Radio Control Models & ELECTRONICS

OCTOBER 1960

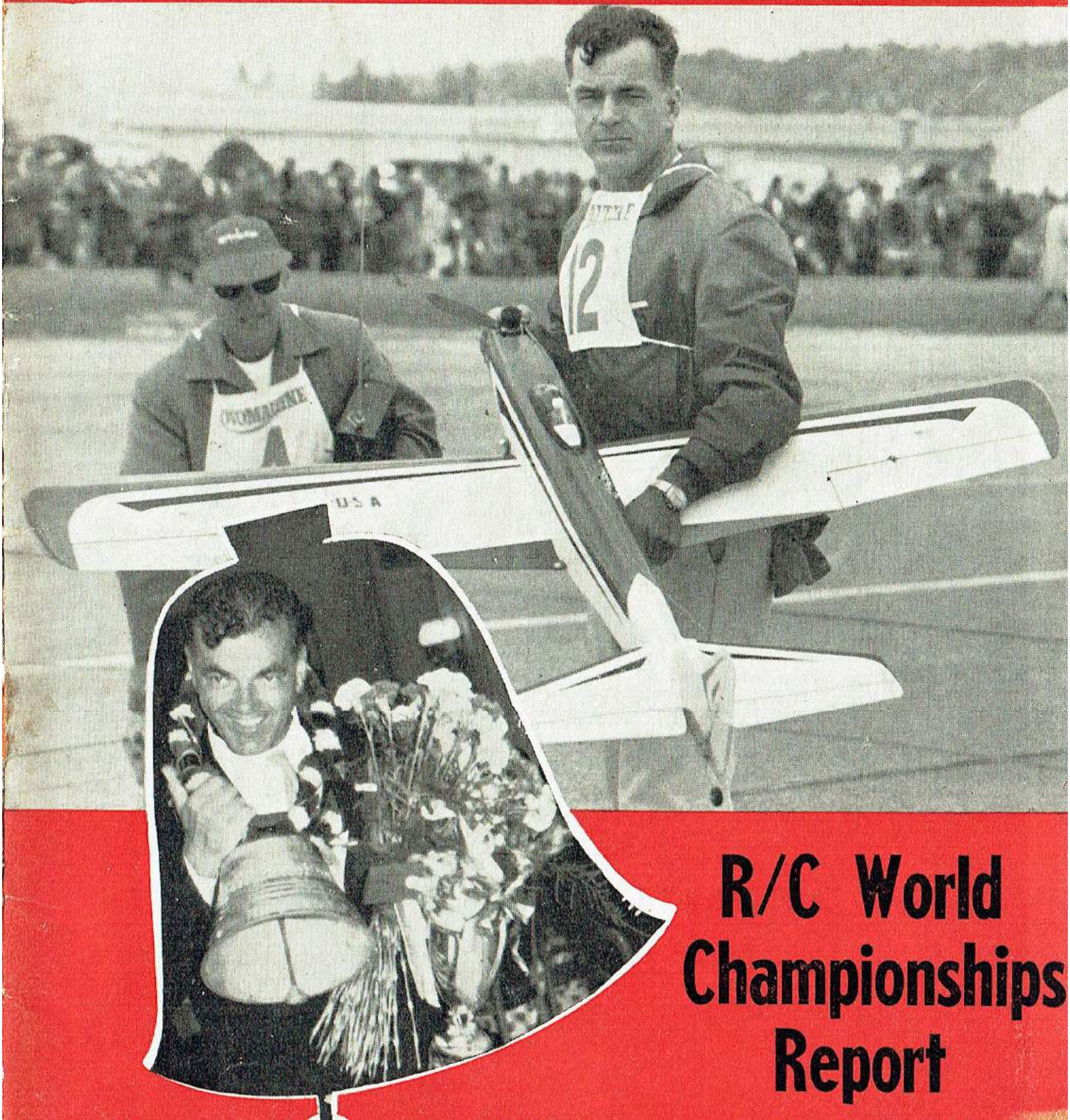
BOAT SELECTOR GEAR & KITCHEN RUDDER DETAILS

★ ★ ★

THE IVY-AM C.W. TRANSMITTER

★ ★ ★

PRICE - - TWO SHILLINGS



R/C World Championships Report

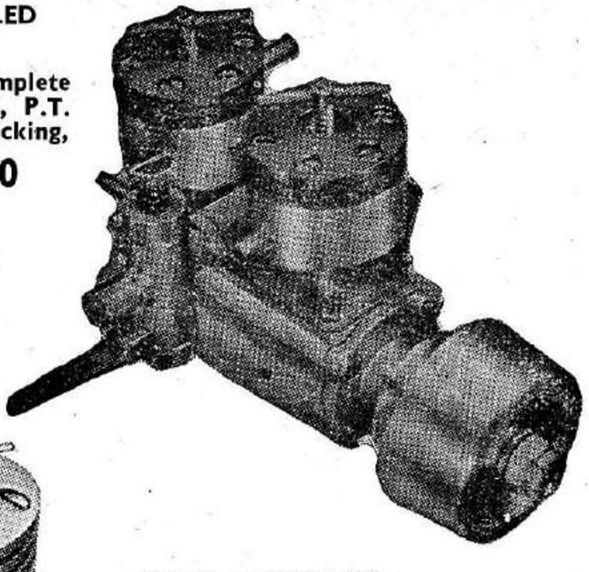
TAPLIN TWIN

British Patent No. 747742

WATERCOOLED VERSION :

Price complete with flywheel, P.T. postage & packing,

£9.16.0



AIRCOOLED VERSION :

Price complete as shown, inc. P.T. postage and packing,

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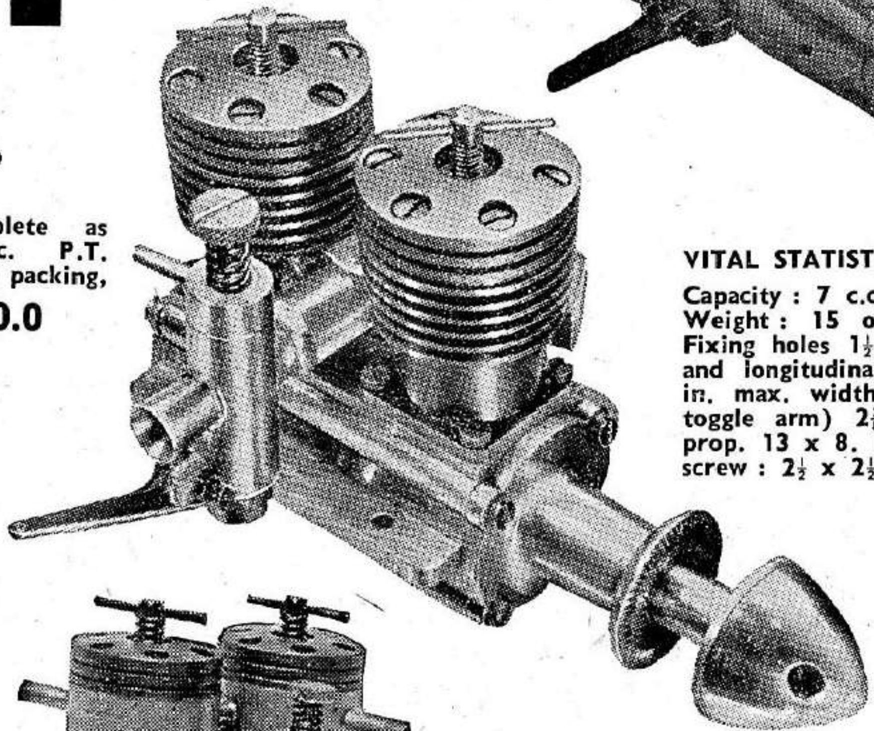


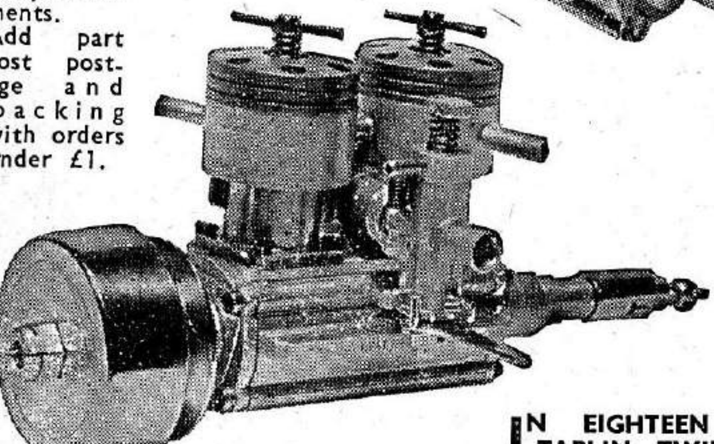
HOW TO ORDER

Name and address with remittance and precise requirements. Add part cost postage and packing with orders under £1.

VITAL STATISTICS :

Capacity : 7 c.c. (6.92 c.c. actual). Weight : 15 oz. Engine bearers : Fixing holes $1\frac{1}{2}$ in. centres laterally and longitudinally. Max. height $3\frac{1}{2}$ in. max. width (excluding throttle toggle arm) $2\frac{3}{8}$ in. Recommended prop. 13 x 8. Recommended waterscrew : $2\frac{1}{2}$ x $2\frac{1}{2}$ (2-blader).

THREE BEARING CRANKSHAFT ALL BALL RACES



WATERCOOLED WITH FORWARD FLYWEEL

for more convenient starting. In response to demand this version is also available, price, inc. flywheel, P.T., postage and packing,

£11.8.0

IN EIGHTEEN MONTHS since its introduction the TAPLIN TWIN has made modelling history. Its air-cooled version was the power unit for two RADIO CONTROLLED WORLD RECORDS, has been used for countless models ranging from prizewinning scale controliners to high performance r/c designs, and enjoys a worldwide reputation to the extent that American model magazines describe in-line twins as "taplinised". The water cooled version has swept the board in the model boat world, where it is nothing out of the ordinary for almost the whole of an entry to be TAPLIN TWIN POWERED.

If you have not yet bought yours, here are a few special features to help you decide : Wide speed range (500/7,000 r.p.m.); barrel type carburettor (infinite adjustment just like "full-size") quiet running; no vibration; clock or anti-clock running; handsome with anodised heads and spinner; easy starter; simple synchronisation: Recommended fuel: Mercury Marine Diesel Fuel.

Order safely by post since we guarantee satisfaction or money back. We will send yours anywhere in the world securely packed and insured, or just round the corner. You will find new enjoyment in your modelling with a TAPLIN TWIN—try one and see.

By the way, our PRIZE OFFER of £50 for a new R/C WORLD RECORD (anything except point-to-point) is still open, you can win it provided you use a TAPLIN TWIN.

TAPLIN ACCESSORIES

STAINLESS STEEL TWO-BLADER WATERSCREW : Matches the T.T. engine, $2\frac{1}{2}$ in. dia. $2\frac{1}{2}$ in. pitch; tapped 4BA. Price : 9/6d. inc. P.T.

SILENCER : Nickel-plated Burgess type with centre baffle. Length overall 6 in., dia. $1\frac{3}{8}$ in. Price: 4/9d. inc. P.T.

80 c.c. TANK : Nickel-plated 80 c.c. with Terry fixing filler cap. Length 4 in., o.d. $1\frac{3}{8}$ in. Price: 4/9d. inc. P.T.

Birchington Engineering Co. Ltd.

BIRCHINGTON, KENT.

Tel.: Thanet 41265/6

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Here, There & Everywhere

Kazmirski King of the Klangers

FIRST world championship for radio controlled aircraft at Dubendorf-Zurich played to a total crowd over the two days of nearly 10,000 spectators, who paid about 3/6d. each for the pleasure. Never could money have been better spent as the strong British contingent who holidayed in Switzerland to enjoy the event will agree. Giant-size Ed. Kazmirski proved a clear-cut champion, well ahead of the rest of the field. But—on their day—either of the other two Americans Bob Dunham and Harold de Bolt could have been the winner, Bob fairly easily, Harold with a struggle. No one else in the entry was really in their class *this year.* Our own team proved the steadiest and most reliable to gain the team award. Frank van den Bergh might well have been marked into second or third place and put up a wonderful show. Olsen and Uwins—who was our number one team man by the way — supported his performance ably. If they can go on improving the next world champion may even be amongst them.

Swiss Aero Club—which in this instance means Arnold Degen who carried the show almost singlehanded—provided Swiss cow bells in all sizes for participants, hence our cover montage showing Ed. with his "elephant bell". The boys had been really ringing the bell for two exhilarating days so were suitably rewarded.

We have given a considerable amount of space to this event in our pages. It is, after all, the first real world R/C event accorded F.A.I. status, and the first at which an American entry has been received. There are some single channel operators who feel that the "multis" are getting too much space, and that our own particular "stars" are featured too often in our pages. That criticism is fairly accepted, but on this occasion we are completely impenitent. It was a grand meeting that made history in the R/C world, we are proud of our British team, and confident that most readers will for once sit back and enjoy our report whatever their special R/C interests.

The Ivy-AM Transmitter

Number Two in our special projects series appears this month in great detail. It makes a complete unit with the Ivy Receiver described last month,

CONTENTS

NOTE : F. C. Judd's C.R.T. Oscilloscope has been held over until next month owing to pressure of space.

Subscription Rates : 12 months (home), 28/6; (overseas) 27/6, including enlarged Christmas Number.

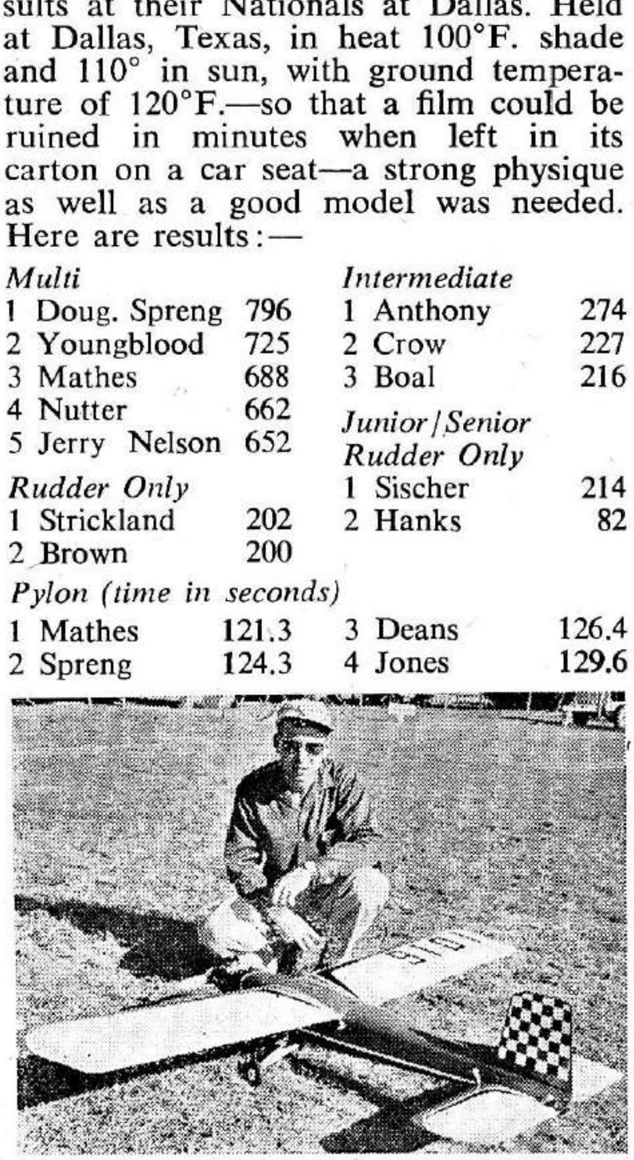
and so should be enough to put the veriest tyro "in business". Once again we have enjoyed the whole-hearted support of MacGregor Industries who have produced a really first-class kit that will take the last vestige of difficulty out of construction, and advance notice of the case that is being provided in shining anodised aluminium and blue plastic, convinces us that here is a winner which enthusiasts will be delighted to display in public.

If, in spite of our efforts to meet the need for really basic building instructions, some readers are still at a loss, please do not hesitate to write for enlightenment. There is no occasion to be bashful about your ignorance—the information may never have been published anywhere—so make certain and join the growing ranks of *active* radio controllers.

American Nationals Results

We are indebted to East Bay Radio Controllers "Carrier" Newsletter for stop press news of American R/C results at their Nationals at Dallas. Held at Dallas, Texas, in heat 100°F. shade and 110° in sun, with ground temperature of 120°F.—so that a film could be ruined in minutes when left in its carton on a car seat—a strong physique as well as a good model was needed. Here are results:—

Multi		*Intermediate*	
1 Doug. Spreng	796	1 Anthony	274
2 Youngblood	725	2 Crow	227
3 Mathes	688	3 Boal	216
4 Nutter	662	*Junior/Senior Rudder Only*	
5 Jerry Nelson	652		
Rudder Only		1 Sischer	214
1 Strickland	202	2 Hanks	82
2 Brown	200		
Pylon (time in seconds)			
1 Mathes	121.3	3 Deans	126.4
2 Spreng	124.3	4 Jones	129.6



Doug. Spreng, Larks, Los Angeles, with his U.S. Nats. winner. Note return of the highwing. Motor is the new Lee 45. R/c equipment o/d.

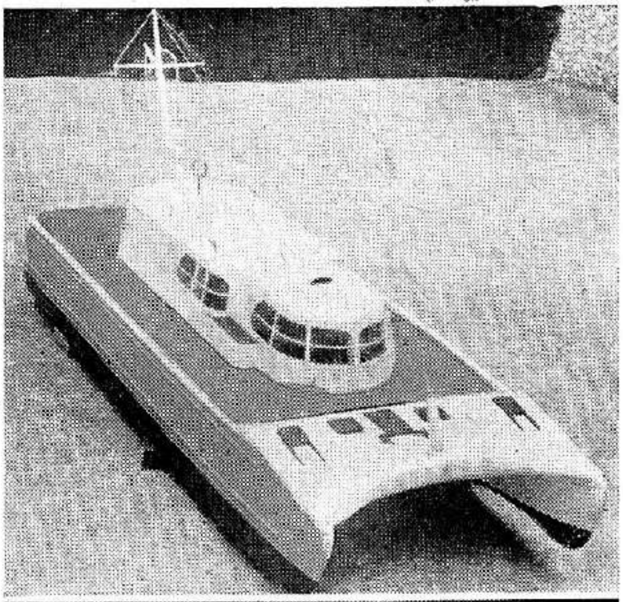
Frank van den Bergh brandishes his cow-bell at Zurich, with Mrs. v.d. B. congratulating hubby.

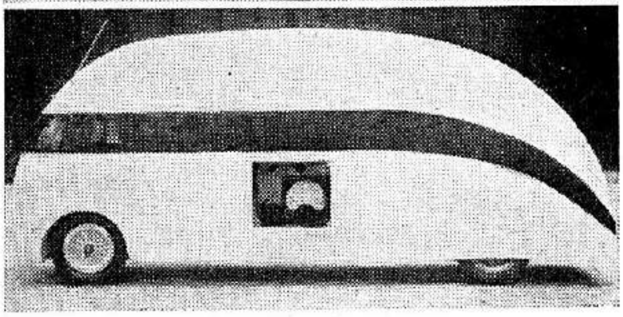
U.S. Circus at German Nats

Fresh from their Zurich success the American team motored many hundreds of miles to Kassel to give demonstrations and meet some of the German enthusiasts. Highlight was a formation take-off by Dunham and Kazmirski, followed by a vertical rolling climb; the same two then made a high speed low level formation run with Bob Dunham flying inverted. "Pappy" de Bolt's "jump" take-off over the crowd at right angles to his leisurely taxiing past the crowd also surprised. Then the boys changed planes with Germans Stegmaier and Shumacher flying the U.S. team's models, and Walt Good really working Stegmaier's. Increase of multi interest is likely as a consequence, though high cost of such equipment (half cost of a Volkswagen as one flyer put it) will prevent anything sensational. Though, as our correspondent Bill Park adds they may see a lot of corncob pipes next year . . .

Sutton Coldfield R.C.M.A.C.

Members are becoming more contest minded, reports press secretary A. R. Gibbs, with regular entry lists around the twenty mark. A series of misfortunes has been dogging the more active members, the chain of disasters including comp. sec. Ray Crabtree's injured finger in prop arc of a new model, which he then proceeded to write off against a fence; wing shedding in mid-air by the club boffin, Cyril Brown; one model waiting to be harvested in a cornfield by Johnny Pearson; and one model in the canal by Don Sanderson;





Interesting models built by R. P. Brown. Meter shown in side of lorry is enclosed by a panel when in use.

The first R.C.M. & E. trophy. This small bronze Eros suitably engraved has been presented for competition in the Intermediate Class at the Middle Wallop R/C rally, which by now will have taken place on September 4th.

plus large pieces of runway mixed with engine (twice) by Chairman Bert Marsh. Apart from which all is well.

Models with a Difference

South Coast R.C.M.S. secretary R. P. Brown sends us pictures of two rather different R/C ventures that he has made. First is the futuristic catamaran, developed from a type seen in an American magazine. This is 44 in. long, beam of 16 in., and powered by a 15 c.c. four cylinder engine. Radio is single channel working rudder and engine control only. Other model is a 28 in. long van, powered by a 12 volt ex-Govt. motor. This is multi channel, with six reeds working steering, reversing, two speeds in both forward and reverse. Chassis is wood, body of $\frac{1}{16}$ in. ply. Wheels are ex-Maserati model and not really in keeping, but used to save time. Can be steered to a hair, but requires to be dropped into low gear to make turns owing to its excellent turn of speed. We should like to see more vehicle models which are ultra safe test beds of special interest to those unable for lack of suitable water to try out ideas in boats.

Herne Bay R/C

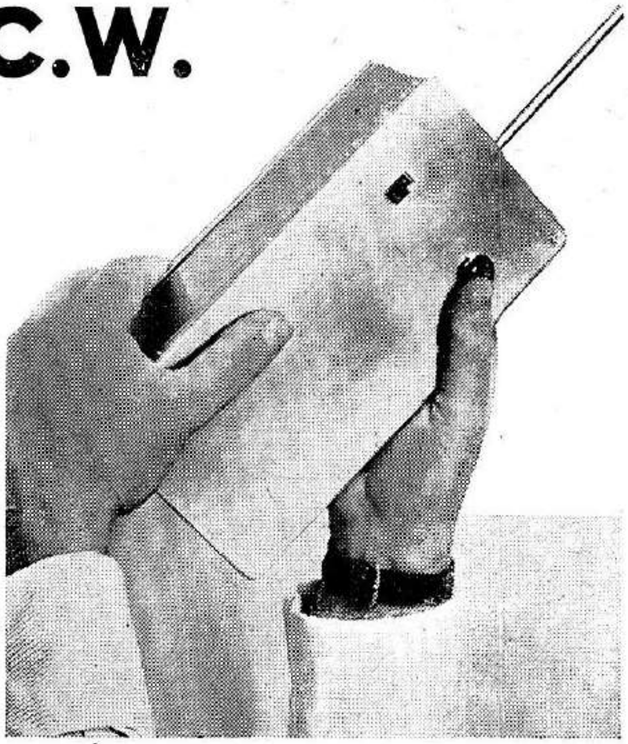
The third meeting at Herne Bay organised by the Birchington R.C.P.B.C. showed that here indeed was a regatta which may well rival Poole if it continues to progress at the current rate. Forty entries in steering and twenty-five in speed is a good entry anywhere, and it has already been suggested that it might be possible to make it a two-day affair next year. As it was, with each entrant allowed two minutes starting time and four minutes on the water, everyone got his crack between 11 a.m. and 5.30 p.m., with a short lunch break.

Winners were: Herne Bay Challenge Trophy (steering)—1. I. Wood (Victoria) 160 pts.; 2. M. Taplin (Birchington) 155; equal 3rd. H. J. Taplin and J. Taplin, 150. Speed (course at a guess 160 yards, triangular)—1. G. Honnest Redlich (Mortlake) 24.2 secs.; 2. A. McDonald (Birchington) 24.8 secs.; 3. L. Wood (Victoria) 25.0 secs. Top four in steering used Taplin Twins, top three in speed all Gannets. There was relatively little radio trouble, which helped the smooth running of this friendly and enjoyable meeting.

Dave Posner tries J. Scott, Canada's acoustic tachometer at Cranfield world championships. Second from right is Ken Bedford of E.T.A. Instruments.

The Ivy-AM C.W. Transmitter

TOMMY IVES OFFERS A NEW VERSION OF AN OLD FRIEND TO OPERATE LAST MONTH'S IVY RECEIVER



Prototype of the hand held Ivy-AM Transmitter. It has convenient shape and nice balance. Kit version will have anodised front panel, suitably engraved and handsome blue plastic case.

THE "IVY" receiver described in last month's issue can be operated from any C.W. transmitter. The Aeromodeller transmitter described in "Simple Radio Control" would be ideal for those readers who wish to construct their own.

The design has been revised and brought into line with modern trends such as hand held units with a loaded aerial.

The output from such a transmitter is lower than a ground based unit with a ¼ wave aerial and it is not crystal controlled. It is essential therefore to ensure that it does in fact radiate within the allotted frequency (i.e. 26.96 meg. cycles to 27.28).

A frequency checking service will be made available to those who ask for it and a simple method of checking the radiated frequency will be described later.

The circuit is the familiar cross coupled type. It uses a double triode valve designed for high frequency work. The filament current is rather high at 200 m.A. and if desired may be replaced with two valves having a lower filament current consumption. A reduced output will be inevitable however.

Also for those who wish for a higher capacity battery the Tx. unit may be housed in a larger case with a ¼ wave aerial and be ground based with a keying lead. The only change necessary would be the inclusion of a keying choke to isolate the H.F. current from the keying lead.

Provision may be made for an 0-50 m.A. meter and is strongly recommended. An 0-5 m.A. is essential for the receiver and with the addition of a suitable resistance across the meter terminals may be converted into an 0-50 provided it can be calibrated with a meter of known accuracy.

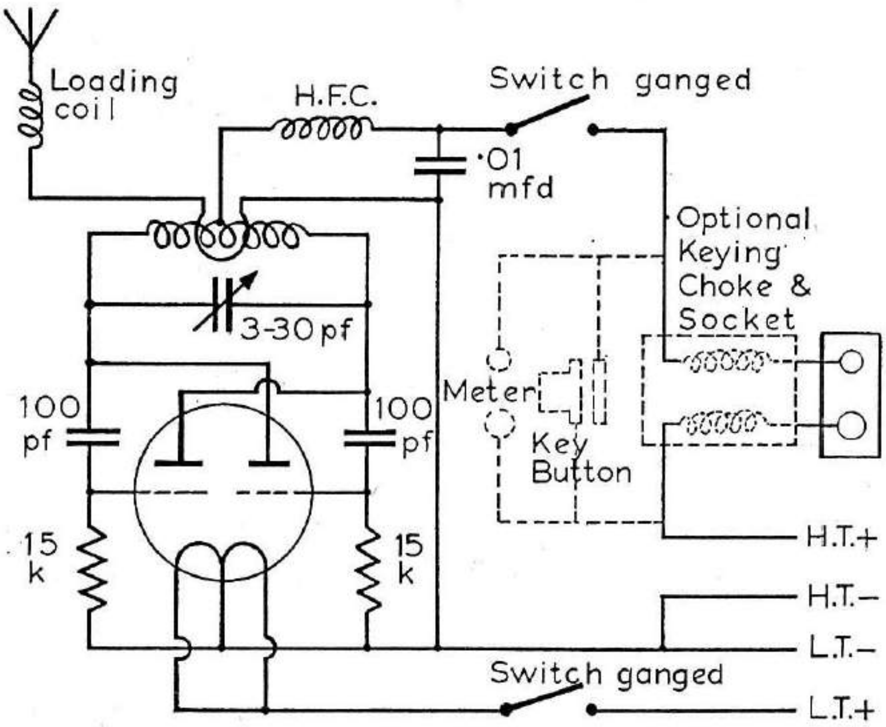
For the L.T. the Ever Ready AD 4 (or equivalent) is recommended and the case has been designed to accommodate it. The H.T. can be 90 or 135 volt and the case will accommodate either. With 15K. resistors in the valve grid circuit the H.T. current is approx. 12 m.A. and 20 m.A. respectively. If desired this may be varied by increasing or reducing the grid resistors. With higher H.T. current, however, the life of the batteries will be reduced and with lower current the range may be much lower. It is a matter of compromise to suit the operator.

Construction

Commence with the bakelite panel (see Fig. 1). Cut to size and drill the holes as shown. The large hole may be cut as described in the receiver article. Bolt or rivet the valve holder in place. If two valves are used cut two large holes side by side and fit two holders. Fit eyelets or eyelet tags to holes 1 to 11. Fix the pre-set tuning capacitor (if obtainable the Phillips beehive is ideal for the job).

Case (fig. 3)

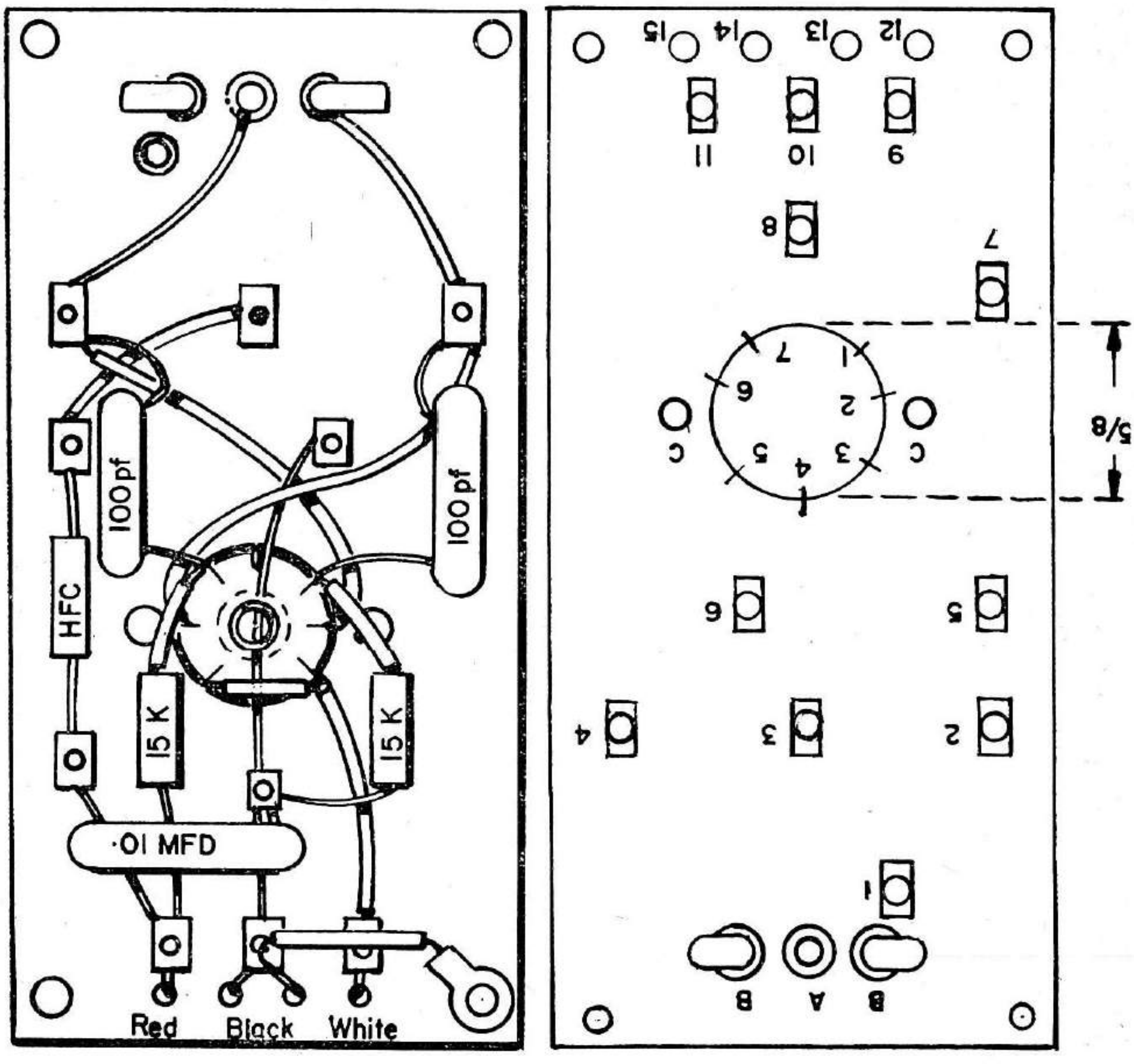
Start with the front panel, a blank of half hard aluminium 9 in. × 4¾ in. ×

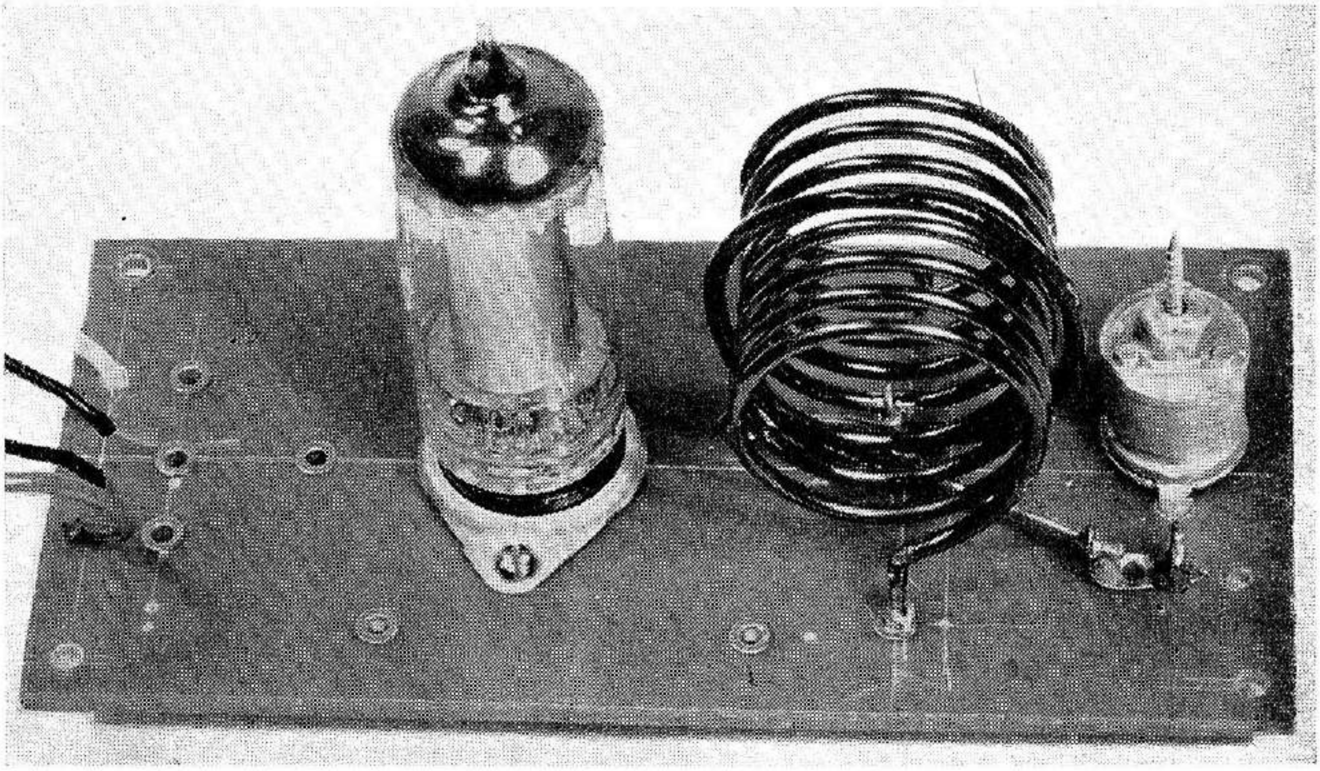


22 s.w.g. Scribe a line ¼ in. from the edge all round. Notch each corner ¼ in. × ¼ in. Bend each side at right angles on the scribed line. Repeat for back panel. Holes in the front panel are made to suit the type of switches obtained.

Next the sides which are made in one piece. A similar blank 25½ in. × 2⅝ in.

Figs. 1 and 2, Point-to-point wiring of underside of bakelite panel and drilling jig with numbered holes of panel, reading from underside. Circuit diagram is on left, which shows extreme simplicity.





is bent to fit *inside* the front and back panels. The joint should not be made to overlap, butt together only at bottom centre of the case. The sides may be made in two pieces if considered easier and a further butt joint be made at top centre. Whichever method, a cut-out at top centre is required $\frac{3}{4}$ in. deep × $\frac{1}{2}$ in. wide for the aerial socket.

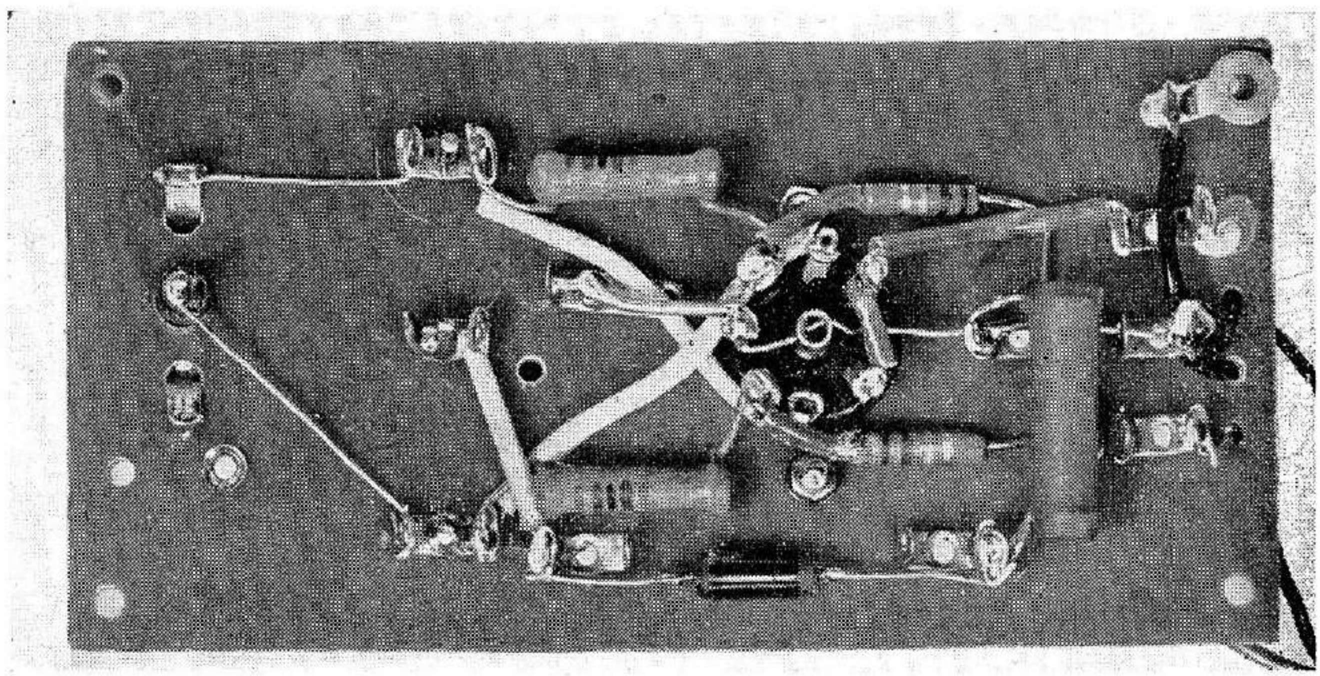
*Assembly*N Drill $\frac{3}{32}$ in. dia. holes in the panel side flanges $\frac{1}{8}$ in. in from the edge. Two in each flange on the back panel and one in the top and bottom flange of the front panel is sufficient. Assemble the case and transfer the holes to the side member. Drill these holes $\frac{1}{16}$ in. dia. No. 4 × $\frac{1}{8}$ in. long self tapping screws are then used as fixing. For those not favouring this method of assembly, long screws, studding or tapped distance pieces close in each corner right through the front and back panel is quite successful.

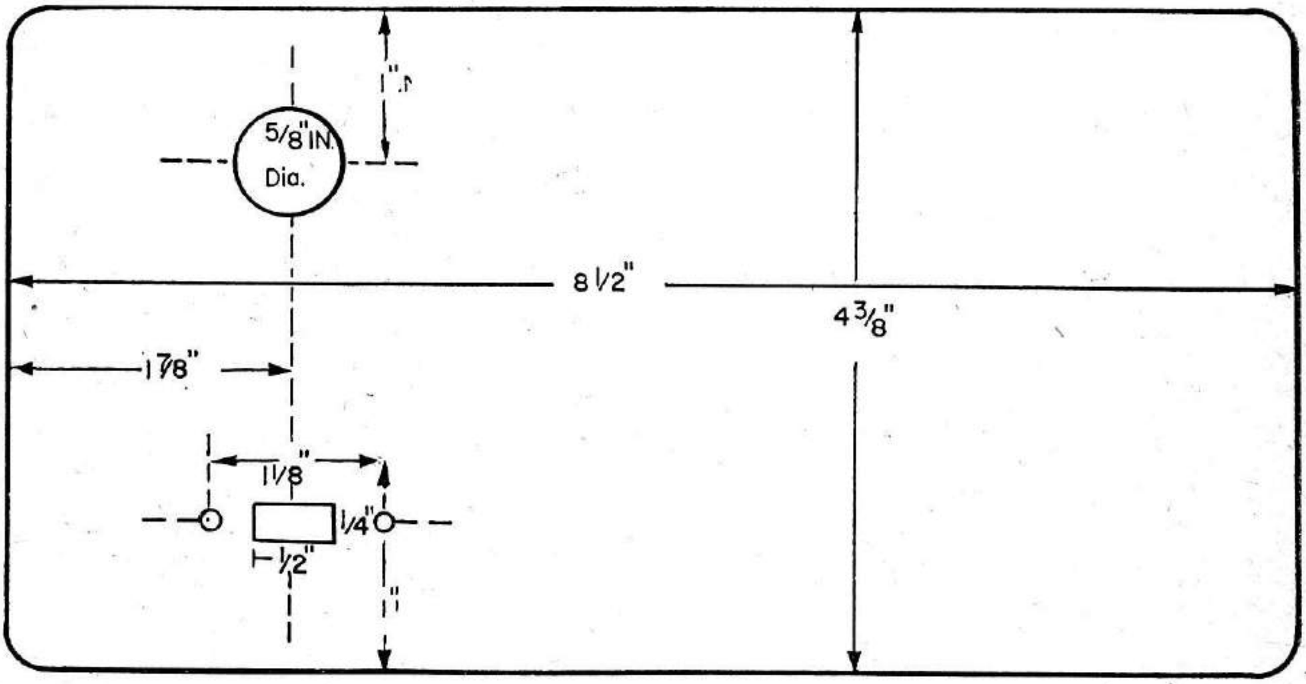
Chassis (fig. 4)

A blank of the same material $5\frac{3}{8}$ in. × $4\frac{1}{8}$ in. is bent at right angles to form a bracket $2\frac{7}{8}$ in. × $2\frac{1}{2}$ in. × $4\frac{1}{8}$ in. long.

Above : View of topside of bakelite panel, completed with coil, valve, etc., in place.

Below : Underside of panel, photographed from the prototype set. Ample space should enable the least skilled to assemble without difficulty.





Position the longer side on the inside of the front panel leaving $\frac{1}{16}$ in. clear to the flanges. Transfer the switch holes. Position the bakelite panel on the remaining short side along the top edge. Transfer the fixing holes. Cut a slot also for the rubber grommet protecting the battery leads.

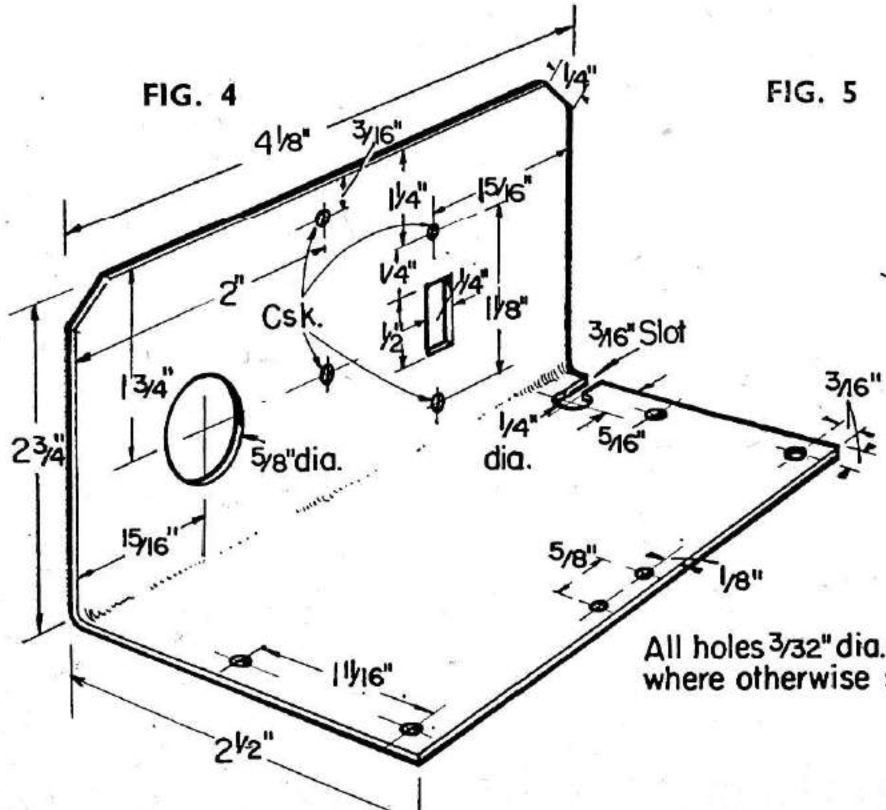
Aerial Socket (fig. 5)

A block of bakelite or similar insulating material 2 in. $\times$ $\frac{3}{4}$ in. $\times$ $\frac{1}{2}$ in. is required. Drill a $\frac{1}{4}$ in. dia. hole $\times$ $1\frac{1}{2}$ in. deep as shown. (A $\frac{5}{16}$ in. dia. or larger hole is required if car type aerial is used.) File a semi-circular cut-out along top edge sufficiently deep to break into the drilled hole $\frac{1}{32}$ in. at least. A contact is next made from brass or bronze spring strip $\frac{1}{2}$ in. wide $\times$ about 22 s.w.g. Bend to suit cut-out. Fix this spring contact at the undrilled end of the block with small screws making certain contact is made under tension. Include a solder tag with one of the screws. Drill and tap the block on the bottom edge and fix to the chassis with csk screws making certain they will not make contact with the aerial.

Tuning Coil (fig. 6)

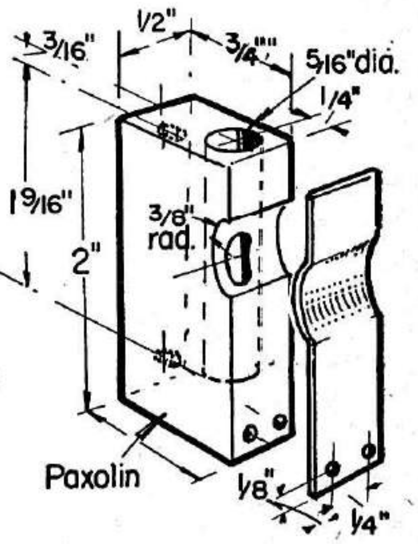
Obtain a $\frac{7}{8}$ in. piece of dowel or metal rod or tube about a foot long. Drill a small hole at right angles at one end.

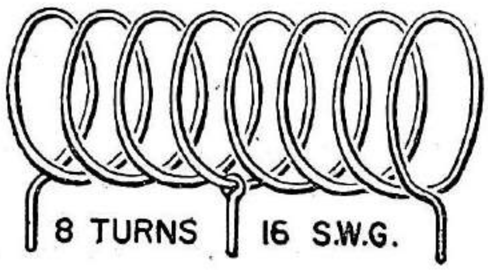
FIG. 4



All holes 3/32" dia. except where otherwise stated

FIG. 5

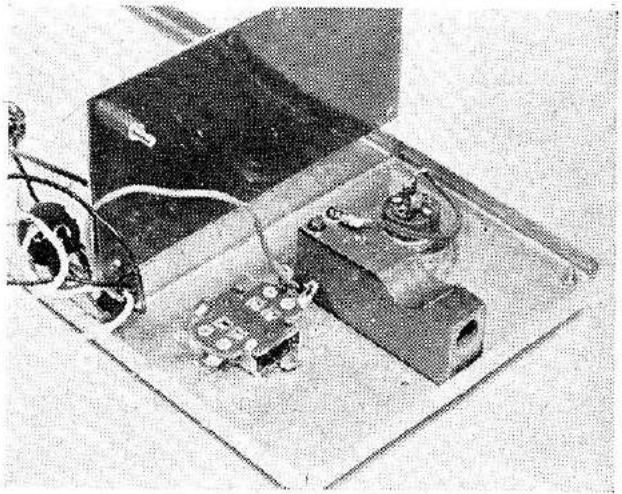




Above : Fig. 6, Tuning coil after removing winding former, and with centre tapping in place.

Left : Fig. 3, Dimensioned drawing of front panel for transmitter case.

Right : Detail of aerial socket and panel switches.



Take a 40 in. length of 16 gauge wire and thread it through the hole. The other end should be secured in a vice. Put one turn on and pull the wire hard to straighten it. Keeping a tension on the wire wind on 12 turns each turn touching the next. The wire will spring open and can be slipped off the rod. You now have more turns than are required and this must be reduced to eight full turns with an additional ½ in. at each end. Take a short length of 18g. tinned copper wire, form it into a loop. Scrape the ends of the coil clean and bend as shown in the drawing. Also scrape a short length at the middle turn for soldering the loop. Fix the loop in position twist it to hold it in position and solder it. The coil is now ready for fixing when required.

Point to Point Wiring

The following points on the bakelite panel may be connected and soldered before fixing any components.

Point A to tag 2, Point B to tag 4, tag 3 to tag 5, tag 2 to pin 6 (valve holder), tag 4 to pin 2 (valve holder), tag 6 through pin 4 (valve holder) centre spigot (valve holder) tag 8 to tag 10. Pins 1 and 7 (valve holder) to tag 11. Tag 7 to tag 9.

The components may now be connected as follows:—100 pf. capacitor from tag 2 to pin 5 (valve holder), 100 pf. tag 4 to pin 3 (valve holder). High frequency choke tag 5 to tag 7, 15K. resistor pin 3 (valve holder) to tag 8, 15K. pin 5 (valve holder) to tag 8, .01 capacitor tag 7 to tag 8, short lead from tag 10 to 8 B.A. solder tag at corner hole on panel (this is for earthing to the case).

Bakelite Panel Topside

Cut a 5½ in. length of 16 or 18g. wire. Slide on a length of systoflex leaving sufficient each end for soldering. Clean the ends. Form into a single loop approx. 1¼ in. diameter leaving the ends facing opposite directions. Bend ¼ in. each end at right angles and poke through the holes in tags 1 and 6. Solder in position.

Place the tuning coil in position inside the single loop and poke the three ends through the holes in tags 2, 3 and 4. Leave the coil approx. ⅜ in. above the panel. Solder in position.

Solder the battery leads in position. Red lead from tag 9 and through the adjacent hole in the panel. Leave this lead approx. 3 ins. long. Two lengths of black flex 6 ins. long to tag 10 and through the two adjacent holes. White lead 3 ins. long from tag 11 and through the adjacent hole.

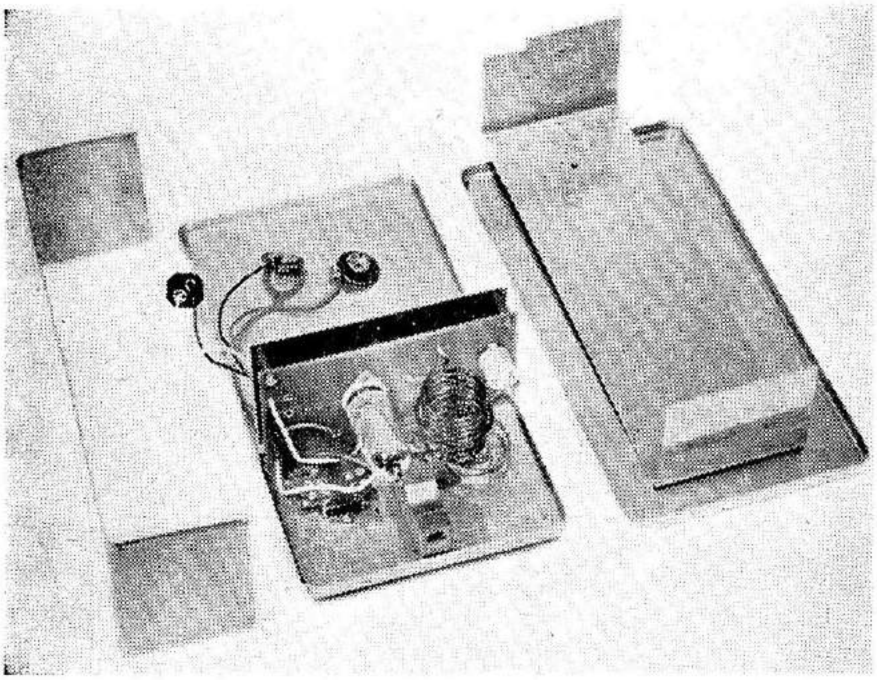
Solder a 6 in. length of white flex to the positive pole of the L.T. battery plug (the large one). Solder one of the black leads from the panel to the negative pole of the plug. Solder an H.T. battery connector to the remaining black lead from the panel.

Assembly

Place the chassis in place on the case front and fit the switch and push button. These will hold the chassis in place.

Fix the bakelite panel to the chassis with 8 B.A. screws. Use ½ in. lengths of small diameter tube to act as spacers keeping the panel away from the chassis. In the kit of parts there is also a piece of thin bakelite to be fixed against the chassis to prevent any short to the chassis. When fixed the coil should be on the left looking at the back of the case.

Solder the white lead from tag 11 to one of the tags on the switch. Solder



The prototype case, built-up transmitter, less batteries, opened to show construction. This case was built with radiused corners as pattern for production front panel. Since the average enthusiast will not have equipment for radiusing in this way, case described in text has squared corners. Kit case, by the way, has fully radiused corners throughout.

the spare 6 in. white lead from the battery plug to the other tag. Make quite sure you have connected the correct tags as otherwise you will short the battery when switching on.

On the other side of the switch solder a red lead from one tag of the push button and on the push button solder the lead from tag 9. Solder a 6 in. length of red flex from the other tag of the switch and connect the H.T. battery connector to the end. (Note if the H.T. battery has a plugsocket substitute a plug for the two connectors.)

Solder a short length of flex from tag 1 on the panel to the aerial socket tag.

Setting Up and Tuning

We now come to the important part. The transmitter is easy to set up but in order to comply with regulations we must ensure that it is radiating within the correct frequency band.

Insert the valve in the holder, the aerial in the socket and connect the batteries. A 2K. resistor temporarily connected in the H.T. battery line may save the valve filament if you have wired up or hooked up incorrectly. Also connect an 0-50 m.A. meter in the H.T. line.

Switch on and note the current reading with the button depressed. If it is around the correct figure disconnect the 2K. resistor as all is well. Place a calibrated wavemeter (the absorption type will do) near the Tx. tuning coil and as you vary the Tx. tuning capacitor note the point at which the needle of the meter moves. If an indicator bulb is included in the wavemeter it will glow when the Tx. is on tune. Be careful to remove any stray hand or body capacity from the transmitter after each adjustment of the capacitor.

When this is completed you are in business.

Meter

Provision for connecting a meter when the transmitter is in its case can be made if desired and is strongly recommended. It will give a visual indication of the state of the batteries if plugged in before use. Make a hole in the case front and chassis to accommodate a two pin socket such as is used in the receiver H.T. circuit. The connections to the socket are taken to the two tags of the push button and on plugging in the meter the button is short circuited and a continuous current reading is obtained. An 0-50 m.A. meter may be used for this job but if desired the meter used for checking the receiver (an 0-5 meter) may be used with a suitable resistance shunted across its terminals. Connect the 0-5 meter in series with an 0-50 of known accuracy. Take a short length of resistance wire (a few ohms only is necessary). The meters may be connected to the transmitter H.T. line or any other circuit which will give a reading within the range of the 0-50 meter. Switch on and it will be noted that the 05 meter is hard over. Connect the spare resistance wire across its terminals and adjust the length until the two meters have the same reading position. The resistance may then be made up in permanent form for attachment to the meter when the higher reading is required. No plug should be fitted to the transmitter socket when the meter is not in place as this would prevent operation of the button.

Loaded Aerial

The aerial may consist of a 4 ft. collapsible car type but the use of a loaded aerial will give greater range. With the car type aerial and a bottom loaded coil fixed the Tx. panel the range will be greater but in the writer's opinion the centre loaded aerial is to be preferred. The Tx. has a much lower range than a ground based unit and any method which increases the radiated energy is to be recommended.

For the centre loaded aerial two methods are possible: (1) A fixed inductance coil with the number of turns adjusted to approx. the correct figure. A full description of this type will be found in *Aeromodeller* page 18, January, 1959, and it is not proposed to repeat it here. The number of turns will vary if the aerial dimensions and coil size, etc. are not adhered to (the Field Strength Meter described on page 18 of the same issue will be ideal for checking output whilst adjusting the turns); (2) A slugged coil in which the inductance is varied by adjustment of the slug. For this type proceed as follows:—Make a panel of bakelite $2\frac{1}{2}$ ins. × $\frac{1}{2}$ in. Fix small Terry clips at each end. Fix a 8 m/m polystyrene former to the opposite face of the panel wound with approx. 25 turns of 24g. enamelled copper wire. Some form of binding the turns or fixing them with a collar will be necessary. Bare the ends and fix to the Terry clips. Solder if possible. Take two 24 in. lengths of aluminium tube $\frac{1}{4}$ in. diameter and join them with a short plug of insulating material leaving a space of $1\frac{1}{2}$ ins. between the tubes. Clip the coil mount to the space at the centre of the aerial having one Terry clip on each section. Plug the aerial in its socket, switch on and adjust the slug until a maximum reading is obtained in the m.A. meter. If the slug has to be screwed fully home there is not enough turns. If it is fully out some turns will have to be removed.

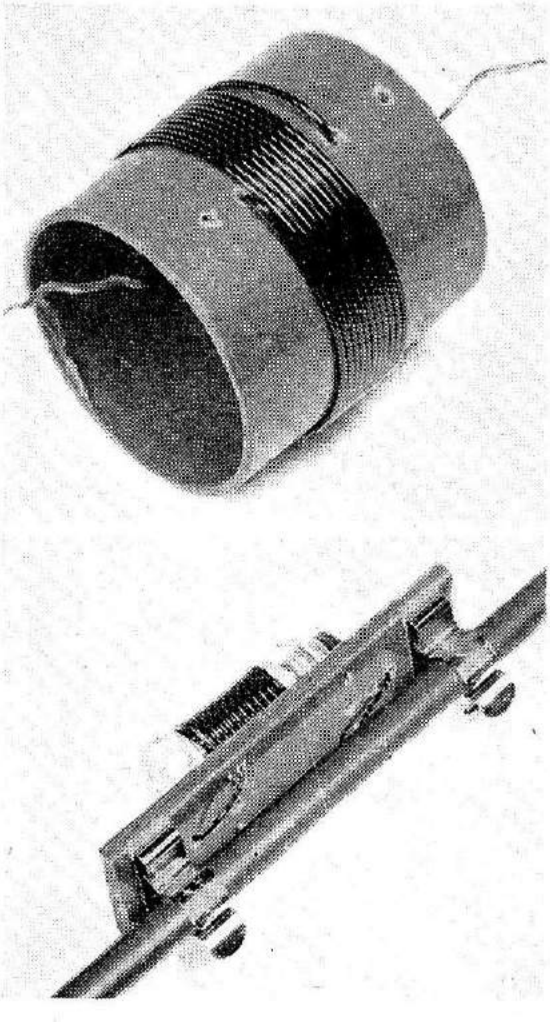
For those who wish to have a bottom loaded aerial even though this gives a lower radiation fix a former to the Tx. panel near tag 1. Follow the procedure described above but start with less turns (say 18).

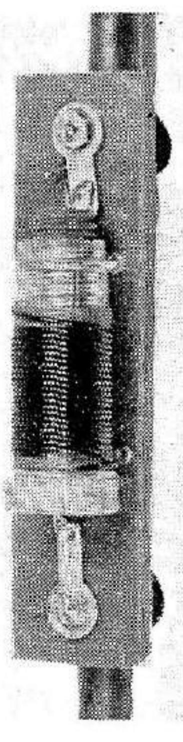
When completed dope with polystyrene lacquer (not cement).

Absorption Wavemeter

Such a meter is fairly easy to construct but it must be calibrated by an expert.

Make a panel 2 ins. square with an extension for holding when in use. The extension can be approx. $2\frac{1}{2}$ ins. × $\frac{3}{4}$ in. Take a piece of $\frac{3}{4}$ in. tube 3 ins. long (bakelite, ebonite or polystyrene, etc.). Block up one end for fixing to the panel. Wind one turn of 20g. copper wire at the open end of the tube and





On left: Standard type of fixed inductance aerial loading coil. Below: Two views of the slugged loading coil specially developed for this transmitter.

take the ends up the tube leading them out through two holes at the side. It might help if this is done before the end is blocked up. Close to this coil wind eight turns of the same wire spaced to about ¾ ins. long and take the two ends up the tube and out through two holes on the opposite side. Fix the tube to the panel and fix an 0-50 pf. variable capacitor to the panel beside it. It is preferable to have a capacitor with a centre spindle so that a knob with a pointer may be fixed. Connect the two ends (after baring) of the larger coil to the capacitor. Fix a flash lamp bulb holder to the panel and solder the two leads from the small coil to it.

Another method suggested by Dave McQue which is fairly simple and quite reliable is available if one can beg, borrow or steal a crystal of the overtone or third harmonic type.

Connect a short length of flex to one pin of the crystal. Connect up a receiver of the carrier type (e.g. the "Ivy" type) switch on and hold the crystal by its case with the flex lead dangling near the receiver. Adjust the receiver until moving the crystal closer causes the receiver current to fall in the same way as when a transmitter is keyed. Make only a small adjustment of the receiver tuning slug each time keeping the receiver in its sensitive state by constant adjustment of the sensitivity slug. Continue to tune until the maximum drop is obtained with the crystal as far away as possible.

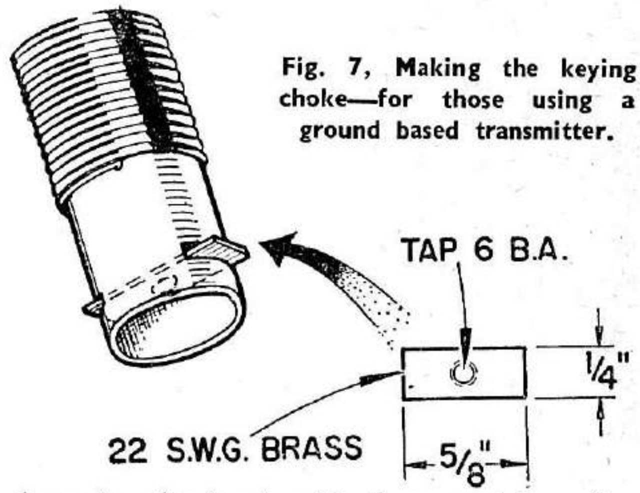


Fig. 7, Making the keying choke—for those using a ground based transmitter.

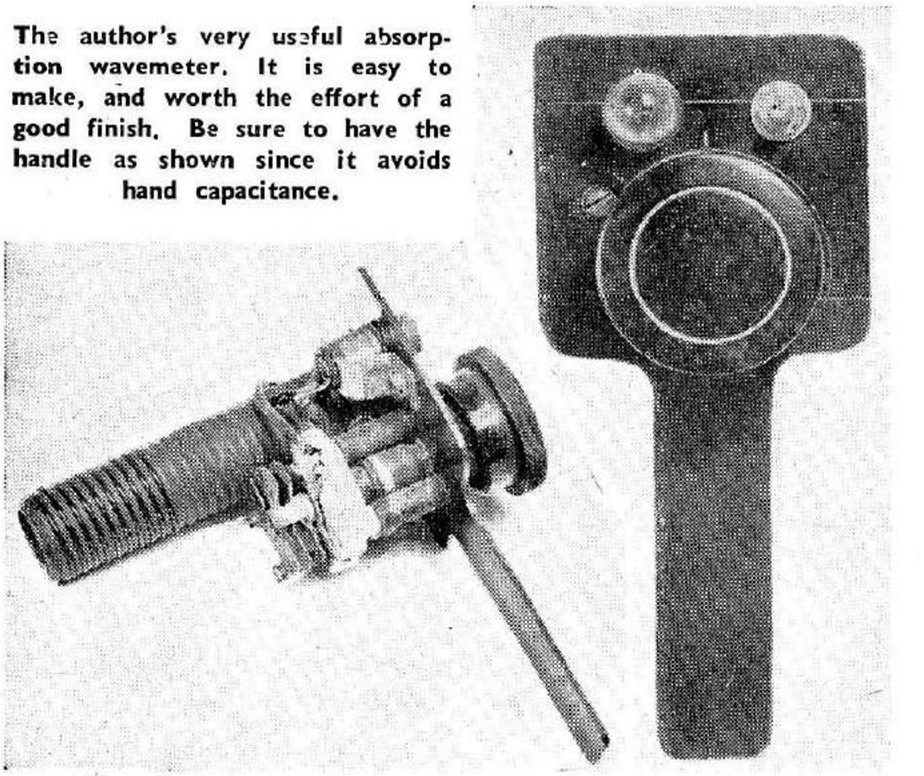
Take the transmitter some 50 yards away and tune it to the receiver with the help of a friend.

Keying Choke

For those who use a ground based transmitter a keying choke is necessary. It can be made from a piece of 2 in. × $\frac{9}{16}$ in. bakelite tube or 12 m/m tagged Alladin former drilled and slotted as shown (Fig. 7). Two separate windings each of 28g. enamelled copper wire are wound one on top of the other, the four ends are taken through drill holes and out through the inside of the tube. Fix the tube to the panel and take one end of each winding to tag 9 and to the switch tag in place of the lead from the switch tag through the push button to tag 9. The other ends of each winding go to a two pin socket on the Tx case. the keying lead or the meter may be plugged in her but see that the large pin of the plug when it goes to the lead to the switch tag. If a meter is desired to be connected permanently in circuit it should be in series with the socket so that a reading is only obtained when the key is depressed.

This completes the unit and it only remains to say that information as to frequency checking will be supplied on request. A stamped addressed envelope please.

The author's very useful absorption wavemeter. It is easy to make, and worth the effort of a good finish. Be sure to have the handle as shown since it avoids hand capacitance.



COMPLETE LIST OF PARTS REQUIRED.

CASE AND CHASSIS ASSEMBLY

2 Half hard aluminium panels, 9″ × 4¼″ × 22 s.w.g.
1 Half hard aluminium panels, 25½″ × 2⅝″ × 22 s.w.g.
1 Half hard aluminium panels, 5⅜″ × 4⅛″ × 22 s.w.g.
10 No. 4 × ⅛″ long self tapping screws (or long screws, etc. if used).
4 8 B.A. × ⅝″ long screws with nuts and washers.
4 3/32″ bore × ½″ long tube distance pieces.
1 ¾″ dia. rubber grommet.

AERIAL SOCKET ASSEMBLY

1 Bakelite or similar block 2″ × ¾″ × ½″.
1 Brass or bronze spring strip, 1½″ long × 22 s.w.g.
2 8 B.A. × ¼″ long screws.
1 8 B.A. Solder tag.
2 6 B.A. × ¼″ long screws (csk only).

AERIAL AND LOADING COIL

2 24″ lengths ¼″ o/d. × 22 s.w.g. Aluminium tubing.
1 Bakelite or similar, ¼″ dia. × 1½″ long rod.
1 Bakelite or similar, 2½″ × ½″ × 3/32″ sheet.
1 8 m/m Polystyrene former and slug.
2 ¼″ Terry tool clips.
2 8 B.A. × ¼″ long screws with nuts, washers and solder tags.
1 Length of 24 s.w.g. enamelled copper wire. 24″ approx.
(None of the above are required if plain car type aerial used.)

TRANSMITTER COMPONENTS

1 Bakelite or similar panel, 4⅛″ × 2″ × 1/16″.
11 Eyelet or solder tags.
1 B7G Moulded valveholder.
2 8 B.A. × ¼″ long screws with nuts and washers.
1 0—30 pf. Trimmer. (Ceramic, Beehive, etc.).
1 H.F. Choke. (Miniature ferrite cored, Denco, R.E.P., etc.).
2 100 pf. Tubular Ceramics. (Radiospares).
2 15 K. ohm. ½ watt resistors. (Radiospares).
1 .01 mfd. Capacitor. (Radiospares).
1 Valve. 3A5 or DCC 90.
1 Length of 16 s.w.g. enamelled copper wire. 48″ approx.

TRANSMITTER SUNDRY COMPONENTS

1 D. P. S. T. Toggle or slide switch. (Radiospares).
1 S. P. Press contact or bell switch.
1 Length each colour, red, black, blue, green, flexible connecting wire. 12″ approx.
1 Length yellow 18 s.w.g. solid copper wire. 12″ approx.
2 Pairs "press-stud" battery connectors.
1 Two pin battery plug. (One two pin plug and socket if meter fitted.)
(Additional components as required for ground based unit.)

BATTERIES

1 1.5 volt L.T. (Exide H.1158 or eqv.).
1 90 volt H.T. (Exide DM.526 or eqv.) or 135 volt H.T. (2- Exide DM.501 or eqv.)

NOTE.—A complete set of parts including aluminium and plastic case, chassis, aerial block, tagboard, coils, etc., ready made, and components as listed above are available from MacGregor Industries.

Next Month . . . ON SALE 10th OCTOBER

HIGHLIGHTS OF THE ISSUE INCLUDE:

ACTUATING MECHANISMS pull out wall chart ★ New Basic Principles of Radio Control Series starts for beginners ★ Making a Simple C.R.T. Oscilloscope ★ One Valve Two Transistor Rx from Belgium ★ All Transistor Rx from Holland ★ Cuckson on Modulation Technique for Multi ★ Rallies and Regatta Reports ★ Boat R/C Installation ★ New Equipment ★ Here, There and Everywhere

Introduction to TRANSISTORS

PART 4 : BY DAVE McQUE

THE most popular arrangement, common emitter, is the one we shall look at this month.

Consider Fig. 1. As was shown in Part 2 most of the emitter current, Ie, flows to the collector. Some of the holes injected by the emitter combine with electrons in the base and further electrons represented by Ib, the base current, flow in via RB. No, the arrows are not the wrong way round they indicate the direction of 'conventional' current which was decided on before electrons were known. However, as holes move in the opposite direction to electrons the direction for holes and conventional current tie up nicely as does the arrow on the emitter in the transmistor symbol. Now if we vary the base current, by adjusting RB say, we shall vary the emitter and collector currents and as these are larger than the base current, current amplication is obtained. The ratio of the change in collector current to the change in base current, $\frac{\delta Ic}{\delta Ib}$, is known as the beta ($\beta$). On transistor data sheets it is also referred to variously as alpha dash (a′) and forward current transfer ratio (h_{fe}). As alpha equals $\frac{\delta Ic}{\delta Ie}$ and Ic equals Ie — Ib, $\beta = \frac{a}{1 - a}$.

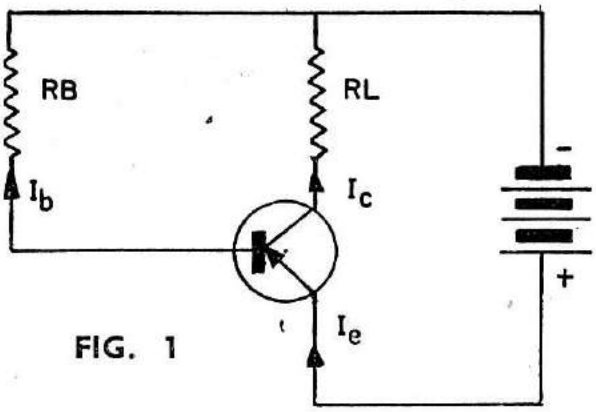


FIG. 1

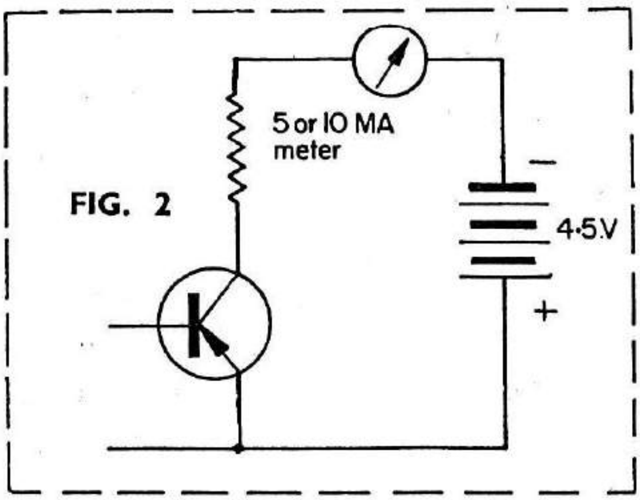


FIG. 2

Values for beta vary from one type of transistor to another and within a type the normal spread has a ratio of about 2:1. For example any Newmarket type V10/15A will have a beta of from 15 to 30 whilst a V10/30A will have a beta in the range from 30 to 50. With 'surplus' transistors you take pot luck!

The actual value of beta for any transistor is not constant as it varies with temperature and current. Beta tends to fall off both at low and high currents although much effort has gone into producing transistors which retain a high beta at high currents, especially in the higher power types and those intended for 'switching' applications. The fall in beta, in small transistors, at collector currents below about ½ m.A. provides a convenient means of controlling the gain or amplication, particularly in the intermediate frequency amplifiers of superhet receivers, but generally speaking a collector current of not less than 0.3 m.A. should be aimed at if the full amplication is required. With the small audio transformers, e.g. D 1001, sometimes used to couple from one stage to another, the standing collector current should not be more than about 0.5 m.A. to avoid saturation of its iron core. Whilst it is possible to adjust the standing collector current in Fig. 1 for individual transistors by selection of RB, as the collector base leakage current is amplified by the transistor action in this arrangement it is not practical if reliable operation is required over the normal range in temperature experienced in models. Even in this country the temperature of the cabin of a model aircraft can rise to 50° C. (122°P), when the sun does shine and it is not only the ambient or environment temperature with which we are concerned, but the actual temperature of the 'works'. As soon as a transistor starts passing current there will be power dissipation mostly at the collector junction as this has the volts across it, and power is volts (pressure) times current (rate of flow). To see this for yourself look up Fig. 2. Use a socket and you can try different transistors readily. Don't leave out the resistor it will protect your meter and transistor.

First of all short the base to the emitter, all the meter will indicate will be little more than the Icbo. If the indicated current is negligible remove the short and you will see the collector current rise. This is due to the amplifying action of the transistor, the collector-base leakage current providing the input base current. Grip the transistor in your fingers to warm it up and note how the current climbs. You will see that the leakage current with open base, Iceo, is beta times the Icbo.

Under certain circumstances a condition known as 'thermal runaway' can occur. This happens when the increase in leakage current caused by the power dissipated at the collector junction causes sufficient further power dissipation and increase in leakage current for the action to become cumulative and end in the rapid destruction of the transistor. Fortunately this will only occur with low values of load resistance. The maximum power dissipation in the transistor will occur when half the supply voltage is dropped across the transistor and the other half across the load (plus, etc. internal resistance of the battery if you want to be fussy), i.e.

$$P \text{ max.} = \frac{\left(\frac{V}{2}\right)^2}{RL}$$ where P max. is

the max. possible power dissipation V is the supply voltage and RL the total

FIG. 3a: Resistance and capacitance coupling with stabilising by tapped or two battery method.

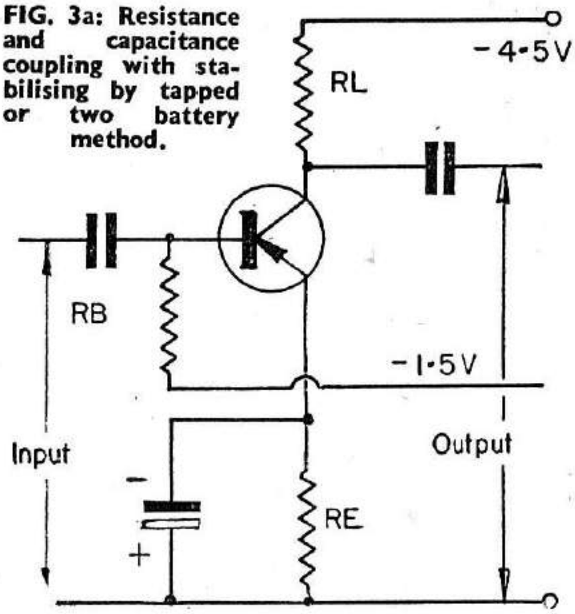


FIG. 3b: Transformer coupling. FIG. 3b: Transformer coupling.

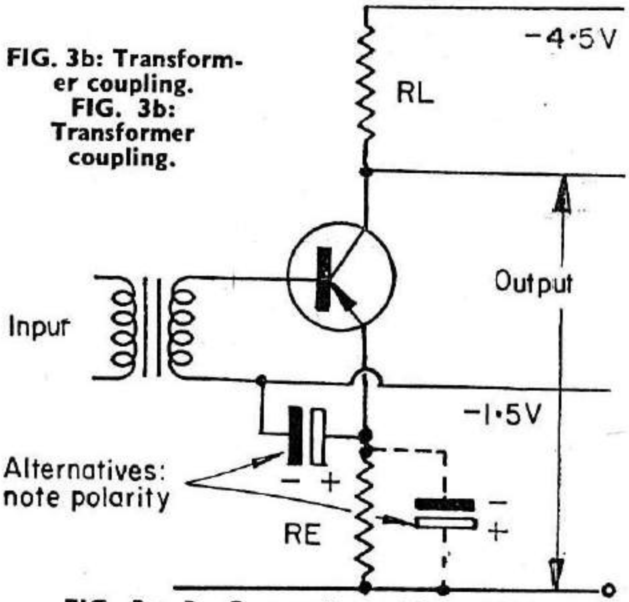


FIG. 3c: R. C. coupling with stabilising by potential dividers. FIG. 3d: Transformer coupling.

Typical values for Fig. 3 (a and c) 4.5 volt supply.

For Ie ≏ ½ m.A. :		For Ie ≏ 1 m.A. :	
Re	3.3k.	Re	1.5k.
RB 1	4.7k.	RB 1	3.3k.
RB 2	10k.	RB 2	6.8k.
RL	3.3k.	RL	1.5k.

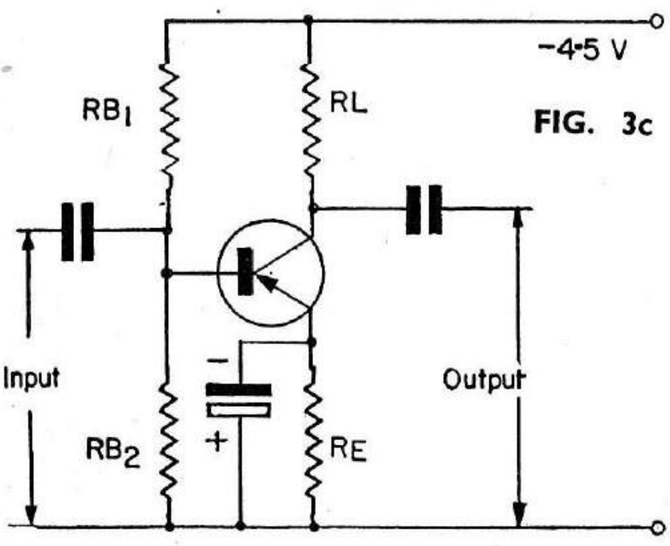
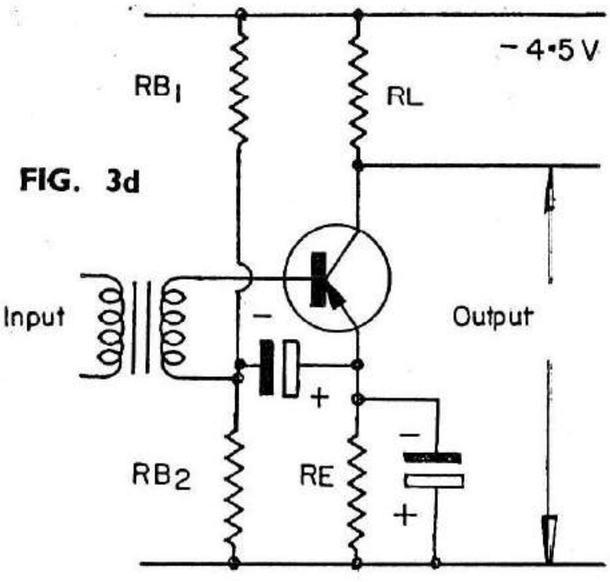


FIG. 3c

FIG. 3d



series load. For instance in the circuit of Fig. 2:

$$P\ max. = \frac{\left(\frac{4.5}{2}\right)^2}{100}\ watts = \frac{81}{1600}\ watts.$$

$$\simeq 0.05\ watts\ or\ 50\ mW.$$

Which is quite safe for the majority of audio transistors. For testing surface barrier and other lower rated types it would be best to reduce the battery to 3 volts and increase RL to 220 Ω to reduce P max. to about 10 mW.

Rearrangement of the formula to

$$RL = \frac{\left(\frac{V}{2}\right)^2}{P\ max}.$$

makes it convenient for finding the minimum value of safe load resistor under all conditions for a given P max. to return to our amplifier. We could bias this to the desired collector current by means of a resistor to the —Ve rail. However, I think it is clear that this is not a practical method if operation over a reasonable temperature range is desired and individual setting up is to be avoided. I am sticking to audio or tone amplifiers here where we are concerned with A.C. amplification and can use capacitor or transformer coupling between stages and these can be separately biased. We saw in part 3 how the biasing conditions for a common base amplifier may be readily set up and are very stable. In its simplest terms the best way to arrange the biasing for a common emitter amplifier is to arrange for the D.C. conditions to approach the common base whilst the A.C. remain common emitter.

The most economical way of biasing in both components and current drain is to use the tapped or two battery method as shown in Fig. 3a and b. The transformer coupled case (Fig. 3b is particularly attractive as with only the low resistance secondary in the base circuit the D.C. conditions are for all practical purposes those of common base). Thus, so long as the emitter supply voltage is large compared with the change in base to emitter voltage over the working temperature range, the emitter (and collector current) for all practical purposes can be taken as

$$\frac{\text{emitter battery volts}}{\text{emitter bias resistance}}.$$

The emitter base voltage with germanium transistors is typically 0.2V. at 25°C. and — 0.1V. at 55°C. a total change of 0.3V. so that if we arrange the emitter battery to be 1.5V. and set the emitter resistor to 1.3K. to give us a current of 1 m.A. at 25°C. this will rise to about 1.25 m.A. at 55°C. Had the battery voltage chosen been 3V. and a 2.8K. resistor used the current would have risen to only about 1.1 m.A. You will see that the larger the emitter volts the better the stability. However, that obained with 1.5V. is usually adequate.

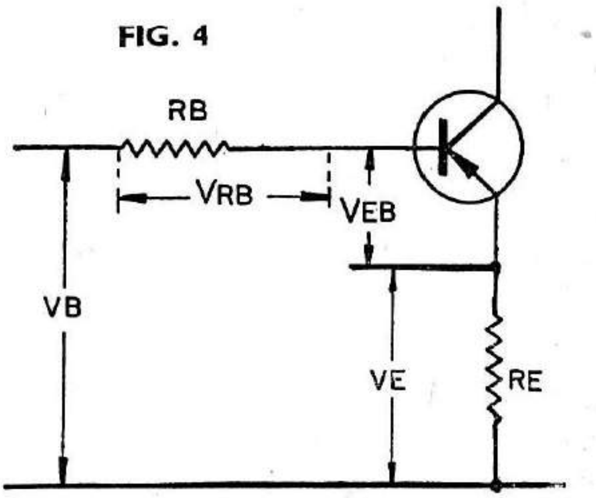
When we come to the capacity coupled case the situation is more complicated as there must be some resistance in the base circuit (RB) to avoid shorting the signal. It is desirable that this resistor should be reasonably large compared with the input resistance of the transistor which is of the order of 500 to 2,000 ohms.

Remember the transistor is a current amplifier and if RB is made large compared with the input resistance most of the signal currents will flow in the transistor. On the other hand if we make RB too large the biassing stability approaches that of Fig. 1. Compromise practical values lie in the range 1 to 10K., the lower values being used for amplifiers operating at more than a milliamp or so when the transistor input resistance is correspondingly lower.

Consider Fig. 4.

Besides the variation in VEB due to temperature, we have the variation in VRB to consider. This is due to the variation in base current caused by differences in beta from one transistor to another, and variation in collector/base leakage current with temperature. Generally speaking it is necessary to make VB larger than in the transformer coupled case and the larger the value of RB the larger the value of VB desirable for a given degree of stability.

FIG. 4



McQUERY COLUMN

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

I POSSESS an R.E.P. Unitone Transmitter, and wish to know if I can fit this with a neon battery voltage warning device. Further, if this is possible, would you kindly instruct me in fitting with details of components required.—P. J. E. O'C., FARNBOROUGH.

The system operates on the principle that a series resistor charges up a capacitor across the neon indicator. As soon as the striking voltage of the neon is reached the capacitor discharges through it very rapidly. The cycle of charge then repeats itself.

I regret I have no details of the values for capacitor and resistor but the system is used by R.E.P. and they will no doubt be happy to supply you with details and components.

WOULD you be kind enough to advise where and when it is possible to see radio control airplanes being flown—either at meetings or clubs—preferably Southern District?

—R. C., ASHFORD.

You should be able to obtain the address of clubs in the Southern area (and most of them now have a radio control section) from the S.M.A.E., Londonderry House, 19 Park Lane, London, W.1.

I believe there is R/C flying every Sunday morning on Epsom Downs.

COULD I use the Hill Mk. Rx. for the receipt of tone signals, and would the reed unit replace the relay, or what modifications would be required?—M. R. T., WELLINGTON.

The Hill Rx. was designed specifically for carrier operation and I doubt whether it would be satisfactory on tone especially for reed work.

This receiver makes use of the quench noise generated to apply through a feedback network and diodes sufficient bias to cut off the last valve. Upon receipt of a carrier the quench noise is considerably reduced and the valve conducts.

In the case of tone receivers it is desirable to eliminate the quench noise for efficient operation and in particular this applies to reeds where more than one tone is required.

To modify for tone you would eliminate the feedback and diodes and I doubt whether there would be enough gain for reed work. A further stage would be needed with higher battery consumption. In the case of a boat this would not matter a great deal as larger batteries could be carried.

MY friend and I have been presented with £10 to make a radio controlled demonstration aircraft, preferably with a 'joystick control'.

£10 obviously limits our choice to single channel but we thought that the 'Galloping Ghost' system would be within our means. (We intend to build all the radio equipment ourselves.)

Starting eagerly on the "Aeromodeller" Transmitter we constructed this for about 20/-. However, on working out the cost of the pulse box required, together with the "Aeromodeller" Transistor receiver (as recommended in July, 1957, "Aeromodeller") and cost of aircraft with engine, we find that we have a few pounds too little. Unfortunately we are unable to obtain any more money.

We would be very grateful indeed therefore, if you could recommend to us a slightly cheaper 'pulsable' receiver for home construction. We were wondering if the ordinary "Aeromodeller" Receiver would do, or the Pike Miniature. These two receivers would be nicely within our meagre means.—D. W., BRIGHTON.

I would have said that it was impossible to produce a complete radio controlled aircraft for £10 unless the very smallest model and engine were used to cut the cost and the problem then would be lightweight receiver and batteries.

These could be dealt with by the expert but even then great care in tuning and maintenance would be necessary and I would certainly not recommend it to the novice. Also, if it were possible, to do so in such a short time would be asking quite something. A good deal of testing would be necessary to acquaint oneself with procedure, etc., and hours of practice at flying if a reasonable demonstration was to be made.

The 'Pike' miniature is considered now to be out of date and the "Aeromodeller" Receiver whilst good in its time does not give the large current change of the modern receivers and a good change does make for reliability in the hands of the novice. Given time it could be mastered by the novice and it is cheap to make. A modern version of the single valve receiver was published in our September issue.

Pulse systems are very good indeed but again they are not really for the novice and do cost a little more.

WITH regard to your article on "Boystick Control" in the May issue of RADIO CONTROL MODELS & ELECTRONICS, *are the red spot type of transistors suitable? Also is it possible to fit a system to give more positive down elevator as used by Charles Riall in his valve pulser?*—R. A., FAREHAM.

The 'red spot' transistors are quite suitable for the "Boystick" control. See that they have a reasonable gain however (say not less than 15).

The system can be modified to give a very fast pulse in the same way as that adopted by Charles Riall. The two 4 mfd. capacitors will need replacing with a pair for each side one of each to be switched out for fast pulse. It will be a case of trial and error but you could start at .5 mfd. for the fast pulse and leave the 4 mfds. to be switched. This will give a slightly slower pulse when both are in circuit but may be all right.

I AM building my first radio control transmitter and receiver ("Aeromodeller" Tx. and Rx.).

I find that this is for keying and I would like to operate my model boat on pulse.

Could you please tell me how to operate this single channel on pulse?

—D. L., BLYTH.

There are several ways of modulating a transmitter for pulse work. You do not say whether you wish to use proportional control or some other pulse method, but I presume that you mean the former.

The simplest way is to have a relay in your pulse circuit and to use the relay contacts to switch the transmitter on or off at the required frequency and pulse width. Details of an electronic pulser with a relay appeared in the "Aeromodeller Annual 1958/9" and several mechanical systems have appeared in "Aeromodeller" and "Model Maker" which could be suitable for your purpose.

There are problems connected with pulse work and if you are new to R/C I would suggest that you confine your activities to simple control first and graduate to the more complex systems.

1. *Which transistors and relays are especially recommended for G.G. pulser units?*

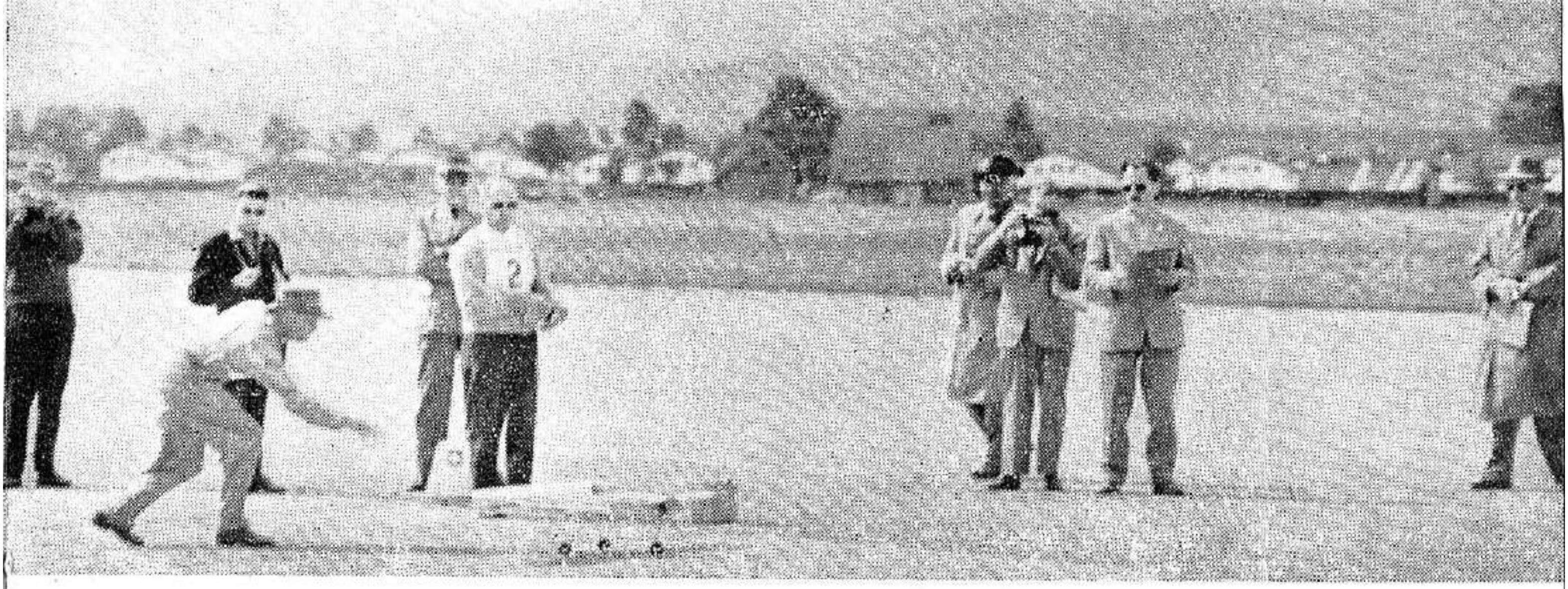
2. *Are there any small electric motors of greater torque than the Mighty Midget or Ever Ready T.G.18, suitable for G. G. operation and weighing not more than three-four oz?*

—J. W. R., ROCHESTER.

Any audio transistor would be suitable on Galloping Ghost but on relays the requirement is that it should respond faithfully to the M/S variations and this really calls for a balanced armature of very light weight.

The only light weight armature I know is the Siemens H/speed and although it is unbalanced it would probably be all right. I cannot recommend any particular relay sold by our advertisers for obvious reasons.

The Micromax motor from Germany has very high torque and would probably be suitable but care must be taken to avoid overloading as the current under these conditions can be high enough to damage the motor. If used for G.G. a series resistance would seem to be desirable with a reduced torque.



Fredy Bickel, 1959 winner, takes off against an Alpine background at Dubendorf.

First F.A.I. World R/C Championship at Dubendorf

COMPOSITE REPORT BY "WINDY" KREULEN, ED. JOHNSON AND DICKIE DICKSON. PICTURES BY DICKIE DICKSON AND ROGER CLARK. OFFICIAL R.A.I. SCHEDULE DRAWINGS.

HIGH standard of flying must be keynote of first F.A.I. World R/C Championship. In previous years this event has not been given official world status and has been confined to European entrants. Now with full U.S. team of Ed. Kazmirski, Bob Dunham and Harold de Bolt, with Walt Good as team manager it can claim to have had world's cream.

Any of first half dozen could have won in an "ordinary" year, but Ed. Kazmirski provided quality in both flights that was quite unbeatable. Our only fair comment must be "superb"! His team mates also each produced one excellent flight, but motor/r.c. trouble is no respecter of persons so their totals were not competitive.

British team produced the best combined effort with six fine flights to take team prize. No other team achieved six even flights. Note in the scoring that Frank van den Bergh's second flight was only beaten by Ed. Kazmirski's two over 6,000 efforts and Stegmaier's 5,940 (eight points lead).

Of special interest was comparative eclipse of past winners Gobeaux and Bickel. The Belgian flew splendidly, but his skill was at a discount with last year's model now hopelessly dated for expert performance. He actually had time trouble on second flight waiting for motor to cut so that he could land deadstick. On first round flight he suffered from being opening man. Bickel never showed, since early engine stall on first flight gave him a mere 610, but second flight gave no indication that he could have been a danger.

Modern demands are for smallish, fast, unstable models that must be flown all the time. Audible monitoring indicated how the experts worked unceasingly, with constant signal beeps. Speed is all important. Winner's second round time of 10 min. 40 secs. is near ultimate for the schedule—10 min. dead would be absolute minimum! In contrast Van den Bergh took 13 min. for his top flight.

Germans Saamann and Stegmaier who placed second and third flying the typical round fuselage "German" models were impressive. We liked Saamann's slow rolls and 8s—indeed some of his patterns were best of the meeting. On second flight he flew over judges' heads and was lucky to be marked so highly. Stegmaier tended to fly very high on second flight—we preferred his first effort in worse weather conditions.

Czech, Swedish and other Belgian entry were outclassed but can count the experience as valuable.

Altogether a stimulating meeting—we would not have missed it for anything.

For those in search of detail, a flight-by-flight commentary will appear in October issue of "Aeromodeller".

Dr. Walt Good with the "Merry Mac Monitor" designed by Howard McEntee which was his inseparable companion.

'WINDY' KREULEN WRITES:

VERY little 'technical gen', all competitors used commercial gear. High standard of flying, with nice looking planes. Rules may soon be altered, as pilots can do more and better than rules demand. Reeds, pneumatic or proportional in 1st, 2nd and 3rd place proves each system is good if user develops right plane and flying technique.

In the various aeromodelling magazines much information is given about commercial R/C equipment, and makers or the 'trade' do all they can to get top marks for their stuff. The writer is in the trade and owns a 'good-running' model shop. He likes flying R/C models very much, and can 'buy and try' almost any commercial set. To be quite honest some four years ago nothing much good in respect of 'reliability' could be bought, and those who did actually fly a R/C model used 'home made' or 'reworked' factory equipment. Single channel flying could be managed more or less by the man that had much patience. Multi-flying was only for those with 'bags of money' and a technical staff at their disposal. The writer missed the International R/C contest last year, but two years ago in the 'tent' that housed the competitor's transmitters during the event most Tx's were 'home made'!

And now at Dubendorf only three or four transmitters out of 22 appeared to be home-made! Yes! The days when the man who wanted to fly his model under radio control had to be an electronic 'wizard' belonging to the past. The contest flyer has no time to be troubled by electronics and mechanics. He builds planes and gets flying, he has to train and practice the flying schedule. He likes the 'flying' often NOT the building and usually knows nothing about the electronic properties of the equipment he uses. For him the Tx. and Rx. and servos are only devices to make his flying possible.

Because of this the writer has not learned much more about electronics at this contest, there was no exchange of circuits and talk about servos among the competitors, but much about model design and flying technique. The general interest only being how will the 10-channel Bellaphon set-up with its full proportional steering show up against the straightforward 8 or 10 channel reed receivers.

The writer thinks that the latter won the battle, and that a full proportional set-up has only theoretical advantages.

Obviously one who never has flown a model plane under radio control will have the idea that if the control surfaces of a model will follow the movement of the joystick, flying will be something like driving a car or real plane. It is very difficult to explain that this is by no means true! Even worse, is that the makers of this type of equipment take advantage of this belief and claim it is right! They use slogans like: "Fly like the real pilot! No button pressing, but joystick control", and so on!

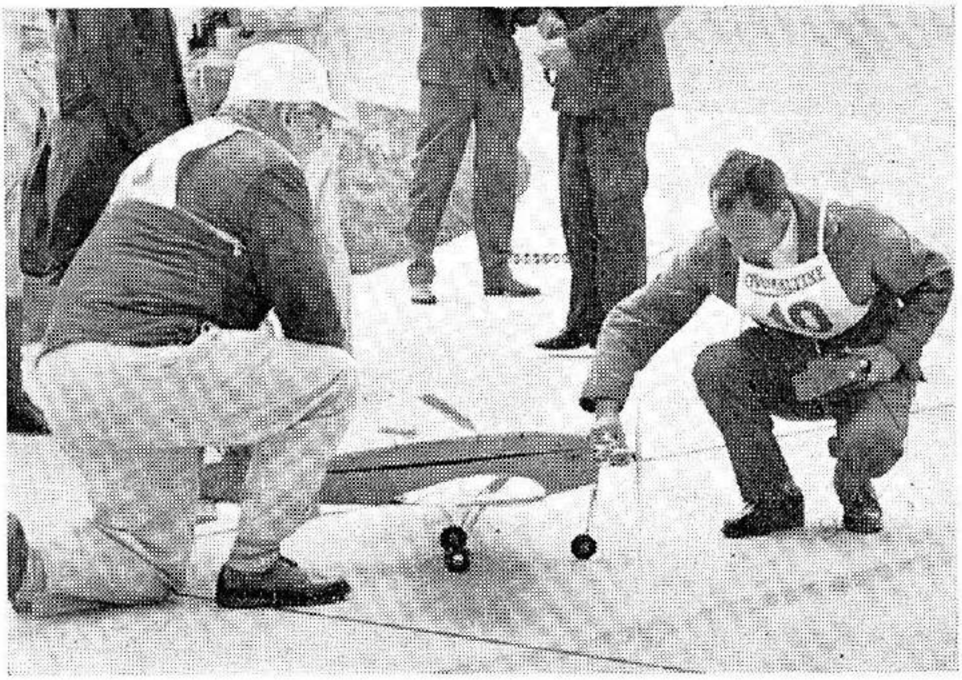
The writer prefers the saying of Chris Olsen. "I would rather rely on my thumb as a mechanical pulser". In fact, the turns, loops and the whole flying of Stegmaier or Samann who used partly proportional gear were *not* noticeably 'smoother'.

The question whether 'pneumatic' has advantages over 'electric' is not easily answered. Some years ago 'pneumatic' had the advantage of being lighter than electric, but nowadays this is not true any more. Light and reliable servos are on sale in most hobby shops and small batteries with large capacity are available nowadays.

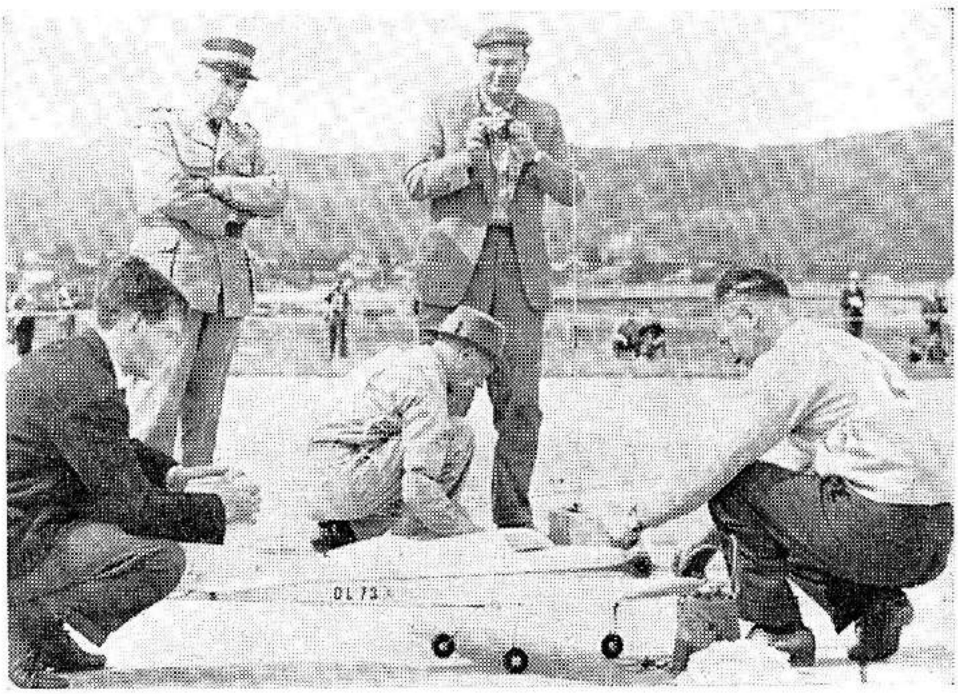
The pneumatic system has the disadvantage that it cannot be bought in separate parts, one has to buy the complete set including the engine and airpump. If the engine stops in the air little 'spare movements of the control' surfaces are left.

Actually the Bellaphon set leaves the

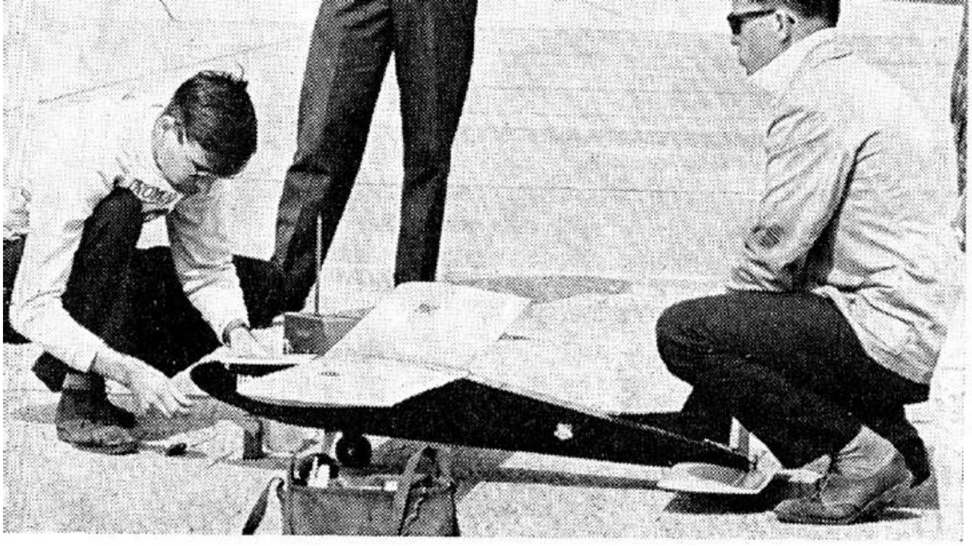
Bob Dunham, U.S.A., with his 'Voltswagon'. His contest flights were marred by some engine hesitation, but in a subsequent exhibition demonstration he produced what all agreed to be the "flight of the meeting".



Unlucky Ernst Klauser makes the best of a bad job with a "bitza" model, following destruction of his No. 1 job a week earlier through a neighbouring "pirate" operator. His own design Tx. (all transistorised) is in regular demand to rescue clubmates' models which they have "lost".



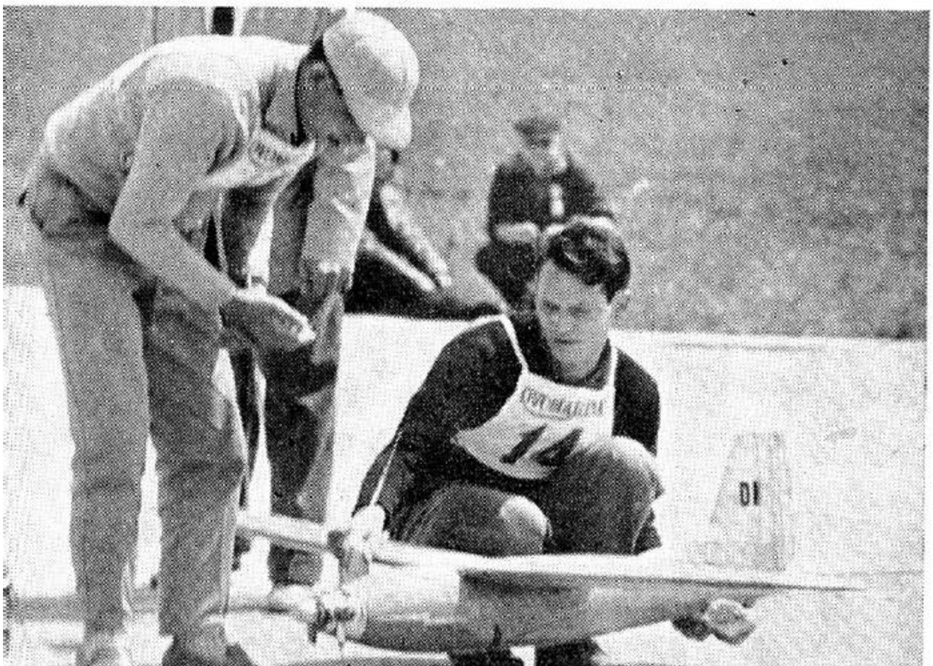
Last year's winner, Fredy Bickel, readies his model. With his electronic partner Nievergelt he has done much to popularise R/C flying in Europe and deserved better fortune in the contest.



Chris. Olsen starts "Uproar", assisted by mechanic J. Crawley.

Frau and Gustav Saamann pose before their model whilst waiting for their second flight.

Stegmaier team—Karl-Heinz in the fancy German hat—check revs. before releasing model.



World R/C (
Mainly th

Winner Ed. Kazmirski looks grim
flight, though team manage

Our top man Frank van den Berg
Below : The end of a good moc
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Championships

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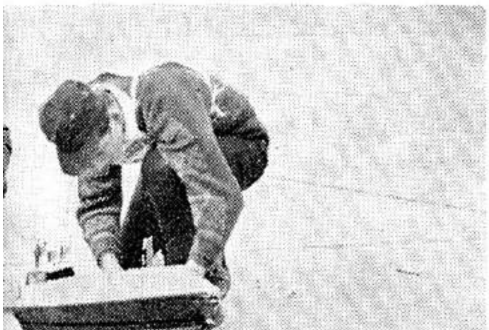
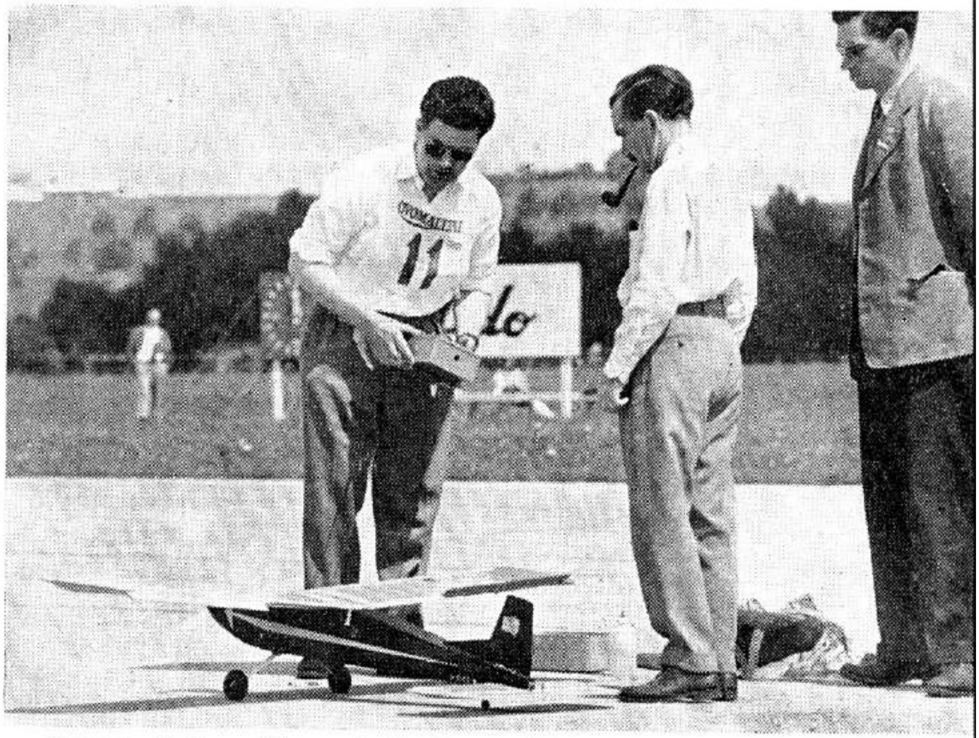
as he leaves the field after No. 1
Doc Good is more cheerful.

with Ed. Johnson on the tarmac.
el. Hans Gast sadly picks up the
es !

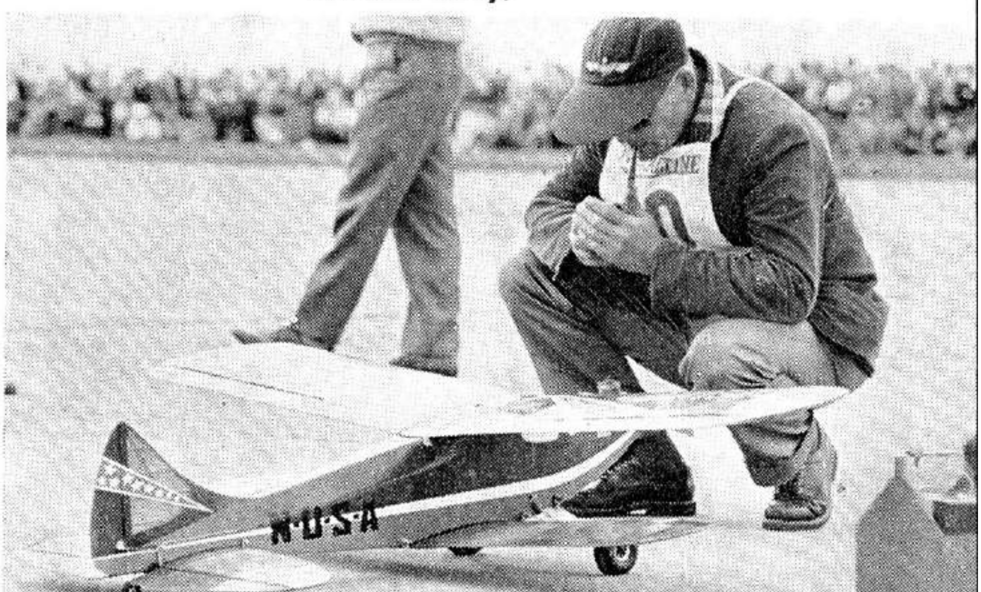


Dr. Gobeaux holds son Jean-Pierre's model. Nose wheel has pneumatic brake.



Stewart Uwins with mechanic George Honnest-Redlich and team manager Ed. Johnson.

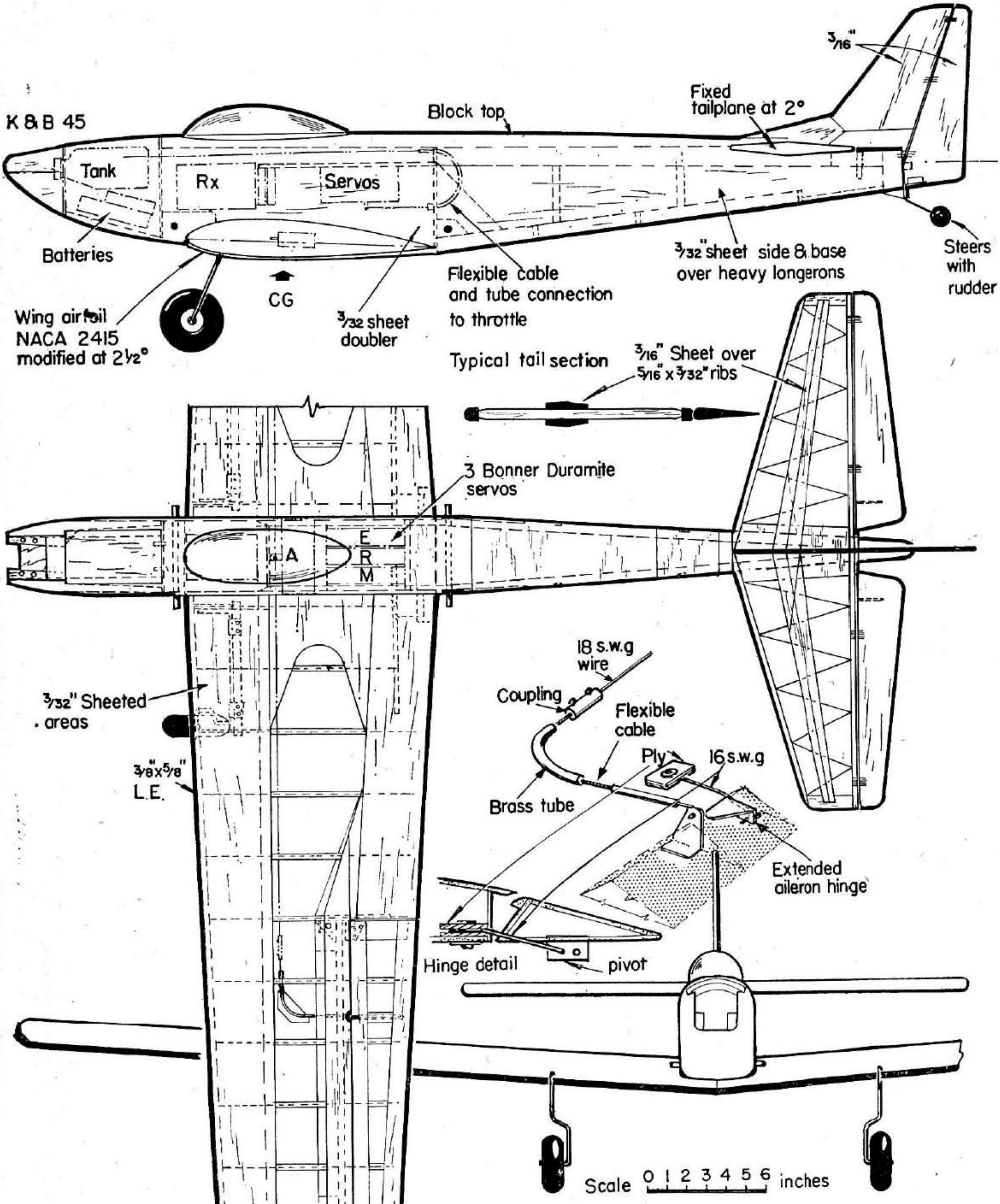
Harold de Bolt pauses to light the famous corncob before flying his No. 2 model, a modified "Custom Bipe" of the Live Wire family.



Typical Czech model. Powered with the M V V S 2.47 c.c. motors these were lowest powered entries. In spite of this their flying was surprisingly versatile, though outclassed by the 'big guns' present.

Ill-fated Italian entry on the tarmac. Mechanic Bacchi prepares the model, while pilot Erminio Corghi stands ready with Tx. slung camera fashion. For the second year, however, an early dive in under power prevented us from judging his ability in the air.

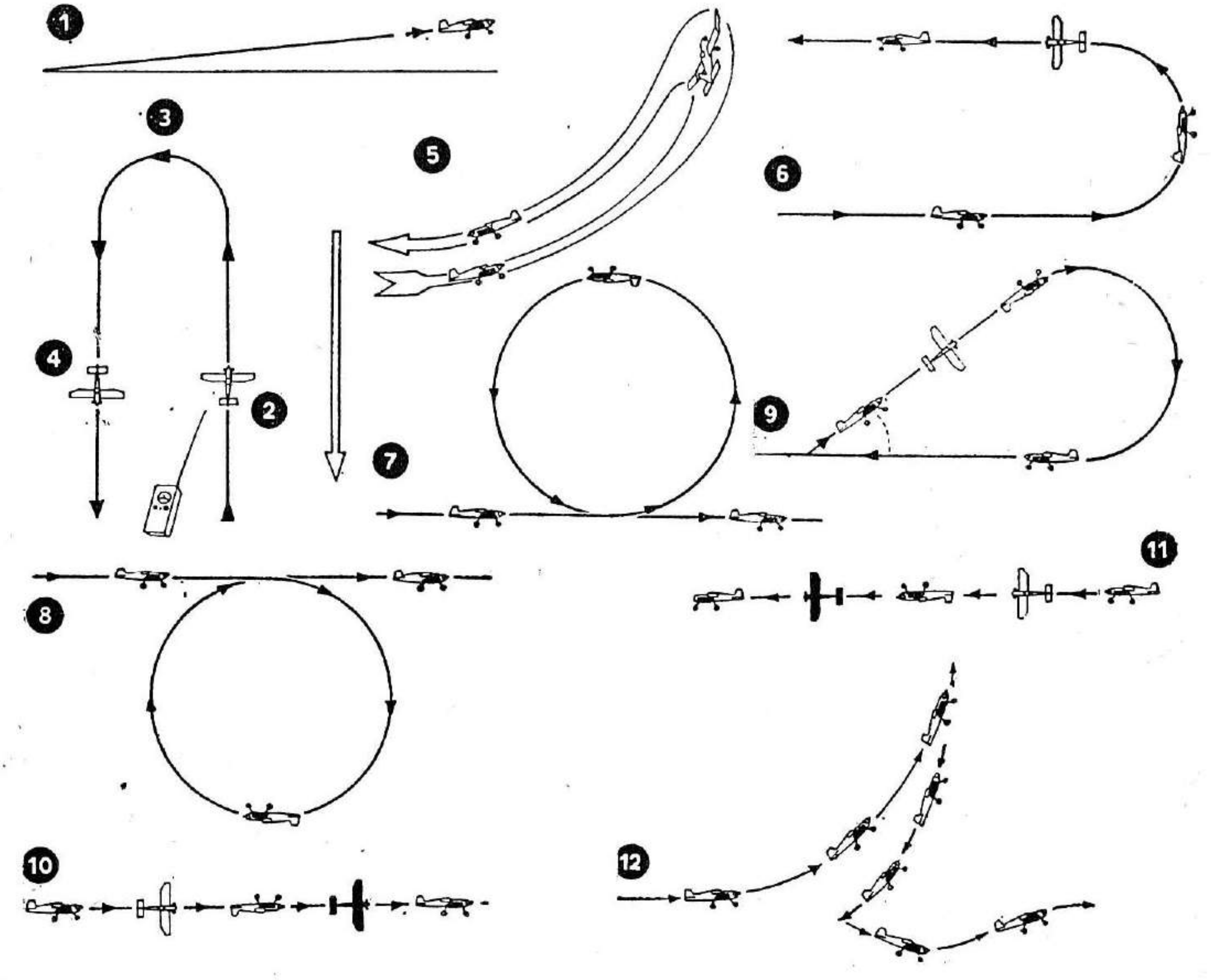
Swedish entrant Dilot with his well prepared model. Here again it was competing in a class too high for it, and the visit must be regarded mainly as valuable experience. In a year or two there is every prospect of a strong Scandinavian challenge developing.



Detailed drawings and building instructions for "Orion" appeared in June, 1960, issue of our American contemporary "Model Airplane News".

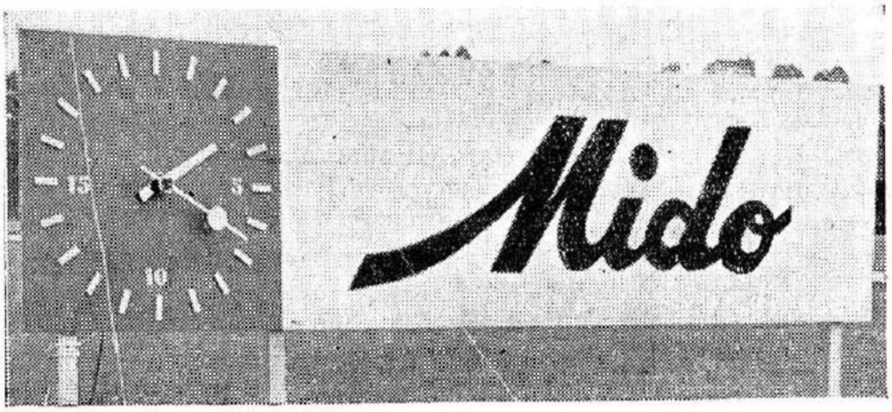
RESULTS / MODEL DETAILS

			1.	2.	Total	Span	Wing Loading ozs./ sq. ft.	Weight lbs.	Engine	Radio
1	Kazmirski, Ed.	U.S.A.	6275	6183	12,458	5′ 8″	16	6.173	K & B 45	Orbit
2	Samann, G.	Germany	5611	5650	11,261	6′ 6″	15.65	7.275	Ruppert 9.7	Bellaphon
3	Stegmaier, K.-H.	Germany	5233	5940	11,173	5′ 8½″	20	9.479	Ruppert 9.3	Stegmaier
4	Van den Bergh, F.	Great Britain	5082	5932	11,014	5′ 6¼″	14.5	6.835	K & B 45	Orbit
5	Olsen, C. H.	Great Britain	5317	5327	10,644	5′ 0″ 5′ 5″	14.3 12.2	4.96 5.07	ETA 29	R.E.P.
6	Gobeaux, J.-P.	Belgium	4977	5021	9,998	6′ 8½″	15.0 13.5	8.157 7.385	Ruppert 9.6	O/D
7	De Bolt, H.	U.S.A.	2702	5668	8,370	5′ 4¼″ 4′ 11″	13.8 12.2	6.173 7.055	K & B 45	Bramco
8	Uwins, F.	Great Britain	1678	5394	7,072	5′ 5″	13.5	5.643	Merco 35	R.E.P.
9	Klauser, E.	Switzerland	2651	3951	6,602	6′ 2″	13.2	6.173	F.M.O.	O/D
10	Dunham, R.	U.S.A.	4923	385	5,308	5′ 9″ 5′ 8″	17.5 16	6.173 7.055	K & B 45	Orbit
11	Bickel, F.	Switzerland	610	3844	4,454	6′ 1¼″ 6′ 2″	15.4 15.45	7.275 7.275	O.S. 35	Nievergelt
12	De Dobbeler, J.	Belgium	820	1869	2,689	6′ 1½″	17	8.044	Webra 7.6	Orbit
13	Maritz, F.	Switzerland	1151	425	1,576	6′ 1½″	18	8.267	Ruppert 7.6	OMU
14	Hajic	Czechoslovakia	800	631	1,431	5′ 0½″	16.6	5.622	MVVS 2.47	O/D
15	Havlin, Z.	Czechoslovakia	754	336	1,090	4′ 4″	16.4	5.291	MVVS 2.47	O/D
16	Dilot, R.	Sweden	105	850	955	6′ 7¾″	17.8	7.716	K & B 45	Bramco
17	Gast, H.	Germany	632	0	632	6′ 6″	15.65	7.275	Ruppert 9.6	Stegmaier
18	Michalovic, J.	Czechoslovakia	514	0	514	4′ 8¾″	17.4	5.952	MVVS 2.47	O/D
19	Corghi	Italy	425	0	425					
20	Eliasson, P. A.	Sweden	95	0	95	4′ 6″	13.1	5.732	O.S. 29	R.E.P.



The imposing Mido clock which ticked off the remorseless minutes of each flyer's allotted quarter of an hour. A bell rang when time was up.

Illustrations below from the official programme are the F.A.I. visual interpretation of scoring schedule, items all being marked out of ten and multiplied by X figure shown in our table.

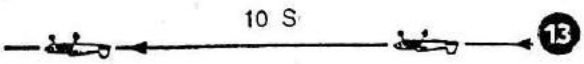


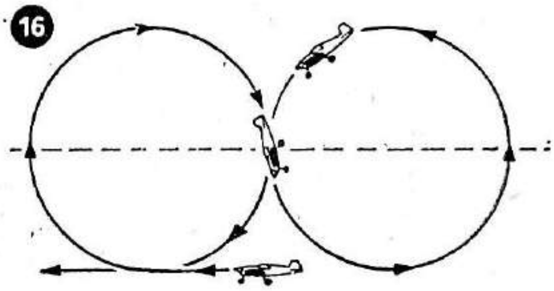
SCORING SCHEDULE

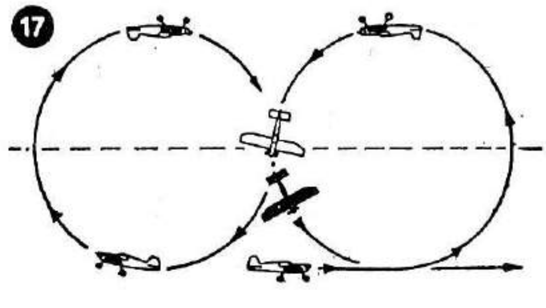
No.	Manoeuvre	X
1	R.O.G. (obligatory)	5
2	Straight flight into wind from over Tx.	5
3	Turn LEFT	5
4	Return Flight	5
5	Wind-over	5
6	Immelman Turn (½ loop followed by ½ roll)	10
7	Loops : 1st	4
	2nd (consecutive on same axis) ...	6
	3rd (consecutive on same axis) ...	8
8	Inverted Loops : 1st	10
	2nd (on same axis)	12
	3rd (on same axis)	14
9	Split S (½ roll followed by ½ loop) ...	12
10	Roll	8

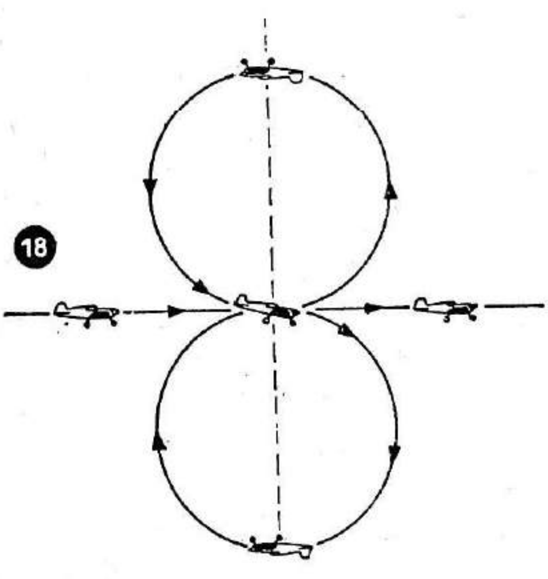
No.	Manoeuvre	X
11	Roll in opposite rotation to 10 ...	15
12	Stall	10
13	Inverted flight in straight line (min. 10 secs.)	14
14	Left-hand Circle in inverted flight: Diameter : Min. 50 m. Max. 100 m.	16
15	Right-hand Circle in inverted flight : Stipulations as 14	16
16	Horizontal Eight	13
17	Cuban Eight	18
18	Vertical Eight	15
19	Spin : 2 turns	6
	3rd turn	6
20	Approach in rectangular circuit ...	10
21	Landing	5

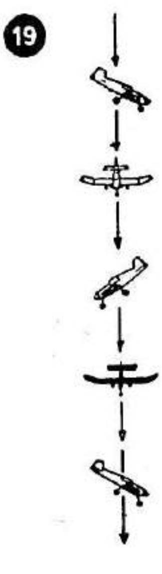
Additional points awarded for accuracy of landing.

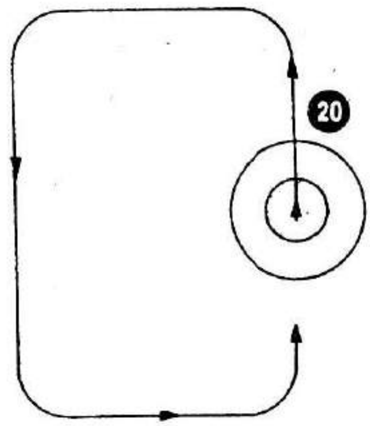


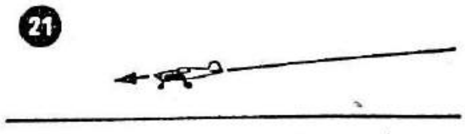












buyer no choice in his servos as other servos than the 'Bellamatic' cannot be used. The whole 'set-up' is 'tuned' and 'balanced' to work only with these servos. The built-in 'pulser' has the appropriate and corresponding speed for the Bellamatic servo. Anyone who prefers to do a little experimenting with home-made gear will not appreciate these features!

Are so-called 'tuned filters' superior to 'reeds' is another question and also hard to answer. It is at present definitely not proven. True a 'reed unit' is somewhat 'delicate', but a very long development has made the present day reed receiver a very useful thing. It is far cheaper, and easier to adjust than one would actually think.

The relays in a reed receiver work more reliably and and are less sensitive permitting more contact pressure, thus allowing for switching higher currents!

The actual 'trouble' and unreliable operating of reed equipment of the past, was due to 'unstable' transmitters. We must credit the man who came upon the idea of using the present day widely used 'tuned choke L.F. generator that produces rock stable tones', and holds these even when the batteries drop to two-thirds of their actual voltage! This made multi-channel flying with reeds possible! The circuit is old, and why it was never used before, is a mystery!

For years and years, the writer and plenty of other people have been tuning and adjusting reeds and pots. and doing very little flying! The modern multi-channel set has to be tuned once, and will keep tuned for a long period. The man who wants to fly a multi plane today can get a reliable set and other gear, and start flying. Obviously in England he will be best off with say, an Octone, in the U.S.A. there is more choice★, but these sets are on no account better, and in Germany it will be Bellaphon. The electronic part has reached its practical limit, we modellers can now begin to use it to its full advantage!

★ *"Orbit", "Bramco", and so on.*

* * *

WHAT IMPRESSED 'WINDY' MOST

1. The 'super finish' of the American models!
2. The simple but very practical design of the 'Uproar'.
3. The number of British supporters that came to see the show! R/C must be very popular in England I reckon!
4. The high 'flying speed' of the American models!
5. The ability of F.v/d Bergh's model to take off from a rough grass field!
6. The demonstration flights by 'Orbit'-man Bob Dunham.
7. The way Ernst Klauser controlled his temper when his model landed on the head of a spectator and crashed!
8. The 'combat R/C flying' of Uwins and Olsen!
9. The excellent way the commentator interviewed the various 'pilots'. His ability to speak three languages, and show he knew what he was talking about.
10. The OUTSTANDINGLY GOOD ORGANITION of the whole event by Mr. Arnold Degen and his staff. I doubt if any aero club can beat him in a future contest in this respect.

THE JOHNSON REPORT

ED. Kazmirski : Orion. Orbit 8 channel Tx. and Rx. Four Bonner servos. K. & B. Torpedo 45. Model weight 6 lb. 2 ozs. Rudder and aileron: Bonners; return to neutral elevator had 'trimmable' portion around level flight setting. Down elevator had to be 'pulsed' to hold model inverted. Model very fast so only small surfaces and deflections were needed. Landing technique is to 'select' elevator position—way out, then control descent rate only by increase/decrease in power. Soft tyres make for 'touch and stick' landings—wheel position critical. Too far back='nose in' on landing. Too far forward gives bounce! Two wheel or tricycle choice for undercarriage determined (a) Do you fly from runways or grass? (b) Does your flight schedule include *ground* handling manoeuvres? For grass, two wheel is best, for runway a ground handling trike is preferred. Used pen cells for actuator power—four off. Changed them every six or seven flights. Hints on 'keeping 'em flying'. After each outing: (1) Check all wiring joints. (2) Check all fixing bolts. (3) Test *all* batteries under load. (4) Before installing any servo, remove case for access to wires. (5) Tie back wires so that 'pull' is not on soldered joint. (White wire most prone to fracture on Duramite, usually after five hours' operation.) (6) Do as many manoeuvres as possible on high speed. Hence Kasmirski's 'high speed' spin. Motor liable to cut if in low speed for 'spin'!

Bob Dunham ("Mr. Orbit"): Voltswagon. Orbit 10 relayless receiver. Medco 10 reed unit. Five-transistorised Duramites operating directly from reed unit contacts. K. & B. R/C receiver size 2 x 1 x 1½ in. Weight 3 oz. Contained 1 valve, 2 transistors. XFY 34. Ardente 1079 transformer. Transistor type not critical. 30V. H.T. and 1½V. L.T. Voltage supply units contained 6 DEAC 225's, which operate servos, and supply voltage for receiver via built-in transistor convertor. So—one supply unit in moulded polythene type case with B7G socket for all receiver and servo power. Transistorised Duramites, a possible name Transimites, approx. $25 retail. Modification kits available separately for orthodox Duramites. Different P/C board with built-in transistors, and different sector. Four channels used on elevator, one servo for 'full control'—one servo to move the neutral. Reed contact gap, when using transistorised servos, far less critical than is needed for relay operation. Advantages: low weight, *no* relay contact troubles. Cost of complete rig approx. same as with relay version. You save the cost of relays, but pay more for servos. Procedure for take off is to feed in up elevator trim as model accelerates. Landing technique as with Kazmirski. Fly it at the ground. Wing dihedral very low. *Orions* and *Voltswagons* only any good if they go fast. VW wing thin (9%) symmetrical. Sheet covered. Steerable nose wheel, operated by rudder servo. Main wheels braking, operated by elevator trim servo.

Sammaan. Own design — mid-wing. Modified Graupner 10. Modified Bellamatics. Rumour said electronic Tx. Pulsers as opposed to previous Micromax powered type. Balanced controls. Ruppert 9.6 c.c. flat twin diesel. *Vertical* receiver aerial.

Stegmaier. Own design equipment. Transmitter had built-in pulsers, on rudder and elevator for proportional. Vacuum operated servos. *No* pulser on aileron control. Ruppert 9.7 c.c. twin diesel.

De Bolt: Playboy. Own design, modified Pursuit, low wing. 8 channels. Bramco on ground Tx. with control hand-held control box. 4 Demco servos.

Dilot. Own design model with K. & B. 45 R/C and 11/6 prop. Bramco 8 channel equipment. Hand-held type transmitter. American Steeb. servos.

Eliasson. Single channel compounded biplane. Cross between BiFli and Smog Hog. OS 35 R/C. 11 x 4 Tornado. Graupner Mikroton receiver. Bonner dual varicomps, controlling left and right rudder. Three speed engine, up and down elevator and one way ailerons. Balanced controls. Paxolin tube torque rods.

Van den Bergh: Skyduster. Own design. Torp. 45. Orbit 10. 5 Duramites. 2 one elevator, as Dunham.

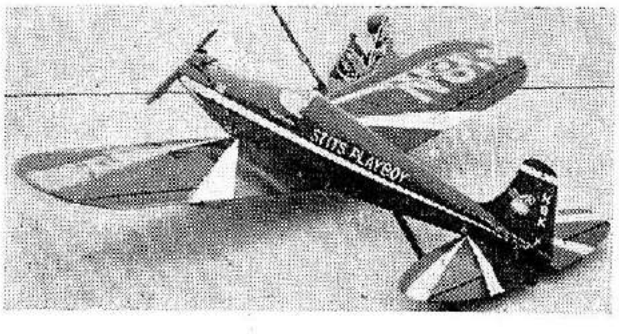
Olsen: Uproar. 4 Olsen/Remtrol servos. Eta 29, with new type exhaust valve. Trimmable elevator.

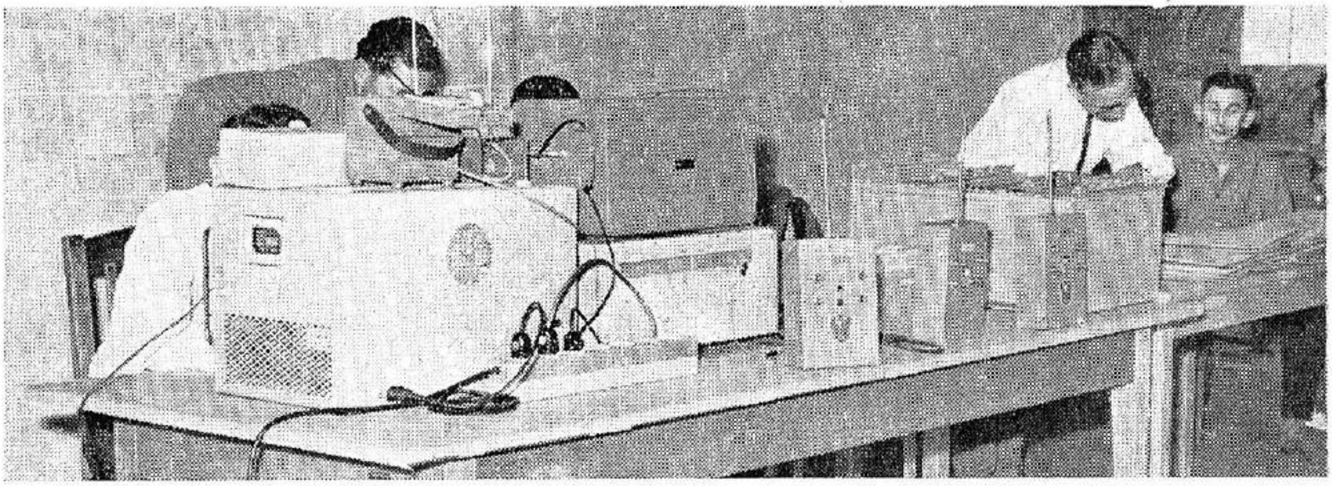
Uwins. As Olsen but Merco 35 R/C.

Czechoslovakia. All equipment home-built. Receivers. 1 valve, 2 transistors. Working via transistor converter from 4½V. flat battery. No switch. Slide battery into holder to switch on. Tx. incorporates 1 valve for each channel plus crystal controlled oscillator and modulation and output stages. Tone generators are tuning forks. Model controls operated from engine generated pressure. Models had two rudders in line. One operated electrically—one by pressure. No reservoir. Engine stops and all controls stop except for electrical rudder for steering back to landing.

Clever nosewheel brake on the Gobeaux model.

Illfated Stits Playboy which went in for "Pappy" de Bolt—taken, wisely, before the event.





Chambers of Horrors! Imposing array of P.O. test equipment used to vet all Tx. and Rx.!

RANDOM THOUGHTS . . .

Bob Dunham's exhibition display finest flight of meeting—no other man in Europe (or world) could have done his inverted 80 m.p.h. 200 yard run at ten feet above runway to thrill crowd.

* * *

Chris and Frank's two-up-at-once combat display was G.B.'s very effective answer to this. Honours even.

* * *

Five judges within thirty feet of each other, all comparing notes not the ideal method for an international (two sets of results, top and bottom, discounted anyway). Why not spread them around at different viewpoints so they can really judge flights?

* * *

Five minute rule for an attempt leads to abuses. Under rules, entrant not liking weather can come and fiddle for five minutes, come again later in better conditions. It was done! Why not penalty for not succeeding first attempt say 500 points?

* * *

What is a mouse when it spins? The old nonsense riddle applies to FAI rule of three spins. Do judges count four spins, five spins, etc., for first three, or mark down for inability to come out to order? This wants tidying up.

* * *

F.A.I. pattern in words now ornamented with *official pictures*—not always as we imagined them. U.S. boys had a round dozen queries on them alone—and they were sprung on us all rather late in the day. Is the artist's handiwork correct?

* * *

Doc Good duly enrolled Messrs. Gast and Corghi into the "Down Elevator Club" open only to those unfortunates who have completely written off models under power against U.S. competition. There is genuine and most official looking certificate and all!

* * *

Winner Ed. Kazmirski, only one of U.S. team not connected in any way with model trade (except as consumer). Claims to be 39 "just like Jack Benny" which may be a let out—is partner in family business of production engineers.

* * *

U.S. boys in as much awe of Olsen-V. d. Bergh-Uwins set up, as our team was in awe of them. Shows what a few thousands of miles of water does with only written reports to go on.

* * *

Distinguished British supporters included Charles Riall, who brought his "toys" along;; Howard Boys who made it on a £5 bike; Denny Allen and party; Vic Rigby and party to mention but a few.

* * *

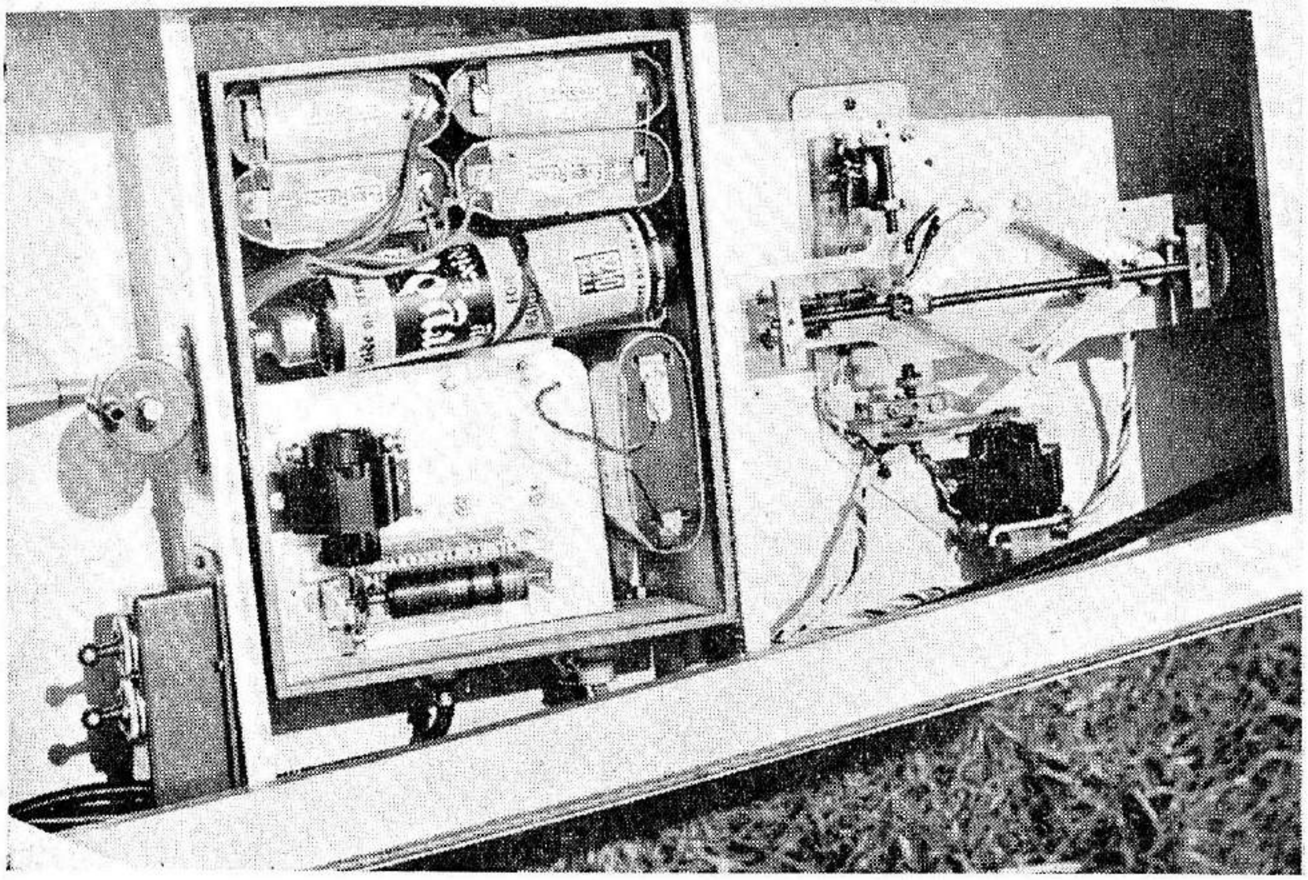
Monday at the Streil's shop in Rotel-Strasse was centre of R/C invasion! Everybody who was anybody turned up—and if it can't be bought there it can't be made in Europe!

* * *

We phoned our results home to England from there—but would they take the money? Eventually agreed to put it in the Pestolozzi Homes box! Thanks Mr. and Mrs. S.

* * *

Huge "Mido" clock facing competitors, judges, and crowd, kept everyone advised of the relentless minutes. Rex Franklin was there—is a clockmaker—can we hope for imitation Rex?



The author's selector mechanism installed in G. C. Chapman's cruiser to actuate the Kitchen rudder also described in this issue, proportional linkage for which is on the right. The whole battery box and selector unit lifts out in seconds.

Motor Driven Selector

FOR BOAT WORK

by

I. R. Bittle

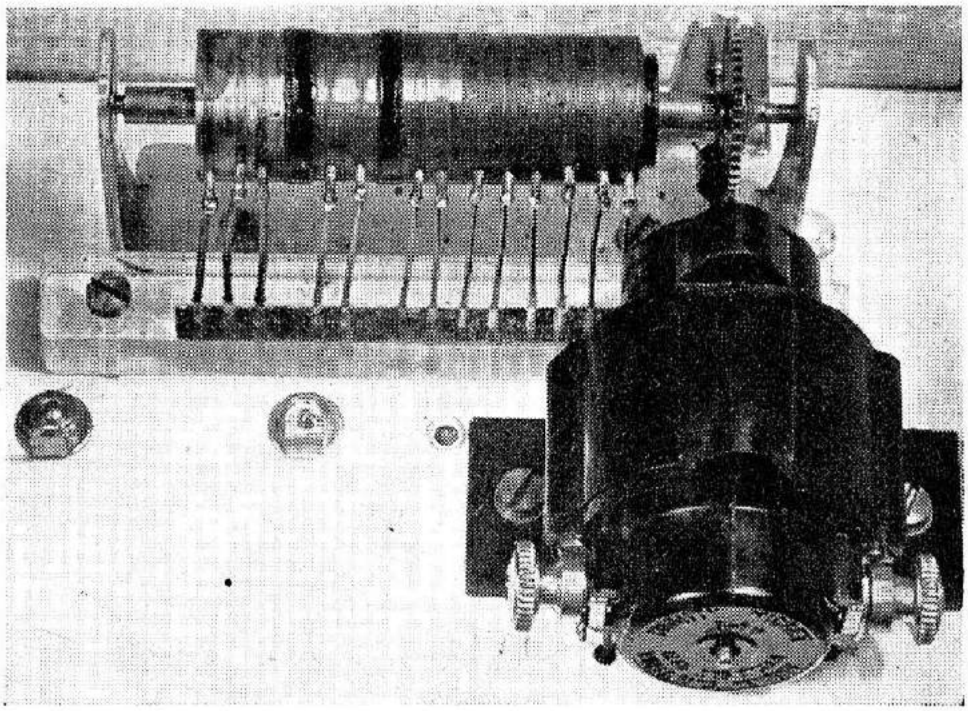
THIS ARTICLE AND THAT WHICH FOLLOWS ON THE KITCHEN RUDDER ARE THE WORK OF MEMBERS OF THE NORTH KENT NOMADS, A CLUB LONG KNOWN FOR ITS AERO-MODELLING ACTIVITIES (WORLD RECORD R/C DISTANCE MAN CHARLIE DANCE IS A MEMBER) AND NOW ESTABLISHING A PROMISING MODEL BOAT CADRE

THIS system was developed by G. C. Chapman and the author to give two separate progressive controls using single channel radio equipment without the need for mark-space and rate control with all the heavy current drain involved.

In the simplest form, the system was employed to give progressive rudder and engine speed control in a 42 in. cruiser powered by a 10 c.c. petrol engine. In the more advanced form, the system was used to control the two functions of a Kitchen rudder, and to provide 'neutral cups' and rudder centralising, in a 36 in. boat powered by a 3.5 c.c. diesel. Both boats have been operated over three months without any failure from the selectors.

In essence, the system is no more than the ordinary post office selectors, but it is lightly constructed, operated by a Mighty Midget electric motor on 3 volts, and can be made to select and return to zero position very quickly.

Before describing the construction it is necessary to point out that the originals were built with the aid of a comprehensively equipped Myford lathe and a drilling machine, but these details of construction are offered in the knowledge that this is not essential.



Close-up of the selector drum and the thirteen contacts. Whilst the unit described can be copied exactly and will provide first rate operation, it is probable that most would-be users will modify it to suit their particular requirements.

Selector

The selector is really a development of the R/C actuator which was described by Laurie Ellis in the *Aeromodeller*.

Here the Mighty Midget is made to turn a contact drum through the 50:1 step down gears which can be purchased for 1/- from Messrs. Franks of New Oxford Street (these ubiquitous gears are in a part of a slot meter train and two such sets of worm and wheel make up one unit).

The contacts drum is in two parts—one part used to index the drum to any one of four positions—the other to carry the necessary bridging contacts to control the actuators. In the diagram of the drum development the contacts EFG and HJK are used to operate two actuators, say EFG for rudder and HJK for engine.

Referring to the same diagram, the Mighty Midget is connected through a 3 volt battery (Ever Ready 1839 used in original) to contact A, which wipes continuously on the brass indexing drum, and through the relay contacts to B and D (a P100 relay was used but any relay with good contacts would be suitable). Contact B is connected to the normally made side of the relay. Clearly with normal standing current the selector will run unless contact B is on the Araldite pad in its track. Then, provided the selector will stop quickly, when the current to the motor stops, the selector will always 'home' with contact B on the Araldite pad. Contact D moves on a track which is interrupted with four pads of Araldite which align with bridge contacts C1, C2, C3, C4, on the second drum.

On receipt of signal the relay changes over and the motor circuit is completed through A and D, via the brass indexing drum and the selector will run until contact D lies on the pad 1. This will bring bridge contact C1 under the actuator contacts E and F and produce say, right rudder.

On release of signal the selector will run round to its home position making very briefly contacts via C2, C3 and C4, and producing a small movement of left rudder via FG, but no net movement of the engine actuator.

Position 2 of the selector can be found by giving a short pulse of signal to bring D on to pad 1, a short period of 'no signal' whilst D is carried to brass between 1 and 2 and then a held signal whilst D rests on pad 2. Position 2 will give left rudder through FG and C2.

Similarly 3 may be found by giving two pulses of signal and holding, and position 4 by 3 pulses and holding.

For high speed and reliable operation these signals must be sent out by a control box.

Control Box

The control box has to provide a simple method of transmitting the necessary code. The signals required for the various positions are: position 1—single continuous signal

position 2—pulse—hold ;
position 3—pulse—pulse—hold ;
position 4—pulse—pulse—pulse—hold.

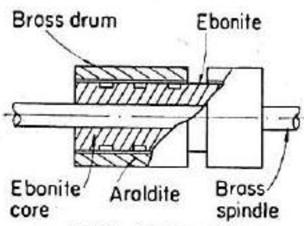
In addition the control box must be matched to the selector to give a minimum delay between the sending of a signal and the indexing to the correct position.

The original system gives a lag of less than one second between pressing of any control box button and the movement of the appropriate actuator.

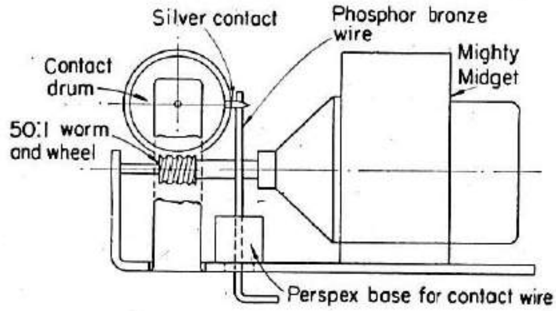
Several ways of making such a box have been published previously, but this is offered as a simple matched box.

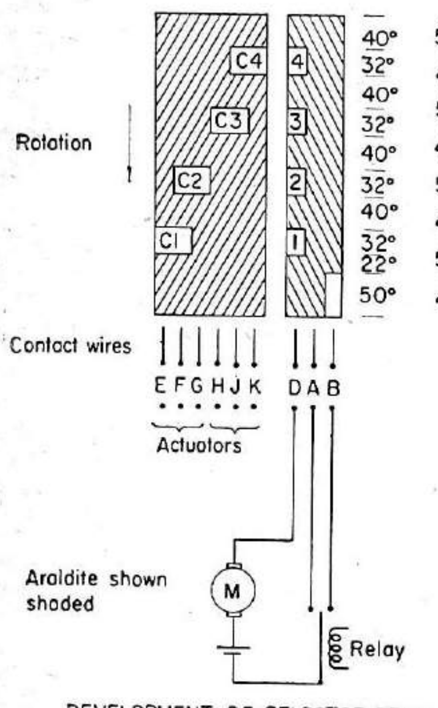
The control box is made in a very similar way to the selector. Here another drum is driven through the 50:1 reduction gears using another Mighty Midget and a 3 volt battery, and as before a relay is required to control the drum rotation. (This relay may be a high resistance relay but any relay which will operate on 3 or 4½ volts would be preferable.)

Referring to the development of the control box drum, contact A, which wipes the drum continuously, is connected via a 3 volt battery through the Mighty Midget to the relay. Contact B is connected to the normally made contact of the relay. Contact C is connected through a 10 ohm potentiometer to the other side of the relay and D is connected directly to the same side of the relay. The drum has one Araldite pad in the track of B and when the relay is not energised the drum homes with the pad under contact B. When the relay is energised contact is made through both C and D. The full voltage is applied through D and the drum starts and runs until D comes on to the Araldite strip and then the motor is fed via C through the speed controlling potentiometer (in this way the static friction is overcome by the full 3 volts). The drum will come to rest when the pad in track of C comes under C and will have made about seven-eighths of a reduction. The breaking of the relay

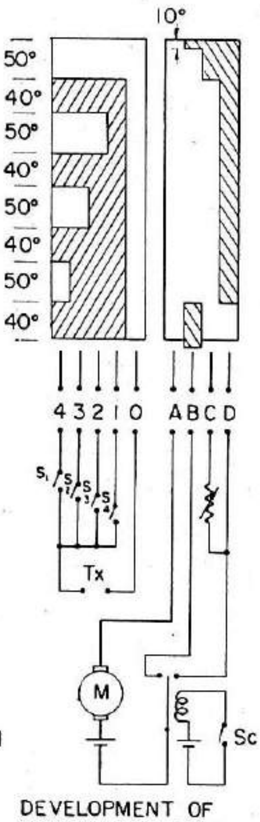


PART SECTION OF CONTACT DRUM

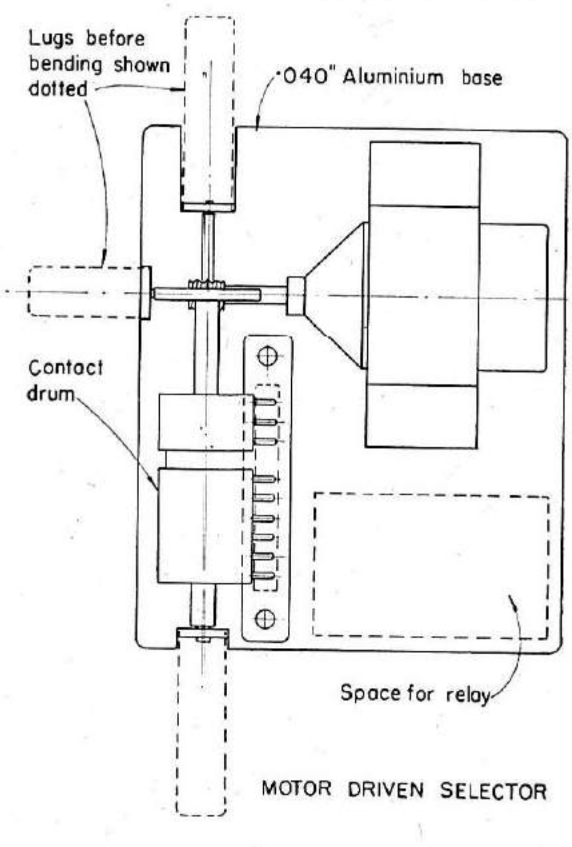




DEVELOPMENT OF SELECTOR DRUM



DEVELOPMENT OF CONTROL BOX DRUM



MOTOR DRIVEN SELECTOR

current will apply full voltage through B to bring drum to home position.

The second drum of the control box has five wipers 0, 1, 2, 3, and 4, and the contacts 1, 2, 3, 4, are connected through switches S1, S2, S3, S4, via the keying lead of the transmitter to common contact and this second drum has four equally spaced contacts as shown in the development. When the drums are in the home position the contacts 1, 2, 3 and 4 rest on Araldite and give no signal and it is easily seen that if say, S3 is closed and the relay energised, the subsequent rotation through seven-eighths turn would transmit pulse—pulse—hold (position 3). Similarly switches S1, S2 and S4 will give the other signals required.

It should be noted that the drum is laid out to give the same delay on all four positions and this assists materially in judging the actuator movement.

It is clear that four double pole, single throw, press switches are required, but these can be made quite easily or there are suitable ganged switches on the surplus market.

Construction

The selector and control box are substantially identical items in form and the details of the selector will serve for both.

The baseplate was made by fretsawing from .040 in. aluminium sheet and bent up.

The drum was machined from ½ in. stock brass and the outside surface was milled to receive Araldite for pads 0, 1, 2, 3, 4, on the indexing drum and milled away to leave only contacts C1, C2, C3, C4, on the other part. The milled depth was about .025 in. The drum was then drilled and bored, roughly, to about ⅜ in. inside dia. and parted off in one piece, i.e. without separating the two parts of the drum.

An ebonite rod was then turned to make a loose fit (.005 in. clearance) inside the drum and the ebonite was serrated with shallow parting cuts. The drum was then stuck to the ebonite and at the same time the whole of the outside of the drum thickly coated with Araldite.

It will help with the inevitable explanations if the Araldite is coloured. This can be done easily by mixing say, red Dylon with the hardener for some 15 minutes before adding the adhesive. In coating the drum it is as well to avoid air bubbles, although these can be filled afterwards and a wet finger is useful to get the Araldite in the right places.

When the Araldite was set the drum was skimmed over to the original diameter and the two parts separated electrically by a single parting cut. The ebonite was drilled to take a ⅛ in. dia. spindle and then the ebonite parted to give a drum complete.

⅛ in. brass rod served as a spindle and was turned down at both ends to give bearing spigots and one end also turned down to take the wheel of the reduction gear. (This wheel can be pressed off the original shaft and soft soldered to the spindle of the selector drum.)

The Mighty Midget was modified by either removing the end cap and bearing on the old pattern, or opening the bearing to $\frac{3}{32}$ in. dia. on the current pattern to give shaft clearance. The worm which was integral with its shaft was cut to length and drilled axially $\frac{1}{16}$ in. dia. to accept the shaft of the Mighty Midget and the two soldered together. The motor was then fixed to the baseplate and set up to turn freely with the bearing provided by the baseplate lug.

The drum was then mounted on its lugs in holes carefully drilled to give smooth meshing, and the assembly checked for smooth running.

The base for the contacts was made from ¼ in. thick perspex and was drilled to take eight contact wires. This involved eight holes of .021 in. dia. (No. 75 drill) and a certain amount of care was required. The contact wires were of .022 in. phosphor bronze salvaged from vacuum cleaner motor brushes and these were a push fit in the perspex. Soldering loops were made on the end of each wire and a slot is required in the baseplate to clear these loops.

The contacts were made from .032 in. dia. silver wire (this is surprisingly cheap from Johnson Matthey) and were made by flattening the end of the wire and then drilling through the flat, No. 75 again, to take the phosphor bronze wire. The contact was then soldered to the wire and cut to length.

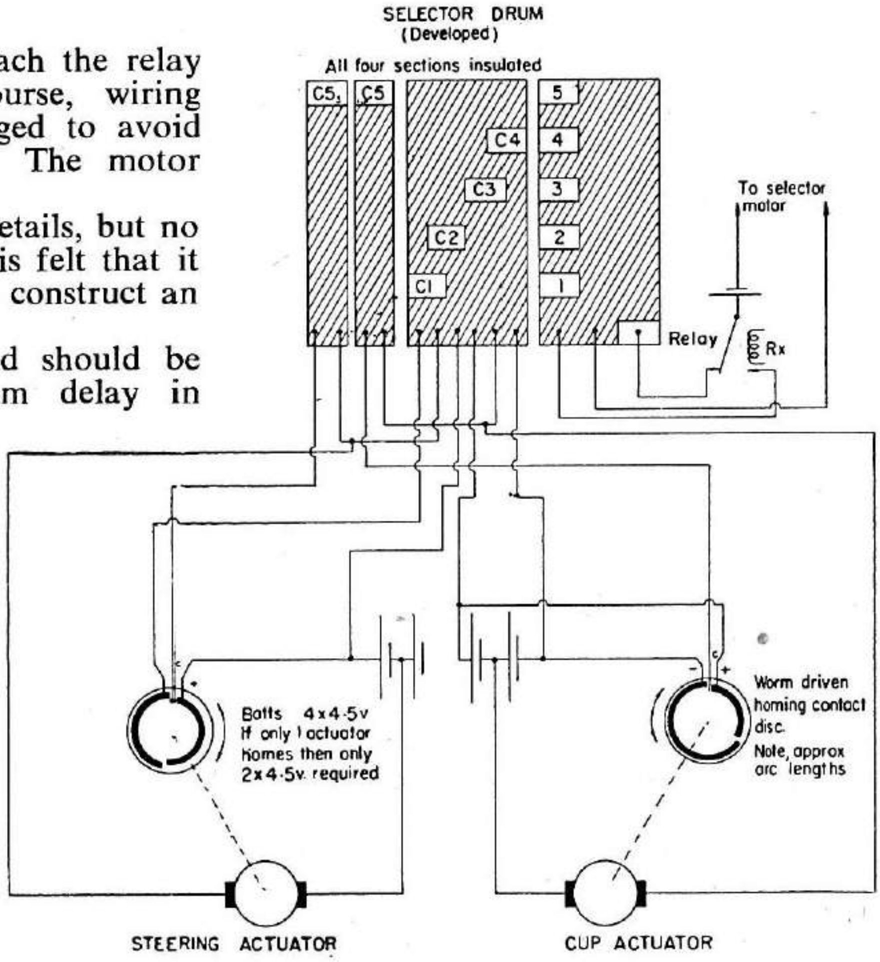
The perspex was drilled and tapped 8 B.A. for fixing to the base and it was found necessary for the contacts to bear quite heavily on the drum to provide a positive braking action on the drum.

General

Provision is made to attach the relay to the base and, of course, wiring should be neat and arranged to avoid failure due to vibration. The motor should be suppressed.

The drawing shows the details, but no dimensions are given as it is felt that it is unlikely that anyone will construct an identical one.

In use the control speed should be adjusted to give minimum delay in selecting the desired position. The synchronisation is dependent on battery voltage, but in use the first sign of lack of synchronisation is a missed signal, which is not followed by a series of missed signals and the remedy is to replace batteries immediately.



The number of positions is not limited to four, a five position selector has been used with complete success and will be given in form with an article on a kitchen rudder. In this case the selector contact drum was in three sections and in all 13 contacts wipe on these sections. This selector will 'find' all five positions in turn and home in seven seconds.

In offering this it is felt that there are other ways of making the equipment, perhaps silver wire is not necessary on the contacts, and so on, but at least it is offered in the knowledge that it has been tried and not found wanting.

Kitchen Rudder

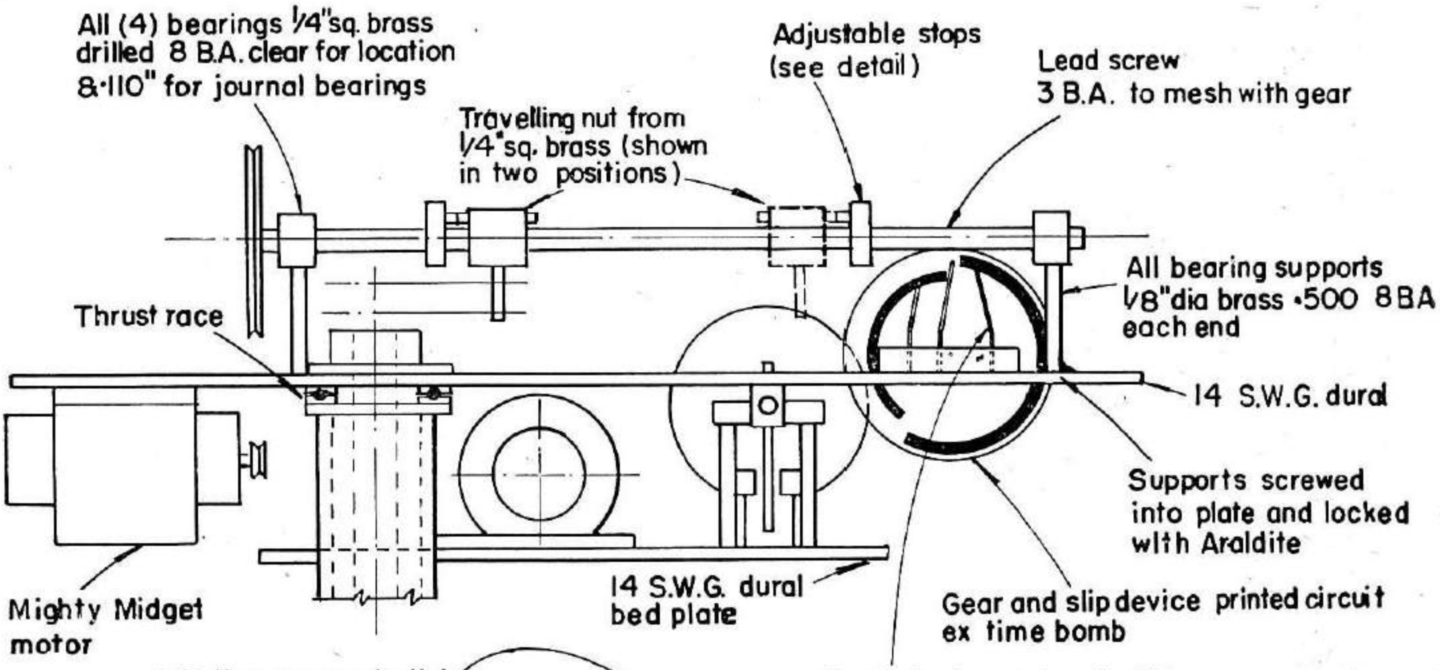
& ACTUATING MECHANISM

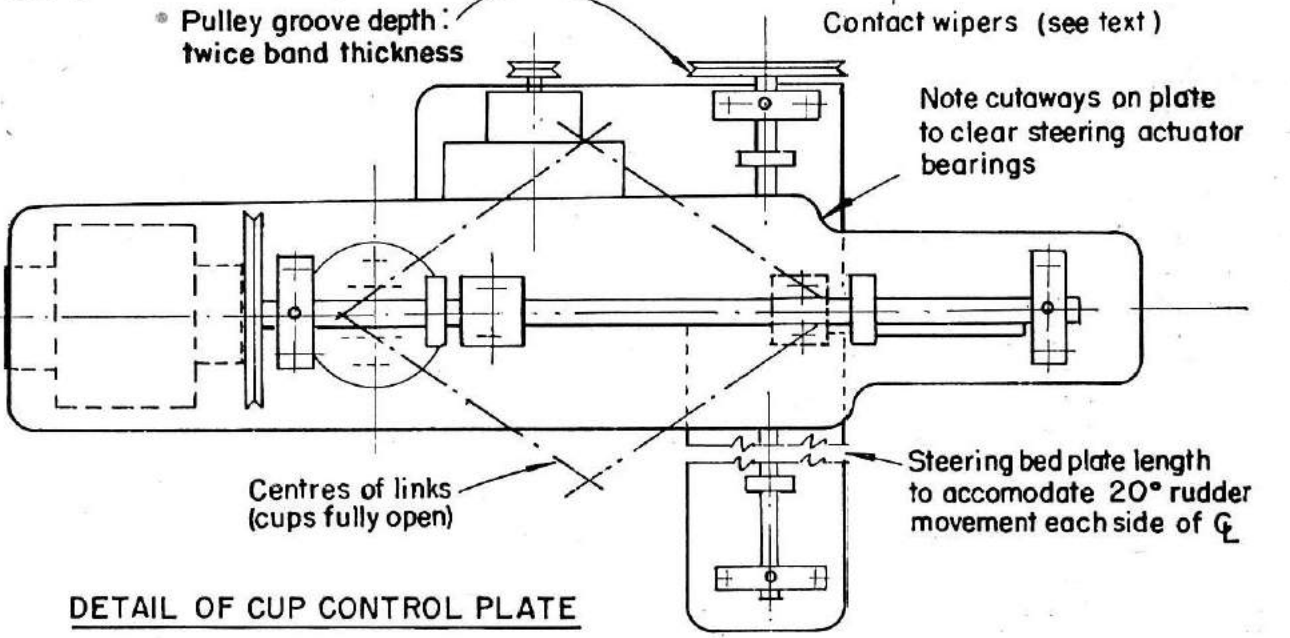
By G. C. Chapman

THE writer's interest in the Kitchen Rudder for model boat work was because it has certain attractions over the conventional steering and speed control.

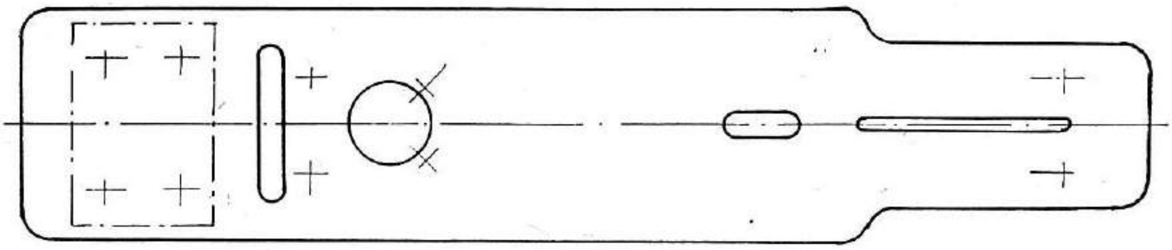
In operation the Kitchen Rudder is fascinating and a source of amazement to the uninitiated. One has complete control regarding steering as well as infinite control from max. speed to zero, and slight control of reverse speed. It is fair to mention that accurate steering in reverse is difficult to accomplish since one obviously has very peculiar flow conditions around the cups at this time, but it is a question of learning to operate the rudder rather than a basic fault of the principle.

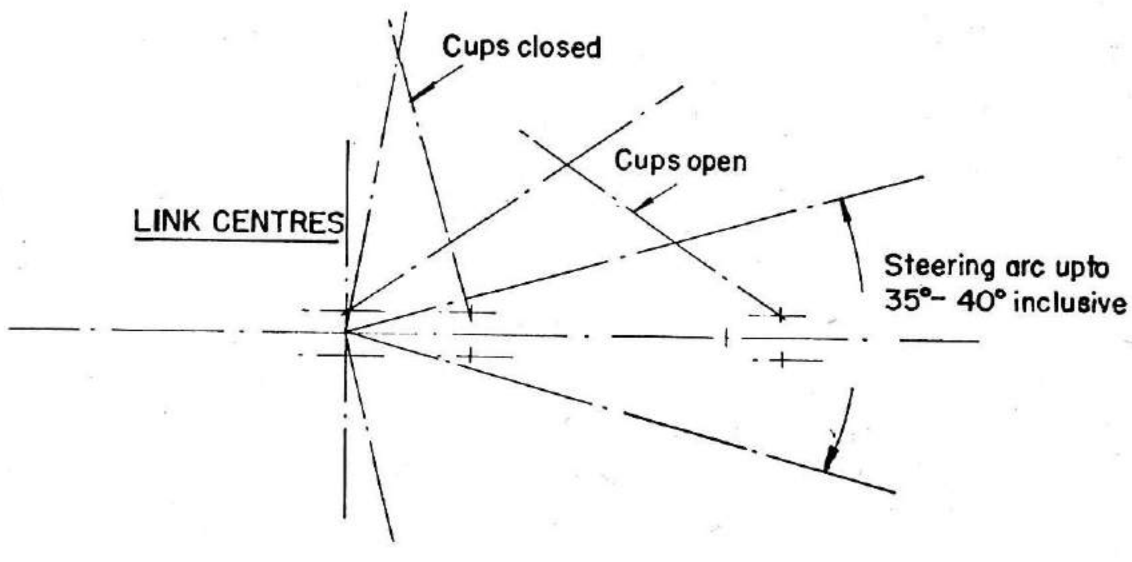
The writer's boat, a 36 in. hard chine hull driven by an ED.346 is of heavy construction and moves at quite a fair turn of speed, yet it can be stopped dead by the Kitchen Rudder in some two lengths. Further, it is very convenient to be able to tune the engine of the boat in the water when the cups are at the fully open position, ask one's assistant to operate the appropriate control with the boat just sitting on the water with the engine running, and then come out of the water at one's

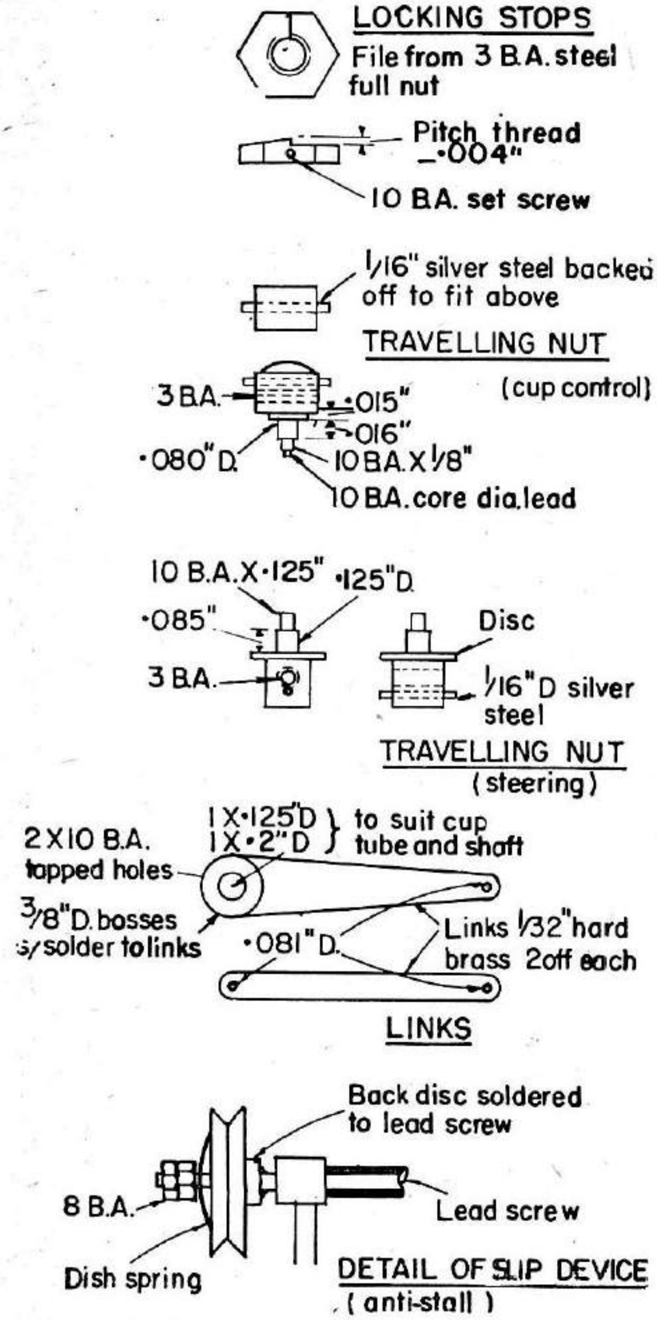


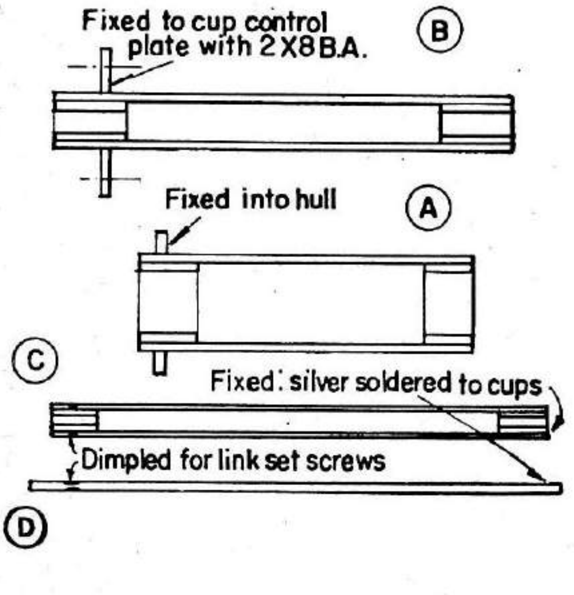


DETAIL OF CUP CONTROL PLATE









leisure rather than do a Forth Bridge act twixt boat and control box!

The principle of the Kitchen Rudder is for an adjustable duct to be mounted around the propeller so that one can control the direction of the thrust of the screw bringing the cups together or apart for speed control, and by turning them as a pair for steering control.

With this basic principle in mind a design was produced to bring about these functions as simply and as trouble-free as possible.

At this point it is appropriate to mention that the writer is indebted to Mr. I. R. Bittle and Mr. A. D. Smith for their guidance and constructive criticism on the project.

Method of Control and Operation

The actuator can be controlled either by multi channel, four or six reeds, or by the selector system of I. R. Bittle previously described.

This rudder was operated by the selector method and gave fast enough response at all speeds.

Dealing with steering control first, this is of the conventional lead screw and travelling nut mechanism, and whereas one normally moves the rudder operating bar, this is now in the form of a baseplate carrying the cup control mechanism. Referring to the electrical circuit it will be seen that on the boat selector moving to position 1, current is made to flow through the motor in one direction giving, say, right rudder, and by moving to position 2, the current flows in the opposite direction giving left rudder. Whilst this is all very well for simple steering, it is sometimes useful to be able to put the boat quickly on to a straight course. Towards this end homing contacts are fitted so that on making position 5 on the selector the rudder homes straight (to be more correct, homes to give straight running with allowance for torque). At this stage the method discussed has been no more than the movement of two rudders set either side of the propeller, swinging as a fixed pair. For speed and control we now move these two rudders independently.

The cup control plate carries the lead screw and travelling nut in just the same way as with the steering actuator; the motor is underslung for convenience and to give a reasonable belt length.

The method of giving the cups angular movement is by our old friend the lazy tongs mechanism. One end of the tongs is locked to the shaft and bearing tube carrying the cups, whilst the other ends of the two pairs of links meet at the common point on the travelling nut. It will be seen that as the nut moves back and forth along the lead screw so the cups are moved about their axes in opposite directions.

It has been arranged that when the travelling nut is furthest from the rudder post, the cups are at a fully opened position, and when it is nearest the rudder post they are fully closed.

As this piece of equipment was made solely on an experimental basis, the writer first thought that it would be advantageous to have the cups homing on a stop position as well, i.e. when the selector reaches position 5 we have the condition in the actuator of steering straight—cups producing no boat movement. Whilst this may be extremely useful for certain types of intricate course steering for normal Sunday afternoon running, it was found something of a nuisance and disconnected. It has been left on, however, for those who may feel they have a need for the full box of tricks.

Electrically, the method of operation of the cup control is exactly the same as for steering except that time positions 3 and 4 are used on the selector to reverse polarity on the motor to give cups open and cups closed respectively.

Method of Construction

The prototype was produced from bits and pieces in the writer's workshop, and the only items which need to be purchased are the two Mighty Midget motors (the writer strongly recommends Mighty Midget motors since whilst they are a little more costly initially, their running costs are considerably lower than the cheaper motors on the market). The 14 s.w.g. dural bed plate for the steering actuator should be marked out, profiled, drilled and tapped to take the bearing supports and homing device contacts.

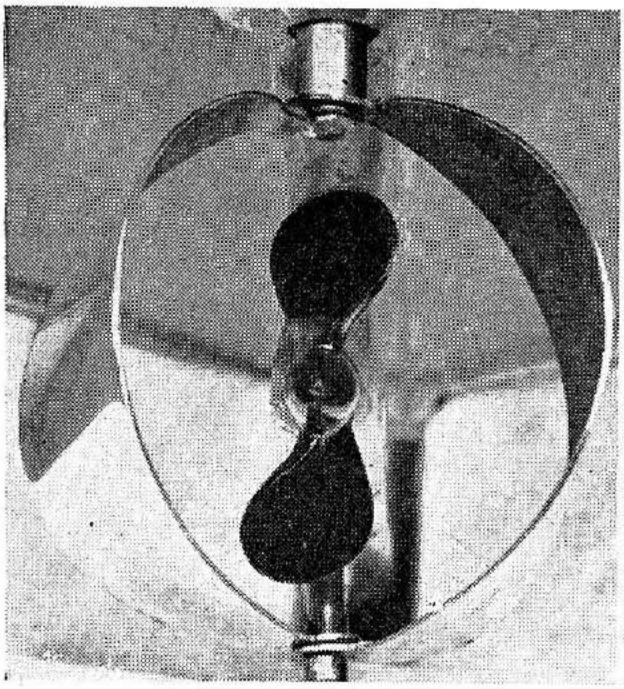
The bearing supports were made from ⅛ in. dia. brass rod, screwed 8 B.A. each end, screwed firmly into the dural bed and a fillet of Araldite wiped into the corner to give added strength.

The bearings were made from ¼ in. square brass, drilled to clear the 8 B.A. ends of the support rods and drilled .110 in. dia. to carry the reduced end of the 3 B.A. steel lead screw, a small oil hole being drilled at the top. With the bearings and lead screw assembled, the homing worm wheel is held in position and its centre marked on the bearing formed on the bed. The contact carrier was made from ¼ in. sheet perspex, drilled to carry the other end of the homing gear and also for the three contact wires. The main pulley, approximately 1 in. diameter, was then fitted to the end of the lead screw together with its slip device. This slip device is something of a luxury but it does prevent the heavy current surge of a stalled motor. If it is not fitted, then the pulley can be secured permanently to the lead screw. The Mighty Midget is then fitted to the base and the mechanism given a test run to ensure that it runs sweetly and all is in line. The travelling nut was machined from ¼ in. square stock brass and should present no problem.

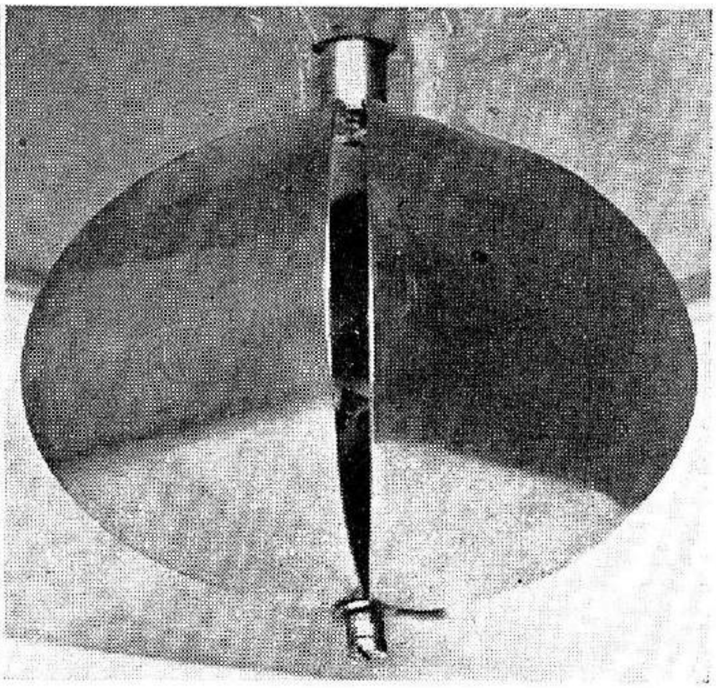
The limiting device consists of a stop pin carried on the travelling nut which engages in a sprag formed on a 3 B.A. full nut. This nut can be secured either by a small set screw (brass) or, if length permits, by a lock nut behind it.

The homing contact drum was extracted from a time bomb mechanism purchased from Messrs. Proops of Tottenham Court Road, London, which consisted of a useful collection of gears together with two slip devices already mounted on to a gear which conveniently meshes with 3 B.A. to form a worm wheel. The disc of the slip device was used to carry the contacts arcs produced on the printed circuit and Araldited to it. The wipers were made of silver wire tips soldered to phosphor bronze wire, and fitted to the perspex as described in the previous article on selector. This slip device proves very useful since one can change one's "homed" position at will simply by slipping the circuit disc round.

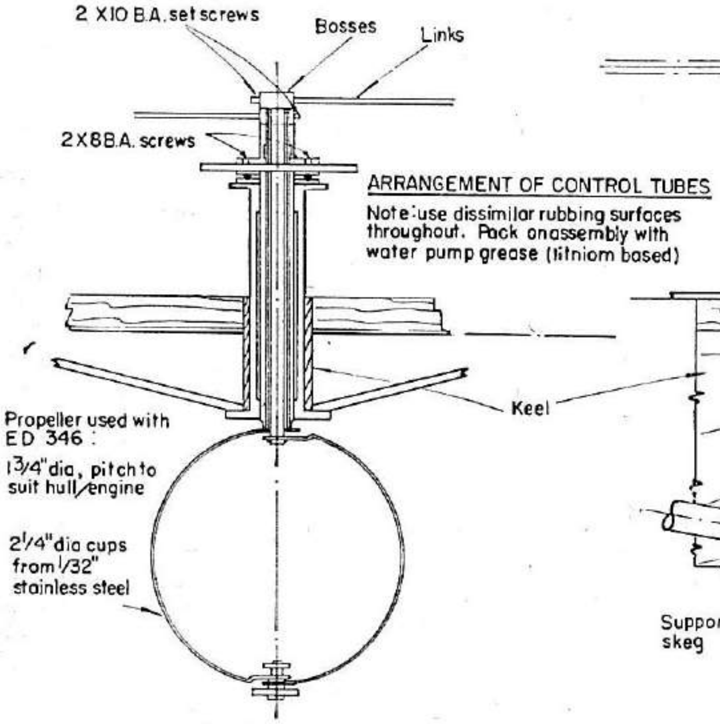
The manufacture of the cup (speed) control actuator is very similar to that of the steering mechanism, and regarding lead screw and bearings and supports, these should be made and tested in exactly the same way. If a homing device is to be fitted then clearly the number of teeth on the worm wheel will have to be greater than that used for steering. It was found that the stop position of the cups was approximately

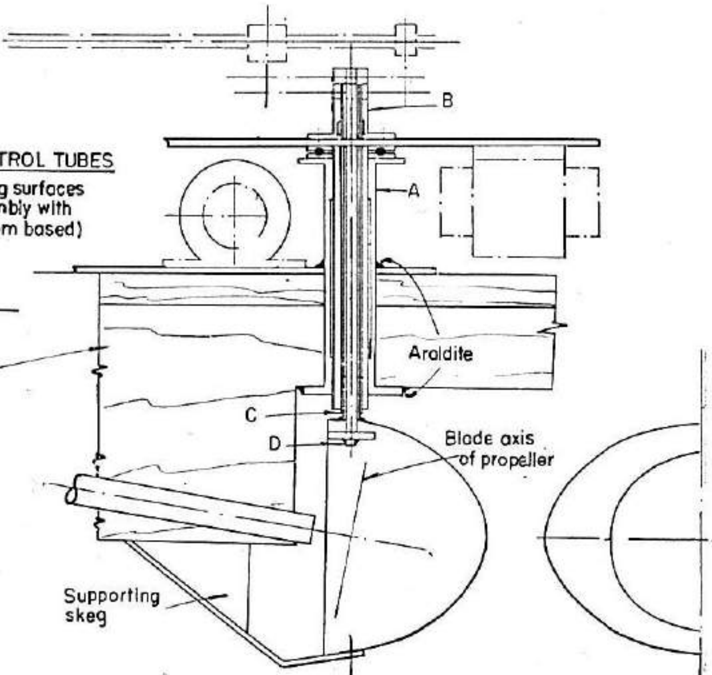


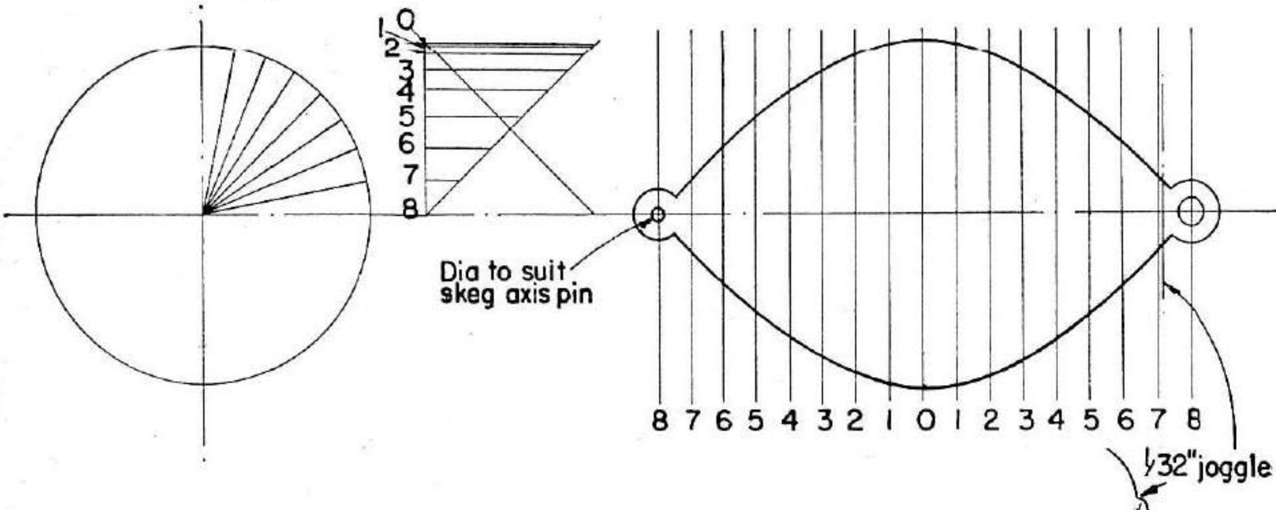
Kitchen rudder shown in almost full open position, which gives an idea of prop clearance desirable, and shows how the developed parts are located.



Here the Kitchen rudder is completely closed, and should then line up fore and aft through the boat. Halves do not close tight, but leave the slit shown.







½ in. of nut travel from the reverse position. This information is given to assist in deciding the length of contact arc.

The links were manufactured from $\frac{1}{32}$ in. hard brass (a material known as Point Rule and used in the printing trade and obtainable from Smiths of Clerkenwell).

The cups were made from stainless steel, and it is suggested that this material or mild steel at least be used since subsequent silver soldering necessary would soften the brass, and if the writer's cups are anything to go on, it has been found most useful to be able to bend the cups back into position after a few stones have been inadvertently picked up from the bottom of the pond and passed through the cups with amazing speed. Whilst stainless steel is difficult to work, the writer managed quite well with tin snips and considers it well worth the extra effort.

The cups are cut to the developed shape, and it is strongly recommended that the maker develops his own cups directly on to the steel since this does give greater accuracy and produces a neater looking finished result. The cups were formed by simply bending them round a mandrel slightly smaller than the finished diameter to allow for the outward spring. They were then joggled top and bottom to allow one to fit inside the other, drilled for the locating pin of the skeg, and to carry the control tube and shaft at the top. The control of the cups is brought from the actuators to the cups by a system of shaft and tubes mounted through the keel.

The diameter of tube A is dictated by the tubes which it has to contain, the writer's tube build up is as follows, starting from the innermost shaft.

Shaft D is ⅛ in. dia. silver steel which is silver soldered to the cup and joggled innermost. This is carried on the end bearings of tube C; the outside of tube C being silver soldered to the outer cup. The assembly C and D is free to rotate inside tube B which is fixed at its upper end to the cup control plate, and this whole assembly mounted to B is free to turn within A. On the writer's model tube A is a piece of ½ in. bore brass tubing, and it is suggested that careful selection of the tubes is made so that tube A does not grow any more. Tube A is virtually the rudder post bearing and is a good fit into the keel, the tube is Araldited into position top and bottom for sealing purposes.

The light thrust imposed by the cup control plate is carried on a thrust race mounted between flange on tube A, i.e. the underside of the dural plate. Whilst a race is shown this is not strictly necessary.

Assembly into Hull

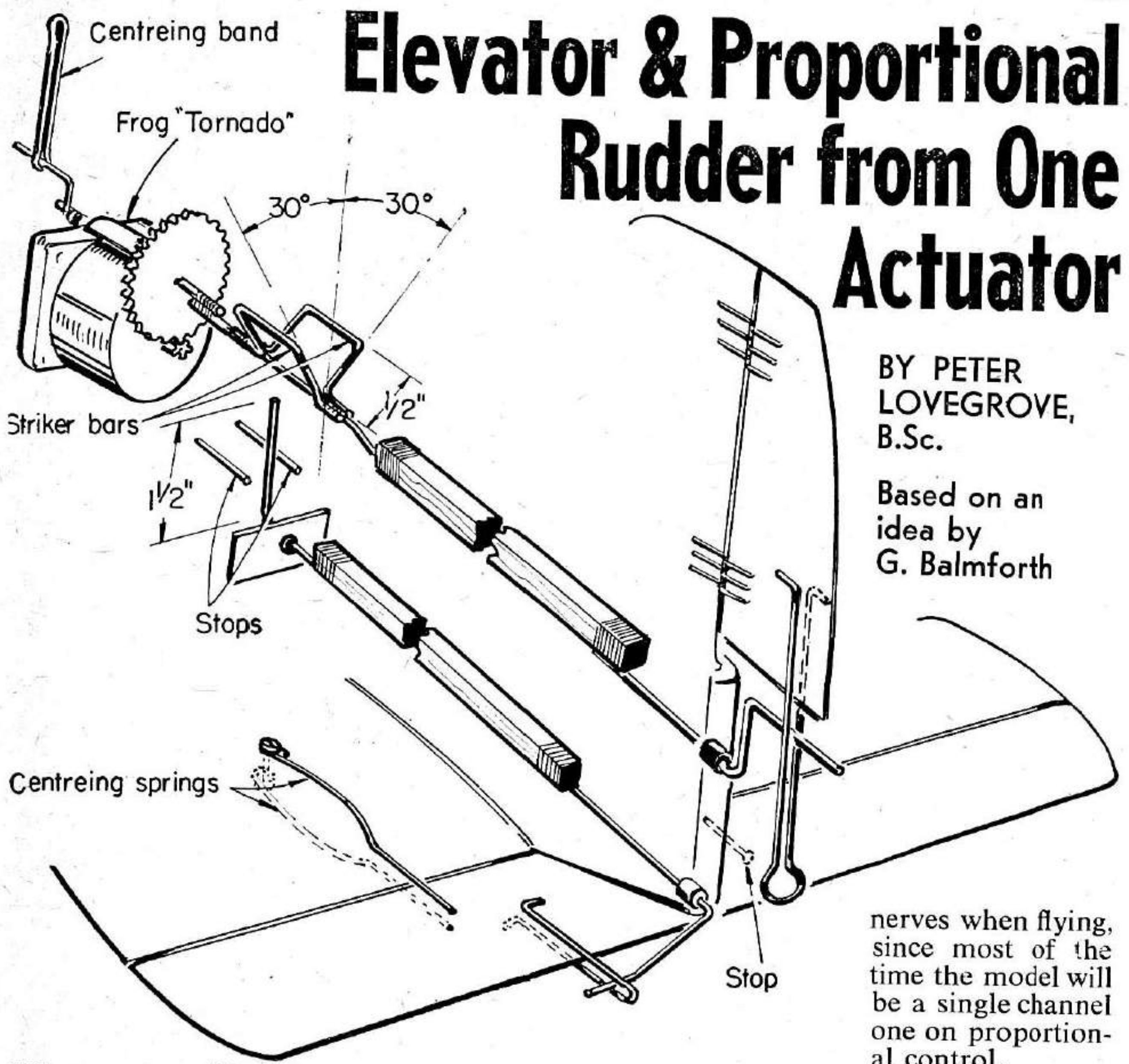
It is strongly recommended that before installing in the sometimes confined space of a hull, actuators are made and assembled to a piece of substantial plywood and given a good 'playing with' so that one becomes familiar with the mechanism and also any slacknesses and so on can be taken up before final fitting. To assemble, tube A is firstly firmly fixed to the hull, the steering actuator assembled — complete with travelling nut and driving tube—and located in position, the thrust race is laid in the flange of tube A. Tube B is fixed to the control plate which has fixed to it the motor and homing device. This is then lowered through tube A and the steering travelling nut located through the elongated slot. With the skeg removed from the hull the cups are inserted inside tube B as one assembly and the link which is to locate on tube C fitted to it. At this stage it is a good idea to substitute the set screws with brass screws. These screws are tightened gently for marking purposes in what appears to be the approximate position, and the link fitted which is to engage with shaft D—again screws tightened gently. The travelling nut and locking devices should be already fitted to the cup lead screw, and this is located on the bearing supports ensuring that the thread does not top with the worm wheel. The links are now brought round so as to locate with the travelling nut and the 10 B.A. nut engaged on the reduced diameter at the end. The nut and washer are then run up so as to lock on the shoulder of the travelling nut, and there should be just a small amount of end float so the links do not bind. A few drops of light oil are applied to the bearings, and the mechanism should operate smoothly throughout the traverses indicating that there are no tight spots.

The rudder is now ready for a short test on the pond. The cups are removed and their respective shaft and tube dimpled for the final assembly with steel set screws.

Elevator & Proportional Rudder from One Actuator

BY PETER LOVEGROVE, B.Sc.

Based on an idea by G. Balmforth



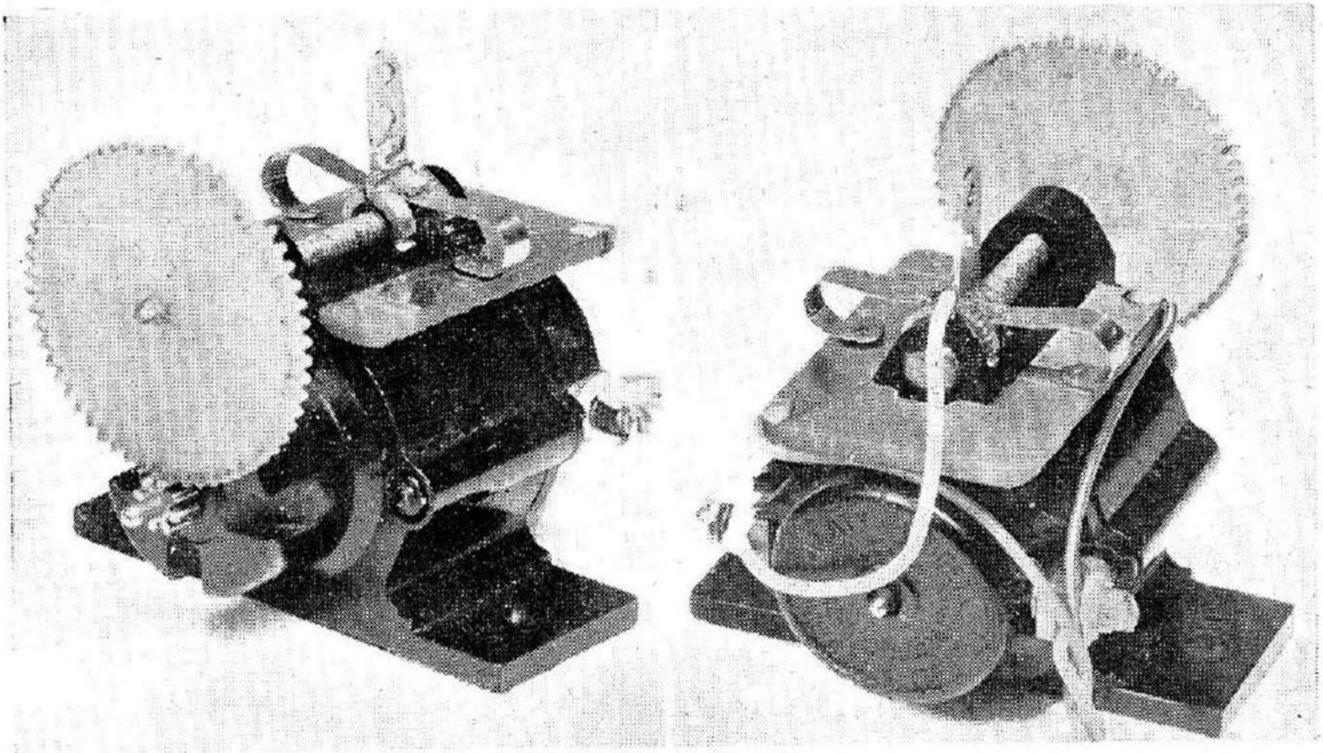
THIS system differs from the Galloping Ghost scheme in that the rudder is pulsed at a fixed rate and automatically goes neutral when up or down elevator is brought in by full or no-signal. Such a scheme requires rather less in the way of control gear at the transmitting end and is also far easier to fly successfully than the G.G. system. This is in no way meant as a criticism of the latter; dual-proportional control in any form is excellent, but it is not easy to learn to fly it. Nor is it merely a case of keeping the control surfaces small on the first models in order to make them manageable for learning. I reduced the control areas on one low-wing G.G. design to produce a pylon racer and the darned thing turned out to be the most manoeuvrable I had ever made!

Therefore I think there is much to be said for a non-simultaneous rudder-elevator system. The tyro is less likely to clobber his model so often and generally will not be in such a state of nerves when flying, since most of the time the model will be a single channel one on proportional control.

The actuator in this system, like that in the G.G., consists of one motor. There is no weight problem and the scheme has been used by G. Balmforth in a "Gasser" by which it seems ideally suited. He used a Frog Tornado with its own nylon gears. A single No. 8 battery served, with a tap between each 1½ V. cell. With 1½ V. the Tornado draws only 60-80 m.A. current so that a reasonable life is obtained.

Reference to drawing will show the principles of the system. The layshaft of the motor drives a crank which controls the rudder proportionally in the normal way. This crank only swings in the upper 180° arc, its movement being restricted by the rate of pulsing, mark-space variation, battery supply, and spring tension. If full or no-signal is given the motor drives the crank round to bottom dead centre where it hits a stop.

The rudder loop is enlarged slightly at the bottom so that it can rest neutral



Mighty Midget Modified . . . .

WE have received from Mr. M. Franklin of Leicester a very neat little servo using the Mighty Midget as a basis. He has been using it for about a year for trimmable engine control and has found it very satisfactory. It is now being used in conjunction with a standard Bonner for trimmable elevator for inverted flying.

The main Nylon gear is threaded partly 6 B.A. and is a tight fit on a 6 B.A. shaft. The nut on the shaft is a standard M/Midget filed flat on one side to allow it to slide on the paxolin switch board. This board is a standard printed circuit board cut to allow travel to the maximum either end of the shaft.

The sliding contacts are centre punched to give better running either way. The P.C. board is cut so as to allow the shaft to assist the contact pressure as it rotates.

ELEVATOR AND PROPORTIONAL RUDDER . . Continued from page 303

although the crank is actually a few degrees off centre due to the stop. Slipstream helps to hold the rudder when elevator is applied.

On this rudder-control shaft are two square loops or cranks which, when the rudder crank swings to B.D.C., strike the elevator linkage and apply up or down elevator as the case may be. The elevator is spring-loaded neutral as is done with compound escapements.

Points to concentrate experiments on:—

1. Centring pull and radius at which it is applied to gear shaft.
2. Angle between the square 'striker' loops, and radius of striker bars relative to (3).
3. Length of actuating levers on front and rear of elevator torque rod.
4. Positioning of pivots for elevator torque rod relative to rudder torque rod pivots.
5. Stiffness of elevator centring springs.
6. Pulse rate on control box. Four to eight cycles seems to be the best range from which to choose.

One simple modification may be made and that is to omit the stop at the bottom of the rudder crank swing. On full or no-signal the motor will then rotate freely in one direction or the other. The elevator is thus fully deflected and returns to neutral once in every revolution of the rudder crank. This avoids stalling the motor (not serious really at 80 m.A.) but still gives up or down elevator with neutral rudder. But, of course, to rotate fully the striker loops must be able to ride up off the end of the elevator lever.

SOLDERS & Soldering Methods

By R. H. WARRING

SOLDERING is something which people seem to do well—or very badly. And unfortunately too many modellers struggle along in the latter category, with resultant failures due to dry joints, etc. Soldering is an *essential* feature of most electrical work, so let us examine the basic facts and requirements for successful work.

Soft soldering, to which we are referring, applies to the use of soldering alloys of relatively low melting point which wet the surfaces of the metals to be joined, fill the spaces between these surfaces and adhere strongly to these surfaces after solidifying — or should do! The soft solders most widely used are alloys of tin and lead, and these are available in a range of different compositions. The composition governs the melting point of the solder, and thus the soldering iron bit temperature required for proper application.

Basically the tin-lead alloys within the range of useable solders all *commence* to melt at 183 degrees C., but only one specific alloy (62 per cent. tin) will actually become fully liquid at this temperature. The others remain in a 'pasty' or 'plastic' until some higher temperature is reached. It is generally reckoned that the *bit* temperature required is 40 degrees C. higher than the actual melting point of the solder—and this can represent a difference of nearly 100 degrees C. over the range of common commercial solders — see Table I.

Solders most commonly used for electrical work comprise the range 40/60 tin/lead to 60/40 tin/lead and an iron maintaining just enough heat for work with a 60/40 alloy will not, most probably, be really hot enough for a 40/60 alloy.

Of the lower melting point solders, 60/40 alloy is specified for electronic work where there is a danger of overheating delicate components; 60/40 and 45/55, generally, for television and radio assembly work; and 45/55 and 40/60 for general electrical and radio work.

The higher melting point solders may be necessary on other electrical work subject to elevated service temperatures —hence the use of the 20/80 alloy on lamps, motors and dynamos—or in extreme cases it may be necessary to go to 'hard' soldering or silver soldering to ensure that the soldered joint does not soften under working conditions. On the other hand, even the low melting point of 189 degrees C. for the 60/40 alloy may still be too high where components are especially heat-sensitive or connecting leads are short. In such cases an even lower melting point alloy —either a lead-tin-cadmium or lead-tin-bismuth alloy may be used.

Solder, as purchased for electrical work, is not just a standard material. Its composition — and thus its working characteristics—can vary widely. For most radio control wiring, in fact, the 60/40 alloy is probably the best to use on account of the minimum heating required. It also scores on two other points—good 'wetting' properties due to the high proportion of tin and a small 'plastic' range (only between 183 degrees C. and 189 degrees C.), which means that it solidifies quickly so that wire joints have only to be held in position for a minimum of time. Industrially there is an equal call for solders with a large 'plastic' range—e.g. a solder for cable jointing which is normally the 30/70 alloy with an 86 degree C. plastic range.

The main thing here is not to get them mixed up! A solder for 'wiped' joints is useless for making quick wiring connections. A general-purpose electrical solder may represent a penalty of some 50 degrees C. extra temperature over what could be used, with consequent greater risk of damage to heat-sensitive components. Transistor leads, for example, can be soldered success-

TABLE I

Alloy tin/lead	Melting point C.	Bit temp. required C.
60/40	189	229
50/50	214	254
45/55	225	265
40/60	232	272
30/70	255	295
20/80	275	315

fully with a low melting point solder without the use of a 'heat dam'—but they could be ruined with the same technique using a higher melting point alloy.

Fluxes do not normally concern the user in electrical soldering since cored solder is almost invariably employed incorporating a 'safe' or non-corrosive resin flux. Any resin-flux residue left, in fact, is even protective.

Resin, however, has a relatively slow fluxing action, hence it will give indifferent results on some surfaces, particularly those which are not cleaned or tinned. Activators are sometimes included in the resin flux to overcome this limitation, some of which may leave behind potentially corrosive products unless fully decomposed by heating. Again this is not normally a worry when the activated flux is used in a cored solder since the flux is automatically heated to a high temperature and melted by application to the solder bit and is normally quite safe for electrical work.

Corrosive fluxes, on the other hand, should never be used for electrical work—even if it does provide an answer to a joint which 'will not stick'. Zinc chloride ('killed spirits') is an excellent flux, but very corrosive. The fused flux residue left after jointing requires washing away in hot water (preferably with a few drops of hydrodilene acid added) immediately. Otherwise the residue sets hard and will not later respond to washing. A final rinse in alkaline water is then required to ensure complete cleanliness. The use of a very weak *acid* wash at first may seem contradictory, but this is to break down the oxychloride formed by fusion. This is then washed off, and final acid traces removed, by the rinse in an alkaline solution.

With acid-type fluxes, areas other than the joint may be affected since rapid evaporation of the flux causes a spray which can re-deposit corrosive particles several inches away from the joint. The one exception is phosphoric acid, which is an effective flux for steel, brass and copper. This does not normally leave a corrosive residue and can normally be regarded as a 'safe' flux—but again one not recommended for electrical work.

Resin fluxes should be perfectly adequate for soldering tinplate, electrotinned copper and brass and other properly 'tinned' surfaces. They are slow in action on bare copper and bare brass, but these surfaces can be satisfactorily 'tinned' provided they are initially clean. Activated resin fluxes generally have rapid action on bare copper and brass and a reasonable response on clean steel. Plain resin flux is too slow for most practical purposes on steel.

Thus the requirements, and the techniques, differ for electrical soldering, and, say, soldering steel wire undercarriages and brass tanks. The use of a corrosive flux is generally acceptable on steel, since such components are usually amenable to adequate cleaning afterwards. But again the use of corrosive fluxes on fuel tanks is not advisable since any deposit remaining on the inside is difficult to remove or neutralise entirely and may be a source of trouble later on. On the other hand is it *acceptable* to ensure a positive, trouble-free initial joint—whereas for electrical work it is *not* acceptable under any circumstances—if you want a reliable result.

It seems labouring a point to stress cleanliness as an essential feature of satisfactory soldering, but this is a major source of trouble. Unless surfaces are grease-free, solder will not run properly, even if the surfaces are 'tinned' previously. Equally, a bare copper or brass surface will never 'tin' properly unless clean to start with. It is more important to ensure absolute cleanliness when tinning bare copper or brass (or steel) than in soldering to a tinned surface, since the latter will tend to remain 'cleaner' as far as oxidation and atmospheric corrosion is concerned. But in all cases if solder melts properly and yet does not 'run' the answer is that the surface is not *clean*. It is just as simple as that—and the cure is just as obvious.

Finally, a word about bit temperatures. The small commercial irons with pencil bits have a satisfactory bit temperature for all solders up to about 40/60 alloy—provided they are operated at the correct voltage. Normally they are specified for 230-240 volt operation. Some mains voltages are only 200—and others, nominally higher, are pulled down to this figure at peak load periods. At such lower mains voltages the average electric soldering iron just will not get hot enough for satisfactory soldering. It merely renders the solder in its 'plastic' state where it is not fully melted and good joints are impossible.

Anyone who persistently fails to make clean, neat joints quickly after practice with an electric iron could well check his mains voltage against the iron specification. If this appears in order, then a change to 60/40 solder might make all the difference. Otherwise an auto-transformer may be a necessary piece of ancillary equipment to boost the mains voltage to a higher level.

The *capacity* of the iron to maintain a satisfactory temperature is, obviously, related to its size—and this also must be born in mind when doing a repetition job, or where a relatively long joint is required (e.g. soldering two steel undercarriage wires side-by-side). Thus there is no 'universal' soldering iron for all soldering jobs. Small bits are the logical choice for light electrical assembly work but larger irons for 'engineering' jobs. Many people, in fact, find it an advantage to abandon the electric iron in favour of a plain iron heated in a gas flame for soldering steel.

The Ultimate —Absolute Command

THOUGHTS ON SOLIDTRONICS BY TOMMY IVES

Zell Ritchie flew this Zell Sabre, Solidtronics equipped in U.N. Nats. at Dallas. He completely shattered it with a series of loops that ended too near the ground. R/C equipment survived undamaged!

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No this is not a pipe dream but a solid fact. In fact it is a "Solidtronics" fact.

We were intrigued when we received a leaflet issued by the Solidtronics Corporation of Van Nuys, California, dealing with what is called a "Telemetering Duplexer". It sounded complicated but on the front cover was a picture of a powered model aircraft.

Naturally we investigated and found that it was a system for providing additional channels by means of switching two sub carriers on a proportional basis. This was reminiscent of Dr. Walt Good but we found that it went even further than his system.

The frequencies lie in the band from the low audio section to the low radio frequency spectrum.

In the system described two sub carriers are transmitted and the Frequency Modulation system is used in the Transmitter. The frequency of each sub carrier is varied about a mean value and this provides two commands (or the equivalent of four channels). At the same time a separate multivibrator switches the two sub carriers at a pre-

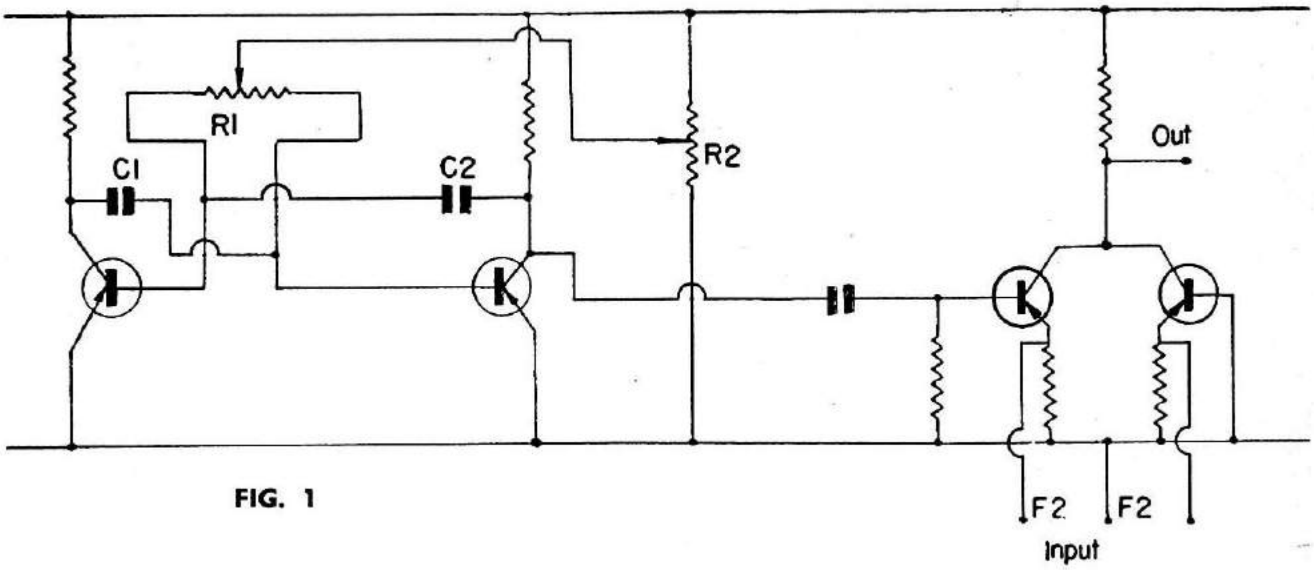


FIG. 1

determined frequency (described as the repetition rate) and also a mark space (called the symmetry ratio). Each provides a separate command (or two channels). The repetition rate is also varied as in the Galloping Ghost system and the result is four commands all fully proportional and simultaneous.

What are the snags? Firstly, of course, the cost is not the smallest item and is in fact around 500 dollars. Range is not exceptional (ground range 1,000 ft.) but is adequate for all purposes and if the model goes out of range a fail safe system operates. To quote "when the model begins to get out of range all controls will show a reduction in travel. When it is completely out of range all surfaces will return to neutral and the throttle will return to the cut off position".

The system incorporates fully proportional servo systems and they will not be self-centring. What happens if the batteries fail when a control is on?

Later we received full details issued by the makers with the units and it is clear that as foolproof a system as could be devised is available for those who have the "lolly" and in fact when compared with some of the expensive reed systems and considering what it gives is not so expensive at that.

Referring to the drawings Fig. 1 gives details of the electronic switch which gives the mark/space and repetition rate and it will be seen that the first half is our old friend the multivibrator as used in the G/G systems. As, however, it is necessary to switch the two sub carriers the output stage is different from the normal. The two sub carrier frequencies are fed to the emitters of the output transistors whose collectors

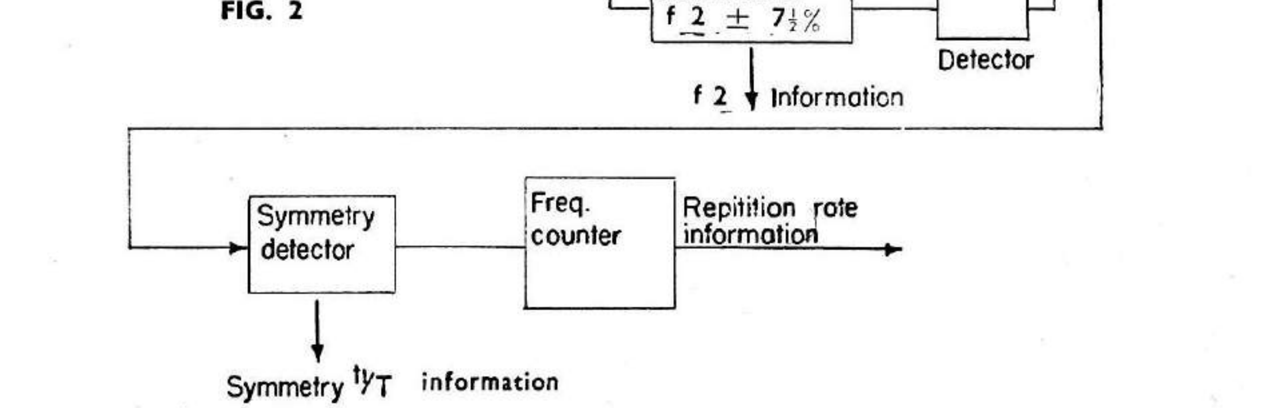


FIG. 2

are in parallel. When one transistor is on the other is off so that the multivibrator switches the two and the output is two alternate frequencies switched at a frequency determined by the multivib. From the transmitter, therefore, you have an output which includes two sub-carriers each providing a proportional command and these in turn are switched at a varying frequency and varying symmetry thus providing four independent commands all simultaneous with complete freedom from interaction.

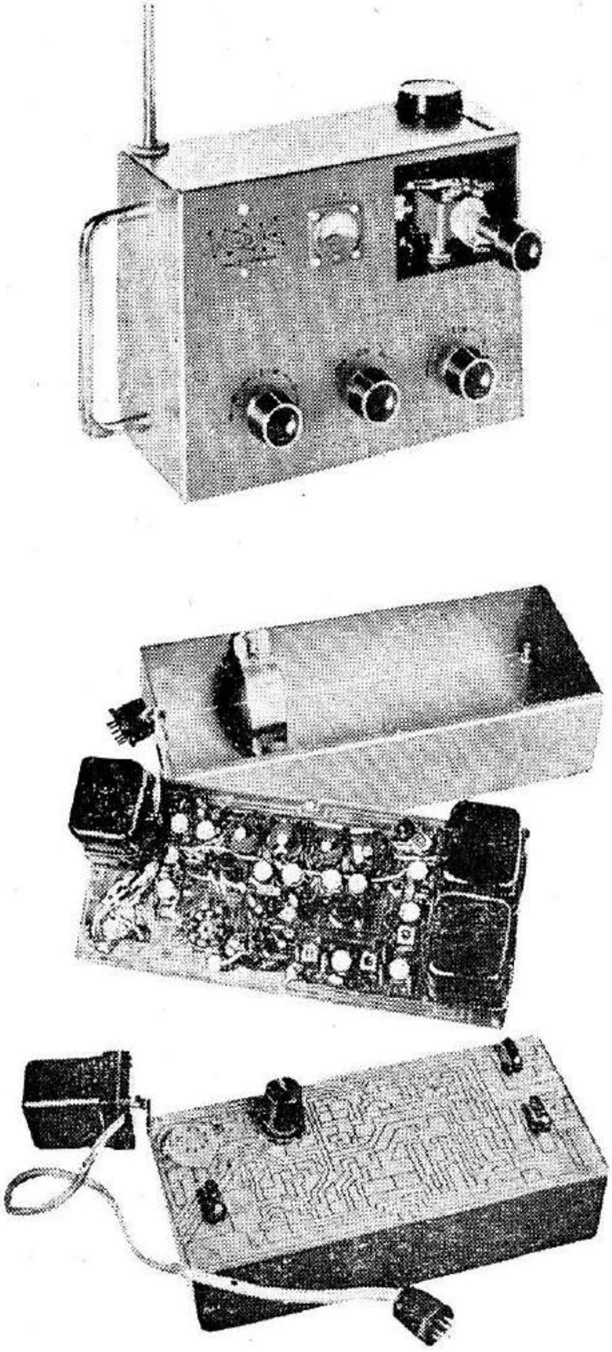
The transmitter is crystal controlled.

Figure 2 shows the decoding arrangements. The receiver is a super-heterodyne (presumably crystal controlled) and is tuned at the factory before despatch. From the Super-het output there is a band pass filter and a limiter. This feeds into two separate frequency discriminators whose output is a DC component plus or minus depending upon the frequency transmitted. The DC output fi and fii provides control for the servos which operate on the true servo principle. Although not stated each servo will have its associated servo amplifier. The output from the discriminators is also fed to separate detectors whose function is to provide a square wave output which is present as a result of the switching at the Tx.

The square wave is fed into a symmetry detector with a DC output for the next servo followed by a frequency counter which provides a DC output for the fourth servo.

Proportional trim controls for rudder and elevator are provided and these can be operated "in flight".

The receiver is completely transistorised (35 transistors) and is fully temperature stabilised. It is claimed that operation can be obtained at minus 10 to plus 140°F.



What you get for the money! Rudder, ailerons and elevator are controlled by large knob upper right front. Centre lower is on/off and outside knobs for trim. P.C. receiver, stuffed with transistors is below.

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

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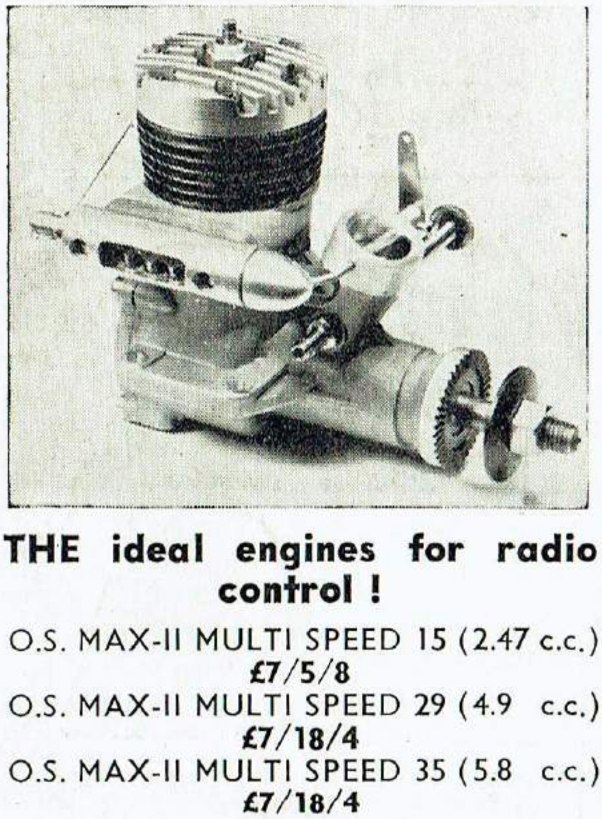

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