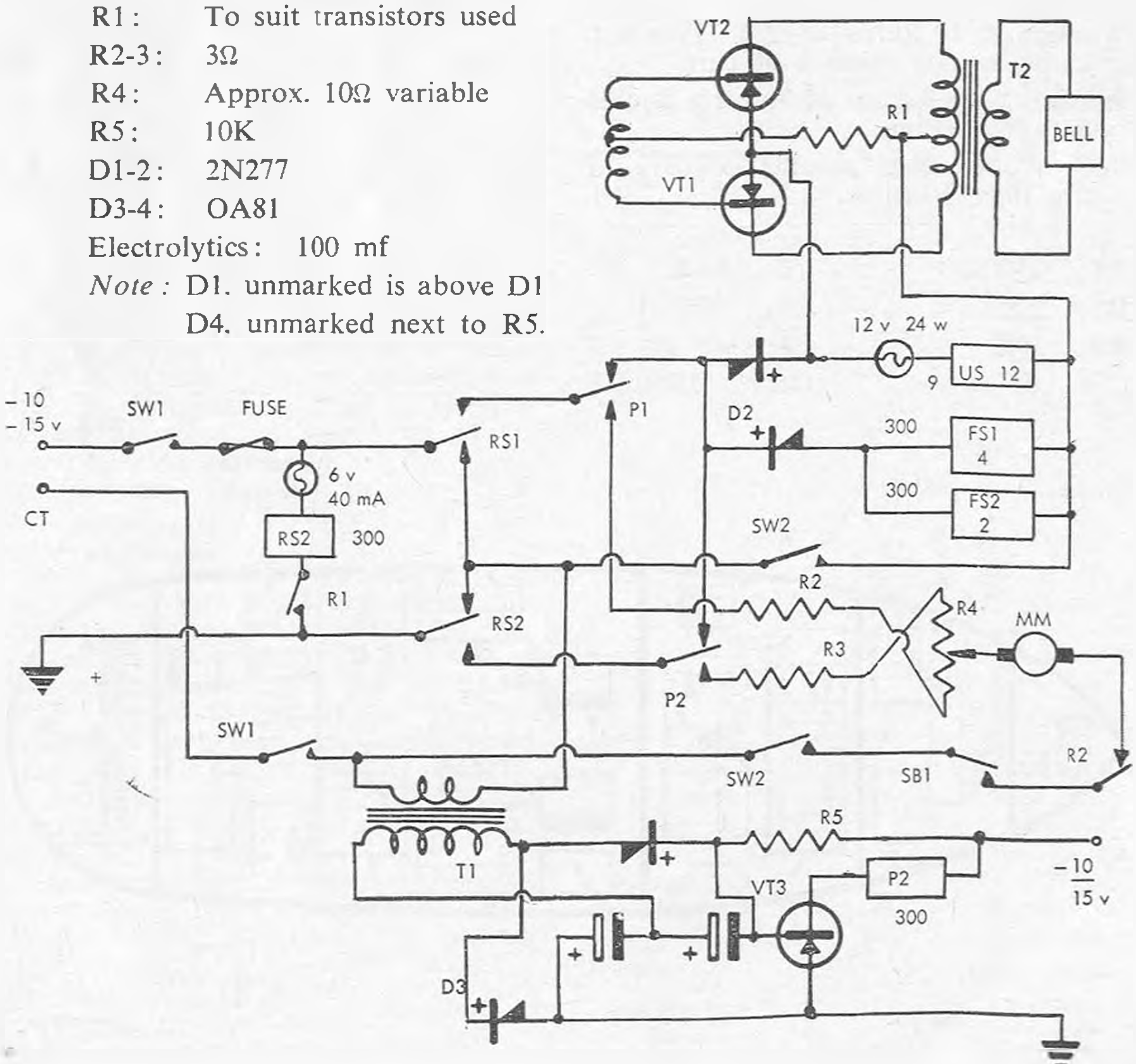
VT1-3: General switching types (GET114) or similar
R1: To suit transistors used
R2-3: 3Ω
R4: Approx. 10Ω variable
R5: 10K
D1-2: 2N277
D3-4: OA81
Electrolytics: 100 mf
Note: D1. unmarked is above D1
D4. unmarked next to R5.

A Hill 2 valve receiver is used with the valve filaments connected in series and stabilised with a zener diode; a converter is also used here (see Fig. 5). Two series relays are required. R1 functioning normally and R2 operating to cut the rudder motor when switching from pulsing to mark; this is particularly important when going astern. Without R2 hard aport cannot be maintained.

Decoder

The decoding circuit is shown in Fig. 6. A switching transistor is used in conjunction with a standard type relay. The two "dud" power transistors are used as rectifiers and as can be seen a "mark pulse" operates the uniselector whereas a "space" operates the function relays.

FIG. 6



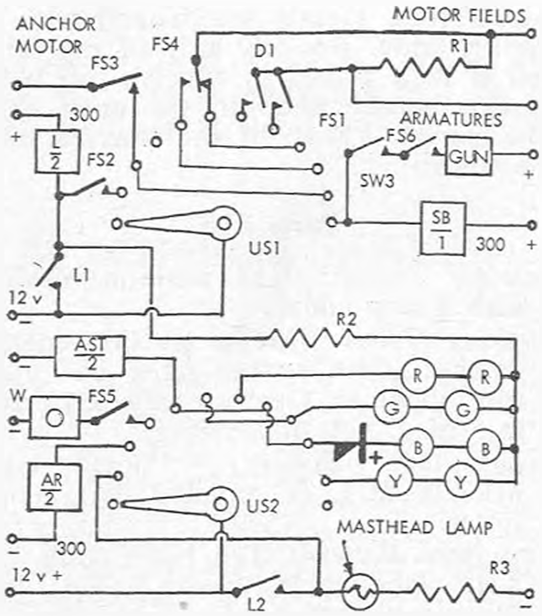


FIG. 7

Values

R1: 1Ω; R2: 40Ω; R3: 12Ω.

Across the uniselector and lamp (acting as a barretter) is a miniature 17 cps. oscillator which is connected to a G.P.O. telephone bell. A new gap was cut in the bell housing to restrict the gong travel to about $\frac{1}{16}$ in. This is just about the right volume for an engine room telegraph.

Sequence Switch

The switching sequence is arranged so that the tug can back out from the jetty; complete it's work and then return to be tied up, or drop anchor, with a minimum of delay. The circuit is shown in Fig. 7.

Points of probable interest are.

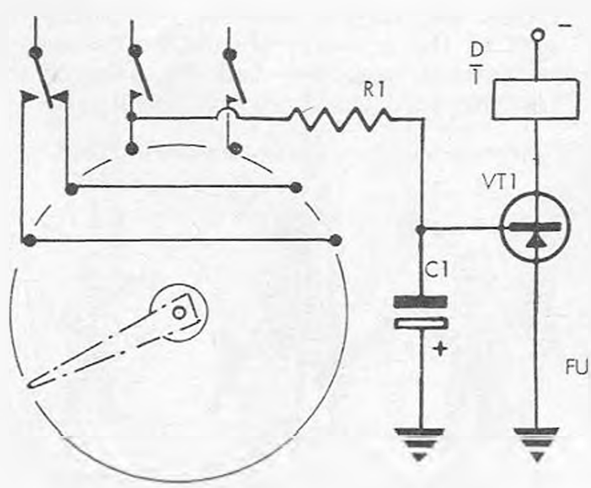
(a) Full ahead delay

This delay was incorporated so that when manoeuvring close to another boat, "full ahead" could be deftly omitted by switching fairly quickly to the next position and thus avoiding an embarrassing leap ahead instead of a wanted slow astern.

(b) Lights

The lights lock on; as, when dusk descends they are required for the rest of the evening. To switch off, the main switch is momentarily opened. The colours of the navigation lights give the pilot a check on the boat's operation. The rectifier in series with the astern lights prevents the current through AST and L relays from giving a false indication.

FIG. 8



FULL AHEAD DELAY

Values for Full Ahead Delay Circuit

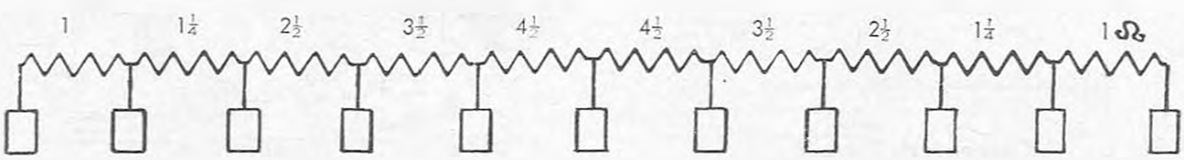
R1: 100K; C1: 1000 μf;

VT1: GET114 or similar.

Construction of steering resistance unit

Spaces between insulated collars are $\frac{1}{64}$ in. canvas bakelite (undercut). Resistances are graded so that the "midships" command is accurately positioned.

STEERING CONTROL RESISTANCES



(c) Main propulsion Motors

The motors were 24 volt shunt wound. In order to obtain sufficient power on 12 volts the two field coils of each motor were connected in parallel. See Fig. 8 for the complete circuit. The two motors are geared together with two brass gears and are direct coupled through dogs to two inch contra-rotating three blade propellers.

(d) Towing attachment

In order to take another suitably rigged boat in tow a grapnel can be fired on to the disabled boat's deck, where the claws will catch in the deck rails or rigging. If this function is not required SW3 is operated, then in this condition the tug can rest at anchor with a minimum current consumption as the steering motor is cut off. (The transmitter may also be switched off).

(e) Distress signal

If the tug develops a leak R2 coil tags become immersed which partially short circuits this relay causing a heavier current to flow through R1. hence it locks up and the telegraph bell rings continuously.

(f) Smoke

The following method is used which has proved quite satisfactory for up to ten minutes running time. Strips of old canvas about $1\frac{1}{2}$ in. wide are soaked in a saturated solution of potassium nitrate and hung up to dry. A strip of this is then loosely interwound with a slightly wider dry oily strip of rag. The coil is then placed in a valve can with a wire handle fixed to the open end. The canvas is then lit and lowered into the funnel.

Parts List

Selector Switch: 12 position Yaxley with a stop added.

Steering Wheel: Model traction engine flywheel with spokes of $\frac{1}{8}$ in. brass rod tapped in. Gearbox is worm drive to 5 Meg. pot. underneath.

Transmitter Battery: Lucas type MLZ9E H.T. is supplied by a converter.

Tug Boat Battery: Ten NIFE cells 2.5 AH. Obtainable from Radio and Electrical Mart, Kent.

Boat Relays: R1, Siemens H.S. 3000 ohms R2 keying relay 5000 ohms. Switching relays G.E.C. 670 ohm ex sealed can. Rewound with 5500 turns of 36 B & S en.

Uniselector: 2 x 12 contacts rewound for 9 volts.

Lights: Mast head 3W 12 volt. Navigation lights 6.3v. 40 mA.

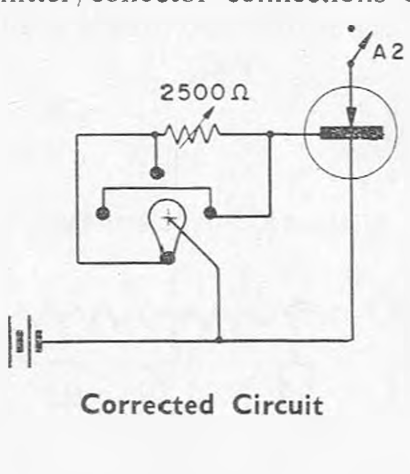
Motors: Ex-American I.F.F. equip.

T2 Transformer: Core $\frac{3}{8}$ in. stack of No. 40T Radiometal P. 1500-1500 turns of 36 B & S en. F.B. 38-38 do. Sec. 1700 do.

ERRATA

Easy S/C Pulse Boat (May 1963)

A circuit error appeared in the article which should be noted. This occurs on page 226 and concerns the contact pannel on the 4 pawl actuator and also the emitter/collector connections of the OC28 are shown reversed. The rotating arm of the actuator should be connected to battery negative, and the base of the transistor to the 4 switch terminals.



Corrected Circuit

"But it isn't a submarine . . ."

Bi-simpl SERVOS

By CHARLES RIALL

Very little effort is needed to convert Mighty Midget motors for proportional work

THE "Bisimpl" system, described in last month's article, is just the thing for Simpl Simul experimenters who want to progress towards a more truly dual proportional system without pawning the washing machine to pay the deposit on the new gear! The circuit turns rate variation into a second mark/space at a second relay, but since the distribution of this mark/space change is not as good as the basic mark/space (due to the way rate change is spread at the control box), we prefer to use the true M/s on the elevator and the rate generated M/s on the rudder/ailerons.

If space = up evelator and slow rate = left rudder, this only requires the S.S. transmitter control to be tuned through 90° clockwise, if S.S. was arranged to give left rudder on space.

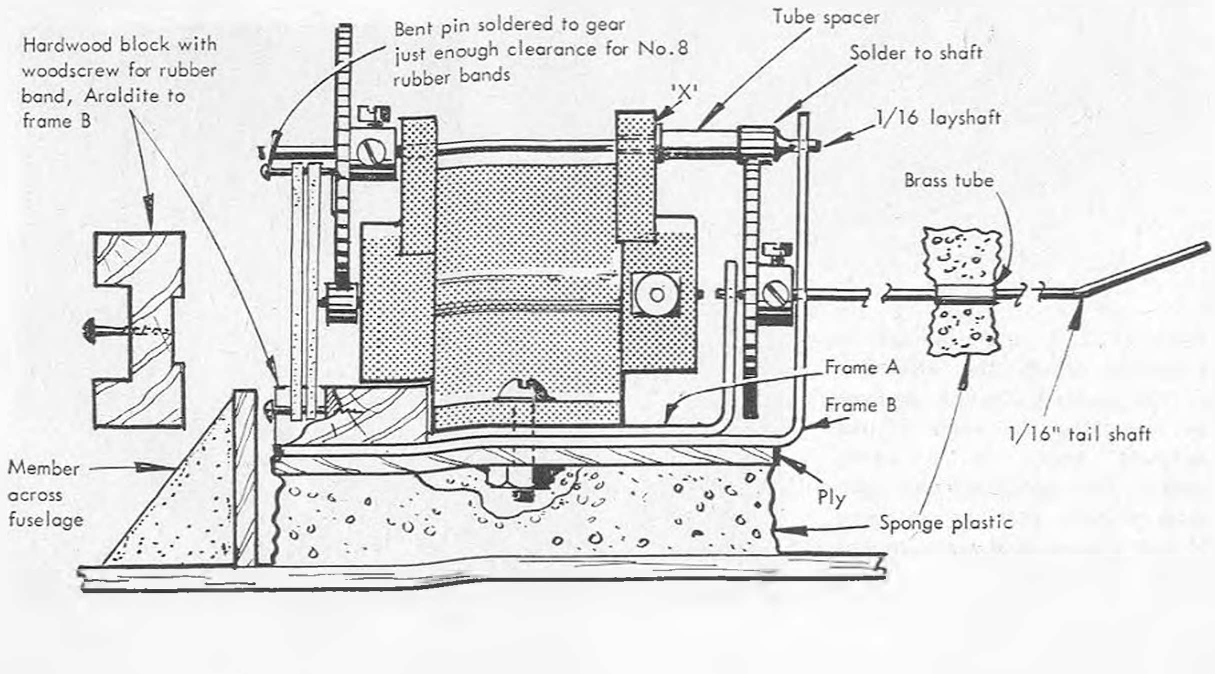
The circuit can be adjusted to produce neutral rudder at different rates by suitable selection of C3, and I chose a rate of 7 c/s, with the idea of using a reed unit and tone change for engine control. However, this was subsequently abandoned in favour of a filter circuit, which is functioning well on the bench but has not so far been airborne. Using the filter circuit will allow experiments with higher rates for neutral rudder in the future.

The neutral rudder rate of 7 c/s. is a "guesstimate" but the slowest rate used, for full left rudder, is known to be 4 c/s. With the servos described here, this gives a visible pulsing of the rudder when at full left, on the ground, but no detectable flutter of the model.

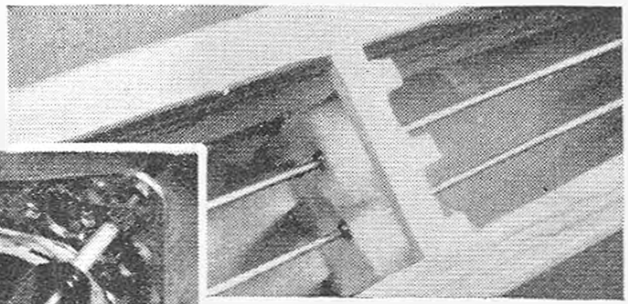
Servos

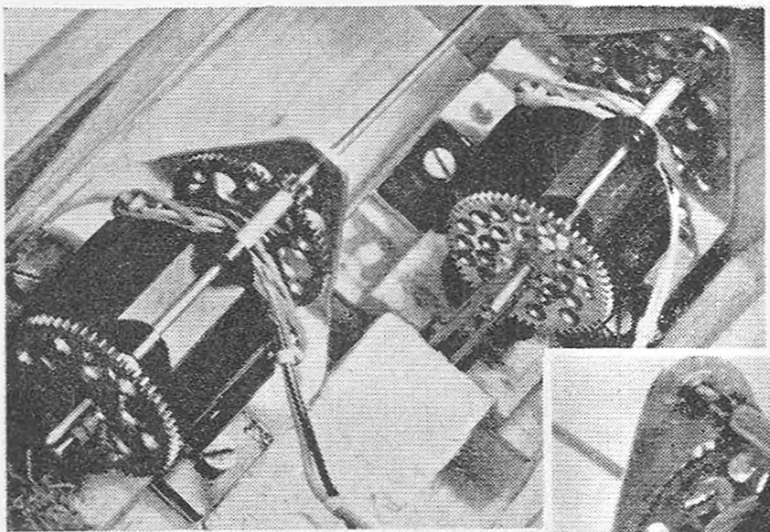
Having achieved the necessary dual proportional output, the problem was to produce a servo (or actuator if you wish to be technical about it!) suitable for it. Here, *Radio Control Models & Electronics*, July 1962, provided the in-

FIG. 1



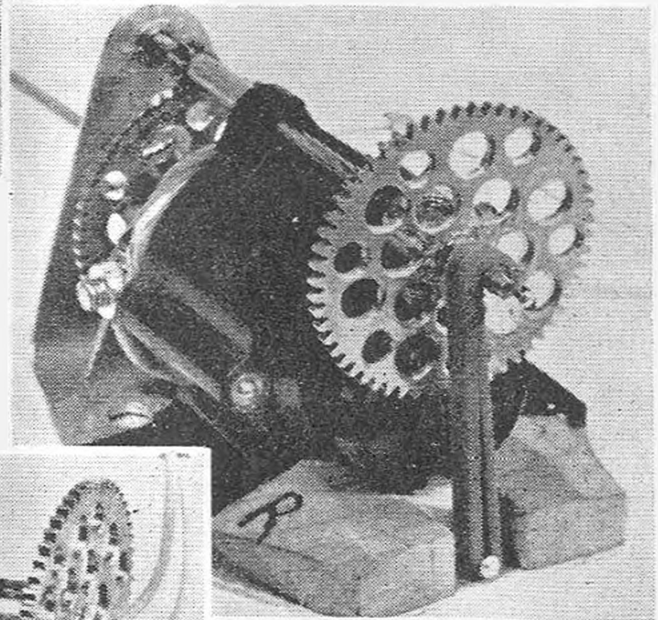
Right : Tailshaft bearings set in sponge plastic between crosspieces in rear fuselage prevent whip in shafts.

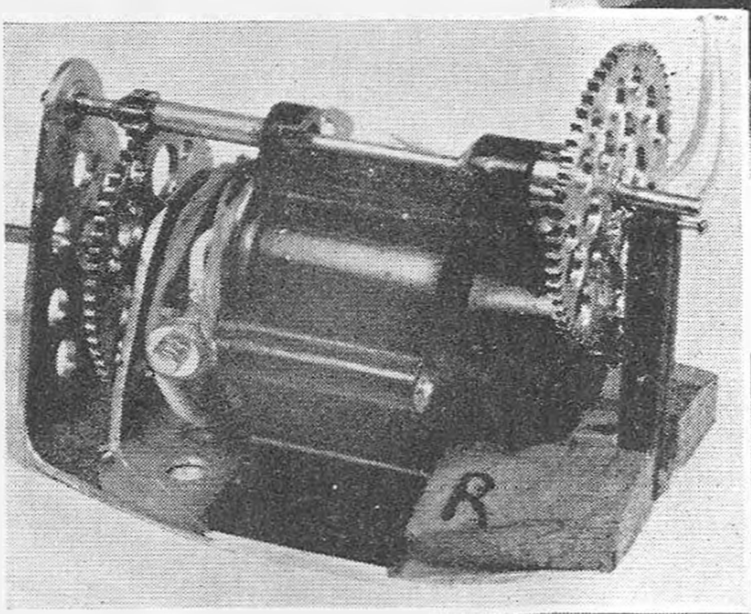




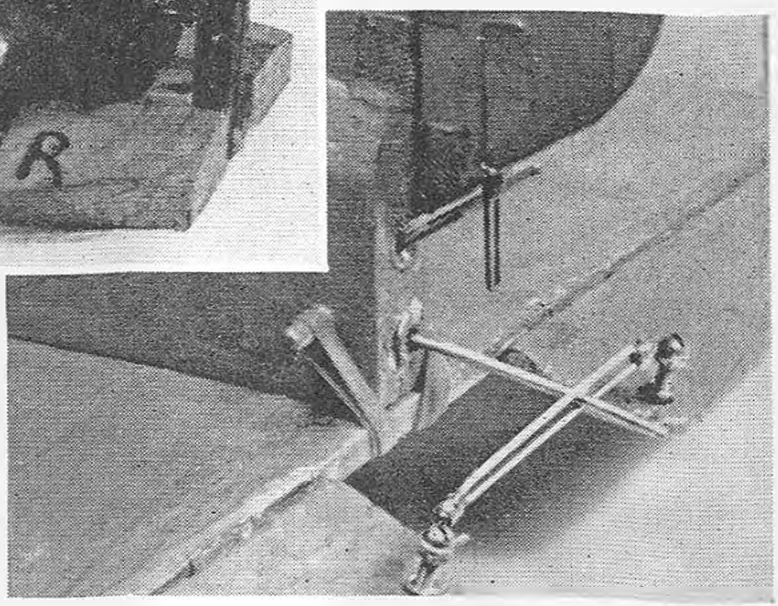
Left : Rudder and elevator servos installed in model, note staggered mounting to save width. Do not mount too close for free movement.

Right : Front view of a rudder servo showing how the pin carries the rubber band over the layshaft, before striking the stretched part of the band ; a well cushioned stop system. The gears are drilled to save a few precious grammes and probably help to lower inertia.





Left : The drilled out rear tail-shaft bearing of the motor and frames "A" and "B" show clearly in this view.



Right : Tail end linkage is simplicity itself, the deflection of the surfaces can be changed by increasing the angle of the tailshaft ends. In a heavy prang, the tailshafts may pull through their bearings, so there is less chance of damage to the servos themselves.

spiration in "Gadgets and Gimmickry" with an idea from "Mars Pulse". A double geared Mighty Midget was required and this idea gave a simple answer for the basic layout (Fig. 1). The next problem was the centring, and the best results have been obtained with the rubber band pin as close to the layshaft as possible. No stops are required; the layshaft rotates just over 360° in each direction, until the pin has carried the rubber bands again. This gives about 50°-60° each way on the tailshaft. This had been evolved before *R.C.M. & E.* published the Russian idea in "International Gimmickry" in November 1962, and it was interesting to see a parallel approach to the problem.

Old production Mighty Midgets with $\frac{1}{16}$ in. layshaft bearings and $\frac{1}{16}$ in. bore large brass gears were used. This made the job easy, but the present type of Mighty Midget could be adapted with little extra trouble. There is little point in producing accurately dimensioned drawings for the construction of these servos. It is much too difficult to make them that way and end up with the gears properly in mesh. If old production Mighty Midgets are available, proceed as follows:—

Construction

1. If desired, the base of the Mighty Midget can be reduced by $\frac{1}{32}$ in. each side, to assist in getting two servos side by side in a restricted fuselage width.
2. Cut strips of 20 s.w.g. aluminium alloy $1\frac{9}{16}$ in. wide and longer than necessary.
3. Unreel these strips, rubbing them with household soap to give an indication of temperature for quenching by the onset of charring of the soap. Bend at right angles.
4. Drill $\frac{1}{8}$ in. holes for Mighty Midget base mounting.
5. Remove Mighty Midget armature and reassemble case.
6. Bolt Mighty Midget case to right angle from A and use armature bearings as jig to mark frame A with $\frac{1}{16}$ in. drill. Take apart; drill frame A; reassemble with frame B as well and mark frame B for tailshaft and layshaft; take apart and drill.
7. Drill layshaft bearing (X) to clear layshaft completely.
8. Drill and tap bosses of large brass gears for second set screws at right angles to existing ones (a precautionary measure).
9. A refinement at this stage would be to bush the bearings in the frames with hollow rivets.
10. Assemble servo using a short shaft in place of tailshaft.
11. Without electrics connected, servo should just about centre from extremes under pull of bands. Brush pressure can be reduced and "Electrotube" used on brushes if desired.
12. When operation is considered satisfactory, dissemble and shape frames around bearings and drill plenty of lightening holes.
13. Scratch polished finish off Mighty Midget base: re-assemble servo to work freely again. Then use Araldite around Mighty Midget and frames through lightening holes. This allows removal of bolts and subsequent installation of servo in model without gear mesh being affected.
14. Cut $\frac{3}{32}$ in. ply platform; drill to suit Mighty Midget base and Araldite nuts below. Cement to plastic sponge block and cement sponge to fuselage. (Note: Balsa can be used in place of sponge to determine size of sponge; sight through tailshaft bearing at rear of fuselage. Cut suitably shaped sponge block using NEW razor blade. Sponge can be cut very accurately with care and this obviates use of universal joint in tailshaft).
15. Put in member across fuselage just forward of servos to aid crash resistance (this has already been proved of value!)
16. Arrange steady bearings for tailshafts halfway down fuselage. Hollow rivets or short pieces of tube glued through pieces of sponge are suitable. Position by sighting through tailshaft bearing.

*Do NOT make gap between frames wider than is necessary for full operation of large gear. Washers to take up play will be most difficult to fit when servo is installed in fuselage.

Now read on for an Engine Control System . . .

Bi-simpl ENGINE CONTROL

By

PETER LOVEGROVE, B.Sc.

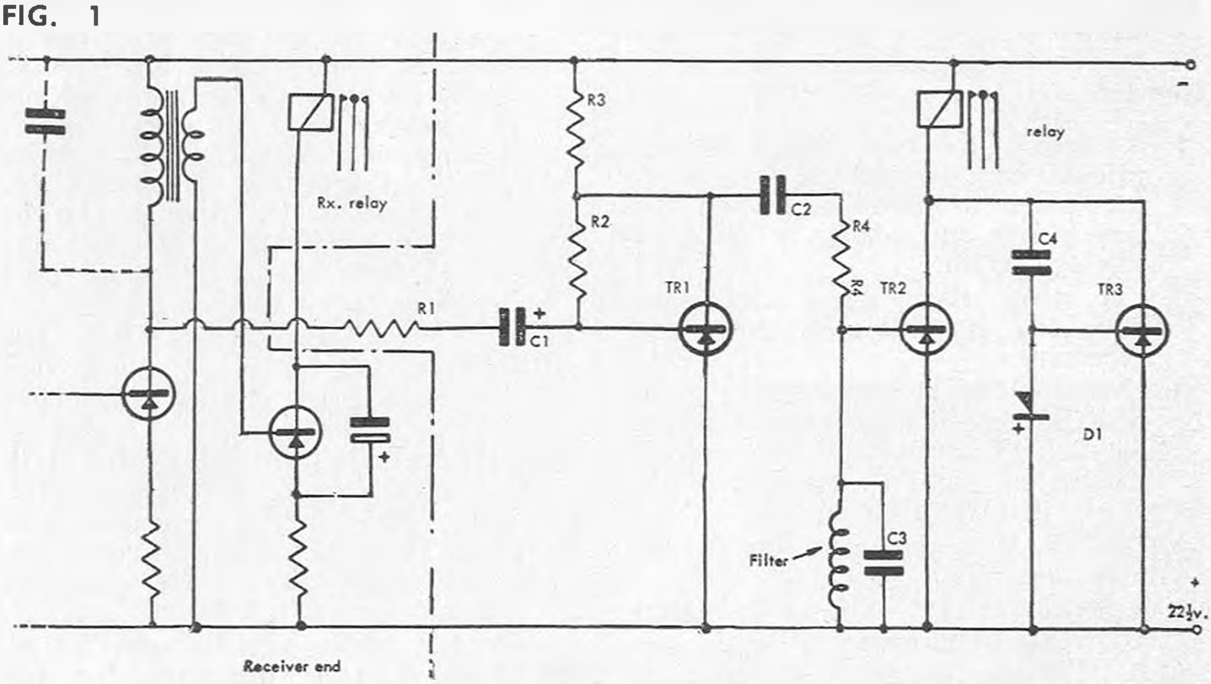
ONE of the major advantages of the BiSimpl system is that it allows the use of higher pulse rates overall, so minimising "flutter" of the control surfaces. However, owing to these higher pulse rates, it is not possible to use a reed unit (simultaneously with the pulsing receiver relay) to obtain engine control. For this reason, a filter circuit has been chosen, since there is no inertial effect to be overcome as is the case with a reed unit.

A "fail-to-slow" scheme, where loss of special tone, or all tones, automatically gives slow engine, will provide a certain degree of protection for the model so this has been retained. A slugging system, identical to that which is used in the basic Bisimpl circuit, prevents the output from following the normal pulsing. (But, owing to the use of a tuned filter, this slugging is such that a rapid-acting engine servo *can* be pulsed manually to give a mean engine speed between maximum and minimum for landing approaches, etc.). A complete change from the special tone will cause the engine relay to open, giving low speed throttle. With the tones suitably chosen for the receiver in use, the pulsing is not affected by changing between them, so engine can be blipped without any effect on the flying controls.

The system is suitable for coupling to a "Unitone" or similar. Of course, other, similar receivers can be adapted in like manner.

The circuit is shown in Fig. 1. The

FIG. 1



Component List

R1 = 22K ohm — 1M ohm (the higher the better).
R2 = 4.7 — 6.8M ohm.
R3 = 4.7K ohm.
R4 = 4.7 — 100K ohm.
C1 = 0.01 — 0.1 μF.
C2 = 0.001 — 0.005 μF.
C3 = About 0.1 μF.
C4 = 0.05 — 0.5 μF (lower values when relay resistance higher).
Relay = 3 — 5.8K ohm.
Diode = OA81.
TR1, TR2, TR3 = OC44.
Filter — FX1011 wound full of 44 s.w.g. wire or Rameco 450 c/s filter.

relay used was a Siemens 5.8K ohm one. in one case, and a 3K ohm in the other case. The Siemens relays are imported and marketed by B and R Relays Ltd., London, but they are. we think. available from Ed. Johnson. Because these relays are available with double pole, change-over contacts. they permit the use of servos which need 4.8 volts each way, i.e., those incorporating Microperm motors. However, with a Mighty Midget servo, only single change over contacts are necessary with 2.4 volts each way.

A glance at the circuit shows a fearful range of values for almost every component, but let us consider step-by-step just how the optimum choice is made in each case. First of all, assemble TR1 stage as far as shown in Fig. 2 and select, and wire in R2 such that there is 0.5 to 1 mA. passing through the collector resistance R3 (4.7K ohm). If you are lazy, make R2 equal to 6.8 MΩ.

Now wire up the rest of the circuit, putting in the following values for the components as a starting point:

R1 — 1 MΩ
C1 — 0.1 mfd.
C3 — 0.1 mfd.
R4 — 100 KΩ
C2 — 0.005 mfd.
C4 — 0.1 mfd.

In making the circuit adjustments, you may find it easier to work with the pulsed tone, or with "full" steady tones. We suggest the former as probably better. At this point a brief note on the operation of R1 C1 and R4 C2 might be helpful. These impedance chains serve. in effect, to restrict the input to the filter stage so that the bandwidth is not too large. If this were not so, the "brute force" of the incoming signal would swamp the selective effect of the filter circuit, and prevent it from operating correctly. What we wish to do is to obtain the maximum difference between the average current through the relay when the resonant, special, tone is on and when any other tone is on.

With the values suggested as a starting point, there should be a noticeable change in the relay current when the resonant note of the filter is tuned in. Once this peak, however small, has been located, one should adjust R1 C1 and R4 C2 until the required change in relay current is achieved. In practice

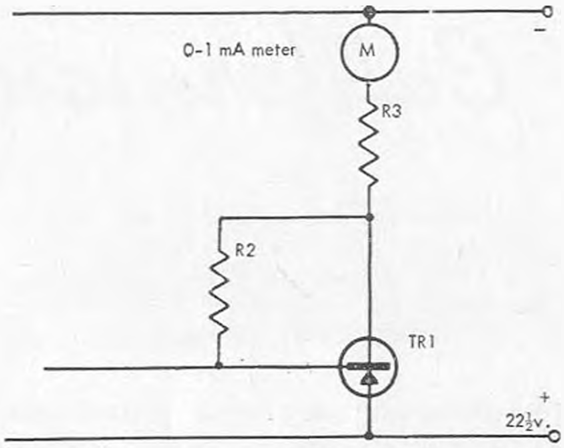


FIG. 2

you may well find that C1 can be left at 0.1 mfd. and C2 at 0.005 or 0.001 all the main adjustments being made on R1, R4.

Once the current through the relay has been set to close the relay on special tone and release it on other tones, the slugging capacitor C4 can be chosen to hold the relay in (just) through the longest break in tone that occurs in normal pulsing. If C4 needs to be large enough to be electrolytic, we suggest that you use a Tantalum (S.T.C. Type "Stantelum") capacitor, as the reduced leakage gives a lower off tone current.

If you should have trouble because the best note for the filter circuit is too high for your receiver, or too low, tune it to a lower or higher note by adding more capacity (up to 0.5 μF) or removing some. Be sure to use paper or Mylar capacitors and remember that four times the capacity only lowers the tuned frequency by a half or conversely, reducing the present 0.1 mfd. capacitor to one quarter of its value will only double the tuned resonant frequency, because of the square law involved.

Batteries

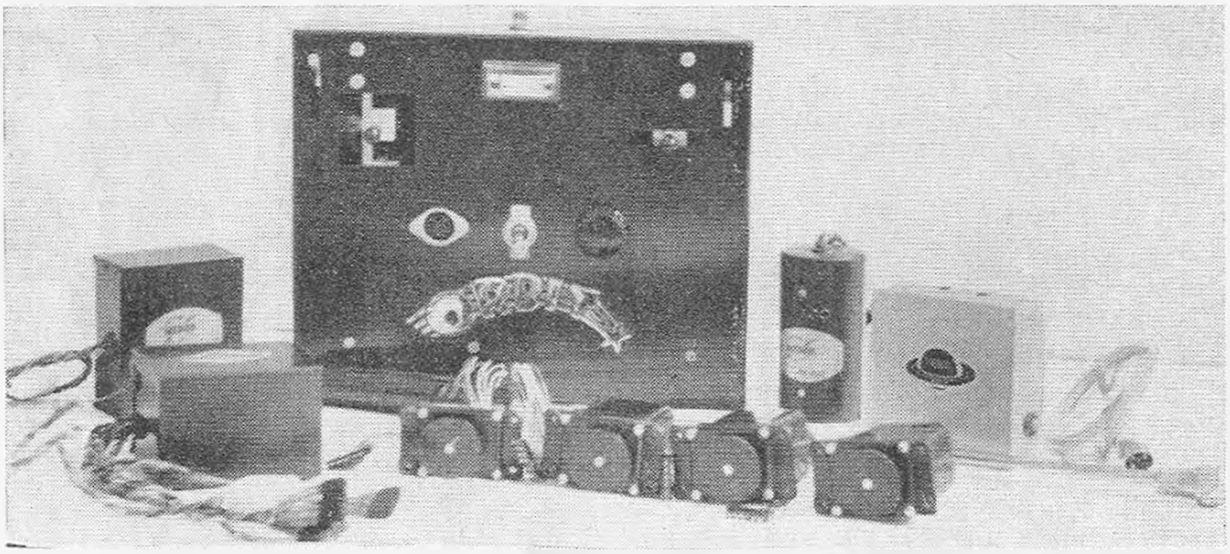
On receiver and discriminating system such as this, the H.T. battery drain is rather large and normal small 22½v. batteries go down as you look at them! What we do is use the 22½v. sections from which 90v. and 67½v. batteries are built. The 67½v. one, oddly enough, has 3 such sections and costs eleven shillings, whereas the 90v. one has 4 and costs nine shillings! These sections carry the requisite loading easily and for a very long time, but do have to be soldered in, unless you fit clips to their leads.

Californian Newsletter

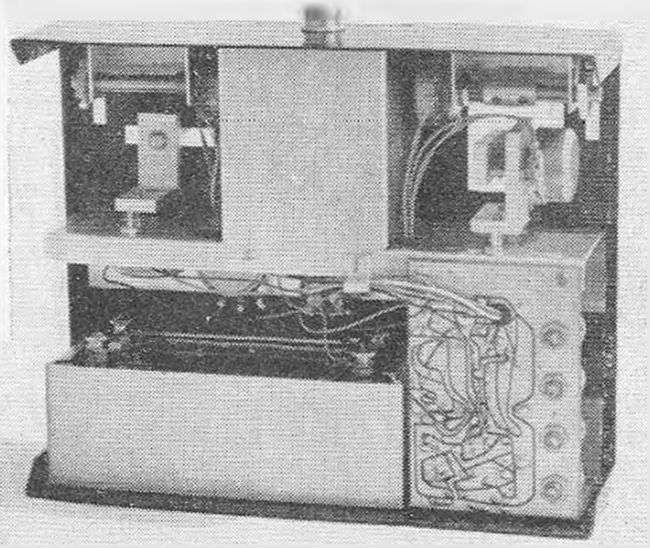
Leicester modeller and radio control enthusiast currently working for Orbit Electronics in California provides an exclusive report on Orbit's latest equipment.

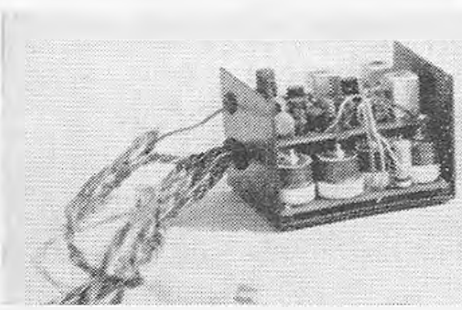
READERS, and multi fans in particular, may be interested in the few details and pictures I have of the new proportional outfit which has been under development at Garden Grove for some time.

The price of the complete set, four servos, receiver, transmitter, batteries and two chargers will be 595 dollars and servos are to be sold separately also at 39.95 dollars each. The transmitter works off 12 volts and is temperature stable up to 150 degrees F. It is an all transistor circuit, using silicon transistors of the highest quality. Looking at the front face, there are two control



Above : Layout of complete Orbit proportional set, with transmitter, chargers and power pack at rear and receiver and servos in foreground. Right : Receiver and transmitter lids removed to reveal "innards" as referred to in text.

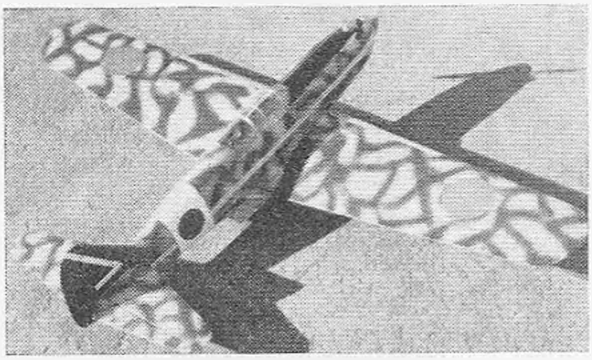




columns. Rudder and Elevator are on the left and Aileron on the right with Aileron trim just below the latter. while motor control is at extreme right.

With the transmitter back removed one can see four master pots at the extreme right of the lower printed circuit board. These pots are for alignment to the receiver.

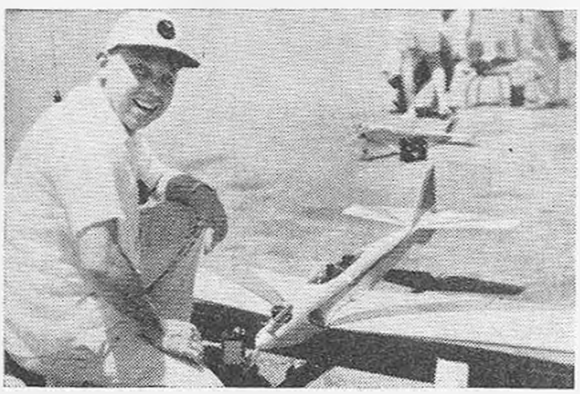
The transmitter will also be available with one stick control for those who prefer this type. Under the aerial bush



in alloy "box" is the complete R.F. section.

The receiver will be sold with complete wiring harness so customers can just fit and forget. In the picture showing the whole system grouped together one can just see the receiver cup cores which control its operating frequency. The receiver is built in two decks for

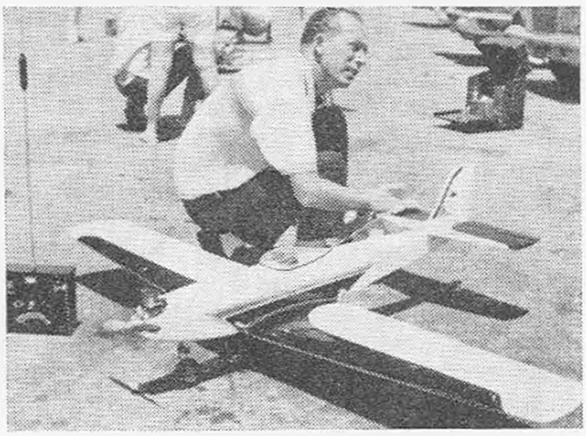
Below : Dr. Ralph Brooke 1963 U.S. Team member with his "Whistler". Orbit proportional equipped and Veco 45 R/C powered. Right : Bob Dunham (Mr. Orbit) and four year old "Voltswagon". Orbit proportional radio and Lee .45 engine.



Left : Dick Riggs' scale Kawasaki Hien "Tony" is fully aerobatic. Orbit proportional radio and Merco .49 power. Above : Phill Gerrard and McCoy .60 delta. Retracting undercarriage and Orbit 10 reed radio.

easy servicing. In this configuration it is extremely compact, working off six volts supplied by a *Medco* power pack.

Amplifiers are built into the servos, which are extremely light and perfectly linear in control movement, which follows the movement of the transmitter exactly. I have flown this system in



several different model aeroplanes and have found the transfer from reeds to proportional so easy it is ridiculous. If one can fly "bang bang" style with reeds, learn to squeeze the control stick and before you know where you are, you are flying with the best of them. No sweat!

I don't know delivery rate of this gear yet, but having once flown this system one just does not want to know reeds again.

MAURICE FRANKLIN.

Gadgets and C

WE have a large number of small simple gadgets this month. the first comes from C. Prendergast.

Flush Switch (Sketch **A**)

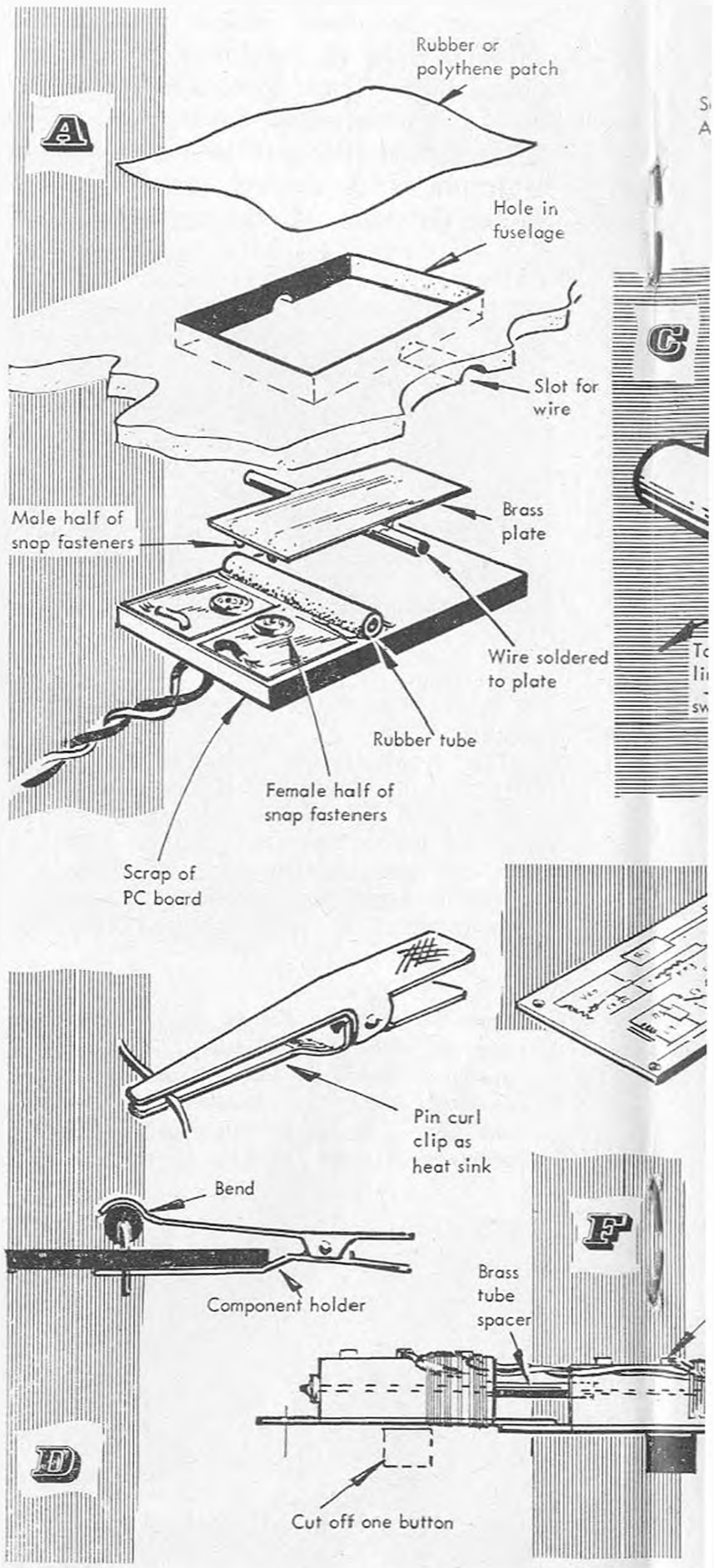
Small models and scale subjects need not be marred by the appearance of a switch if this idea is adopted. The designer says that it may also be used on a transmitter. The actual contacts are pairs of small snap fasteners, the male halves of which are soldered to a strip of brass about half an inch wide, and the female halves to a scrap of printed circuit board. The brass strip is pivoted on a short length of wire and a scrap of rubber tube fixed with Evo-stick to the printed circuit board serves to keep the contacts apart when the switch is in the off position. When assembled in the sheet side of a fuselage, the switch is operated by pressing the snap fastener end of the brass strip so that the snaps connect. To switch off; press the other end and the snaps "unsnap" breaking the circuit. A thin piece of rubber is stuck over the hole in the side of the fuselage, renders the switch watertight yet permits the switch operation by pressing in the appropriate place.

Miniature Plug and Socket (Sketch **B**)

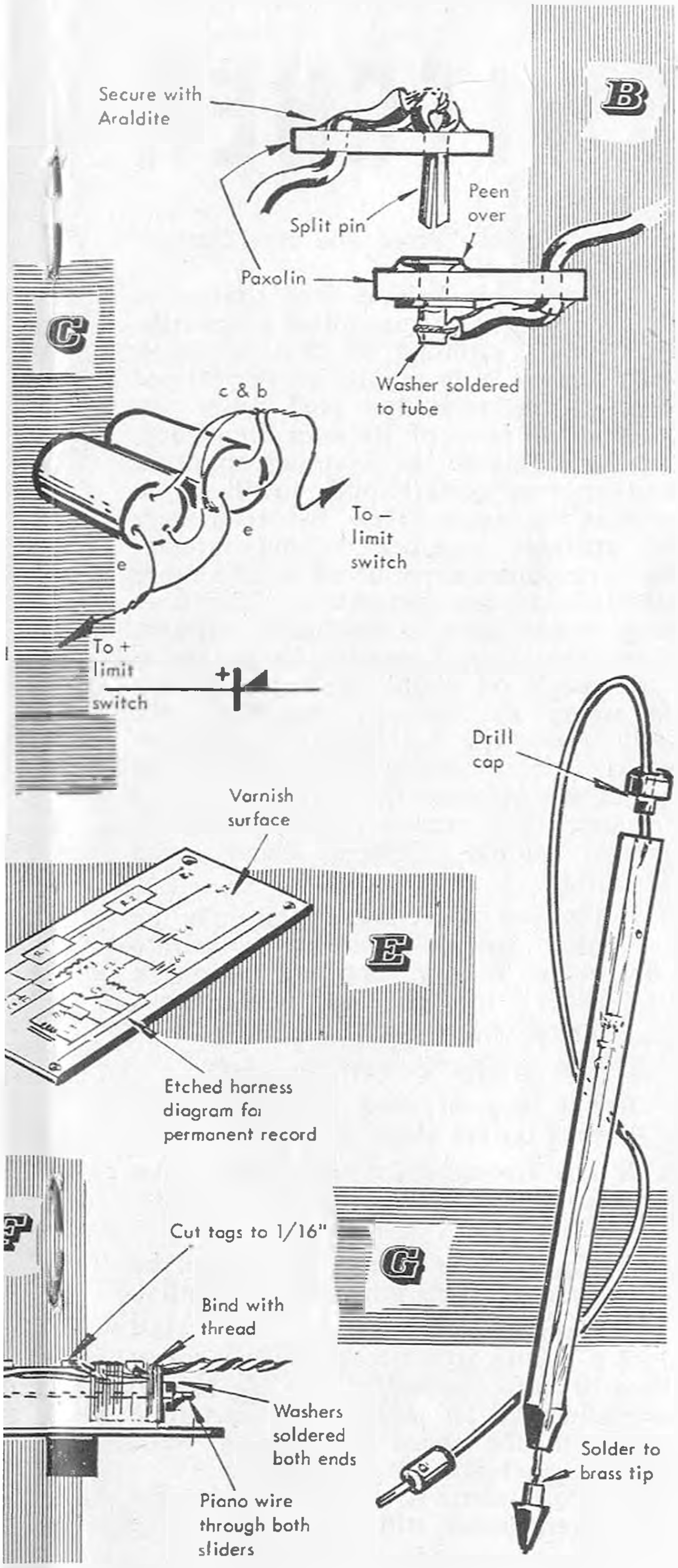
W. S. Brereton uses miniature split pins for plugs and a scrap of brass tubing for a socket when making one way connectors for subminiature models. Such connectors may also serve as a switch. The split pin is Araldited to a scrap of Paxolin which serves to lock the plug lead. The socket is fitted to a similar piece of Paxolin and comprises a short length of brass tube belled out at the end, passed through the Paxolin and secured by soldering a washer on the other side. Araldite may be smeared over all except the contact surfaces, to provide insulation.

Diodes for Limit Switches (Sketch **C**)

A. P. Dowsey, having used diodes for limit switches for some time, now avoids the problem of searching for suitable diodes with low resistance and high current capacity. The answer apparently is to use transistors; two GET 114s connected in parallel. Three of a cheaper or substandard type would be needed for small motors such as an Eveready TG18, just join the collecters to the bases and wire the emitter to the positive side of the circuit, the other connection going to Negative. A pair of transistors may be insulated with tape or put in a small plastic thimble.



d Gimmickry



Cheap Heat Sinks (Sketch D)

Here is a quickie from F. T. Newington: Woolworth's pin-curl clips are small enough to fit into tight corners although the ends may be filed a little for subminiature work. They have adequate spring pressure to form an effective heat sink, and we are informed that the cost is less than a penny a time. We find that, suitably bent, they can be used for holding small components in place whilst soldering.

Permanent Record (Sketch E)

After reading our "Bargain Basement" articles, M. J. McCullagh thought he would follow the "tips to posterity" and use a piece of printed circuit board, suitably etched, as a means of identifying the harness or the complete circuit (theoretical), of his boat. Using a rule pen and dope the drawing is made on the circuit board in a similar manner to that which might otherwise be produced on a piece of card as suggested in the article. The board is then etched leaving an indelible record of a very professional appearance.

Space Saving Slide Switch (Sketch F)

E. Scholfield found that the soldering tags on his stackpole slide switches took up too much space in his "Apollo". This receiver needs three switches, two of them ganged together for the servo circuit. A considerable amount of space is saved by cutting the tags down to $\frac{1}{16}$ in., soldering on the leads and binding them tightly to the switch body with thread, finishing with a smear of Evo-stick. The thread can then be cut where it crosses the front of the switch, allowing free operation. The operating knob of one of the gang switches may be sawn off if the switches are mounted on the fuselage side. This saves having an extra slot.

Test Probes (Sketch E)

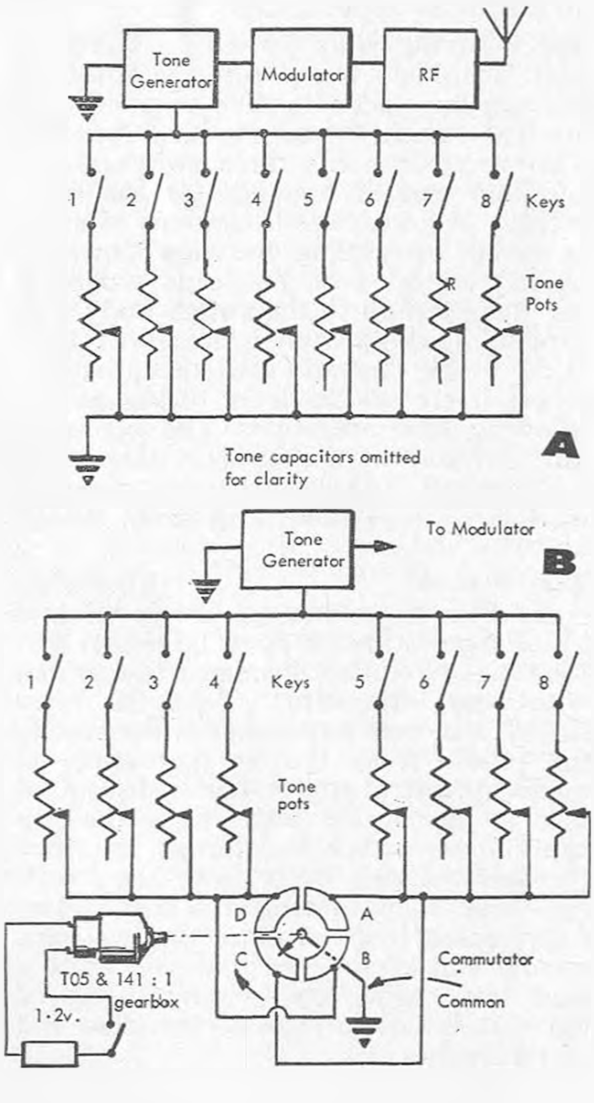
R. Bennett makes good use of old "Bic" type ballpoint pens, he shows that they make excellent insulated test probes with very little effort. Take the brass tip of the pen and remove the empty ink tube. Wash the tip thoroughly in meths or petrol and solder a length of flex to the inside end. Drill the top cap of the pen $\frac{1}{8}$ in., thread the wire through the pen body from the "writing" end, then through the cap. Carefully replace the tip, place the cap back on the end of the pen and you have a neat test probe, the colour coding of the wire is visible through the clear end of the body.

Easy "Simultaneous" from Almost any Multi Transmitter

WITH G. TORTORA'S SWITCHER

FOLLOWERS of the "Half Pint 8" series will no doubt be interested in the mechanical time sharing system which Giuseppe Tortora uses on his home built eight channel transmitter to obtain simultaneous operation from one tone generator. The system is extremely easy to apply to any non-simultaneous transmitter and is, if anything, easier on transistorised transmitters. Fig. 1A shows the Tx before the modification illustrated at B.

FIG. 1



The principle behind time sharing is that the tones are transmitted alternately with great rapidity so that although each tone is only on the air for 50 per cent of the time, the reed "sees" an interrupted note of its own frequency, but is unable to do anything about it, and sings on quite happily to fill in the gaps in the signal. Thus, two reeds may be operated together without interaction sometimes experienced by the more usual twin tone generator. The only snag would seem to be that at extreme range the overall response might be a little weak on simul. This is unlikely to worry the average modeller, who only uses simul for spin, a manoeuvre which is best done where the pilot can accurately estimate the correct headings for entry and recovery. The following points should further clarify the situation:

1. 100 per cent modulation may be used (some transmitters operate below 50 per cent modulation in order to obtain simultaneous operation).
2. The system is easy to apply.
3. The receiver need not have a high gain output stage.
4. The frequency of the mixed tones is not important as to compatability.
5. The receiver circuit should **not** be linear. as the tones are sequential.

When fitting the system to the "Half Pint 8" outfit it is necessary to increase the 10 mfd. capacitors in the servo amplifiers to 50 mfd. This has little effect on the speed of centring when using a Bellamatic or similar servo.

Do not attempt to simplify the switching arrangement still further by using

(*Continued on page* 456)

Right: One of the tiny (29 in. span) biplanes into which the original "Half Pint 8" receiver and four servos are packed.

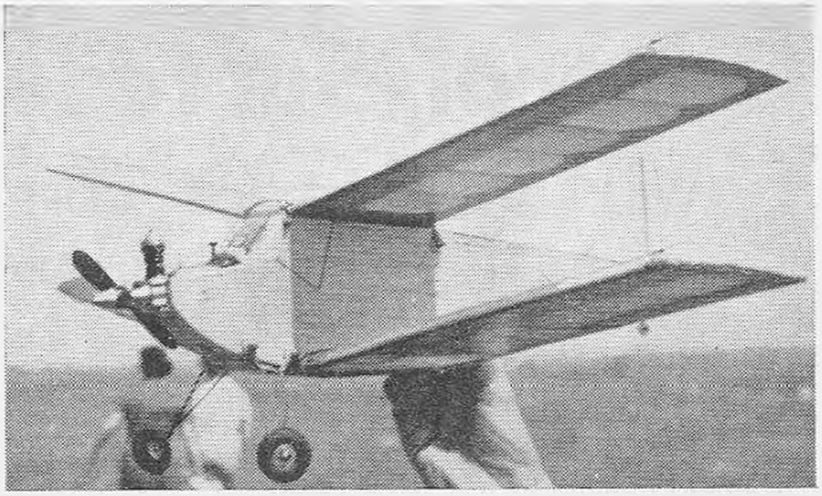
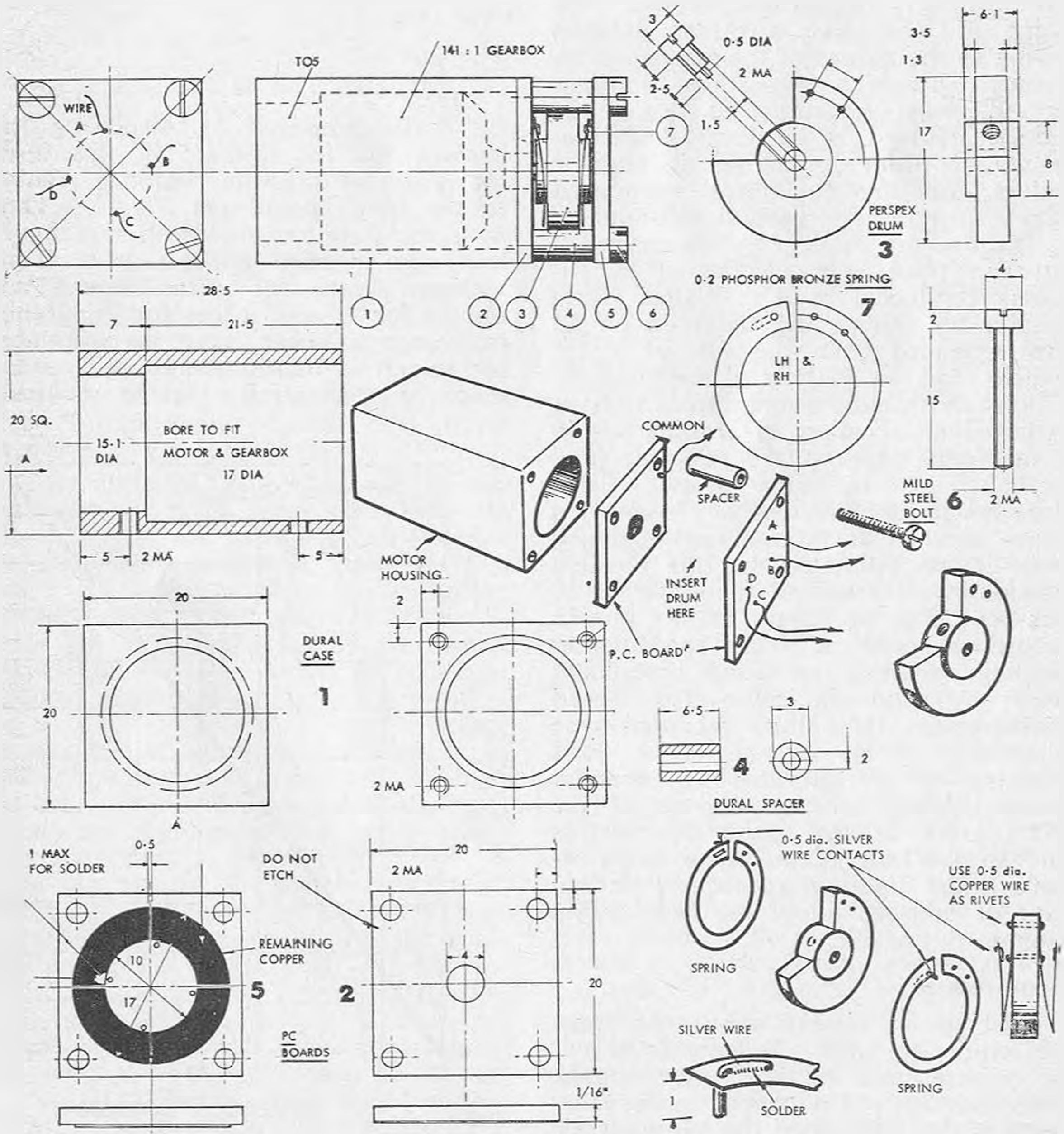


FIG. 2 FULL SIZE WORKING DRAWINGS



Control Surface Forces

WILL YOUR SERVOS COPE? . . .

R. H. WARRING EXPLAINS

THE actual amount of 'push' or 'pull' force required to move a control surface to its deflected or 'control' position has been variously estimated as anything from an ounce or so at low speeds to a pound or even several pounds at high speed. Very little experimental data has been forthcoming on this very important subject, and some of what has is rather dubious owing to the nature of the test measurement. This is a pity since the *only* accurate way of forming an idea of the forces involved is by direct measurement, in order to arrive at realistic values for any coefficient introduced into a formula for general solution.

The one ray of light in this respect—so far, at least—is a series of experiments conducted by Dr. Walter Good with a fin and rudder mounted on an arm extended from the side of a car which, from an analysis of the test conditions and results, would appear to have achieved an accuracy of reading within a maximum error of 10 per cent (and probably less in many cases). Early experiments by the writer (some ten years ago, in fact) were not pursued since it was estimated that the possible maximum error was of the order of 20 per cent, plus or minus, mainly due to recording speed as a car speedometer reading; whereas the Good experiment used a wind indicator for speed measurement (and thus recorded true airspeed). Some recent check tests working at a *calibrated* speedometer speed reading achieved figures of the same order as the Good experiments and so the latter data, being more extensive, are taken in subsequent derivation of aerodynamic force relationship later in this article.

Requirements

First let us clearly define the force we require to know. Technically this is not a pure 'push' or 'pull' force but the *hinge moment* of a control surface defined as the product of the aerodynamic

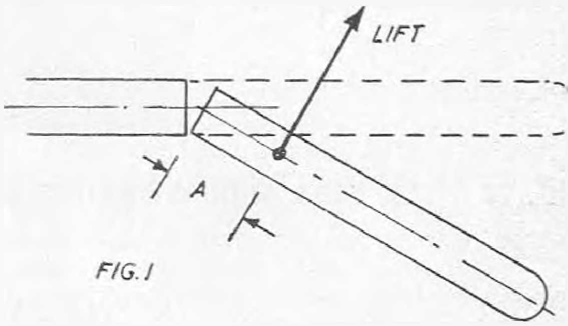


FIG. 1

lift force produced by displacing the surface and the distance of this force (or centre of pressure position) relative to the hinge point—see Fig. 1. Thus with the notation shown in this figure the hinge moment equals L x A. Convienient units for measurement are ounces for 'L' and inches for 'A'. Hence the hinge moment is so many ounce-inches. It is only a matter of convenience or convention to write moments

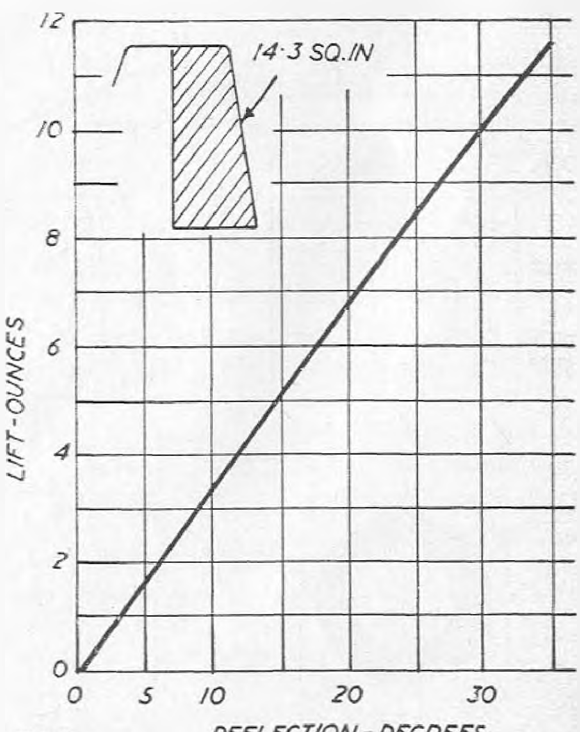


FIG. 2

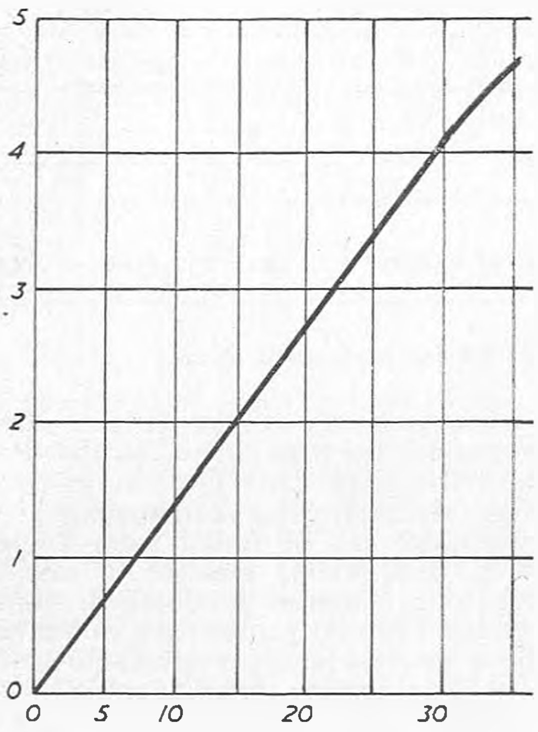


FIG. 3

this way round. To quote a figure of inch-ounces would be equally explicit but in the case of a *moment* the force is usually put before the linear measurement, and hyphenated, in order to avoid confusion with *work* units which are conventionally written the other way round, e.g., foot-pounds.

To start with, both 'L' and 'A' are unknown. We do know that both are liable to change with the amount of angular deflection, and that the lift force will be proportional to the square of the speed. The only way to determine either accurately is by direct measurement under controlled test conditions. However, as far as the position of the lift force is concerned—distance A—we can be pretty sure that for large deflections, at least (e.g., anything over 10 degrees) it will be substantially constant and located at the aerodynamic centre.

In the case of flat plate section (e.g., a rudder or elevator carved from sheet balsa, even if tapered towards the trailing edge), the position of 'A' will approximate very closely to C/5. In the case of a definite aerofoil section (as might be used on a Frise-type aileron) the position of A will closely approximate to C/4. Since a majority of critical control surface 'force' cases concern the rudder and elevators and these will normally comprise 'flat plate' sections, we can adopt a figure of C/5 as more or less standard.

The lift generated by a displaced control surface can be calculated on similar lines to aerofoil by the formula

$$\text{Lift} = C_L \frac{p}{2} S V^2$$

where C_L = the lift coefficient appropriate to the angle of attack (or angle of displacement in the case of a control surface).
p = air density.
S = surface area of aerofoil (displaced control surface).
V = velocity (airspeed).

This formula can be rendered in terms of *model* units as

$$\text{Lift (ounces)} = 0.000132\ C_L\ S\ V^2$$

where C_L = lift coefficient, as before.
S = control surface area in sq. in.
V = speed of flight in m.p.h.

The one unknown is now the lift coefficient (C_L) and it is necessary to resort to experimental data in order to determine this, bearing in mind that there will be a different value of the lift coefficient for various angles of deflection.

Dr. Good's original experimental data was reduced in the form of hinge moments related to control surface deflection on the basis that the value of 'A' was 25 per cent of the mean chord, although a flat plate section was employed. Fig. 2 renders this data in terms of lift force (measured) against angle of deflection, and from this Fig. 3 and Table I derives corresponding values of *lift coefficient,* based on a value of A of C/5 (which we feel is more correct). Since it is the *hinge* moments which were measured in the original series of experiments the resulting lift coefficients given in Fig. 3 and Table I are somewhat higher than values suggested by Dr. Good as typical —for example he quotes C = 2.22 (reduced to model units consistent with C_L =1.0 in "full size" units) as being typical for 20 degrees deflection against the tabular figure of C_L = 2.75. The actual *hinge moments* are the same in each case, but it is necessary to appreciate that the lift coefficient values given

TABLE I Control Surface Lift Coefficients

Angle of deflection	5°	10°	15°	20°	25°	30°	35°
* CL calculated on DR good data for A = C/4	—	1.1	1.67	2.22	2.78	3.33	—
* CL for flat plate sections A = C/5	.69	1.375	2.06	2.75	3.44	4.1	4.6

*For insulation in the formula :—
Lift (ounces) = .000132 CL x surface area (sq. in.) x speed (m.p.h.)

are based on the assumption that dimension 'A' is equal to C/5 (not C/4).

Application

From this data it is now readily possible to calculate the hinge moment for any control surface with a fair degree of accuracy—the only 'unknown' now remaining being the flying speed. Designing for the extreme case—maximum speed—means estimating just what that maximum speed really is; and any error will be doubled in effect since the lift force (and hence the hinge moment) is proportional to the *square* of the speed. A 'typical' flying speed for a rudder-only model might be anything between about 25 m.p.h. and 60 m.p.h. (in a spiral dive). The 'multi' model may normally have an airspeed between 35-40 and 60 m.p.h. through a range of manoeuvres, but perhaps build up to 90 m.p.h. in a steep dive. Anybody's guess is virtually as good as the next, until we have some really accurate method of recording flying speeds.

Rather than flog that particular subject to death—without adding usefully to known data—let us examine a typical design study for finding the hinge moment for a typical control surface (e.g., a rudder or elevator, bearing in mind that in the latter case the total hinge moment will be doubled for a pair of elevators).

The geometry of the surface—Fig. 4—enables the area to be calculated and also the factor 'A'. For any given design deflector the corresponding lift coefficient can be found from Table I. It is then readily possible to calculate the hinge moment produced at various speeds. Typical geometrical values have been inserted as an example to calculate corresponding hinge moment figures in Table II.

From these it is readily possible to see the servo 'push-pull' force required, bearing in mind that this also must be rendered as a *moment* since the 'push-pull' force operates on a control horn—Fig. 5. The *servo moment* is there-

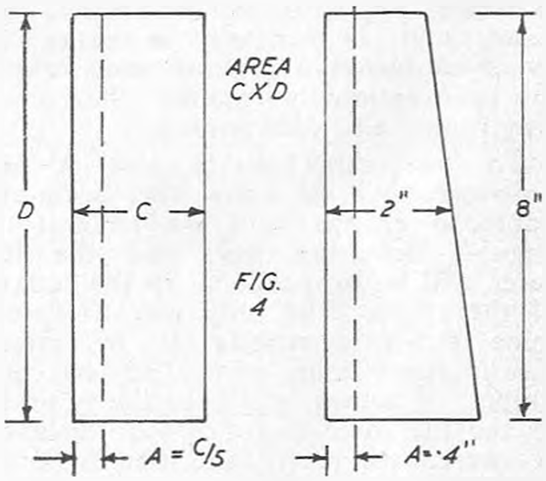


TABLE II Hinge Moment Calculations

Control surface area	—	16 sq. in.
Mean chord	—	2 in.
Value of A = 1/5 x 2	=	.4 in.
Design Deflection	—	25°
Value of CL (from Table I) = 3.44		

Speed m.p.h.	Lift Force ozs.	Hinge Moment in. ozs.
30	6.55	2.62
40	11.65	4.67
50	18.2	7.3
60	26.2	10.5
70	35.6	14.25
80	46.5	18.6
90	58.9	23.6
100	72.7	29.2

TABLE III

Linear Travel (in.)	.1	.2	.3	.4	.5	.6	.7	.8	.9
Displacement per in. "H" (degrees)	5½	11	17½	23½	30	37	44½	53	69

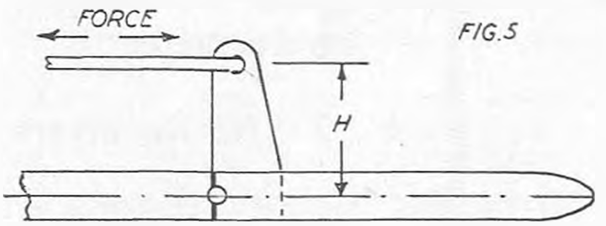


FIG. 5

fore the 'push' or 'pull' available multiplied by the effective length of the control horn H. The latter is, of course, variable by design. Increasing H will increase the servo moment for a given available 'push-pull'. However, the dimension H is mainly bound up with the design deflection of the control surface related to the available amount of linear travel given by the actuator.

For a given servo (giving a specific amount of linear travel), the value of H is therefore fixed by the amount of deflection required. This solution is purely a matter of simple geometry. If provision is made to change the value of H (i.e., in order to have a range of control deflections available) then the limiting case for design is the *lowest* value of servo moment available (smallest value of H), which also happens to correspond to maximum deflection and consequently maximum hinge moment. It would therefore be necessary to calculate hinge moment on this maximum deflection.

Servo Power

The basic requirement is, simply, that the servo moment available should be greater than the maximum hinge moment that is likely to be generated by the control surface (i.e., at maximum estimated flying speed). Some positive reserve of servo moment is obviously desirable to overcome any hinge stiffness or linkage friction, and to provide a safety factor (against deterioration of servo batteries, for example). Logically a minimum safety factor of 1.5 would seem advisable, and most people would probably prefer more.

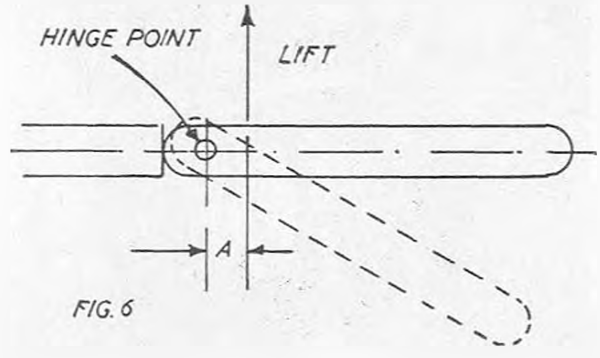


FIG. 6

A useful reference for control linkage geometry is given in *Aeromodeller Annual* 1960-61 (Bellcrank geometry). The basic relationship between push-pull movement (linear travel) and control surface displacement per inch of effective control horn length (H) is summarised in Table III. Thus, for example, ½ in. linear travel with a 1 in. control horn length (H = 1) will give 30 degrees control surface deflection; and ⅝ in. linear travel nearly 40 degrees deflection. In the case of practical control surface designs, therefore, with maximum deflections of the order of 20-30 degrees the value of H will normally be greater than unity and hence the *servo moment* available will be greater than the 'push-pull' force output of the servo. Table III should provide a good check whether this is so, or not, knowing the linear travel available from a given servo; and also provide a provisional estimate for the value of H required for a given design deflection.

If the available *servo moment* is marginal, or even less than the calculated maximum hinge moment, the simple solution is, of course, to set the hinge point back from the leading edge, thus reducing the value of A—see Fig. 6. Dimension A is measured from the hinge point to the aerodynamic centre, not from the leading edge of the control surface unless leading edge and hinge point coincide.

Moving the hinge point back to C/10, for example, *halves* the hinge moment (compared with the surface hinged at the leading edge). A fully (aerodynamically) balanced surface with the hinge point at A (C/5) is not necessarily a good thing, however, since the efficiency of the control surface may be considerably reduced. Some notes of balanced control surfaces appeared in an earlier article.

Test Report

EDITORIAL REVIEW

with measurements by

J. H. BRUNT

★ 6 channel outfit

★ Single channel transmitter

★ 2 S/C Receivers

SOME examples from the house of Min-X start the ball rolling this month. First, the "Min-X Powermite Single Channel Transistor Transmitter".

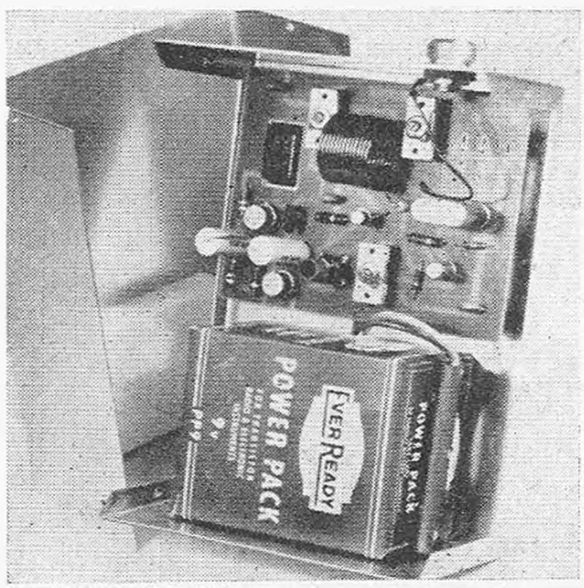
Following the well known Min-X configuration, this ultrasimple folded metal case finished in the familiar gold anodising, conceals an intelligently laid out all transistor circuit, which provides a really powerful R.F. signal. A hefty, and hefty can be the only word for it, centre loaded aerial, obviously contributes greatly to the ability of the transmitter to radiate the high power available. From the pilot's point of view, as soon as one picks up and extends the aerial, there is a distinct sense of unbalance even if the transmitter is held at the extreme top. Not a comfortable position for keying. Admittedly, the keying button itself warrants a bouquet, comfortable to operate, no sharp edges to dig into one's thumb and an action so light yet positive that the quickest quick blip is possible, thanks to the use of a miroswitch below the button.

There is one physical point in favour of a solidly constructed aerial, in that sooner or later someone is going to stand in the way just as you turn round. This often has the effect of bending the tip of the aerial so that after a hard season's flying, it is difficult to retract it fully and in some cases the aerial either breaks or becomes excessively loose at the joints. If aerials are going to be slim, let us have them built like a fishing rod; thin wall steel tube with a piano wire top piece.

The transmitter employs wave modulation with a radiated carrier between keying signals. A single PP9 (9 volt dry battery) is a power supply and in common with most transmitters is carried below the glass epoxy printed circuit board and is accessible by removing the four self tap screws holding the two halves of the case together.

Test Figures

Transmitter: Tone Modulation 700 c/s. *square wave or pulse modulation.*
Total Currents:
Carrier Wave — 37 mA. aerial collapsed.
Carrier Wave — 42 mA. aerial extended.
Modulation Applied — 28 mA. aerial extended.
Field Strength — High.
R.F. Output — 100 mW. approx.



A Min-X "Powermite" transmitter showing the components clearly. Note the lack of heatsink on the output transistor. It does get a little warm, but not excessively so.

Ground range: see receiver tests.

Physical Data

Case size: Height 6⅛ in.; width 4½ in.; depth 2½ in. + ⅜ in. switch projection.
Aerial (removeable): Retracted 15½ in.; extended 48½ in.
Weight: 1 lb. 13 oz. including battery; weight of transmitter includes aerial (5 oz.).
Controls: One slide on/off switch; one microswitch keying button.
Case: Gold anodised folded aluminium.

Two C/S receivers ; relay and relayless.

Min-X "Compact"

There is still quite a large following for relay single channel receivers. The "Compact" fills the bill nicely; being robustly constructed and hardly larger than the smaller but not subminiature relayless receivers currently available. One output stage is saved in the 4 transistor circuit which. in common with most Min-X receivers, employs interstage transformers. The relay has a small armature and is, of course, suitable for pulse proportional control systems when correctly adjusted. The glass epoxy circuit board uses large area plated lands, a point which should contribute to reliable operation as there is practically no chance of land failure should the board be severely flexed in a lrash. The metal case is about 20 s.w.g. and affords plenty of protection.

Test Figures

Receiver Standing Current — 3 volt supply.
Relay (Total Receiver Current) in at 20 mA. out at 18 mA.
Tone Signal — 28 mA.
No Signal — 7.5 mA.
Carrier Wave Only — 2 mA. (when tuned to carrier).
Sensitivity — Better than 5 μV modulated to 75 or 100 per cent will cause relay to operate.
Tone Frequencies —
Peak 1000 c.p.s. } at 100%
Range 500-1400 c.p.s. (sine) } and 75%
170-2100 c.p.s. (square)

Physical Data

Size: Leigth 1⅞ in.: width 1⅜ in.; depth $\frac{15}{16}$ in.
Weight: 1.6 oz.

Recommended Aerial Length: Minimum 12 in.; maximum 36 in.
Batteries: 3 volts receiver supply (2 U7 or similar cells in series).
Separate supply, voltage to suit servo or escapement switched by a relay.
Typical Airborne Load (receiver and battery plus escapement): Minimum weight with separate 3 volt escapement supply 5¾ oz.
Typical proportional set up (receiver and battery plus Mighty Midget motor and DEAC 2.4 + 2.4 volt pack) 7-7½ oz.

Ground range with Min-X Powermite Tx (separate escapement battery) 1.300 yards.

Min-X Sportsmaster

The "Sportsmaster" is a caseless relayless dual output receiver of similar circuit configuration, but of course having output stages to provide an On Signal and a No Signal output of similar polarity for use with magnetic proportional actuators of the "Septalette" type, or for quick blip facilities when using escapements which do not carry their own separate "back" contact It is not possible to use motorised sequential actuators or motorised proportional systems with this receiver. It is somewhat lighter than the "Compact" and is intended to be fixed to a bulkhead in the model with a piece of sponge rubber as a shock absorbing mounting. The instructions for both receivers are extremely explicit and show a variety of applications. The theoretical circuit is given a valuable point where experimenters are concerned, though not, we hasten to add, to encourage all and sundry to "fiddle".

Test Figures

Total Currents:
No Signal —
6 mA.
Carrier Wave Only —
6 mA.
Current Rise —
300 mA. into 11 ohm D.C. resistance actuator with 7.5 v. input modulated 1000 c.p.s. 100 per cent.
Tone Frequency Range —
200-5000 c.p.s. with sine wave modulation.
3 volt supply —
50-5000 c.p.s. with square wave modulation.

Ground range with Min-X Powermite Tx (11Ω escapement load) 500 yds.

Physical Data

Size: Length 2 in.; width $1\frac{1}{4}$ in.; height $\frac{3}{4}$ in. (to top of tallest component) + $\frac{1}{2}$ in. for sponge rubber when installed.

Weight: 0.9 oz.

Recommended Aerial Length: Min. 12 in.; max. 36 in.

Batteries —
6 volts (two U7s in series).

Output Wiring —
On Signal output between white wire and black (neg.);
Off Signal output between orange wire and black (neg.);
Red wire receiver plus.

Typical Airborne Load (receiver and battery plus escapement) 4 oz.; receiver and compound escapement plus throttle escapement (common battery) 5 oz.; receiver, battery and "Septalette" magnetic actuator $5\frac{1}{2}$ oz.

Now something for multi enthusiasts . . .

R.C.S. "6" Outfit

In order to supply the needs of the multi sport flier who aspires to rudder, elevator and throttle only, and the more sporty types who use aileron in place of rudder, Messrs. R.C.S. now supply a six channel version of their all transistor twelve channel transmitter, using one tone generator. With this arrangement, the aileron key is used wired in and is operated from the left hand tone generator together with throttle and elevator already supplied by this part of the circuit. The general handling of the transmitter and its construction has of course been dealt with in the preview of the system published in our July, 1963, issue. The same issue also dealt with the reed bank, only six reeds of which are wired into the harness of a new super-regen receiver.

The receiver is a straightforward super-regen using two stages of amplification, each transformer coupled. It is contained in the same moulded nylon and polished aluminium case, which is supplied with the superhet, consequently there is plenty of breathing space around the fewer number of components. With a six channel model, one is not necessarily concerned with subminiaturisation. Extensive use is made of plug-in electrolytic capacitors, and the whole receiver is solidly constructed on a paper laminate P.C. board. Tuning is very broad, both on the receiver R.F. and on the tone pot with the transmitter; the latter covering about "$1\frac{1}{2}$ reeds" each, making for easy adjustment.

The R.C.S. Six Channel outfit from front with back removed, the receiver stands in front of its case. The meter is not fitted for flying.

Test Figures — Receiver

Total Currents — No Signal 3 mA.

Carrier Wave Only — 3 mA.

Tone Modulation Applied — between 13-14 mA. (depends on frequency).

Sensitivity — 10 μV modulation 100 per cent sine or square wave will cause appropriate reeds to operate.

Reed Bank Frequencies (C.P.S.)

1 - 575	2 - 550	3 - 525	4 - 500
5 - 475	6 - 450	7 - 425	8 - 390
9 - 360	10 - 335	11 - 310	12 - 290

Physical Data

Size: Length 3 in.; width $1\frac{3}{4}$ in.; height $1\frac{5}{16}$ in.

Weight: 3 oz.

Batteries: Receiver — PP3 (minimum size) 9 volts.
Servo batteries to suit servo (4.5 to 7.2 when using R.C.S. relayless multi servos).

Output Wiring: Reed 3, orange; 4, yellow; 7, mauve; 8, grey; 9, white; 10, black. Common reed comb pink.

Approximate Airborne Load (receiver and battery plus three R.C.S. servos and 7.2 volt DEAC pack) 13 oz.

RCS 6 Channel Transmitter

First a few extra notes on its handling. Balance of the transmitter is very comfortable and the keying switches are conveniently placed and quite light, though not as light as some pilots, we have met, like. This is largely a case of personal preference, we feel, and the equipment is intended to be used by average pilots. However, the action is free enough for confidence whilst one familiarises oneself with its handling. Almost every make of transmitter has a slightly different feel, but like a new car one "gets with it" after driving for about half an hour. All in all a combination of this transmitter and receiver should provide the answer to the larger group of modellers who wish to limit themselves to six channels initially, intending to progress to Bi Simultaneous, twelve channels (if necessary in stages of two). The makers will carry out the necessary conversion to dual simultaneous, and add the appropriate tone stages with their associated key switches, which are catered for by the circuit board and case construction (removeable chrome buttons occupy the switch holes). Extra wires are connected to the receiver which of course should be returned for the purpose of setting up the transmitter tones. Alternatively, one could then change over to their superhet receiver.

Test Figures

Modulation Frequencies —
(Mid range of pots)

c.p.s.	*Channel*	*Typical Pot Range*
525	3	
475	4	
425	7	400 - 450
380	8	
350	9	
335	10	310 - 360

Total Currents —

	Carrier Wave	*Modulation*
Extended Aerial	50 mA.	36-37 mA.
Collapsed Aerial	42 mA.	34-35 mA.

R.F. Output —
100 mW. + Field Strength High Ground range with R.C.S. 6 channel super-regen Rx 1,000 yds.

Physical Data — Transmitter

Size: 5¼ in. wide; 3⅛ in. deep; 7 in. high + ⅞ in. high carrying handle on top, and ¾ in. projection of keying switches on front.

Aerial retracted, projects 8¾ in. from top of case.

Aerial extended — 43 in.

Weight: 3 lb. 4½ oz. including battery.

Batteries: 12 volts (two PP1s in series).

Controls: 3 two-way centre biased Bulgin switches, light spring specials, 1 toggle on/off switch.

Case: Pressed steel silver grey hammertone finish with clip-on back giving access to batteries and shrouded trim pots tone section.

Extra: Test meter is supplied to plug into the twin sockets on top of the transmitter. It is a miniature meter which is modified to read R.F. output or battery volts under load. A slide switch on the meter box facilitates the change over and two miniature sockets provide additional connections for use with other equipment, so that it may be used as a Milliameter. The meter costs £4.0.0d. but is provided free to purchasers of a complete 12 channel outfit with 6 servos. The servos themselves are exceptionally light weight, only 1¾ oz. using a Microperm motor and the ever popular "T.A.S.A." type single battery servo amplifier for 7.2 volts. We shall deal with the servo in a separate test report later.

Manufacturers, suppliers, and prices

Min-X equipment manufactured by: Min-X Radio Inc., 6555 Oakland, Detroit 2, Mich., U.S.A. Obtainable from Ed. Johnson, The Drug Store, Larkhill, Wilts.

Prices:

Min-X "Powermite" Tx	£15.3.4d.
Min-X "Compact" Rx	£12.0.0d.
Min-X "Sportsmaster" Rx	£10.0.0d.

R.C.S.

R.C.S. equipment manufactured by: Radio Control Specialists, National Works, Bath Road, Hounslow, Middx. Obtainable from manufacturer and model shops.

Prices:

6 Channel Tx	£34.0.0d.
6 Channel Tx + 6 channel Super-regen Rx	£48.0.0d.
Test Meter	£4.0.0d.
Transistorised Multi Servo	£8.10.0d.

Starting with R/C Boats

Part 3 : By R. P. Meredeth

AS mentioned in part two, I was fast becoming aware of the fact that electric motors for propulsion in boats had their limitations, even though they also had many advantages. Weighing the pros and cons of electric propulsion, compared to I/c engines, I decided to have one last fling with the former type of power unit.

Glass Fibre Electrics

My fifth model was another M.T.B. and was constructed on 48 in. L.O.A. a glass fibre hull which I acquired through a local model shop. It was cheap and had obviously been ill treated, for it had a hole in the side, the whole hull was cracked along the keel and starboard chine. The hull was one of the early RipMax variety and had very smart lines. I jigged it up for correct alignment with temporary bulkheads made from hardboard, and after opening up the cracks to give a better key the whole internal structure received a further two layers of strand matt, saturated in resin, from which (not without difficulty) all air bubbles were extracted, so making a really sound hull. Up till then, the outside surfaces were patched up and the whole hull was fitted up, painted, and power units and servos were installed. The weight of the hull was almost doubled possibly due to the glassfibre reinforcement. ' For power supply, I chose two Hughes 12 volt motors running in series and driving a pair of screws. The model was fitted with twin rudders, speed control was affected with a variable resistance as described earlier in this series. It was controlled by two of the six relays with two for steering (Rod and Jockey) and two for special effects, or to change over in the event of one relay going u/s.

Exide accumulators provided the power. It was taken to a local contest for test rather than to compete. It had the appearance of a smart fast model but when it was launched and "full ahead" was selected, it was so disappointing that I almost hid my face in shame. The trouble was too much weight aft (the C.G. must have been somewhere at the end of the wake), in fact, it only wanted a good wave to lift the bows and the whole lot would have gone down stern first.

My First "Twin"

Had I used Venners Silver Zinc accumulators, it would have been a different story, but from my unfortunate experience of the past, plus the cost of such accumulators, this was out of the question. Within a week, I had virtually torn out the innards, including the twin shafts, twin rudders, and both the Hughes motors, and installed a single shaft and rudder to suit. The power unit was one of the very first Taplin Twins. Came the day of launching at a local derby at Bourneville, a faulty steering motor prevented my taking part. Eager to run the boat, a pal and I moved further down the pool away from the contest area, running the boat free, back and forth across the water; didn't we "wind it up", its speed was almost fearsome, particularly if it was coming towards one prior to turning it about. Unfortunately my friend, in turning the model about, made no allowance for the wind, with the result that just as Arnold Wilson of Birmingham I.R.C.M.S. was negotiating the channel in a steering event with his electric M.T.B., this purring monster came hurtling down the channel missing all the buoys doing it clean. Come to think of it, such navigation was remarkable, since there was no radio in control. Arnold just managed to move his boat in time, so avoiding what could have been a very nasty collision as his model was all wood construction. It is obvious which would have suffered most. Fortunately, it all ended happily.

"Diesel/Electric"

Now, since imitation is the sincerest form of flattery, I decided I wanted the model to move ahead, stop, and be able to go astern as desired. To this end I attempted to copy a past master at the art of engineering and radio; Arthur Bailey, who also had an M.T.B., which did just that without the use of a V/P screw. It was effected by a sequence of power, i.e. Engine, Centrifugal clutch and electric motor both driving on the same shaft. Its operation was such that the clutch did not engage at low revs with the engine working. One side of the clutch unit was connected to an electric motor, which in turn drove the screw so that, below say 2,000 r.p.m. the model could do everything an electric boat could do, but for that extra bit of zip. All one had to do was to advance the throttle, whereupon the engine engaged the clutch, the electric motor went open circuit through a switch connected to the throttle arm, and away it went as fast as the engine could pump it out (Well Arthur's did) but my efforts were attended by certain shortcomings.

Having tasted speed like the ton-up boys I wanted more, but before performing a major operation I secured the first prize in the special effects class at the 1959 Premier Contest of the I.R.C.M.S. at Hull. Using similar gear to that in the 1958 Model M.T.B.

This time everything worked, and the effects also brought me the I.R.C.M.S. Challenge Trophy and Replica. Preparation of this type of model takes considerable time and since the electrical circuits are numerous, there is also the ever present risk that a fractured wire or "short" caused in transit could scupper your chances. I do feel strongly that to ensure that a model is working perfectly, every competitor should be allowed a brief period on the air to test his gear.

Four Strokes

The next move was to sell the twin and purchase a Gannet 15 c.c. O.H.V. It was some engine, but it brought with it problems of steering, even with a balanced rudder, it takes a fair amount of power when using a large engine. A new steering unit was constructed, consisting of a Taplin geared industrial motor driving a nylon ex-W.D. worm gear matched to a steel spur on the top of which was mounted a fibre arm travelling 60° (30 each side of centre) between two limit switches. Total transit time was 2½ seconds. It functioned perfectly. The only snag was that it proved much too fast for the Bourneville pool. This water often became crowded with small boats and it is an easy matter to unknowingly run down and sink a youngster's pride and joy, to the consternation of angry parents. Some of the small free running models are often lost to view in the wash of a fast boat.

Spectators

Then you come up against the Al. Read type of situation; boats belting down the pool at a high rate of knots, curious by-stander bent on making himself known steps forward almost knocking your transmitter out of your hand. You've met 'em. "Did you make it?" Reply, brief and to the point, "Yes". Bystander; "I was thinking about making one like that". Reply (still watching model); "Oh Yes". Model is turned about to travel in opposite direction. Bystander moves to the other side of you concealing model from view. Bystander; "How much did it cost?" Casting furtive glance over his shoulder, you observe model nearly up on the bank the other end of pool, swinging it hard over, you hiss through your teeth in so doing "It's difficult to assess with all the labour involved". Bystander; "I once made a super duper scorcher 7 ft. long, but didn't have time to finish it". Terse reply "Oh Yes". Boat is now halfway across pool when bystander decides to move to your other side, just as an A class yacht seems destined to cross the path of the model. Bystander in moving trips over the lead to your battery box, pulling out the plug in doing so, before you can take action to avoid the yacht.

Then that awful crunch, yacht becomes dismasted, model out of control, travelling at a fair bat, clouts the concrete side of the pool, stoving in the bows and slowly settles down in the water. You know before you get there what to expect; almost a week of repairs, drying out the radio (and if it's salt water you've probably had it, unless you act quickly and flood it with fresh water first before drying out). Meanwhile, the bystander, being far cleverer than you, has scarpered before you have chance to vent your anger. If only people would wait until you have the boat on the stand before asking questions, which you would answer with pleasure when the model is safe, but possibly that's asking too much. Now before some avid reader decides to write and say, self contained batteries in a hand held transmitter would have prevented such a situation, I would point out that I agree the point but also emphasise I prefer large capacity batteries, since they last longer and more important still are substantially cheaper.

The moral to be taken from the above fictitious example; The faster the model the quicker you have got to be on the button.

Book Review

CONDUCTED BY

T. H. IVES

"TRANSISTOR CIRCUITS FOR RADIO CONTROLLED MODELS" by Howard Boys. Publishers Bernards (Publishers) Ltd. Size: 9½" × 7¼". 60 pages with 59 line drawings. Semi-stiff cover.

THE author of this interesting book is well known in model aircraft circles and is very familiar to the older members of the aeromodelling fraternity. His interest in Radio Control dates back to the very early days and he is thus well equipped to present a book giving as it does a résumé of the many and varied systems in use today.

The first section is devoted to explaining the uses to which a transistor can be put and includes some drawings and symbols to help the uninitiated.

Simple receiver circuits using a valve detector followed by one or more transistors lead to more complex systems using all transistors. An interesting superhet is included.

The transmitter section covers some simple valve circuits with transistor modulators and a circuit for an all-transistor low power transmitter is given.

One small section deals with Rx. output circuits and drawings of a proportional actuator for use with transistors are given.

The latter half of the book covers commercial circuits and some successful systems developed by well-known personalities abroad.

One interesting item is a mention on page 53 of a tuning fork stabilised tone generator. The multi boys do have trouble (less frequently nowadays) with tone frequency drift and this idea seems worth following up. It would, of course, need special tuning of the reeds initially.

A useful book which we can recommend to the modellers who wish to know more about transistors.

SWITCHER

(*Continued from page* 145)

a relay; valuable time is lost as the armature contact changes over from one contact to the other, so readers would be well advised to stick to the commutator idea.

Mechanical Construction

A nice solid engineering job as used on the original system, would ensure even mixing of the tones and consistent performance. Rigidity is the most important feature of the construction, and any readers wishing to modify the working drawings shown here should pay attention to this requirement.

The speed of the motor should be about right when run on 1.2 volts. The reason for a two part switching disc is that the motor speed on a higher voltage is insufficient to obtain the required repetition rate. If a lower rate of repetition is required, a variable resistance may be put in the circuit, and a higher voltage used, say 1.5 or 2v. The rest of the construction should be self-explanatory from the drawings, but it is worth stressing that solder should be kept away from the parts of the printed circuit track over which the wipers pass.

Correction

A correction is necessary to the "Half Pint 8 Receiver" which appeared in the June 1963 issue. The component wiring; Fig. 8 on page 283, was incorrectly lettered in that the emitter and collecter of Tr1 were transposed. The same mistake occurs on Tr4. This, of course, should have been obvious from the theoretical diagram in the previous instalment. The same error was transferred to the component placement list on the same page, i.e., emitter to hole 46, collecter to hole 28, and the case connection to hole 48. Tr4 emitter goes to hole 65, and its collecter to hole 63.

On page 282, the bottom of C7 goes to hole 32. The author recommends that a silicon transistor of not less than 60 or 70 gain should be used in the final stage if the receiver is oversensitive to temperature change. The original receiver performed successfully between 10° and 35° C.

Commercial Developments

By
TONY
DOWDESWELL

CONSUMER STAFF MEMBER SAMPLES NEW PRODUCTS AT HOME & ABROAD

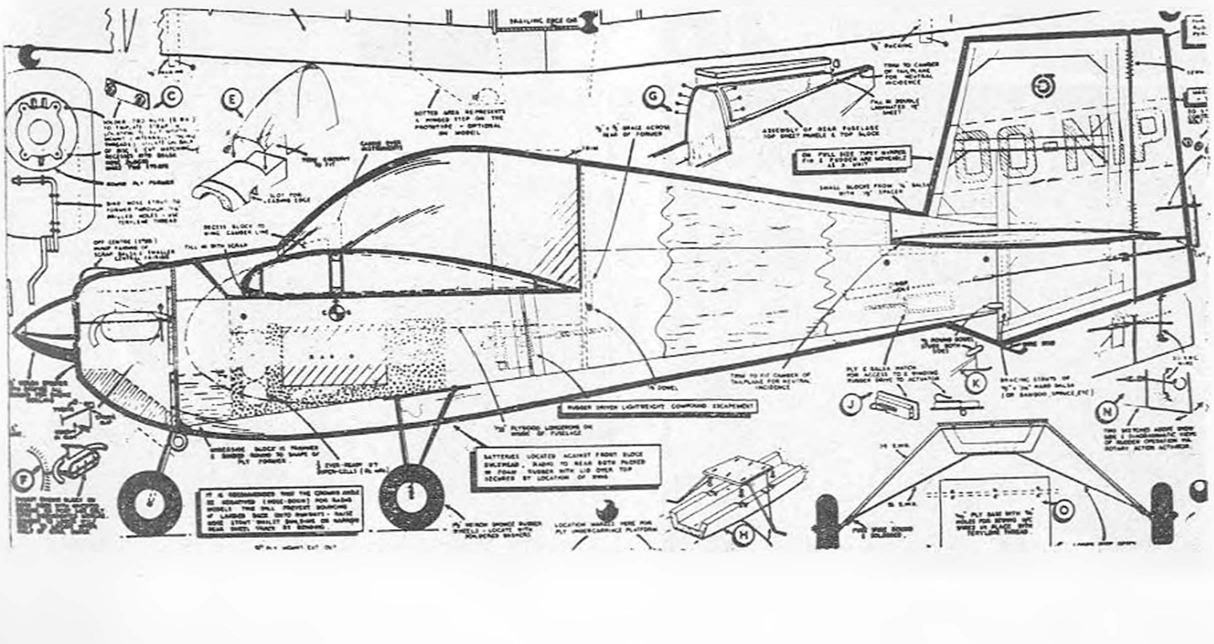
COMPARED with countries like Germany and U.S.A., offerings of model aeroplane kits for radio control in Britain have been modest. **Veron,** however, have introduced a couple of new R/C model kits during the last two years and are all set now to launch another. We have always considered Avions Fairey's **Tipsy Nipper** a cracking subject for scale radio control and now it has been made just that much easier by the introduction of the Veron kit. This 34 in. miniature is ideal for lightweight radio gear (up to 6 oz.) and small .5 to .8 c.c. motors and the 220 sq. in. wing with thick, lifting section should help to make it quite spritely.

The kit contains pre-shaped bottom, hatches, leading and trailing edges and die-cut parts, pre-shaped undercarriage legs, wheels, spinner and cockpit, tissue and a meticulously detailed plan with ten illustrated construction stages. There has been quite a clamouring for this one at the office and we feel that Veron's Tipsy Nipper will be very popular among the sport fliers. Price for the kit is £3.3.0d.

From **Cosmic Hobbies** came a neat **nylon battery box** for four pen cells (6 volts). This is well made and should not break, since it is flexible. Contacts are arranged so that it is not possible to fit pen cells incorrectly and receiver connections are made to the male and female press stud connectors on the lid. Not all receivers however require 6 volts, and 4.5 volts is more common. In this case, one cell may be replaced by a block of wood. To complete the circuit, use a drawing pin at one end of the block to simulate the negative pole and a round-head stud or wood-screw in the other as the positive pole, connecting the two with a piece of hook-up wire soldered in place. Size is $2\frac{3}{16}$ in. x $1\frac{3}{16}$ in. x $1\frac{3}{16}$ in. and the box adds only .3 oz. to an installation weight. Price, at 4/-, is very reasonable.

Also from Cosmic comes an **Adjustable Control Link** with clevis end to attach to a control horn. The sample received reminded us so much of the key links in our IBM electric typwriter that we immediately had the latter apart to compare and to discover that the two links are the same design down to the joggled end opposite the clevis. The fact that this item was originally designed for a rather different use does not, however, detract from its usefulness for attaching push rods to control surfaces because for this application it is ideal, and the fine thread permits very

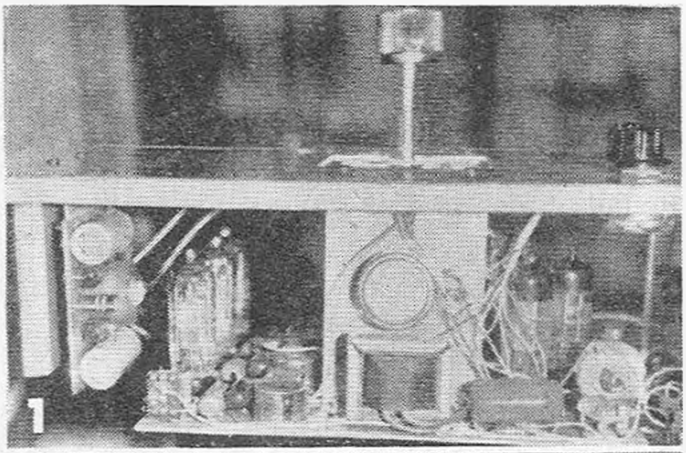
Extract from Veron's Tipsy Nipper plan displays well detailed constructional sketches. Fin is slightly out of scale to improve flight characteristics.

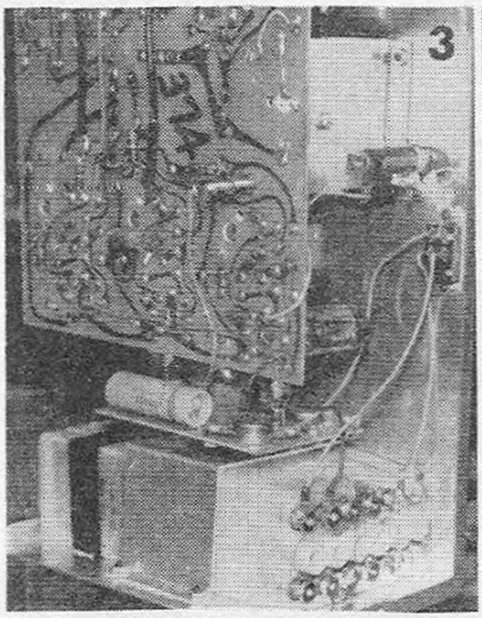


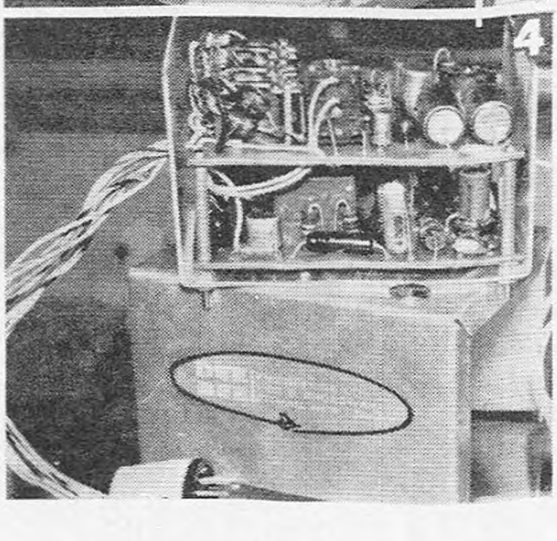
accurate adjustments. It is very light, only about ¼ oz., but we do wish the stem were a little longer and that it were cheaper than 5/-.

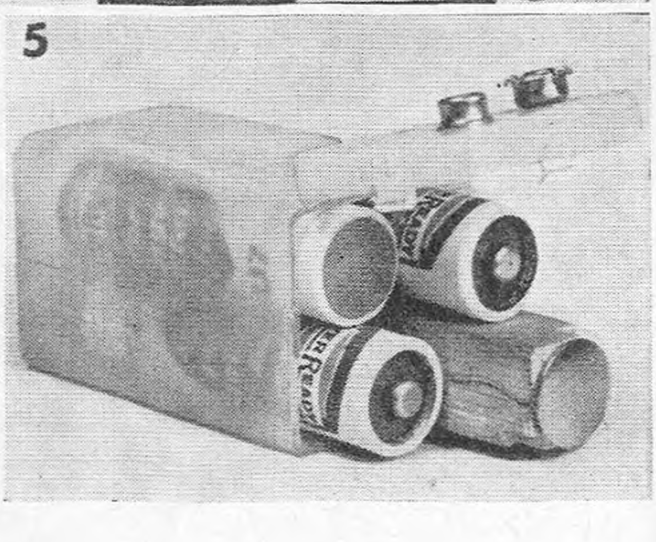
Our last readership survey told us that our readers have a considerable interest in tuned filter receivers. One radio control dealer who has devoted considerable effort in the development of such circuits is **Malcolm Douglas** of York. who has now published some of his conclusions in a ten page (size 10 in. x 8 in.) **Circuit Manual.** A number of circuits are published therein. The first is a 9 volt all transistor super-regen receiver designed as one unit to drive succeeding filter stages. Several filter stage circuits are provided,

1, Printed circuit component board of Dee Bee Quadruplex proportional transmitter. 2, Complete Quadruplex system, with receiver and servos wired to demonstration rig. 3, Power converter and rechargeable cells in transmitter. 4, Close-up of Quadruplex receiver with case top removed. 5, Cosmic Hobbies nylon battery box with pen cells. Note wood block to replace fourth cell.









Complete Digicon proportional control system with Bonner Duramite closed loop servos. Note that all is ready wired for installation. Rudder and engine are controlled from the left hand transmitter column and aileron and elevator from the right hand.

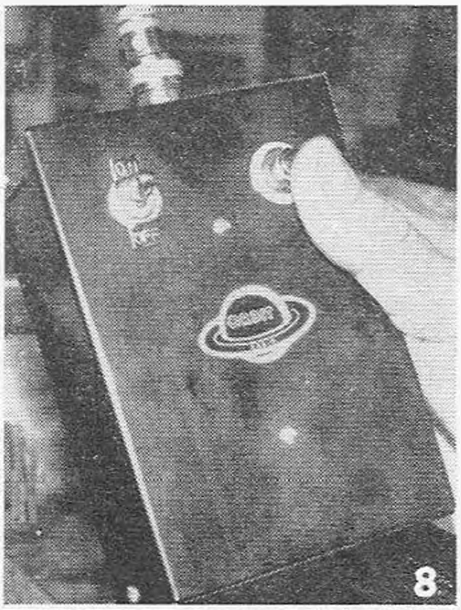
for relay operation with a Jaico "Tini-Mite" relay or relayless with direct output into a Bonner Transmite servo with positive signal and negative for Servistor or Transitone Electronic relay servo switchers. All the filter circuits are designed around the Rameco Filter Units.

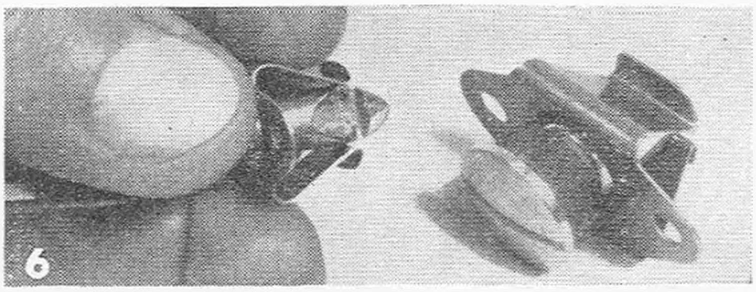
Another circuit is one for an all transistor transmitter to match the receiver and filter units, the manual thus comprising an entire set of circuits for one complete system. Input power to the final R.F. stage is approximately 100 mW., and the set works off 12 volts, supplied by eight pen cells or a suitable pack of nickel cadmium cells. It is designed for tone operation, but could also be built without tone circuits for use with carrier wave receivers. Modulation level is 90-100 per cent, depending on tone frequency. The Circuit Manual costs 3/- and printed circuits are available for the receiver, transmitter and relay filter circuits.

A complete kit of parts is also obtainable for the **receiver (RX 1)** which comprises four transistors, five electrolytic and five non-electrolytic capacitors, eleven resistors, ready wound R.F.C. and tuning coil, high quality printed circuit board, clear plastic case, knife edge miniature slide switch, wire and printed circuit solder, plus press stud battery connector. The kit is well presented with sets of components in small plastic bags. Extras such as slide switch and battery connecter make it just that little more complete and worth £3.0.0d.

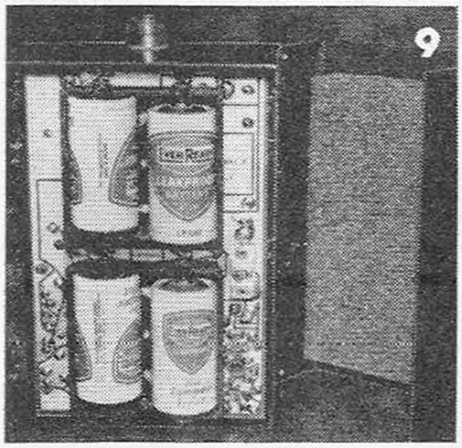
Malcolm also sent along a picture of the new **Digicon proportional** system designed and manufactured by Californians Doug Spreng and Don Mathes. This is a transistorised set providing four fully proportional controls. All receiving end electronics are in the receiver box and none in the servos which are Bonner Duramite Closed Loop type. Transmitter provides ¼ watt output with non-centre loaded aerial and as can be seen from the illustration there are two control sticks, with trim adjustment on each control. We also like the ready made wiring harness. Price for the complete system comprising transmitter, receiver, four servos, Tx and Rx power units, switch, universal charger, plugs and sockets is a mere 500 dollars, £250 in Great Britain. Expensive, eh! Well its something to buy when we come up on Bingo next time.

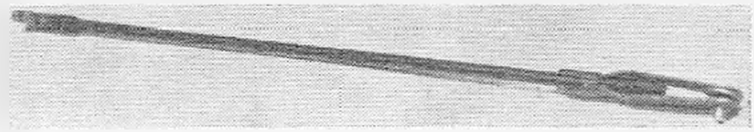
Another kit comes from **Remcon Electronics** who have introduced an inexpensive **transistor amplifier** for the Bonner Duramite servo. This has all British components including six transis-





6, Oddie Fasteners. Note how the stud of the fastener held between fingers is twisted, prising the clip apart. 7, Preformed components of Veron's Tipsy Nipper kit. 8, Front face of diminutive Orbit T1 all transistor single channel transmitter. Uses centre loaded aerial. 9, Back of Orbit T1 removed to reveal battery clip. 10, Cosmic Hobbies Adjustable Control Link.





tors and eleven tiny 1/10th watt resistors. An interesting feature is that all components except transistors sit flat on the baseboard which has an excellent etched circuit. This kit is not difficult to build, in fact it goes together in double quick time and we have enjoyed good airborne results now for several weeks. For those "going relayless" it really cuts the cost of equipment at £3 per kit and it's really fun to build with explicit instruction sheet. We shall be saying more about this next month.

Some interesting little samples we obtained are **"Oddie Fasteners"** which are just the job for holding down hatches on both boats and aircraft. The fastener comprises a stud, washer and clip. The double grooved end of the stud appearing rather like a barb from one elevation, pushes down between two spring leaves of the clip, the barbs preventing the stud from being extracted unless it is twisted through 90 degrees with a screwdriver. Twisting the stud in this manner prises the spring leaves apart and permits effortless removal of the stud. For use as a hold down for hatches the clip should be anchored by its lips at either end and the hatch sandwiched between the head of the stud and the rubber washer. Manufactured in a range of sizes and variations by Oddie, Bradbury & Cull Ltd., Portswood Road, Southampton, this company will supply small quantities direct. These little fasteners are worth a try.

Experimenters and modellers who employ government surplus equipment should not miss the latest **Arthur Sallis Catalogue** containing illustrated details of the useful equipment available from this 93 North Road, Brighton, company. Boat modellers looking for a suitable electric propulsion motor should take a look at the wide range available, plus accumulators, relays, gear units and special switches, all of which should be of interest to tinkerers and in particular, boat enthusiasts making complicated delay and sequence control systems. Furthermore, a whole range of radio components are available and an extensive list of meters (we counted 38 different types). The catalogue costs only 2/-, plus 6d., postage, is credited against any subsequent equipment order worth £2 or more excluding postage.

Just before closing for this issue, we visited **Henry J. Nicholls'** shop at 308 Holloway Road, N.7, to see a sample **Dee Bee** proportional radio control unit in action on the counter where Henry had rigged it up. The Dee Bee system, imported from U.S.A., is triple proportional (rudder, elevator and aileron) with positionable engine control. The receiver is a super-regen with a valve detector stage and a built in power converter to feed the valve. With the decoding stages this forms a hefty 10 oz. pack.

The servos are switched by relays, three Dee Bee proportional servos for rudder, elevator and aileron (tested *R.C.M. & E.,* August 1963) plus an Annco low speed servo for motor control. Receiver size is 3¼ in. x 2⅝ in. x 2⅛ in.

Transmitter is a 6 lb. affair with a case size of 12 in. x 9 in. x 4 in. Main control stick moves left and right for aileron, up and down for elevator and a centre sprung knob atop the stick controls the rudder function. Motor control is operated by two buttons in the top of the case and next to these is a toggle switch which when thrown to the "up" position couples the rudder and ailerons via the aileron axis of the control stick. In the down position the transmitter is triple simultaneous and the rudder uncoupled. Transmitter uses valves throughout but there are no dry batteries, nickel cadmium cells and a power converter being a feature of the unit.

The Dee Bee proportional system is definitely a clever system designed by modellers. Compared with some proportional units which, so we are told, are on the way, it is less complex, for instance the servos wiggle a little. However, as we saw at Kenley last year, it is very effective in the air. After only a few minutes of playing with it on the bench however, it became obvious that here was a completely different form of multiple control system, likely to take just about anyone right back to the raw beginner stage. The system, complete with servos and excellent instruction manual may be supplied for the quite reasonable sum of £125.

Also available from the same shop is **silk** and **nylon** for model covering. Silk is available in the following colours: white, yellow, orange, burnt (deep) orange, red, lustrous pink, purple, black and red/white checkerboard. Price per square yard is 7/6d. Those prefering tougher nylon can obtain this in red, white or blue for pieces size 36 in. x 45 in. price 8/6d.

Just arrived, the very day we visited "308" was a sample of the new **Orbit T1** single channel transistor transmitter. This is very small in size, only 5½ in. x 3¾ in. x 2⅝ in. and very light. It is crystal controlled like all American commercial Txs (regulations out there) and has a tone frequency of approximately 400 c.p.s. It works off four U11 size cells which fit into two battery clips mounted direct to the neat printed circuit board. Anodised in the customary Orbit black, the transmitter costs about £15 though to the best of our knowledge, an Orbit receiver to match it is as yet not available, although reportedly on the way.

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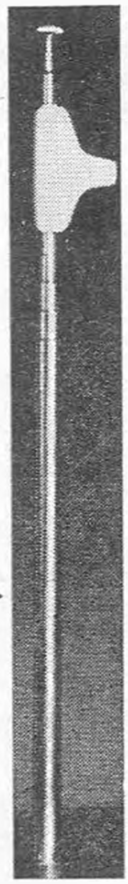

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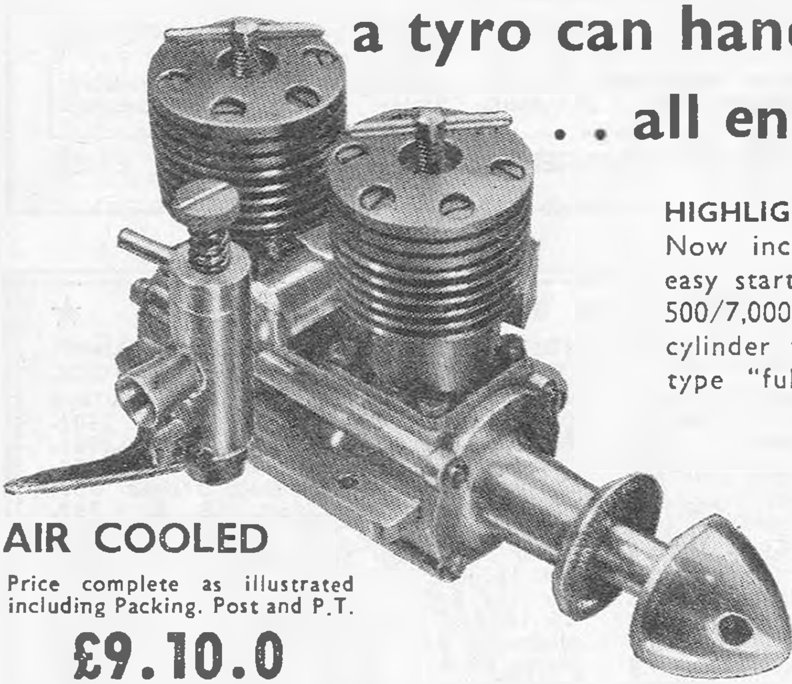

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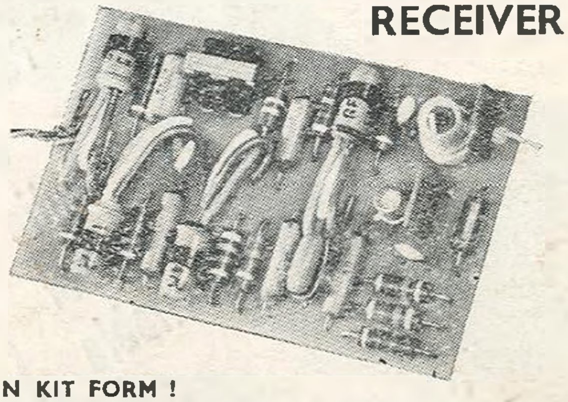

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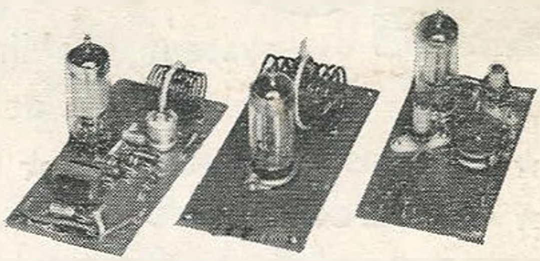

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Corrections to Miniten Transmitter — July 1963

1. Circuit

(a) 2.5H Vinkor should read 1.5H.

(b) 0.005 connected between pins 1 and 5 of DF97 correct on circuit; 0.02 shown on printed circuit layout.

2. Printed Circuit Board

(a) Top left hand corner: the land should stretch down to connect the 470K to the modulation side of the 1.5H pot core.

(b) 0.2 should be 0.005.

(c) The land between the 27 Mc/s Xtal and the bottom of the tuning coil should be connected. as shown, the coil is not connected to anything at the bottom end.

(d) The centre tag of the 3-30 pf trimmed is not connected to anything. This should go to the same land that carries one end of the tank coil. The other end should (i.e., side tag) be soldered into the slotted hole.

(e) There is no tag hole in the lands for the aerial link coupling; this should be soldered to the common negative land at the point nearest to the two holes in laminate provided for it. The arrow on the Printed Circuit layout points to the tank coil.

(f) The grid resistor after D97 should be 6.8K.

Note: The Remcon P.C. board and components as supplied by H. L. Smith are correct in every detail and no alterations to the board and components are necessary if one is not etching the board.