RADIO CONTROL MODELS & ELECTRONICS

MAY 1962 PRICE 2s

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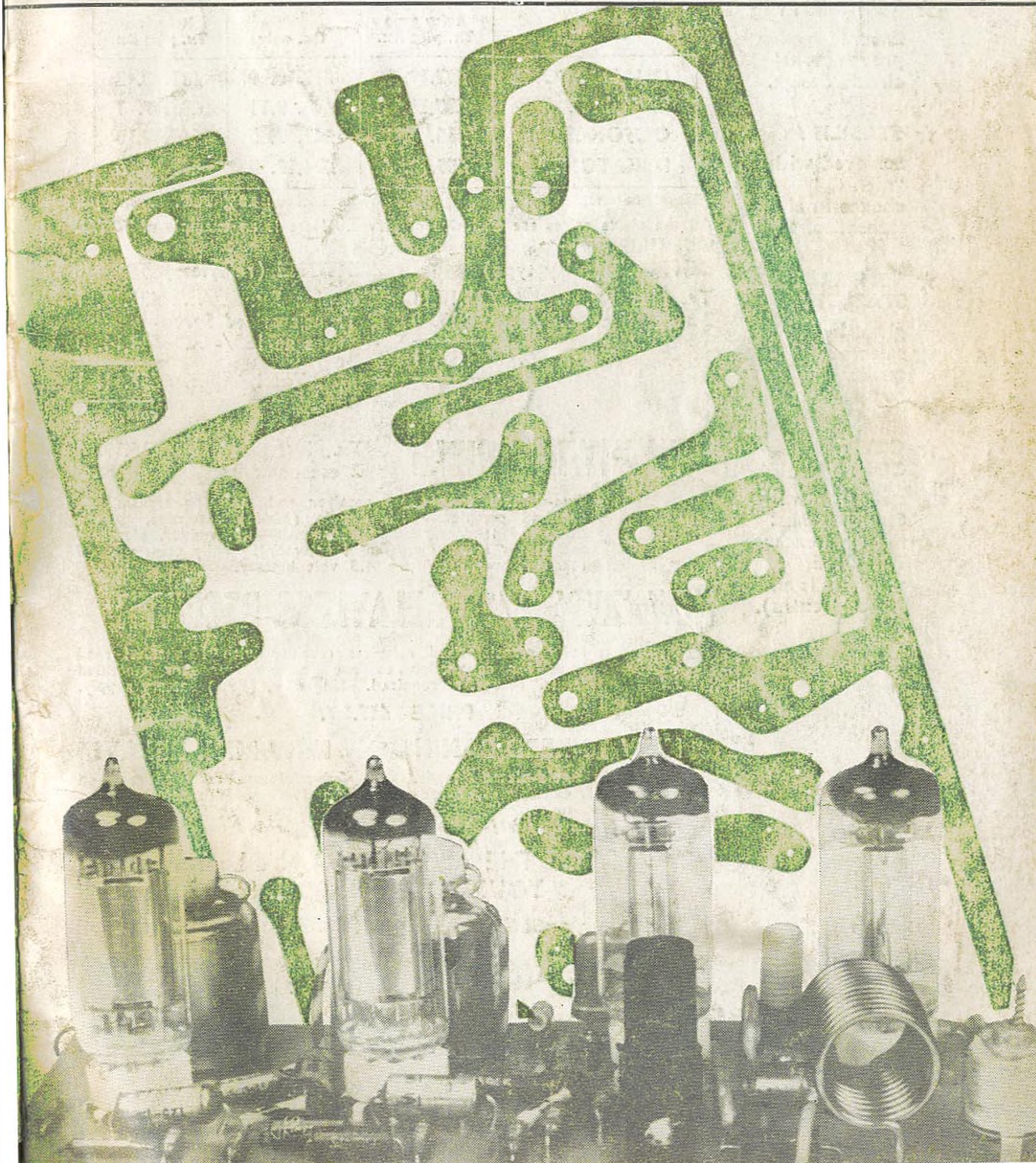
SIMULTANEOUS 10 CHANNEL TX., BUILDING THE MICRODYNE ONE RX., EASY TESTER FOR RESISTORS AND CAPACITORS, BOAT R/C



RADIO AND ELECTRONIC PRODUCTS

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Based on our original, proven circuit designs all 'REP' multi receivers for 1962 now have the valve stage replaced by a RF transistor, New foolproof relays and the NEW 'REP' 10-reed bank. All receivers work off a single 9 volt (PP.3) battery. Transmitters incorporate NEW, improved switches and easier battery access.

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achieved with "high Q" chokes in all transmitters

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given by selected high-quality components

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standard on all "multi" transmitters (except TRITONE, where it is an optional extra).

	Relay type Tx. plus Rx.	Rx. only	Relayless Tx. plus Rx.
QUADRATONE	£32.19. 2	£18.18. 9	£31. 3. 2
SEXTONE	£35.18.11	£20. 9.11	£33.17. 1
OCTONE*	£50. 6. 7	£22. 9. 5	£45.10.10
DEKATONE*	£59.18. 6	£24.19. 9	£52.14. 6

**Simultaneous.* *All prices include 10% P.T. surcharge.*

All the above prices are exclusive of servos. Here is an example of **TOTAL** comparative costs :—

SEXTONE (relay type)

Tx. plus Rx. ...	£35.18.11
3 Servomites at 59/8	£8.19. 0
Total ...	£44.17.11

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Tx. plus Rx. ...	£33.17. 1
3 Transistorised Servomites at 158/- ...	£23.14. 0
Total ...	£57.11. 1 *complete*

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Tx., Rx. plus 2 escapements. **£26.19. 4** *complete*

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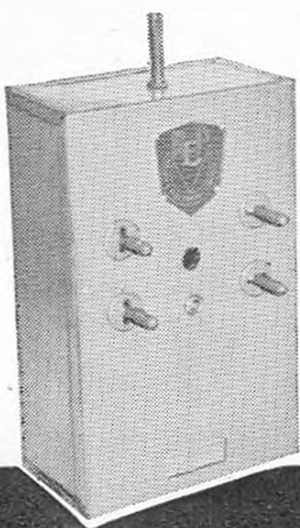

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RADIO CONTROL MODELS & ELECTRONICS

MAY 1962

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CONTENTS

NEXT MONTH . . .

Highlights of the issue include . . .

SELECTONE RX.
PORTABLE BREADBOARD
TRANSISTOR TRENDS
R/C DESTROYER
GADGETS AND GIMMICKRY
SERVO REPORT
PHOTO-ELECTRIC SYSTEMS

Plus the usual favourites

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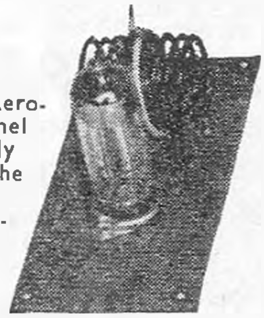

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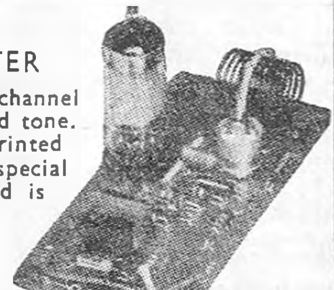

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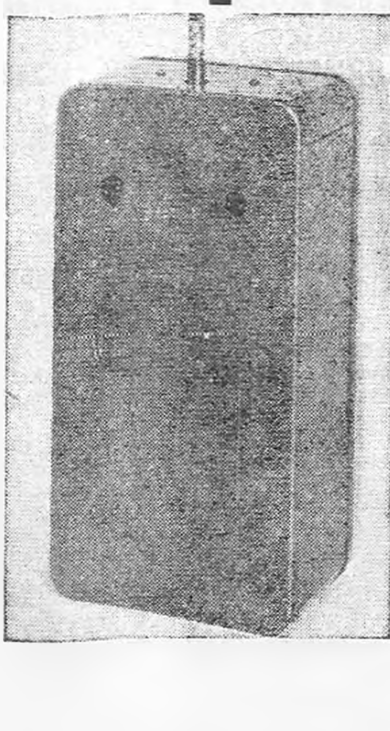

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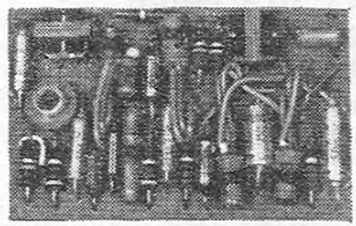

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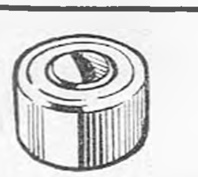

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Here, There & Everywhere

Birthday Issue

Two years, and much current has flowed under the wheatstone bridge. It is now two years since the first copy of Radio Control Models and Electronics made its appearance, now only 24 issues later we feel we are settling in with the *average* reader. Not so settled we may say as to be in a rut, but containing sufficient new material to encourage the modeller to experiment and so widen the application field of radio control.

The past years have seen great strides with commercial radio control equipment, manufacturers doing their utmost to provide something which is foolproof, simple for the beginner, and compact enough for the smaller model. One of the biggest strides is relayless gear which is rapidly becoming a standard. Electronic and reliable ability are becoming more of a fact in the light of experienced gained with and suggestions made by you, the average modeller.

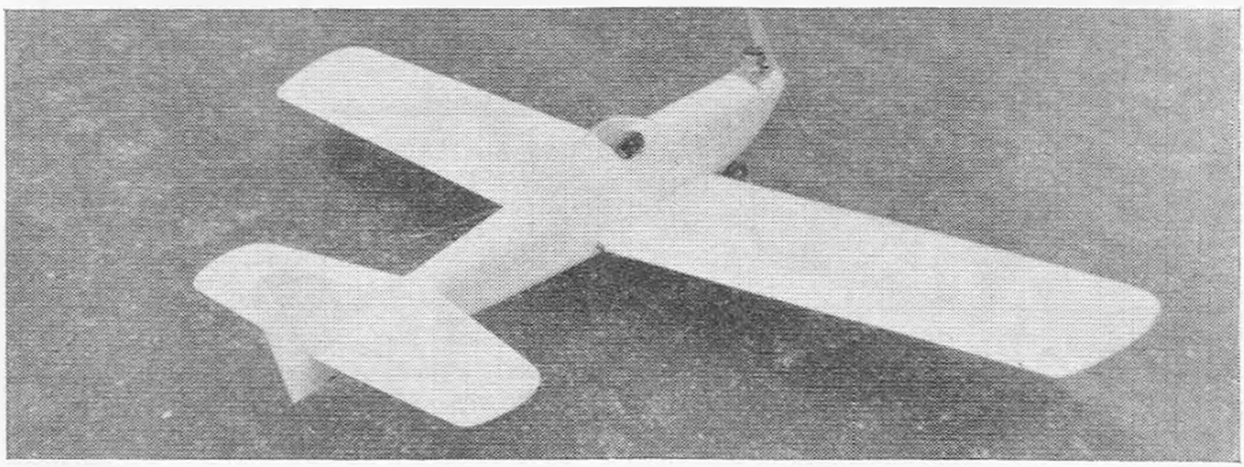
This year's Nuremberg Toy Fair (they still call those £120 sets of equipment toys), where the manufacturers have made a definite attempt to appeal to the beginner and the non-electronic modeller; complete installations without the use of a soldering iron, minimum battery requirements, and plenty of completely enclosed units intended to be "fiddle proof", crash resistant and appealing to the eye. At home, British manufacturers provide some extremely useful contributions for all classes of radio modeller, the latest being a completely new set of transistorised relayless multi-gear and an excellent solution to the single function and sports flyer classes in a twin-tone tuned filter outfit, both these from R.E.P. Ltd. and the new E.D. "Auto-pilot"; a one unit installation with a motorised servo for the beginners single channel model.

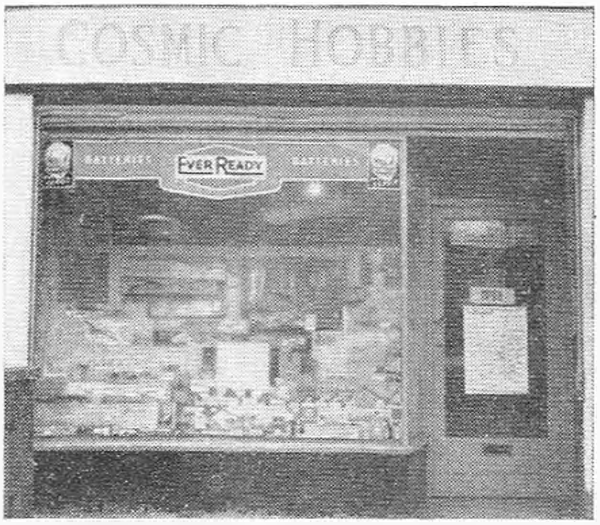
Remember, *you* are the customer and British manufacturers should have your support and criticisms which can contribute to "improving the breed" of British gear still further. It must be remembered that price for price, our own goods contain more for the modeller and less for H.M. Customs.

Spreading the Movement

Modellers in the Lancashire area and those in North Cheshire who have felt out in the cold to date will rejoice in the news that the "Lancashire Area Radio Controlled Aircraft Society" has been formed, the inaugural meeting was held on February 15th. Future meetings will be held twice a month on Thursdays at 8 o'clock at 209 Deansgate, Manchester. All details may be obtained from the secretary, D. Powell, 8 Boundary Road, Cheadle, Cheshire. Their chairman, F. Allen, of 3 Pickmear Gardens, Cheadle Hulme, Cheshire, has added his services to our frequency checking list.

Below : Big Daddy photographed before the final colour scheme was applied.





No. 44 Sheen Lane, photographed for easy identification !

Spot the Shop

One of the new shops fulfilling the need for everything connected with radio control modelling including advice, have made their presence felt in our advertising section and may be instantly recognised in our photograph. One can spot a comprehensive range of the essentials cramming the window. "Cosmic Hobbies" now occupies the premises vacated by Messrs. R.E.P. when they opened their new factory, so Sheen Lane shoppers should keep their eyes peeled for number 44.

Bigger and Smoother

Our photograph shows "Big Daddy", 72 in. span (plus tips), 8½ lb. McCoy 60 powered with full span ailerons and an all sheet covered wing. This latest design by John Singleton was built by Ed. Johnson.

Those lean of pocket will probably bemoan the fact that it takes a lot of timber to build and a higher gallonage of fuel if one wants really smooth flying. Perhaps the "Better Mouse-trap Brigade" will dream up some aerodynamic way of taking the bumps out of multi when small models are used. We watch with interest the application of full span ailerons in this country, it certainly looks easier from a constructional point of view and could probably be operated from a servo in the fuselage; one less plug to become detached.

More Gen on the Grundig

The *latest* report (see page 232) shows that a little optimism accompanied our new equipment review last month in our effort to display what was hot news. The Grundig Rx. as should be seen from the photograph, is about the size of five matchboxes, it is not a superhet but the additional front-end stage makes it more selective and issues less radiation. The transmitter is not simultaneous in its four channel state and the wiring harness does not include DEACs. We are informed that the new Bellamatic has no higher output, although the clutch does afford protection from shocks transmitted through the control linkage. The makers claim the 5.5 in./oz.—6.9 in./oz. output is more than adequate for model purposes.

Forthcoming Nautical Contests

April 23rd—Easter Monday Invitation Meeting.
April 29th — Open (radio only) Regatta; Radio Steering Speed and Team Relay Race.
May 20th—Intertown R/C Contest; Wolverhampton v. Manchester & Birmingham.
July 15th—Second Round Intertown Contest.
August 26th—Open Regatta R/C Straight Running.
September 16th—Final Intertown R/C Contest.

All regattas start at 11 a.m. prompt to be held in the West Park, Wolverhampton. Further details from the Secretary (s.a.e. please).

Hull group of I.R.C.M.S. are holding a Regatta at Whitsun (Sunday and Monday) on the East Park Pond, Hull. A two-day event is planned for yachts, electric and power boats. All visitors welcome, entry forms available from P.A. Bone, 13 Murrayfield Road, Chanterlands Avenue, Hull.

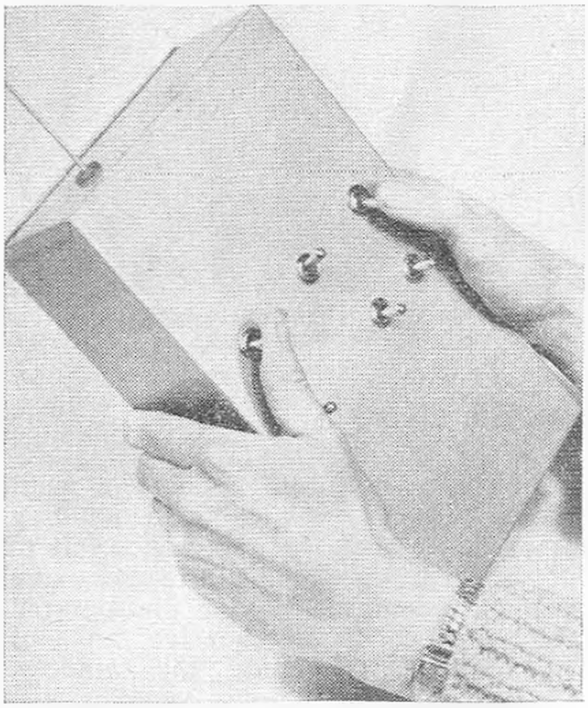
Huddersfield Society of Model Engineers hold their Annual Loco Rally and Model Boat Regatta on the 8th and 9th September, at their track and pond at Highfields, Huddersfield. Saturday, September 8th, will be for tuning up and on Sunday, September 9th, will be held for model locomotives and boats; there will be Radio Control, Straight Steering and Hydroplane events, commencing at 11 a.m. Details from Hon. Secretary, G. Calverley, 126 Weatherhill Road, Lindley, Huddersfield.

Q Class meeting will be held at the Rick Pond, Surbiton, on May 5th and 6th, entries should be in by April 7th. Hurry, they may take some late comers.

The Duo-Ten Tx.

Bi-simultaneous, ten channel, super slim, hand held, easy P.C. construction—the Tx. that you have been waiting to build

By GEOFF CHAPMAN



THE design of the electronics of this Transmitter is not supposed to be in any way original although the circuit used is believed to be a selection of the best of what has gone before. Each section of the circuit—tone generators—crystal doubler—power amplifier have all been well tried and tested and found to be non-critical in setting, moderate on power consumption and stable in use. Details and availability of the case, printed circuit and other components are given at the end of this article. It was from these sources that the original bits and pieces were obtained since they are of the most suited quality at the right price.

Whilst the initial outlay for this 10 channel simultaneous Tx. is reasonable at £10-£12, the price may seem a little high for those whose immediate needs are for three or four channels only; however, for another thirty shillings or so spent at the time of building one can have the complete box of tricks. It is therefore the obvious choice for those who are considering anything further than single channel.

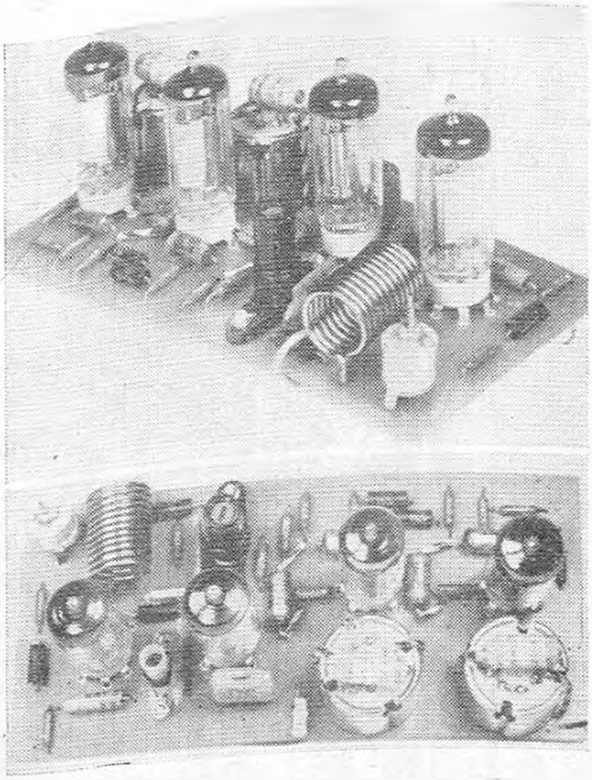
Printed circuitry renders the correct assembly a simple task for anyone who can wield a soldering iron. The P/C has been so designed that it is quite easy to make different sized and shaped components fit—the board is therefore slightly larger than strictly necessary. Even so, the use of printed circuit board reduces the space taken by a conventional chassis and by locating the chassis in the vertical plane permits a case of extremely slim dimensions to be made.

The current consumption of the R.F. section is about 15 m.A., thanks being due to Eric Hill for suggesting that a 3V4 (DL 94) is used in place of a 3A4 with a corresponding saving of both H.T. and L.T. battery consumption.

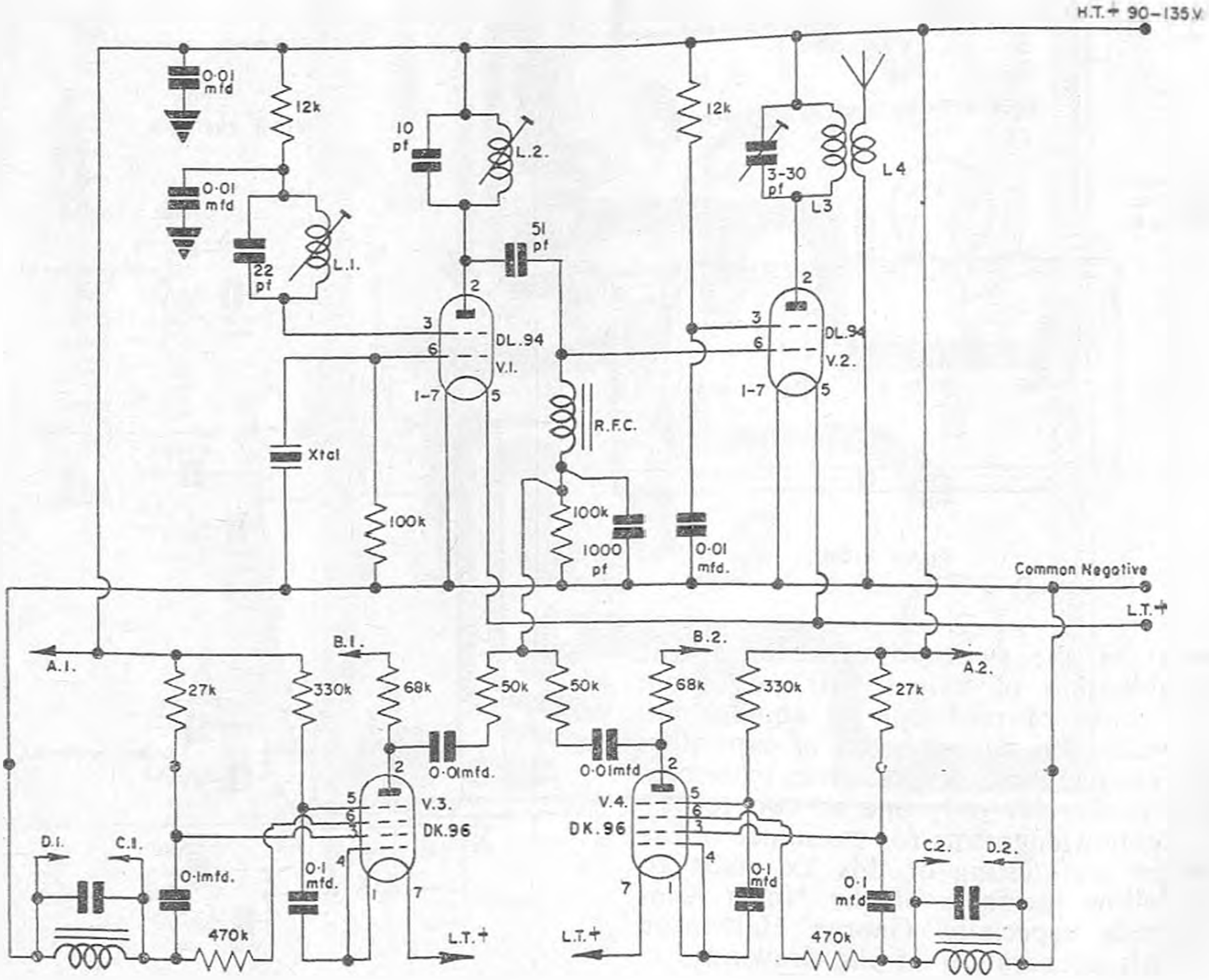
Whilst on the subject of batteries the Mark II case sold by the OBM Co. admits the use of either 135v. or 90v. H.T. and the AD4 for L.T. battery. The choice of H.T. voltage depends almost entirely on the type of aerial one wishes to use, namely the elegant telescopic versus the efficient centre-loaded. It has been proven that with 135v. H.T. and a bottom-loaded telescopic aerial the range is little or no better than using 90v. H.T. and a centre-loaded aerial. From a cost/life point of view two 90v. batteries used in parallel which cost 23/-. Further, a telescopic aerial costs approximately £1 initially whereas the centre-loaded job costs under 7/-.

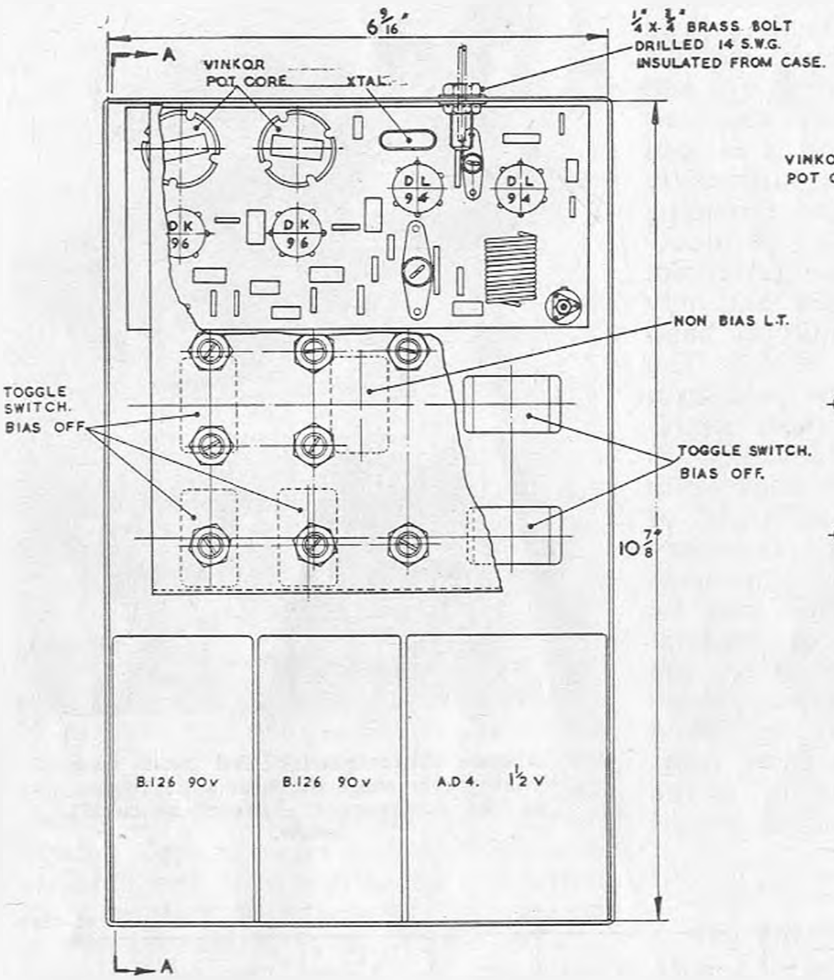
This situation applies equally well to commercial equipment where it must be remembered that eye-appeal in the shop counts far more than efficient operation on the flying field. This is not a criticism of the trade, far from it, they can only produce and sell what we, the general public will buy.

Simultaneous operation conjures up in most people's minds a distinctly critical electronic arrangement which requires expensive equipment to line up and check. This circuit at any rate has proved this to be false and it is said that the pot. cores used are particularly suited to this application and providing a matched pair are used (2.5 H inductance) no trouble should be experienced. After all, what better final test, and only test necessary, has one readily at hand than a Rx. driving a reed bank? The original was tuned in on the pots. to a reed Rx. and drove two reeds simultaneously without any modification to the Tx. In any case if the chokes are matched, the valves (DK 96's) are of similar characteristics and reasonably close tolerance (10% max.) components are used there is little that can be adjusted except the depth of modulation, controlled by the two 47K ohm resistors. Setting up instructions covers this adjustment should it be found necessary. Care should be given, however, to the lining up of the Tx. to the Rx. and reed unit by the initial adjust-

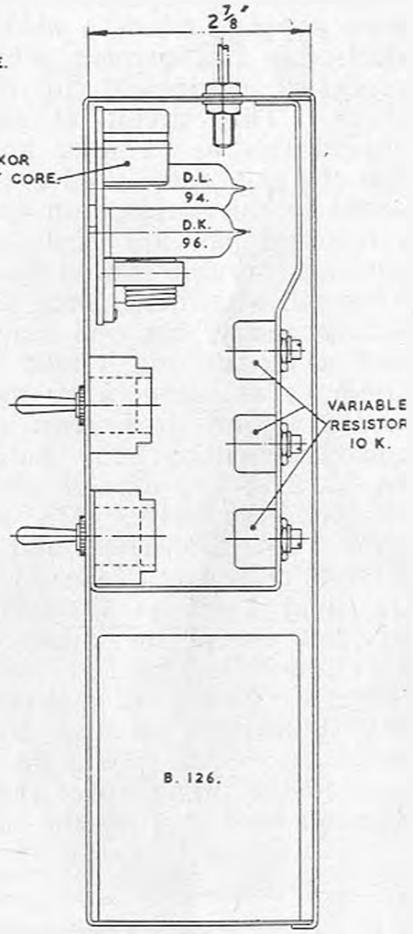


Above : Three-quarter and plan view photographs show the neat wide spacing of the components. Theoretical circuit below.

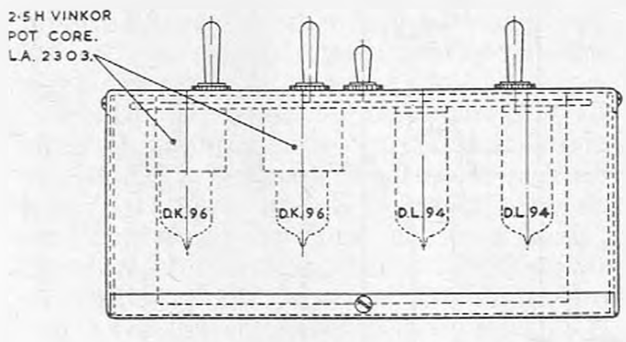




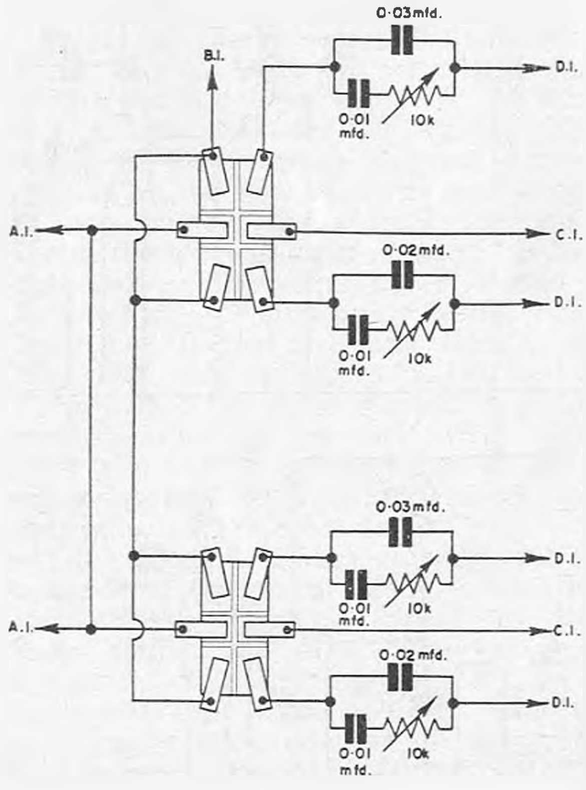
VIEW WITH BACK PLATE REMOVED.



VIEW ON A - A.



PLAN VIEW.

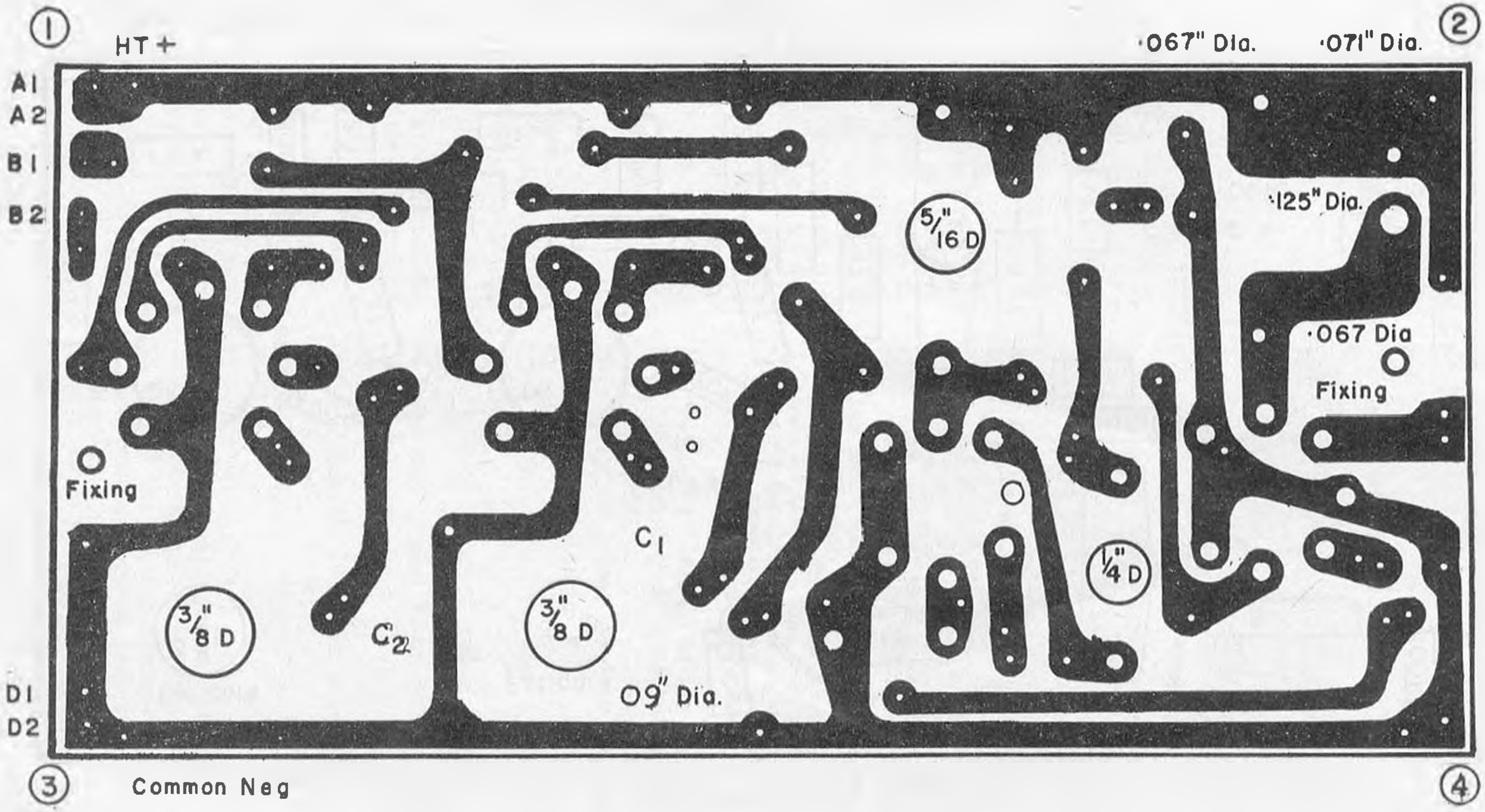


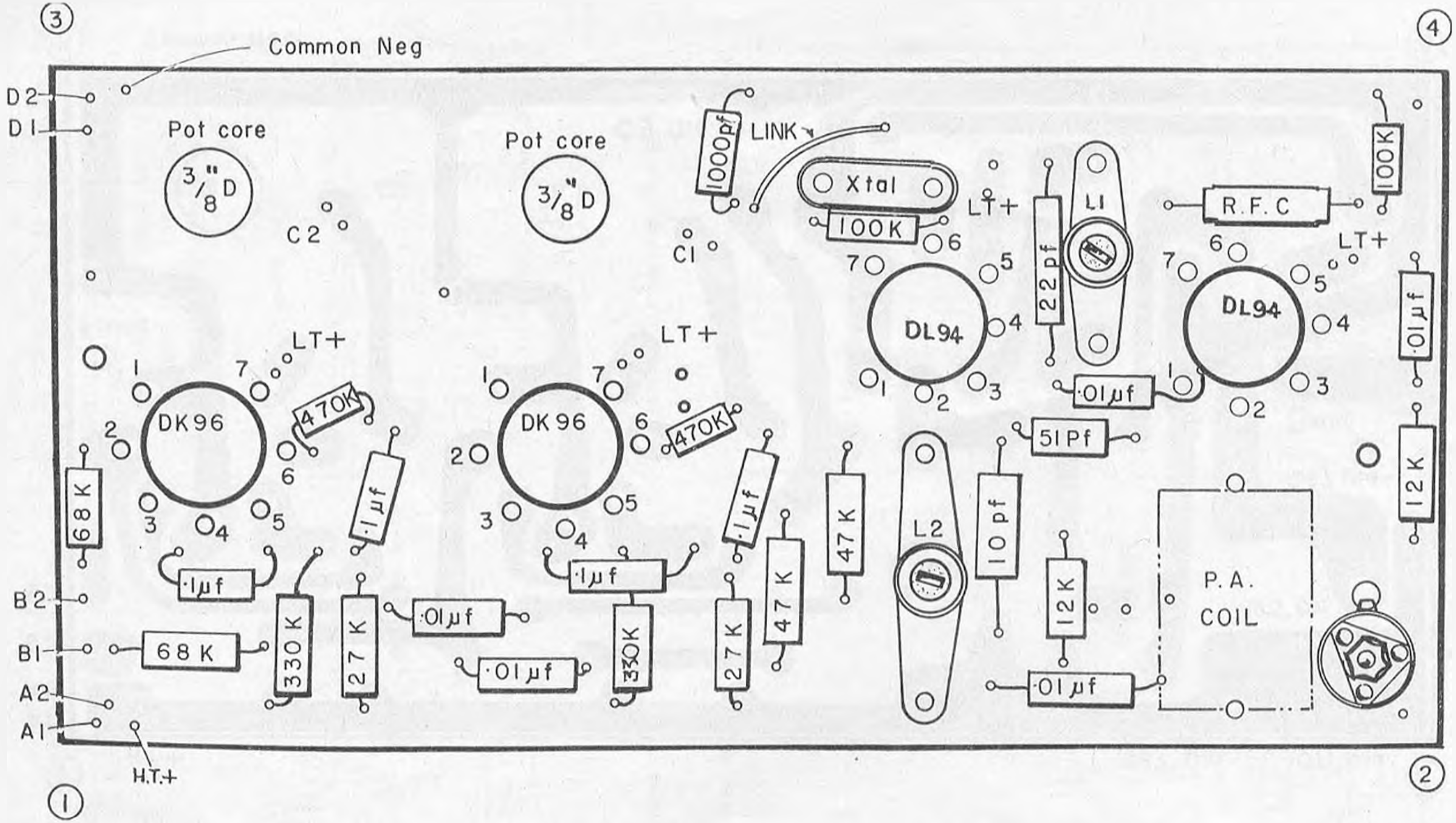
ment of the switched capacitance; the combination of values will vary from one make of reed unit to another but providing the correct value of capacitors are chosen the 10K pot. gives extremely fine tuning for only one or two reeds.

Acknowledgments for assistance in the design and testing of this Tx. must go to fellow members of the North Kent Nomads especially George Hattemore for his preparation of the drawings.

Full-size Printed Circuit Panel

Use 3/32 in. thick laminate if possible





Component Placement Diagram

Hold this page up to the light to register with Printed Circuit.

Construction of Chassis

It is assumed that either printed circuit board will be purchased or the constructor has the skill to make his own by one of the methods previously published. Whilst $\frac{1}{16}$ in. laminate was used originally, $\frac{3}{32}$ in. laminate would be an improvement.

Wind coils as follows:

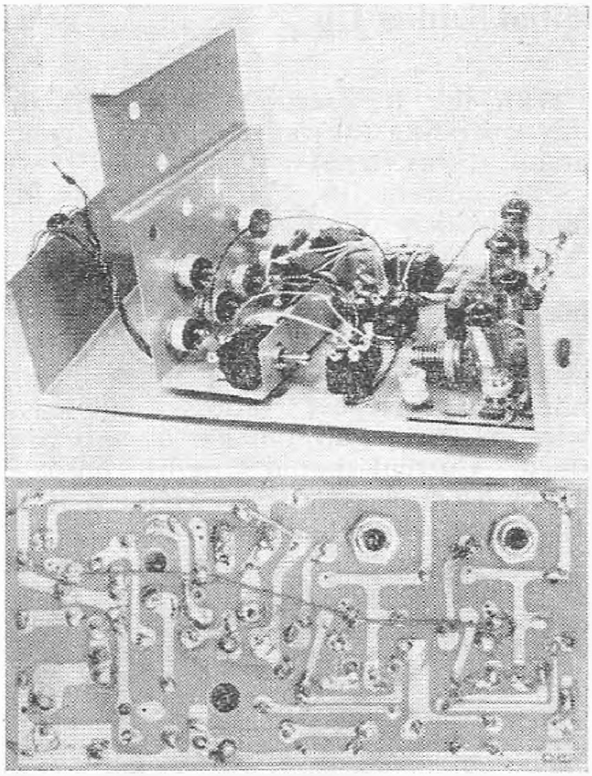
L I. 22 turns of 32 s.w.g. enam. wire on $\frac{1}{4}$ in. aladdin former.

L II. $9\frac{1}{2}$ turns of 22 s.w.g. enam. wire on $\frac{3}{8}$ in. aladdin former.

L III. 12 turns of 16 s.w.g. enam. wire on $\frac{5}{8}$ in. mandrel, close wound, leaving 1 in. straight both ends. Allow to spring open slightly—space the 12 turns over one inch and bend ends down as shown in photograph.

RFC 2 amp TVI choke wound fully with 41 s.w.g. enam. wire.

1 Remove centre metal core from P/C valve bases to allow them to seat nearly flush on board. Push tags into holes but do not solder until other adjacent components are ready for soldering.
2 Fix $\frac{1}{4}$ in. former by 10 BA screws and nuts, using slots of screws to hold wire—clean and solder quickly both wire to screw heads and nuts to copper laminate.
3 22pf. across screws of L 1.
4 Fix adjacent .01.
5 51pf.
6 Solder a length of stranded PVC wire (2 amp) to aerial hole to serve for 2 turns aerial link winding. Clean ends, tin and solder P.A. coil (L III) in place. Centre of coil to be approximately $\frac{3}{4}$ in. above board. At the same time locate and solder 3-30 pf. beehive trimmer in place.
7 Fit adjacent 12K.
8 RFC and 100K.
9 Brook's Midget Crystal — solder in place or wire flat to top side of P.C. board and take wires from pins through crystal holes.
10 Adjacent 100K.
11 .01μf—2 off.
12 $\frac{3}{8}$ in. former of L II fitted as L I, this time using 8 BA screws, etc.
13 10pf. across L II.
14 1000pf.—leave one end (opposite to earth end) long to form jumper.
15 Solder jumper.
16 47K.
17 47K.
18 27K.



Top photograph shows the pots. in process of wiring. Note how the lower switches hold the pot. panel to the front of the main case. Underside of the Printed Circuit panel appears below; the heater connections are direct wiring, following a normal practice.

N.B. Solder 19 and 20 at the same time.
19 470K insert and twist to square up (see photo).
20 .1μf. leave wires long to angle (see photo).
21 330K.
22 .1μf.
23 .01μf.
24 .01μf.
25 27K.
N.B. Solder 26 and 27 at the same time.
26 470K.
27 .1μf.
N.B. Solder 28, 29, 30 at the same time.
28 330K.
29 68K.
30 .1μf.
31 68K.
32 Solder .02 cap. across pot. core and fit same. Repeat for other pot. core.
33 Solder L.T. positive jumpers in place. See photograph of underside printed circuit. Check all connections.

With the P/C thus complete, fit valves and connect up to H.T. and L.T. for bench test. Temporarily wire up two switches each with two preset pots. and a selection of .01μF, .02μF, .03μF capacitors — stripping an old radio chassis comes in useful here.

Initial Setting Up

With the RF section of the circuit only operating (do not connect to Tone circuit at this stage).

The current in the H.T. will be approximately 30 m.A. Working from Paxolin side of P/C board with slugs at top of aladdin formers, screw in L I until current drops to lowest and then rises 1 m.A. Screw in L II until further minimum is found, adjust Beehive for minimum. Repeat process at least twice to ensure all tunable circuits are tuned. Current should now be approximately 15 m.A. (with 90v H.T.) if it is higher say 20 m.A. or more increase 12K resistors to 15K or 20K but do not go beyond the point where tuning dips are easily seen; in any case the Tx. may be used for remainder of the tests even if current is above acceptable minimum.

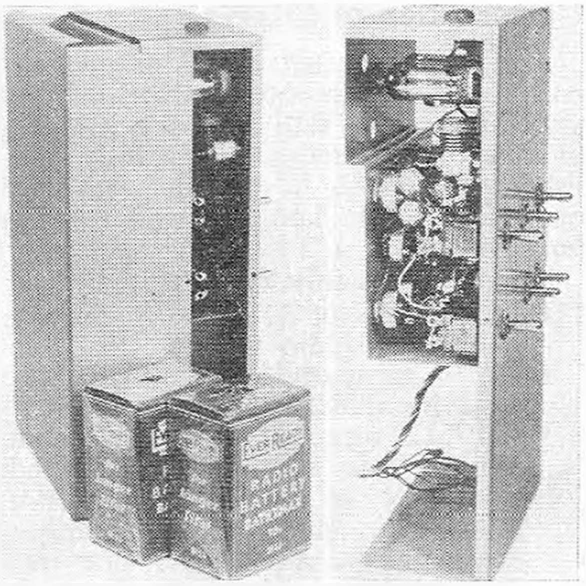
For the second stage of test, tone setting, an audible source is most useful, either 'phones across the output of a tone Rx.—monitor, or household radio tuned to approximately 23 metres shortwave or 107-108 m/cs V.H.F. If later source is used the Tx. must be very close to the receiver dial.

To check tone stage, pot. cores, valves, etc., temporarily close circuits A, B—C, D, and A_2 B_2— C_2 D_2 separately, a high pitch note should be heard.

Leave A, B, temporarily made and connect up 2 preset pots., capacitors, and switch combination to C, D, operating the switch should produce a lower note than heard previously. Connect A, B, to make across switch and operate a Reed Rx., now providing the correct combination of capacitors have been chosen a reed should "speak".

For those who do not know the correct note for a reed to operate, this can be heard by placing high resistance phones across a 4K reed bank and twanging, say, one of the centre reeds, the note required to drive this reed will be heard in the phones for a few seconds; use low resistance phones for a low resistance reed bank of course.

Assuming 'music' is being produced connect a switch with a pre-set pot. with a different combination of capacitors to the other half of the tone circuit, this should operate two other reeds and by careful adjustment of the pot. any two reeds should operate simultaneously—mine did, so should yours! If it is possible to operate reeds singly but not in pairs the chances are that the depth of modulation is at fault and this can be corrected by changing the values of the 47K resistors. If a 'scope is not available one of the 47K resistors should be replaced with a 100K variable resistor and the Tx. keyed to operate two simultaneous tones then the variable resistor is adjusted until the two reeds are speaking. The amount of resistance is measured and replaced by a fixed resistor. As mentioned previously the original did not need this treatment so the writer has no first hand knowledge of dealing with trouble in this circuit.



Left-hand picture shows how the back of the case fits and the scale is indicated by the H.T. batteries. Right-hand view shows the pot. panel in position, enclosing the Tx. panel and switches.

The next stage is to find the combination of capacitors to drive both the longest and shortest reeds, this gives a basis to select those in between. The second stage is to allocate the channels to their various functions, that is switch positions and reed selections. The more important channels are normally located towards the centre of the reed bank.

Having sorted out the arrangement of capacitors associated with each pot. it was found that Hunts Mouldseal variety were the right size to fit nicely around each pot. with stranded wire connectors going to each of the two switch terminals. The exact arrangement here is left to the constructor to suit the capacitors he has at hand. Remember to *lower* pitch of note *increase* capacitance or vice versa.

Installing in Case

Assuming the constructor is either buying or making a case as described here, the assembly of the Tx. P.C. to the case is by mounting the board on two ¼ in. insulated stand offs (drilled, large dia. plastic knitting needle will serve) through which two 10 BA x ½ in. screws pass.

Before mounting, however, leads to the various points on the circuit which have external connections should be made in stranded P.V.C. wire. These are:—

Earth: 1. L.T. and 2. H.T.
Pot core 1, Pot Core 2.

B_1: Switch outer poles Tone Circuit 1.

B_2: Switch outer poles Tone Circuit 2.

A_1: Switch centre poles same side as B_1.

A_2: Switch centre poles same side as B_2.

C_1: Switch centre poles opposite A_1.

C_2: Switch centre poles opposite A_2.

Colour coding and noting is essential.

The other two poles remaining on each switch take the capacitors attached to the pre-set pots.

The two turns aerial link is soldered to the bottom of the aerial socket direct if using a centre loaded aerial. If using a telescopic aerial, a bottom loading coil consisting of 10 turns 20 s.w.g. enam. wire ¼ in. diameter for five foot aerial must be interposed between link coil and aerial base.

Before locking the aerial link to the coil it must be adjusted to give the maximum output without overloading. On the original this position was found to be approximately one turn in from the anode end of the P.A. coil, this, of course, with the aerial in place. Best checked with a Field Strength Meter or Rx. at range. The unbiased two-way switch on the original is used for switching L.T. only, but it can be arranged so that carrier and tone are keyed together, whilst this does save the H.T. battery it is not considered good practice.

Parts List

The O.B.M. Co., 4 Lowden Road, Southall, will be pleased to supply C.W.O. U.K. post paid the following items: *See advertisement on page* 257.

Mark II Super Slim Case and preset potentiometer chassis with all holes punched and to suit 10 g. wire aerial, finished in grey hammertone complete with aerial socket.
Matched tuned chokes 2.5 inductance.
Ready drilled Printed Circuit Board and Four P/C valve bases.
Two DL94 and two DK96 valves.
13.5 mc/s Nominal Frequency Midget Crystal.
Switches—Biased off, long toggle, light pressure.
Switches ON/OFF two position to match above.
Aerial loading coil.

★ ★ ★

Messrs. Smiths, 287 Edgware Road, London, W.2, will be pleased to supply C.W.O. the following radio components. For those purchasing a complete set, wire cut to the required length will be supplied for a nominal sum. A s.a.e. to Smiths will bring full details.

3-30pf. Beehive Trimmer.
36 in. 16 s.w.g. enam., 36 in. 32 s.w.g. enam., 24 in. 22 s.w.g. enam.
¼ in. aladdin former and slug.
⅜ in. aladdin former and slug.
1 2 amp T.V.1 choke to be rewound by constructor with 41 s.w.g. enam. wire.

Resistors 5% tolerance	capacitors.
2X 12K.	7X .01μf.
2X 100K.	1000 pf.
2X 68K.	10 pf.
2X 27K.	22 pf.
2X 330K.	51 pf.
2X 470K.	4X .1μf.
2X 47K.	

10 x 10K lin. pots. dia. or less x 1 in. front to back.
A selection of .01, .02, .03μf capacitors depending on tones required Hunts Moldseal or equal typical set might be 7 x .01μf, 9 x .02μf, 4 x .03μf.

Aerial from two pieces of 10 or 14 s.w.g. piano wire (upper part 27 in. long, lower part 24 in., plus 3 in. lead) and a Ripmax centre loading coil unit.

Readers may be interested in the 8 channel hand-held transmitter (non-simul) which appeared in our May, 1961, issue which is available, price 2/4d. from these offices. We also publish a ground based version of the latter on leaflet R/C 802, price 2/4d. post free.

Gremlin War '62

Flight stresses on R/C gear can be harmful, at speed

PART - - - 2

"G" for Gremlin

We know that the term "G" is not strictly correct in its application in this case, but in order to avoid constantly referring to centrifugal force, inertia, and acceleration, we shall for our purposes retain its use.

THIS month we shall deal with "G" forces and their effect on a radio controlled model. Model aircraft are far more susceptible to the effects of "G" than boats.

Unlike vibration, "G" is a force that we cannot minimise, luckily it does not reach an appreciable level in our present day models and we may deal with this gremlin by reducing its effects.

Study figure **1A**; it will be seen that an aircraft proceeding along a level course only has the weight of its equipment bearing on the fuselage and the weight of the whole remaining aircraft components supported on its wings and tail surfaces, in other words the normal force of gravity. Now let us put the model into a loop, vertical bank, or bunt. If we discount the normal gravitational pull we see that *centrifugal* force tends to throw the model and its equipment towards the outside of the circle in whichever plane this manoeuvre executed. For our purposes we shall assume that the axis of the model is always in a looping or bunting plane, as severe side slipping or skidding will occur if this were not so. **B** shows the forces operating on the model. Now let us suppose that the model is pulling out of a dive or at the bottom of a loop **C**, we now have to add "G" to the normal gravity, expressed as W, providing in the case of a two "G" pull-out, twice the weight of the model. Whereas if the model had been executing a vertical bank only one "G" would be imposed on the bottom of the fuselage. It is this additional "weight" which is so likely to cause the most trouble when designing a model for stunt work.

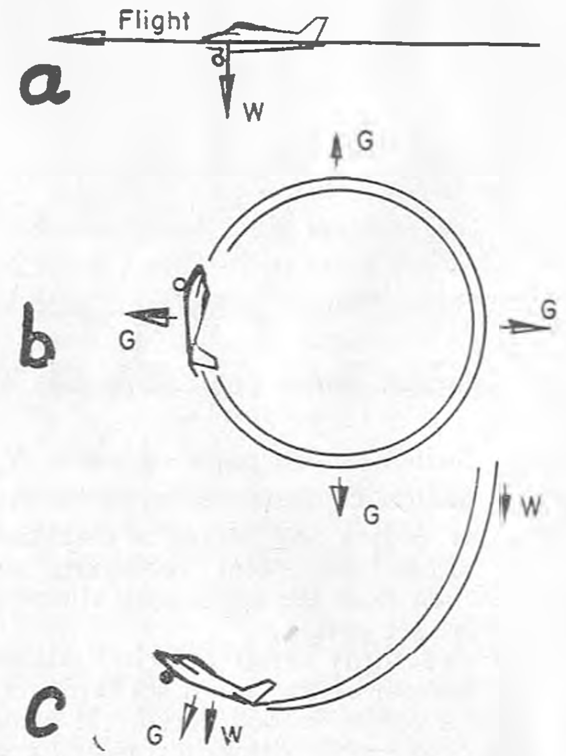
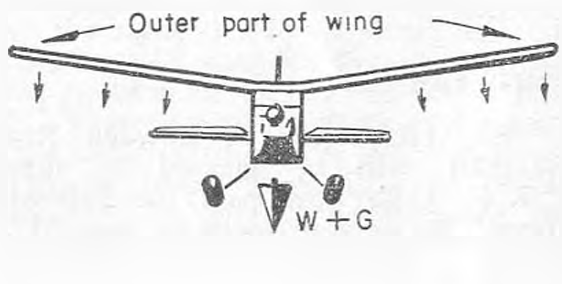


FIG. 1

Many models are hopelessly understressed for stunts in the full multi-schedule so the design of a really strong pair of wings is of paramount importance; Study Figure 2. In calculating the load on the wings it is only necessary to estimate the weight, hence the "G" factor, as being that of the model *less wings*.

FIG. 2



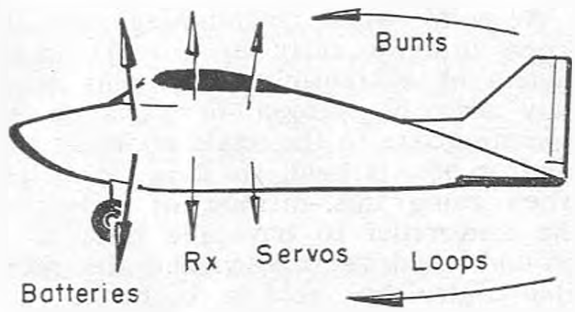


FIG. 3

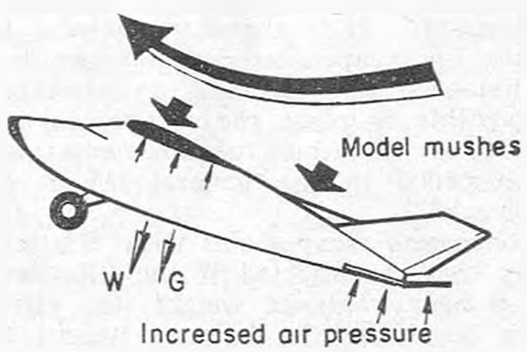
Effects of "G" on Equipment

We must consider the effects of "G" on equipment when it tries to throw this valuable pay-load towards the top, or embed it further in the bottom of the fuselage during bunts and loops. More than the usual precautions are necessary to ensure that the equipment does not damage either itself or the model when flying inverted, as precisely the same forces will be set up during bunts as those in loops providing both manoeuvres are executed at a similar speed. Figure 3 shows the positions of the loading on a typical fuselage.

Effects on Control Response

If a model "mushes" severely when recovering from a manoeuvre, a certain amount of air pressure on the surfaces (usually the elevators), only partly offset by "G" itself, tends to reduce the ability of a surface to neutralise quickly when driven by a spring centred servo. Figure 4 shows how the surface is almost pushed up as the model drags its tail around. Luckily the force here is only quite small and the effect would be of less consequence except when using servos of very marginal power.

FIG. 4



Back to the Vibration Gremlin

When one supports heavy equipment on nice soft sponge rubber to damp out vibration, one may run into trouble when "G" pushes the equipment so hard down on the rubber that it compresses the latter into a hard *conducting* lump between the fuselage and the bottom (or top) of the model. The obvious solution is to incorporate a sufficiently thick layer of rubber so that the amount of compression is reduced. In fact in an extreme case one might find that with the thin layer of rubber, the equipment almost made contact with the bottom of the fuselage itself. Figure 5 shows the gear in its displaced position.

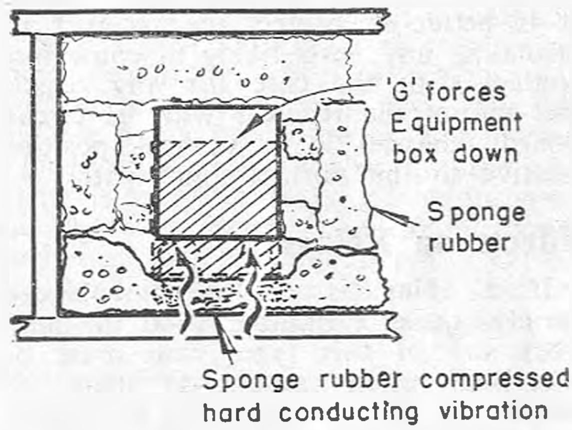


FIG. 5

Distortion of Servos

If servos are mounted on a thin ply plate, quite a popular lay-out these days, severe "G" combined with heavy servos and mounting points too widely spaced may cause the servo board to bend as the loading is imposed upon it, this in turn may distort the servos themselves if they are screwed down rigidly to this board.

Naturally this is harmful not only to the servos from a point of wear and tear, but leads to inconsistency of operation during the manoeuvre. Gears may be forced into too tight a mesh, with the result that the servo no longer has the power output required, furthermore printed circuit wipers may become misaligned causing short circuits through the amplifiers. Figure 6 shows what can happen to a set of gears and wipers under such circumstances.

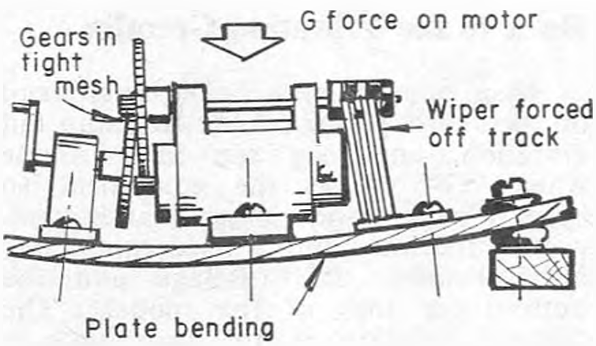


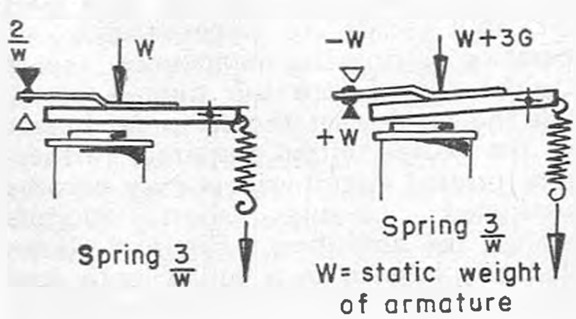
FIG. 6

Receivers themselves may become damaged due to the chassis bending in the middle, causing adjacent opponents at the R.F. end to move around, which in some cases can lead to an off-tune effect. Flimsily constructed reed banks may also become distorted and give inconsistent results. It is better to protect the receiver by insulating any parts likely to come into contact with the case for any reason and mount the receiver with its circuit board (chassis) in a vertical position relative to the normal flight path.

Effects on Relays

If a relay is of the unbalanced variety, quite a number used in multi work are of this type, care must be exercised when mounting them to ensure that the armature lies in a vertical position preferably with its pivot axis also vertical, thus the effects of "G" are minimised. Figure 7 shows what could happen to a relay with the armature in a horizontal position. The weight of the armature overbalanced by the spring, would when loaded with "G", produce an over balance of the spring. Pulse systems are particularly vulnerable in this respect as a change in the relay characteristics can produce a considerable change in the effects of mark/space ratio, producing a strong bias in one direction.

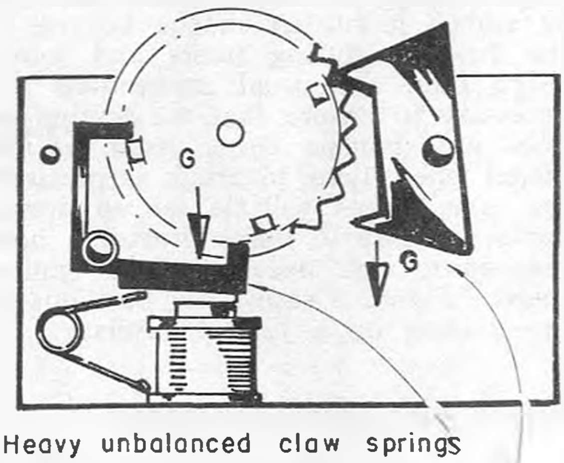
FIG. 7



A point worth mentioning here is when using a relay in a mark/space system at a transmitter end this relay may also be subject to variation in operation due to the angle at which the control box is held, so it is far better when using this method of switching the transmitter to have the relay in a ground-based transmitter and the portable control box held in the hand.

Unbalance of Escapements

Gremlin "G" also strikes at the simplest of equipment, in fact the armature of a simple escapement may be affected in the same manner as a relay, the difficulty being that the design of a



Heavy unbalanced claw springs when subjected to excess G. Heavy unbalanced rattler forced hard against star wheel.

FIG. 8

number of escapements is such that it is not possible to have a vertical armature and the additional fact that such armatures are not often balanced, means that an extra strong return spring is necessary to combat the effects of unbalance. This in turn leads to the need for extra power from the receiver in order to provide the extra current needed by the escapement in these circumstances. It is therefore helpful to choose an escapement design which has as balanced and as light an armature as possible to place the escapement on its side so that these requirements may be included in the general layout of the model.

Compound escapements with "Rattler" delay may be affected if the "Rattler" has a heavy balance weight; the effect being to throw the balance weight to one side or to centre and reduce the ability of the "Rattler" claws to vibrate freely. Here again this is only likely to effect the less well made equipment which in all probability be avoided in the high speed type of installation (see Fig. 8).

Effects on Control Linkages

Here again we find that a slight effect of "G" with push rods and other linkages which may become jammed if a clear way is not left for them to move to and fro, any slight deflection may tend to produce binding against the cut-outs in various formers. It is doubtful that any slight shortening as the effect of a bowing movement would change the angle of the control surfaces appreciably (see Fig. 9).

It is just a case of finding as light a material for the push rod as possible; the good old faithful ¼ in. sq. balsa seems to be quite adequate.

Generally

The last few items have been covered in order to show that problems, however slight, do exist in this respect. It is helpful to ascertain the amount of "G" likely to be present in a difficult

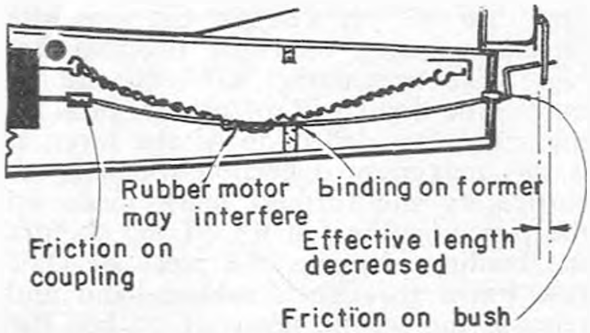


FIG. 9

installation so that the effect on a piece of equipment more likely to suffer may be suitably protected. Naturally one of the best ways of finding out how much "G" is present is to get some kind soul to fly a similar model to that which you intend to build and fit it with a simple recording unit. Such a gimmick is most useful for future reference and some idea of the forces set up in stunt patterns may be given at each stage of the test flying procedure of any model.

One can see whether or not the airframe is going to "take it" before proceeding to the more violent manoeuvres, furthermore one's equipment can be installed in a safe manner before doing so. Here's how to make one . . .

A Simple "G" Recorder

By PETER HOLLAND

The simplest possible recorder may be made in a few minutes from junk box scraps and may be strapped to the inside or outside of the fuselage. Study figure 10, there is nothing to it. Simply a weighted lever with a centring rubber band. The end of the lever carries a small inked pad of felt such as a No. 1 size "Flowmaster" pen tip (tenpence) soaked in the appropriate "brew" and a piece of card which may be replaced for each recording. A second lever loaded with a rubber band is released by a D/T fuse to lift the recording lever before a landing is made. In this way it is easy to avoid a misleading reading caused by landing shocks.

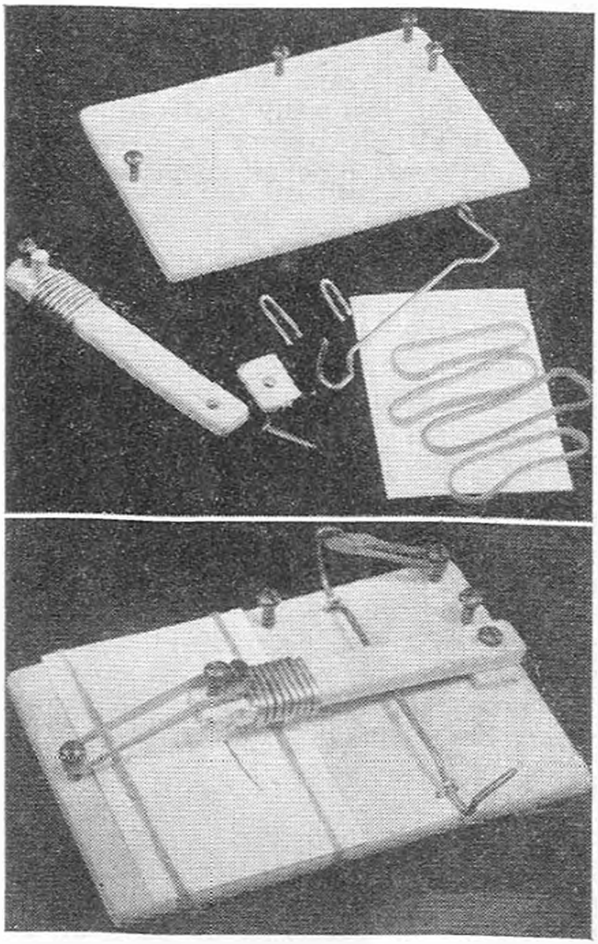
Calibration of the instrument is simplicity itself. First remove the centring band from the main lever and weigh the arm at its tip on a reasonably sensitive letter balance or good kitchen scales.

Now, with the band in place, press the unit down with the weighed end of the lever still resting on the scales and note the position of lever when a weight equivalent to twice that of the lever, three times and four times, is read on the scales. The position to which the lever is forced by the spring of the scales is now indicated at spaces one "G" apart. In other words if one were to weigh the lever and then to add a weight to the lever three times its own weight, the pointer would move to that equivalent of 4G, and the felt tip would mark a line to the limit of this movement.

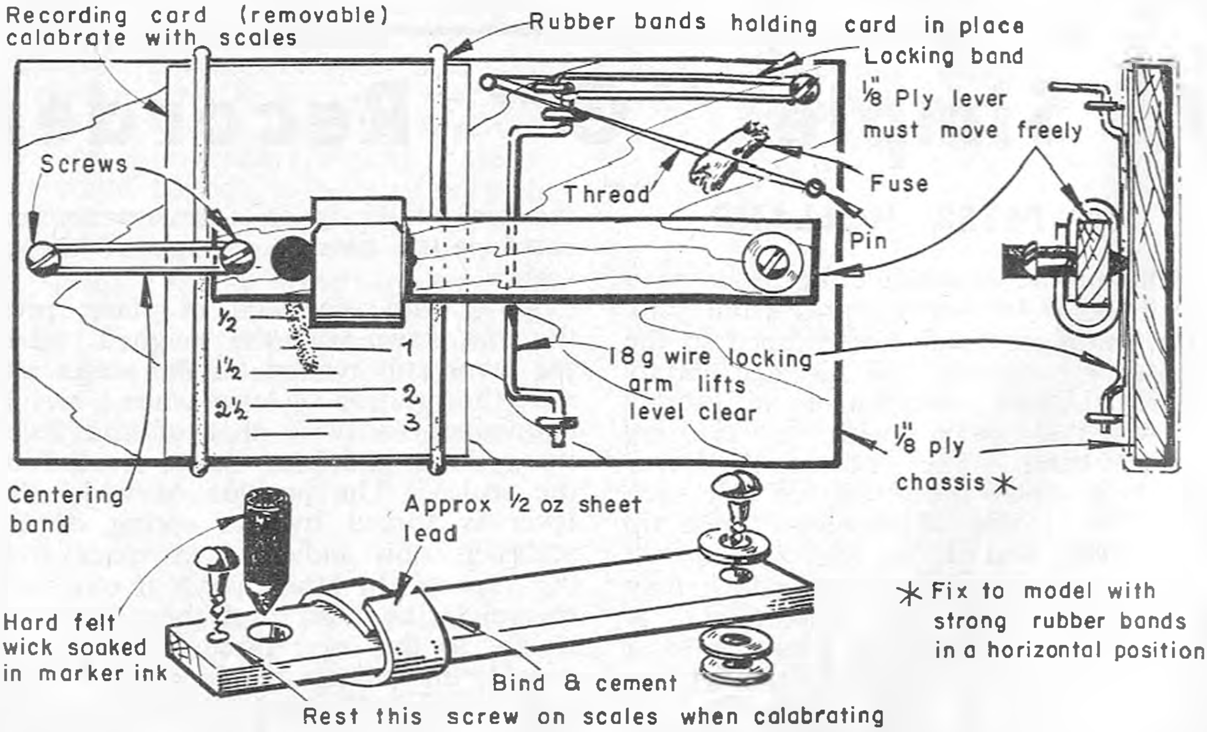
Now what happens in flight ? The model is launched and as it goes through different manoeuvres the lever is pushed down as "G" takes effect or "up" as "G" is felt in the opposite direction during bunts or inverted flying. The maximum "G" encountered during the flight will, of course, produce the maximum deflection of the lever, it is this maximum deflection which is recorded by the furthest mark made on the paper by the felt tip. Later, before the landing is made, the piece of D/T fuse burns through a rubber band and releases the second lever which lifts the marker clear of the paper thus preventing any movement during a landing shock. One measures the length of the line from centre by means of a cardboard scale marked out by the initial calibration process just described.

A more sophisticated recorder could employ a small electric motor to drive a roll of paper beneath the felt tip to produce a continuous trace. It should then be possible to analyse the exact force through every manoeuvre, including landing shocks, but the simple unit illustrated here should be all that is required for average use. Having read

[Continued on page 256]



The completed recorder on the right with all the components above. Diagram below shows the parts full size.



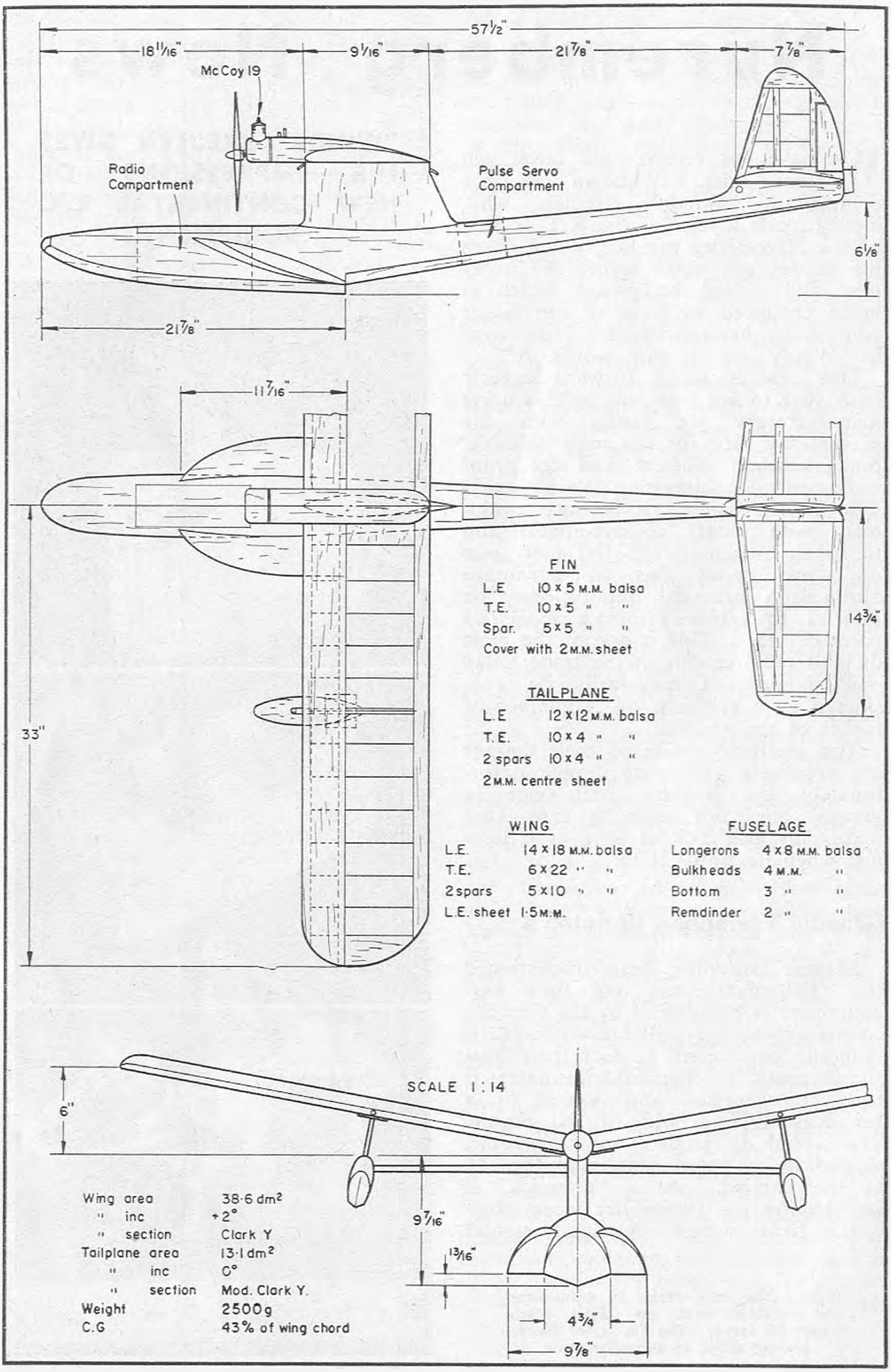
The Plan opposite . . . .

Modified and built by

Fausto Ossola of Lugano

An R/C "SEA CAT"

(Plan from "Aero Revue Swiss")


57½"
18 11/16"
9 1/16"
21 7/8"
7 7/8"
McCoy 19
Radio Compartment
Pulse Servo Compartment
6 1/8"
21 7/8"
11 7/16"
33"
14¾"
FIN
L.E 10 x 5 M.M. balsa
T.E. 10 x 5 " "
Spar. 5 x 5 " "
Cover with 2 M.M. sheet
TAILPLANE
L.E 12 x 12 M.M. balsa
T.E. 10 x 4 " "
2 spars 10 x 4 " "
2 M.M. centre sheet
WING
L.E. 14 x 18 M.M. balsa
T.E. 6 x 22 " "
2 spars 5 x 10 " "
L.E. sheet 1·5 M.M.
FUSELAGE
Longerons 4 x 8 M.M. balsa
Bulkheads 4 M.M. "
Bottom 3 " "
Remdinder 2 " "
SCALE 1:14
6"
9 7/16"
13/16"
4¾"
9 7/8"
Wing area 38·6 dm²
" inc +2°
" section Clark Y
Tailplane area 13·1 dm²
" inc 0°
" section Mod. Clark Y.
Weight 2500g
C.G 43% of wing chord

Nuremberg News

"WINDY" KREULEN GIVES HIS IMPRESSIONS OF NEW CONTINENTAL R/C EQUIPMENT

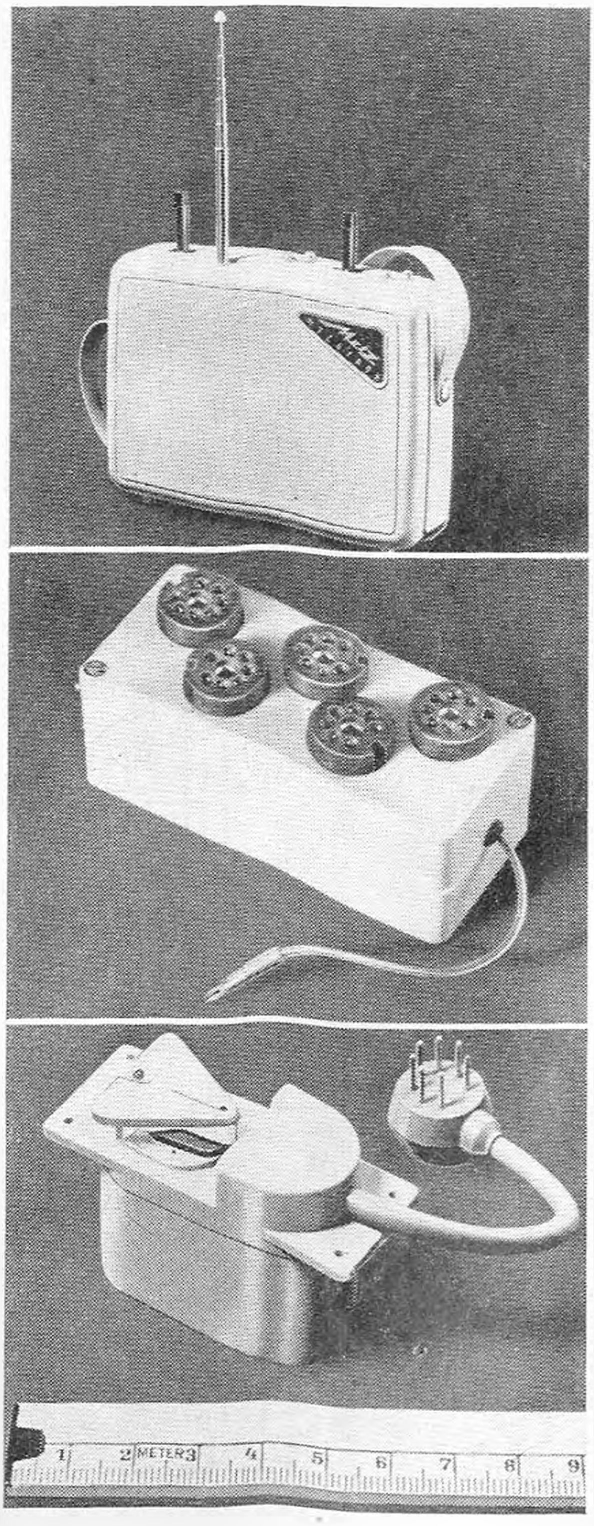
We have just received the latest gen from our well-known overseas contributor, "Windy" Kreulen, who, having made a tour of the R/C section of the Nuremberg toy fair, jotted down his impressions upon seeing the many new and varied equipment which is being produced by some of our larger continental manufacturers. Now over to "Windy" in his own words.

One always looks forward eagerly each year to see how our neighbouring manufacturers are faring with the present-day race for the most saleable, prang resistant, efficient, and clot proof radio-control equipment. We all know that the Germans can produce equipment with plenty of eye-appeal and thorough workmanship; the new gear on view shows this to advantage although a practical outlook may be difficult to achieve from a *modellers* point of view. This is one of the most difficult requirements in the trade today and should not necessarily be considered as a criticism on a number of makes of equipment.

The electronics side of their designs are extremely interesting though unfortunately the average multi-pilot in general does not seem to care what makes his gear tick as long as it ticks just when he wants it to.

Grundig Variophon/Varioton 8

Messrs. Graupner have discontinued the "Bellaphon" sets and their new equipment is being built by the Grundig company who are well known for their domestic equipment, in fact their dual simultaneous 8 channel transmitter is fully transistorised and housed in a broadcast type cabinet of red plastic. The aerial is angled and telescopic, stowed in a special drawer in the top of the cabinet. As a "gimmick" it switches on the transmitter when plugged in to its socket. A slightly tighter



Right: The new Metz 10 transmitter and receiver with the latest Mecatronic 20 servo. The Tx. is, of course, photographed to a smaller scale.

fit would have been reassuring. The chance of losing the aerial and hence all signal if one is a rather energetic pilot; this may be rather frightening when flying "Orions", etc.

The transmitter is available as a four-channel unit with a four position control stick in the top, a further four-channel tone generator complete with a second control stick may be plugged in without any soldering, to provide dual simultaneous operation. Although the audio-tones need no adjustment, provision is made inside the case.

The receiver and filter circuits consist of separate matchbox size sections, the first part comprises a receiver with a double front end, employing two H.F. stages to get more gain and make the reception more selective. This provides a further advantage in that one may operate two receivers together which would please boat enthusiasts, who would then operate two receivers on four channels each from the same transmitter. The receiver front end feeds a series of filter-circuits, two circuits in each block with its own relay for each control, there are lead through plugs and sockets in each block which is colour coded to correspond with the coloured dot opposite the transmitter levers. There is a mechanical alignment system to ensure that the units are not disturbed and no strain is imposed on the sockets, which appear to be with built-in transistor holders. The servos plug into seven-pin sub-miniature valve holder connections in the side of each filter unit. The total weight of the receiver is a little over six ounces and operates on six volts.

A separate battery supply on a prefabricated harness feeds the servos, which are the revised version of the "Bellamatic" which now has an over ride clutch which imposes the limit switches and possibly to avoid damage to the light weight gears. In terms of current consumption this servo is excellent but one must adapt the model to suit output.

All. repeat all, this equipment is assembled without any soldering whatsoever, again a facility to tempt the lazy modeller. An additional idea for boat people is the Unimatic single-channel servo fitted with an adapter plate carrying a switch so that the driving motor of an electric craft may be started, stopped or reversed.

Metz Mecatron Equipment

It is well known that the Metz R/C manufacturers use entirely different electronic methods in their equipment, this does not mean that their circuitry is particularly "hush-hush", on the contrary, use is made of circuits well known in the radio and electronic field. The only modelling item that we can recognise easily is the reed unit in the ten channel receiver. The circuit is not shown nor was a *working* set for demonstration, the outfit is triple-simultaneous, operated by a four position control stick and a two position stick in the left hand with four push-buttons positioned around this lever. The right-hand stick will operate two channels simultaneously, the left-hand one and buttons are on the third tone generator.

The transmitter operates with one valve, eleven transistors and several rectifiers and employs a novel method of modulation to prevent interference; a six K.C. frequency is modulated with the 350 to 670 c/s reed frequencies. It is not possible in the limited space available to explain just how this works, but we may be assured that it is a good method and it is absolutely impossible for the receiver to respond to a transmitter of any other manufacturer even if it is spot-on the same H.F. frequency.

The transmitter carries built-in Nicad cells which provide sufficient power for ten hours continuous operation (record flights); the receiver has five seven-pin plugs and sockets on top of the case for connections to servos. Here again it is not possible to use any servo other than those recommended, as part of the servo amplifier is incorporated in the receiver. Regrettably very little gen was available and the gear was not being operated although it may be similar to the multi-servos used in the three channel gear. The only criticisms being that these particular servos do not neutralise with the precision we would wish and the leads to the seven-pin plug are rather short.

The Metz "baby" has a revised circuit to provide greater range and the servo has been completely redesigned for greater reliability. The gear is comparatively weighty; little wonder that it is so popular for boats; it is, of course, a well made set of equipment which works perfectly.

[Continued on page 241]

A FEATURE FOR THE EXPERIMENTER, COMPRISING IDEAS AND TIPS FOR ALL

Gadgets and

Slipping Link for Throttles

First, one from a bundle of brainwaves from A. H. Thomas. Throttles operating from multi-servos must have some arrangement in the linkage so that the travel of the throttle arm is equal to the throw of the servo. A further advantage would be that the adjustment of the idling speed by use of the idle-stop screw has no effect on the linkage.

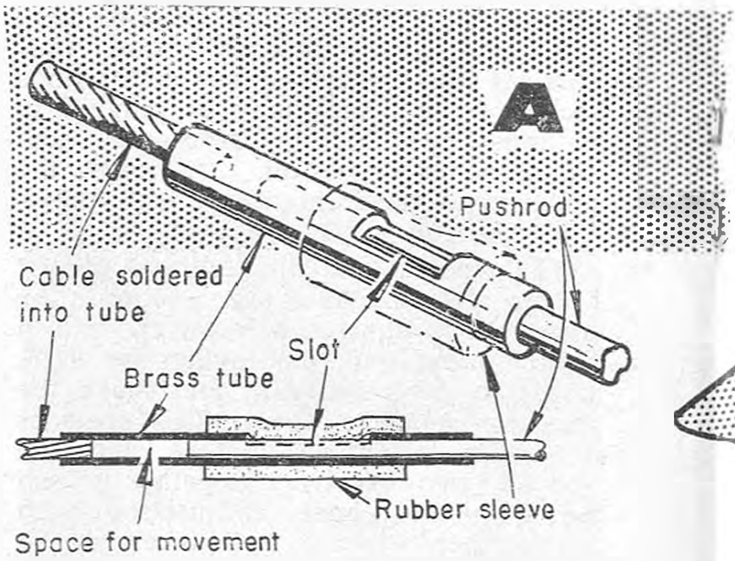
There have been several methods of adjustment and compensation; kinked wires and "peg-in-slot" arrangements, but this particular gimmick is not only easy to make but tidy in appearance. Study sketch **A**; select a piece of brass tube to suit the wire push-rod (16 s.w.g.) and file a cut-out so that the wire is exposed. The tube should be cut about half way through with sufficient length of tube left at one end to take up movement of the push-rod and to accommodate the end of the throttle cable. Now select a piece of rubber tubing which is a really tight fit on the brass tube, this will press hard on the throttle wire and provide an efficient friction clutch. One may then adjust the throttle end of the linkage without switching on the radio when tuning the engine. The servo over-rides without any undue strain when it reaches the limits of the throttle movement. With all these over-ride arrangements one must arrange that the throttle movement is *less* than that of the servo.

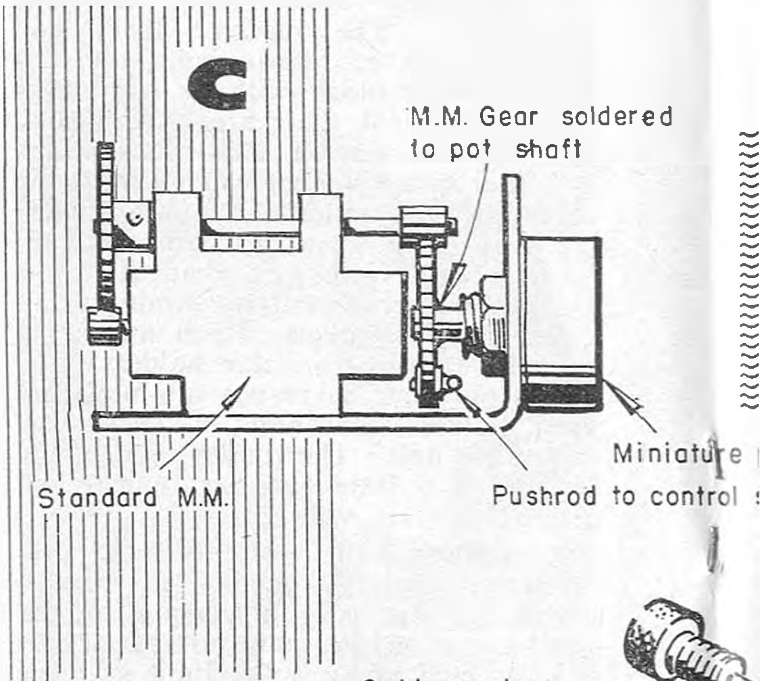
Tidy DEACs

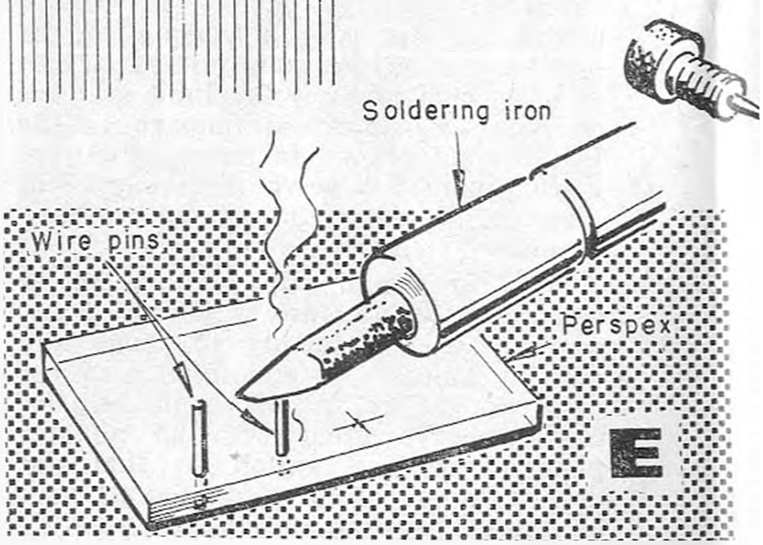
G. L. Patterson uses a strip of Fablon to tape his cells together in banks as in sketch **B**. Hold the cells firmly together and wind a strip, which is slightly wider than the cells, tightly round the edge, to which it will adhere, at the same time pulling them tightly together. The result is a very strong pack which no twisting or pulling will separate.

Quick Feedback Servo

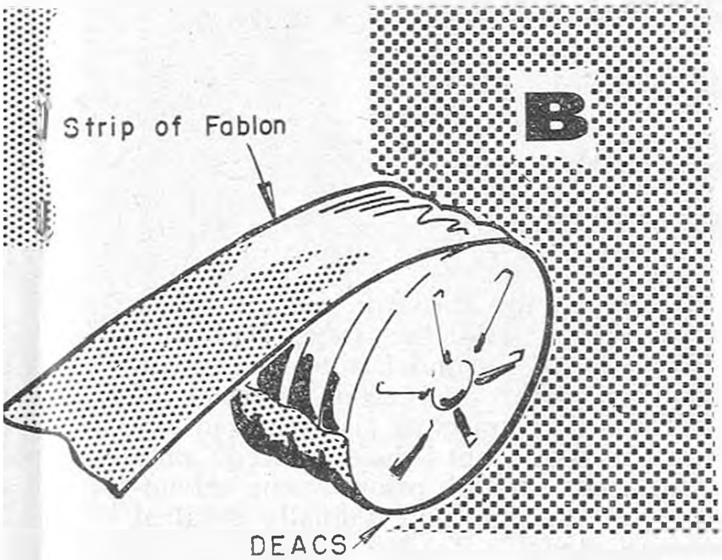
F. Strout, writing in *M.A.R.S. Pulse* discovered that small 1 K linear pots. have just the right size shaft to fit the hole left in a Mighty Midget gear when its bush has been pushed out. Solder

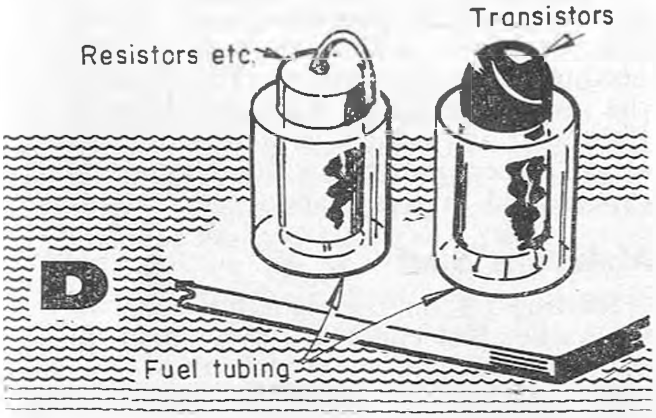


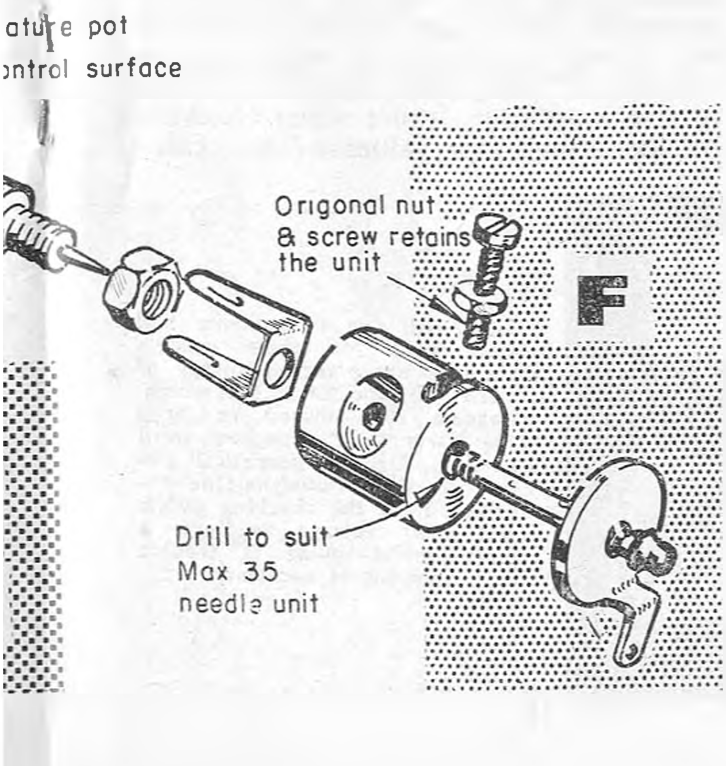




d Gimmickry







the gear onto the pot. shaft, drill to take a push-rod and mount the pot. in an aluminium bracket so that it engages in a second opinion on the counter-shaft of the Mighty Midget motor. Sketch **C** shows a side view of the servo.

Supporting Components

"Windy" Kreulen sent us sketches **D** and **E**, the first shows the clever use of fuel tubing of the appropriate bore to support vertical components on a printed panel. The tubing is pressed down hard against the panel and there is sufficient friction on the component to hold it in place. This now relieves most of the loading and prevents the components vibrating or flexing their leads when the receiver takes a gambol around the fuselage.

D.I.Y. Tagboard

Now on to sketch **E** which shows "Windy's" use of a soldering iron to press connecting pins (pieces of thick copper wire) into an odd scrap of Perspex to make tagboards for hook-ups, or even permanent installations. The heat of the soldering iron softens the plastic as it is conducted through the wire. The wire then sinks into the Perspex which holds it fast on cooling. The wire becomes tinned automatically by this process and a quick dab when making connections is insufficient to disturb the pins.

Perspex is quite a useful material for initial hook-ups; one can see what is going on from both sides of the panel, read values from the other side and mark out lands for P.C. work—ED.

Throttle Repair

The "prangability" of throttle units on R/C aircraft is a sore point with many modellers; and we welcome P. T. Walters' idea for repairing K & B throttle unit, the needle unit being particularly vulnerable. The repair procedure is as follows: Remove the needle valve completely, knock the end cap out, remove the barrel and drill it right through to take a standard MAX 35 needle unit. Reassemble as indicated on the sketch **F**.

This conversion has been found to work very nicely as it turns the needle on "slow motor" resulting in cleaner running and permits adjustment to the link arm by slackening off the spraybar locking screw.

Building the Microdyne-One Rx.

(An Esse Vee Electronics Kit)

A Simple Matter with these Stage - by - Stage Instructions

WE thought that it was time for a British manufacturer to feature in a "build it" type article; there seems to have been a dearth of information in this respect to date. Having reviewed the receiver in its completed form some months ago we decided to subject the kit to a practicle constructional test. No special tools were used and the whole exercise was carried out as near to the conditions likely to be experienced by the average modeller.

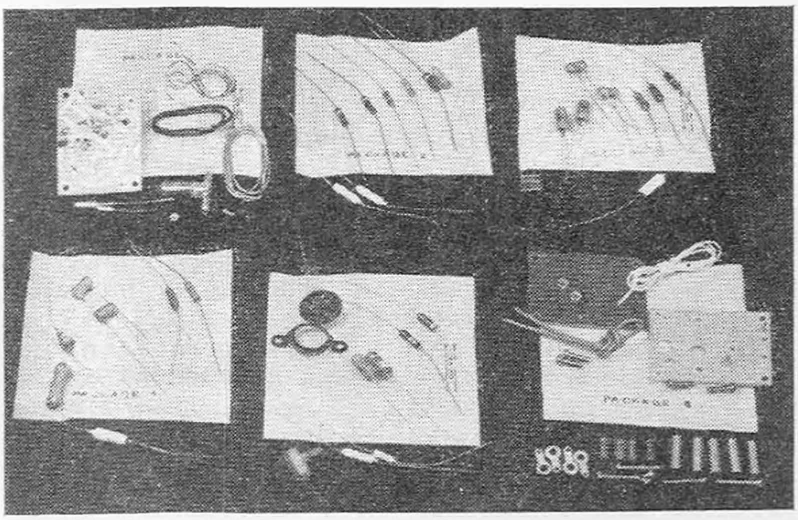
Circuit

The Microdyne-One follows a fairly normal pattern of super-regen. pattern with transformer coupling to the first stage and relayless output. The circuit appears in figure one, the coloured connections are made as follows: Black to 9 volts neg., red to 9 volts + and separate 4.5 volt + escapement battery and escapement, yellow to the other escapement connection and blue to the escapement battery neg.

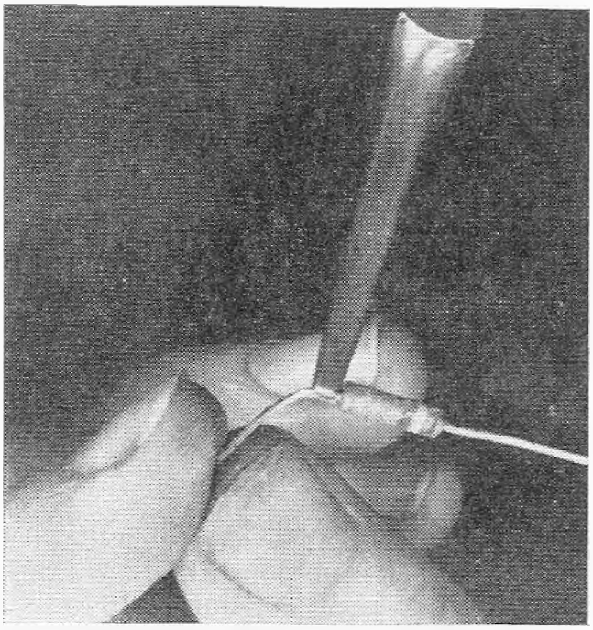
The receiver is constructed on two panels, the lower one forms a printed circuit and carries most of the components including the R.F. section. The final stages with the large V15/20IP output transistor and last two stages on the top deck. A certain amount of interboard connecting is required by this method but the reduced plan dimensions should prove to be advantageous when the unit is finally installed in the model. Readers may find that the mixture of printed circuit wiring and the more traditional form of connecting rather confusing. However, if the instruction leaflet, which is profusely illustrated and clearly written is to hand at all times, no difficulties should be experienced in this respect.

Making a Start

Starting off on the right track is half the battle; first check all the component packages opening them one at a time, checking and replacing the bits one packet at a time. In this way one is certain to retain each "batch" of bits in its correct envelope for speedy selection later. Reference should be made to the instruction leaflet when checking or identifying the values of the com-



Left: All the components laid out neatly on their packets showing the plentiful supply of "bits" a good £4.19.6d. worth. Readers are advised to keep the parts in the packets until needed. Right: Theoretical circuit of the Microdyne-One receiver, note the checking points and their voltage readings, a most useful point if trouble shooting is necessary.



Above : The correct way to bend the ends of component wires, the wires must be adjacent to the component itself. Right : Aerial coupling coil soldered to P.C. but not to rivet, keep the insulation close to the left-hand end to avoid shorting on that eyelet.

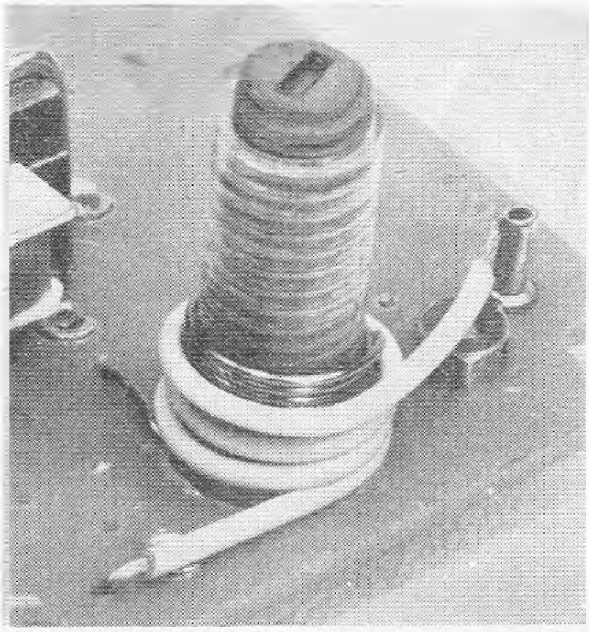
ponents. The leaflet gives a list of colour coding for readers who have not yet memorised the standard colouration code. Transistors are dealt with in a similar manner. Those not familiar with the emitter, base and collector wire positions on the R.F. transistor should be particularly careful not to remove the coloured sleeving from its leads. The other transistors although they have sleeving attached are graded and identified (by means of colour dabs) to suit the various functions in the circuit.

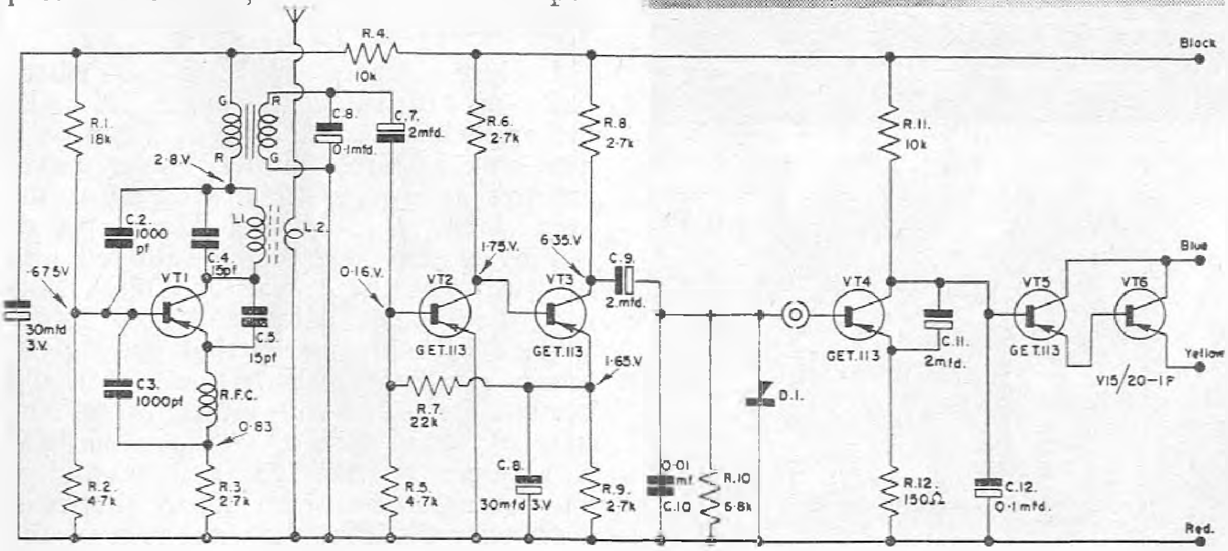
Preparation of Components

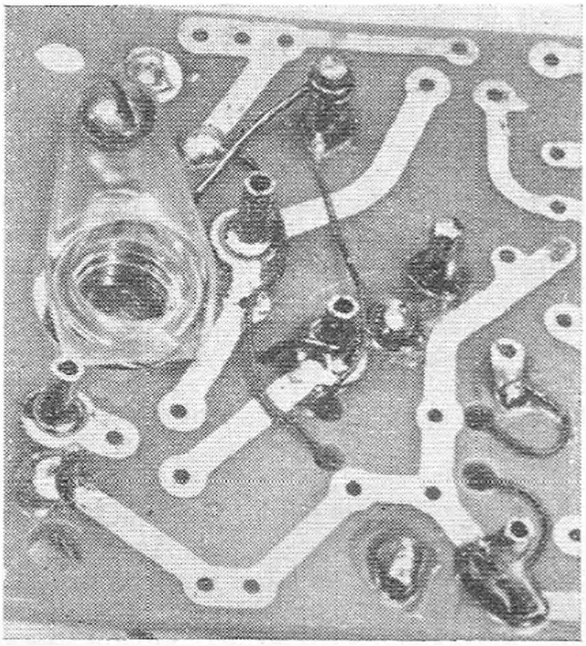
Cleanliness and care should be the pass-words here, some of the components in our kit required extra thorough cleaning on the leads and bending of the miniature component leads *must* be done with the aid of a pair of snipe-nosed pliers. Failure to do this could result in "two piece" resistors. The holes in the printed circuit panel are positioned so that the leads have to be carefully bent to establish a mechanical fit. Any forcing of an incorrectly bent lead could result in a damaged component. This is particularly important in the case of some of the resistors which have heavy gauge wire connections.

Flexibles

Before attempting to pass the end of a flexible wire through a panel into a P.C. land the individual wires should be twisted tightly together and given just a touch of solder to prevent them spreading and hindering the free passage of the wire as a result. This simple



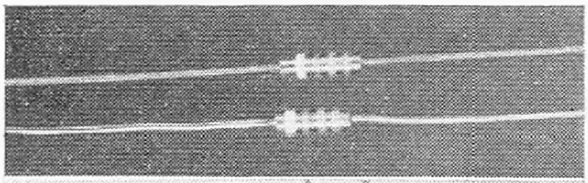


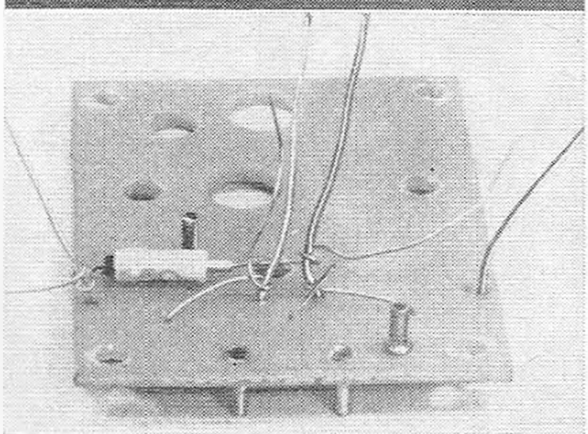


precaution saves tinning later and harsh words now. Here again and we must keep repeating, the instructions on the leaflet should be strictly observed, to ensure assembly in the correct order. Failure to do this would result in unsoldering several connections to put things right, a procedure which is both time wasting and one which can lead to damage of the components due to excess heating.

The stand off connections facilitated by the use of tubular rivets are used for certain connections and it is important to follow the instructions carefully to ensure the correct positioning of the wires on these rivets and the order in which they are soldered. For example, the tuning coil and its aerial coupling coil must be given a final tweak to ensure that the turns are tight, even and firm before soldering their ends to the appropriate connections, thereby ensuring that they remain in this state without the use of adhesive.

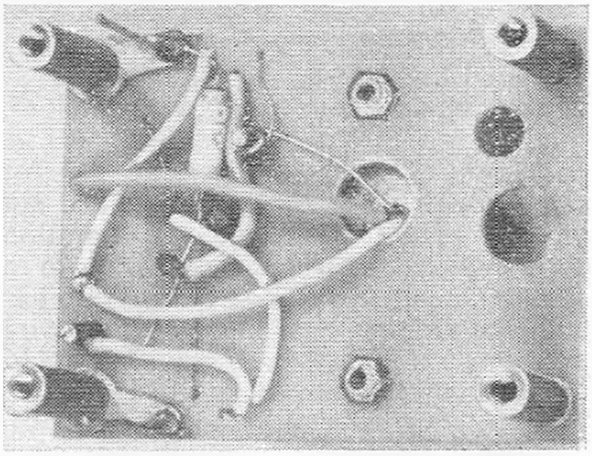
Above: The first few joints, check transformer for continuity. Below: The top panel from below with connections loosely made. We found the resistor leads (upper picture) needed a lot of cleaning. Right: Insulated sleeving over the finished connections.





Insulation

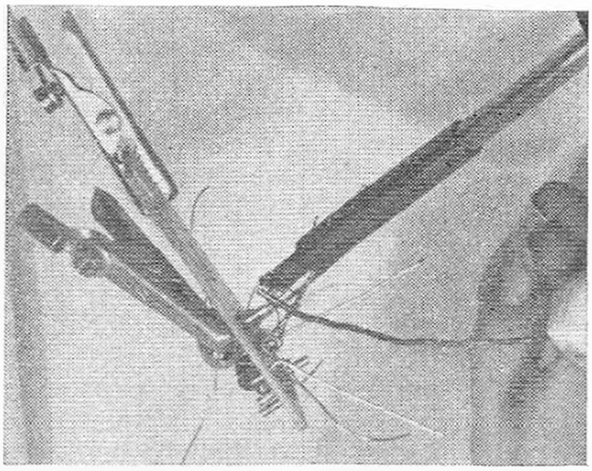
Plastic sleeving is provided in the kit and should be used as directed to insulate some of the leads on the upper panel, which follows the more traditional trend of trailing leads and direct component to component connections. One should also remember to leave some leads long enough for connection



to the lower panel when the final assembly is done. Here again careful bending and a final check to make sure that the tubular rivets concerned are quite clear of solder will save a lot of fiddling later on.

Transistors

Luckily nearly all the transistor leads are of sufficient length to make the application of a crocodile clip as a heat sink a simple matter. Never, never attempt to forego this procedure, the heat from a soldering iron spreads rapidly up the lead being soldered into the heart of the transistor, this results in a permanent damage to the latter. It must be remembered that placing the fingers on the transistor to see if it did become heated is no indication of the state of affairs inside. As soon as heat is applied the damage is done and it may be a second or so before that heat is transferred from the vital part of the

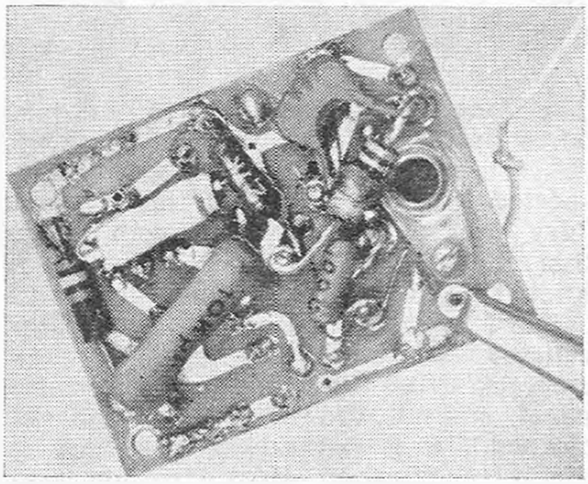


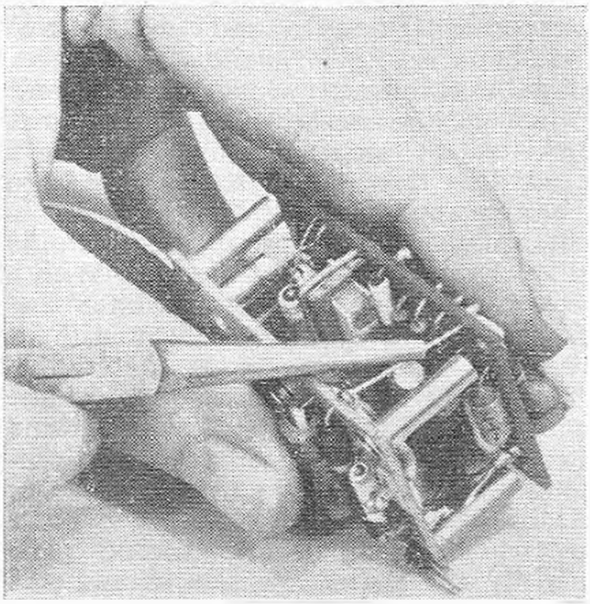
transistor to its case. Some transistors do get warm when working but in all probability the artificial heating caused by a soldering iron is much more than that for which they are designed.

Heat Sinks

The principle of the heat sink is to absorb the heat from the transistor lead so that the lead remains cool as it enters the transistor. There are several ways of applying heat sinks, the most common being a clamp fitted to the lead which conducts the heat into itself on the principle that for a given period of time and a certain temperature, a larger quantity of material will take longer to warm up than one of lesser bulk. Naturally the bulk of a crocodile clip or a pair of tweezers is far greater than the tiny lead of the transistor, so if this heat sink is placed between source of heat and the transistor, then the transistor itself will receive a smaller dose of heat in a given time. Naturally if the soldering iron is left on the joint for too long a time the heat sink will become saturated, that is, warmed to the same temperature as the wire on the soldering iron side, consequently the wire on the other side of the heat sink will heat up and conduct the heat into the transistor. Several other methods can be used to provide suitable absorption including wrapping the transistor up in a pad of wet tissue, in fact some modellers rest the whole set in a saucer of water so that the transistors are submerged with the panel remaining high and dry and ready for soldering. Whilst this water technique is suitable for inaccessible components careful "blotting" is required to dry the circuit up before testing. No, *do not* apply strong artificial heating to dry it out.

Above : Heat shunts on the transistor leads. Right : Finished lower panel under-side. Below : Making interpanel connections.



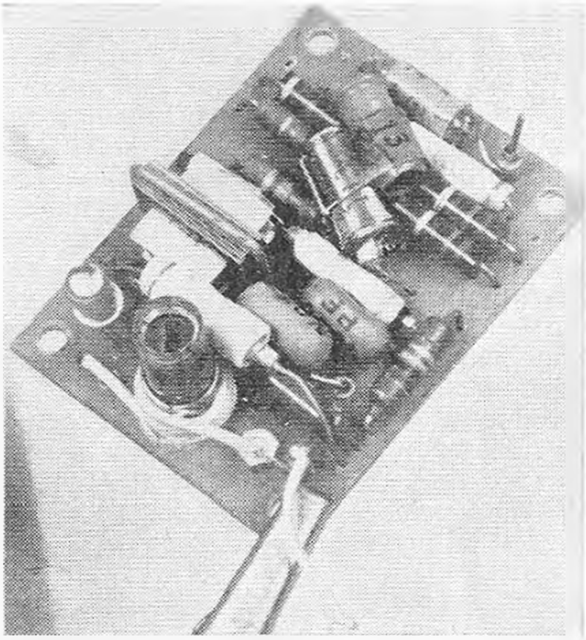


Assembling the Two Panels

Make quite sure that the inter-panel connections are perfectly clean and free from access solder before bolting the two boards together in their appropriate rivets, final soldering may then be done and these last few joints checked for continuity.

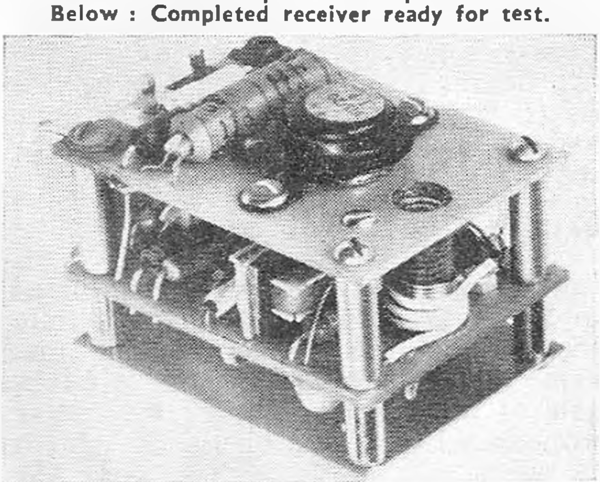
Stage by Stage Checking

The transformer comes ready soldered to the P.C. panel, possibly to ensure that its connections are intact and made in the correct order. It is advisable to check for continuity by putting a meter set for ohms on the P.C. lands to which the transformer is connected.



The same procedure can be adopted when the tuning coil has been soldered. All solder joints must be carefully inspected to make sure that they are not "dry" or so heavily laden with solder that they bridge adjacent "lands". A joint should be made with minimum amount of solder so that a small fillet can be seen all round the wire as it emerges from the hole, the printed panel is prefluxed and should not be cleaned. It is not advisable to pre-tin the wires further, except where previously indicated, as such extra coating of solder may make the wires too tight to fit in the pre-drilled holes. A nice bright soldered joint is an indication of the correct amount of heat. One which appears crystalline and dull is indicative of too little heat. It is a mistake to use too cool an iron as this, curiously enough, results in more heat

Above : Top of lower panel.
Below : Completed receiver ready for test.



being conducted to the component as it has to be held on the joint for a longer time than is necessary. When using a nice hot iron, a quick touch is all that is required to do the trick. P.C. soldering is a technique which may require practice from a beginner, a good chance to learn is by soldering the tubular rivets on to their respective lands. Later, when wires are to be dealt with, place the component so that its leads go through the appropriate holes, remembering that electrolitic capacitors must be placed so that their polarity is correct. (It may be helpful to bend the leads on the copper side of the panel) and place the solder provided in the kit in the angle between the wire and the copper land. Now apply the clean pre-tinned soldering iron to the joint so that the bit touches both wire and land. As soon as the solder runs remove the solder and the iron together smartly and blow on the joint. Never allow solder to accumulate in blobs on the bit of the iron.

As some of the components are soldered to the copper side of the board, care should be exercised to ensure that the soldering iron is not waved around to the detriment of these components which might become "fryed" in the process. Even on the upper side of the panel, it is very little use to provide heat sinks for the transistor leads if one inadvertently touches the case of the transistor with the iron.

Test Procedure

With the receiver wired up to an escapement and a 3.5 volt flash-lamp bulb connected parallel with the escapement (between red and yellow) the batteries, *which should be new*, may be connected with a double pole switch in the negative lines. A brief flick of the switch should produce a weak flash from the bulb or a skip from the escapement. Now is the time to test with the transmitter which should be a 27 mc/s carrier wave type. With a reduced aerial on the transmitter and the receiver several yards away with its 20 in. aerial hanging free and clear of the battery and escapement leads the transmitter should be held on signal and the tuning slug adjusted with an insulated screwdriver made from a piece of plastic knitting-needle. At some point in the tuning the lamp should glow brightly and the escapement should pull in. Continue tuning past this point until the lamp reduces in brilliance. One simply turns the slug back until the brightest point is reached again. The receiver should now be bang on the middle of the band of the Tx. If the lamp will not light throughout the tuning range the following check should be made; place a pair of earphones across the diode on the lower deck, that is between battery + and point X (the interpanel connection terminating in a tubular rivet adjacent to the neg. connection tag). A rushing sound should be heard indicating that the front end is super-regening when the transmitter is off. This hiss should cease as the receiver approaches an in-tune condition. If this stage of the test is satisfactory and there is no gain to drive the escapement, one must suspect the final stages, careful stage by stage checking is necessary, working from the audio end back using a meter to indicate the amount of gain.

When satisfactory results have been obtained at close range a final check should be carried out in a suitable open piece of ground to ascertain the maximum range to be expected. Some slight re-tuning may be necessary at extreme range using the lamp to give indication. An alternative method, one which is more closely allied to operating conditions is to remove the lamp and tune till the escapement pulls in, noting the point at which it operates, continue turning the dust iron slug until the escapement drops out again. Now turn the slug back exactly half way between these two points and re-check at close range. Mark the position of the slug and carry out the same test to ascertain whether or not the centre of the operating range still lies on the settings. If there is any variation, the long slug will have to be reset half way between the short and long way positions, although it would be better to err on the side of the maximum range.

NURENBERG NEWS

[Continued from page 233]

O.M.U.

This is the pioneer R/C firm of Germany and has many years of development to its credit. The search for an absolutely fixed audio frequency has made these people go so far as to build a Tx. with reed-governed audio-generators; the transmitter has lever switches for the ten channels. two channels per switch in common with British and American equipment. The fact that the audio frequency is so rock-stable under all conditions would seem to put it in the class of a world beater.

A set was purchased and one tone generator observed in action. Quite nice, but how on earth does one adapt this set to operate other receivers? Trimming the reeds in the generator was not the solution to get simultaneous matching. Certainly not a task for the impatient. Clearly this combination of transmitter and receiver must be *very* accurately matched, and a severe crash might put the receiver reed-unit out of commission.

The new O.M.U. transistorised servos are more promising; they have power centring and develop sufficient control pull. Precision of neutralising is quite good but the method of mounting the square plastic box would require more work than we are normally accustomed to. The novel idea of the O.M.U. and Metz servos is the use of a special electric motor with two windings, two commutators and four brushes so that no centre tap is required on this supply battery. Incidently the makers of DEAC cells dislike the policy of centre tapping as some modellers recharge them in a block which can lead to damage in some cells when one half of the pack is less discharged than the other.

Disadvantages of the twin commutator motor are that there are two more brushes which might be a source of weakness with the servo and the fact that the winding not energised may create an E.M.F. while the motor runs on the other winding.

The O.M.U. receiver was illustrated in *Aeromodeller* but is now in one completely sealed unit. Most of these items have been treated in the nature of a preview. Further gen will be available from the O.M.U. as soon as production gets underweigh. The Grundig/Graupner and Metz outfits should be available in Germany in about three or four months.

Easy Battery Charger

By M. J. ENDACOTT

For home or field

DURING the last twelve or eighteen months, particularly since the introduction of relay eliminators, all-transistor receivers, etc., it has become popular for a single integral pack of rechargeable cells, usually DEACS, to be used in models. A single pack of six or seven cells can now be used to supply power to the receiver, amplifiers and servos for multi, or escapements for single channel models. Also becoming more common are transmitter converters supplying full H.T. and L.T. voltage requirements from a 6v. accumulator. One such outfit to offer these advantages is the R.E.P. Dekatone; it was primarily with this equipment in mind that the charger was developed, although it can, of course, be modified to suit individual needs.

Rating

The charger is designed to work from two sources of supply, and to provide two outputs. Their function is described as follows:—

INPUTS (1) 200-250v. A.C. mains.
(2) 12v. D.C. supply.

The latter enables the charger to be run from a car battery or similar supply. This is considered to be an essential feature of the design, as the model can be connected to the charger for a few minutes if convenient between flights during a day's flying to keep the cells up to scratch. Provided your car battery is in good condition, current drain is extremely low whilst charging DEAC cells, so no trouble should be experienced starting your car at the end of the day.

OUTPUTS (1) Approx. 14v. @ 10-35 m.A.
(2) Approx. 14v. @ 0.1-0.25 m.A.

Both outputs are variable to adjust the current to the recommended charging rate; the first for DEAC cells, the second for EXIDE PRA35U transmitter accumulators.

Circuitry

The circuit is extremely simple, and no trouble should be experienced in construction. All components are easily obtainable, but in case of difficulty most of the items required can be purchased from G. W. Smith & Co. Ltd., 3 and 34 Lisle Street, London, W.C.2.

The mains transformer is a charger transformer having a tapped primary of 210-220-240v. to suit local mains voltages. The secondary winding has an output of 17v. After allowing for the voltage drop across the rectifier, etc., this is reduced to approximately 14v. The smallest obtainable can be bought, as total current consumption will not exceed ¼ amp. Most transformers will easily supply this current.

The rectifier is a selenium L.T. full wave bridge rectifier of 12/18v. 1.5a. rating. Again maximum permitted current is far in excess of that likely to be used, but as no smaller rectifiers are available at a comparable price, this satisfies requirements.

A meter was incorporated in order to make the charging rate variable, but always under instant supervision. A 0-35 m.A. meter with a broken case was bought cheaply at a Government surplus store. If 450DK or 500DKZ cells are to be charged, a 0-50 m.A. or a 0-1a. meter will be required. The meter is shunted with a wire wound resistor of the appropriate value to extend its scale to 350 m.A. (.35a.) when used to charge the transmitter accumulators.

Slide switches are used by the author similar to those commonly used by modellers in receiver installations. In both cases they are of the D.P.D.T. change over type and are rated at 250v. 1 amp A.C.

No on/off switch is fitted; the charger is switched off by simply isolating it from its source of supply. It should be noted that the cells must be unplugged after charging, otherwise they will slowly be discharged back through the circuit of the charger. This is evident by watching the needle of the meter, which will indicate a negative reading after the supply is disconnected.

With the Dekatone receiver pack, one

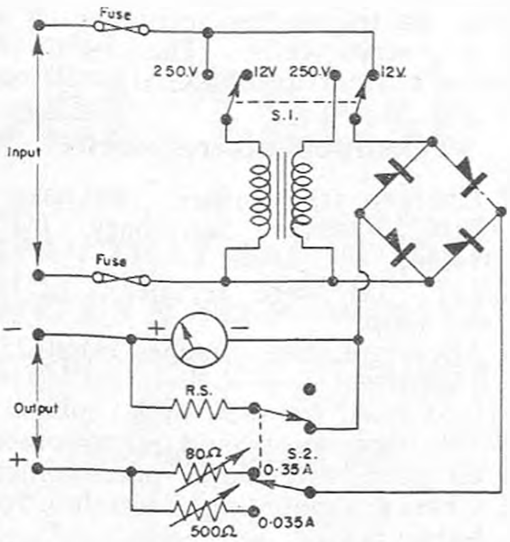


FIG. 1 Theoretical Circuit.

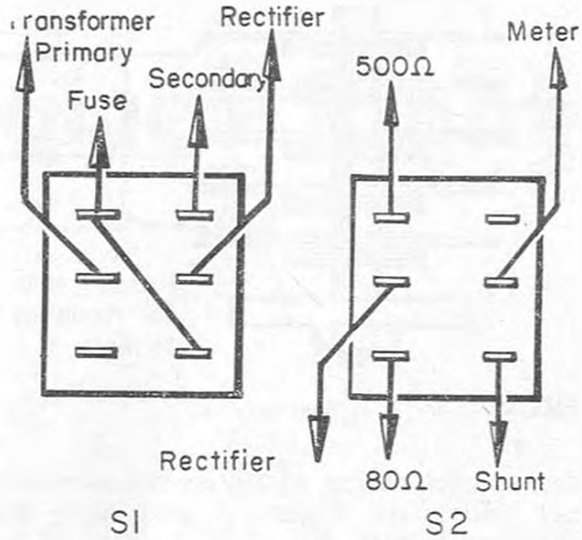


FIG. 3 Switch Connections

cell is used only for supplying L.T. to the valve. As drain on this cell is low, there is a danger of it eventually becoming overcharged if it is always recharged with the other cells. Consequently the output leads terminates in two plugs. These are wired so that one will charge all the cells in series if connected, the other only those cells which supply power to the servos and receiver converter.

It should be noted that the input voltage selector switch *must* be adjusted to 250v. *before* connecting the charger to the mains otherwise the fuses will blow and severe damage can occur to the charger if 250v. is applied to the 12v. input.

It is recommended that anyone dubious of their ability to take this essential precaution should run two separate leads from the charger and fit different plugs to them in order to prevent mistakes.

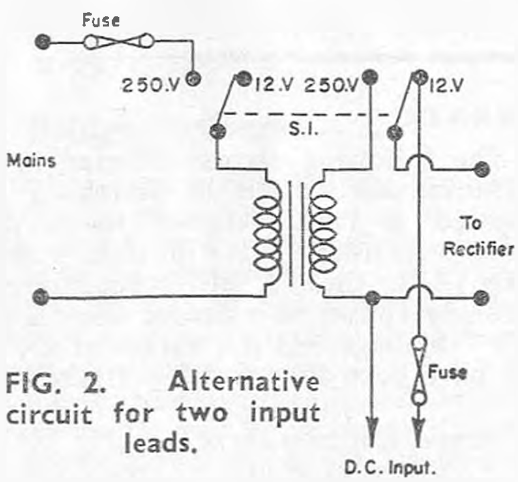


FIG. 2. Alternative circuit for two input leads.

It will be noticed that by putting the D.C. input connections 'in front of' the rectifier it is not necessary to observe polarity of the input. since D.C. of either polarity will be conducted by the appropriate arms of the rectifier bridge.

Construction

Construction is commenced by cutting out the front panel from 18 s.w.g. aluminium. Two $\frac{3}{8}$ in. holes must be drilled for the potentiometers. two slots each $\frac{1}{2}$ in. x $\frac{1}{4}$ in. cut for the switches and a $2\frac{1}{4}$ in. dia. hole for the meter. A clean large hole can be cut in aluminium with a fretsaw if the proper tool is not available.

The rectifier is mounted on a paxolin strip which, in turn, is mounted onto the back of the meter by means of the meter's terminals.

The mains transformer is bolted to the front panel by two long 6 BA bolts, suitably spaced with nuts to clear the potentiometers and fuse-holder.

Next the switches are mounted on the panel, after they have been taken apart and the contacts thoroughly cleaned. Small pointer knobs can be fitted to the potentiometer spindles, and a tagstrip is fitted to one end of the panel to which all input and output wires are soldered. The fuseholder is mounted underneath the mains transformer.

After all the components have been positioned, the unit can be wired up as shown in the circuit of Figure 1 or 2, depending on which version is being constructed. Care must be taken over

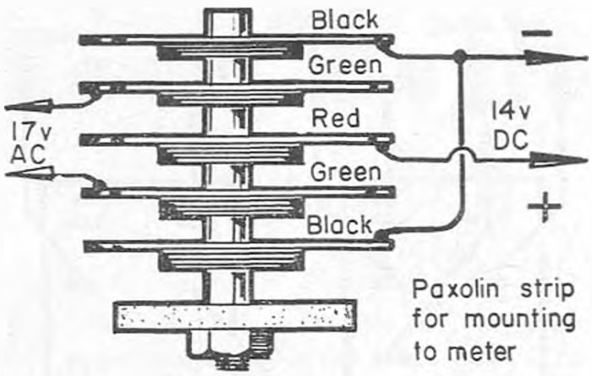


FIG. 4 Rectifier.

the correct wiring of the switches which are shown in Figure 3 and also the rectifier (Figure 4).

Testing

When the wiring is completed, a check can be made on the low current range (.035a.). If this is satisfactory the shunt resistor can be wound for the .35a. range of the meter. This is calculated as follows:—

$$R_s = \frac{R_m}{n-1}$$

where R_s is value of shunt resistor
R_m is the meter resistance.
n is the factor scale is to be multiplied by. Here n = 10.

If no means is available to measure or calculate the required length of resistance wire, it is best to connect a calibrated meter in series with the charger meter and then adjust a length of resistance wire until both meters indicate the same current. Further details on this and other methods were given by F. G. Rayer in his article in the February issue of *R.C.M. &E.*

The output leads terminate in a 4-pin and a 5-pin plug. These connections are shown in Figure 5. The 4-pin will charge the transmitter accumulators and the six servo cells. The 5-pin plug supplies current to all DEAC cells only.

Components required

1 Charger transformer. Primary 0-210-220-240v.; Secondary 0-17v., 1 amp.
1 L.T. full wave rectifier. 12/18v., 1.5 amp.
2 Miniature slide switches rated 250v. 1 amp A.C.
1 0-35 m.A. (or 0-50 m.A.) meter.
1 500 ohm wirewound potentiometer.
1 80 ohm wirewound potentiometer.
1 Chassis mounting double fuse-holder.
1 6-way tagstrip.
2 Small pointer knobs.
Front panel 9 in. x 3 in. of 18 s.w.g. aluminium.
2 150 m.A. 1¼ in. fuses.

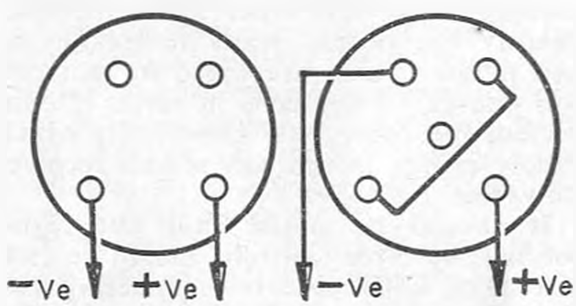


FIG. 5 Plug Connections

Finish

If desired, the panel can be painted a light grey and markings stencilled or painted on to give an attractive appearance. The completed panel can then be mounted in a plywood box, suitably finished, and fitted with rubber feet to protect the surface of the table or car parcel shelf.

"Strange, I'm sure there was some reaction".

ERRATA

The following errors occurred in our "Transmistor" article in March: Fig. 1 omitted a land between the crystal, V.T. 3 emitter and 470 ohm resistor. Page 132, the "5 pf." capacitor was wrongly shown in place of the 5K pre-set. On page 133 the values of C4 and C5 have been transposed in figure three.

Get Those Values Right

SPAN THAT GAP IN YOUR WORKSHOP WITH A SIMPLE R.C.L. BRIDGE

By K. WILLISS

SOME form of R.C.L. bridge will be a valuable asset to the radio control enthusiast, as it will enable components to be checked prior to use and should be most helpful for fault finding.

The accuracy of the completed instrument will depend entirely on the accuracy of the components used and on the calibration of the ratio dial RV1.

The instrument described has several desirable features for the home constructor.

1. The energising voltage is derived from a transistor oscillator, thereby dispensing with the bulk and weight of a mains or battery powered valve unit.
2. Null detection can be made with a pair of earphones which most R/C fans will already possess or alternatively an oscilloscope or AC millivoltmeter.
3. The scale marking will be linear and only one scale is used for all ranges.
4. Only one capacitance standard is required, the ranges being extended by the switching of precision resistors, which are cheaper and more easily obtainable.

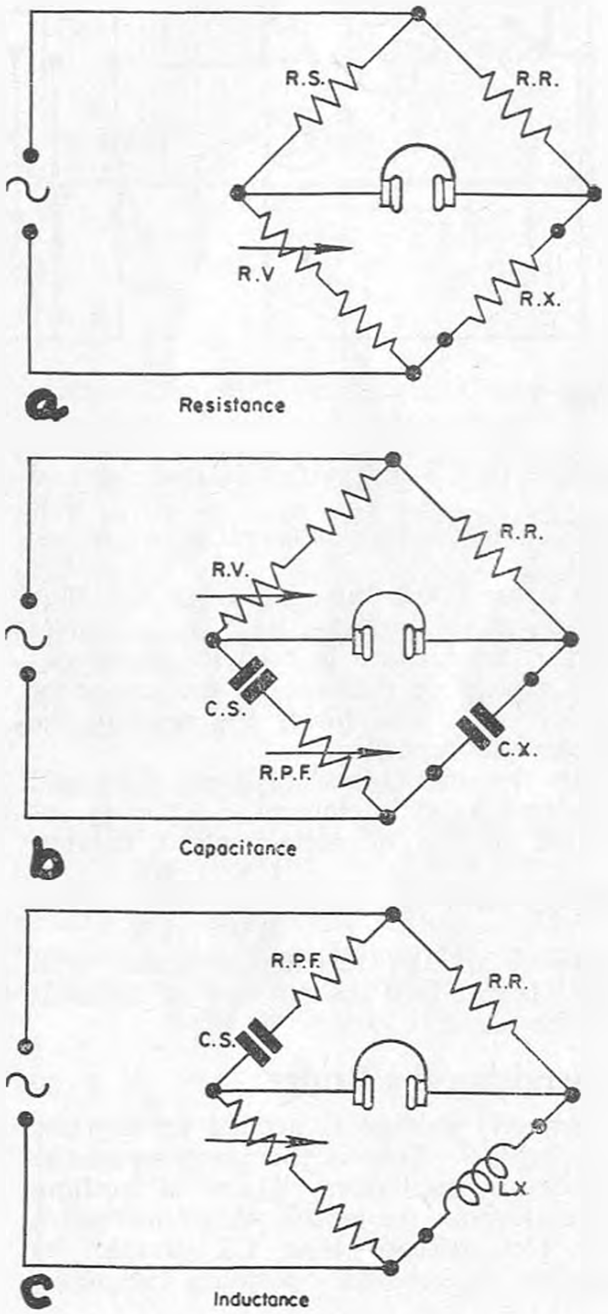


FIG. 1

The Bridge Networks

In this instrument the bridge networks have been arranged so that all ranges of R.C. & L. uses the same scale. This is accomplished by switching the bridge elements. The complete circuit is shown in Fig. 1a. The three basic circuits are shown in Fig. 1.

In the resistance bridge it will be seen that the circuit will be in balance when, with an unknown resistance inserted in the Rx. position and RV adjusted so that the ratio $\frac{RS}{RV} = \frac{RR}{RX}$. When this condition is met, the voltage appearing across the detector will be zero, this is known as the null point. The value Rx. can then be read from the calibrated ratio dial RV.

The operation of the capacitance bridge is similar except that RS is re-

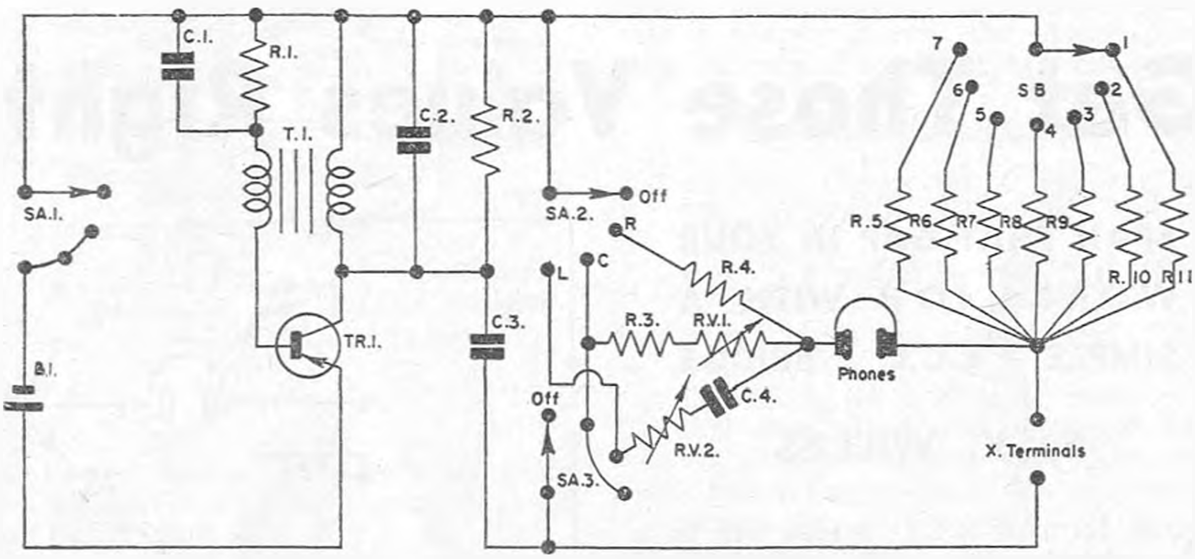


FIG. 2

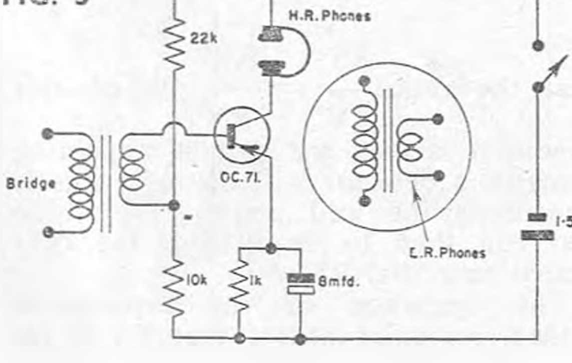
placed by CS and with CX inserted and RV adjusted until the ratio $\frac{RV}{CS} = \frac{RR}{CX}$ the value CX being read from RV. The extra variable resistor RPF is the power factor control and is used to cancel out any resistance element in the capacitor under test. The lower the reading the better the capacitor.

In the inductance bridge CS is still retained as one element LX being inserted in the opposite section balance being when the ratio $\frac{CX}{RV} = \frac{RR}{LX}$. The purpose of the resistor in series with RV1 is to adjust the position of the ends of the scale.

Energising the Bridge

An AC voltage is needed to energise the bridge. This is the purpose of the transistor oscillator. There is nothing special about the circuit which will work on 1½v.. except that C2 should be selected to give an operating frequency of approximately 1,000 c/s. Most types of transistor will work in this circuit, the transformer is one of the standard transistor type of 4-1 ratio, the larger winding being in the collector circuit. The windings must be connected the right way round to give a phase reversal to set up oscillation. The complete circuit is shown in Fig. 2.

FIG. 3



Detection

As previously stated, this can be a pair of 'phones preferably of high impedance (low impedance types can be employed but with a loss of sensitivity unless a stepdown transformer is used). An added refinement for better sensitivity would be a built-in transistor amplifier, a suitable circuit is shown in Fig. 3. High resistance 'phones can be directly connected as the collector load; Low resistance 'phones via a transformer to prevent interaction between oscillator and detector, separate batteries for the amplifier would be required in this case.

Components

For reliable results *only good quality components should be used.* The pot. for the ratio arm RV1 should be of the linear wire wound type of at least 1½ ins. diameter and should be capable of being closely adjusted and free from backlash. Almost any type could be used for RV2 but a log. type will be the most useful as most of its adjustments will be at the low end, log wire wound pots. may be difficult to obtain so a carbon pot. could be used. The range resistors should be 1% high stability types or higher tolerance types if another bridge is available to select them. The capacitance standard should be a low loss mica, a paper could be used if of good quality.

Construction

A suggested layout for the front panel on which all the components are mounted is shown in Fig. 4. Hole size and position should be checked against the actual components used before drilling any holes. Assembly can now commence. Pots., switches, terminals and jack socket are mounted and the resistors and capacitor soldered in (Fig. 5). The prototype oscillator was mounted on a piece of terminal board as shown in Fig. 6. A suitably etched piece of printed circuit laminate could be used to advantage here. The dials can be marked on white card with ink then clear varnished or covered with thin Perspex, the cursor can easily be made by attaching a piece of Perspex to the bottom of the knob as indicated in Fig. 7. The hair line can be made by scribing the underside with a razor blade.

Calibration

This is the most important part in finishing the instrument; it should not be difficult if a resistance decade box is available, if not, purchase an extra 10K 1% to use as a standard value.

The procedure is as follows. The 10K standard is inserted between the X terminals and the range switches adjusted to R and 5 respectively. The null point is found with RV1. This point can be marked 1. Range 4 is then

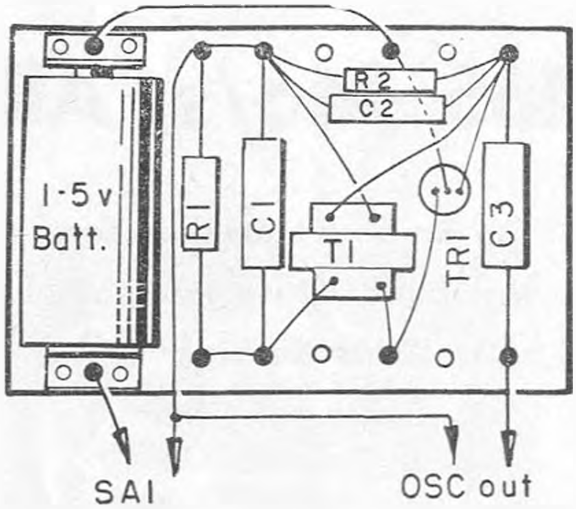


FIG. 6

selected, the null point found and the scale marked 10. (If these points do not come approximately equal distance from each end the value of R3 will have to be adjusted and calibration recommenced.) The distance between 1 and 10 is then divided into 9 equal spacings and marked 2, 3, etc. These can now be subdivided into 10. These sub-divisions can be extended above and below 1 and 10. This completes the calibration.

Using the Bridge

To measure an unknown R C or L connect the detector and insert the unknown between the X terminals and select the appropriate bridge. When measuring resistance adjust SB in conjunction with RV1 to obtain the null

[Continued on page 251]

FIG. 4

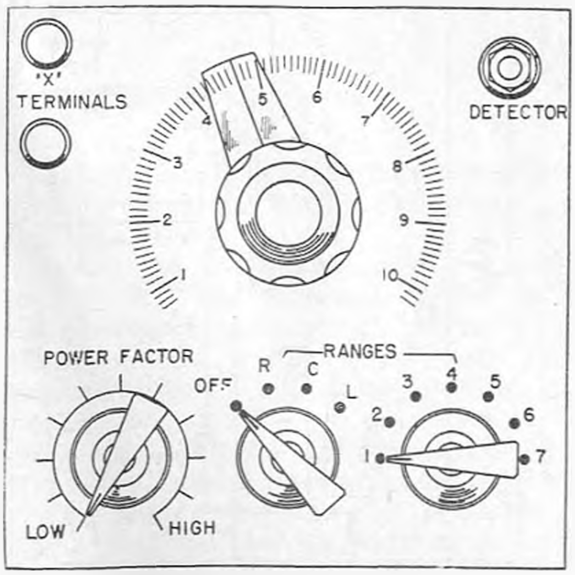
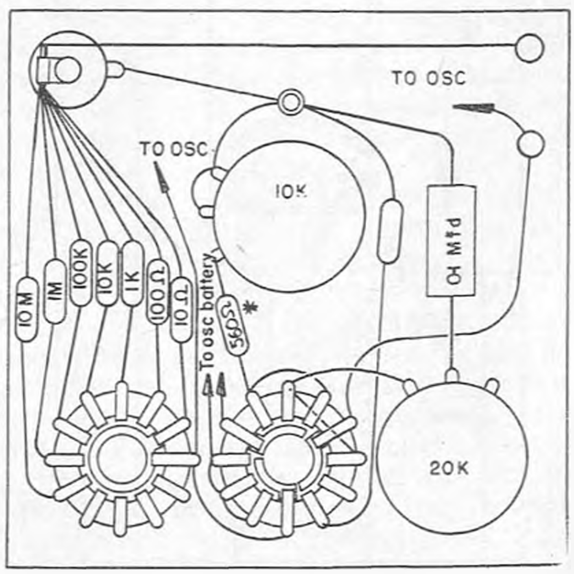


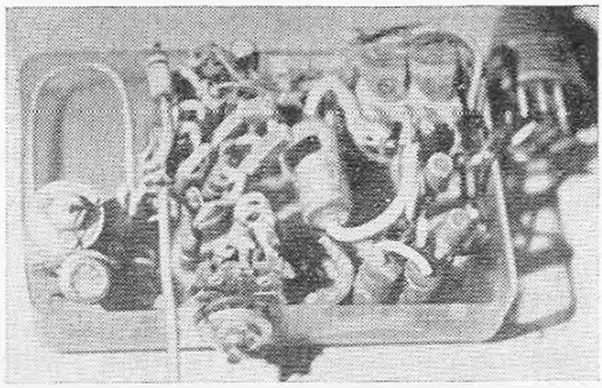
FIG. 5



465 Mc/s All Transistor Rx.

The Rx. in its original form was built to use two channels. This version has a single pot filter

By M. J. Gingell



The prototype Rx. with two pot. filters and a pair of relays.

465 MC/S Radio Control differs little from 27 Mc/s. The only difference lies in the circuitry for generating and detecting the required frequency. In this article I shall attempt to describe my solutions to these problems.

Very little information will be found about this topic in radio control books or indeed in any textbook in V.N.F.—U.N.F. techniques. This probably accounts for the lack of support of our second wavelength. The second point that is always brought up is the difficulty of obtaining suitable components.

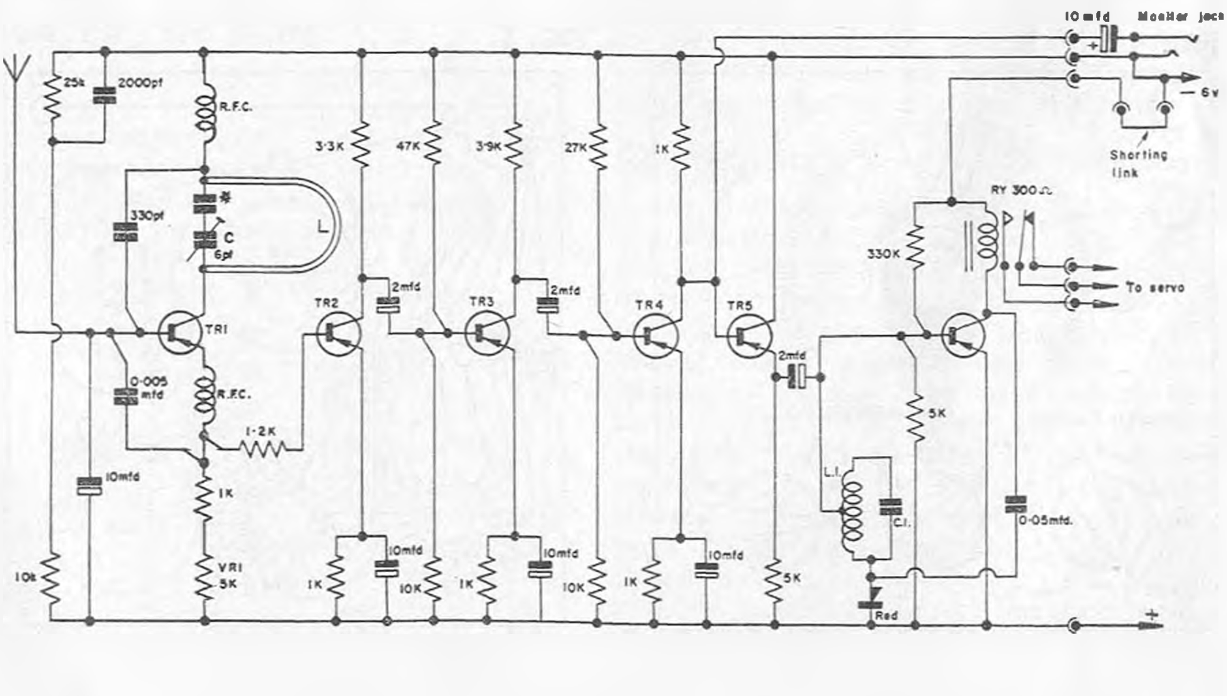
A practical all-transistor 465 Mc/s Receiver

Up to now the all-transistor 465 Mc/s Rx. has been considered impracticable. This has mainly been due to the difficulty of getting transistors to work at this frequency. Now, however, transistors are coming on to the market that will work to frequencies in excess of 1000 Mc/s. The particular transistor used in my receiver has a cut-off frequency of 1000-1200 Mc/s. It is not expensive either at 25/-.

Circuit Description

Except for the front end, the circuit is quite conventional and in fact ideas for it were taken from other circuits that have appeared in these pages.

FIG. 1 Theoretical Circuit



The front end is the real heart of the receiver. It is really very similar to many 27 Mc/s transistor super-regenerative detector circuits. The main difference lies only in the tuning circuit and the better transistor. This front end could be used in conjunction with any of the usual multi channel systems—reeds, tuned filters, etc. Tone modulations of the signal is a must, however, as the current change at the receiver is very small—too small for direct operation of a relay.

In the circuit (Fig. 1) the detector is directly coupled to the first A.F. amplifier. This feeds a two-stage R/C coupled amplifier followed by an emitter follower stage and a frequency selective output stage operating a relay. The audio frequency used is at 4.35 kc/s. A selective output stage was chosen because this eliminates the quench frequency and any odd disturbances that the receiver might pick up. You might think that 4 kc/s is rather high. There are two good reasons for my choice of this.

1. A better Q is obtainable from the tuned circuit at a higher frequency (within limits).
2. I used a Simple Simul pulsed modulation and you can get a better wave form using a high audio frequency carrier.

Power requirements are quite modest. An average of 10 m.A. at 6 volts—this can be supplied from pen cells or DEACS. The supply voltage is critical so DEACS are preferable. If the supply volts fall the circuit will not work unless RV1 is readjusted. So watch your batteries.

Construction

Again, this is conventional — printed circuits being the best for smallness and neatness.

Details of the tuning loop are shown in Fig. 3. The material should be 16 s.w.g. copper wire either enamelled or silver plated. I have used both quite successfully. The tuning loop is supported on small tags at about ¼ in. above the printed circuit board. The transistor holder is mounted similarly.

The tuning capacitor is a sawn off 0-6pf. Phillips beehive trimmer in series with a small capacitor made by wrap-

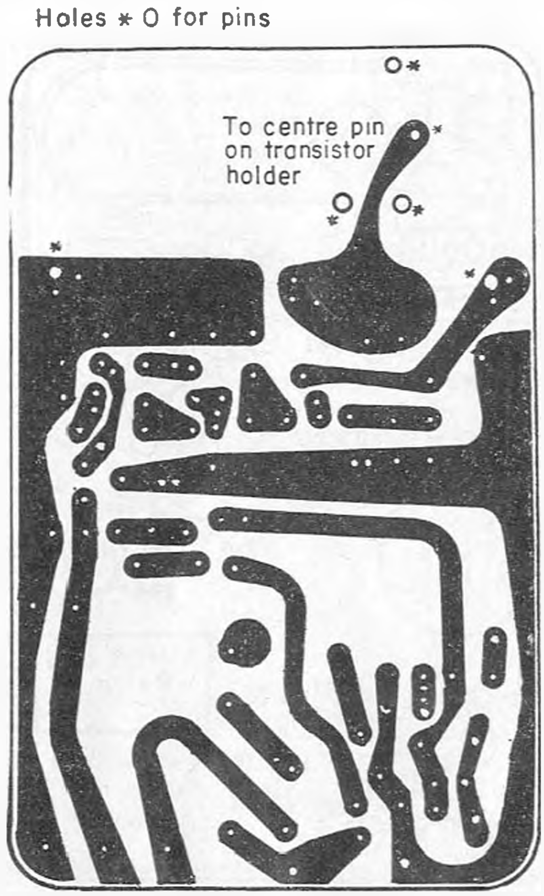


FIG. 2 Full-size P.C. Panel.

ping one or two turns of insulated wire round one of the trimmer tags. The trimmer and series capacitor are connected between the ends of the tuning loop (Fig. 3).

Small tags are also used to support the ends of the R.F. chokes and the terminals of the V.M.F. transistor holder.

It cannot be stressed too strongly that all leads should be very short and connections well soldered. Preferably connections should be no longer that those shown in Fig. 2. Beginners should try and copy the R.F. layout exactly to ensure the best results.

The aerial must be connected directly into the circuit as any connecting lead defeats the object of having a short aerial. The length is very critical. It should be about 5 in. long (see adjustment notes). Flexible wire must not be used for the aerial as this will give very inconsistent results due to capacity variations. The aerial should be arranged to be vertical in the model or pick-up will vary according to the models orientation with respect to the transmitter.

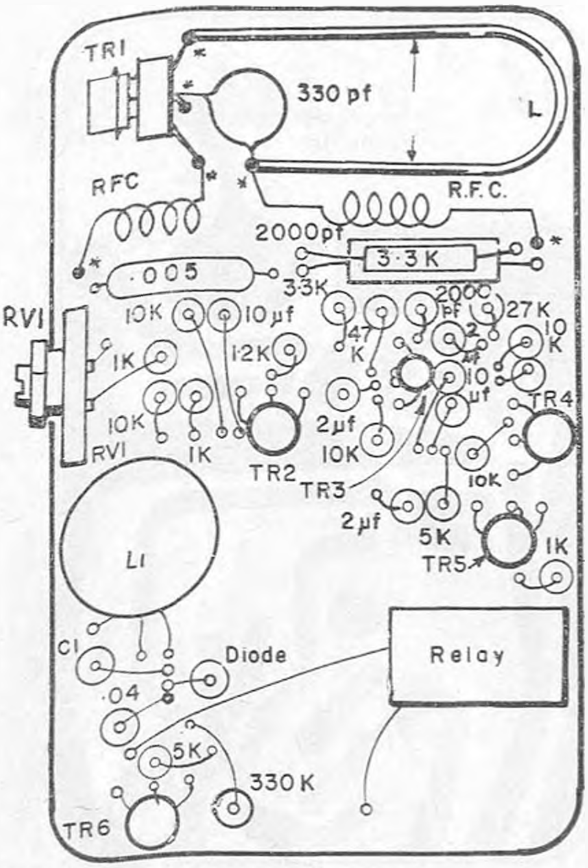
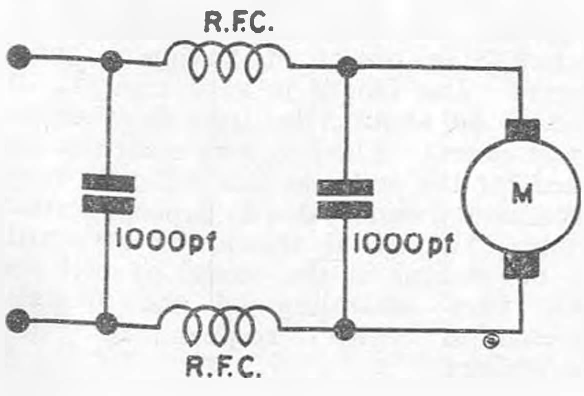


FIG. 3 Component Placement.

NOTE.—*Dimensions of tuning loop L; $\frac{5}{8}$ in. wide, long leg $1\frac{3}{8}$ in. Short leg $1\frac{1}{4}$ in. long, both measured from top of loop.*

Adjustment Notes

Connect an earphone (I used a deaf aid type—250) to the amplified output of the detector. If the circuit is working correctly a rushing noise will be heard. If not, adjustments must be made to the aerial length, RV1 and failing that to the other components in the R.F. stage (always assuming that everything is connected correctly in the first place!). The aerial length should be adjusted by



snipping pieces off until the best results are achieved.

The overall working length of my aerial finished up at $4\frac{5}{8}$ in.

Final adjustment for best sensitivity should be done with the transmitter switched on and placed at a good distance away. A pulsed tone is the best form of signal for adjustment. It pays to experiment with all the component values if you want the very best results.

Further points worth noting

The receiver has a very good range. The ultimate limit has not been measured but it was found that it worked as well as ever over more than half a mile ground range (with no obstructions). Care must be taken that no obstacles can come between the Tx. and Rx. or contact may be lost. Even people come under the heading of obstacles! This is so much more important at 465 mc/s than at 27 mc/s.

The Rx. fits into a small plastic box that originally contained a pack of playing cards. The weight is little more than a comparable 27 mc/s receiver ($3\frac{1}{2}$ oz.). So let it not be said that 465 mc/s is out for aircraft.

The reader must not run off with the idea that 465 mc/s has suddenly become easy. It hasn't. Great care must be exercised in construction and layout. The general principles are the same as 27 mc/s only details are different. The same circuits are used on both frequencies. They look different, however, only because the tuned circuit is made from a loop of wire or tubing. The inductances and capacitances which, although small, can seriously affect the circuit operation because they are of the same order of magnitude as the tuning L & C. Half an inch of connecting wire can shift the tuning frequency by 50 mc/s. So remember cut your leads down to $\frac{1}{8}$ in. or less otherwise you are just wasting your time. Of course these warnings apply only to the R.F. stage —you can wire the audio stages up how you like.

Interference suppression

Servo motors and relay contacts can cause serious interference on 465 mc/s so it is worth fitting simple suppressors.

Fig. 4 shows a smoothing circuit for small motors of the Mighty Midget type. The R.F. chokes can be self-supporting and the components should be wired directly to the motor terminals.

A simple R.C. suppressor fitted to the relay contacts is more important than that in Fig. 4 because arcing can set up V.H.F. oscillations in the connecting wires very easily.

Component List

Resistors		Capacitors	
$\frac{1}{4}$w. 10% tolerance		1	330pf.
5	1K.	1	2000pf. Ceramic.
1	1.2K.	1	.005μf.
1	3.3K.	1	.05 Hunts min. micromold.
1	3.9K.		
2	5K.	3	2μf.
3	10K.	5	10μf. 6v. wkg.
1	25K.		
1	21K.		
1	47K.	1	0-6pf. beehive
1	330K.	1	.01μf (C). Hunts.
1	5K pot. (VR1).		

Inductors

L Tuning loop (see Fig. 1).
L 112mH. 315 turns tapped at 45 on Mullard FX1011 Core.
RFC R.F. Chokes. 4 turns, 20 s.w.g. spaced over $\frac{1}{2}$ in. and self-supporting (wound on a mandrel $\frac{1}{8}$ in. diameter).

Transistors

TR1 2N1742 Philco (Electronic Precision Equipment Ltd., Eastbourne).
TR2-5. Red spot. OC70 or OC71.
TR6. OC71.
Diode, any.

Relay

Gruner 300.

Bibliography

1. Radio Control. By F. C. Judd. G2BCX. Data Publications Ltd.
2. Radio Control for Models. Harborough Press. By G. Honnest-Redlich.

GET THOSE VALUES RIGHT

[Continued from page 247]

point. The value is then read as follows: assuming the null point is found on Range 4 and 4.7 on RV1, it will be seen from the table in Fig. 8 that Range 4 when measuring resistance is 1K the unknown will be 1K x 4.7 = 4.7K.

When measuring capacitance and inductance RV1 should be adjusted in conjunction with the power factor control, final adjustment being made on RV1. In a bridge of this type it is not practical to measure PF but as a guide it should be low for mica ceramic and paper capacitors and higher for inductances. Normally a special bridge would be required to test electrolytic capacitors in which a polarising voltage is applied but a good indication will be obtained with the bridge described providing it has been recently polarised.

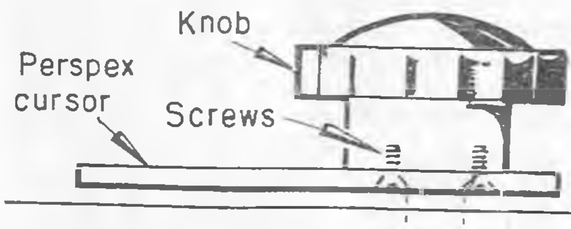


FIG. 7

Parts List

R1	27K.	C1	0.04 Hunts
R2	10K.	C2	0.002 Hunts. See text.
R3	560 ohm see text.	C3	0.002 Hunts.
R4	10K ohm 1% High Stability.	C4	0.1 1% mica.
R5	10m ohm ,,	T1	3-1 transistor.
R6	1m ohm ,,	TR1	OC71 or similar.
R7	100K ohm ,,	SA	3P 4W rotary.
R8	10K ohm ,,	SB	1P 7W rotary.
R9	1K ohm ,,	RV1	10K W/W Lin.
R10	100K ohm ,,	RV2	20K Carbon Log.
R11	10 ohm ,,		

Case 6 ins. x 6 ins. x 2 ins. approximately.
2 Terminals (Bulgin T103).
1 Jack Socket (Bulgin J2).
1 Large Knob.
3 Small Knobs (Bulgin K107).
Terminal Strip.

FIG 8 RANGES TABLE

Ranges	1	2	3	4	5	6	7
Resistance	1Ω	10Ω	100Ω	1K	10K	100K	1M
Capacitance	10mfd.	1mfd.	.1mfd.	.01mfd.	1000 pf.	100 pf.	10 pf.
Inductance	.1mH	1mH	10mH	.1H	1H	10H	100H

New Equipment

THE LATEST DEVELOPMENTS

Smaller and Smaller

We hear that Messrs. Ripmax are to introduce a new tiny receiver for the sub-miniature model. Naturally it is an all-transistor relayless tone set using 4 transistors with 2 transformer couplings between the stages. Size 2 in. by $1\frac{1}{4}$ in., weight 0.8 oz. We hope to review this receiver in detail when it becomes available. The receiver will be known as the Mini Path-finder and some idea of the size can be seen by the hand in the photograph.

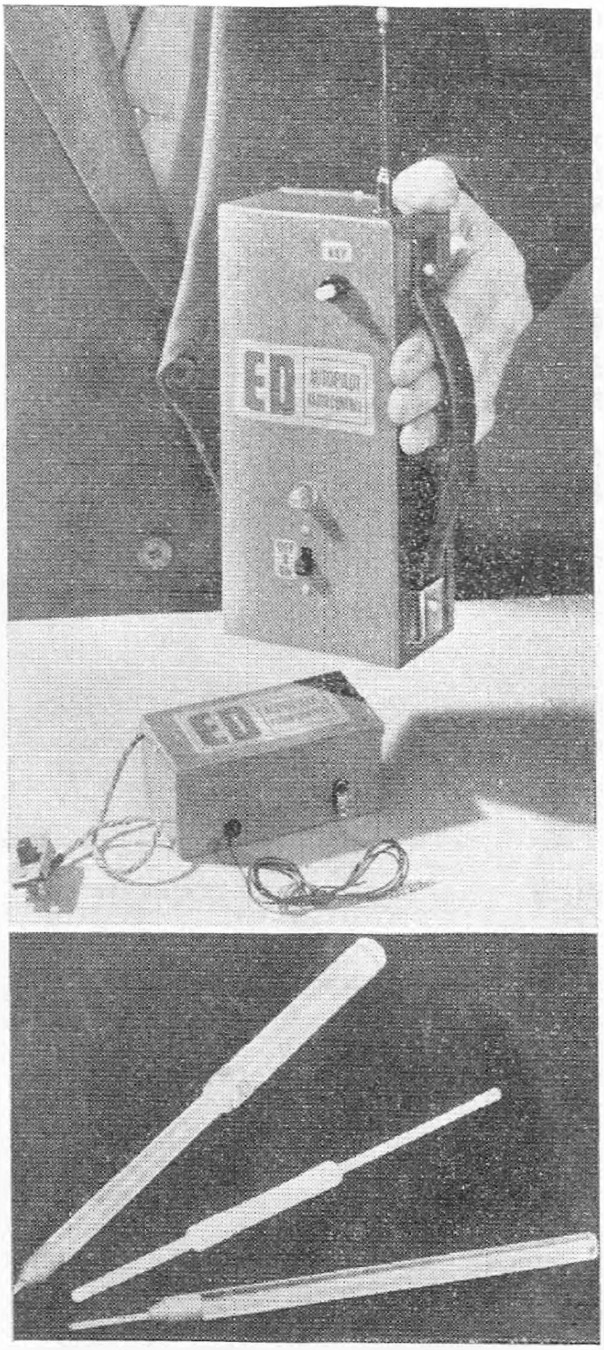
Even more diminutive workmanship appears in the Otarion receiver from the U.S., it weighs less than half an ounce and 27 miniaturised components, including 2 type T112 German transformers are crammed into a space 1 in. by $1\frac{1}{4}$ in. by $\frac{5}{8}$ in. An indicator lamp is built into the circuit to assist in the tuning (and probably acts as some kind of voltage control). It operates a normal escapement (Bonner or Elmic "Corporal" recommended) from a common supply of 3.3 volts drawing 15 m.A. no carrier, and 4 m.A. continuous carrier, this figure of course rises with the tone signal to provide the operating power for the escapement. Initial batch via Ed. Johnson cost £11 15s. each including tax.

The set is temperature stable from 0° to 120° F. We conducted a satisfactory bench test, but here again we hope to give a full review shortly when we have had a chance to fly the receiver.

The same company also manufactures one of the tiniest switches we have seen, very light in action and made almost entirely of pure silver; size is actually $\frac{1}{4}$ in. by $\frac{1}{4}$ in. by $\frac{1}{8}$ in. and is rated 50 volts D.C. 1 amp (price 14/-). One has to do something when the size of the receiver gets down to some of the proportions of today.

Denco Trimming Tools

The following useful trimming tools are available from Messrs. Denco as follows: Type T.T.1 it is 6 in. long with



Top picture of the "Auto-pilot" shows its compactness and simplicity. Below: Denco trimmers; T.T.5 below, T.T.1 above, with the hexagonal job between.

a tiny copper screwdriver blade type (2/-); T.T.5, a 5 in. long version for 4 mm. Neosid dust iron cores (2/6d.) and an all polystyrene hexagonal trimmer (1/9d.).

Cases to Your Requirements

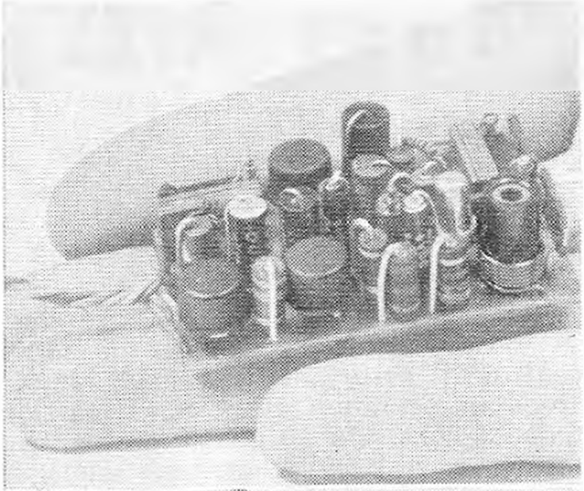
Messrs. Smith's of Edgware Road will make a 16 gauge aluminium chassis to your own requirements. As these may be produced up to 6 ins. deep, the addition of a flat piece of alloy to the back forms an excellent case for transmitters.

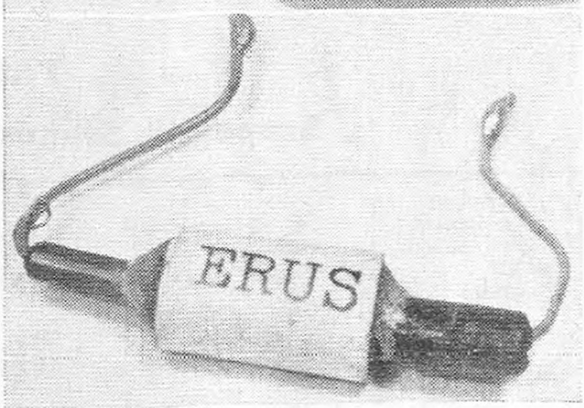
E.D.'s "Auto-pilot"

A new complete outfit designed to appeal to the novice will provide single channel rudder control without any installation worries whatsoever. The transmitter is a 27 mc/s keyed tone type drawing 9 m.A. on carrier, 4 m.A. for tone and 25 m.A. L.T. from a 90 volt B.131 H.T. and 1.5 volt A.D. 35 L.T. batteries. The single D.L.24 valve was used in an $8\frac{1}{2}$ in. high. $3\frac{3}{4}$ in. wide, $2\frac{1}{4}$ in. deep case which weighs 2 lb. 6 oz.

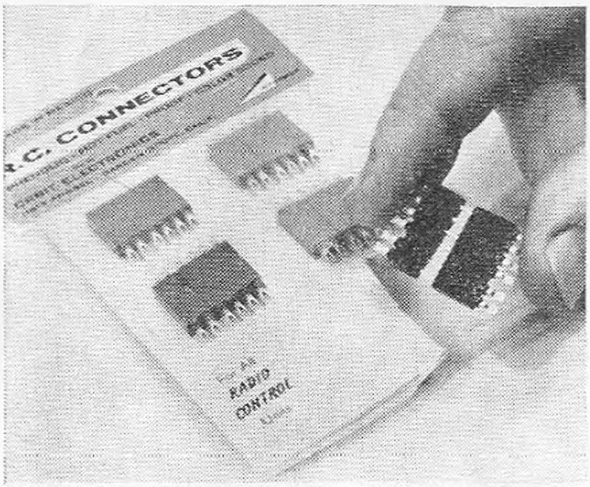
The receiver circuit is based on the Black Arrow series with a valve R.F. stage followed by two transistor amplifier stages and a Bleep relay. A motorised servo is incorporated in the same case together with one B122 22.5 volt H.T. battery and four U.12's; 1.5 volts L.T. and 4.5 volts servo power. The receiver idles at 2 m.A. which goes down to 1.5 m.A. on receipt of carrier rising to 6 m.A. on tone. L.T. draws 25 m.A. and the actuator 260 m.A. at 3 *volts*. The sequence of operation is held for "left", pulse-hold for "right". Servo neutralises on releasing the transmitter key.

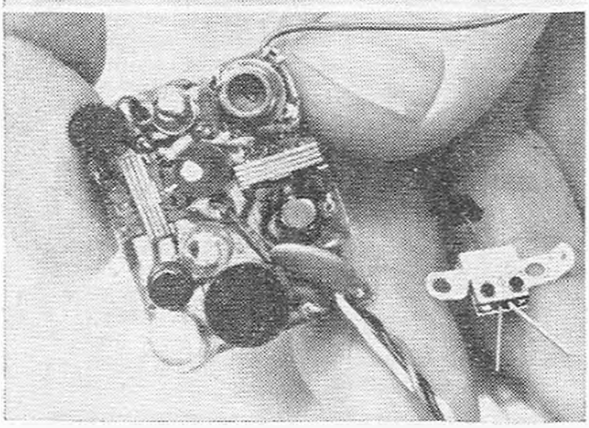
Both the Receiver and Transmitter have the components soldered direct to printed circuit boards, ground range is claimed as 400 yards, extending to 1200 yards in the air and the price $12\frac{1}{2}$ gns. less tax.

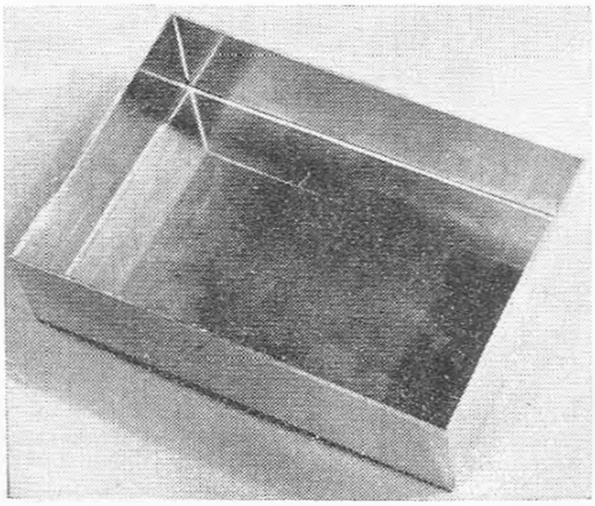




Above (top): Prototype of the Mini-pathfinder showing deep upright placement. Lower: And ERUS appears to be some form of cunning resistance which the maker claims precludes escapement skip, their advertisement appeared in our March issue. The value must be matched to the equipment. Below: The neat Smith's chassis. Bottom (left): This photograph of the Otarion Rx. and switch is only a little less than full size. Upper (left): The new orbit connectors provide an excellent means of joining servo harnesses, etc., are coloured-coded. This sample came direct from the U.S.A. (no importer yet).







Boat R/C

PART 1

R. H. WARRING

lists the many boat systems

The radio controlled boat is a far less risky proposition than the radio controlled aeroplane and their lower speed of operation gives more reaction time. Thus the 'timing' of control actions is less important and sequence switching can be used to extend the controls available through additional services.

Primary Control

Rudder is the primary control and it is an advantage to make this as directly selective as possible. By this is meant that given the choice between compound actuator with three sequence positions and one with, say, five or six sequence positions, the *three position* actuator would be preferred. Two positions would be used for rudder and the third for selecting further non-critical control services in sequence through a

TABLE 1

Scope of Standard R/C Equipment

Type of Equipment	Used with	Control(s)	Action	Remarks
Single Channel	Simple Servo	Rudder	Bang-bang, S-N	Self-neutralising action essential on all high speed craft
	Compound Servo plus	Rudder	Bang-bang, S-N	
	Secondary Actuator	Motor Speed	Sequence	Some special boat servos make provision for direct switching of engine speed on main servo
Multi Three Channel 1 & 2	Multi Servo	Rudder	Bang-bang, S-N	
3	Single Channel Actuator	Motor Speed	Sequence	
Four Channel 1 & 2	Multi Servo	Rudder	Bang-bang, S-N	Recommended for high speed craft
3 & 4	Multi Servo	Motor Speed	Progressive	
or Four Channel 1 & 2	Multi Servo	Rudder	Bang-bang, S-N	
3	Single Channel Actuator	Motor Speed	Sequence	
4	Single Channel Actuator	Auxiliary Control Service(s)	Sequence	Scope can be extended to more than one service via sequence switching
Five Channel 1 & 2	Multi Servo	Rudder	Bang-bang, S-N	
3 & 4	Multi Servo	Motor Speed	Progressive	
5	Single Channel Actuator	Auxiliary Control Service(s)	Sequence	Scope can be extended to more than one service via sequence switching
More than 5 Channels	Usually an unnecessary extravagance unless direct selection or particular services is desired			

TABLE II

Complete Selection Chart for R/C Power Boats

Size Hull Length Power	Small, Light Up to 20″ Electric	Small 18″ Electric	Medium 24″ Diesel	Medium 24″ Electric	Medium 34″ Diesel	Medium 36″ Electric	Large 44″ Diesel	Large 48″ and above Electric	Large 48″ and above Diesel
Receiver Type	All Transistor for minimum weight	All Transistor	All Transistor	Any	Any	Any	Any	Any	Any
Actuator for Rudder Action	Clockwork or Rubber Escapement S-N	Servo S-N Preferred	Servo S-N Essential	Servo S-N Preferred	Servo S-N Essential	Servo S-N Preferred	Servo S-N Essential	Servo S-N Preferred	Servo S-N Essential
Engine Speed Control	No	No	2-Speed	Yes	Progressive Preferred	Yes	Progressive Preferred	Yes	Progressive Preferred
Via	—	—	Compound Actuator & Secondary Servo	Servo or Sequence Switching	Servo	Servo or Sequence Switching	Servo	Servo or Sequence Switching	Servo
Single Channel Receiver with:									
(i) Simple Actuator	Rudder	Rudder	Rudder	Rudder	Rudder	Rudder	Rudder	Rudder	Rudder
(ii) Compound Actuator	—	—	Rudder Plus Throttle	Rudder Plus Motor	Rudder Plus Throttle	Rudder Plus Motor	Rudder Plus Throttle	Rudder Plus Motor	Rudder Plus Throttle
(iii) Cascaded Escapements	—	—	—	Rudder Motor Auxiliary Services	—	—	—	—	—
Single Channel Proportional	—	—	Rudder	Rudder	Rudder	Rudder	—	—	—
Multi Channel Receivers (See Table 1)	—	—	3 or 4 Channel	3 — 5 Channel	3 — 5 Channel	3 — 5 Channel	3 — 5 Channel	3 — 5 Channel	3 — 5 Channel
Multi Proportional	—	—	—	Rudder Plus Motor	Rudder Plus Throttle	Rudder Plus Motor	Rudder Plus Throttle	Rudder Plus Motor	Rudder Plus Throttle
Other Services Operated Via	—	—	—	—	—	Sequence Switching	Sequence Switching	Sequence Switching	Sequence Switching

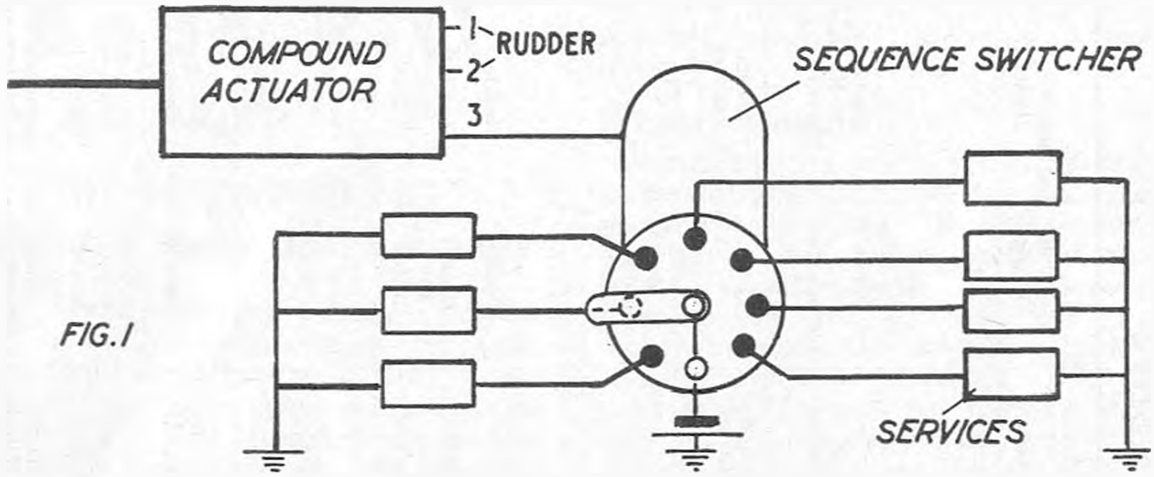


FIG. 1

secondary switcher.

The basic rule is that the primary control (rudder) should be capable of selection as directly as possible. The only other important functional control is motor speed. It is an advantage to have this capable of direct selection on high speed craft, but not absolutely necessary on slower speed craft of any size. Non-critical auxiliary control services can be selected in sequence via a further switching position.

Direct and indirect control selection with single channel radio and a compound actuator offering 'quick blip' or 'third position' is illustrated in Fig. 1. The two most readily selected 'hold' signals are utilised for rudder. The third switching position is then used to operate a sequence stepper to which any number of auxiliary services can be connected (up to the number of the switcher contacts), each operated by its own actuator. The switcher is merely stepped round one position at a time on each 'third position' or 'quick blip' signal, completing that corresponding servo circuit. It is therefore necessary to step through unwanted services to reach the desired service, in sequence. In practice, one or more step positions would be left blank to provide neutral position(s)—no auxiliary controls in operation.

"G" RECORDER

[Continued from page 230]

the force likely to be experienced from such a test it is a simple matter to press the equipment down on its mountings to see whether the points mentioned earlier in this article have been taken care of by careful installation procedure. It will *not* give an indication of whether the forces will adversely effect a piece of equipment on its own, but merely when installed in the model.

TEA CHEST

"A PINCH OF SALT"

As Manufacturers, Importers and Wholesale Distributors of Radio Control Equipment and Modelling Supplies to the many hundreds of bona fide model shops in Gt. Britain, not to mention our friends overseas, we feel that some comment should be made in public on an advertisement in the March issue of this publication.

As can be readily seen, not only was this announcement in very bad taste, unpatriotic, and intentionally misleading, but it virtually inferred that the British Model Press is corrupt and rotten to the core.

We must admit that we are surprised that this Magazine itself did not take the necessary steps and request proof of such allegations before going to print; however, now that it is in print there are several points which should be cleared up.

(1) The British model dealer is not a dummy. He does a damn good job, lives for the hobby, carries a most comprehensive stock of ALL items, and gives a personal service backing up the products which he sells. He is there at your beck and call six days a week and invariably bends over backwards to help and assist you from a tube of cement to the model of your dreams. He is there to advise and encourage modellers from six to sixty and nothing is too much trouble for him.

(2) Only a fool will pay more for an item than he has to; however, if in paying a reasonable price you get the guarantee and service from your local retailer, backed up by the knowledge that the quality of the product justifies National distribution, then surely the labourer is worthy of his hire and **you** benefit the most.

(3) Because an item comes from "Utopia" or is of "Utopian" quality it is not necessarily good. ALL countries produce good, indifferent, and bad equipment—it is up to you to make your own free choice—so don't be bamboozled!!

(4) We challenge the statement "That no British equivalents are good enough", and even if there is any truth in it in a specific instance, then we fail to see the logic in boasting about it. SHAME ON YOU MR. ADVERTISER.

(5) The reviews which you read are **genuine.** If a product does not come up to scratch, we know that a copy of the review is sent to the maker and the decision as to whether it is published or not is up to him. (Fair enough!) In 14 years of trading we have yet to see a "cooked" review, and we feel that this advertiser (who is virtually a newcomer) would do well to learn some manners and "get his knees brown" before making such sweeping comments. If he has a genuine complaint to make he should approach the Federation of Model Aeronautical Manufacturers and Wholesalers, who we feel sure will be only too pleased to investigate the matter.

(6) This advertiser is not a Model Shop in the generally accepted meaning of this description as he prefers to be seen by appointment only.

(7) His billhead states that he is Manufacturer, Wholesaler, Retailer, Importer, Exporter (Uncle Tom Cobley and all). We wonder which "department" concocted the advertisement as no matter which way it is read, it is certainly ANTI one or more of them!

(8) Buy a good stock of salt, and watch out for "Utopian" quality products.

In conclusion—**Support your local model shop.** He stocks and sells ALL modelling supplies and is NOT just interested in the high price "cream" items.

HE will be pleased to sell you a 6d. tube of cement without an appointment—so pop in and see him today for a chat, a bottle or fuel or some **Radio Control Equipment.**

—HE SELLS THEM ALL.

Contributed by **RIPMAX MODEL ACCESSORIES, 80 Highgate Road, Kentish Town, London, N.W.5**

NEW! THE E.D. AUTOPILOT

BRINGS RADIO CONTROL WITHIN THE REACH OF ALL!

★ Now at last, E.D. pioneers of model Radio Control, have evolved, after years of research, a complete Radio Control unit at a price **everyone** can afford.

Compact, lightweight, efficient unique design for one-hand control with low battery consumption.

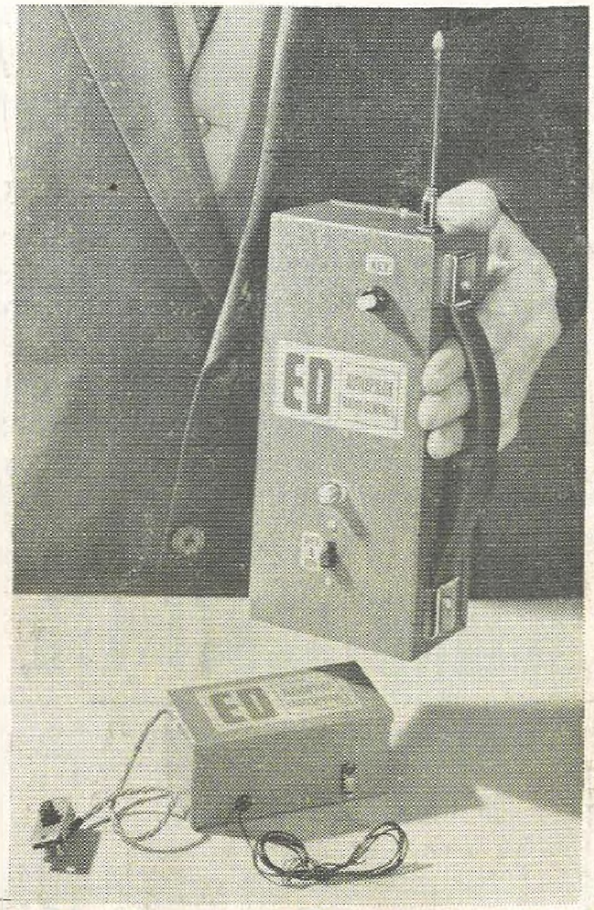
Suitable for Model Aircraft, Boats, Cars and in fact, all working models.

The E.D. AUTOPILOT is a complete powerful transmitter and sensitive transistorised receiver with unique built-in electric motor operated actuator. The receiver has convenient ON-OFF switch and Neon warning light. The AUTOPILOT is ready to build into the model —no wiring—nothing else to buy—only batteries!

Beautifully finished, stove enamel hammered finish for extra durability.

ONLY 12½ GNS. COMPLETE PLUS TAX

BRITISH & BEST! FULLY GUARANTEED

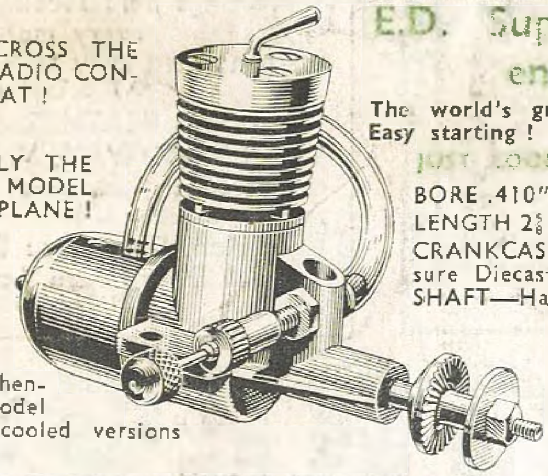


E.D. **FIRST** TO CROSS THE CHANNEL WITH A RADIO CONTROLLED MODEL BOAT!

E.D. **FIRST** TO FLY THE CHANNEL WITH A MODEL ENGINE POWERED PLANE!

Over a million modellers use E.D. engines—because they are BEST

There's a large comprehensive range of E.D. Model engines air or water-cooled versions from .46c.c. to 10c.c.



E.D. Super PEP .8cc diesel engine only 36/8 Plus Tax

The world's greatest small diesel engine value! Easy starting! Top quality! High performance!

JUST LOOK AT THE SPECIFICATION!

BORE .410". STROKE .375". WEIGHT $1\frac{3}{4}$ oz. LENGTH $2\frac{5}{8}$". WIDTH $1\frac{1}{8}$". HEIGHT $1\frac{7}{8}$".

CRANKCASE UNIT—Light Alloy L.N.2. Pressure Diecasting. PISTON—Mehanite. CRANKSHAFT—Hardened Steel. CON-ROD—Phosphor Bronze. CYLINDER—Hardened Steel.

MAIN BEARING—Phosphor Bronze.

SPRAYBAR—Brass.

TANK—Aluminium.

FREE! POST COUPON for details of the unique E.D. range of Radio Control equipment and E.D. Model Engines, and name and address of nearest stockist.

E.D. Engineering & Electronics Ltd., Island Farm Road, West Molesey, Surrey.

Telephone: Molesey 6037 PBX.

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