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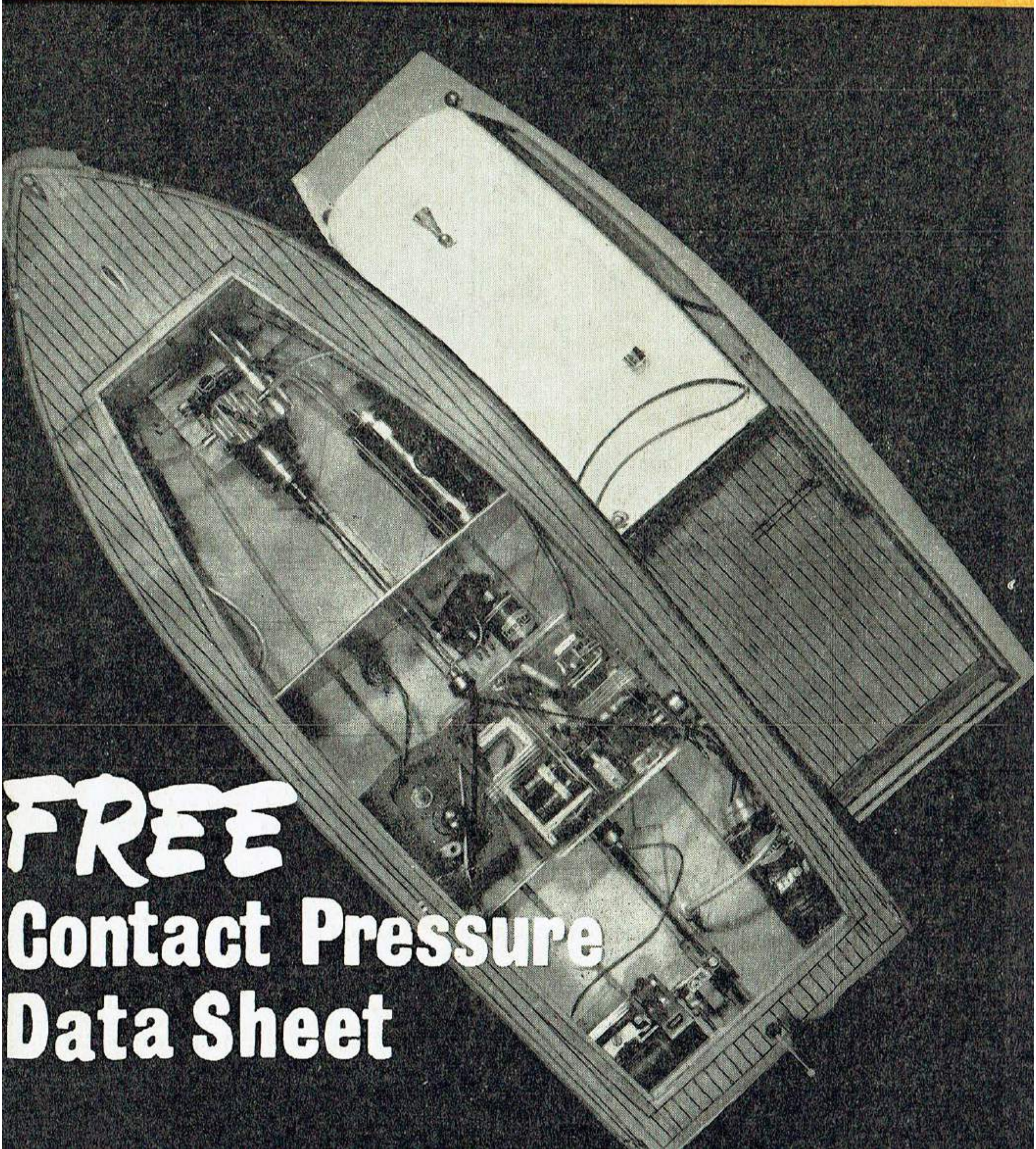

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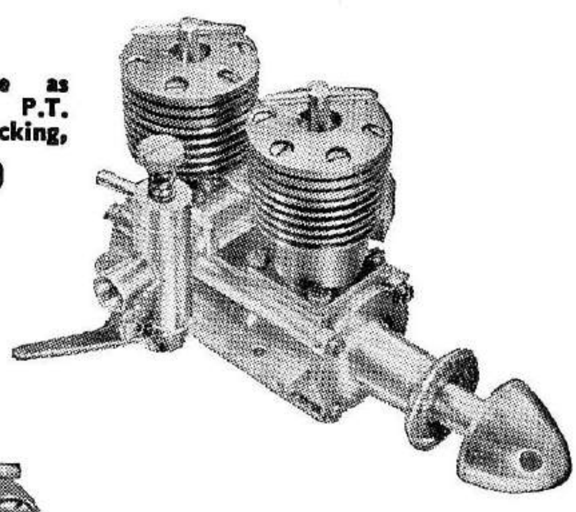

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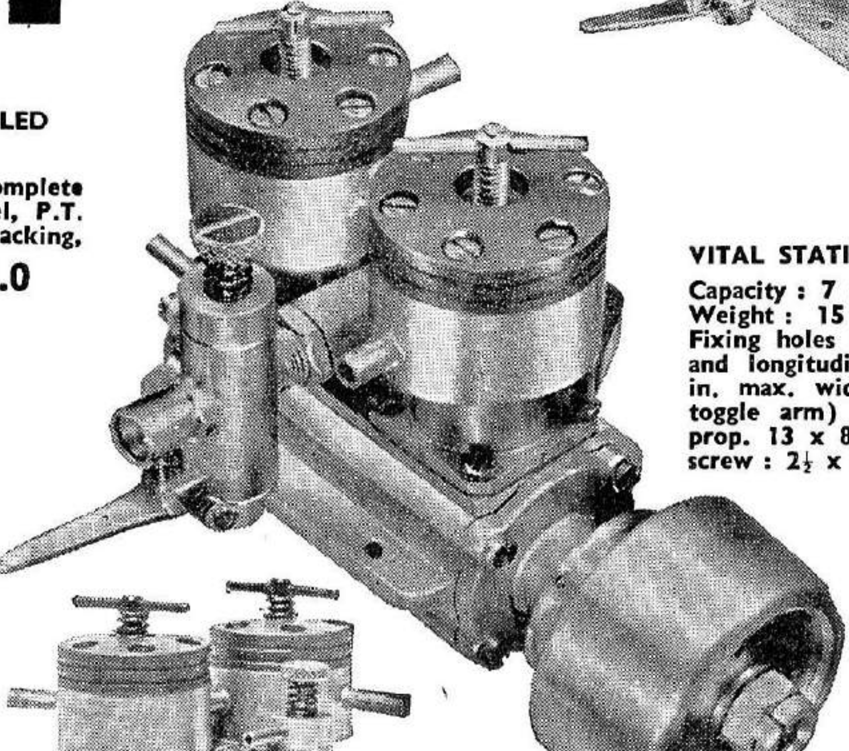

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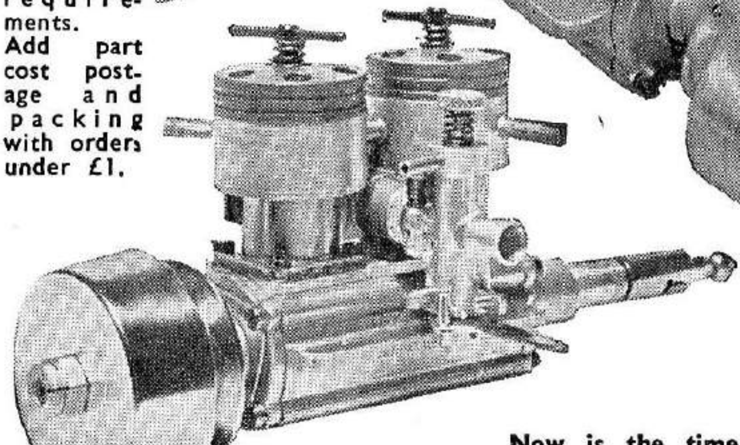

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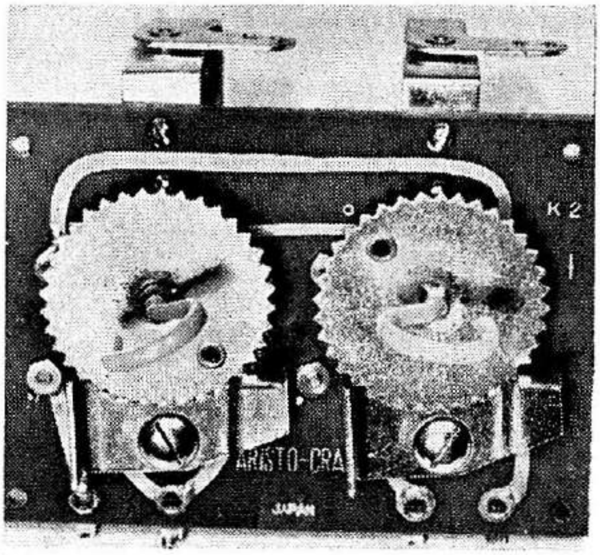

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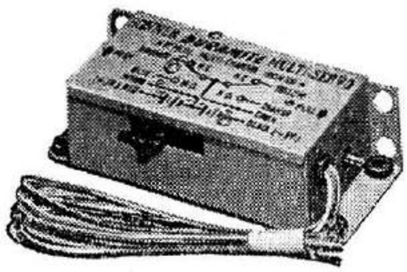

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Radio Control Models & Electronics

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Here, There & Everywhere

Snoozing Lion ?

"DON'T you think you are a bit too pre-occupied with foreign equipment?" so said one of our many R/C visitors at the recent International Boat Show, where we were showing models in association with the *Daily Express*. Our rejoinder was: "Of course we are! There just isn't enough British equipment to make a song and dance about!"

On reflection, we wondered if we had been unduly harsh in that spot assessment, and started to think what the British radio control market amounted to as at today's date. Alas, it does not require any very long thought and consideration. Two major British Rx. and Tx. manufacturing concerns, only one of which is, as yet, keyed to adequate production, plus a small number of small producers, either "garden shed" boys or larger firms toying with R/C accessories as a not very important sideline. Amongst kit producers only the model boat side is catered for to any extent, though here it is fortunate that virtually any boat kit of 18 ins. or more l.o.a. can be used for R/C. The model aircraft potential must be enormous, but what do we find? Established kits are *two* in number only—the near veteran *Junior* 60, on which so many tyros have "solo-ed" and the near extinct *Radio Queen*.

All praise therefore to Henry J. Nicholls who scores a notable first with the release of *Galahad*, which we hail as the first all British *modern* R/C kit. Others have designs in the prototype stage, we have seen Phil Smith's projected Veron *Viscount* job, and very lovely it looks; *Uproar* in its latest version may ultimately be kitted; but why are we waiting? The lucky dealers who have handled the token quantities of such kits as *Orion* and some of the De Bolt products know that mere price is no barrier, there are literally hundreds of would-be purchasers with their money ready.

In the same way enthusiasts are eagerly buying American and continental Rx. and Tx. and fairly high-priced accessories, notwithstanding the maintenance and service problems which are legion. Here again, British manufacturers are at the prototype stage with comparable sets, which must, by virtue of the saving in import duty and labour costs, be available at about 75% of the cost of foreign equipment and enjoy the great virtue of convenient servicing facilities.

At a conservative estimate there is an open market for development with a *present* potential for at least £100,000 per annum, and, given the right products, almost unlimited expansion. When will

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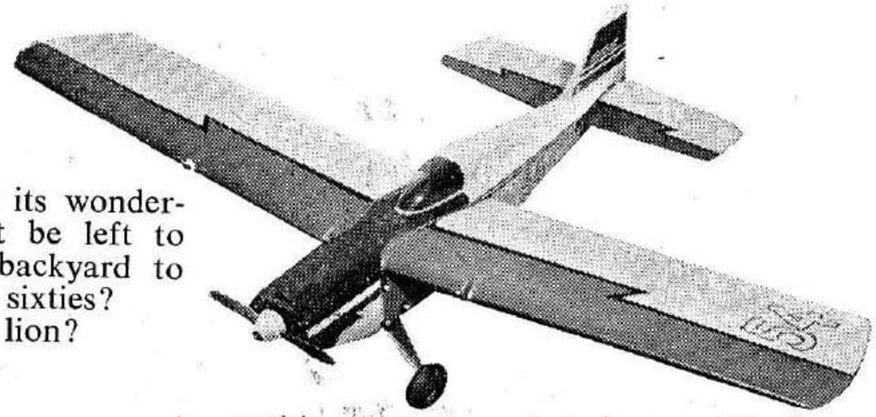


Phil Smith's prototype of the Veron Viscount, now released for R/C. Span 54 ins., for 2.49 to 5 c.c. engines.

the "big boys" wake up to its wonderful possibilities, or must it be left to some new Morris of the backyard to be the R/C tycoon of the sixties?

Won't someone dig that lion?

Boat on the Cover

Pirana, this month's cover picture is a monohedron hulled boat designed by Vic Smeed as a *Model Maker* Christmas design. Our interest lies particularly in the R/C gear installed by David Connolly, a regular contributor to *R.C.M. & E.* Using an *Aeromodeller* Transistor Rx. it features proportional rudder control with instantaneous response, coupled with engine speed control, all achieved via a simple single channel receiver! Engine is a Frog. 3.50 with twin needles, one adjusted for high speed running only, and one which is cut in at low speeds. Altogether a set-up which does a lot with relatively inexpensive gear and one which we hope David will write up for us when full trials have been completed.

That Flying Scale R/C Contest

Mr. G. A. V. Marsh, President of the Sutton Coldfield R.C. M.A.C., whose excellent case for a flying scale R/C contest in this year's calendar was published in a recent issue of *R.C.M. & E.,* writes that his club are now implementing their argument by including just such an event in their rally to be held at R.A.F. Wellesbourne, Warwickshire on May 7th, 1961. The contest will include both single and multi-channel types, with models also being judged for finish and true scale detail.

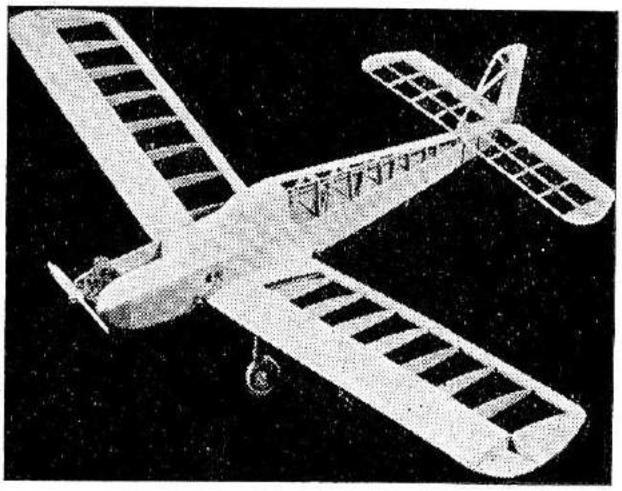
Three trophies have been donated by club members for this and two other "ordinary" R/C events to take place at the same rally for functional single and multi-channel, plus second and third place awards in each event.

It is hoped that other organisations will be encouraged by this to include similar events in their programmes, particularly at national level. Club competitions secretary, to whom application for entry forms should be made, is R. Masters, 30 Western Road, Wylde Green, Sutton Coldfield, Warwickshire.

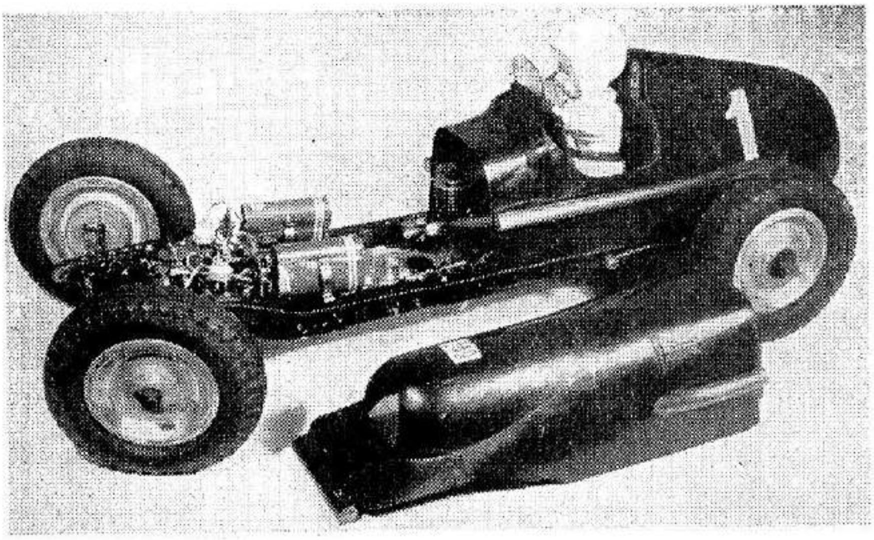
Even if a scale model is not yet on *your* production line, there is still time to include it, so treat this as a challenge and give the Sutton Coldfield boys the support they deserve.

Appointment of Assistant Editor

We thank the many enthusiasts who rallied to our enquiry for an assistant editor. We have, however, appointed from our existing staff Peter Holland who will be known to many readers of our sister magazine, *Model Maker,* for his series of "space models" a year or two ago, for his R/C tug in a bucket which enlivened more than one TV programme, and for a variety of other models which he has produced over the years. A keen R/C enthusiast with a glorious impartiality for boats, aircraft, cars and bug-eyed-monsters his particular *forte* lies in ingenious applications of the basic signal. Added to this, he has the valuable asset of artistic talent which will not be wasted in future issues of *R.C.M. & E.* Tommy Ives continues in his capacity of Consulting Editor, and should have more time for original creative work.



Mercury's Galahad, shown uncovered. This R/C kit is for 1.5 to 2.5 c.c., single or multi R/C. As shown, weight is 27 ozs.



Jerry Buck's R/C car, one of the earliest to be so controlled, which most of the R/C pioneers will remember. (Photo: A. Hamer).

The Ideal Reviewer

Our plea for an Admirable Crichton to conduct our Test Reviews has met with an immediate response from none less than Chris Olsen, whose offer to try his hand in this direction we welcome with open arms. There are not enough sets in production and readily available to provide such reviews every month, but the very next one along will be going to Chris for his critical observations.

We do not know who will be the brave manufacturer to set the ball rolling, but we can assure him that Chris will be completely fair, pull no punches, give praise where due, and condemn nothing without chapter and verse for his statements. As one of Britain's—no, one of the world's—leading *practical* exponents of multi-channel flying he knows what is wanted, has tried most of the better known commercial equipment, and, indeed, until recently built all his own. As such his views on equipment will be accepted as expert opinion and for that very reason will be most carefully weighed . . . finally, his employment is in the field of electronics, so that he is adequately equipped for the technical side of reviewing.

Radio Control for Model Cars

Our big sister *Model Maker* is this month adding *"and Model Cars"* to her title, and increasing in size by eight pages to give even wider coverage to this aspect of modelling. We were therefore delighted to turn up a picture of Jerry Buck's old No. 1 car, with its doll at the wheel, which, to our recollection was one of the very first successful cars to be radio controlled. We can remember No 1 proceeding at a flat out 5 m.p.h. on the canteen floor at Rist's Wire Works, Stoke-on-Trent, where so many early diesel rail-racing meetings were held. That hectic speed was by no means to be despised since it required every ounce of concentration to keep that doll steering round a tin can pylon course. Jerry Buck is now more interested in boat R/C, but perhaps even yet old No. 1 is chocked up against a veteran appearance some day in the future.

The Nice Things People Say . . .

We are happy to say that bouquets seem to be getting well ahead of the brickbats (though we treasure these too since they are nearly always completely factual and not mere abuse of the "Dear Pig" type). Our good friend, Paul Runge writing in his bi-monthly *Grid Leaks* gives us a wonderful boost for the busy months ahead with, ". . . for an infant it has made a decided impact . . . will have a bright and glowing future, we predict, if they follow in the gigantic footsteps with which they have begun".

Grid Leaks, by the way, can now be subscribed in this country with a minimum of trouble through the good offices of our regular advertiser, Malcolm Douglass, to whom application should be made. It is a treasure chest of valuable practical material and should be on all enthusiasts' subscription list.

Another little bouquet, this time for "Modulation" Cuckson comes from Australia, where our reader writes of that series of articles, "Gets more into a few words than I've gained from two years of solid experiment with modulation systems for R/C". Which, of course, emboldens us to hope that friend Cuckson will be back with more in the very near future. Others have written with kindly words like "excellent", "Jolly", "splendid", "fine", all of which cheer us up a lot.

Speed Trials

So many readers have expressed interest in FAST Club activities that we have digested this report by Ken Willard on the original FAST meeting at Famoso Airport which established Don Mathe's record of 110.4 *m.p.h. Since, of course, superseded by Jack Bentley and Bob Dunham who flew the model at a speed of* 114.5 *m.p.h. on May* 15*th,* 1960, *at Los Angeles Model Airport.*

THE FAST Club of California, which, of course, stands for First All Speed Team, organised the first radio meeting ever staged primarily to enable the boys to have a crack under acceptable conditions at an attempt on the F.A.I. world speed record for R/C models then held by Russia at 66 m.p.h. It was hoped that by making all arrangements and organising the meeting as a trial, more applications for record attempts would be forthcoming, as a much more convenient and rewarding system than if each aspirant separately went through the formalities and arranged for a suitable and approved timing system to be placed at his disposal.

All the modeller was required to provide was a machine that complied with the rules. The timing gear was so simple to operate that any potential entrant could have a spot check on the speed of his machine once the gear was set up.

The vast area of tarmac at Famoso Airport proved ideal for the event and the "Speed Trap", as the club terms it, was laid out to permit speed runs to be made parallel to the wind direction. In order that the system could be operated by any official observer, the Fast Club spent much care in the design and construction of the sighting and timing mechanism.

The basic arrangement may be seen from Fig. 1. A flight path of 100 meters (plus an inch for insurance factor) was laid out, the path was terminated by two base lines perpendicular to the line of flight. These base lines were carried back 100 yards to intersect a line parallel to the flight path. A tripod and theodolite head was set up at each of these last two intersections and checked for level transit and for the centres being plumb with the intersections.

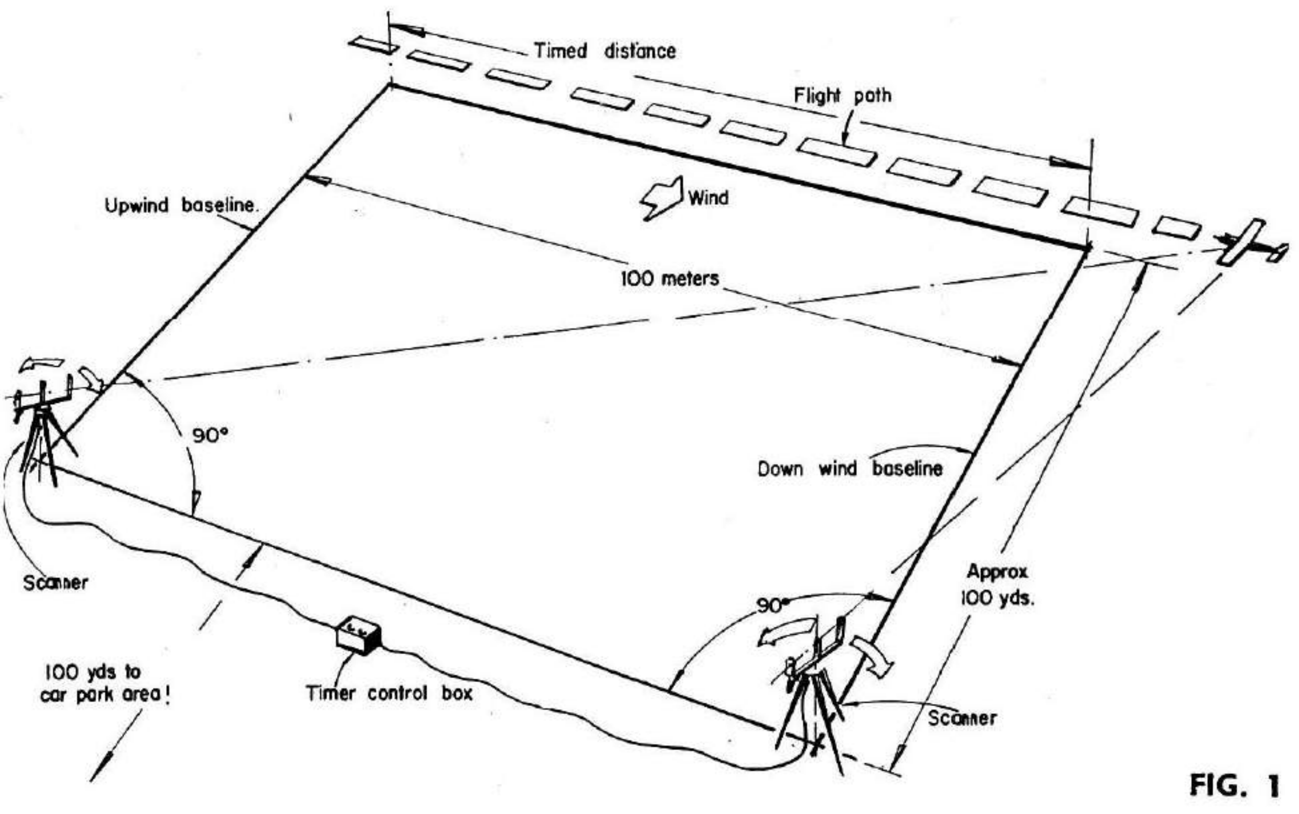


FIG. 1

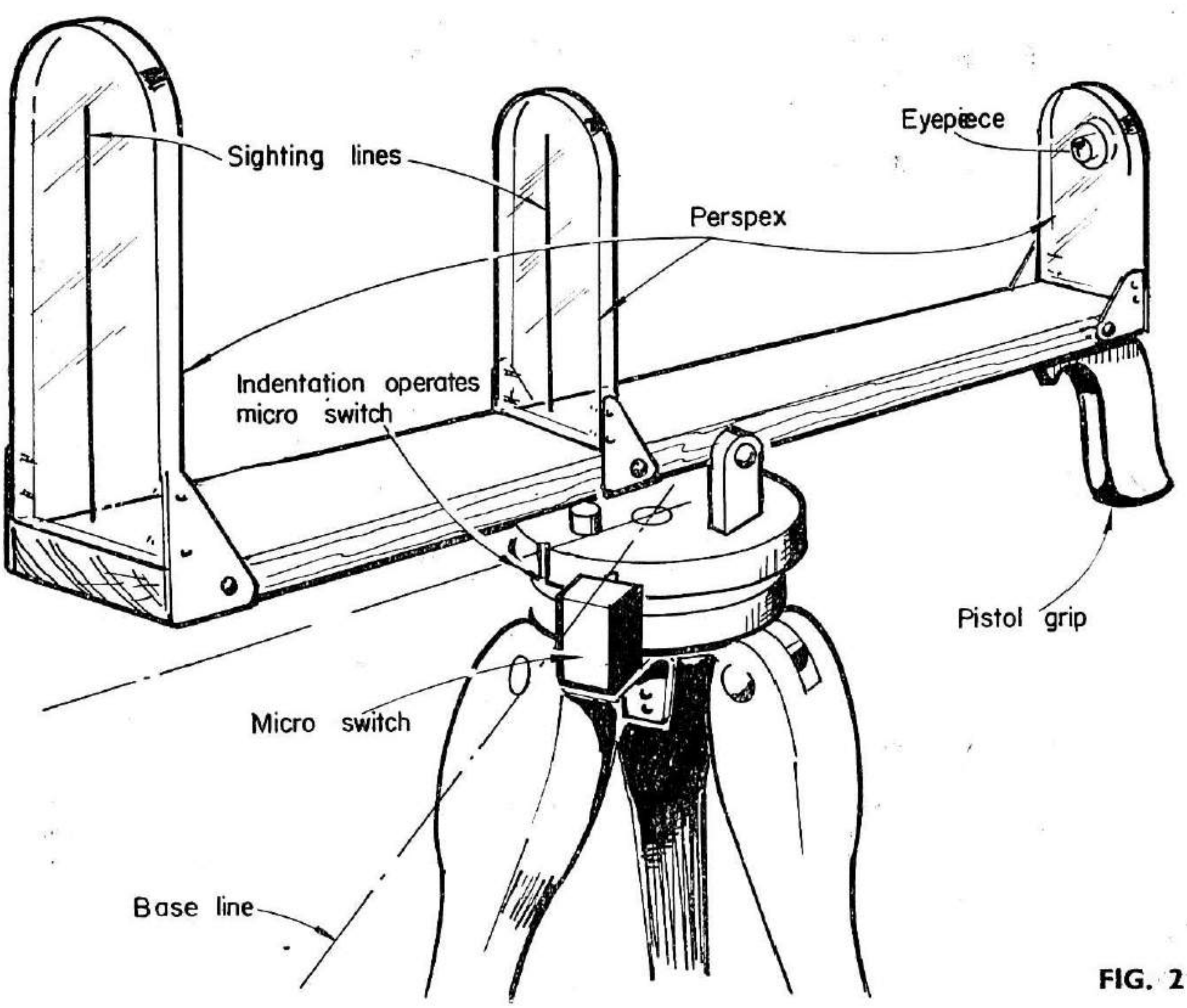


FIG. 2

The ingenious sighting scanners comprised a 23 in. long arm on which were mounted three perspex uprights, one with a peep hole and the other two with vertical sighting lines. A pistol grip handle was fitted at the operator's end of the arm, and the whole unit mounted on rocker pivots so that a variation in altitude of the model can be followed.

Electrical linkage is provided by a micro switch fixed to the stationary part of the tripod head exactly in line with the base line. A small indentation in the rotating part of the head operated the switch when the sighting lines of the scanner lined up with the end of the flight path. An identical scanner was set up at the start end of the course to enable the watch to be electrically triggered as the scanner (already tracking the model) passed the first base line. Meanwhile the second observer traines his scanner on the model and follows it through the speed trap until the second base line is passed, when the watch is stopped by closing the micro switch. Details of the scanners are given in Fig. 2. It might be possible to increase the accuracy of the switching mechanism still further by lengthening the switch mounting bracket and fitting a striker arm in place of the present "notch" system (Fig. 3). This would reduce the arc over which the switch would be actually operating and permit greater accuracy in setting up.

Final accuracy depends on the observers following the model closely. The system eliminates all the delay associated with hand operated watches, but if one wants to be absolutely free from dispute, a couple of cameras could be electrically triggered at the same time as the watch to record the model actually passing the ends of the base lines. If the model did not appear in the centre of the negative it would indicate that the scanner was not following with sufficient accuracy. However, it should then be possible to scale the excess distance and provide a corrected speed calculation. Obviously a short run could not class as a record, but such

photographic evidence would add weight to a record application by proving beyond all doubt the efficiency of the equipment and the ability of the observers.

For the purpose of the record attempts, a team of five was used. An observer operated each of the two scanners; a recorder read the watch and reset the switch circuit preparatory to the return run of the model; a signaller indicated that the recorder was ready and a further signaller stood by the competitor to show when the flight was about to commence.

Don Mathes put on an amazing show with his specially designed speed model which first, proving to be rather a handful, managed to push the record up to 85.6 miles per hour. Continuing to trim, he recorded six flights of 86, 89, 103, 104, and 108 m.p.h. reaching a stage when the model would maintain direction once set on its speed run. The sixth flight was recorded at an average of 110.4 m.p.h. which started with an *upwind* run of 120 m.p.h. The motor was not running so well when the downwind run was made, so a *mere* 100.8 brought the average down. It seems likely that Don will better this record without making any changes to the model; standard Supersonic 1000 fuel was used and the motor appears to be about two years old (according to its serial number).

A three-view of the model is shown here, construction of the fuselage is a plain box, wing has full depth spars and is sheet covered; the section is 7% symmetrical, zero-zero rigging 38% chord C.G. Dihedral approximately 10° and a total weight of five pounds.

O/D eight channel radio gear was installed, but only four channels were used to operate rudder and elevator. A three ounce tank provided sufficient fuel for two minutes run; no throttle control was provided, though a prototype model was so equipped in order to reduce power for initial test flights.

Another excellent model at this inaugural meeting was built by Bud Hartranft; low wing with fillets, high speed finish, ailerons coupled to rudder and trimmable elevator from six of eight channels. A .29 supplied the power for 83.1 m.p.h.

The piloting was a treat to watch; climbing to altitude the elevator would be trimmed, then a climbing turn on to line, down in a shallow dive and across

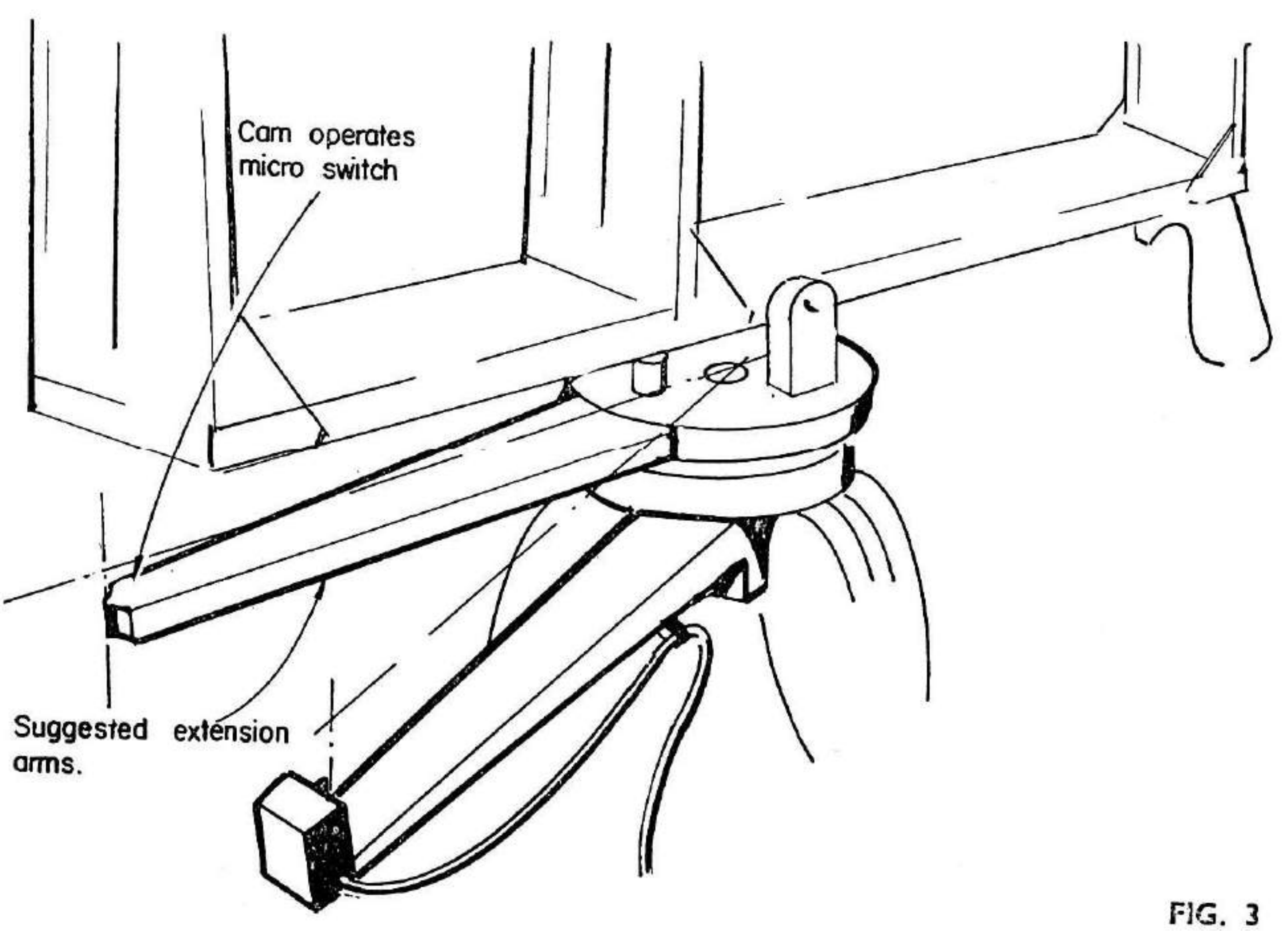
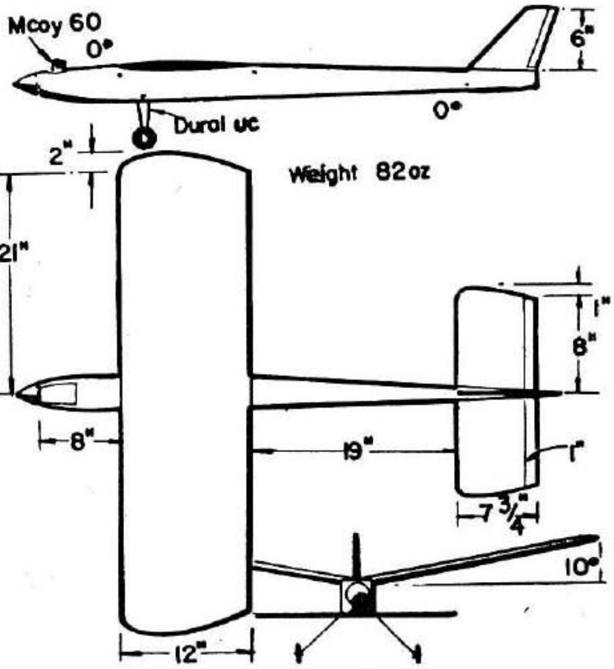


FIG. 3

the speed trap smooth and level, climbing to repeat the maneouvre at the far end. Several runs were made and if one run proved good several runs would be made in the opposite direction to obtain the highest for the average. This is permissible in the F.A.I. rules. The contestant is given half an hour to make the runs in both directions and provided the model does not land between flying the upwind and downwind sections, any number of runs can be made, selecting the best pair as the attempt.

The rule derived from full-size requirements makes no mention of the runs being consecutive, but it should be noted in the recent amendments to the Code Sportif that the base (timed run) shall now be 200 metres and level flight must be maintained for not less than 100 metres before entering the speed course.

The form of launching is now optional, so a few of the dicey moments may be eliminated from the flight. Who will be the first to make an efficient launching ramp?



Mon Mathe's model; note that sleek fuselage.

Flash . . .!

Latest from LARKS; Bob Dunham exceeds 124 *m.p.h.*

Mod. Tech. Mods.

Modulation Technique, Part 4, published last month did not contain the Harmonic content graph which should have been numbered Fig. 1, making Figs. 1 and 2 actually 2a and 2b. Fig. 5 is a "typical method of using series L.C. circuits" and should have been so titled.

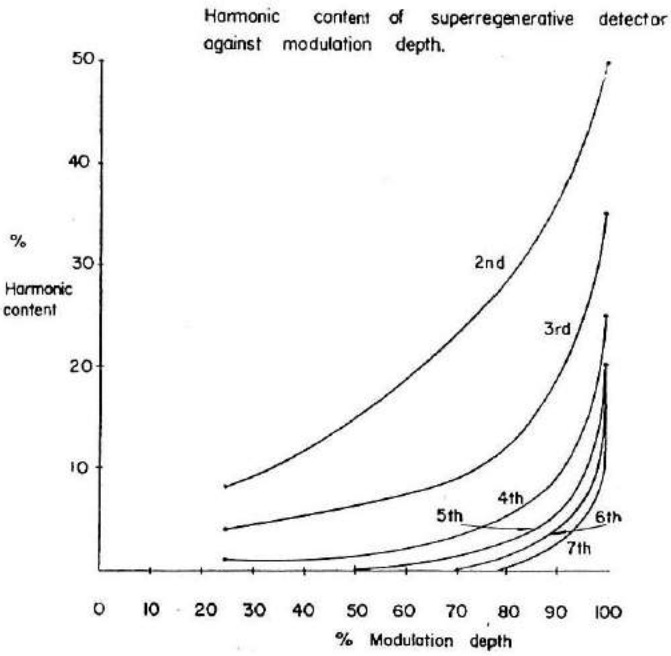
Paragraph on parallel tuned circuit should read . . . maximum at *resonance* fo . . . and equation $2 = \frac{L}{CR}$ should be

$$Z = \frac{L}{CR}$$

On page 68, column 2, line 28, "assures" should be *assumes*. Fig. 8a and 8b should have been referred to at the top of column 1, page 70, as follows: . . . one circuit worthy of mention, i.e. the tuned secondary, untuned primary, *see Fig. 8a and 8b.*

Throughout the article the symbol Q has been replaced by ϕ.

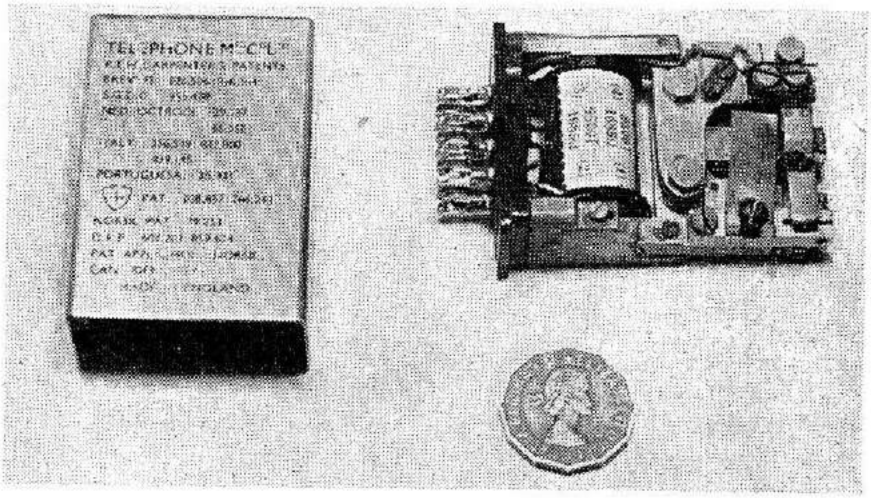
Our apologies !



The Carpenter's Relay

Type 5C9B & 5A57A

These two useful relays will be of particular interest to the boat modeller. Bob Mitchell gives a technical description and Ian McGrath supplies the experimental data.



THE two relays are similar in construction with the one exception of coil windings. Type 5A57A has a coil resistance of some 65 ohms and 2,400 faras. while its twin brother, type 5C8B, illustrated, has two coils being similar and each consists of 9,500 faras. and a coil resistance of 1,685 ohms. Both relays are polarized. The construction is very neat indeed and is a sound engineering job. The relay is symmetrical about a longitudinal axis (which is, in fact, the longitudinal axis of the armature). The armature, which can be seen between the sensitivity slab magnet in the centre right of the illustration, is of the partially balanced kind—each side stable—and whose sensitivity can be adjusted by "helper" slab magnets each side. These magnets, being employed in a conventional way, have two main functions:—

(1) To provide positive movement.
(2) To provide sure closing of the contacts.

All contacts are electrically isolated from the main frame.

Adjustment

When this component is purchased no doubt all the adjusting screws will be sealed. In this case, unless the relay is operating in an unnecessary or unsatisfactory way it is as well to have it as it stands.

However, a word or two about adjustment can cause no harm. Before embarking on the procedure it should be understood that these components must be adjusted with a certain amount of care.

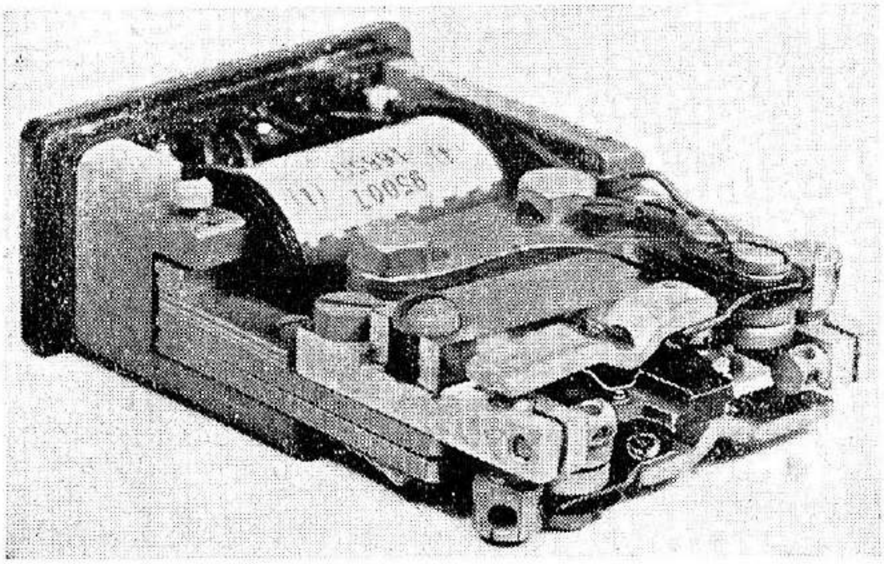
There are two conditions under which the relay can operate, namely:

(1) One side stable, i.e. the armature has a natural tendency to remain on one contact.
(2) Both sides stable, i.e. the armature has no natural tendency and is moved by the passing of a suitable current through the coil.

For condition (1) unscrew the locking bolts (one of which can be seen at the extreme bottom right in the illustration). Presuming the relay to be in condition; (2) the armature is moved over onto the contact on which it will be finally unstable. Holding the relay close to the ear this contact is screwed in (in fact, the contact adjustment screw moves out) until a positive "click" is heard. This click is made by the armature changing from one contact to the other; incidentally this click gives some indication of the use of the helper magnets. Now it will be found that if the armature is pulled back again it will move back to the stable contact. This contact can be adjusted for different degrees of sensitivity. For condition (2) the same steps are taken, however, the unstable contact is screwed back about ⅛ of a turn. The other contact is now adjusted until the clicks are approximately equal.

Operating Conditions

It was found that these relays operated (with a good waveform on an oscilloscope) up to 1,500 cycles. The following data was also recorded:—



TOP : A 5C9B shown slightly larger than full size. The capstan type contact adjusting screws and their locking pinch bolts are easily identified. Armature is the dark stepped piece (lower right).

BOTTOM : Test circuit.

Type	*Maximum Sensitivity*	*Normal Op. Sensitivity*
5A57A	45 μA	295 μA
5C9B	42 μA	275 μA

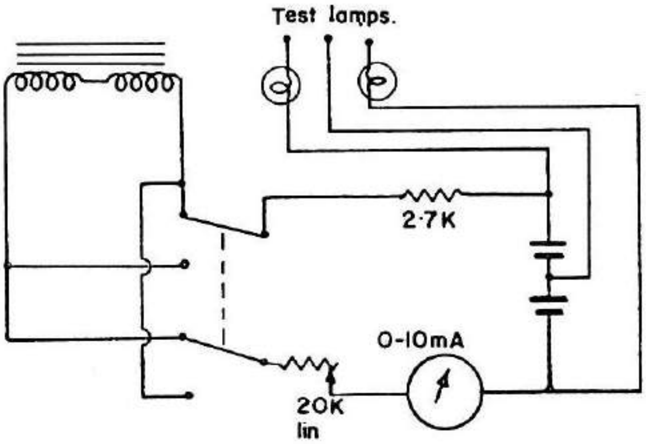
N.B.—All currents are those of pulling-in. Falling-out currents were found to be $\frac{5}{6}$ the value for pulling-in. For maximum sensitivity this fraction became $\frac{2}{3}$. While readings for type 5A57A were as shown two sets were taken for type 5C9B:—

(a) Having the coils in parallel.
(b) Having the coils in series.

As can be expected the results were almost identical.

If under with condition the current flows through the coils in the wrong direction, the armature will not move hence some care must be exercised in wiring these components correctly — it may be as well to rig up the relay in a test circuit such as that shown.

For type 5A57A the circuit is identical save that the relay has only one coil.



Uses

Of course, it would be impossible to name all the uses for these neat relays, but for the R/C enthusiast there are certain functions for which it is ideal. The first that comes to mind is its use in multibrator pulsing units. These relays are ideal for model boats but due to their weight (4 oz.) are unsuitable for aircraft.

By suitably modifying Radiospares miniature tagboard (by removing the solder tags) and removing the can and base from the relay it can be mounted on the tagboard. This brings its weight to 3.1 oz.

Type 5C9B can be obtained from stroke unit type 101. Ref.: 10Q/16090.

Type 5C9B is the government relay. Ref.: 10F/16244.

Type 5A57A is the government relay. Ref.: 10F/16247.

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.

Simpl Simul Plus

By CHARLES RIALL

A FAMILIAR figure on the flying field Charles Riall has astonished many people with his masterly control of Rattler with its "Galloping Ghost" equipment. He has produced most of the patterns usually confined to the "Multi" boys, but he found the outside loop too difficult to perform with any precision.

During a recent spell in hospital he put on paper his ideas for obtaining more positive down elevator in order to make the outside loop more like the real thing, and from the evidence of his latest flying it certainly looks as though he has mastered this most difficult of all manoeuvres.

We will let him explain the reason for the particular set-up and how it works, but he asks us to say that credit for the circuitry should be given to Peter Cook who used as a basis the secondary circuit used by Sinclair in his dual proportional system ("Aeromodeller", August, 1959).

Now over to Charles for his comments:—

The basic idea is to use the normal Simpl Simul for all flying except full down elevator, which is brought in non-proportionally by a separate servo. This gives very little gallop for normal flying since the elevator is hardly below neutral with the "crank" at B.D.C. and very little UP elevator is required to make the model loop.

The connecting link between the elevators is now made thus:—

A pull-on wire "A" will pull elevator down until "crank" has moved into vee in upper wire (Fig. 1). Since this gives

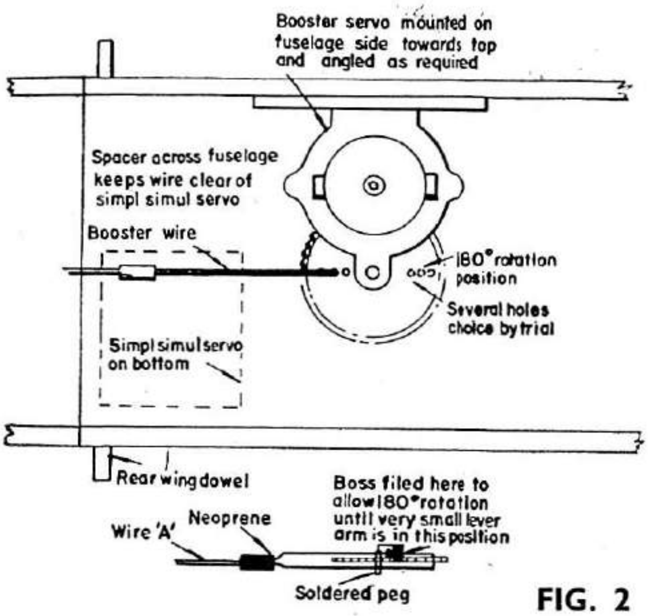


FIG. 2

solid down (i.e. no pulsing), very little extra down movement is required to give tight outside loops.

The "Elevator Booster" servo to provide the pull consists of a Mighty Midget with gear which merely runs 180° and then stalls. Although this may seem crude, the M.M.'s and DEAC's will take it, as proved in my long spins, and in this application the stalled condition is only for short periods. Installation as in Fig. 2. The servo is switched by a separate relay. I use a double contact change-over Siemens 90 Ω.

With my set-up of a particular tone to *keep* the engine at fast, this is necessary so that the centre tap to engine control servo can be broken when solid down elevator is selected by means of a greatly increased pulse rate. At such a rate the reed won't continue to operate and would therefore otherwise go to SLOW.

An alternative would be to use a single change-over relay to transfer the

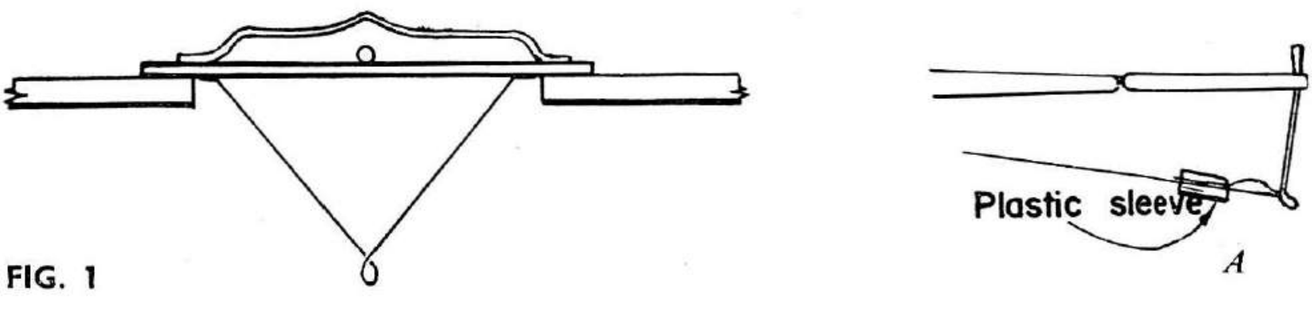


FIG. 1

engine control centre tap to the booster servo, but this wouldn't run the DEAC's down equally.

This Siemens relay is in a circuit inspired by the Sinclair dual-proportional system, and worked out by a friend, Peter Cook (see Fig. 3). The relay must remain OUT at normal pulse rates and pull IN at extra fast rate.

I would not attempt to explain how it works; no doubt this will be clear to you.

Meters can be inserted at points X. At normal fast pulse, about 5 m.A. flows through relay coil and at extra fast pulse rate current rises to over 20 m.A. and pulls in relay.

The 1K Ω between OC 71 and minus can be omitted but its presence prevents quite a few milliamps "going to waste".

The circuit seems to work with various combinations of components and the values shown are the result of experimenting with variable pots. and various condensers, and the bits and pieces I had available.

I have used the four DEAC's with a series 4.7 Ω resistance to drive the booster servo since this discharges the batteries equally. When the DEAC's are fully charged the booster servo may "twitch" a bit at normal pulse rates, but this does not matter since the

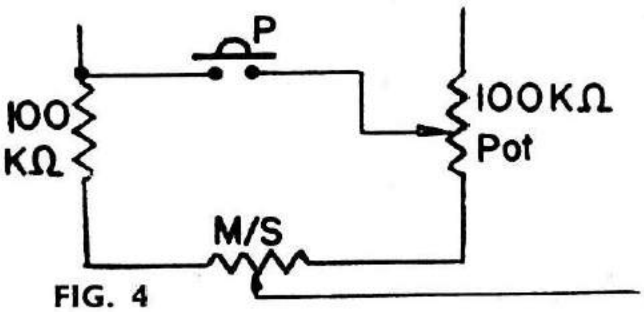
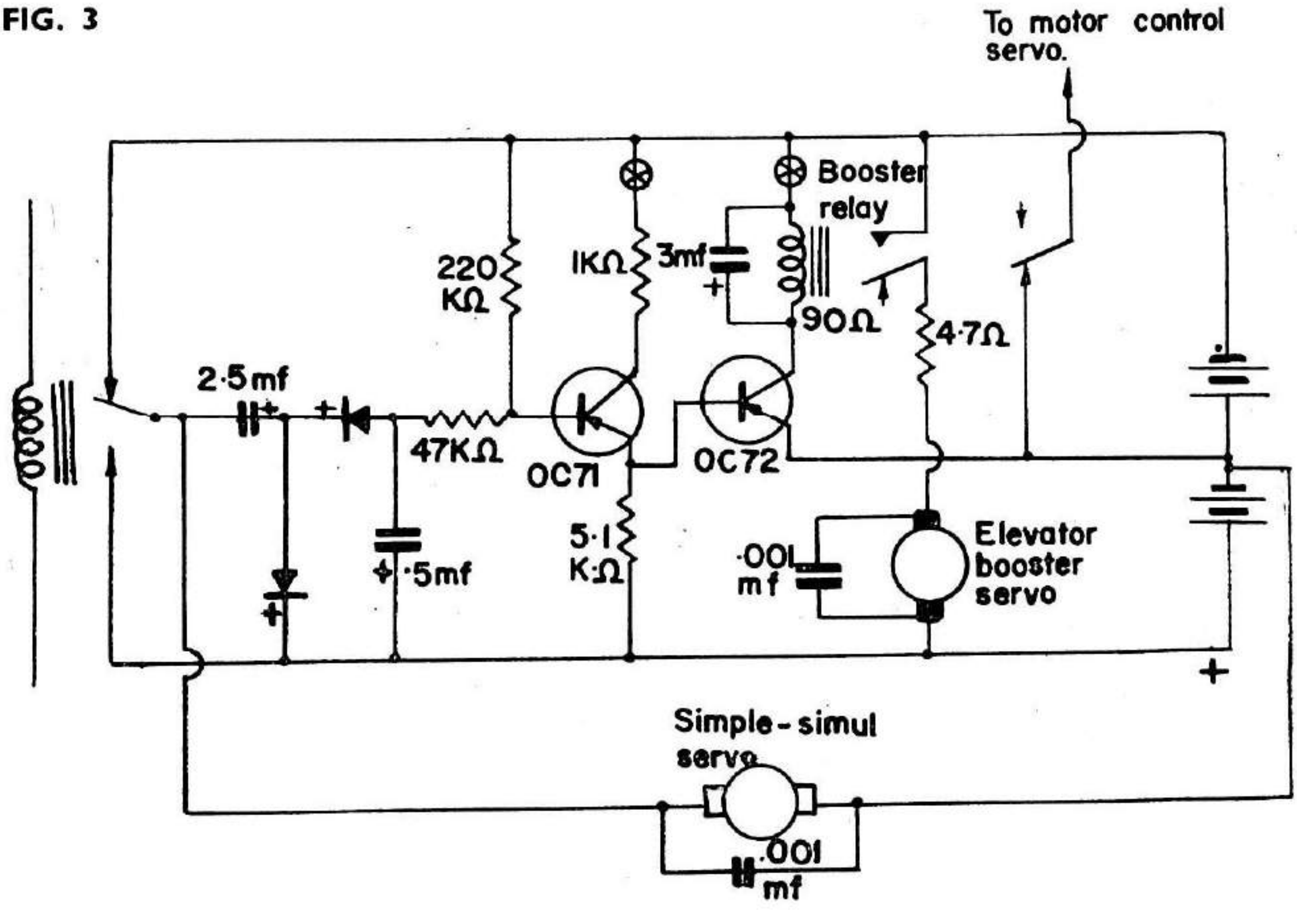


FIG. 4

SIMPL SIMUL servo easily overcomes it. If the DEAC's are allowed to discharge *very* flat, the booster servo may come fully in at normal rates, and I don't know what would happen in flight, but I think the state of the batteries would be obvious well before that from the stick position for level flight. Using the original "Aeromodeller" valve pulser (3V4's), the extra fast pulse is obtained by closing a switch "P" which parallels the M/S pot. to the wiper of a 100 K Ω pot. in place of one original 100 K Ω resistor (Fig. 4). This gives a variable rate with a tendency towards "space", which is a help with receivers which may hang "on signal" at high pulse rates. If the rate required to give a good pull-in of the booster relay tends to give offset rudder due to this tendency, the vee in the top wire of the

(Continued on page 142)

FIG. 3



More Gen on D.E.A.C.s

The increasing use of these popular cells prompts us to offer a word or two on correct usage and their characteristics.

MIS-USE of a component often leads to unwarranted criticism of the manufacturer; it is possible that one may unwittingly use the goods for a job for which they were never intended, either due to lack of information relating to the said goods or an insufficient understanding of the operating conditions arising from that particular use.

Users of dry cells may be practising a false economy by providing batteries of too small a capacity, the result being merely to reduce reliability and consistency towards the end of that particular cell's life, and increase the strain on the pocket. Now, whilst DEACs will take a lot of punishment, treatment likely to cause the overall life to be shortened may result in shorter periods between chargings towards the end of its life.

We understand that DEACs do not froth and buckle as a result of sudden discharge or unintentional shorting, such behaviour would appear to be caused by mechanical damage incurred in crashes or overheating. Before you decide finally on battery installation, check their position in relation to any hot silencers or in the "wake" of large glo motors, a considerable temperature rise can occur in a battery compartment if adjacent to a radially mounted engine, especially if the latter is inefficiently cowled. The sun beating down on to a metal battery box lid or even a black painted surface can form a miniature oven.

With regard to mounting, permanent installation with a charging socket and switch will enable one to make a sound job of the battery compartment; plenty of sponge rubber all round and a solid bottom and bulkhead to absorb landing shocks. Care should, however, be exercised in charging as indicated in the maker's information leaflets, further useful information given below has been extracted from this source, and for which we are indebted to Messrs. G. A. Stanley Palmer Ltd.

1. Discharge

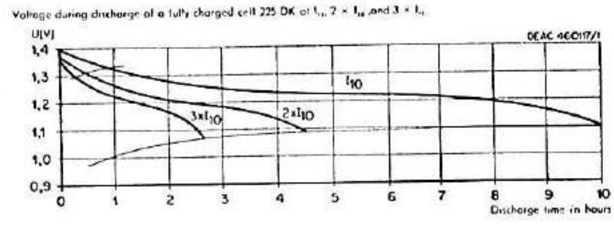
The number of cells in a particular battery is dependent upon the required upper and lower voltage limits. The permissible lower voltage limit is:

for single cells - - 0 volts.
for batteries - 1.0 volts per cell

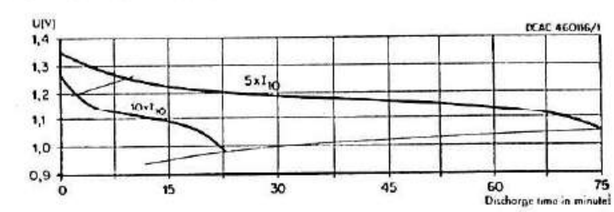
The second value above is specified on the following grounds.

Discharge beyond the cut-off voltage shown in the discharge curves causes the voltage to fall very rapidly to zero. No advantage is gained in terms of capacity by discharging cells to this final limit; the vestigial Ah capacity is of no practical value and varies from cell to cell. Due to this variation, a particular cell in a battery made up of cells in series can reach zero voltage before others, and, because of this, reverse its polarity. Reversal of polarity within certain bounds causes no damage to DEAC cells provided that the current is not too high. After recharge the cells regains its normal polarity and voltage. From the point of view of cell maximum lifetime, however, reversal of polarity should be avoided so far

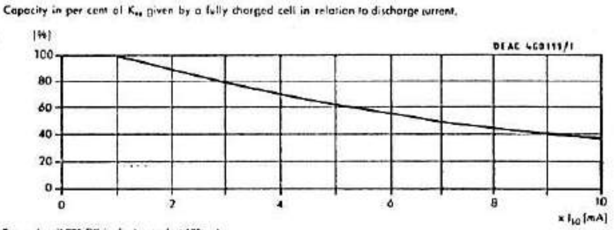
Voltage during discharge of a fully charged cell 225 DK at I_{10}, $2 \times I_{10}$ and $3 \times I_{10}$



Voltage during discharge of a fully charged cell 225 DK at $5 \times I_{10}$ and $10 \times I_{10}$



Capacity in per cent of K_{10} given by a fully charged cell in relation to discharge current.



Eg. A cell 225 DK is discharged at 135 mA
$135 \text{ mA} = 6 \times I_{10}$
225 mAh = 100%
capacity given by the cell: 55% of 225 mAh = 123 mAh.

DISCHARGE CHARACTERISTICS

as possible. It is for this reason that a so-called cut-off voltage limit is specified.

The maximum continuous discharge current should not exceed 10 × 1/10. For short periods of some seconds double this discharge current can be taken (1/10 = 10 hour discharge rate).

2. Normal Charging

A discharged cell can be charged at three to five times its 1/10 current at the beginning of the charging period, but towards the end of the charging period the current 1/10 should not be exceeded. Charging is complete when 1.4 times the Ah capacity taken out of the cell has been reached. This is applicable also for partial discharge.

Charging of a fully discharged cell at a current of 1/10 requires therefore 14 hours.

Permissible overcharges are:—

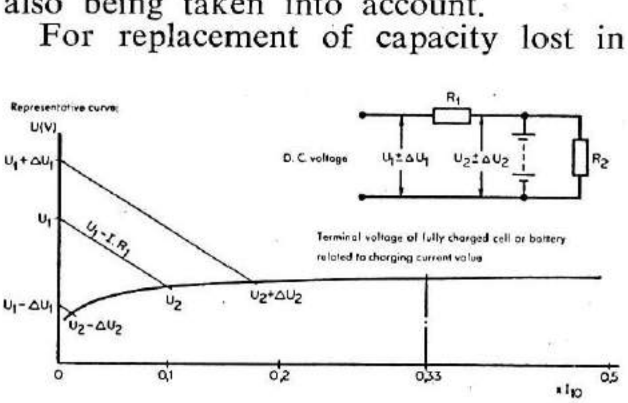
with 1/10 up to 24 hours.
with ½ × 1/10 up to 48 hours.
with ⅓ × 1/10 up to 100 hours total charging time. (This has no immediate ill effect, but from the point of view of long life time is to be avoided).
with 1/5 × 1/10 permanently.

The greatest life time is, however, obtained when the charging rate is related to the discharge, and not exceeded (1.4 times the discharge).

After long periods of storage it is desirable to discharge cells to some extent before recharging.

The permanent charging voltage should be so regulated that the charging current is 1.4 times the discharge current of the cells. In cases where no discharge takes place care should be taken to ensure that the charging current is within the limits 0 to ⅓ × 1/10 with voltage and load fluctuations also being taken into account.

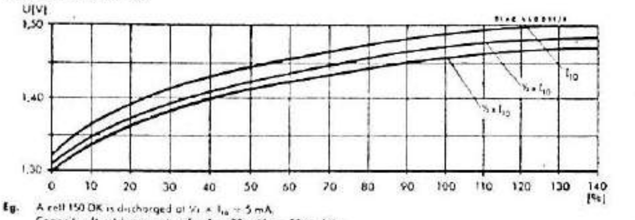
For replacement of capacity lost in



CONTINUES CHARGING

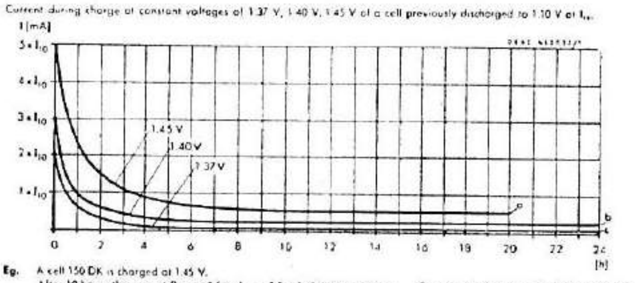
Charging

Voltage during charge of a cell (pre-discharged to 1.10 V) at constant charging currents I_{10}, ½ × I_{10}, ⅓ × I_{10}, related to capacity (in per cent of K_{10}).



Eg. A cell 150 DK is discharged at ⅓ × I_{10} = 5 mA.
Capacity after 6 hours = 6 × 5 mA = 30 mAh, = 20% of K_{10}.
Cell voltage amounts to 1.37 V.

Current during charge at constant voltages of 1.37 V, 1.40 V, 1.45 V of a cell previously discharged to 1.10 V at I_{10}.



Eg. A cell 150 DK is charged at 1.45 V.
After 10 hours the current flow is 0.5 × I_{10} = 7.5 mA charging current.

Capacity at a) 1.4 × K_{10} (fully charged)
Capacity at b) 0.6 × K_{10}
Capacity at c) 0.4 × K_{10}

self-discharge a permanent charging current of $\frac{1}{300}$ 1/10 suffices.

The voltage stabilising effect of DEAC Perma-Seal cells can also be observed from the above curve.

The working point U_2 can be established by plotting the resistance curve of R_1.

4. D.C. Resistance and A.C. Impedance

Detailed values are given in the appropriate data sheets. Because of the low impedance of DEAC Perma-Seal cells they are particularly useful for smoothing purposes. The cell type 450 DK, for example, has an impedance of 65 milliohms at 50 c.p.s., in fully charged condition; this is equivalent to a comparable capacitor having a capacity of 50,000 mfd.

5. Temperature Behaviour

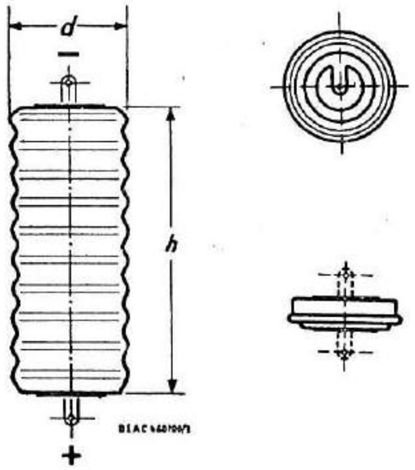
Permissible temperatures are given in the cell data sheets.

By exceeding the temperature limits shown, a reduction in capacity can be expected.

Optimum conditions are charge, discharge and storage at about 20° C.

6. Battery Design

Button-cell batteries—with the exception of 20 DK and 50 DK cells—are made with up to 10 cells welded together, the whole stack then being



Type	Number of cells	Dimensions of battery in mm (approx. values)	
		H	D
100 DK	5 10	30 60	26
150 DK	5 10	33 66	26
225 DK	5 10	45 90	26
450 DK	5 10	41 82	44

covered with plastic sleeving. The end cells carry solder tags. It is advisable always to use welded stacks for batteries instead of separate cells in mechanical contact with each other, to avoid possible contact troubles.

In no event should the cells be soldered.

Where contact springs are used these should be of nickelled spring steel and should have adequate contact pressure. Copper and copper-based alloys can cause local galvanic action and consequent corrosion.

Cylindrical cell batteries can be made — where the already available types 5/450 D and 5/900 D are not appropriate—by covering each individual cell with plastic sleeving and assembling together in a case.

Rectangular cell batteries: where the already available Types 5/D 1.3, 4/D 1.5 or 5/D 1.5 are not appropriate, batteries can be made up in sheet steel cases with inter-cell connectors. The individual cells are insulated from each other by insulating sheet or foil.

Inter-cell connectors are of nickelled steel. No copper or copper-based alloys should be used.

Battery Cases : Battery cases are normally made of sheet steel. Plastic cases can be made provided that the quantity is economic from the point of view of tooling.

7. Mounting of Cells

DEAC gastight cells can be mounted in any position. Cells having safety vents (rectangular and BD types) should not, however, be fitted so that they operate permanently upside down. Should it be required to mount rectangular type cells for permanent operation lying flat enquiry should first be made so that advice can be given regarding the best orientation.

8. Abnormal Operating Conditions

Where operating conditions are abnormal, for example high accelerations, corrosion danger due to high humidity, extreme temperature changes, abnormal air pressures, etc. the advice of the makers should be sought on the application of the cells.

9. Parallel Connection of Perma-Seal Cells to Dry Cells

Normally, parallel connection of gastight DEAC cells should be avoided.

Where, nevertheless, parallel connection cannot be avoided, not only the terminals of the batteries but a pair of cells or a cell group respectively should be connected in parallel at a time. (Meshed parallel connection).

In a number of applications, e.g. portable radio sets, DEAC gastight cells are connected in parallel to an equivalent number of dry cells, the result being longer operation with small voltage variation. For such applications the capacity of the dry batteries should not be much in excess of that of the DEAC gastight cells to which they are connected, so that the compensating current (charging current for the DEAC cells) does not exceed the maximum limits.

10. Potting in Resin

Gastight DEAC cells may be potted in resin, during which procedure, however, the admissible temperatures must not be exceeded.

Maintenance Charge

To compensate for self-discharge a trickle charge current of 1/300 × 1/10 is required, this maintaining the cell voltage at approx. 1.33v.

DEAC Type		50 DK	100 DK	150 DK	225 DK	450 DK
Capacity – 10 hr. rate	Milliampere hrs.	50	100	150	225	450
Discharge current 10 hr. rate	Milliamps	5	10	15	22	45
Average discharge voltage 10 hr. rate	Volts	1.22				
Cut-off voltage 10 hr. rate	Volts	1.10				
Charging rate (14 hr. charge)	Milliamps	5	10	15	22	45
Charging voltage	Volts	from 1.35 to 1.50				
Floating charge voltage	Volts	from 1.35 to 1.45				
Cell weight	in grams	3.5	9	11	12.5	33
Dimensions of cells in mm	diameter	25				43
	height*	5.85	6.1	6.6	8.6	7.6
Permissible temperature in °C	charge	from 0 to + 45				
	discharge	from – 20 to + 45				
	stored	from – 40 to + 60				

* Plus tolerances of approx ± 0.3 mm for single cells

All values, weights, and dimensions approximate.

DATA TABLE.

Floating Charge

The floating charge current must be adjusted so that 1.4 times the current given by the cells is recharged into the cells.

D.C. Resistances (Standard Values)

For short-time load of a fully charged cell the D.C. resistance can be computed as follows:

$$R_i = \frac{0.1}{K_1} \ (\Omega)$$ (introduce K10 expressed in Ah).

E.g. The internal resistance of the cell 450 DK (charged) is:

$$R_i = \frac{0.1}{0.45} = 0.22 \ (\Omega).$$

During shock-load of a few seconds of 900 m.A. (20 1/10) the terminal voltage would be as follows:

$$U_k = U_o - I.R_i = 1.36 - 0.9 \frac{0.1}{0.45}$$

= 1.16 v. (U_o for all charged DEAC cells is approx. 1.36 v.).

A.C. Resistances (Standard Values)

Of a fully charged cell:

	50 *cps*	100 *cps*	1000 *cps*	10000 *cps*
100 DK	260	240	160	130 (m Ω)
150 DK	240	230	190	150 (m Ω)
225 DK	200	190	150	120 (m Ω)
450 DK	65	60	50	40 (m Ω)

For semi-discharged cells the A.C. resistance is increased up to approx. 120% for discharged cells by at least four times the above values.

The manufacturers point out an error in our Battery Performance Data Sheet; figures referring to the capacity of the rectangular type were given in mAh, whereas they should have been Ah. Our apologies, the impression might have been that of a mouse power elephant.

Band Wanted!

We sympathise with those would-be users of R/C controlled camera gear, who as reported in the *British Journal of Photography*, find themselves unable to operate for lack of an allotted waveband. The same problem has, we believe, hampered the development of R/C lawnmowers in this country, though, apparently, it does not prevent R/C operation of garage doors according to current advertisements offering such apparatus. Increasing demand for the use of R/C triggered devices is bound to come, so please Mr. P. M. G. consider this question urgently !

Ten-Year Span

SO runs the title of a report received from Poole Model Yacht Club. There has always been a strong following of radio control among boat modellers, encouraged by the many active clubs in existence today. The wide scope for ingenuity is apparent from examination of a few craft which permit experimental systems to be tried with comparative safety, indeed one has to be extremely unlucky to suffer "Down elevator" effects.

Now, over to Poole . . .

NINETEEN SIXTY-ONE will see the completion of the first decade of Radio Regattas to be held in Poole.

The policy of the Poole Club has always been to encourage the beginner in Radio Control, by including an event which can be entered into with simple equipment, and having the minimum of frustrating rules.

To further development in R/C and the sport in general, for more advanced competitors, some of our events have created a challenge to achieve something better than was done previously. Our novelty event has always given wide scope to the incentive mind to create something quite original, both in the Radio and electronic sphere and also in novel demonstration. A high spot was reached last year when our American competitor, Mr. Francis D. Reynolds, brought his Fire Float over from Seattle. This had a direct 21 channel press button control, on 21 different actions on the boat, from directing one jet of water to finally broadcasting its own commentary to the crowd on the bank. No less novel feature was Col. J. H. Taplin's launch, which allegedly broke down, then sprouted a set of sails out of its deck, and was successfully homed to the shore on R/C.

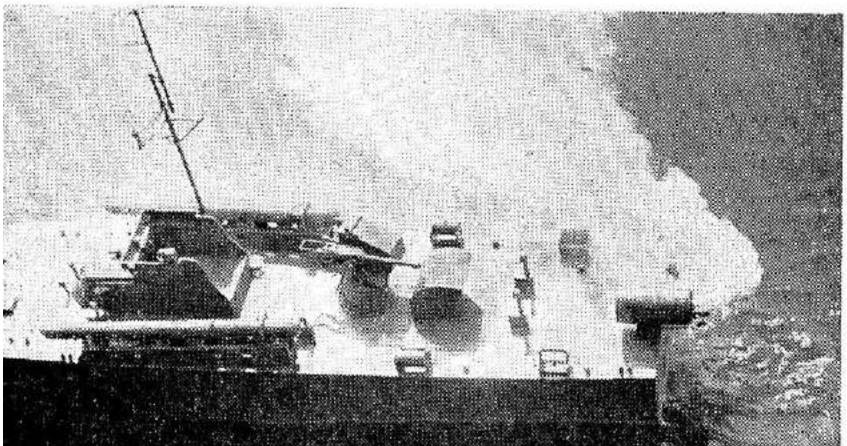
It seems from our experience, that the type of mind which takes up R/C as a pastime, readily welcomes a challenge, and is quick to accept the gauge. We feel modern youth will not be content with free sailing boats in this electronic age, and will gradually turn to R/C model yachting as the only acceptable sport.

For some years now competition has been running in Poole to sail Model Yachts under R/C, two or more boats sailing together without radio interference. These experiments have now reached a high measure of success, and a new sport is born which is very exciting both to the competitor and to the spectators.

In our 10th May Radio Regatta which will be held on the 13th and 14th May, 1961, we propose to challenge the power boat section to real racing. We shall include a special event for power boats to race in pairs without radio interference round a triangular course. If this challenge is accepted and there is no reason to doubt that it cannot be done. We feel it will mean a new impetus will be given to the sport of power boats.

The question of radio interference is no easy one, as it means some measure of agreement between competitors. This can be helped on an occasion when the salient points can be discussed at the "get together" meeting, which is always included in the Poole Radio Regatta, and held in the comfortable Studland Lounge of the "Dolphin". It is here that probably the largest gathering of really experienced Radio Boffins meet. They are all most anxious to see this sport develop into something which can be really exciting racing.

Our completed programme is now ready and enquiries may be made to the Radio Regatta Hon. Secretary, Mr. R. Cane, 227 Blandford Road, Hamworthy, Poole.



A. Wilson's M.T.B. pictured laying an effective smoke screen at the last Poole Regatta.

The Ketchledge Linear Pulser

"After a season's use of the Ketchledge Pulser it is our opinion that this is one of the finest pulsers available for the job of sending off the information of rate and width to the airplane . . ."

WE quote "Printed Circuit", North Jersey Radio Control Club newsletter, to whom we are indebted for publication of this three transistor pulser.

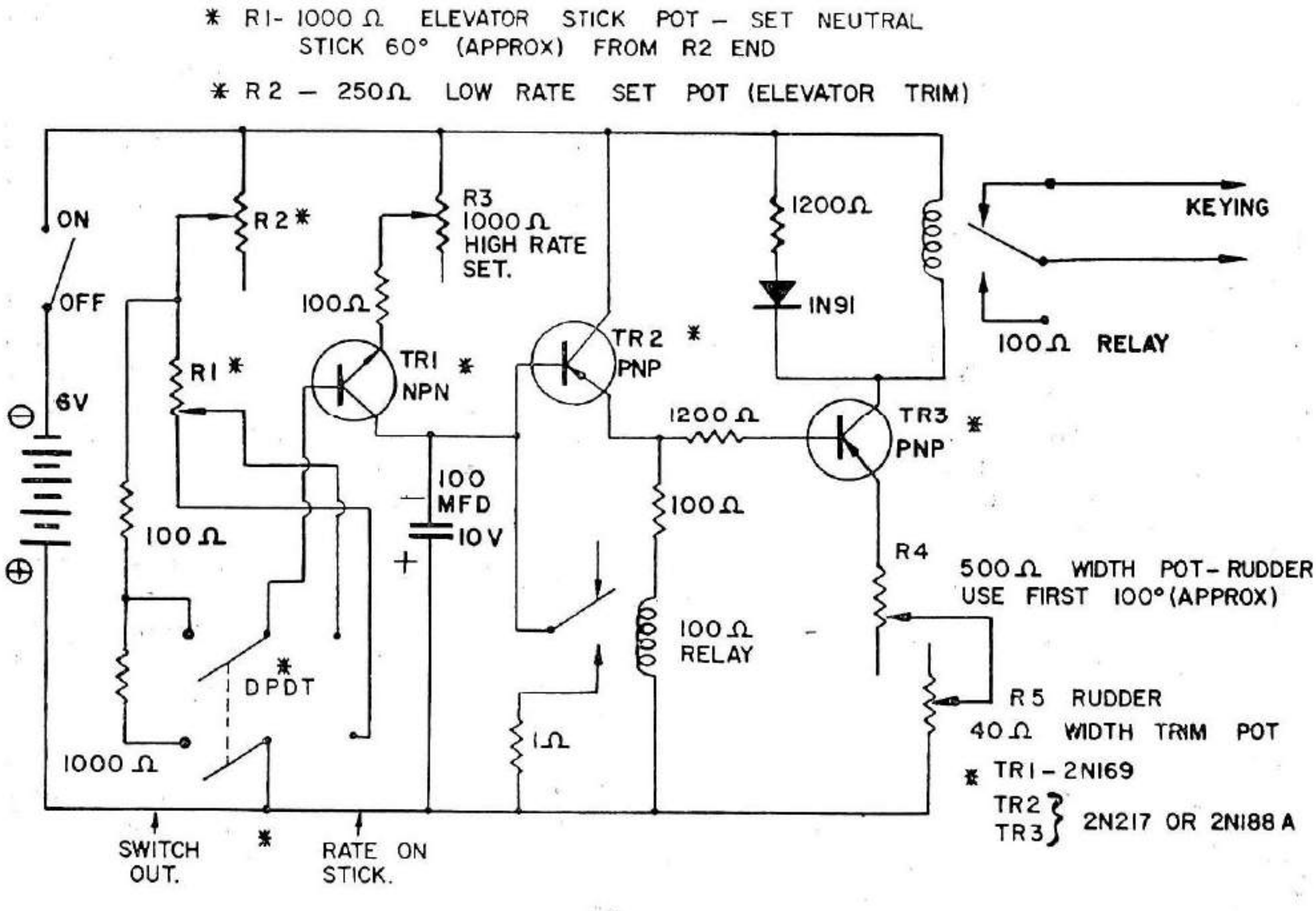
Component equivalents should be available but the relays will have to be obtained before the printed circuit board is made so that the connections may be modified to suit the particular pin arrangement. (It would be nice to see an international standard in this respect.) An alternative method particularly suitable if large relays are used, is to arrange a separate relay panel and wire the relays into the printed circuit.

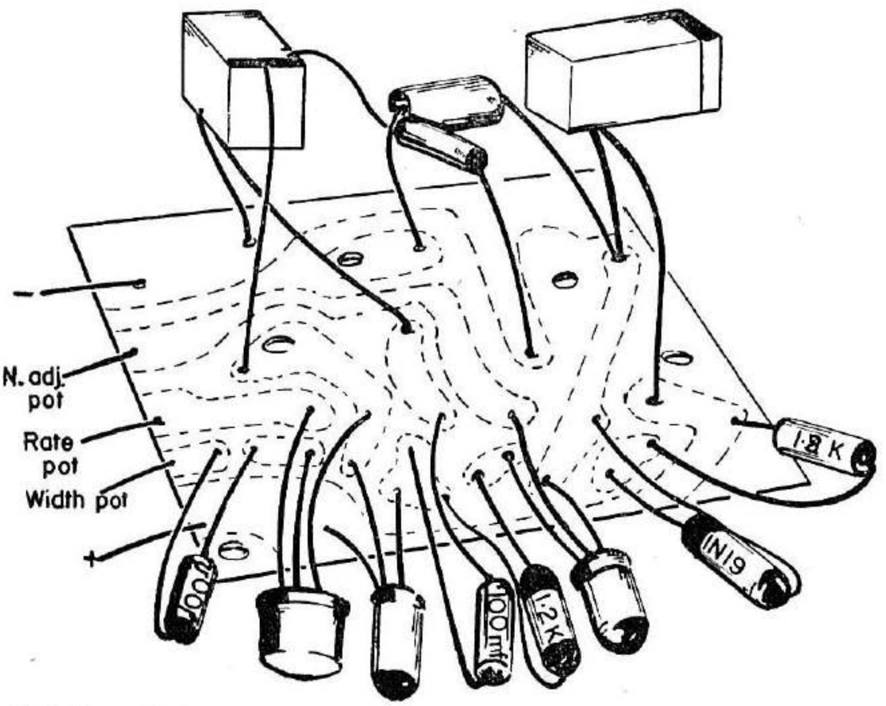
We see a big advantage in the "Rate Switch", in that a learner pilot may fly at a fixed rate in a trimmed elevator position, change to full elevator control at a safe altitude, and switch back to a safe neutral elevator if the nerves become frayed.

Full size Printed Circuit board is shown here, and if diagrammatic wiring arrangements for the board and external connections are followed in conjunction with the theoretical circuit, no head scratching should be necessary.

Having wired up and checked the following preliminary adjustments should be made:

1. Set the "Rate Switch" to the OUT position.
2. Set R5 Rudder Trim at 20 Ω.
3. Set R2 Low Rate at 125 Ω.
4. Set R3 High Rate at 500 Ω.
5. Adjust relays if necessary.





Assembly should present no problems if this exploded wiring diagram is followed.

Calabration

1. Turn on pulser and re-set R3 for a repetition rate of approximately 6 c.p.s., or whatever basic rate you prefer, whilst the stick is at neutral.

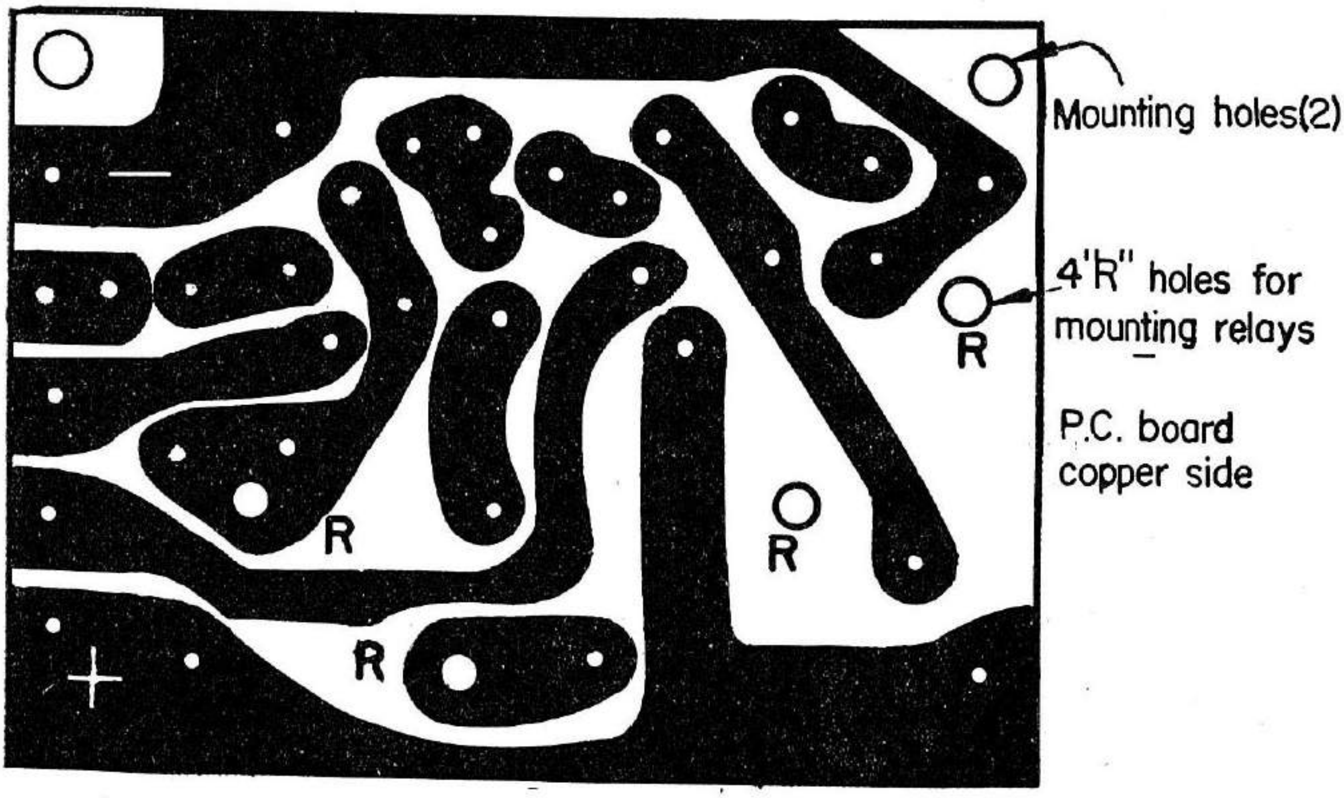
2. Re-set R4 for a 50/50 mark/space and lock the shaft of R4 in the bracket which supports R1 with the stick centred.

3. Without disturbing any of the pot. settings, lock the stick at neutral position on the shaft of R1. There should be no change in the rate when the stick is switched in.

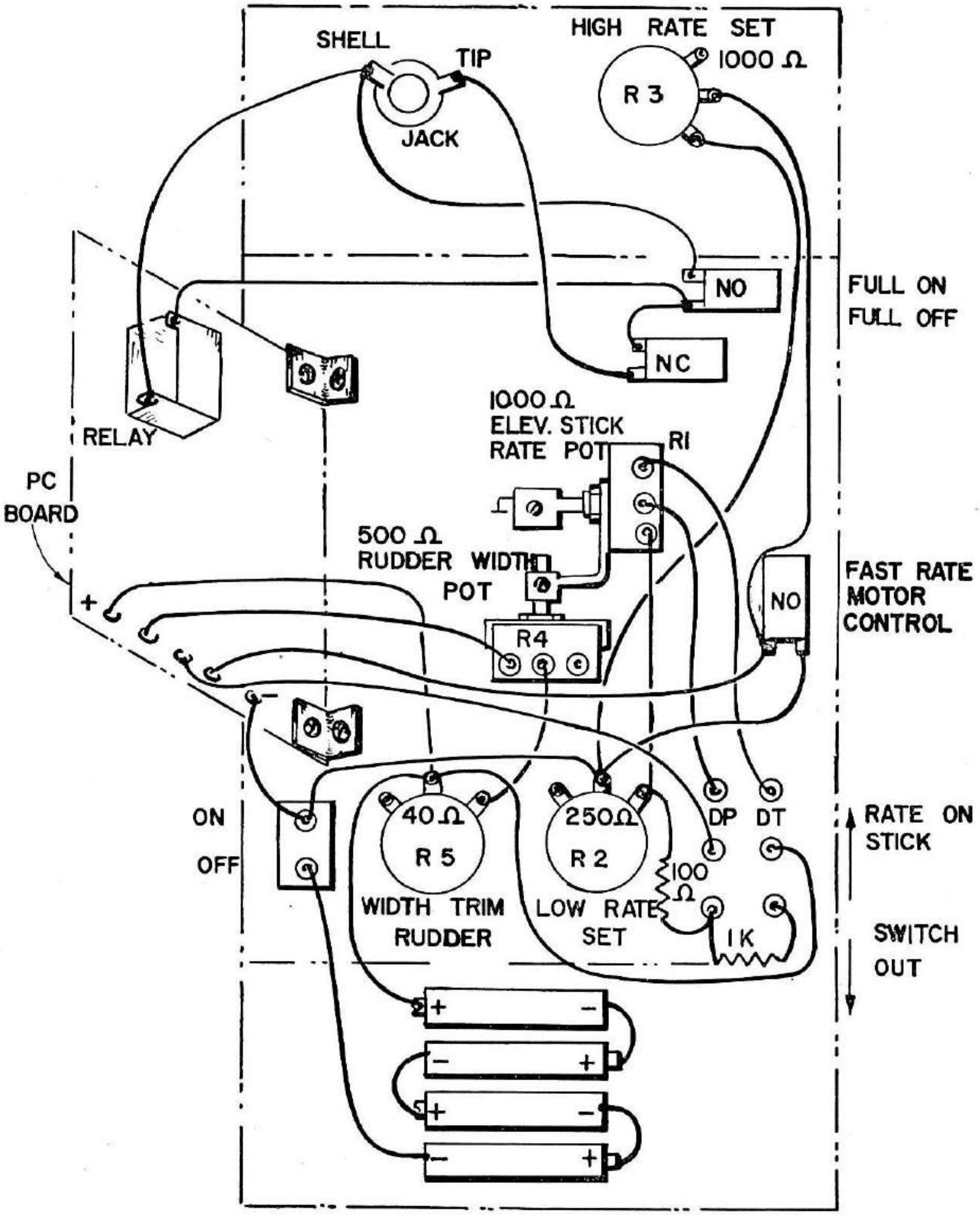
Use

When matching the pulser to the model, the stick is pushed full forward and the required rate is set with R3. Then the stick is pulled full back and low rate set with R2. Repeat and check for interaction.

When in flight, use R3 as elevator trim. The whole arrangement allows the *total rate range* to be expanded, contracted or shifted whilst on the field to suit different models; Simpl Simul, Inductive Kick or intermediate rate/width models flown as rudder only but with elevator trim.



P.C. board copper side



"No, I'm not criticising the radio as radio. But when we use VHF left rudder goes on, and when we switch it off that lowers the under-carriage . . . if you see what I mean . . ."

(With acknowledgment to 'De Haviland Gazette')

Contact Pressure Calculator

By R. H. WARRING

THIS calculator computes the maximum spring pressure which can be obtained from flat cantilever springs. To use, connect spring width to spring thickness; then project across from spring length through the same point on the reference scale to read maximum spring pressure, in grams for either phosphor-bronze or beryllium-copper spring material.

The calculator can equally well be used to arrive at a suitable length, width or thickness of spring in phosphor-bronze or beryllium copper for a required spring pressure. Also the effects of varying the dimensions of a given spring can be investigated, as affecting maximum spring pressure obtainable.

Maximum spring pressure given refers to the maximum value of pressure which can be obtained by setting and maintained without loss through fatigue, etc. Although it may be possible to realise higher pressures with a given size of spring, such pressures imply that the material is over-stressed and so the pressure setting will not be held.

Phosphor-bronze and beryllium copper are recommended spring materials. To calculate maximum spring pressure obtainable with other spring materials, use the phosphor bronze scale and multiply the answer obtained by the appropriate correction factor given below.

Material	*Correction factor*	*Remarks*
Spring temper	0.7	a suitable spring material
Nickel silver extra hard	0.73	
Brass, hard	0.67	brass is not a
half hard	0.5	suitable spring material for consistent service
Copper, hard	0.47	not a suitable
half hard	0.37	spring material except for light wiping contacts

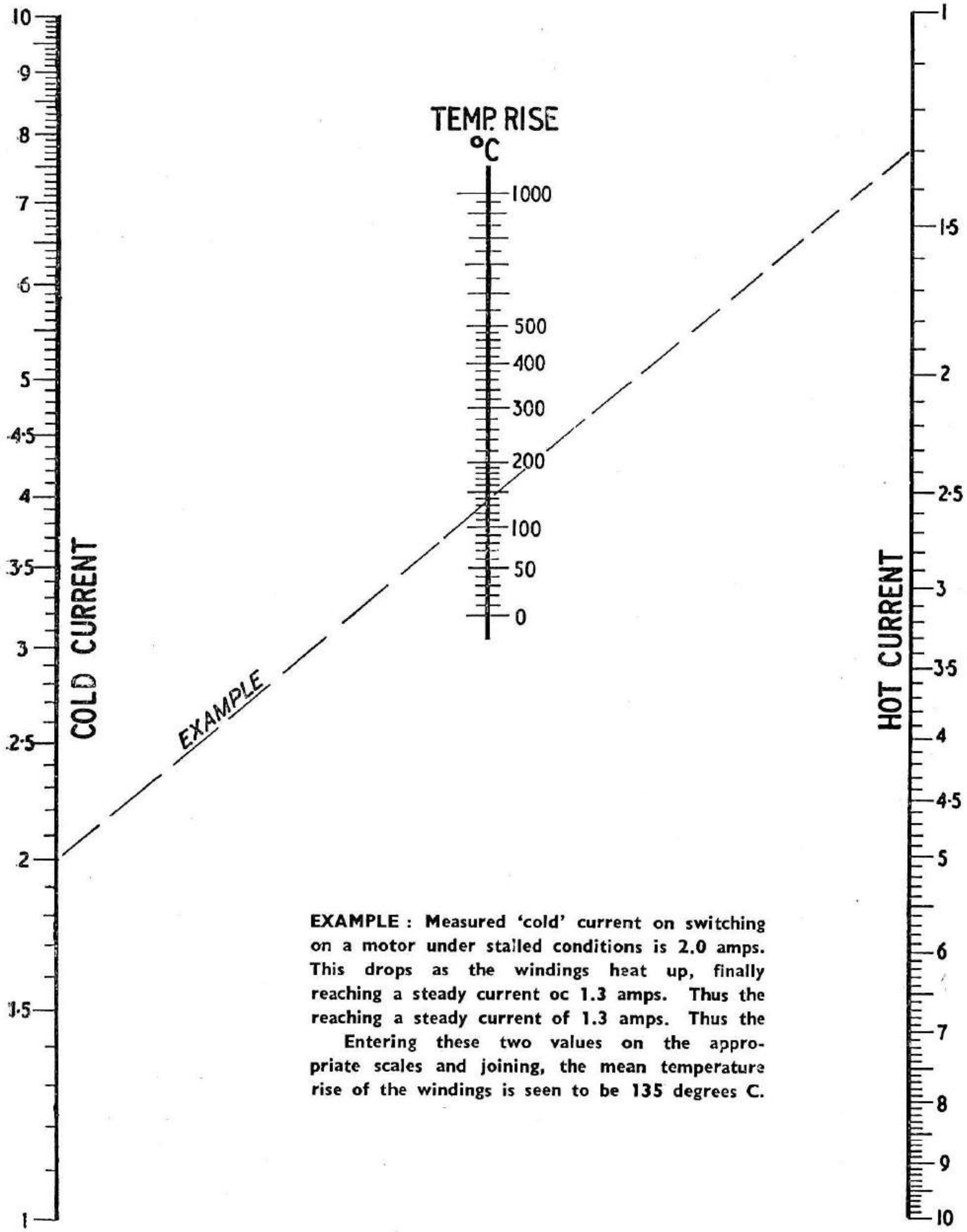
Example: to find the maximum spring pressure available from a phosphor bronze cantilever spring ¾" long, .015" thick and spring width .12". Connect width (.12") to thickness (.015"). Through same point on reference scale project from length (.75) to cut pressure scale. Ans.: 180 grams.

Note: 1 ounce equals 28.35 grams.

Temperature Rise in Coils and Windings

THE heating effect produced by the current flow through any practical coil or winding produces a rise in temperature within the coil and an increase in resistance of the conductors. Under working conditions a steady temperature, and corresponding 'hot' resistance, will be reached at which the rate of heat generation is balanced by the heat dissipation from the outer surface of the coil, and any further losses of heat through conduction to mountings, etc.

Heating is not uniform throughout the coil and simple measurement will give only the average temperature of the coil. Some parts will be at a higher temperature, and some at a lower. Both the design of the coil and the permitted rating must be such that local hot spots do not reach such a temperature that the windings are damaged, e.g. insulation burnt away or even the wire melted. Usually this means limiting the current to a safe value consistent with the carrying capacity of the size of conductor used, and limiting the *rating* of the coil to a specific value. Rating is usually expressed as current squared × coil resistance divided by the curved surface area of the coil, in watts per square inch. A maximum rating of 0.5 watts per square inch is usually



EXAMPLE : Measured 'cold' current on switching on a motor under stalled conditions is 2.0 amps. This drops as the windings heat up, finally reaching a steady current oc 1.3 amps. Thus the reaching a steady current of 1.3 amps. Thus the Entering these two values on the appropriate scales and joining, the mean temperature rise of the windings is seen to be 135 degrees C.

accepted for coils and windings operated continuously.

Where it is necessary to measure or assess the mean temperature of the coil under working conditions, this can be done simply by measuring the hot and cold resistances of the coil and determining the temperature rise from the difference in resistance. This could be important in, say, deciding whether or not a particular type of insulation was suitable for a particular duty.

Further to simplify the method of estimating temperature rise, measurement can be restricted to current change between 'cold' and 'hot' conditions, provided the applied voltage remains the same. To determine the 'cold' and 'hot' currents, current is measured immediately on switching on and the coil

then left to 'warm up'. If there is any appreciable heating the current will slowly decrease, indicating that there is a rise in temperature producing a rise in coil resistance. When the current ceases to fall, steady conditions have been reached and the corresponding temperature represents the mean temperature of the coil for continuous operation under these conditions.

The actual temperature rise can be obtained from the nomogram. 'Cold' and 'Hot' currents are measured, as described above, and the respective values joined on the two scales. The corresponding temperature rise is then read off the centre scale.

Current scales are designated 1 to 10 and can be applied to any units, provided the same units are used on both scales. For instance, if the 'cold' current is 50 milliamps and the 'hot' current 45 milliamps, divide both values by ten and enter the corresponding scales with values 5.0 and 4.5.

Whirr and Click

A new series for the mechanically minded and followers of switchcraft. A. Birch supplies the first two ideas.

THIS month we commence a new series of features for the experimenter. More than a review of gimmickry, these items report the progress of new types of actuating and switching mechanisms dreamed up by modellers who have a particular control system, the needs of which have not been met by commercial or well-known home-made servo or electronic gear.

The success of many an experiment can lie in the sharing of "gen". We know of many good ideas which have been rescued from the junk box when the solution to quite a different problem has been applied to an otherwise discarded piece of equipment. One tends to start going round in circles when one's brain-child refuses to work, when on paper apparently, everything likely to cause Gremlins has been eliminated.

Cautious types may scrap an otherwise excellent idea because in the process of what we call "pre-constructional bug-hunting" (for want of a better term), they think they spot flaws in an otherwise fool-proof system by visualising more difficult operating conditions than actually exist.

By publishing YOUR experiments we may be helping others to solve THEIR problems, in return for which you may be able to chase the Lesser Spotted Bug from your own test bench.

This is a chance to help your fellow experimenters, solve your own problems AND get paid for it, yes we do offer remuneration for accepted material, but we cannot undertake to design ten channel control for your microfilm ornithopter. Not just yet . . .

A. Birch starts the ball rolling with some notes on *Pulsing Pendulums,* the advantages of which he enumerates below. We like the way the rudder pendulum biases the rudder if the angle of bank is too steep for the turn. We already have a pendulum bias in our "Pendulator" linkage between an escapement and the rudder of the Cessna 172 (APS Plan   ) having the same effect but without the flexibility of proportional control.

Now, over to A. Birch; Fig. 1 shows construction.

1. Rudder is controlled and is similar to proportional system except that in place of centre spring a pendulum is used. A fast pulse is a much better MARK-SPACE control, the motor provides more power due to less restriction.
2. Elevators are only connected to motor when being moved.
3. *ON* button for DOWN elevator, *OFF* button for UP elevator are required on control box.
4. Radio must be in order and working to give Down elevator.
5. Elevators stay where set by short blips of up or down, unless (a) radio breaks down, (b) model flies out of range, (c) Tx. is switched off when gliding is required.

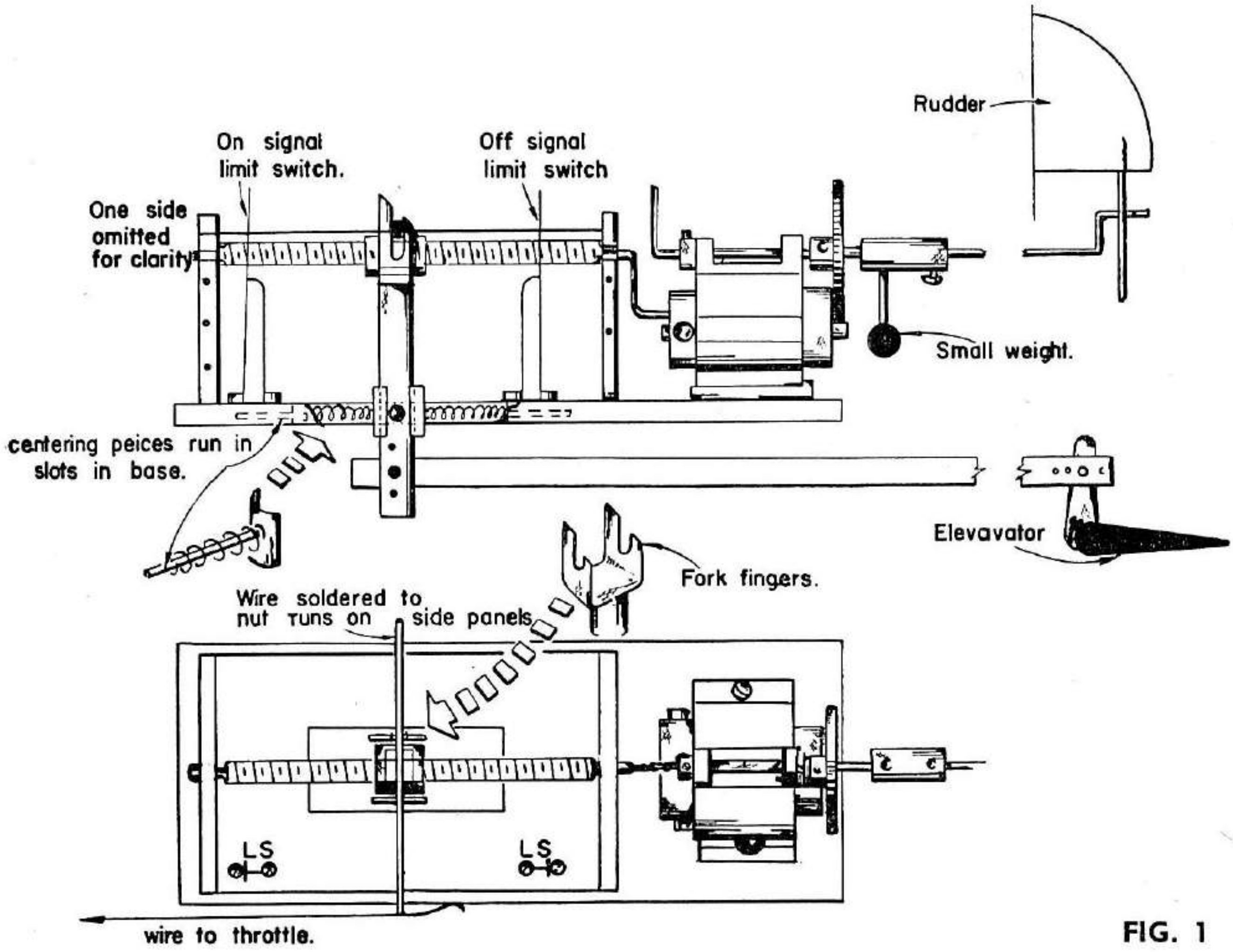


FIG. 1

6. Choice of engine control. Cut at fail safe or set for tick over.

7. Throttle cannot open except by radio signal.

8. Fail safe (see 5 above) engine stops or ticks over and elevator returns to neutral rudder, having been set to a slight turn on reaching limit switch, so that the model circles down.

9. Tx. can be switched off and plane allowed to glide in circles if sufficient height has been attained.

10. If the engine is adjusted to stop under these conditions, elevators and rudder can be reconnected in flight for landing.

11. If the engine is adjusted for tick over, only rudder can be used for landing. But may be reconnected to go up again on full throttle (endurance record!)

This system is compleetly FAIL SAFE. I won't boast how long I have used it without a prang, in case I do!

Once your Tx. pulse is matched to the plane you can dispense with the pendulum on the rudder, because as long as the oscillations are within the 180° arc, that is in the top half or bottom half, you have rudder control and the elevators are not effected.

If by chance your pulses are not fast enough and the motor makes one complete revolution every now and then inching the elevator up or down, it is rectified quite easily by a blip on the up or down button. So you simply steer the plane by joystick connected to an M/S control pot. and adjust your rate of ascent or descent by blips on two buttons. My biggest thrill is not flying it (it is so simple), but to see the fail-safe work and to have a plane in one piece to find what went wrong.

We continue with a second Birch idea shown in Figs. 2 *and* 3. *It seems to be a real battery and weight saver for those who have no objection to all the spring centred control surfaces moving in sequence once per operation.*

Who said Micro Four? Here are seven controls from one battery. I am using five so far, but for the extra two (aileron control) the actuator must be lined up with the centre section in order to connect the aileron pushrods, I had thought of converting my "Gasser" to low wing. Response is very fast and

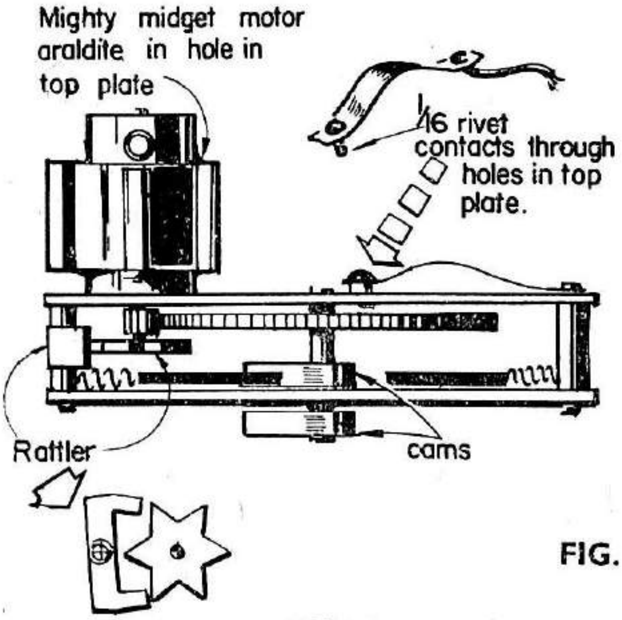
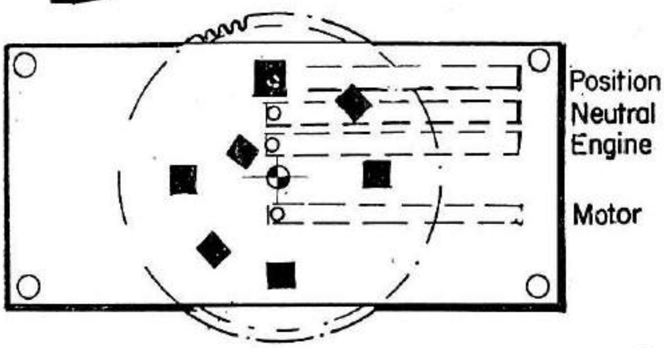
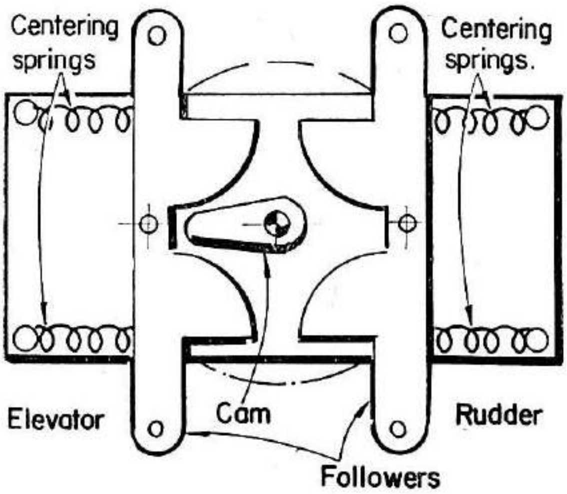
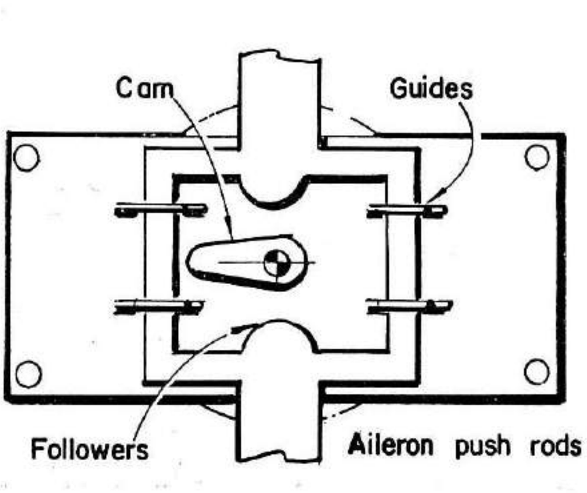


FIG. 2







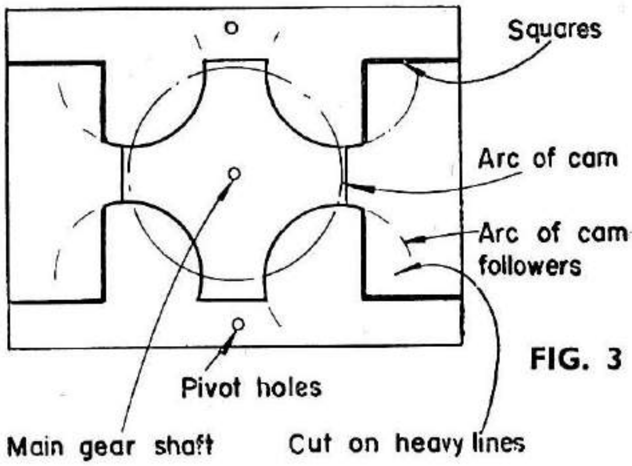


FIG. 3

ABOVE : Method of cutting cam followers to an accurate profile. LEFT (top to bottom) : Side view, plan, top and bottom of lower panel.

never misses, but a beep box would be well worth using (we should say essential—ED.).

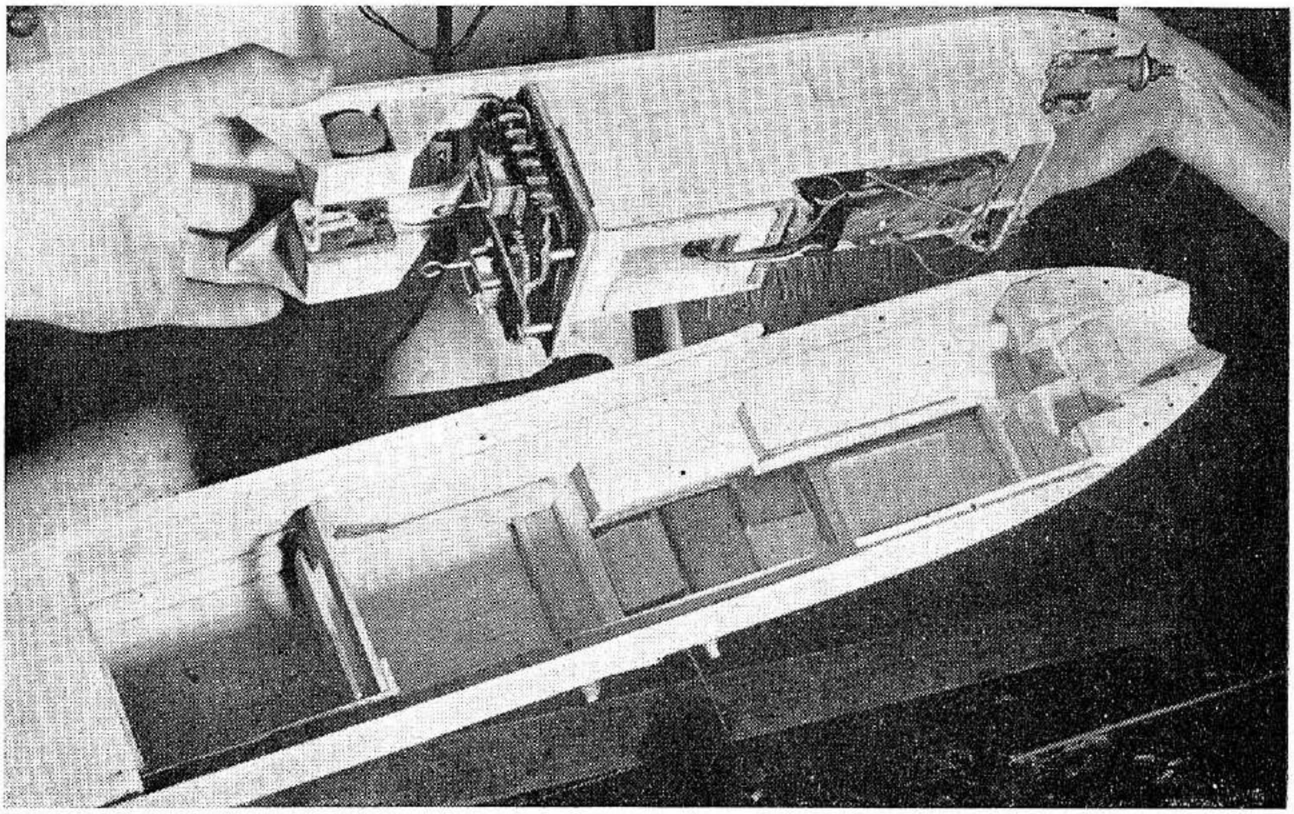
Stops on large gear are cut oblong with fretsaw filled Araldite. Cost is one Might Midget motor with brass gear and a Fred Rising escapement is used for engine control. Cutting and fitting of the paxolin cams and followers must be accurate.

An easy way out is to use compasses and set square. Draw the lot on paxolin and before cutting out or drilling for rudder and elevator follower pivots, bolt the panel pieces and follower material together using the central hole.

The only problem appears to be obtaining the large gear wheel.

However, there are on the surplus market, end plates from an AM generator containing a 2 in. gear which matches the MM. (Proops, Tottenham Court Road provided the original).

It should be remembered that a control system is capable of being used in different types of models; what may be ideal for one may prove unsuitable for others and a supposedly "dicey" arrangement for a high speed model is still of use in a more sedate version. There is no need to restrict the application to one class of model, Hovercraft being quite unfussy in this respect. In fact we welcome suggestions and sketches for new applications of the control systems which we hope to publish in this series.

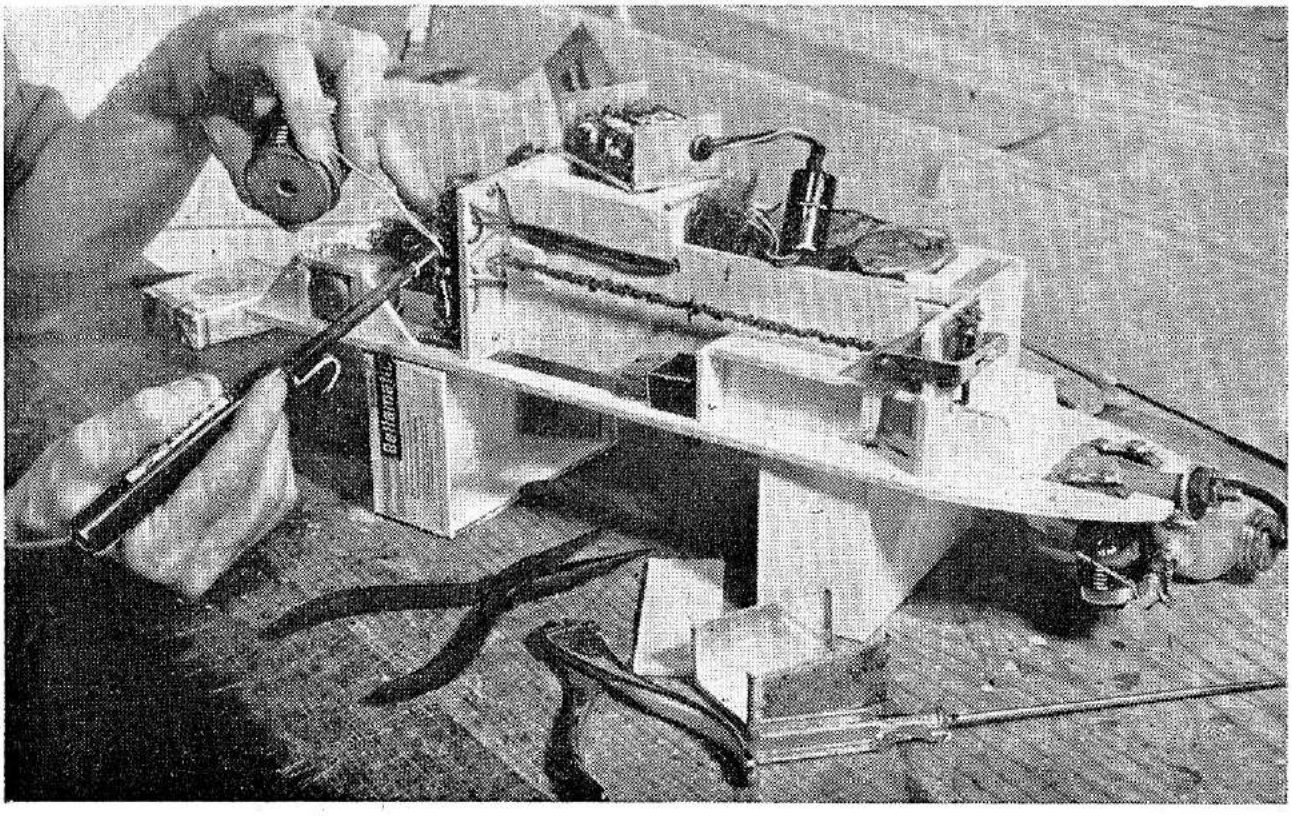


Easy Servicing

By Pat Wheeler

TOP : Removing the unit, note the reinforcing blocks in the fuselage.

BOTTOM : Ease of soldering is shown in this assembly shot (no more scorched fingers or fried formers). TOP (opposite) : Bench check with everything in position and working, except the engine, of course. BOTTOM : All bolted down. Pushrods yet to be added; these can be attached at the servo end, facilitated by the cut-out in the ply plate.



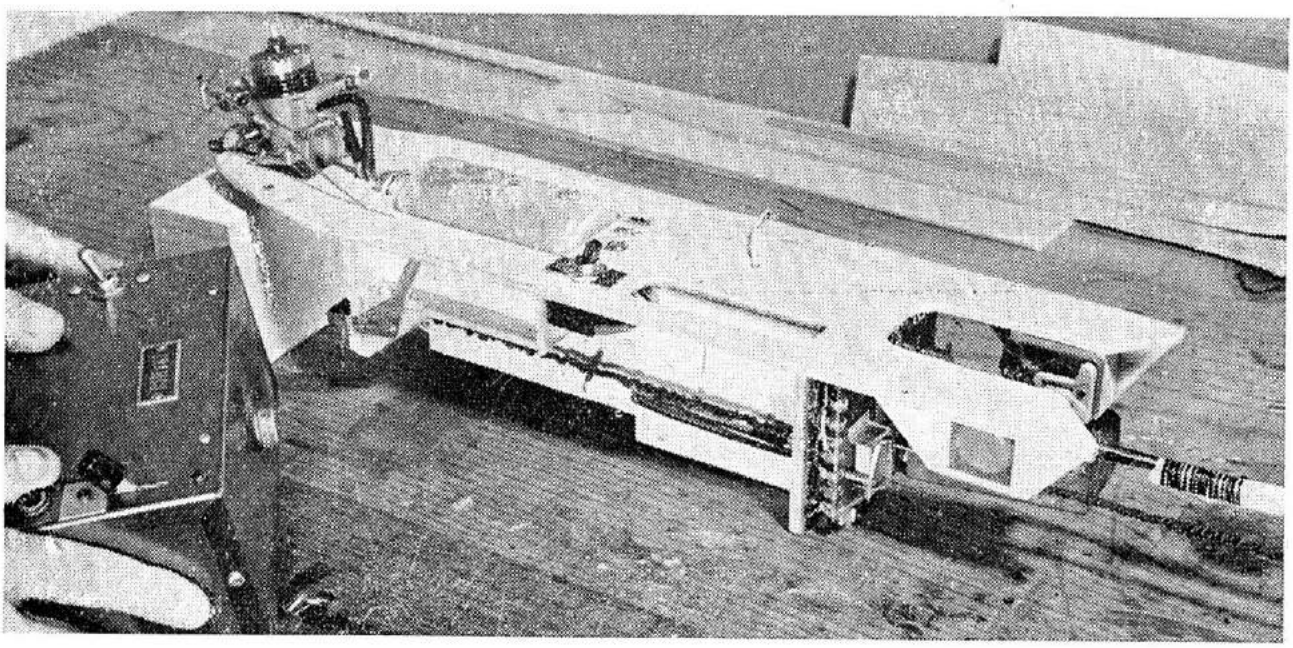
MANY R/C fliers stuff equipment into a model wherever it is easiest to put in, with an eye on the C.G. position. This usually results in frustration when trying to find out "what went wrong": delving fingers are too big, pliers won't go round corners, "it works on the bench but not in the model".

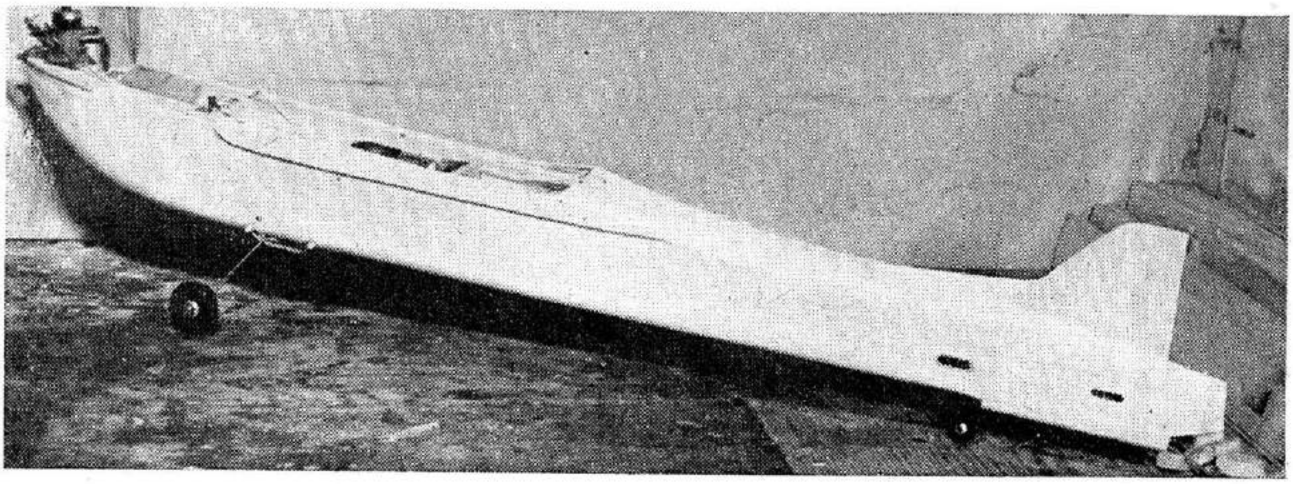
Harold de Bolt pioneered the removable box but even this could be awkward at times. My answer is to lay it all out "on a plate" with each part placed in the position it occupies in the model. The extra work involved in building has further proved the axiom that the more effort you put in the more reliability you can expect in weekly use.

The 'plate' is a $\frac{1}{8}$ in. (4 mm.) birch 3-ply flat piece cut to fit the contour of the model (a Honcho Gasser type is shown) so that it can be machine-screwed in place. On it are built up $\frac{1}{8}$ in. sheet boxes to hold tank, batteries, radio, servos; all wiring is taped in place where it is away from the aerial; all joints are easily inspected. A crash break-off motor mount plate can be added if wanted, using slightly longer holding screws in the same holes.

Nuts soldered to tin plate or inset blind nuts are installed in the fuselage sides pulling up against inset plates of $\frac{1}{16}$ in. ply. The holes are drilled with the whole works assembled in the fuselage to ensure correct alignment. Torsional strength has been increased by the addition of balsa blocks cemented to the inside faces of the fuselage sides so that they are a good fit against the equipment boxes, all this is done before sheeting the bottom of the fuselage.

. . . Now YOU write and tell us how you get round installation problems : Aircraft, boats, cars, or systems which are interchangeable with, to forestall the humorists, the *appropriate* control linkage.





Orbit Ten Channel Receiver and Transmitter

Reviewed by

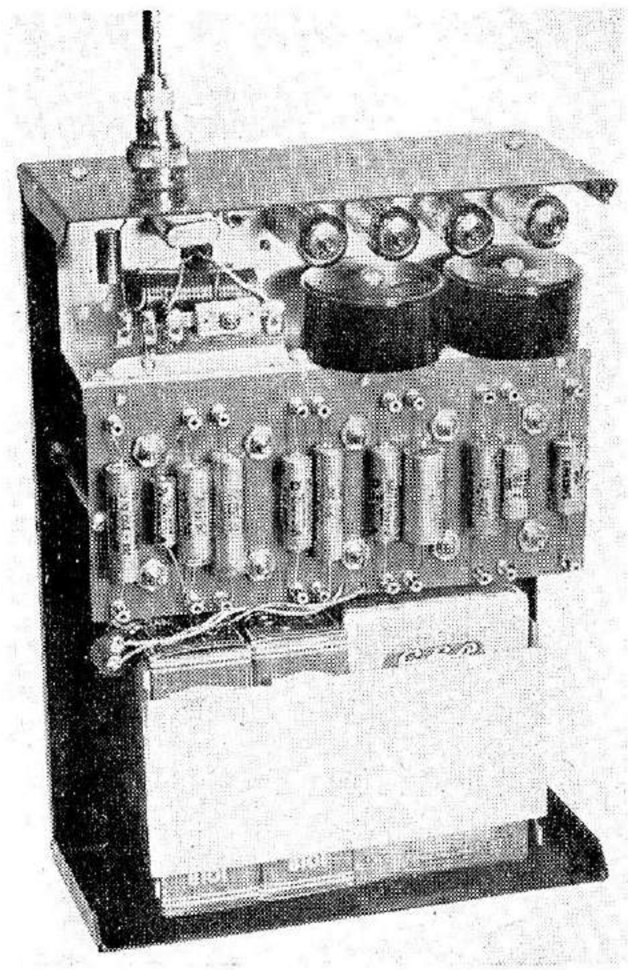
T. H. Ives and Dave McQue

For certain manoeuvres 10 channel equipment is a must and as a result this type of equipment is becoming popular with the more advanced fliers. We were interested therefore to receive for test the 10 channel Orbit Tx. and Rx.

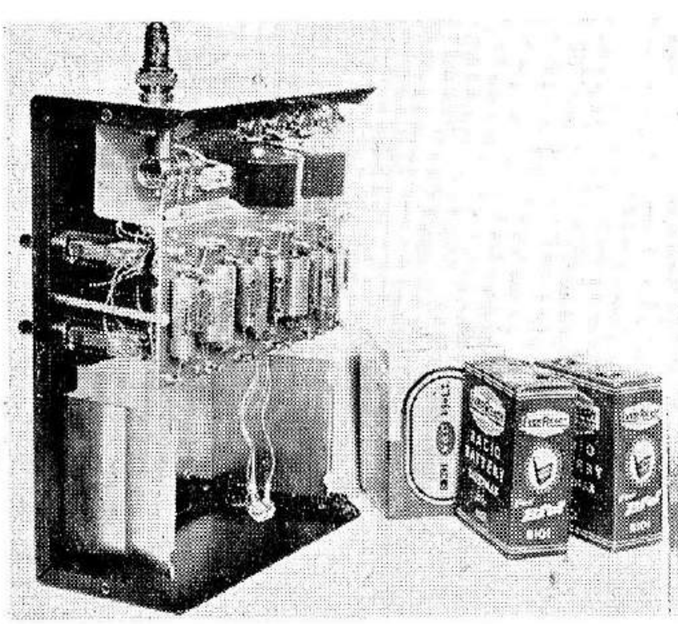
TECHNICALLY speaking the Tx. has some interesting features.

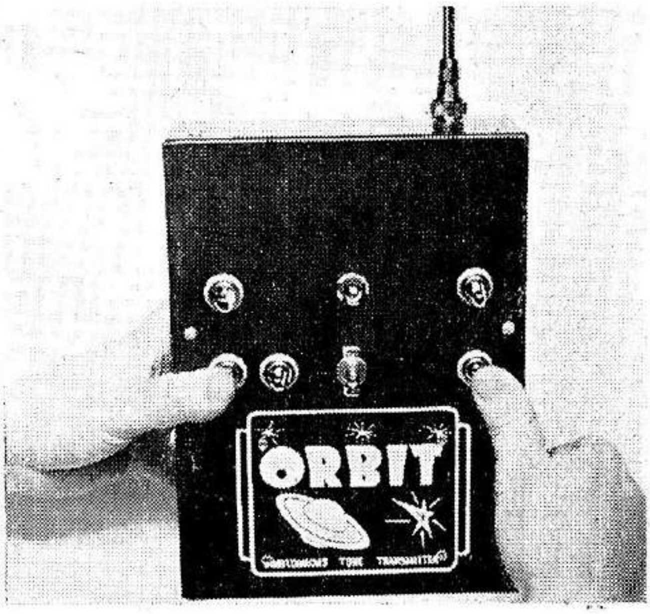
The radio frequency section uses one 3A5 (V4). The left hand triode of this valve is the oscillator controlled by a 26.995 mc/s overtone crystal. This feeds the right hand triode operating as a neutralised amplifier, C4 being adjusted at the factory to cancel out the anode/grid capacitance and its screw sealed with red paint. The neon G1 is connected so that its brightness is a function of both the DC supply and the RF voltage at the amplifier output and makes a simple and effective output indicator.

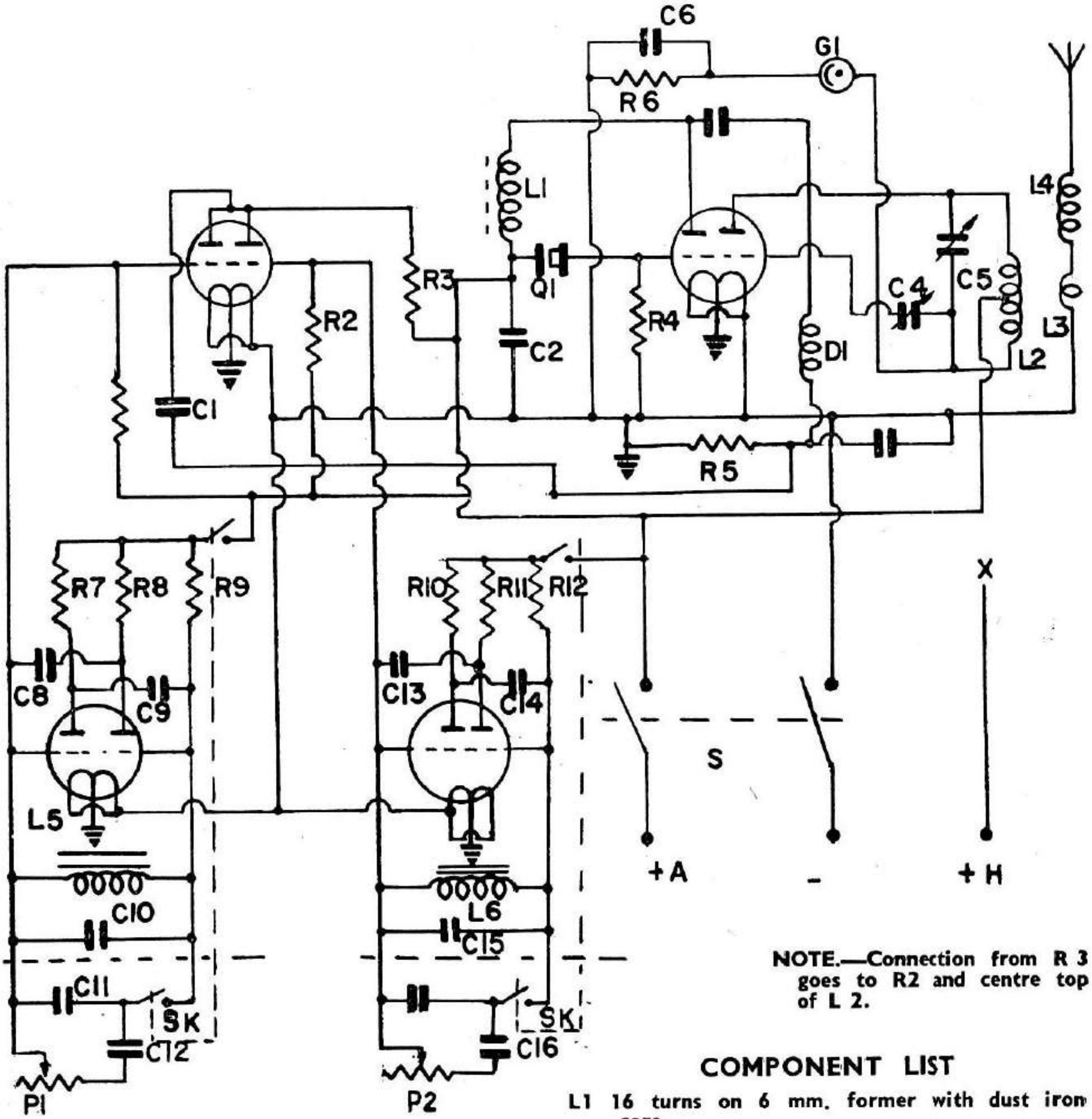
V1 and V2 are the two independent tone oscillators. The circuit might appear to be that of the multi vibrator and it would be but for the tuned circuit comprising L5 and its shunt capacitor. These convert it to an L/C oscillator, albeit with a heavy feedback and grid current damping. The fre-



The Tx. (above and left) showing the business part and battery retaining clip. Below : Standard positioning of controls being demonstrated simultaneously.







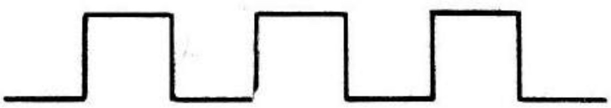
NOTE.—Connection from R 3 goes to R2 and centre top of L 2.

COMPONENT LIST

- **L1** 16 turns on 6 mm. former with dust iron core.
- **L2** 22 turns tapped at 11 turns on 12 mm. air coil.
- **L3** 5 turns coupling to L2.
- **L4** 18 turns loading coil 6 mm. dia.
- **Aerial** 140 cm. telescopic.
- **Q1** crystal. 26.995 mc/s overtone. Other frequencies obtainable.
- **L5** 1 mh choke.
- **L6** 1 henry inductance.

quency stability is good and reducing the H.T. volts to 67½ did not cause the reed notes to be lost.

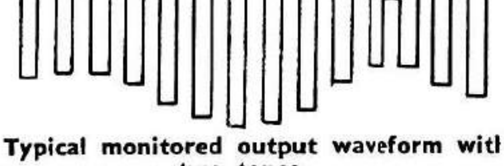
A direct connection from one grid of the oscillators to each grid of the amplifier V3 means that the modulation is virtually square wave and this was verified by the use of a single diode monitor and oscilloscope, viz.:



(Just the sort of thing to make Harry Cuckson's hair curl in fact.)

When the tones are selected simultaneously they are added in the common anode load R3 and applied as grid modulation to the Power Amplifier.

This is similar to the waveform obtained when two sine waves are added the amplitude varying at the beat or difference frequency between the tones



Typical monitored output waveform witl two tones.

The receiver does not reproduce this waveform completely and although two reeds can be operated simultaneously the beating is accentuated and more careful adjustment of the notes is required than for single operation.

The instructions on tuning the Tx. are simple and include adjustment of a dust iron slug in the oscillator circuit. The slug is rotated in a clockwise direction until the neon indicator light dims. It is then rotated in the opposite direction for a quarter of a turn past the point at which the light comes on. Final adjustment of the Tx. is achieved by rotating the tank tuning capacitor in either direction until the indicator light is at peak brightness. The effect is quite sharp and not difficult to achieve. A check with a field strength meter showed that tuning of both controls by means of the indicator light is quite accurate.

The twin tone oscillators and associated amplifiers and the RF section are all 3A5 valves and the total filament consumption is quite high at .88 amp. by present standards.

The H.T. current is quite reasonable at 12 m.A. rising to 15 m.A. with modulation and 20 m.A. for simultaneous. The H.T. battery life would be normal at this rate and stability would not suffer in the event of a drop in voltage.

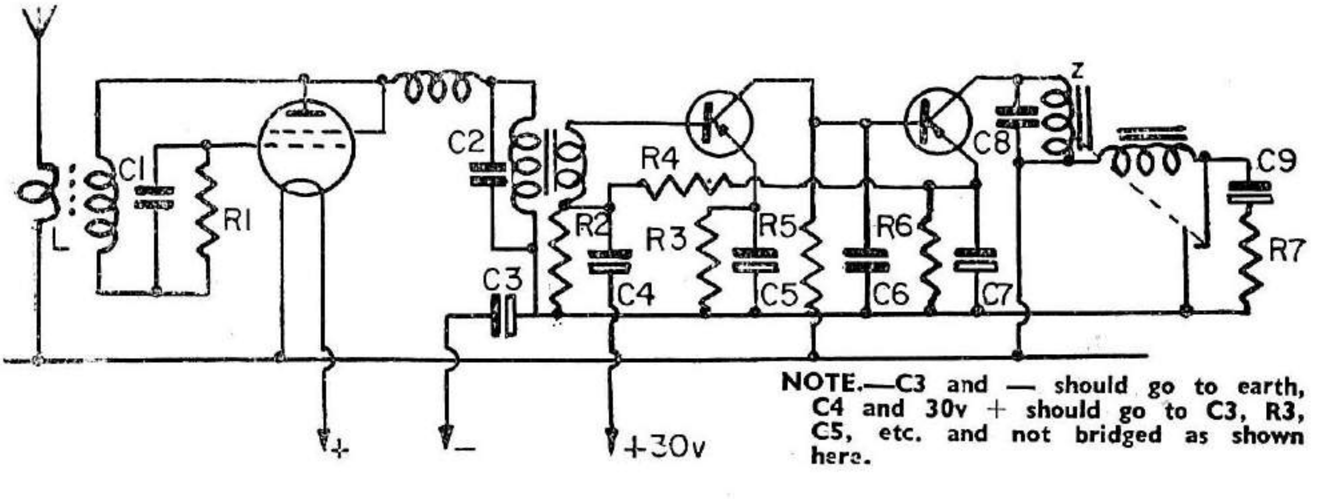
Tone frequencies are between 250 c/s and 500 c/s and for single reed operation separation is adequate.

Construction and wiring is first class and good quality components are used throughout. The front panel of the case includes a shaped cramp to hold the L.T. and H.T. batteries firmly in position. The RF, Oscillators and modulators are assembled on an L shaped strip of heavy gauge aluminium and this is firmly secured to the front panel and to the modulator control panel.

In addition to the Indicator and the on/off switch there are five two-way switches for the control functions. The centring spring arrangement of these switches is quite light and no fatigue should be experienced with extended operation. The positioning is fairly normal and arranged so that those controls which are normally simultaneous are on opposite sides of the panel. One criticism is that the control switches are not marked and in order to adjust the frequencies it is necessary to refer to the instruction sheet. Whilst this is not necessary when operating the Tx. it is useful to have the markings when making any adjustments. A good point is the placing of the pots. inside the case where unauthorised fingers cannot tamper with the adjustment. The stability is such that once adjusted there is no need to touch the control pots. L.T. battery AD4 1.5 volts. H.T. B.101 67½ volts. (2 needed).

Ten Channel Receiver

The receiver is completely enclosed in a light aluminium case measuring $3\frac{3}{4}'' \times 2'' \times 2''$ and at a weight of 8 ozs. is an attractive proposition. It is strong enough to protect the Rx. in a heavy crash. The 10 relays take up a space only $2\frac{3}{8}'' \times 1\frac{5}{8}'' \times \frac{3}{4}''$. Each relay, quite the smallest we have seen is quite positive in action. The point of make and break varies with each but all are within the 2 m.A. and 3 m.A. point. As the maximum current on signal is around 4 to 5 m.A. there is sufficient contact pressure to provide positive operation of the servos. As stated separation of the reeds is adequate but in spite of this when correctly



NOTE.—C3 and — should go to earth, C4 and 30v + should go to C3, R3, C5, etc. and not bridged as shown here.

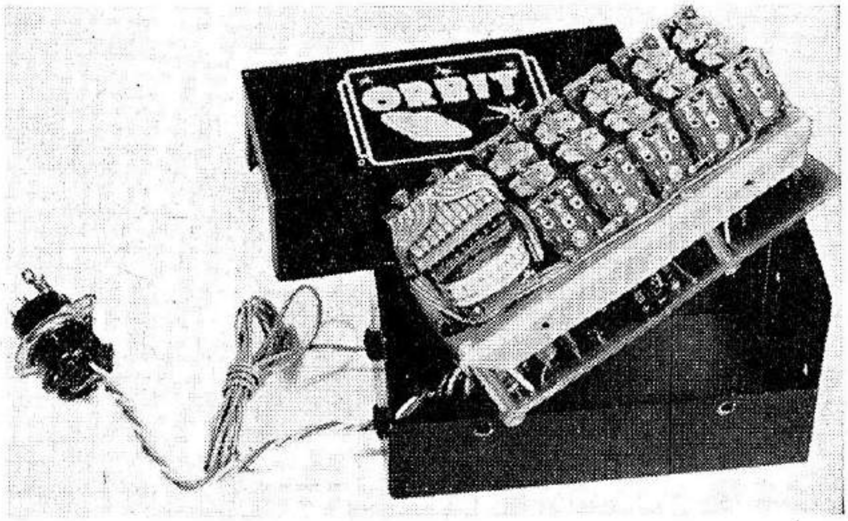
tuned the reed amplitude is quite high providing adequate current through the relays.

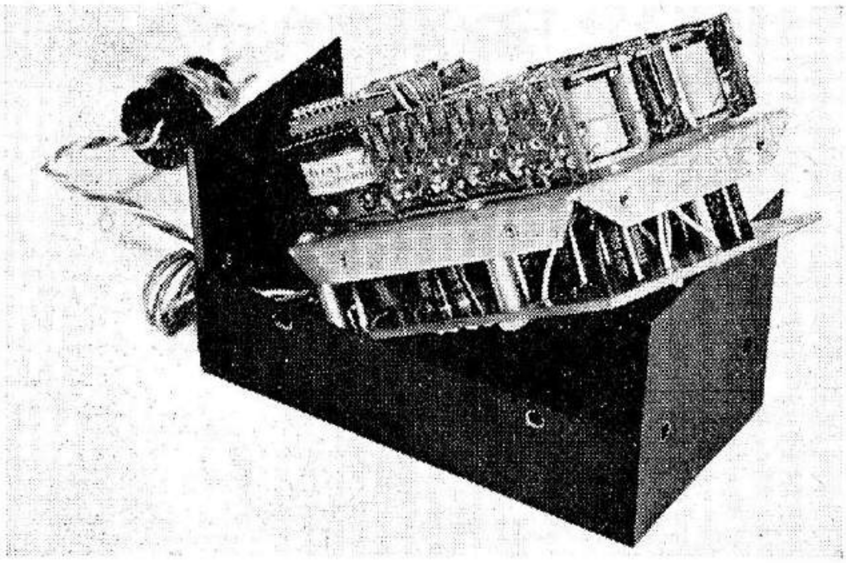
The standing current in the Rx. is 2 m.A. rising to 7 m.A. (approx.) on tone and 11 m.A. on simultaneous.

Tuning was quite easy and could be carried out without a meter. The reed unit coil produces enough "noise" and tuning to the silent point with the Tx. on quite positive. The alternative recommended by the makers is to key a tone and adjust the Rx. tuning slug in opposite directions to find the point at which the reed stops. The point midway between these is the correct tuning point. For safety the receiver should be taken about 100 yds. from the Tx. and retuned. L.T. 1.5 volts at 25 m.A. (U10). H.T. 30 B105.

In conclusion we can say that the equipment is well up to "Orbit" standards and can be thoroughly recommended.

The outfit tested was kindly loaned from stock by Henry J. Nicholls Ltd., 308 Holloway Road, N.7.





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Top : Compact block of ten relays and reed unit. Centre : Double deck construction shows well in this view, note vertical stacking of receiver components. Below : Printed circuit side of the receiver on glass fibre base. Opposite page : Theoretical circuit of the receiver.

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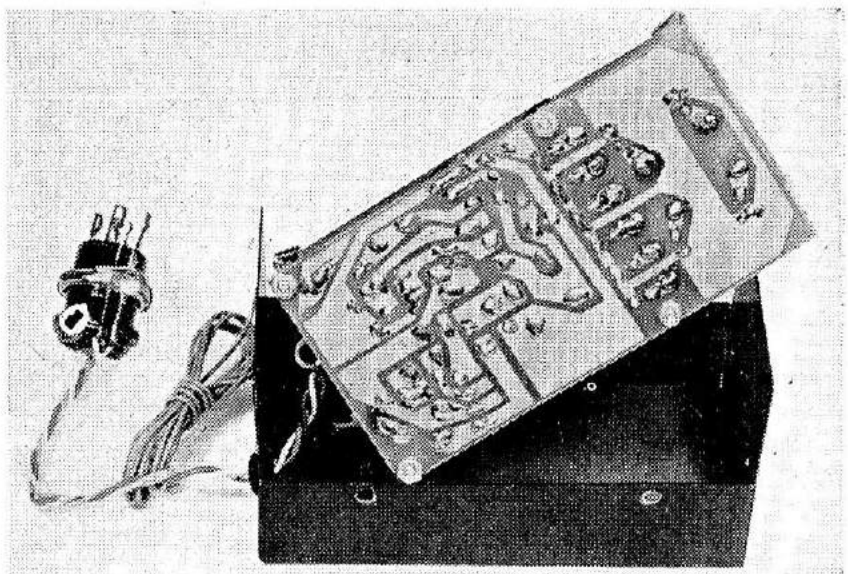


SIMPL SIMUL PLUS

(Continued from page 122)

elevator connector will pull the rudder central providing the off-set isn't too much.

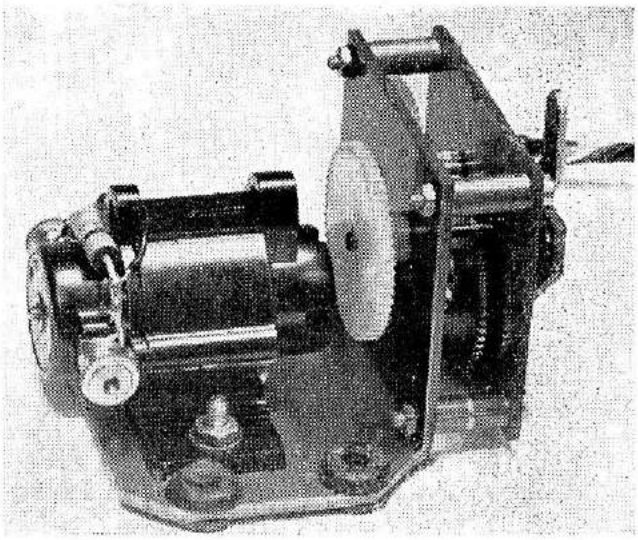
You already have details of my engine control with the reed "switching" a transistor so that the DEAC's can power the lot. I remain a firm believer in the idea of requiring a particular tone to *keep* the motor going!

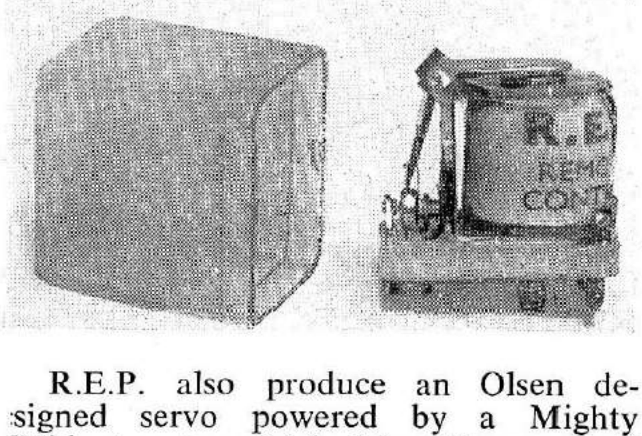
I appreciate that I have moved quite a long way from the *SIMPLE* Simul conception, but it all fits into a 46 oz. Gasser-winger (strengthened) model, now called BIZILIZI !

Although it is rather complicated electronically, to my mind the attraction is that the basic S-S concept, whereby one pulsing electric motor will give control to "bring 'em back alive", is unaffected by the elevator booster and it does not introduce any requirements of precise adjustment of the S-S system.

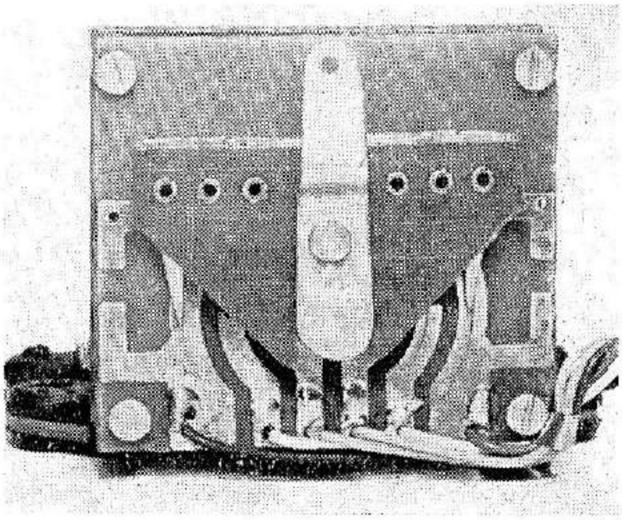
New Equipment

RADIO and Electronic Products have a compact little relay supplied with a clear plastic case which can be hermetically sealed by the customer after contact pressure adjustment if required. All the connections pass through the base so that the unit may be soldered directly into a printed circuit, one bolt serves as a means of attachment and the coil, which is wound on a nylon bobbin has a resistance of 5,000 Ω. Lower resistance windings are available upon request. Price is 25/6d. A vacuum impregnated coil version is available for an extra 5/-.



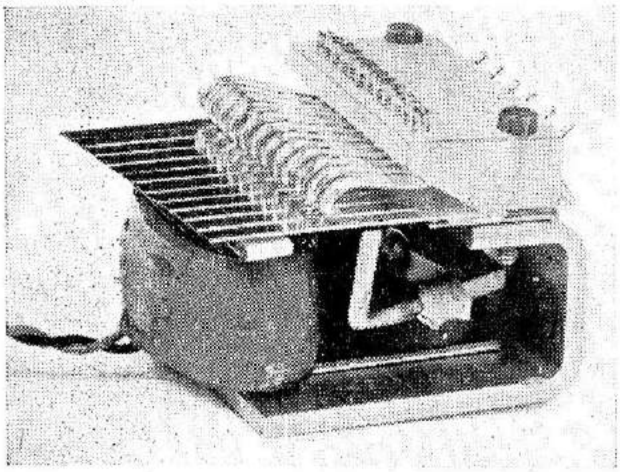


LEFT : R.E.P. Relay. ABOVE : Olsen/R.E.P. Servo, P.C. switchery and adjustable wiper plate shown in this end view below.



R.E.P. also produce an Olsen designed servo powered by a Mighty Midget motor which drives three sets of gears, nylon primary stages terminating in a brass final gear which is secured to a flat on the silver steel main shaft. The output lever is brazed to this shaft, which ensures a very solid set-up indeed. There are no flying connections or pigtails in the printed circuit wiper system.

The contact wiper plate may be adjusted by releasing the locking screw on



the lever, so that a wider break is obtained at self-centring positions to give a trim effect, i.e. left when returning from left or right when returning from right. A short signal in the appropriate direction will change the trim. Extensions to the printed circuit limit switch section enables the 60° total travel to be increased by a further 15°. These extra sections may be soldered to the normal set or connected via a throttle servo to operate at slow speed so that extra rudder movement is available. Of course, only one extension may be used to give more movement one side of neutral, this would normally require some linkage geometry or an angled bearer platform for the servo.

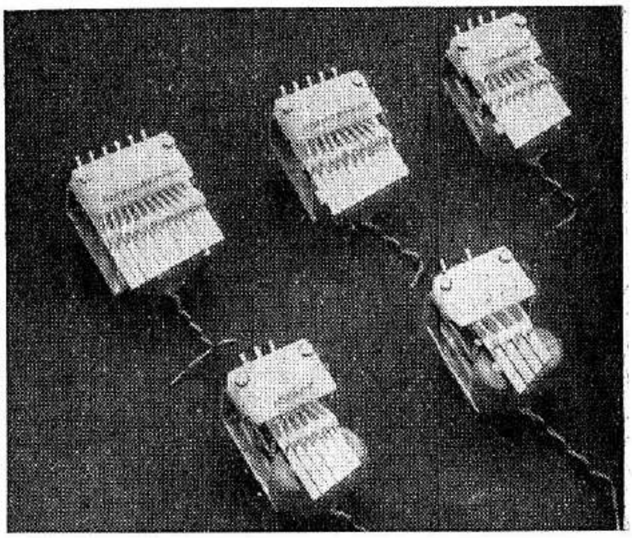
While on the subject of mounting, we are pleased to note the use of rubber grommets for the fixing bolts. It is surprising to see the amount of wear that can be caused by engine vibration when a servo or escapement is rigidly mounted.

Min-X Radio Inc. sent these pictures of their new reed units, features of which are re-designed nylon contact holders which ensure maintenance of setting.

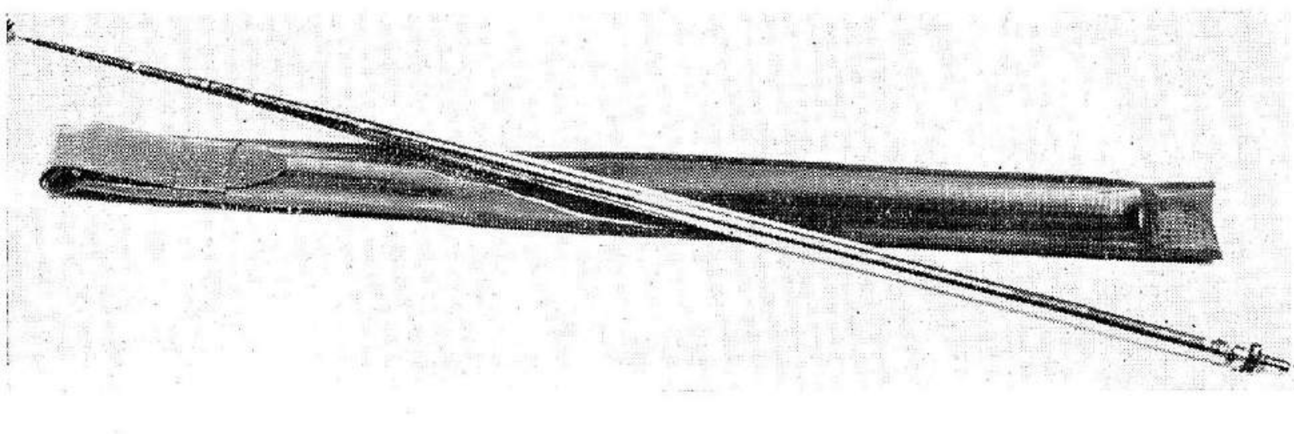
The contacts themselves are positioned to permit better proportional dwell time, assisted by a re-designed bridge. One of the special feature is the use of ceramic magnets.

The compact little Tx. aerial complete with plastic case comes from Roland Scott and costs 25/-. It seems light enough to use on large boats for the Rx.; 9 ins. long extending to 37¾ ins., it has chrome finish and split drilled bolt fixing which allows the aerial to be unscrewed from the Tx. case.

Light Soldering Developments Ltd. have a range of small soldering irons with bit sizes from $\frac{1}{32}$ in. dia. to $\frac{13}{32}$ in. dia. available in voltage ranges from 6 to 250 volts. The smallest "Adamin" models operate on 6 volts and have the element actually inside the bit. Typical small low priced model is the Type 51, 10 watt $\frac{1}{8}$ in. dia. bit. Price 19/6d., weighs $\frac{1}{2}$ oz. without flex (2 oz. with), 6 in. long and takes one minute to heat to 250° C., saturation point in three minutes (375° C.).



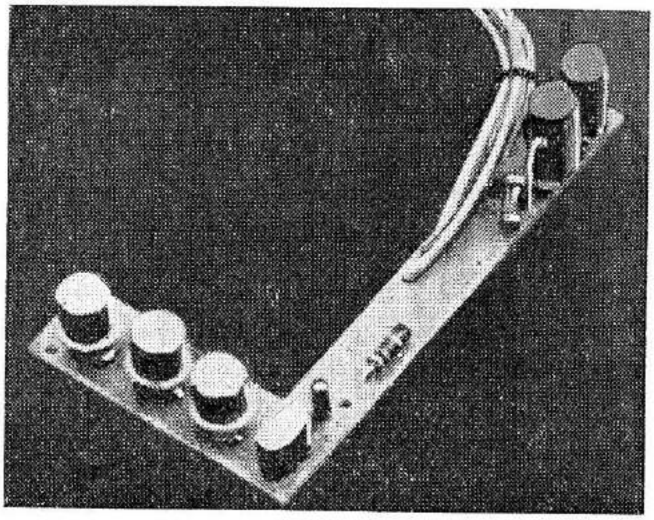
TOP LEFT : Min-X twelve-channel reed unit. ABOVE : Twelve, eight, six and four reed units from the same stable. BELOW : Roland Scott's aerial and case.

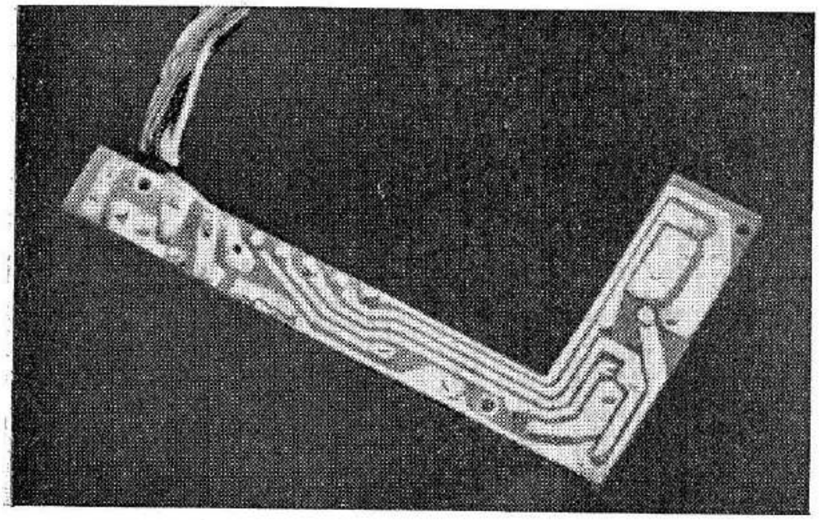


Relayless Servos

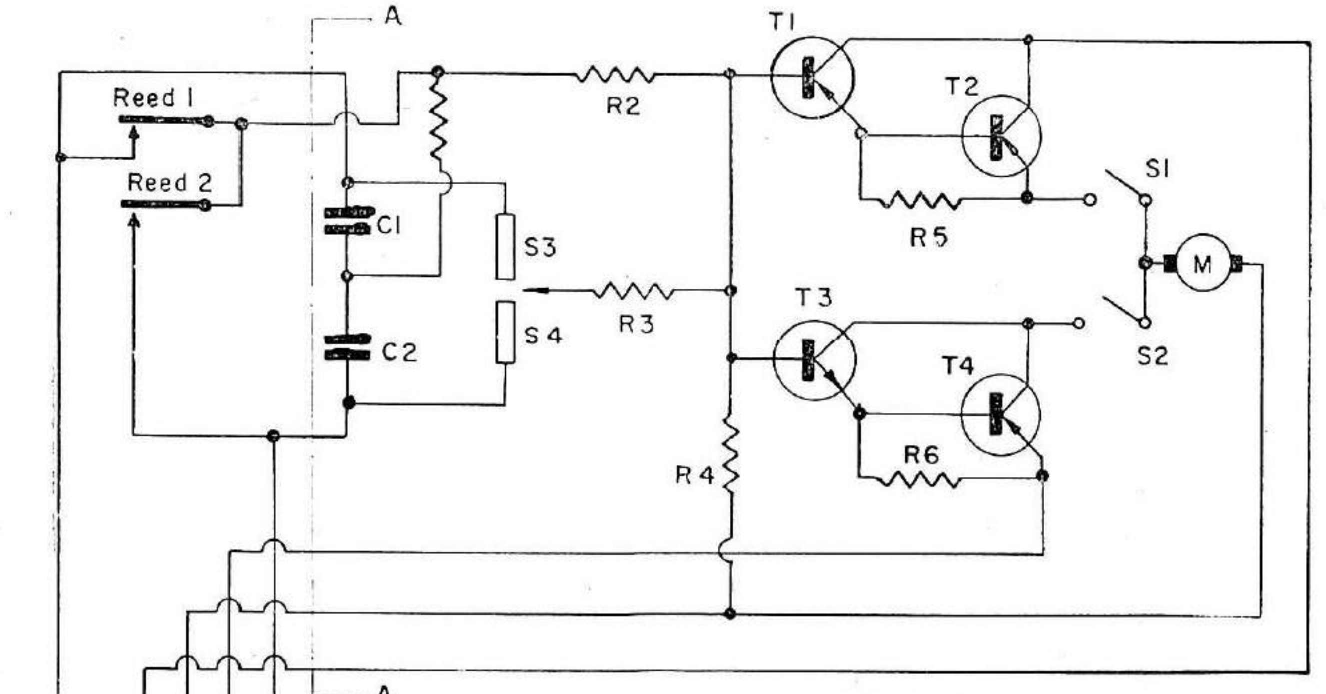
Followers of the relayless brigade will be interested in this booster used by Bob Dunham at the Zurich meeting.

From Aero Revue Suisse



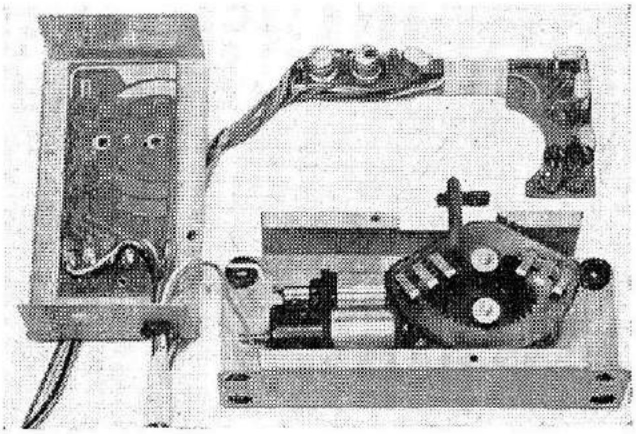


Two views of Bob Dunham's servo power booster. Top view shows the three 2N224 and one 2N214 transistors at the left hand end, two 5Mf capacitors may be identified at the extreme right. Left : A very neat bit of printed circuitry. Theoretical circuit below; external connections at A-A.



COMPONENTS

T1	**2N217**	**R1**	**10 Ω**	**R4**	**4.7 K.**
T3	**2N214**	**R2**	**2.2 K**	**R5, R6**	**47 Ω.**
T2, T4	**2N224**	**R3**	**10 K**	**C1, C2**	**5mf.**



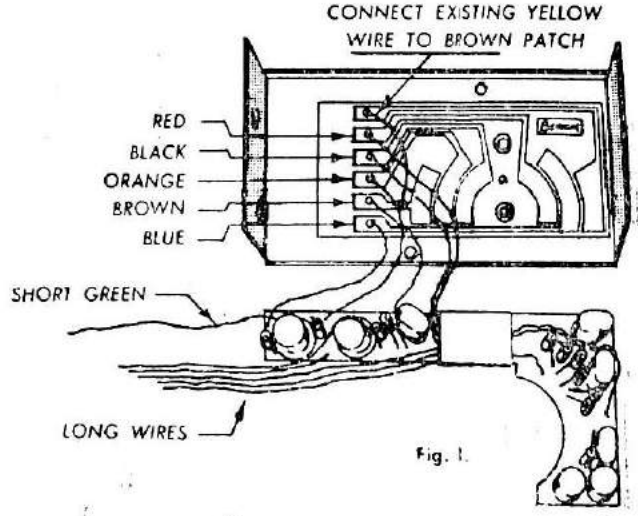
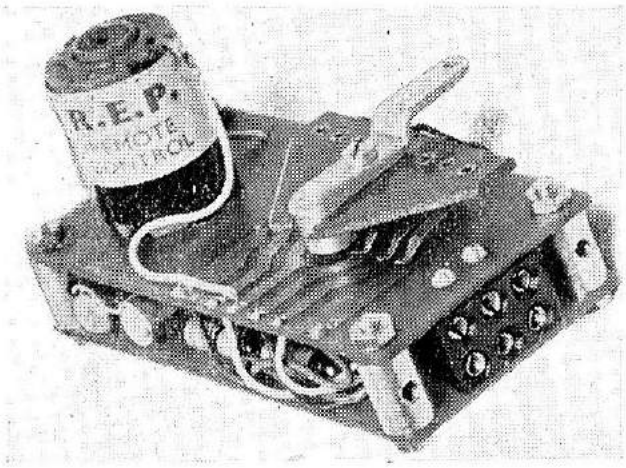


Fig. 1.

Top and Right : Bonner 6 transistor unit for Transmite. Below : R.E.P. 4 transistor servo for use with their Dekatone Rx., required split reeds and uses a "Microperm" motor.



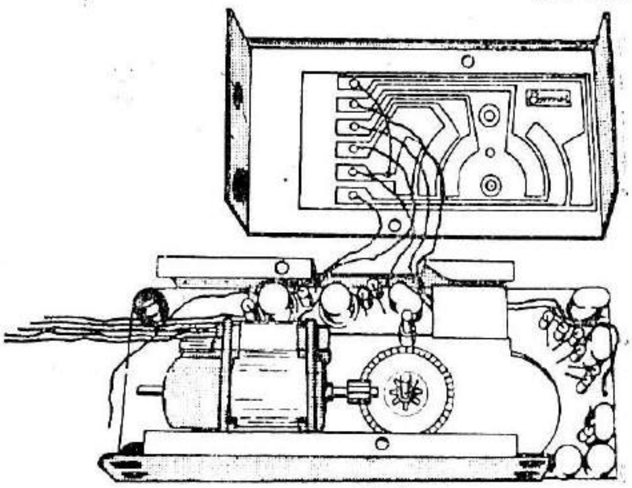
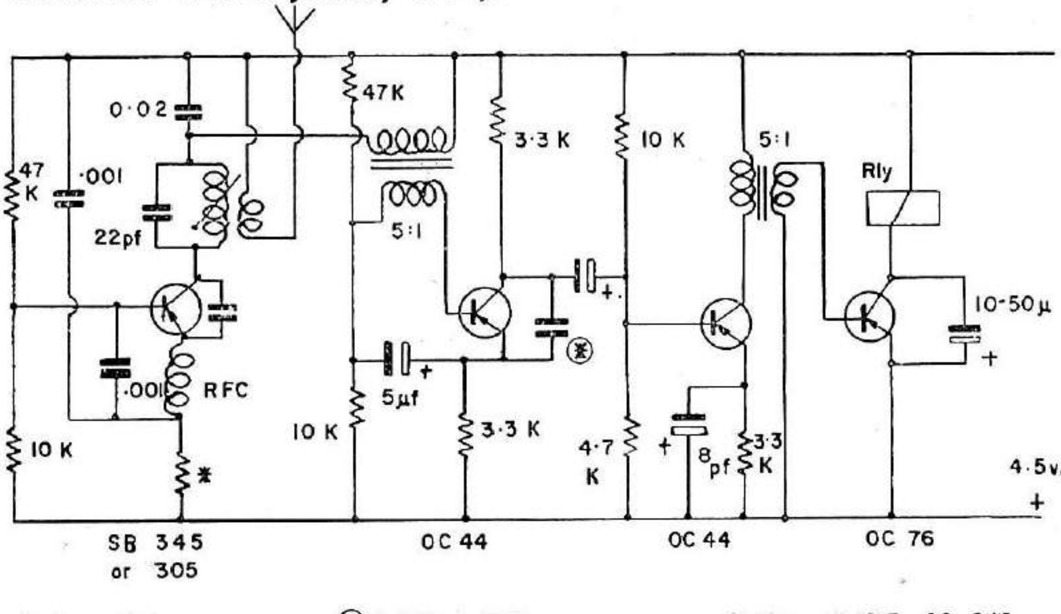


Fig. 2.

Peter Lovegrove put this little all transistor set together as an example of the use of the circuits described by Dave McQue in the series "Introduction to Transistors" (July to November 1960 & January 1961).

Lovegrove All - Transistor Rx.



✱ About 1·5 K adjust for best sensitivity.

(✱)0·005 – 0·02

Tuning coil 10 T 28 SWG on 1/4" former
Aerial Coupling 2T flex.

Basic Radio PART V

By G. E. DIXEY

Voltage Amplifiers

We have now met the more common types of valve employed in radio circuits, and seen how they may be made to amplify a signal applied to the control grid. We shall now look a little more deeply into the subject of voltage amplification and design a simple amplifier.

Valve Parameters (or Constants)

(*a*) *Mutual Conductance* (g_m).

With a certain value of bias voltage V_g applied to the grid a particular value of anode current I_a flows. If the bias voltage is changed the anode current changes.

The ratio—

$$\frac{\text{change of } I_a \text{ (m.A.)}}{\text{change of } V_g \text{ causing } I_a \text{ change}} = g_m$$

Mutual conductance is measured in milliamps per volt (m.A./V.). As an example a valve with a g_m of 5 m.A./V. is one in which a change of grid voltage of 1 volt causes the anode current to change by 5 m.A.

(*b*) *A.C. Resistance* (r_a).

The value of anode voltage V_a also has an influence on the amount of anode current flowing though to a much smaller extent than the grid voltage, since the anode is further from the filament emitting the electrons.

The ratio—

$$\frac{\text{change of } V_a \text{ causing change of } I_a}{\text{change of } I_a \text{ (m.A.)}}$$

is termed the A.C. resistance of the valve and the unit in which it is measured is the K Ω.

The term A.C. resistance may appear to be a vague one and a full explanation is complex, but, because the ratio is one of voltage/current, we can consider it to be resistive.

If you like, consider it as the resistance between the filament and the anode of the valve. This is quite a useful way of looking at it at this stage.

(*c*) *Amplification Factor* (μ)

This is simply a ratio having no units and is a measure of how much the voltage amplified by the valve is greater than the input signal.

$$\mu = \frac{\text{change of } V_a}{\text{change of } V_g \text{ causing } V_a \text{ change}}$$

Relationship between g_m, r_a and μ.

A shorthand way of writing 'a change of' is Δ (delta), so that the above equations may be re-written thus:—

$$g_m = \frac{\Delta I_a}{\Delta V_g}$$

$$r_a = \frac{\Delta V_a}{\Delta I_a}$$

$$\mu = \frac{\Delta V_a}{\Delta V_g}$$

If we multiply g_m by r_a we have,

$$\frac{\Delta I_a}{\Delta V_g} \times \frac{\Delta V_a}{\Delta I_a} = \frac{\Delta V_a}{\Delta V_g} = \mu,$$

since the I_as cancel out.

$$\therefore \mu = r_a \times g_m,$$

and if we know any two of the above we can find the third.

Voltage Gain of a Valve Amplifier

Gain is a term commonly used instead of amplification, and is the ratio of the output voltage of an amplifier to the input voltage.

Suppose an amplifier stage gives out 5 volts A.C. for an input 0.1 volts A.C.

$$\text{The gain (A)} = \frac{5}{0.1} = 50.$$

Suppose that the same valve has r_a = 50 K Ω and g_m = 3 m.A./V.

Then amplification factor μ

$$= 50 \times 3,$$
$$= 150.$$

It is evident that the stage gain A is much less than the amplification factor of the valve.

The reason for this is as follows:—

In Fig. 1(b) is shown an equivalent circuit of the amplifier, and we see that

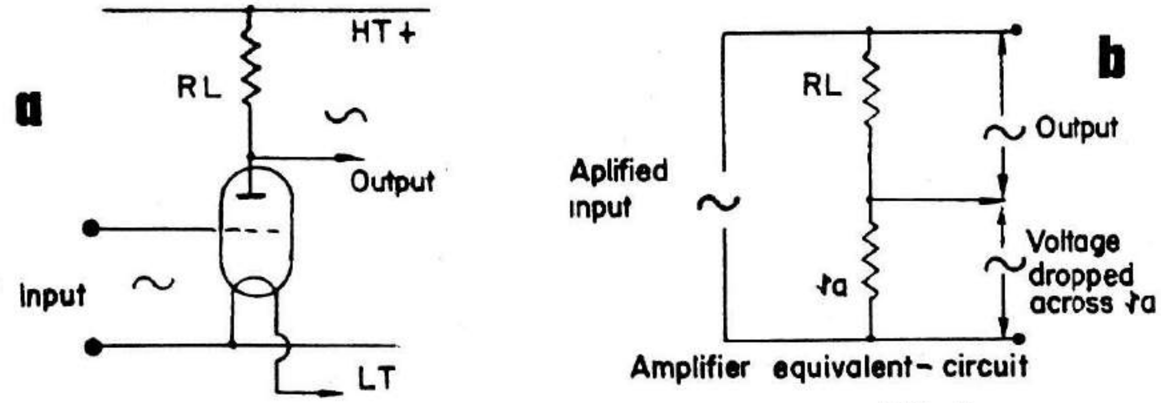


FIG. 1

the amplified voltage appears across r_a and R_L in series. Therfore only a portion of this voltage appears across R_L and is available as the output of the stage. The actual output available depends upon the respective sizes of R_L and r_a. In the example quoted the gain is reduced from 150 to 50, so the value of r_a must be twice as large as R_L, since two-thirds of the voltage is dropped across it.

The gain of the stage is given by A $= \frac{\mu R_L}{r_a + R_L}$ which is always smaller than μ.

If we know the r_a and μ of the valve we can choose R_L to give us the required gain.

Let us do this.

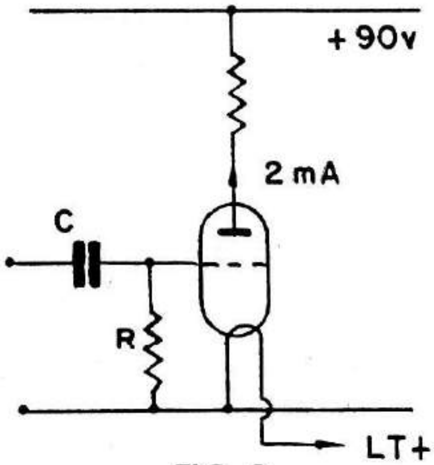


FIG. 2

Suppose that we decide that I_a should be 2 m.A., and that the H.T. is 90v. The 2 m.A. flowing through R_L will cause a volt drop across it, and this must not be too large, since we must always leave sufficient voltage across the valve. However, since we do not know R_L yet, we cannot say what this volt drop will be. If we want 4 volts out for 0.2 volts in our gain must be $\frac{4}{0.2} = 20$, and from valve data we find that r_a

$= 30 \text{ K } \Omega$, and $\mu = 50$,

then since $A = \frac{\mu R_L}{R_L + t_a}$

$$20 = \frac{50 R_L}{30 + R_L}$$

$$\therefore 600 + 20R_L = 50R_L$$

$$\therefore 30R_L = 600,$$

$$\therefore R_L = \frac{600}{30} = 20 \text{ K}\Omega$$

Volt drop across R (by Ohm's law)

$= I_a R_L$

$= 2.10^{-3} \times 20.10^3$,

$= 40$ volts.

Since H.T. voltage is 90v.

Va $= 90—40$,

$= 50$ volts, which is quite adequate.

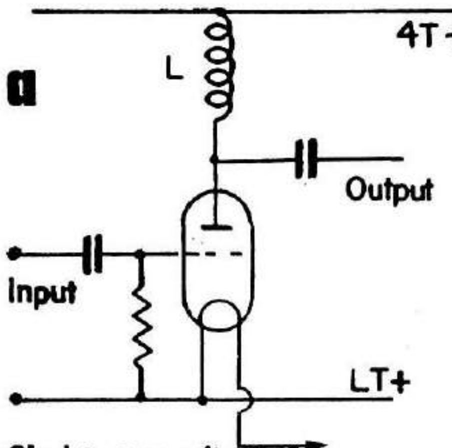
So we have designed a simple amplifier. If we had found the volt drop across R_L to be excessive, we should have had to adjust our bias to reduce I_a and hence the volt drop across R_L.

In Fig. 2 C is a coupling condenser, and R is the 'grid leak'. Without R in circuit a charge builds up on C which would cut the valve off. The grid leak R conducts this charge away to earth.

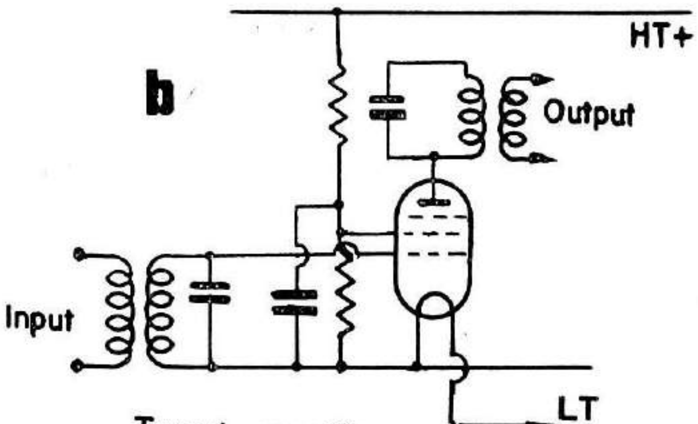
If the output is to be coupled to a further stage, it may be done so through another coupling condenser. Where R_L is a resistor, this method is termed R-C coupling.

Tuned and Untuned Amplifiers

Where the anode load is a resistor,



Choke capacity L-C coupled amplifier.



Tuned amplifier

FIG. 3

the amplifier may be said to be untuned since it does not respond to any one particular frequency. Another form of untuned amplifier is shown in Fig. 3(a), where the load is a choke. This amplifier is said to be L-C coupled.

Fig. 3(b) shows an amplifier where the anode load is a resonant circuit, which, since it responds to a single frequency or narrow band of frequencies only, is a tuned amplifier.

In this example, the grid circuit is also tuned, and such an amplifier may be extremely selective. Its usual application is at radio frequencies.

current flows through R_2, and as a result sets up a volt drop across it of the polarity shown. The positive end of R_2 is connected to the filament and the grid, via R_1, is connected to the negative end. Thus, the grid is made negative with respect to the filament. Do not be confused by the presence of R_1, which is only a grid leak. There is no volt drop across it, and effectively the grid is connected direct to the negative end of R_2. Varying the value of R_2 varies the bias applied to the grid.

The next article deals with the valve oscillator.

Method of Applying Bias (Battery Valves)

So far, we have talked about setting up a particular value of bias voltage without describing how this is achieved.

To bias the valve the grid must be made negative with respect to the filament, which is the same as making the filament positive with respect to the grid and this is what we do in practice.

In Fig. 4 the filament is connected to the L.T. battery the L.T.—being connected to H.T.—by a resistor R_2. The grid is connected to H.T.—through R_1.

The arrows show the path of the anode current I_a, and we see that this

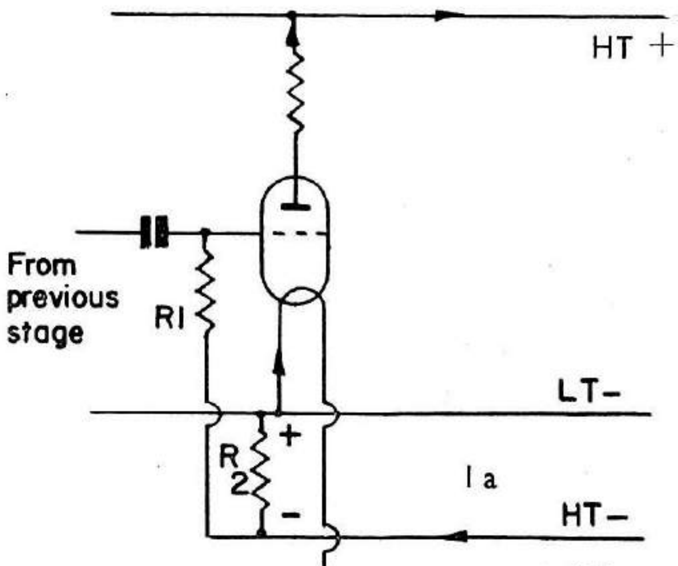


FIG. 4

Part 1-4 appeared in November, 1960 — February, 1961. Back issues are still obtainable from these offices.

McQUERY COLUMN

DAVE McQUE WILL ANSWER QUERIES THROUGH THIS COLUMN EACH MONTH, AND WE WELCOME GENERAL INTEREST PROBLEMS. AT THE MOMENT WE CANNOT UNDERTAKE TO ANSWER QUERIES THROUGH THE POST, NOR SHOULD SETS BE SENT TO US UNLESS SPECIFICALLY REQUESTED.

I HAVE constructed the Dutch all-transistor receiver as published on page 335 of your November issue. I have substituted an SB 305 for the OC 170 and included a 10 K resistor in the collector circuit as per your suggestion.

The only other modification to components specified is the use of 5:1 ratio transformer (Ardente 1079's) instead of the four to one ratio. I have used .01 mfd. for C5 and C6 and tried many values for R1 up and down.

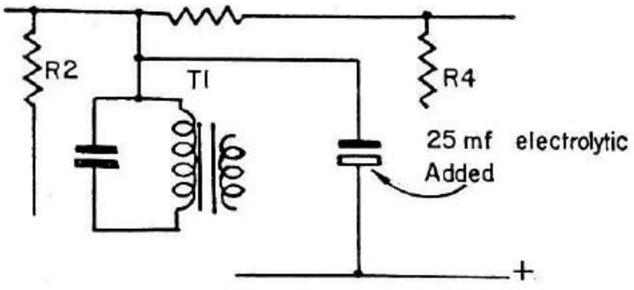
My problem is lack of sensitivity. The receiver will only work when the receiver aerial is very close or touching the transmitter aerial. I would be obliged if you could give me some advice on adjustment of the r.f. stage as this seems to be the offending part. Checking with headphones on the secondary winding of T1 there is no "hiss" or noise without carrier signal although I get a slight note with tone keyed at zero range.

—J. B. R., RADBROOK.

It appears from the description you give that your receivers detector stage is acting as diode and not super-regenerating at all.

It is essential to get the hiss to indicate correct operation.

The 10K resistor should be in the negative line after the point where R4 joins and before junction of T1 as shown below. Put a 25 mfd. electrolytic down to positive. If still no success try replacing R2, R3 with a 50,000 variable resistor, adjust for optimum performance, measure the resistance from the wiper arm (centre contact) to each end when thus adjusted and replace by equivalent fixed resistors. Try increasing C3 to 10 or even 15 pF. if necessary. Is L3 all right, the little R.F. chokes (miniature pile wound) sold by Lasky's, and Henry's seem quite good ?



I RECENTLY bought a book published by you, "Simple Radio Control". From this book I constructed the "Geof. Pike Miniature Receiver", but I am unable to get the required standing current. The standing current obtained is only .2 m.A. The relay fited is an R.E.P. ½ oz. I took this receiver to a model shop and they had no luck either. Could you please inform me if there is any method to raise the standing current (have tried a new valve), or could you please put me in touch with someone capable of putting this set in working order.

—D. L. C., COALVILLE.

It is not clear from your letter whether or not the .2 m.A. standing current is steady or fluctuating, or if it drops further on receipt of a signal.

If it is a steady reading and the steadiness is not due to the meter damping giving a false impression, it is either one of three things, low batteries. (Both H.T. and L.T. MUST be up to full volts to get results, 40 volts instead of 45 isn't enough), if not this then check for a high resistance relay winding, assuming a 10,000 ohm anode load, then at .2 m.A. the voltage at the anode should be 43v., anything much lower than this is suspect if a good meter is used.

A less likely cause of a steady low standing current is an unduly high value grid resistor, this would normally cause the meter to kick a bit however.

If the current fluctuates rapidly try using a larger capacitor in place of the 10 pF. specified, if necessary remove some turns from each end of the coil

to keep the tuning range right. Alternatively put a 100 K resistor across the coil and if needed decrease this to 50 K, do not carry this too far, however, or you will lose sensitivity. You can also try connecting the aerial to the grid end of the coil increasing the 5 pF. capacitor if need be, or even connecting the aerial direct.

Another method of increasing the standing current is to increase the 0.01 capacitor in steps to as much as 0.5 mfd.

I HAVE recently made the "multimeter" as shown in "Simple Radio Control", but I cannot obtain satisfactory results on the 50 m.A. scale, although I have followed the instructions to the letter.

The 5 m.A. meter I am using has a resistance of 90 Ω and was placed in series with an Avo-Minor, a current of 40 m.A. was then supplied as suggested, both meters gave equal readings after the 10 Ω resistor had been adjusted.

The meters were then individually subjected to a known current of 40 m.A.; the Avo read 40 m.A. but the "home-made" meter showed 18 m.A.!

The circuit and resistance (+ and — 5% as recommended) have been carefully checked and found to be in order, and I am at a loss as to what to do.

I should be most grateful if you could advise me on this matter.

—K. S. M., FLIXTON.

It is suggested that you check the voltage across your meter at full scale deflection on both the 5 m.A. and 50 m.A. ranges, in both cases the voltage should be 0.45 volts, use the highest range on the Avo-Minor at which you can get an accurate reading as otherwise this may affect the result. If the voltage is correct then your meter is O.K. The reason for the differing readings on the Avo and your meter is that the Avo has a far lower resistance and in any given circuit will pass more current. (It is assumed that the set-up you used was as per sketch). You will also probably find that your voltage readings will be inaccurate as well if you check as per circuit in second sketch. If so correction by altering the 1·K and 20 K resistors should be fairly easy. A process of trial and error being indicated.

At the same time I would suggest that if you can get it a basic movement of lower resistance would be far better as the present meter may affect the optimum settings of receivers (particularly transistorised ones), so that when removed the correct setting is lost.

RESULTING from your article in the June issue of R.C.M. & E., I have built the TR 4.5 receiver described therein.

The components and transistors used were the specified equivalents with the possible exception of the transformers which are the D1001 as supplied by Henry's Radio Ltd.

The amplifying stages appear to function satisfactorily inasmuch as any noise introduced into the circuit immediately produces the 40 m.A. current rise specified. However, the idling current, without the transmitter on, is only 3-4 m.A., not the 10 m.A. specified.

A modulated signal may be tuned in at close range to give the 40 m.A. rise, but only at short range and tuning is very touchy.

It would appear, therefore, that the "front end' is not functioning satisfactorily, there being a lack of the normal "hiss" associated with super-regenerative receivers.

Can you offer any suggestions for improving the circuit? We note that Norman Kyte of Mullards built a "modified" version of this receiver. Are details of this modification available? Alternatively, could you please put me in touch with Mr. Kyte?

Our thoughts are that possibly the OC 170 is not an exact equivalent for the American A01 and that some circuit change will be necessary to enable the OC 170 to function satisfactorily.

I enclose an S.A.E. for your reply.

—K. G., PARKSTONE.

With reference to your letter of the 15th June you are right in your assumption that the OC 170 is not an equivalent. It is better on 6 volts, and if you have used 4.5 you could try 6 volts.

If this is not the solution try a variation of the 1.2 K emitter resistance and also the base bias network 10 K and 47 K. It is a question of finding the best operating values in order that the transistor quenches correctly.

I HAVE waited impatiently for the publication of an all-transistor relayless receiver, and the 305 seems just the job. Sequential control (1 signal left, 2 signals right, etc.) can be obtained through a rubber-driven compound escapement of the Fred Rising type. I have, however, just abandoned this escapement (operated by my present Hill receiver) for the "Canadian" type actuator made from a Mighty Midget motor ("Aeromodeller", February, 1957, issue).

Could you please tell me whether :—

(1) The 305 Rx. can be modified to operate this Mighty Midget actuator (or eventually some other motorised actuator) with SEQUENCE *control ? The M. Midget only require 1½ volts otherwise it overrides the sellotape breakers. In its present form, it makes use of its two contacts on the receiver relay.*

(2) The M. Midget can be modified to give quick-blip motor control ?

(3) Whether you could recommend a motorised compound actuator which would work off the 305 to give left/right rudder; up/down elevator; blip engine control. In other words to obtain a control similar to that obtained with an Ultraton Rx. and Micro 4 actuator ? The equipment described in the "Aeromodeller", August, 1958, page 426, still requires a relay on the receiver. It also does not provide engine control.

Although I've been flying R/C for one year successfully, I'm still very much a novice, so please make the explanations as simple as possible.

—W. H. S., RHYL.

With reference to your letter it is most unlikely that the 305 all-transistor receiver would operate satisfactorily with a motorised actuator.

With these circuits, sensitive to noise, it is very difficult to include a motor in the system due to the noise generated as even with H.F. chokes in the actuator leads some noise leaks through and any filter would be doubtful in action.

This is probably why the designer uses an actuator.

The Mighty Midget could no doubt be modified to give engine control but for reasons already given is not recommended.

I AM groping in the darkness of a country where R/C holds little interest and no encouragement from most people.

I have started building the Ivy receiver, but I could not find the necessary coil formers; can these be replaced in any way ?

I cannot find a 3A5 or a DCC 90 valve to build the Ivy Tx., so I decided to build the Tx. in J. M. Kearney's book, "R.C. Models for Amateurs" using two 3Q4's. I would have liked to build the Xtal controlled Tx., but the only crystals I can find are in the Kc/s range (can such Xtals be used and what frequency?).

Can you suggest a Tx. circuit which is easier on the pocket ? (I have a means of freq. calibration at an expert's.) I have been a subscriber in "Model Maker" and "Aeromodeller" since 1959 and "Radio Control Models & Electronics" since its birth.

I intend making an actuator; what diam. wire and no. of turns should be used ?

WAGDY ANIS, EGYPT.

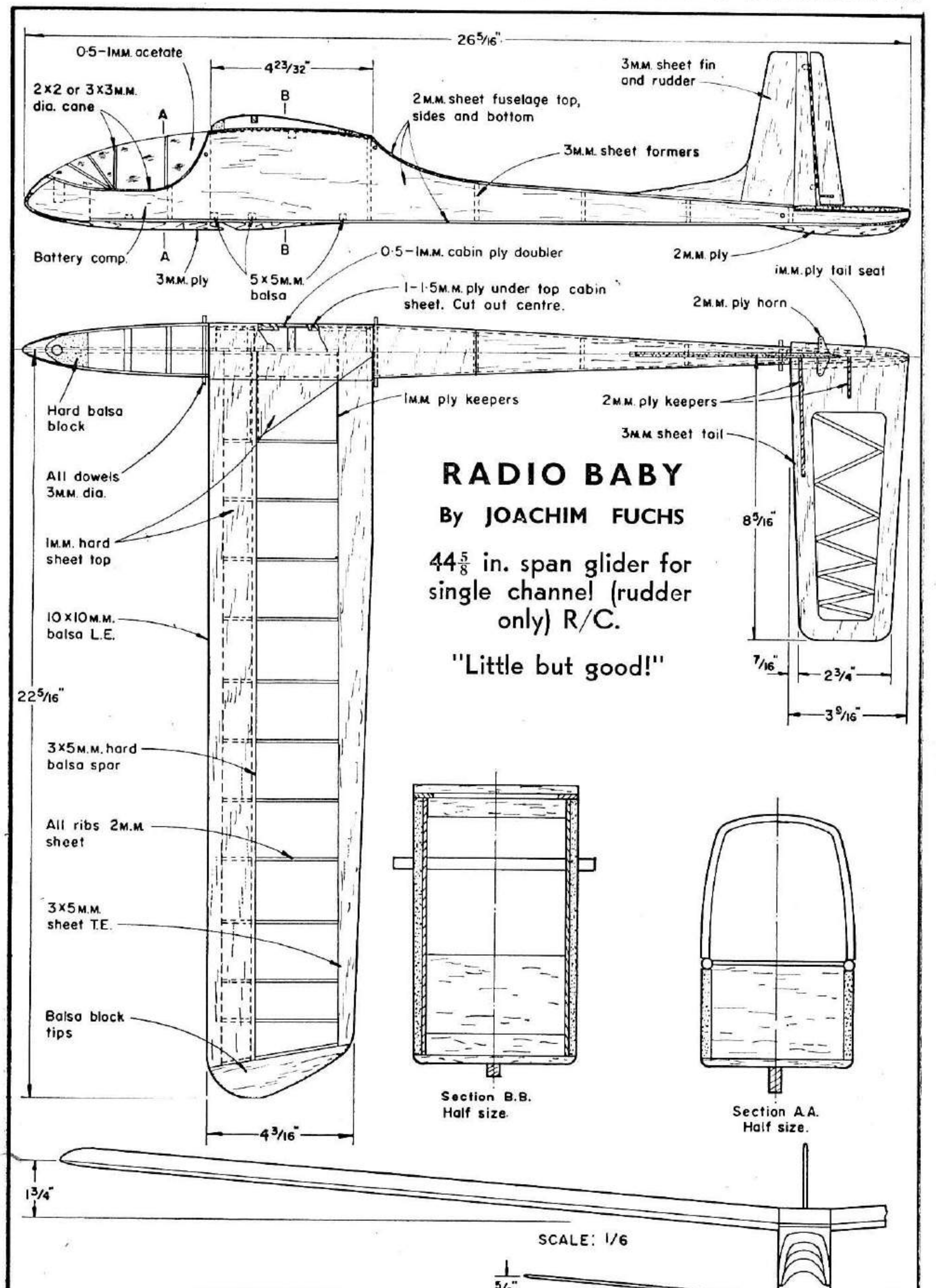
I am sorry to hear that you have obstacles to progress in the radio control model field and unfortunately it is one of those things we have to accept in those countries away from the great industrial centres. No doubt as time goes by matters will improve. We hope so.

In the case of the Ivy receiver, it is not essential to use the coil former specified. You could use a piece of insulating tube about ¼ in. or $\frac{5}{16}$ in. diameter and wind 30 turns on it. The coil could then be tuned by a midget variable capacitor of say, 0.30 pf. capacity. If the coil has too many turns take off one at a time.

The AM/Ivy transmitter is quite inexpensive and if the 3A5 is not available use a 3Q4 or 3S4 or, in fact, any similar valve, two of these would be needed instead of one 3A5 and all you need to do is connect the two filaments in parallel and connect the remainder of the electrodes as in the case of the 3A5.

KC crystals are not usually suitable for crystal controlled transmitters on 27 meg. c/s. A fourth harmonic crystal can be used in a special circuit, but it usually requires three valves.

With regard to the actuator this depends upon your needs and the voltage you propose to use. Start off with 400 turns of 36G enamelled wire.



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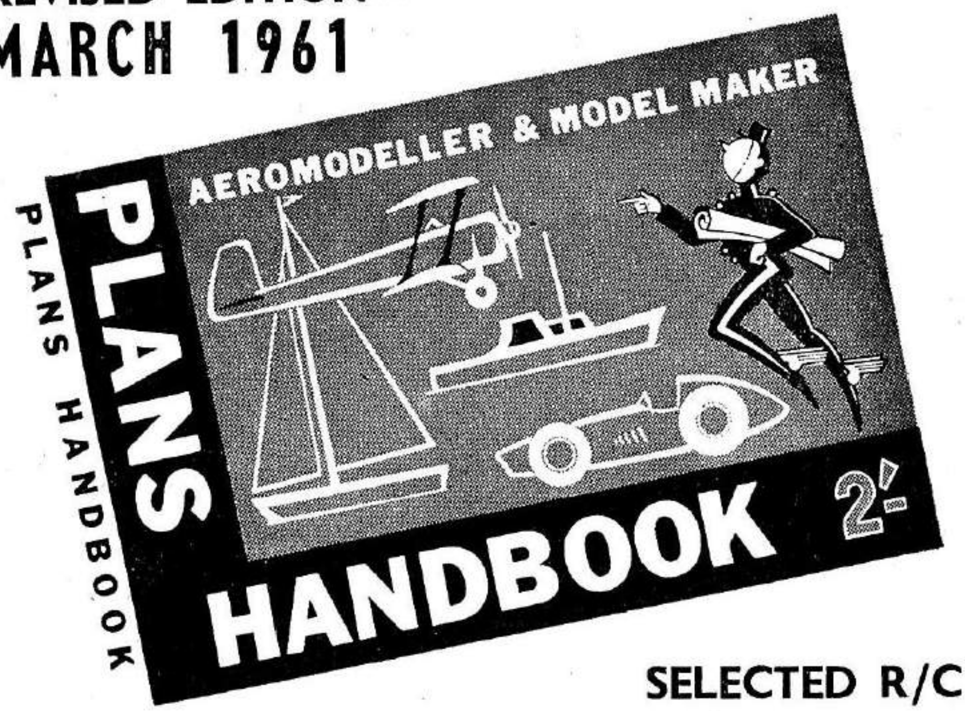

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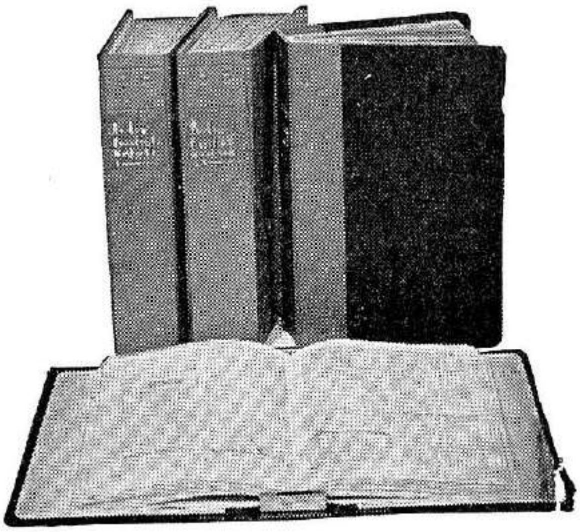

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