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RADIO CONTROL MODELS & ELECTRONICS

JANUARY 1963

VOLUME 4 NUMBER 1

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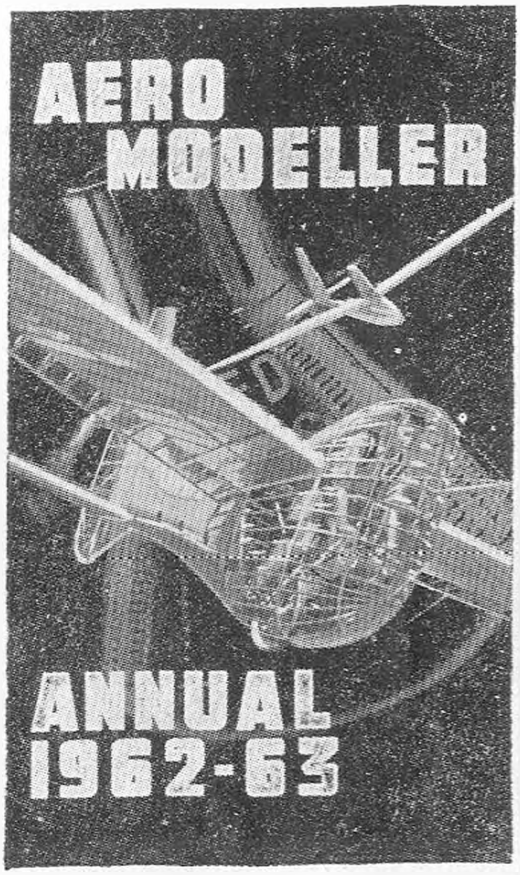
AERO MODELLER ANNUAL



IN ONE YEARLY VOLUME is gathered the cream of the world's model plans, plus articles on subjects of special interest in the current year, plus a selection of practical and theoretical information that will help aeromodellers of all degrees of skill. The cover painting depicts man-powered "Puffin" against a starry sky with American space capsule "Friendship VII" in orbit. Articles include Man-powered Flight ; a 3-volt sub miniature Transistor Receiver by Dave McQue ; Franz Czerny on Jedelsky's "Standard" models ; Schneider Trophy in Minature ; Water-powered Free Flight ; Lightweight Rubber Models by Peter Gasson ; Anti-warp Structures ; Control Surface Design for R/C ; Fact & Fallacy of Design Theory; Scale Prototypes for R/C ; Glide Trim ; Power Prop Selection ; Multi is the Real Answer. Also included : Engine Analyses of the year, International and British Contest results, and a host of fully dimensioned model plans.

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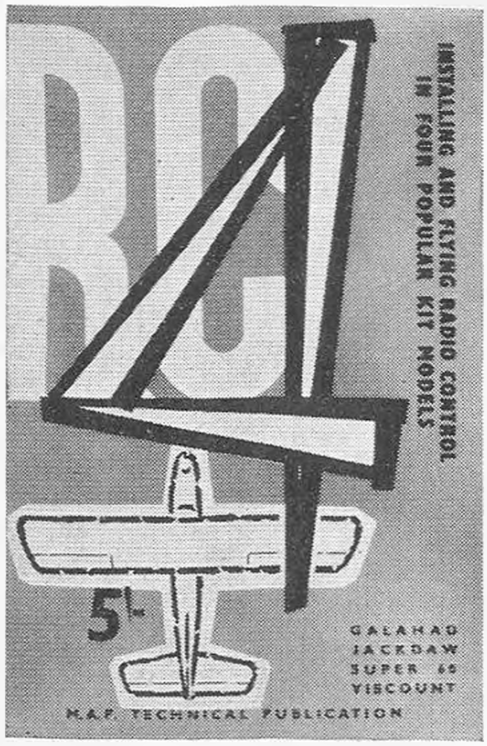
R/C BIG 4



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Here, There & Everywhere

Welcome to 1963

Yes, we know it has not yet arrived, but now is the time to make those resolutions, in plenty of time to be able to drop the appropriate hints as to the type of useful presents that would be most appreciated at Christmas. We have already heard a number of enthusiasts declaring that next year they will "do" scale, proportional, multi, etc.

Make your decision now! There are, of course, a few hardy types who will operate R/C ice breakers and put skis on their aircraft, but we like to think upon winter as a time for construction and development. With regard to the latter, let us take stock of the situation.

Superhets have, during the 1962 season, become almost universal among the top multi men, and with the increasing number of radio modellers to be seen at an average club meeting, whether they be single or multi enthusiasts, some form of simultaneous operation has become desirous if not a necessity. We are frankly surprised that more modellers do not start with six channels of a multi outfit or an ultra simple pulsed rudder with some electro-mechanical gubbins for motor control. We stress motor control, because operating a power boat or aircraft without this facility seems to be rather akin to driving a car without brakes.

Pulsing appears to be coming back a little with the appearance of Don Brown's model at the World Championships and the pulsed Metz equipment. Contests have been won with a simpler form of proportional, wherein No Signal gives full left, Full Signal gives full right and the pulser is the pilot's right thumb. The servo is almost any small geared motor, linked to the rudder by a piece of nylon and a rubber band spins the motor back to the other rudder position. Such an arrangement uses an un-modified single channel transmitter and receiver and is quite a good starting point for the more precise proportional systems to follow in future developments.

Just what is in store for the majority of modellers for 1963, is to a large extent governed by the manufacturers, for the majority of readers we find these days use commercial gear rather than design or build their own. However, if you feel that a particular type of equipment or a certain component is not the complete answer to your requirements, do not hesitate to write to your favourite manufacturer and enquire if he has considered the possibility of a demand for *your* type of equipment in his future production policy. After all, it is the modeller who uses the gear most who can comment upon its suitability and may be able to suggest small production changes which might widen its application.

Manufacturers do a careful study of the potential market before producing equipment, and a few helpful words from his potential customers can be a great help in the design stages.

Overseas Checking

Occasionally we receive enquiries from overseas readers who wish, like our own modellers, to avail themselves of our Frequency Checking Service. Unfortunately, our helpful band of technicians are limited to Britain. We would hesitate to suggest that anyone sends their transmitter over here, for apart from all the complication of Customs regulations and cost of postage, other countries have different standards of R.F. tolerance, etc. It is, therefore, necessary to check with the Post Office authorities, or whoever controls the licensing of operators in one's own country in order to assess the suitability or otherwise of any published circuit whatever it's source, so that the home built transmitter will pass, what are in some countries, stringent regulations.

If we can in any way assist by publishing the names of willing technicians in other countries, who choose to offer their services to fellow modellers, we will add these to a special overseas section of our Frequency Checking List.

We feel that with the rapidly expanding *International* readership of *Radio Control Models & Electronics,* such a step may prove worthwhile in order that the interest may be broadened to encompass those overseas readers who have no facilities or in some cases the "know-how" to check their own gear.

On the Cover

By now a familiar sight at radio regattas, Q class *Mimosa* by G. J. F. Stalkartt uses six channels of an R.E.P. Superhet, independent control of rudder, main and jib sheets. The Superhet is a prototype undergoing contest proving tests prior to full scale production.

The photograph was taken at Poole Regatta, and a report of the event appears this month. There is something refreshingly quiet and efficient in radio control sailing craft, and one's skill as a helmsman is exercised to the utmost. If we may draw a parallel, we would liken it to slope soaring round a pylon racing course.

The other picture: P. Champion's compact all transistor transmitter, featured as this month's constructional article. With simplicity the keynote, and is to be extended to full multi in the second instalment.

What is a "Democomp"?

An idea which seems to be catching on rapidly these days is the organised public spectacle designed to strengthen relations between model clubs and local authorities. Indeed, with the public generally.

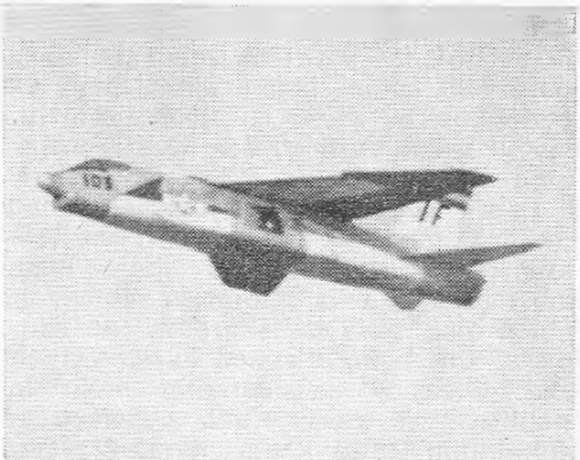
The advantages to be gained by this means, can very often result in extra facilities being granted for the club with regard to flying sites and meeting places. Their immediate effect is, of course, to familiarise the public with our rather specialised hobby and, who knows, attract a few more to our ranks.

The idea of incorporating these demonstrations with a competition has added appeal to both sport flyers and competition men, for having completed their official schedules and contest nerves have been put aside, there is the more light hearted business of flying for fun and for the audience.

An excellent example of the morning contest and afternoon demonstration is reported by Major F. Plessier. Apparently new to France, this type of event was held on September 21st on the 10,000 ft. long runway at the test centre of Bretigny, 20 miles south of Paris. Almost perfect weather and prior publicity of a television show the Saturday before, contributed to the success. Four thousand spectators turned up to watch the Mono and Intermediate contests with entries from other parts of France. The afternoon show was backed up by an informative running commentary whilst models from the smallest (Cox Babe Bee, rudder only) to full house ten channel models were displayed. There was combat, pylon racing and a balloon bursting, rounded off by a spot of crazy flying by models equipped with smoke cannisters and fireworks. Our little picture shows a ducted fan "Crusader", note the airscoops in the fuselage sides instead of an intake in the nose. Definitely one to please the crowd anywhere.

Now, at the risk of being called a wet blanket, may we suggest that when public address commentaries are being given, a few words could be said on the subject of public safety. One sees little notices reminding the public of the fact that they attend at their own risk and that for example—"motor racing, etc., is dangerous". However, far too often we see people crowding a take-off area or straying out to get a better view of a landing approach when at such times a skilful pilot needs all his wits about him, and there is just a chance that reliable as equipment is these days, or however familiar the pilot is with his model or the weather conditions, there is just that remote chance that a 7 or 8 lb. "guided missile" will fall out of the sky with some unfortunate spectator in its path. It may take only *one* such occurrence to severely handicap the hobby generally.

We are *not* knocking the pilots, it is just that we are sure the general public have no idea of the potential hazards.



'Champion' Transmitter

By P. CHAMPION

★ All transistor
★ Simple circuit
★ Bi-Simultaneous
★ Low battery drain

PART 1 Single channel

Introducing a new, simple Tx for the "All Transistor" enthusiast. P. Champion is a member of the I.R.C.M.S. and uses this Tx to control a "Hustler" Delta.

THE circuit is not original but has the advantage of being well tried and proved. The cost of building is relatively cheap and battery consumption being very low (Tx. 30 mA.) the very adequate batteries will last a whole season and cost only 3/- each (PP1 6v.).

The circuit has a crystal oscillator section. It will be noted that this is similar to normal practice except for RV1. It has been found by the writer that this is the only method of controlling and adjusting the oscillator satisfactorily. The reason is that with the active cathodeon crystal the feedback through the crystal can overdrive the stage if the adjustment is in the base bias network, as this feedback cannot then be controlled.

The P.A. stage is a conventional push pull oscillator and draws current only in accordance with the load similar to push pull audio stages. After many experiments the writer is satisfied that this layout is the most efficient and is in fact used in Mullard and S.T.C. designs.

Fairly large coils are used to obtain the maximum efficiency from basically low powered transistors where losses must be kept to a minimum. It will be noted that both coils are in the same plane, this being dictated by size layout and efficiency considerations. No instability will occur, but a screen of aluminium 22-24 s.w.g. may be placed between the oscillator and P.A. (This is good practice with any Tx., see Fig. 2).

OC 171 transistors are used as they are probably better from various aspects connected with modulation but if cost is important OC 170s should be satisfactory.

Stability with regard to temperature and time are excellent, the output drops slightly with cold. and increases with temperature. The Tx. has been tested to 120° F. with no ill effects. After initial setting up no future adjustment should ever be required. It is reassuring though, to have a 6v. .04 bulb that can be plugged into the aerial socket and coupled between the aerial socket and earth. The glow of the bulb indicates everything is satisfactory. The writer uses a bulgin jack socket for the aerial, the inner part of the jack plug being the aerial connection, the 6v. .04 bulb is wired with a diode into a spare jack socket. (Fig. 3).

NOTE: If a jack socket is used, the return side of the jack plug must be insulated from the aerial or no power will be radiated.

Modulator Amplifier

Collector modulation is used and this has been found extremely satisfactory. Unlike other forms of modulation the R.F. power is increased rather than decreased and if sine waves are fed to the amplifier, and the modulation is set to less than 100 per cent, sine waves will be transmitted.

There is sufficient power for 100 per cent modulation and a high impedance audio input is used to enable any valve or transistor tone generator to be used without overloading the generator.

The audio oscillators of Dave Mcque or P. Lovegrove are entirely suitable. also a pulsed audio for proportional.

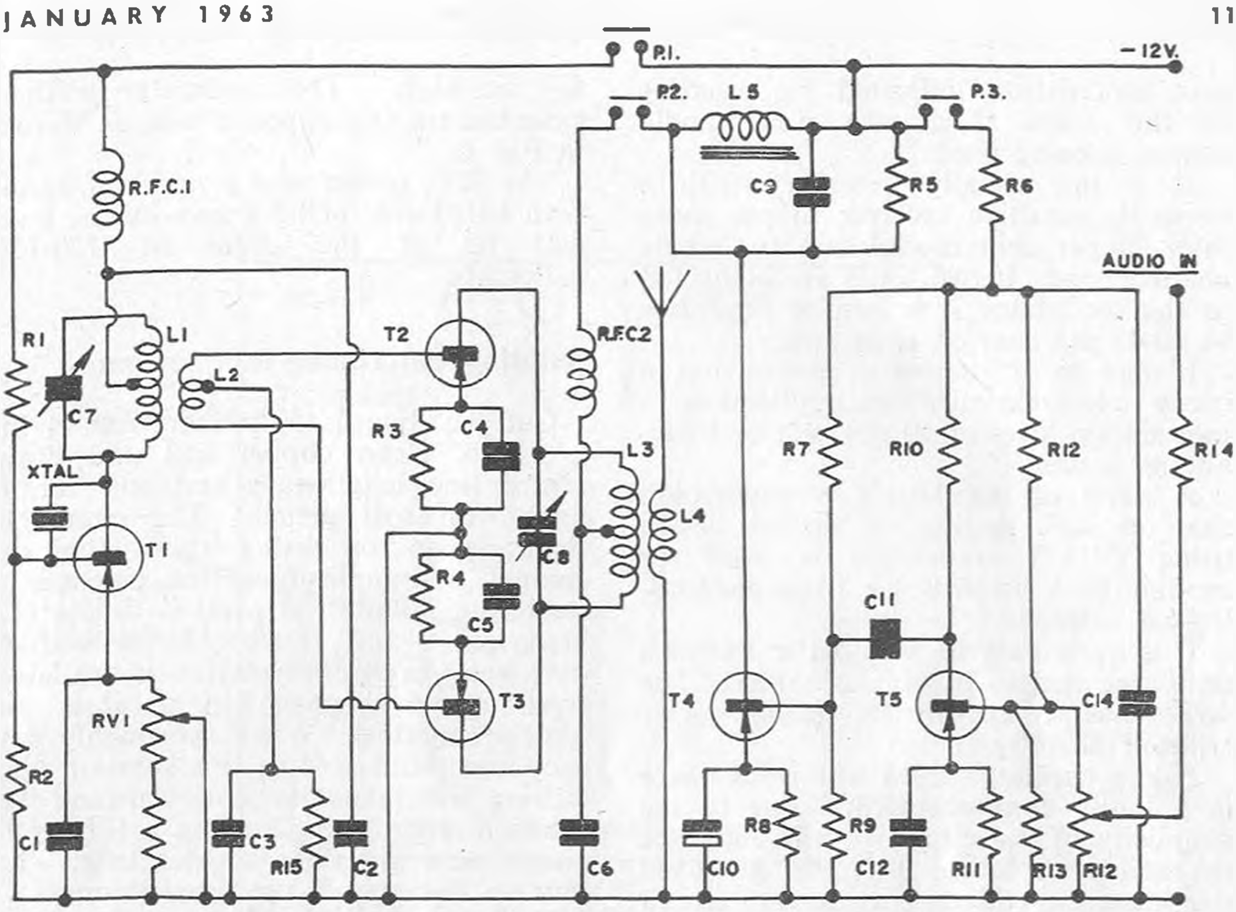


FIG. 1 THEORETICAL CIRCUIT

NOTE: RV2 (from R14) incorrectly numbered as R12 in circuit, C13 is omitted and goes between T5 base and RV2, unmarked resistor between RV1 and +ve is R16.

COMPONENTS REQUIRED

R1	47K	R9	1K	C1	1000 PF	C9	1000 PF		
R2	4.7K	R10	3.3K	C2	,,	C10	75-100 mfd.		
R3	220Ω	R11	1.5K	C3	,,	C11	8-10 mfd.		
R4	220Ω	R12	56K	C4	,,	C12	8-10 mfd.	T1	OC171
R5	1.5K	R13	10K	C5	,,	C13	.01 mfd.	T2	,,
R6	220Ω	R14	330K	C6	,,	C14	100 mfd.	T3	,,
R7	10K	R15	100Ω	C7	3-30 PF Phillips	RV1	1K or 2K	T4	OC76 or GET114
R8	100Ω	R16	100Ω	C8	,, ,,	RV2	1 MΩ	T5	OC71 or OC75

Batteries: Two x P.P.1's
RV1: Henry's submin. or Radiospares slider type.
RV2: Small Henry's, preferably Plessey Skeleton. P.C. altered if necessary to suit pot used.

The construction is straightforward being a two stage R/C coupled single ended output audio amplifier of conventional design, drawing 10-15 mA. at 12v. The p.c. board is made in the same way as the R.F. section and wired in accordance with the circuit.

The only item needing construction is the modulation choke. This is very simple, having only one winding, the turns need not be counted as the bobbin is merely filled with 36 s.w.g. enamelled wire.

The metalwork and bobbin for the choke is a Radiospares midget output or intervalve transformer or other transformer of similar size and construction.

The existing windings are unwound then the bobbin rewound full of 36 s.w.g., the final resistance of the choke should be 80-100Ω. This will have sufficient inductance to operate with modulation audio tones down to 150 cps, i.e., below lowest reed notes normally used.

To set up the modulator connect the audio source to be used to the input and earth, turn the 1 MΩ pot to minimum resistance to earth.

If a scope is available, connect the y amp to earth on the Tx. and to the erected aerial via a diode. Alternatively tune a receiver to the Tx. and listen on earphones to the Tx. If RV2 is now turned up (this is in effect a volume control) the audio will be heard faintly and will then increase in volume up to a certain point, then no further increase will be heard but the tone will roughen, this point is 100 per cent modulation. It is advisable to back off a little from this point. With a 'scope coupled the waveforms can be adjusted and 100 per cent modulation indicated by squaring of the crests if a sine wave audio source is being used.

It is not usually necessary with a normally sensitive receiver to use more than 75 per cent modulation for single channel tone. If two tones are being fed to the modulator it is best to modulate to 40-45 per cent on each tone.

It may be of interest to realise that in many telecommunication applications a modulation level of 10 per cent or thereabouts is used.

A point of interest; it is understood that an R.F. section of similar design using OC 171 transistors is used for sending back information from meteorological balloons.

It is quite easy to set up the Tx. with only one meter, if care is taken. The writer has set up this Tx. on one meter without difficulty.

If the oscillator does not work there is a faulty component, and due to the simplicity of the circuit it will either be the coil or a fault will have destroyed the transistor (this applies to any circuit fault of course). The method of using a diode and mA. meter will indicate whether R.F. is being generated.

If desired, it is possible, with the layout used, to balance the drive on the P.A. transistors as follows: this need not be done but is a sort of final tuning for maximum efficiency.

The sketch in Fig. 5 shows the set up and the adjustment is done before wiring the P.A. The object is to get the same reading on both meters. R.15 and C3 are left out. To get the meters balanced adjust the dust core in the coil, screwing in or out as necessary. When set up, lock the core with styrene cement. The coil windings should also have been cemented after winding as any movement will upset the balance.

The P.A. coil and coupling are wound in the usual way over mandrels of wood, etc.

The oscillator coil is wound over the ribs of the former and if a small hole is drilled through a rib at the centre and each end of the former, the rib chosen being nearest to the hole position in the board, the wire can be passed through the holes and held with cement.

C.7 and C.8 must be adjusted with an insulated tool, not the fingers.

The chassis can be mounted on one side of an aluminium sheet in the case by 8 B.A. bolts and stand offs approx. $\frac{3}{8}$-$\frac{1}{2}$ in. high. The modulator is then mounted on the opposite side as shown in Fig. 6.

The R.F. power into a resonant aerial with 18-20 mA. being drawn by the P.A. will be of the order of 120-150 milliwatts.

Building and Tuning R.F. Section

Cut p.c. board to finished size, 4 in. x $2\frac{1}{2}$ in. clean copper foil and draw centre line lengthways and coil centre lines with soft pencil. The circuit is then drawn on using thin Humbrol enamel, a draughtsman's ink pen and a steel rule. While the paint is drying (12 hrs.) mix $4\frac{1}{2}$ oz. ferric chloride with $\frac{1}{2}$ pint water (a strong *solution* is available from some chemists) in a glass, or plastic container. When thoroughly dry drop the p.c. board in this solution and etching will take $\frac{1}{2}$-1 hour, warming the solution slightly and adding a little sulphuric acid gives the shorter time. To remove the enamel use dope thinners.

Drill next all the holes in the p.c. board and make sure the copper is clean. Make up L1, L2 and L3, L4 and mount L1 with 6 B.A. bolts, L3, L4 are self supporting and held by the fit of the wires through the board and the soldering in circuit.

The oscillator should then be wired completely, except for R.15 and C.3. Turn RV1 to give maximum resistance emitter T.1 to earth (transistor leads cut to approximately $\frac{5}{8}$ in. long and sleeved. Cut off earth lead near to case). Couple P.1 and insert a meter (0-20) mA. in circuit. (See Fig. 4). Couple a diode and 0-5 mA. meter across the bands where the bases of T2 and T3 will be fitted later. Connect up a 12v. battery (check polarity) and adjust C7. A reading should be obtained on the 0-5 mA. meter. Adjust RV1 to give 6 mA. battery current (do not exceed 10 mA.). Repeat these adjustments until the 0-5 mA. meter reads approx. 2-3 mA., and the battery current 6-8 mA. The rest of the circuit may then be wired up. Check that the core is central in L1. Put the plug P.1 in, insert a meter (0-50 mA. or 0-100) between P.2, wire with flex a 6v. .04 bulb across L4. Switch on the Tx. C8 must now be adjusted to tune the P.A. to resonance. Do not allow the P.A. to exceed 20 mA. This is controlled by RV1 increasing the emitter resistance decreases the drive on the P.A. tran-

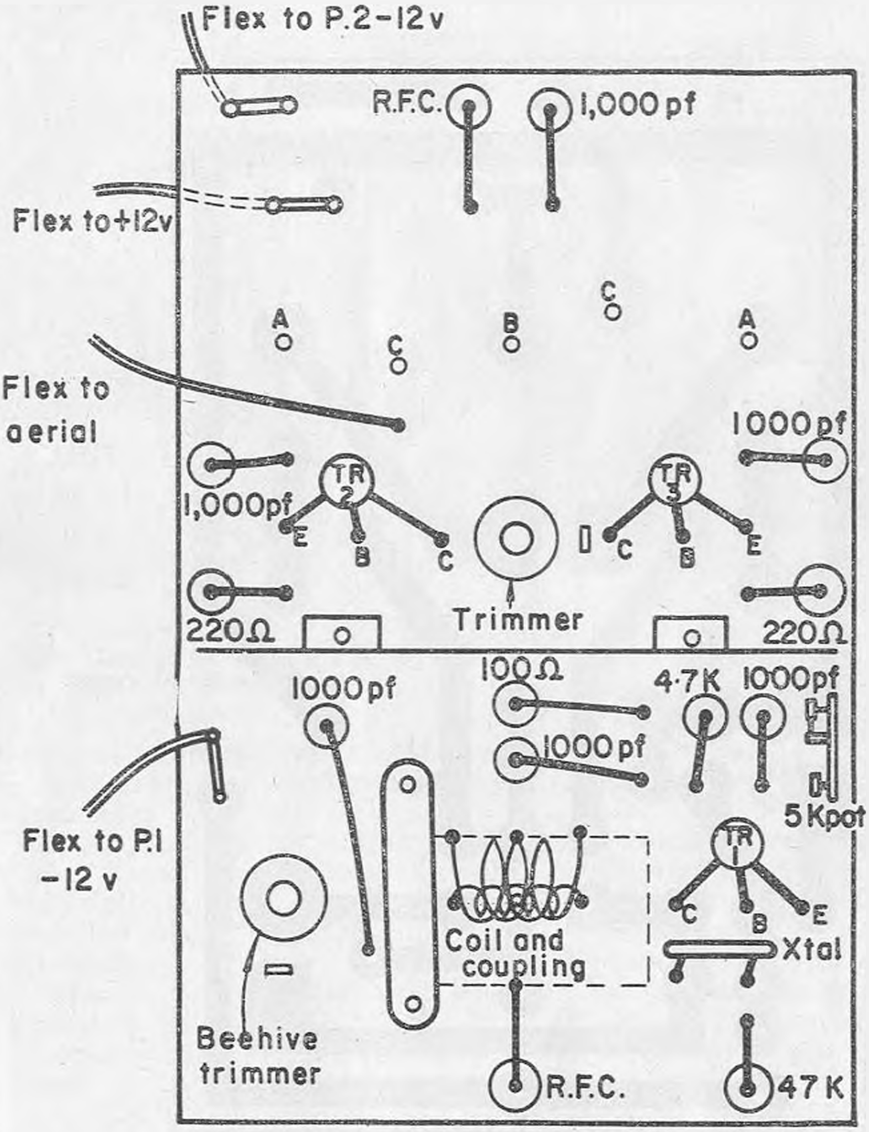


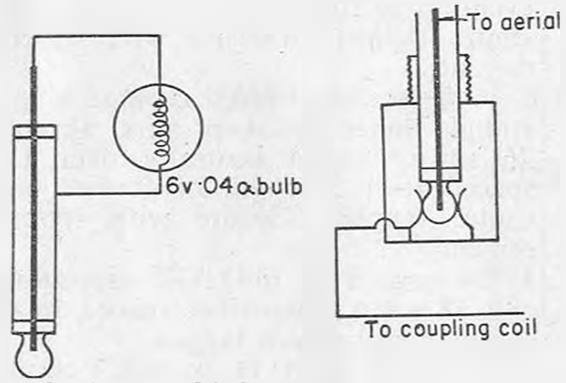
FIG. 2

FULL SIZE PLACEMENT DIAGRAM

Hold page up. to the light to identify circuit lands.

Screen should be 22-24 s.w.g. alluminium.

FIG. 3



A diode should be connected to the aerial side of the bulb.

FIG. 4

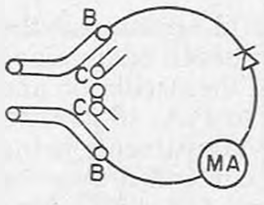
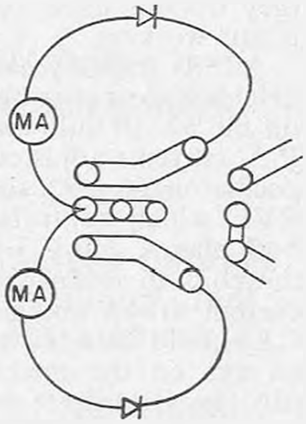


FIG. 5



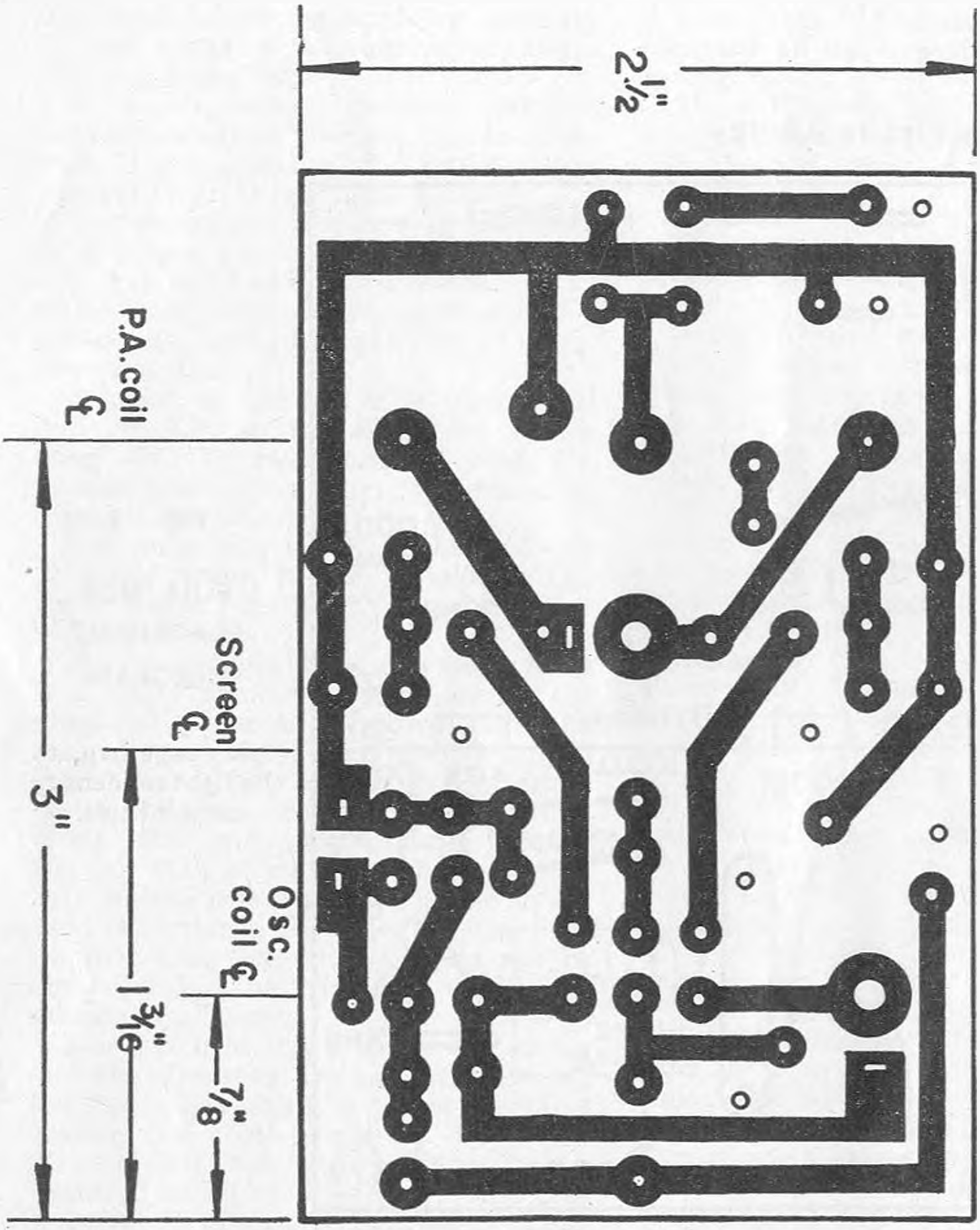


FIG. 6

FULL SIZE P.C. PANEL

sistor and hence the current. The P.A. transistors (T2 T3) will not draw any current until driven by the oscillator. If they do not draw current the oscillator is not working.

At this stage by careful adjustment the brightest glow possible should be obtained on the 6v. .04 bulb and the oscillator and P.A. currents adjusted to P.A. 18-20 mA. oscillator 6-8 mA., the adjustments being RV1, which controls current drawn by both stages, and C.7 and C.8 which tune the coils to resonance but also alter the current drawn and hence RV1 and C.7-C.8 should be adjusted carefully keeping an eye on the meter to check that 10 mA. per transistor is not exceeded. If two meters available keep one across P.1 and do not exceed 10 mA.

Other Components and Parts

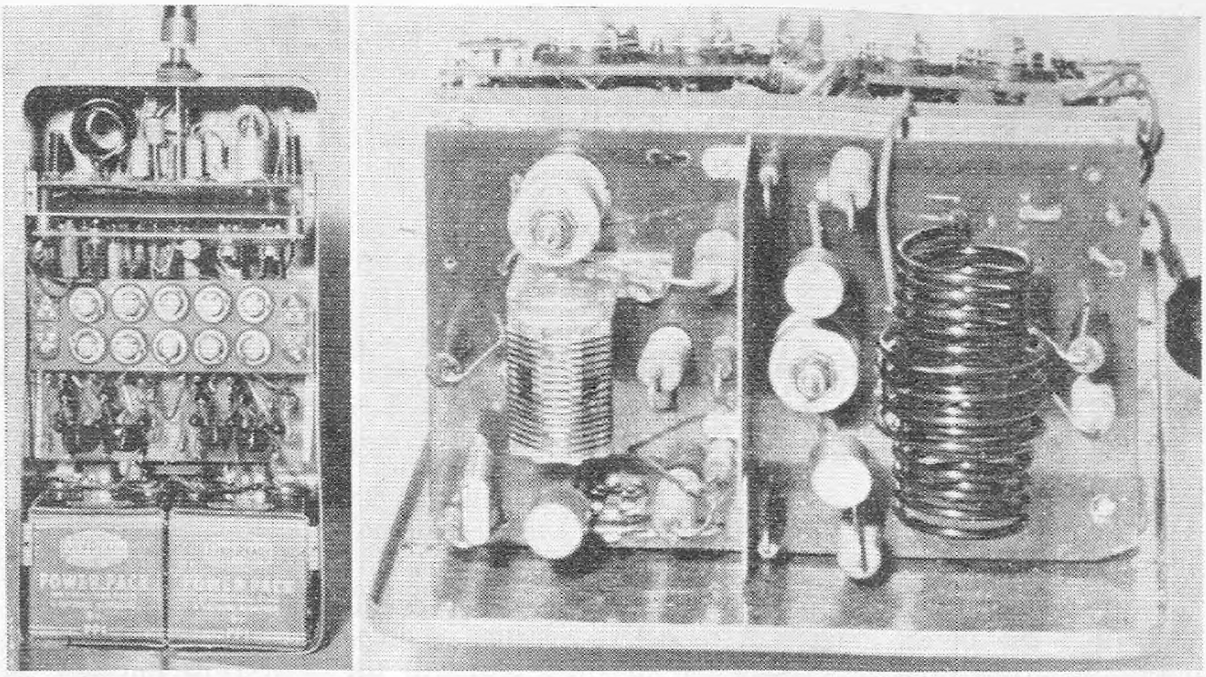
L.1 ⅝ in. dia. Eddystone coil former. Catalogue No. 847. 16 turns spaced evenly over former 26 s.w.g. enamelled centre tapped. (Secure with styrene cement).

L.2 4 turns thin P.V.C. covered single strand tinned hookup wire approx. 26 s.w.g. wound centrally over L.1 spaced to 1/3 length of former and centre tapped. (Secure with styrene cement).

L.3 14 turns ¾ in. O.D. self supporting coil 18 s.w.g. enamelled spaced to fit circuit board centre tapped.

L.4 3 turns 1 in. O.D. over L.3 coupling coil 18 s.w.g. enamelled.

R.F.C. 1 & 2 2 amp neosid choke core (2 amp Radiospares T.V. chokes)



Left: Compact Tx showing tone pots.
Right: Top view of stage 1.

wound or rewound full single layer 36 s.w.g. enamelled (secure with styrene cement).

L.5 Midget Radiospares output or intervalve transformer rewound with bobbin full 36 s.w.g. enam. to form modulation choke (80-100 ohms approximately).

C1-C9 Erie or similar axtial wire leadout ceramic 1,000 Pf.

R1-15 Radiospares ½W. or similar size resistors.

Xtal Cathodeon 2 mm. submin, for series resonant mode overtone crystal. (These can be supplied to frequency chosen. and a pair with 465 Kc/s. spacing may be obtained for superhet use).

Tx. Case MacGregor case Ivy-A.M. Tx. or similar size.

Aerial Centre loaded and tuned to resonance.

Batteries 2 off PP1 (4 snap type connectors required).

P1. P2, P3 Radiospares miniature plugs wires with flex to socket in convenient position. *(To be continued)*

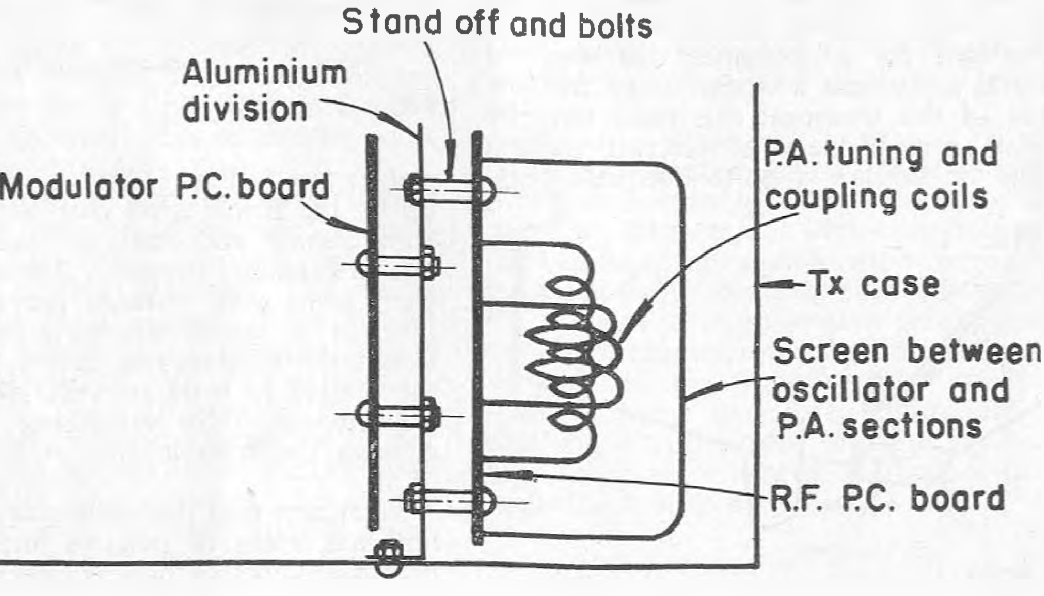


FIG. 7

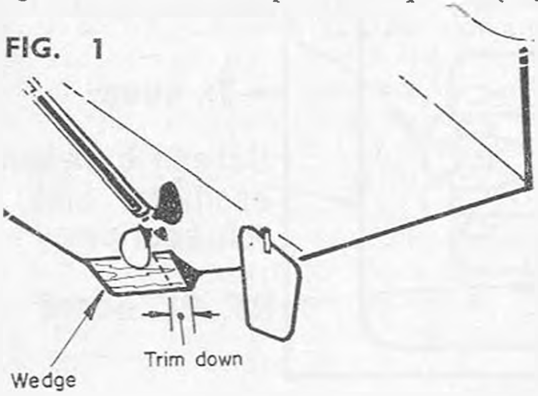
Balanced Turns

First of a number of articles in which VIC SMEED shows how to get the best out of R/C boats

THE best of radio equipment is of little use in an indifferent model, but quite often what may seem an indifferent model requires only minor alterations to prove 100 per cent successful. One of the knottiest problems in boat work, particularly in high speed running, is in achieving smooth, equal turns in each direction, and this is something that no designer can guarantee, affected as it is by differing engine speeds, propeller pitch, and propeller efficiency. Correct turns start with the propeller, odd though it sounds!

We are all familiar with torque effects, i.e., the tendency of the whole boat to rotate in the opposite direction to the propeller on the line of the propeller shaft. With large props and narrow beam the boat will run in a straight line with a permanent heel, and at one time it was thought that it was this tendency to heel over that was the cause of major differences in port or starboard turns. The cure for a permanent list was, we found, to cement a wedge under the low side of the transom; this need only be small, and a piece of aircraft trailing edge or similar is quite adequate (Fig. 1). The best thing is to put rather more on than is expected, and cut down bit by bit until the boat runs flat out on an even keel.

FIG. 1



Certainly this measure goes some way towards evening out turns, but as speeds increased the trouble appeared once again. An afterplane fitted to the transom (Fig. 2) helped in some cases, though this is more usually useful in correcting planing trim angle. A development of this is the hydrovane fitted on the rudder itself (Fig. 3) which was thought up by the Birchington club as being less cumbersome and liable to damage than an afterplane proper. These devices went some way towards preventing the bow of a model dropping in a turn, thus improving turning ability, but when they failed to work on certain models it was obvious that something else was causing the trouble—or, at least, a lot of it.

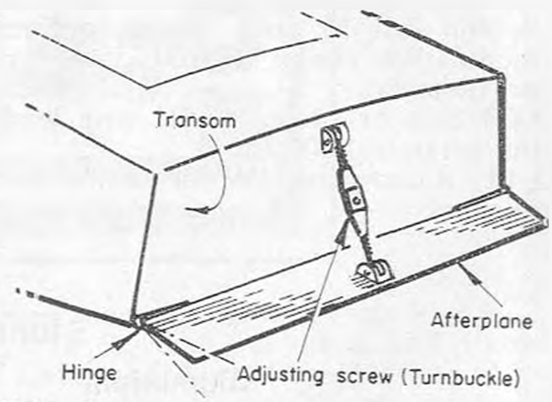


FIG. 2

We know that the underside of a boat hull has areas of positive and negative pressure, and that flow is affected by the

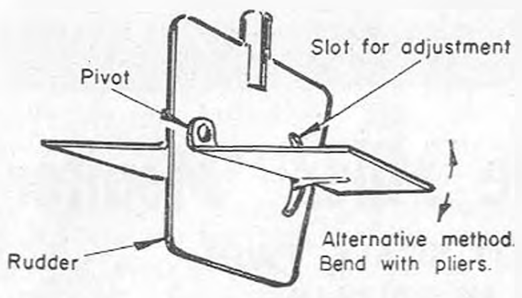


FIG. 3

water drawn in to "feed" the prop. Study of some of the boats suffering from turn troubles suggested that the water ahead of the prop was unlikely to be a common cause, which left the slipstream of the prop as a possible culprit. Now, we are in the fortunate position of knowing a lot of boat enthusiasts who

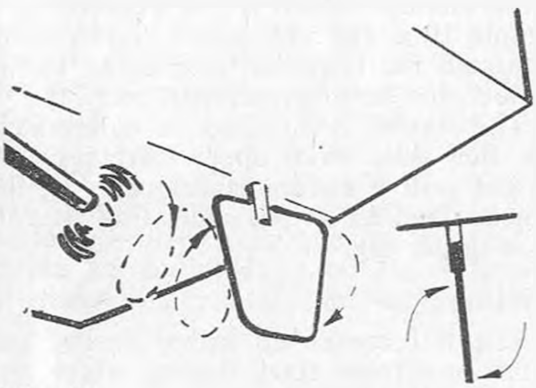


FIG. 4

discuss problems they encounter with us, and many of them will try out suggestions and report back on the results. In several instances we had suggested a change of rudder shape which had had beneficial results; we know, too, that the distance of the rudder aft of the prop has a bearing on the turn characteristic, and the results of one or two experiments with moving the same rudder forward or aft a little with no other change in the boat also tended to point in the same direction.

The theory is that the waterstream coming off the prop, composed as it is of high and low pressure belts, is spiralling rapidly and that this spiral strikes only certain areas of the rudder (Fig. 4). A change of propeller alters the characteristics of the spiral and therefore is likely to produce changes in turn characteristics. Change of rudder shape re-disposes the areas, putting area more or less in the critical part of the spiral; obviously the ideal rudder shape for perfect turns must be tailored to

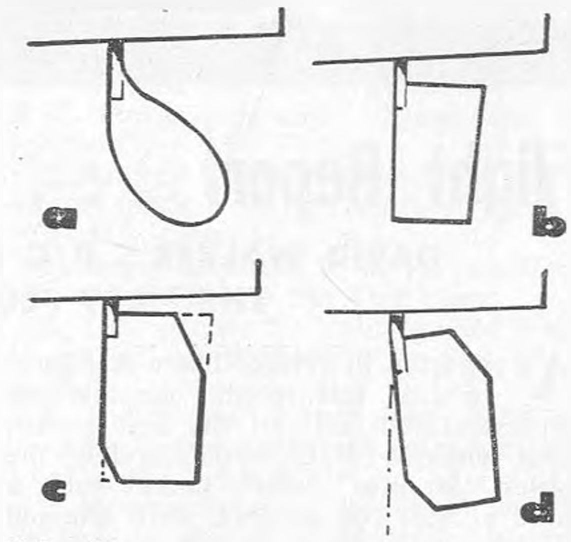


FIG. 5

suit the individual model/engine/propeller combination, but three steps should be enough to get somewhere near the best shape.

The first to put this notion to the test was Col. H. J. Taplin, whose very fast model was fitted with a "pear" rudder as in Fig. 5a. The boat had a wide port turn and a vicious starboard turn, and no amount of fiddling with differential servo-movement, etc., had any effect. Changing the rudder to a straight up-and-down shape (5b) reversed the turns completely—vicious to port, wide to starboard. The corners were then cut off (5c) and an improvement was immediately noticeable—less vicious to port, less wide to starboard—but the adjustment was obviously not quite enough. Step three was to bend the rudder stock (5d) slightly, when turns became virtually equal in either direction. Obviously a similar state could have been reached by superimposing rudders **a** and **b** and plotting a compromise shape.

Our own preference is for an "overbalanced" rudder as a basic shape, which does help to even out slipstream effect to some extent, but even so may need quite severe modification for really balanced turns. Starting with this shape, the score is to find the prop which gives best performance, then try different rudder blades or trimming the original blade—aft top and fore bottom off to ease a port turn, fore top and aft bottom to cure a sharp starboard turn seem the first steps. (Fig. 6).

(*Continued on page* 25)

Flight Report . . . The Miles "Monitor"

DAVID WALKER'S R/C MULTI SCALE TWIN . . . THE FIRST FLOWN IN BRITAIN

As reported in "Here, There & Everywhere" last month, we saw the successful "lift off" of the first British twin engined R/C scale model; the Miles "Monitor" which makes such a good subject for an R/C twin engined model.

David Walker chose a scale of 1/9th giving a wingspan of approximately 72 in. which at 10½ lb. seems to give just the right amount of wing loading for the two Merco 35's. The radial cowlings provide generous accommodation for conveniently large Paxolin bearer plates and the parallel sided, ⅛th sheet cowl drums present no constructional problems. The moderately large diameter of these does, of course, reduce the effectiveness of the airscrews, so it might be advisable to fit slightly larger diameter or three bladed versions (which would be scale) in place of those normally used for this sized motor. The part of the prop which does most of the work is operating in the normal fashion, but the slight loss in efficiency produced by the large cowlings probably accounts for the fact that the model is quite docile and is not affected to any *great* extent by single motor operation.

Construction

The first noticeable feature with this model, is the extreme lightness of the fuselage, far less than the wings in fact. For, with only the Superhet receiver, batteries, and the three servos (rudder, elevator and trim), the ⅛ in. sheet planked construction represents a light weight and spacious component. The receiver is mounted in the cockpit with batteries in the lower and forward part, the servos mounted near to where the leading edge of the wing meets the fuselage.

The wings are rather more solidly constructed; hefty inboard spar sections and generous engine bearers. The whole wing is planked with $\frac{1}{16}$ sheet, and of course accommodates both aileron and throttle servos with a bellcrank linkage similar to that used on the ailerons to operate the throttles in unison. No provision was made for differential throttle operation, as it was felt that the model could cope with any small differences in revs. The tail surfaces are fixed and completely covered with $\frac{1}{16}$th sheet. Control surfaces are scale size and the undercarriage which is not detailed, is a simple 10 gauge wire affair and is fixed, although the tailwheel is coupled to the rudder for taxiing manoeuverability.

The model is finished in camouflage on the sides and upper surfaces and bright yellow undersurfaces carrying the black diagonal stripes indicating its role as a target tug.

Taxiing

The tail comes up rather easily, and after one false start during which the model did a little lawn mowing with its props, Harry Brooks who was at the controls used plenty of up elevator until more speed had been gained. Then, as he eased back to neutral, we saw the first ever take off.

That First Flight

Wallowing slightly, for the motors were not quite giving of their best, it started to gain height, whereupon one motor cut and the model lost height rapidly as the second motor began to fade. The model was now flying over a hollow in the ground and would shortly have disappeared from view — even though it was quite close to the pilot. Not daring to turn under these conditions, the model was put down on rising ground on the far side of the hollow. It was here that a barbed wire fence "sprang into view". This had the effect of providing some realistic looking machine gun scars on the leading edge and breaking the windscreen. However, there was no other damage, the "opened" cockpit was out of the oily slipstream of the motors and another flight was made.

It was now obvious that the high centre of gravity produced by the payload in the wings made the model a little unstable in the roll axis. This, we are sure, was the case and not a condition brought about by uneven power from the motors, or torque. On subsequent flights, one or the other of the motors cut. It was possible to execute wide turns away from the dead motor in either direction, i.e., if the port motor cut turns could be made to starboard, if the starboard motor cut turns to port proved to be the answer. In fact the model was throttled back on one occasion, landed, and taxied straight, still on one motor!

It was clear that the motors definitely needed sorting out; one, a reworked version, seemed a little tight, but Harry pressed on regardless executing a nice roll before the day's flying was concluded. On the whole, it was an informative and rewarding afternoon, and we feel that the lessons learned from observing the model in the air and the occasional agonised expression on the test pilot's face, will contribute to the perfecting of a technique for piloting, a choice of equipment, and the selection of many other suitable prototypes.

A Little Theory

Back at Harry Brook's establishment we summed up the requirements for R/C twins generally. These are as follows:

1. Subject should be chosen for close motor spacing, i.e., "Dakota", "Dove", "Catalina", etc.
2. Single fins seem to be just as effective as twin fins in the Yaw plane.
3. The weight of a twin engined wing is out of all proportion to that of a single.
4. The inertia of that wing could be harmful if the main undercarriage was fixed to the fuselage.
5. If retracting gear is used, it would be best to choose a subject which retracts forward, as landing shocks could distort spanwise retracting types, and severely strain rearward retracting mechanisms.
6. Why stop at two engines? Surely two hefty motors on the inboard stations have a couple of "working dummies" of about 1.5 c.c. just to keep the fans turning outboard.
7. There is, of course, a strong slipstream lift on one wing when the opposite motor cuts. This has the effect of trying to roll the model whilst the

Impressive head-on shot in heading picture shows those large cowlings.

Below : Equally impressive posed shot with its proud owner, gives the appearance of a larger model than its 72 in. span would indicate. Those diagonal markings certainly give it an indivdual appearance when airborne.

motor that is still running causes a yaw. That is why it is necessary to turn towards the good motor so that the lift is on the inside of the turn.

8. Large cowlings, whilst reducing the effective wing area, also reduce the amount of slipstream affecting the wing in this way. Against this, some of the thrust available from the prop is wasted.

9. Perhaps it was just an unlucky afternoon, but one or other of the motors, perfectly reliable individually, seemed to go sick. Can it be that with two motors the fuel tends to foam? Perhaps the control line boys have an answer to this one.

10. In order to cope with the change in directional trim produced by dissimilar motor output, a couple more channels for rudder trim would be helpful, although proportional might be the best answer.

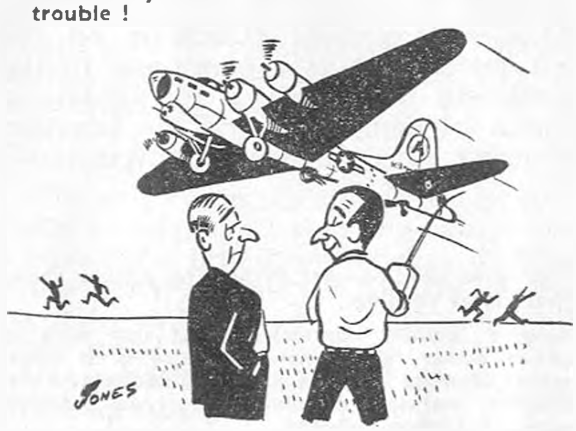
11. Large and as light as possible consistent with strength, as with single engined models, should make the subject easy to fly.

12. Finally, is it all worth it? *Definitely yes*! The sight of an R/C scale twin in flight is far more satisfying compared with a single, than a similar comparison in the control line field.

The problems associated with scale twins are not as difficult to solve as one might have supposed a few years ago, ultra reliable radio equipment and the larger number of experienced pilots with whom to seek advice, are only two of the signs of progress we experience today. If you feel tempted to branch out into this section of the growing scale R/C field we feel that you will have a reasonable amount of success.

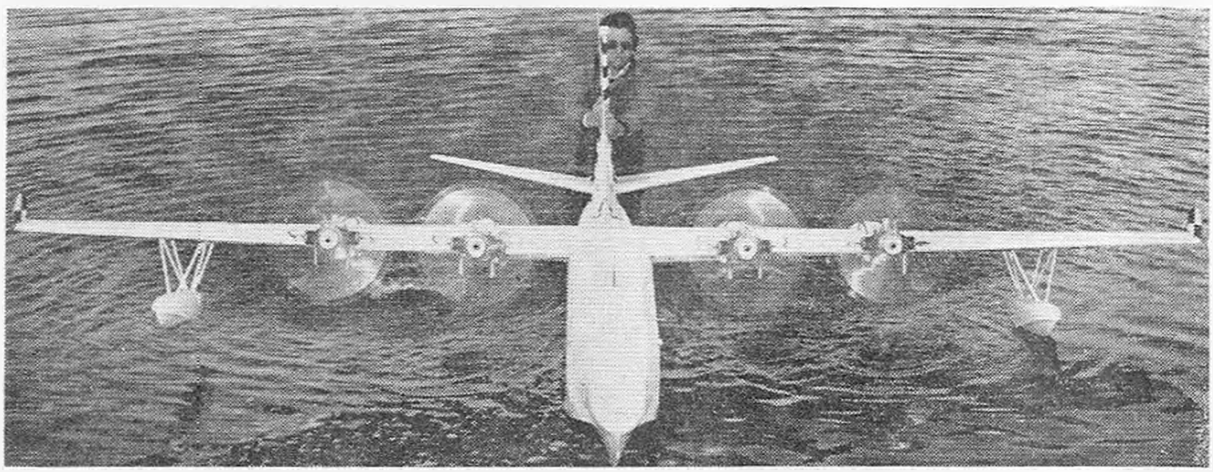
For a first attempt, choose a simple model and get it test flown by an expert, even if you are quite good at multi.

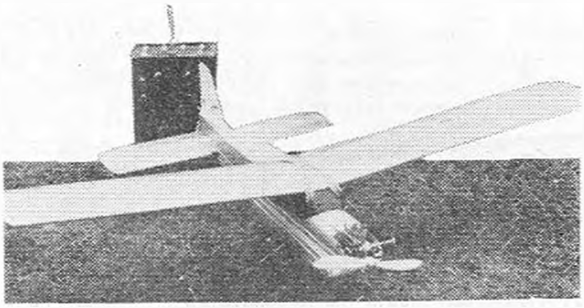
David shows the capacious fuselage whilst Harry indicates that there are TWO servo cables to connect in the wing.
Latest news is that the model has been successfully stunt flown — No more motor trouble !



"Why the panic? I'm on rudder only!"

Below : Food for thought? This Convair shot of a test model of the XP5Y-1, R/C proved invaluable in this case, although we feel that such a model would hardly be placed in the Fly for Fun category !





Building and Flying The Ambroid 'Charger'

PRACTICAL INSTALLATION AND TRIMMING DETAILS

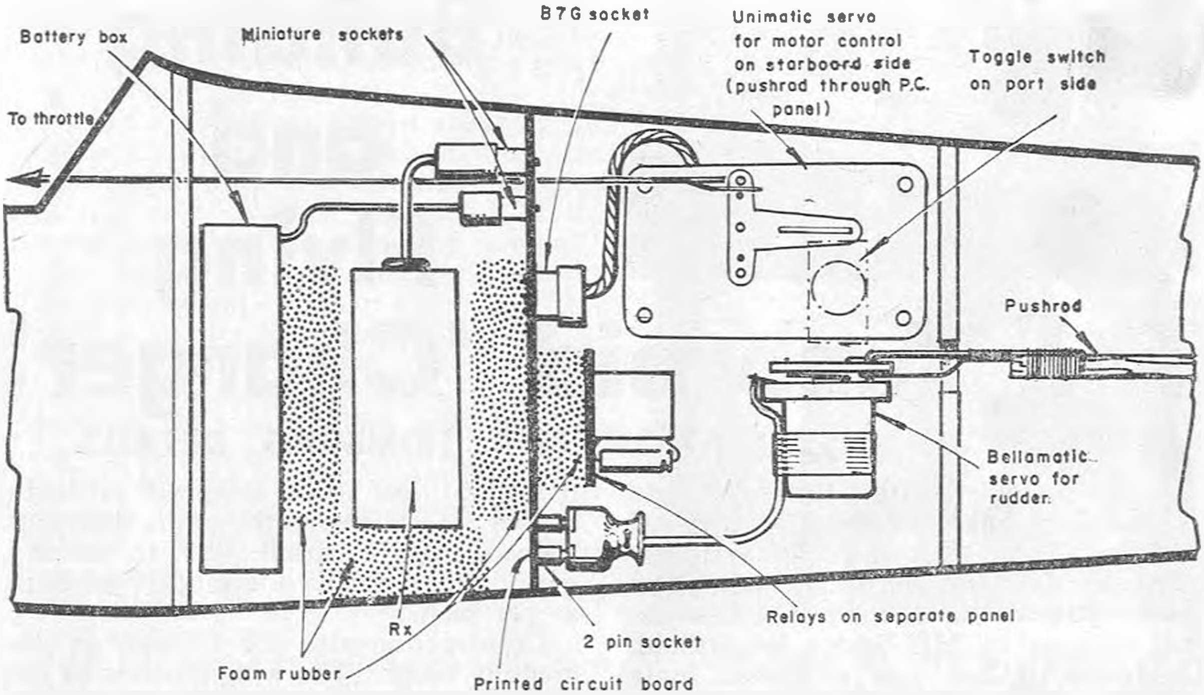
How many British R/C'ers have actually heard of the Charger? If you have not, then it is quite understandable as no rudder only aircraft has set the pace in this country. The Charger was designed by Milt Boone, Bakersfield, California, U.S.A., as a rudder only competition model. At the 1959 U.S. Nationals examples of this design, flown by Mr. Boone and friends from his Bakerfield club, took first, second and third places in the Rudder Only competition. Understandably this achievement made its mark on the modelling public of U.S.A. when the design appeared first in plan form and was subsequently kitted under the **Ambroid** label.

Roland Scott who imported it into Great Britain, sent along one of the kits some time ago, and the model is now complete. Basically the Charger is a good old high wing model. At 48 in. wing span it is of only average size for its category and few would surely describe it as a beautiful machine, although in its dumpy way it has a blunt purposeful attractiveness of its own. It is not therefore until one delves a little deeper to find out what "ticks" that one begins to appreciate the thought that has gone into this design. The high wing is even chord and has a desirably thick (13.3 per cent) flat bottomed wing section with a fairly blunt leading edge shape. The nose moment is long but the wing/tail moment is quite a short couple. The tailplane itself is again even chord. with a symmetrical section, 13 per cent thick, and is low set on the fuselage bottom. Undercarriage is nosewheel tricycle type. fixed permanently to the fuselage, which although essential in the case of the nosewheel leg is uncommon where the mains are concerned, the dural leaf type strapped on with rubber bands being the more popular. Indeed, first reaction was to modify here, but eventually the model was built as per plan.

Construction-wise the Charger is immensely tough. The wing has one of the toughest leading edges yet seen on a model of this type. It consists of a moulded $\frac{9}{16}$ x $\frac{7}{16}$ in. nose reinforced by a $\frac{3}{4}$ x $\frac{1}{4}$ in. strip, set horizontally to form part of the upper surface camber. The trailing edge is a moulding size $\frac{3}{8}$ x $1\frac{1}{4}$ in. (larger than average). There are two webbed main spars, the ribs are close spaced. and the tip blocks are hefty and solid. Cover this with nylon and you have a highly prang proof mainplane.

Forward of the radio compartment the fuselage is practically solid. At the equipment compartment the fuselage sides are reinforced by $\frac{1}{32}$ in. sheet, which though seemingly frail is adequately strong. since it is glued cross-grain to the $\frac{1}{16}$ sheet basic side. This compartment is also reinforced horizontally top. bottom, and vertically on each side by $\frac{5}{16}$ x $\frac{3}{8}$ in. strip imparting immense strength. Aft of here, the sides are "Warren" braced, reinforced with $\frac{1}{32}$ in. ply around the tailplane seat. The fin is built from $\frac{3}{16}$ in. sheet and the rudder is aerodynamically balanced. The tailplane is sheeted top and bottom on both leading and trailing edges, box webbed between ribs and combine strength with lightness.

On opening the kit, it is advisable to avoid disturbing the die cut sheets if possible for so well are they cut that merely lifting the sheets from the box causes them to fall apart. All the balsa has been chosen with an eye to weight, so that all parts provide the strength



required without adding necessarily to the all up weight of the airframe. A 3 oz. polythene bottle and hardware parts are provided for a fuel tank, and the wire undercarriage legs are ready shaped.

The plans in three sheets are, without doubt, a work of art by Bill Dean, who must have put many, many hours of effort into them. Installation details shown are as the prototype, with Orbit 1 receiver, Bonner Varicomp. rudder escapement and Bonner S.N. escapement for engine control. Construction is in 21 illustrated stages, and if the model is built exactly as per plan, there are 170 components, most of which are die cut or pre-shaped.

Although the Charger is designed primarily for single channel systems, our test model was fitted with multi channel equipment. It was quite obvious that any multi system installed would add extra weight. Rudder and engine were the controls required and for the rudder servo the Graupner Bellamatic was chosen, thus a three channel radio set was necessary.

The Min-X six channel was available for installation, but with separated relay box it weighed 7½ oz., rather heavier than desired. However the relayless receiver alone (3½ oz.) with transistor servo amplifiers would constitute a most reliable, delightfully light and compact unit. Unfortunately an amplifier to operate the servos satisfactorily could not be found, so three Gruner 957, 300 ohm. relays mounted on a paxolin base, connected to the reeds with 30 mfd. smoothing capacitors were substituted.

Beauty of the Min-X receiver is its all transistor 6 volts working circuitry, which will work off just four pen cells. All the power required for servos was 3 volts and two U7 pen cells sufficed here, making six in all, conveniently filling a Hillcrest battery box.

Turning now to radio installation; the battery box was placed at the very front of the radio compartment. Behind this was the receiver, which flopped very loosely in soft foam rubber. The Unimatic servo was bolted to the right hand fuselage side and connected to the engine throttle by a wire push rod passing over the receiver and battery box, through the front of the radio equipment. The Bellamatic rudder servo was held in place on the left hand fuselage side by a metal strap and connected to the rudder by a conventional push rod.

Instead of a wiring harness connecting receiver, power supply and servos a piece of copper clad printed circuit board (obtainable from RipMax) was etched to provide a printed circuit that would accommodate sockets to receiver, power supply and servo plugs, connecting them up in the same manner as a free wiring harness. The advantage is obvious. Tags to the sockets are soldered directly to the circuit board and thus eliminate hook-up wires, eliminating one of the prime causes of failure of a radio system. The etched circuit board then forms a removeable bulkhead and the radio components plug into it. An article on the production of printed circuit using the Charger circuit board as a subject, appears on page 32 of this issue.

A 2.5 c.c. engine is necessary, though at least one Charger was powered by a Veco .19 R/C. The design must not be underpowered by using an engine of less than 2.5 c.c. capacity, since the performance would be most disappointing and would defeat the object of the design. This is intended to be a high powered model for which full power is used to gain altitude. Then by throttling back to half motor speed, the model cruises, maintaining constant height. Dropping to slow motor speed allows the model to descend. All this necessitates the use of a throttleable motor, of course, and in this case the Enya .15 R/C glow, which is powerful and holds low speed well, was selected. Also necessary is a three position throttle servo and the Unimatic had only two positions. Those who possess Unimatic servos will know that they have three interchangeable wiper plates (of etched circuit) which provide three modes of operation. A fourth wiper board which provides three position sequence throttle control was therefore designed and is illustrated here full-size. (A suitable wiper plate for the Unimatic is now available from the manufacturers).

This was the second Charger to appear in the local model club, and from the performances of the first, some trimming problems were expected. First flights gave a mighty climb, a floating glide and the ability to climb slightly on slow motor speed! After trimming out it had $\frac{1}{8}$ in. under the trailing edge of the wing and $\frac{1}{4}$ in. over the trailing edge of the tailplane, plus some lead in the nose to bring the balance to correct point $2\frac{1}{2}$ in. back from the leading edge of the wing. By adding extra down thrust so that there were three washers under the rear of the engine and two under the rear of the mounting plate, the necessary packing over the rear of the tailplane was reduced to $\frac{1}{8}$ in. from which it might be concluded that the design is sensitive to changes of engine thrust line, but is quite tolerant to a wide margin of declage angles. The trimming problems seem quite general for six people so far met who used the Charger, all experienced the same problems.

Since our Charger had multi channel radio it was somewhat overweight. The original prototype weighed 39 oz. but ours tipped the scales at 52 oz., one third overweight, which proves the Charger is quite a weight lifter. When it comes to flying, multi channel equipment provides better control.

The Charger is a fine Rudder Only aerobatic model. A spiral dive is the basis of all aerobatic manoeuvres with rudder only models. For instance, one spiral dive was all that was required to roll the Charger; just spiral, let her straighten out, slap on opposite rudder, and round she goes in a marvellous barrel roll!

No one can reasonably expect a multi channel receiver to operate for a long period on four pen cells, and they are best changed fairly frequently. When the Unimatic stalled, it was time to change the servo batteries. Just replacing the two new cells cured the trouble. The Min-X transmitter is gold anodised which shows up any scratches that the case might contract. To combat this ours is enclosed in a soft leather case which fits snugly over it, with holes for the lever switches, pots and aerial socket to protrude. The case, complete with zip, cost only 17/6d. from a local Saddler who made it up to order. Why not try it for your transmitter?

In one of his regular newsletters, Roland Scott who provided the kit stated quite openly his opinion that the Charger was a rather expensive kit priced at £7/16/-. Well, maybe so, but it is certainly one of the finest.

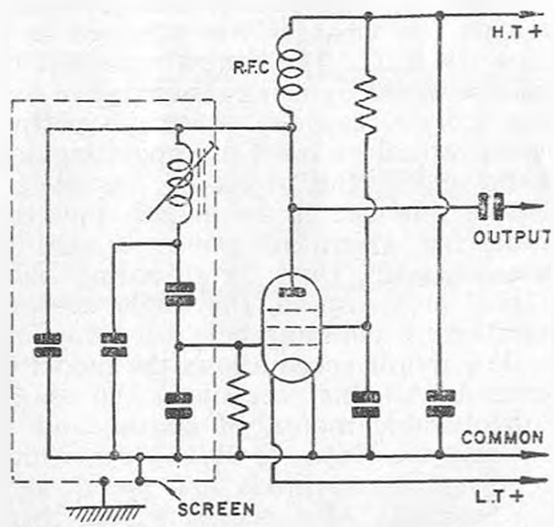
ARE YOU LICENCED ?

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

Variable Freqency Oscillator

J. H. BRUNT REVIEWS THE "TESLA" V.F.O.: A CONTINENTAL CIRCUIT, USEFUL FOR Txs

THE circuit to be described is the result of a thorough search through all the available V.F.O. (Variable Frequency Oscillator) circuits that will give high stability. The object being to get equal to xtal stability without the expense of an xtal. Fig. 1 is a theoretical copy of the original circuit. Fig. 2 is the practical circuit. the result of actual tests carried out in order to prove the suitability of this design for incorporation in radio control transmitters. The following text will give a clearer idea of the advantages of this circuit.



BASIC CIRCUIT FIG. 1

Introduction

As far as can be traced. this circuit was first introduced to British radio amateurs early in 1956. Originally developed in Czechoslovakia. the circuit was produced by TESLA. a Czech state organisation to provide a stable V.F.O. for use at H.F. The stability is indeed very good, in fact the article upon which my own work has been based (see R.S.G.B. Bulletin March, 1956) stated that, "In home made equipment a figure of ± 0.01 per cent is readily attainable without extra precautions". From this it is reasonable to expect that a stability of ± 0.005 per cent can be achieved, providing care is taken in the contruction. Commercially, stabilities in the order of ± 0.002 per cent have been achieved! The upper frequency limit appears to be in the region of 70 Mc/s, in fact some amateurs have used the circuit in 2 metre transmitters, doubling from 72 Mc/s to 144 Mc/s.

At V.H.F., the circuit can be a little tricky. but at 27 Mc/s no problems were met. In the basic circuit given in Fig. 1 a pentode is employed but a triode may also be used. The frequency determining components should be of the highest quality and it is best to house these in a non-magnetic screening box. In the examples shown the frequency is adjusted by the dust cored coil.

A Practical Circuit for 27 Mc/s

The circuit given in Fig. 2 is the result of my own experiments with this circuit, no trouble was experienced, in fact the unit worked first time. The 1L4 is used but a 3S4 or similar valve may also be used. The TESLA circuit is triode connected, in this case the screen grid being used as the anode. The output of the V.F.O. is 27 Mc/s FUNDAMENTAL. The harmonic output is very low which is a great advantage when T.V.1 has to be provided. The output is taken from the anode circuit which is in this case also tuned to 27 Mc/s by L2 and a 20pf capacitor. The pentode thus serving as buffer as well as oscillator, in the same way as in the Electron Coupled U.F.O.—the output being coupled by a capacitor to the grid of the R.F. Amplifier stage.

This capacitor should be kept as low in value as possible, consistent with adequate drive to the R.F. Amp. grid. With a 1L4 sufficient drive was available to drive a 3A4, this with only 67.5 volts H.T. to the 1L4. The 3-30pf trimmer should be set to approx. 1/3 from minimum capacity. The frequency is set by means of L1, the dust core should be approx. half way in the coil for the middle of the model control band.

Finally L2 is adjusted for a dip in anode current, or alternatively adjust L2 to give maximum grid current in the R.F. Amp. stage. The following tips will be of assistance to constructors: (1) Keep all wiring as short as possible. (2) The frequency determining components should be in one group to allow their easy screening. (3) The screening box should preferably be of copper sheet—20 gauge is a good thickness to use—which is also easily worked. (4) Position L2 such that its field is at right angles to the field of L1. No further constructional details are given, as it is felt these will depend on the type and size of the transmitter being built or modified. NOTE: With the 33pf capacitor removed and L1 replaced by an Xtal. the oscillator may be operated as a "Pierce" circuit.

Conclusion

This type of oscillator has a stability—if well constructed—such that it can be used to eliminate an expensive Xtal, thereby considerably reduring the cost of the transmitter. Further, as the frequency is readily adjustable, any desired channel may be rapidly set up, either to avoid interference to another superhet model in the same pond or field, or to enable operating to other "pre-tuned" gear receivers—which is not readily retunable. Finally, apart from the high stability the low harmonic output will be a great help to modellers wishing to

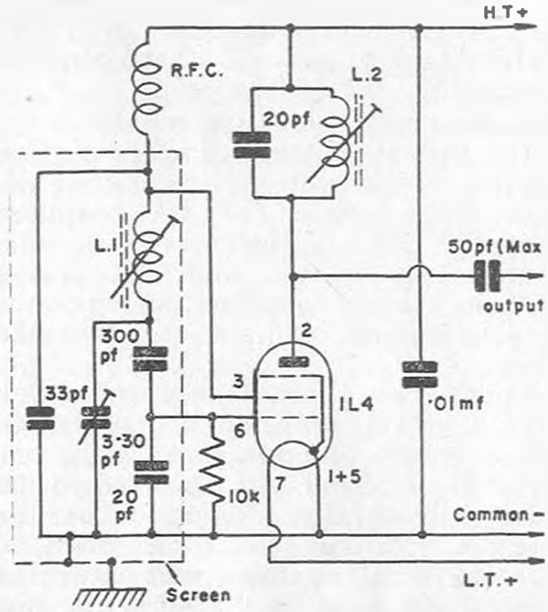


FIG. 2

PRACTICAL CIRCUIT

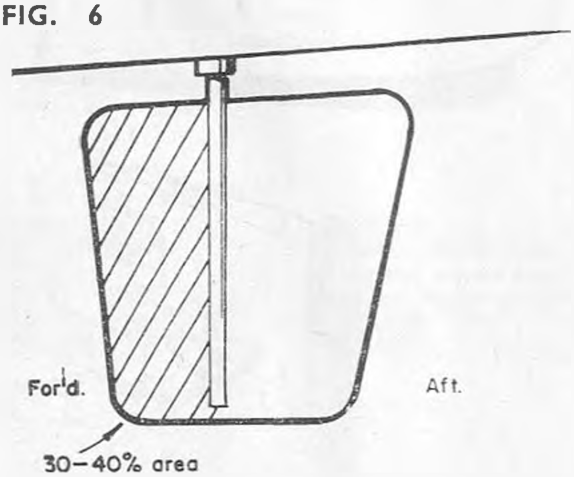
L1 12 turns 34 s.w.g. enam. close wound on ¼ in. former; L2 10 turns 24 s.w.g. enam. close wound on ⅜ in. former. Both coils are dust core tuned.

avoid T.V.I caused by 2nd harmonics in some areas of the country. Possibly some manufacturers will adopt this type of oscillator, in place of the self excited types which are not too stable; and/or the crystal controlled types, which are to say the least expensive, then we can expect cheaper but equally good commercial R/C transmitters. At least we can hope for a move in this direction.

BALANCED TURNS

(Continued from page 17)

FIG. 6



This appears to us to be a case where we have relied rather too much on full-size practice as a guide to rudder effect. We work at entirely different Reynolds numbers and have other major differences, such as a smaller ratio of prop-wash spiral diameter to beam (i.e., the diameter of our propeller spiral in relation to the hull beam is far greater) and many factors have begun to emerge, particularly on fast models (and therefore less noticeable and harder to pin-point on slower models) which show that considerable differences from full size are necessary for top performance with models. But more of this another time!

Gadgets and

LET us start this month's collection of Gadgets and Gimmickry with two useful applications of that plentiful commodity—the broken prop.

Push Rod Adjustment (Sketch **A**)

The first by I. Midgley offers a quick solution to the problem of adjusting the push rod length for the required "neutral". This arrangement is a little lighter than the nut and bolt system used by some modellers and permits easy adjustment without removing the wings.

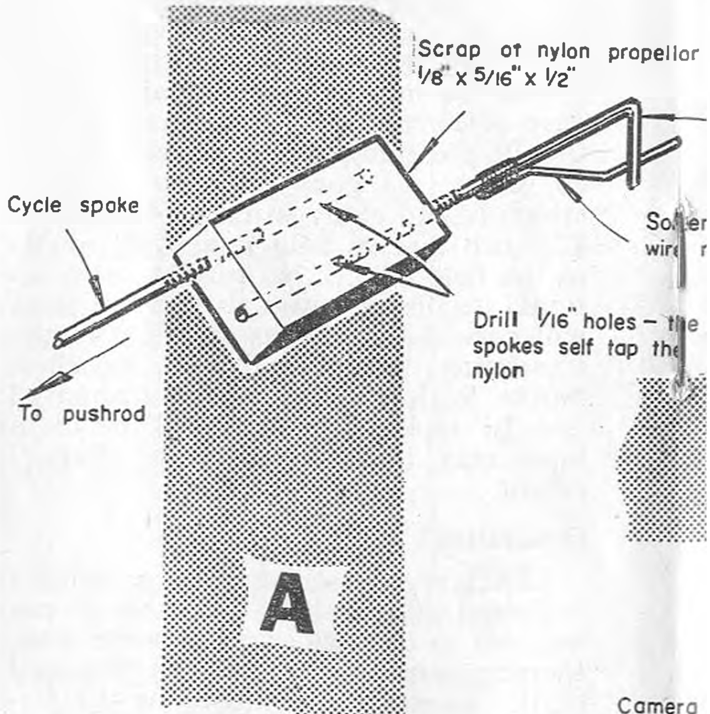
Simply cut a small piece of nylon from a broken propeller and drill it to take a couple of cycle spoke ends, one of which is bound and cemented to the balsa pushrod (after kinking to clear the fuselage aperture), the other provided with the usual retaining wire and bent at right angles to fit the horn. By disconnecting this part from the horn, it may be screwed in or out of the nylon block which it self-taps most effectively. As both pieces of spoke are threaded; twice the amount of adjustment is possible.

Control Horn Repair (Sketch **B**)

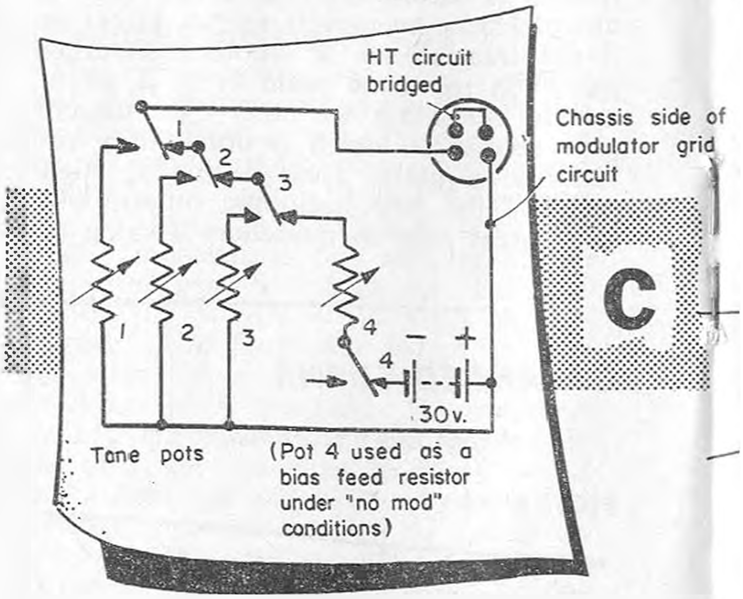
This second idea from I. Midgley uses a further slice of old nylon prop to bush worn control horns. The procedure is to open the hole in the control horn out to at least $\frac{1}{8}$ in. square, press in a tight fitting plug of nylon and warm the assembly up with a soldering iron. The plug which should protrude $\frac{1}{32}$ in. each side of the metal may now be squeezed so that it is locked in place. All that now remains is to hold the horn up to the light, mark the centre of the nylon and drill $\frac{1}{16}$ in. to provide a long wearing bushing to an otherwise useless piece of hardware.

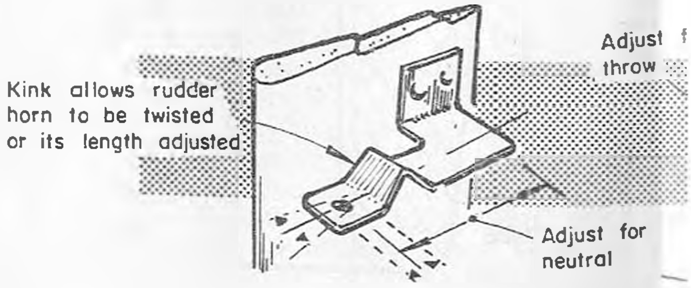
Repairing Dents and Scratches

With the inevitable dents and scratches that appear from time to time in model boats, we find the best filler is Belco Cellulose Putty. This is of course intended for application to metal, but it will adhere readily to any exposed woodwork, undercoat or enamel, and the cellulose content does not appear to have any adverse effects (pickling, etc.) on paints of lead or other base materials. Rubbed down with WET and DRY paper it gives a smooth surface with a feather edge, and with a coat of paint the scars disappear. Damaged contours can be rebuilt, and subsequent prangs do not loosen the filler. L. R. Tanswell suggested this, and the following idea.

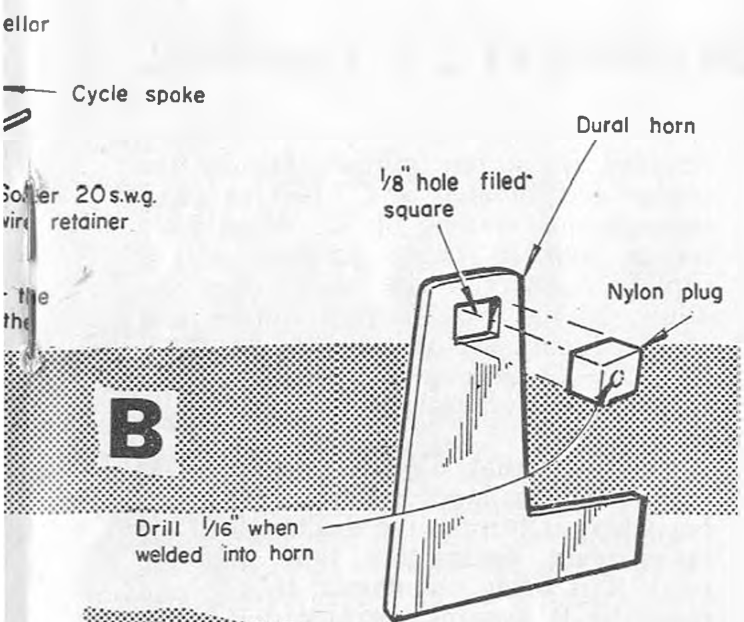


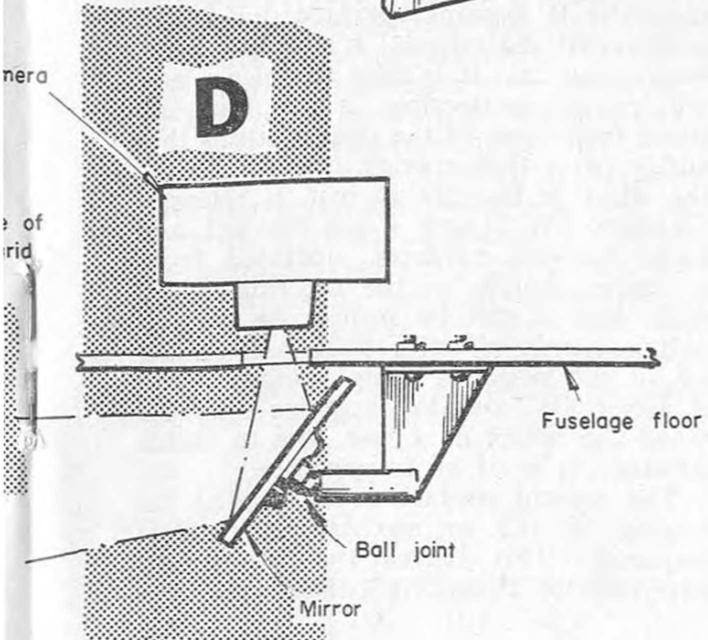
Camera

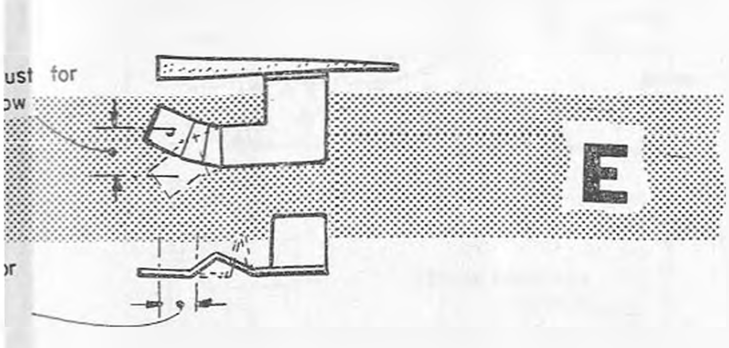




d Gimmickry







A Spot of Circuitry (Sketch C)

With a number of tone transmitters in common use, it is the practice to key the modulator both with the connection of the tune pot in the grid circuit, and at the same time apply +HT to the screen, or anode and screen. This necessitates the use of double push-buttons, whereas micro switches with their more positive action could be used to advantage. The snag is that these are limited to a single change-over contact, both in the ex-government variety and in the new miniature type. It can be seen from the circuit, that the +HT is permanently connected so that with ground based Tx's, the +HT line need not be taken up to the control box, and if a four pin plug is used for the keying lead, the pins in the +HT circuit can be bridged and only a two wire lead used. The battery will last its full shelf life as no current is drawn, and an old battery could well be used for supplying this –ve grid bias. The positive side of the battery must go to the chassis side of the keying socket.

Camera Angles (Sketch D)

Enclosing a miniature camera in a radio model has a few disadvantages in that it is difficult to get shots looking obliquely instead of straight downwards. J. Bridge suggests a mirror mounted on a ball joint on a suitable bracket below the fuselage. A camera may then be placed inside behind a suitable aperture, viewing the scene via a mirror. We would suggest that his arrangement could be used on the side of the fuselage as well if ground clearance was a problem. The advantage of the system is that the mirror may be adjusted while the camera and its control gear remains fixed. Don't forget to print the film from the wrong side of the negative.

Adjustable Control Horn (Sketch E)

J. Perry is responsible for the control horn on "Six Gun" (R.C. 631—A.M. Plans Service) published in December, 1962, issue of *R.C.M. & E.* The crafty kink in this sheet metal horn allows the position of the push rod attachment to be varied to provide either a different amount of throw (to increase or decrease the angle through which the rudder moves). By crimping the horn still further, a differential throw may be obtained (greater movement one side than the other) or a small amount of adjustment for precise neutral position.

Right Wheel

AN R/C STEERING SYSTEM FOR BOATS BY L. R. TANSWELL

MANY control boxes employ keying buttons for steering purposes, but this is just about as realistic as eating roast beef and custard with left handed chop sticks! It is also a fact that those who have difficulty in sorting out left and right when models come towards the control point, find little trouble when presented with a steering wheel. In addition to this, there is something that can best be described as the "feel" of a control box. With a wheel that merely operates contacts between definite stops and with a travel of perhaps 30 degrees, the confusion aspect of left and right can be overcome, but if the wheel can be rotated continuously in either direction, the "feel" approaches that of the real thing.

The requirements of such a system are:

(1) The wheel must be continuously rotatable in either direction.

(2) The left and right steering channels must be keyed while the wheel is being turned in the appropriate direction (this applies to tone and mark/space).

(3) The keying condition must be removed automatically when the steering wheel comes to rest.

In order to satisfy (3), many mechanisms, both mechanical and electrical were tried by the author, and fellow member L. A. Burville; but snags arose under operating conditions before the system to be described was evolved. (As shown in the theoretical circuits).

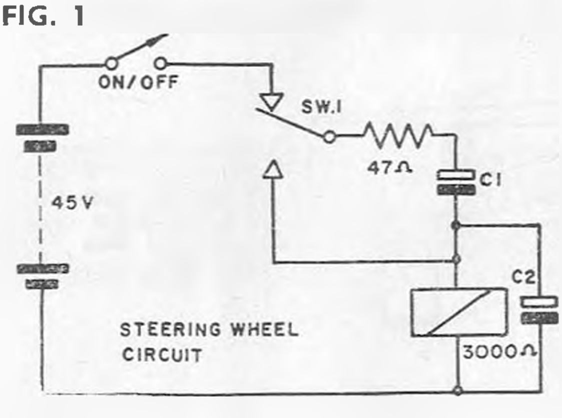
The operation is fairly simple. SW1 is a change-over contact operated by turning the steering wheel, but more of this later. At the moment, consider that if the wheel is turned very slowly either way SW1 changes over at a rate of about 10-15 times per second.

In the position in which it is shown and with the switch on, current will flow to charge C1 and C2. While this is flowing the relay R will operate. When C1 and C2 are charged, current will cease and R will release, having been retained for a few milliseconds by the charge accumulated by C2 leaking away through the winding of R. When SW1 moves into its other position, C1 is rapidly discharged via the 47 ohm. resistor, acting as a current limiter and also reducing arcing troubles at SW1. With SW1 returning to its former state, C1 and C2 recharge and the cycle restarts.

Assuming that SW1 is operating at about 15 times a second when the steering wheel is turned, the discharge of C1 takes place during the time that the relay R is being maintained by C2, and therefore R remains operated during the rotation of the wheel. If this gives the impression that R is slow to release and will cause oversteering—it will not; any more than some of the push buttons that suffer from that spongy touch. When the wheel is brought to rest, R releases. Contacts SW 2 and 3 are the left and right marking contacts, operated from a simple clutch on the steering wheel shaft and as can be seen from the circuit, are only effective if R is operated, i.e., if the wheel is being turned. Thus if either SW2 or SW3 remains operated when the wheel is at rest, due to clutch pressure, it is of no importance.

The second contact of R is used for keying + HT or auxiliary circuits if required. This leaves the mechanical problems of operating contacts SW1, 2

FIG. 1



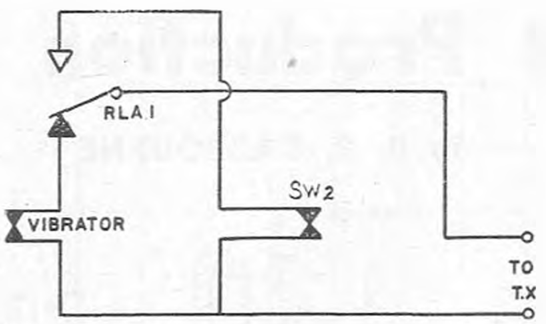


FIG. 2

Mark Space Circuit

and 3. In order to avoid contact bounce and a consequent loss of charging current to C1 and C2, SW1 is made from a commutator taken from an old electric motor or dynamo.

Various sizes of commutator are in use amongst our members, and providing it has an even number of segments (preferably eight or 16 though this is not essential), all will be well. The commutator was removed from the motor and glued with Araldite on a suitable size of shaft, coupled through gearing to the shaft bearing the steering wheel. For an eight segment commutator a ratio of 40:1 was suitable, for a 16 segment one 20:1 would be required and so on.

A brass stud was fixed to the upper end of the commutator and strapped to a pair of opposite segments. For an eight segment one strap to a pair of opposite segments, for a 16 segment one, two pairs and so on.

Three shim brushes of brass were cut, and mounted so that one rested on the brass stud Araldited to the top of the commutator, and the other two brushes were set to bear on the segments, but at 90 degrees to each other. (If more segments are strapped together than as indicated above, bridging of these two brushes will occur, with the result that R relay may be held in direct to the battery and a permanent signal will be transmitted while the wheel is stationary.) It will be seen that if the commutator is rotated, the top brush will be connected to the other two brushes alternately, and the unit will operate as a change-over contact, the top one corresponding to the lever spring of SW1 as shown in the circuit.

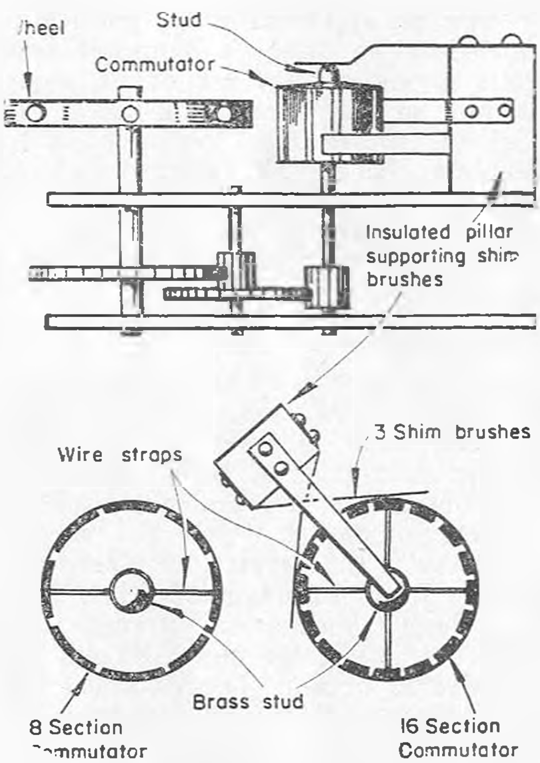
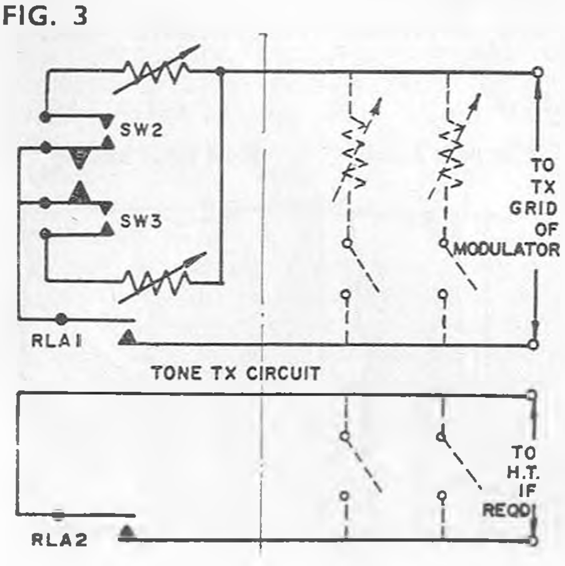


FIG. 4

The brush tension will have a braking effect on the commutator, and this imparts certain impression that as the wheel is turned. you are actually steering the model, which in fact, you are.

SW2 and SW3 are mounted on either side of the steering wheel shaft, and operated by a lever working from a simple slipping clutch. Depending on how close you choose to mount the contacts to the lever will determine how much free movement of the steering wheel you can have without transmitting a signal. Opinions differ, but in the

FIG. 3



(*Continued on page* 33)

Printed Circuit Production

MAKING AND WIRING A PRINTED CIRCUIT NEED NOT BE DIFFICULT IF THE FOLLOWING TIPS ARE OBSERVED

By B. R. CASBOURNE

ALTHOUGH a fair amount of information has appeared in this publication from time to time, a comprehensive article giving correct use of PC board has not so far been published. This article attempts to set out a basis for reliable and cheap PC board design and construction. Some of the points are common knowledge but have been included to keep this article as complete as possible.

Types of Board

For the purposes of home built equipment there are two main types of board. Synthetic Resin Bonded Paper (SRBP) has the advantage of being cheap and easily obtainable. It is eminently suitable for experimenting, general purpose "switchery" and most RF networks. Epoxide Resin Impregnated Glass Fibre has a higher mechanical strength than SRBP but is slightly more difficult and expensive to obtain. The electrical properties are excellent and is to be preferred in RF circuits. The usual accepted thickness of board is $\frac{1}{16}$ in. (.062) including copper foil and the thickness of the latter is usually .0014 in. representing 1 oz. to the square foot.

Design of Board

Many articles published carry not only circuit diagrams but full size PC layout and placement diagrams. This can form one of the major pit-falls if a little care and forethought are not taken. Quite often on having meticulously drawn, etched and drilled the board, the experimenter finds that due to variation in physical dimensions not all the components can be accommodated on the original pattern. It is therefore essential that before a PC pattern is traced all components are to hand and have been assembled "dry" on the board. If enlarging or reducing is required, an easy way is to make use of graph paper and

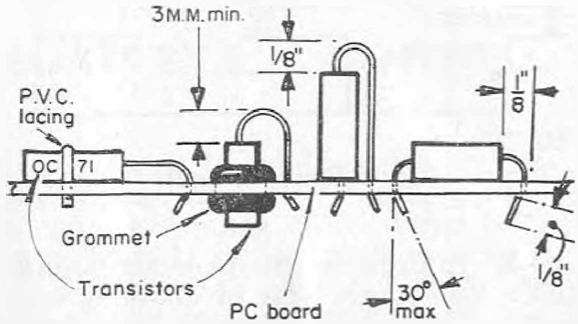


FIG. 1
Mounting Components

a pair of dividers. If it is intended to mount the board on an aluminium or other conducting chassis it is necessary to ensure that the copper lands on the PC board are not shorted out via the fixing screws and chassis. Allow for etching the copper around any fixing holes, sufficient to provide at least $\frac{1}{16}$ in. clearance.

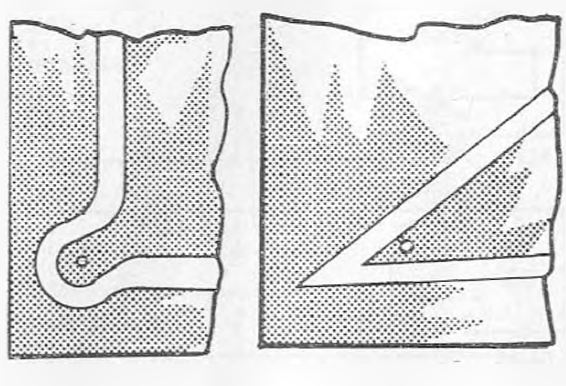
During the design of the actual pattern the following points should be borne in mind. Conductors should preferably be not less than $\frac{1}{32}$ in. (.031 in.) wide and without sharp corners, as these tend to have a greater liability to lift from the board.

The maximum current that may be carried by a conductor is limited by its thickness, width, the material it is printed on and the ambient temperature. The graph in Fig. 3 shows current capacity for a 10° C. rise above ambient on SRBP board.

The minimum recommended spacing

FIG. 2

Correct lands **Bad land shape**



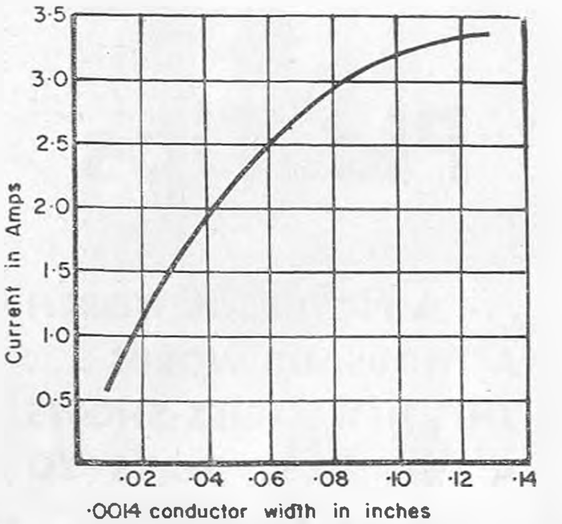


FIG. 3 **Line width current capacity for 10° C. rise above ambient.**

between adjacent conductors on SRBP is as follows:—

0-150v. peak — Minimum spacing $\frac{1}{32}$ in. (.031).

150-300v. peak — Minium spacing $\frac{1}{16}$ in. (.062).

For voltages below 50 the spacing may be reduced to $\frac{1}{64}$ in. (.015). However, care must be taken to ensure complete etching at these widths as the narrow gap between the resist is easily bridged by bubbles thus preventing the etchant reaching the copper.

Care should be taken to ensure that damage is not caused to components by mechanical stress or heat during soldering. This is particularly applicable to transistors. If it is anticipated that transistors will be required for other equipment, holders should be employed to prevent any possibility of damage during unsoldering.

Generally speaking where components weigh less than $\frac{1}{2}$ oz., capacitors, resistors, transistors, etc., they should be mounted in close contact with the PC board. When components weigh more than $\frac{1}{2}$ oz., large electrolytics, transformers, relays, etc., they should be adequately supported other than by their connecting wires.

When attaching components to PC boards it is often desirable that a component be changed for testing or fault finding. Consequently, after passing through the lands, the leads should not be at an angle exceeding 30°. Fig. 1 shows the preferred method of mounting components of a PC board. In no case should the wire be bent down hard against the foil. This tends to increase the chance of a dry joint due to the inability of the solder to flow under the wire.

The mounting of the PC board should be such that it is not under any undue stress. Large changes in ambient such as obtained in an enclosed unit in the hot sun (?) can cause the foil to crack when under stress. Intermittent operation could result and the cause is usually very difficult to trace.

To protect the circuit foil an anti-tracking varnish may be used. The type of varnish should be beyond doubt as some types could cause appreciable losses at 27 Mc/s.

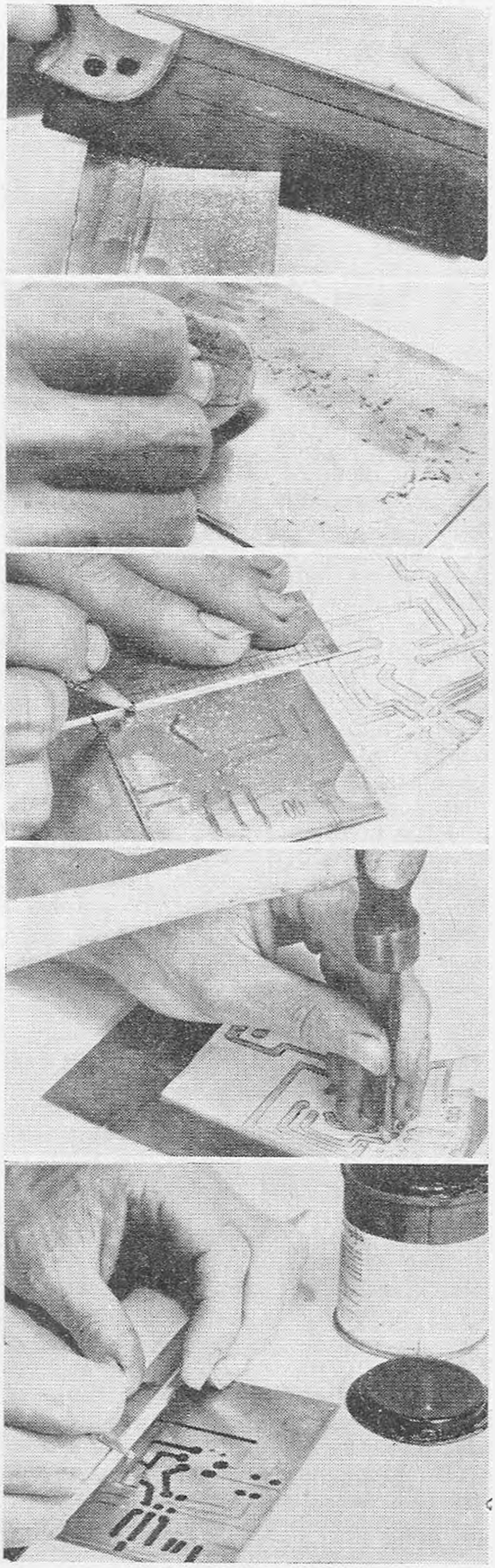
Etching

Many methods of etching have been discussed recently and some of them appear to have failings. However, a method which is extremely cheap and takes about half-an-hour from start to finish (although this does depend a lot on the complexity of the circuit—the half hour was based on the construction of a 5 transistor Rx board) is the use of white Fablon or Contact self adhesive plastic film. This is stuck over the copper foil and the circuit drawn directly on to the surface. The unwanted plastic is cut away with a sharp blade and the board is ready for etching. An efficient method is the use of iron perchloride (obtainable from Johnsons of Hendon through most photographers, price 3/9d. per 1 lb. bottle) which gives a very clean line etch. A concentration of approx. 4 oz. iron perchloride dissolved in a pint of hot (50° C.) water will etch a board in about six minutes. This quantity of fluid is sufficient to etch at least 100 sq. in. of PC board representing a cost of less than $\frac{1}{8}$d. per square inch. The use of very hot water (80° C+) should be avoided as this tends to result in a ragged edge to the copper lands as well as increasing the risk of the plastic film peeling up. Following etching thoroughly wash, remove the plastic resist and scrub the copper lands using a proprietry cleansing powder.

Conclusion

Printed circuit board correctly used is undoubtedly the most reliable and cheapest way of constructing radio control equipment. Provided the basic rules are followed, success can be assured.

More details overleaf



Pic Tips

. . . A PICTURE IS WORTH A THOUSAND WORDS . . . THIS NEW SERIES SHOWS A FEW EASY WAYS TO SUCCESSFUL RADIO CONTROL

★ ★ ★

PRINTED CIRCUITS

★ ★ ★

Stage-by-stage production of Ambroid "Charger" circuit board described on page 23.

Left, top to bottom :

Saw the board at a fairly flat angle, this prevents damage to the laminate. Note copper surface ON TOP.

Use an ink eraser to clean the copper . . . Dirty surface slows the etching.

Place the pattern next to the board and mark lands with very soft pencil using a ruler to line marks up with pattern.

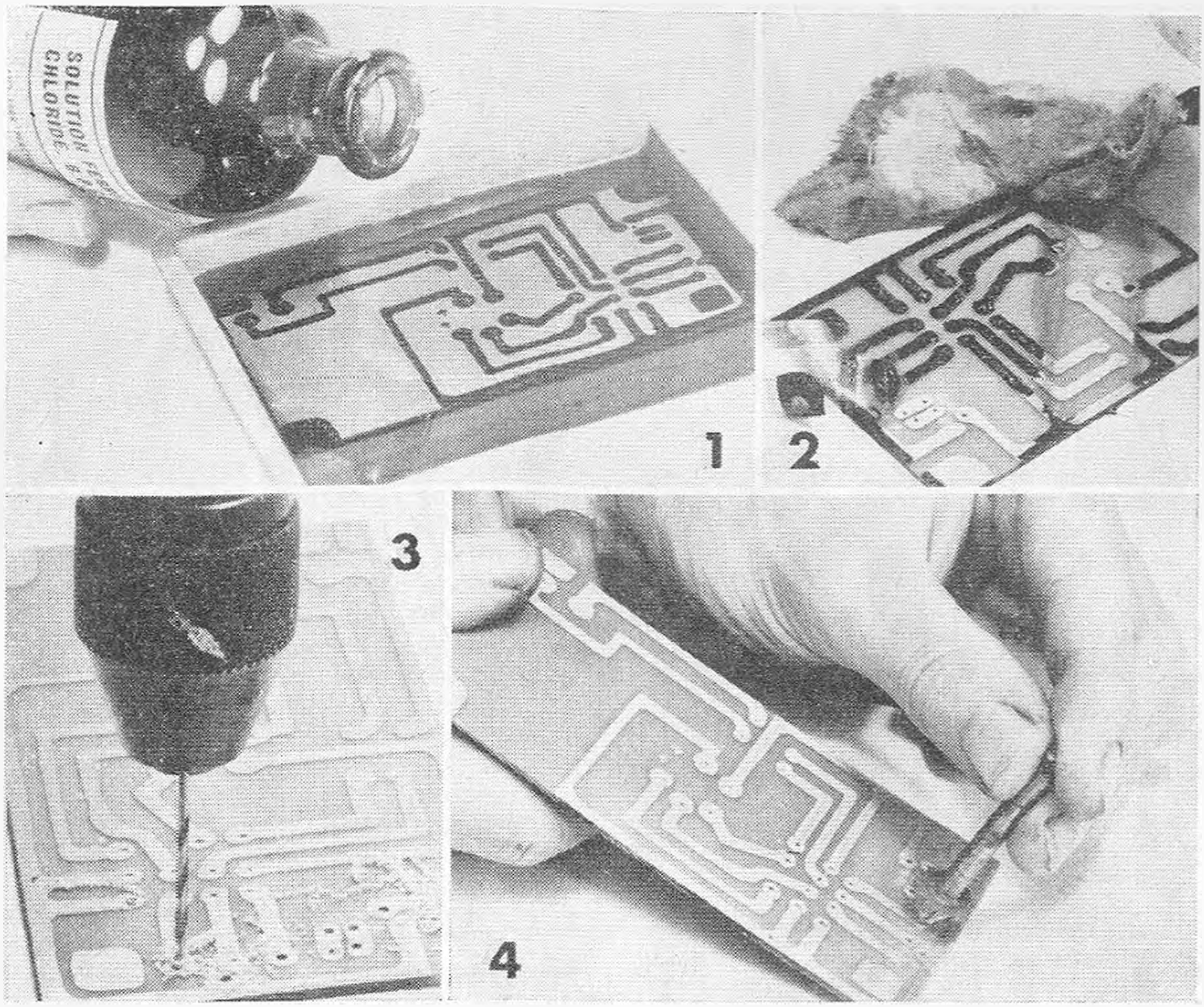
Alternatively, place pattern over copper and mark land holes with a centre punch or even a small nail.

A draughtsman's rule pen or, in this case, a No. 0 paint brush used against a rule with Humbroil enamel or slightly thinned colour dope to paint lands. The rule and brush idea is quite easy and much quicker.

Facing page :

1. With the paint or dope dry, place in a plastic or glazed pottery dish and pour on the strong solution of ferric chloride. Stand dish in hot, not boiling, water to speed the etch.
2. When completely etched wipe dope clear with thinners on a rag, or stick Cellotape over the surface and peel off (the dope comes with it).
3. Drill with light pressure. Holes should just clear wires.
4. De-burr the holes with a countersink held in the hand.

. . . Now where's that soldering iron? . . .

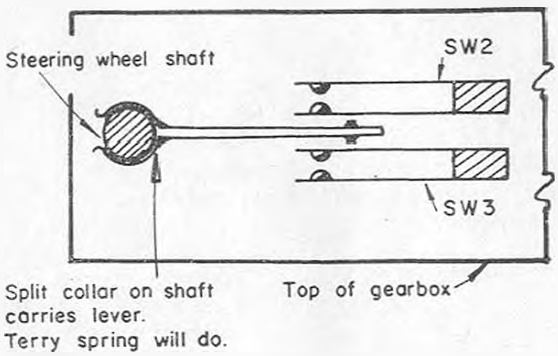


RIGHT WHEEL

(*Continued from page* 29)

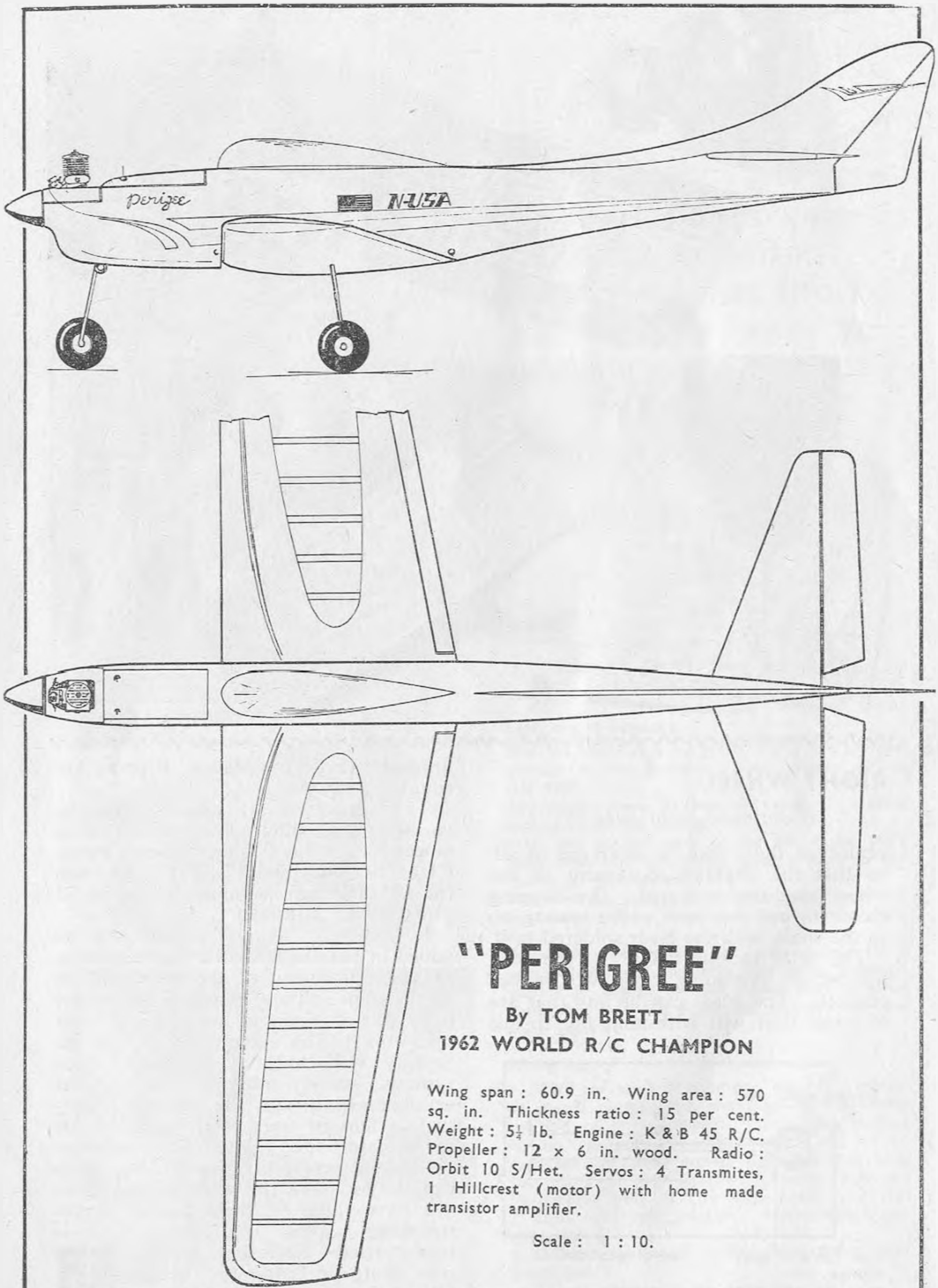
prototype there was no clearance at all, so that the slightest movement of the wheel produced a signal. The slipping clutch in use is a split collar sprung on to the shaft, with the lever soldered to it.

The relay can be a G.P.O. type or a lightweight, providing it has two "make" contacts. The gears can be any that are to hand that will withstand the torque applied. Those by Messrs. Ripmax are suitable.



The values of C1 and C2 can be varied to suit different relay coil resistances, i.e., a 1,500 ohm. winding needs C1 at 100 mfd. and C2 at 32 mfd., and for a 5,000 ohm. winding try C1 at 25 mfd. and C2 at 8 mfd.

If required tuning buttons can be added in parallel with the channel leads, so that adjustment of the radio can be carried out without turning the wheel (this is not essential for three-handed operators!) The system can be applied equally well to tone or mark/space systems, merely altering the contact arrangement to suit the particular control system in use. With a choice of commutator size, relay type, condenser values and gear ratios, most of the parts can be got from the average junk box. We have three of these control boxes operating, some big, some miniaturised, but they have one thing in common, they all work.



"PERIGREE"

By TOM BRETT — 1962 WORLD R/C CHAMPION

Wing span : 60.9 in. Wing area : 570 sq. in. Thickness ratio : 15 per cent. Weight : 5¼ lb. Engine : K & B 45 R/C. Propeller : 12 x 6 in. wood. Radio : Orbit 10 S/Het. Servos : 4 Transmites, 1 Hillcrest (motor) with home made transistor amplifier.

Scale : 1 : 10.

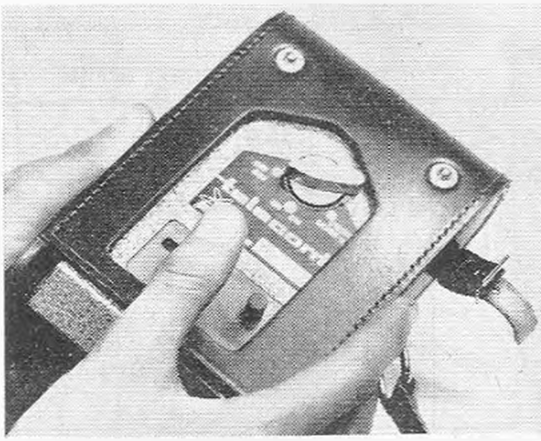
Telecont on Test

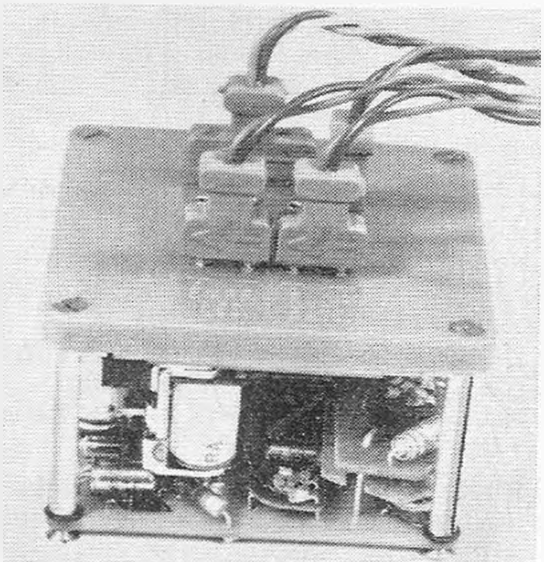
J. H. BRUNT REVIEWS THE 3 CHANNEL VERSION OF THIS COMPACT ALL TRANSISTOR FILTER OUTFIT

FIRST information on this system appears to have been published in "Funkchau", 1962, No. 3. The source of the present information is "Funkchau", 1962, No. 14. Both the Transmitters and Receivers are fully transistorised. The operating frequency is 27.12 Mc/s. the transmitters being crystal controlled. The transmitters are pulse modulated, the R.F. section consists of a crystal controlled oscillator, driving a push pull R.F. Amp employing two transistors. The modulator consists of a two transistor multivibrator type circuit followed by a one transistor amplifier. Making a total of six transistors in the three channel transmitter.

The nine channel transmitter employs 16 transistors, 13 in the modulator. The R.F. section is similar to that of the three channel transmitter. The receiver system is so designed that the required number of channels may be "programmed" by means of "plug in" units.

The H.F. section of the receiver is an Ultra Audion Super-regen Detector, followed by two stages of A.F. amplification, this appears to form one unit on to which plugs another unit consisting of the filter circuits and relays. Three transistors are employed in the tone filter and relay circuits, making a total of six transistors in the three channel receiver assembly. No details are yet to hand with respect to the five and nine channel receivers. Transmitter supply voltage is 12 volts in all cases. Receiver supply voltage is 6 volts.





MANUFACTURER'S DATA
Telecont Three Channel Transmitter (No. S1-760)

Technical Data

RF: 27.12 Mc/s., crystal stabilised.

Modulation: approximately 5, 6 and 7 Kc/s. Square wave.

Output: approximately 150 mW.

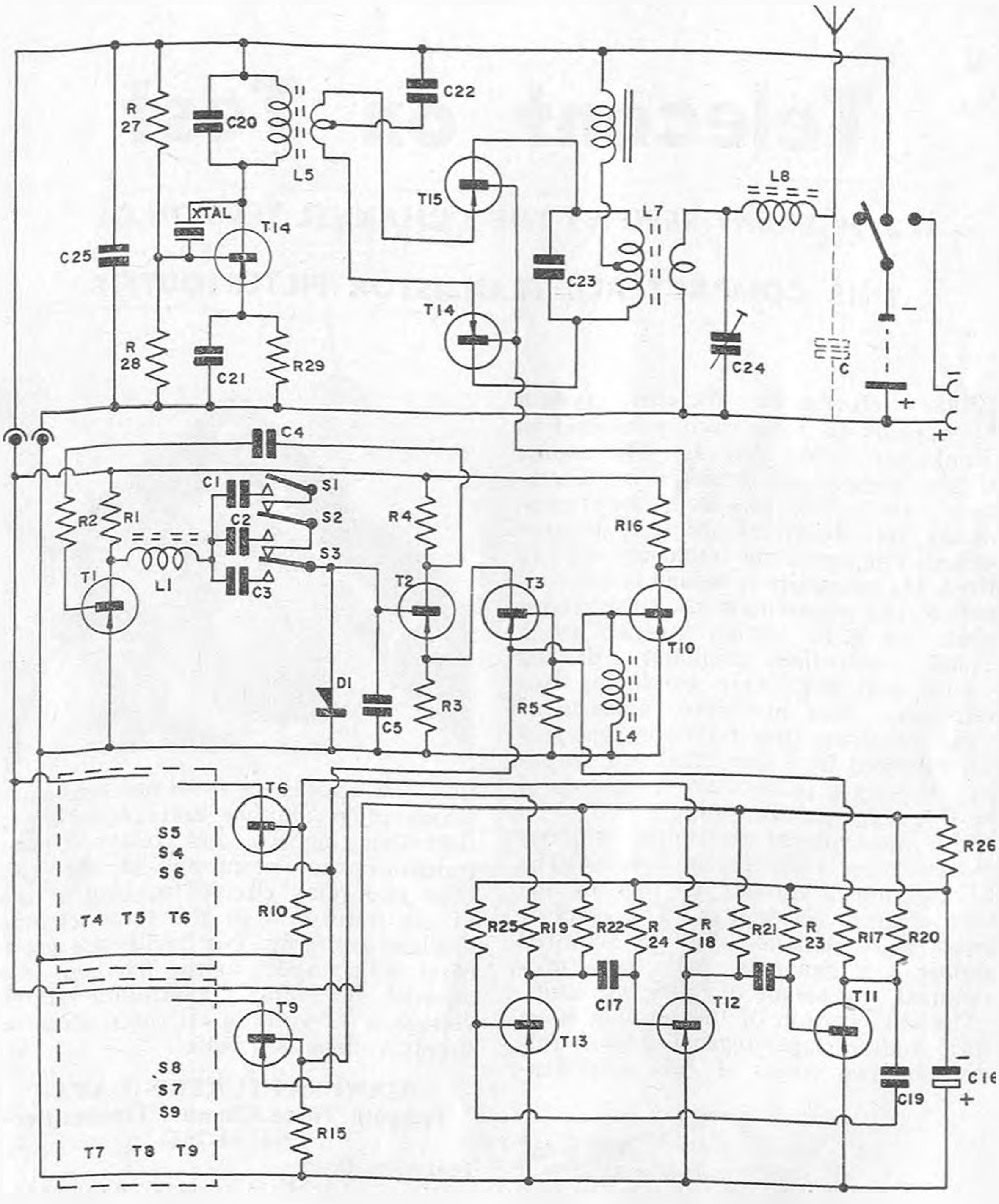
Power Supply: 12 volts DC (10 x DK 225), contained in transmitter case.

Current drain: idling 7 mA. button pressed 40 mA.

Transistors: 3 x AF 113 L HF; 2 x TF 65 NF (LF); 1 x TF 66 switcher.

Diode: 1 x OA 91.

Heading picture shows just how small the Tx is. Natty leather case, too!
Left: The 3 channel Rx with the lower case removed, note the connecting plugs on the top panel.



HF-SECTION
R27 100 kOhm
R28 6.8 kOhm
R29 50 Ohm
C20 10 pF
C21, C22, C25 1000 pF
C23 47 pF
C24 Trimmer 10-150 pF
Xtal 27.12 Mc/s.
LF-GENERATOR
R1 4.7 kOhm
R2 47 kOhm
R3 470 Ohm

COILS
L5 25 T. 2 x 2 T coupling.
LDr 6 Hf
L7 2 x 5 T windings; 2 T coupling.
L8 15 T lead-through cap
All Transistors AF113 L
L1
L4 0.1 H
Di 1 OA91
S1, S2, S3.

R4 3,3 kOhm
R5 2,2 kOhm
R16 12 kOhm
C1, C2 2500 pF
C3 1500 pF
C4 0,1 Mfd
TONE SECTION (Typical values)
R25, R24, R23 25 kOhm
R22, R21, R20 2 kOhm
R26 1.5 kOhm

C1, C2 and C3 matched with L1 for tone required.
C5 1000 pF
T1, T2, T3—TF65, T10 —TF66
C17, C18, C19 1 MFD
C16 10-25 MFD
R19, R18, R17 5 kOhm

TYPICAL CIRCUIT: *Copyright, reproduced by courtesy of Richter-Electronik-Gmb H.*

Description

The transmitter type S1 is non-simultaneous. It is tuned to channels four, five and six of the audio frequency allocation. The identification numbers used in the sketch, match those used in the hook-up template cards which were supplied with the three channel receiver E1.

Power Supply

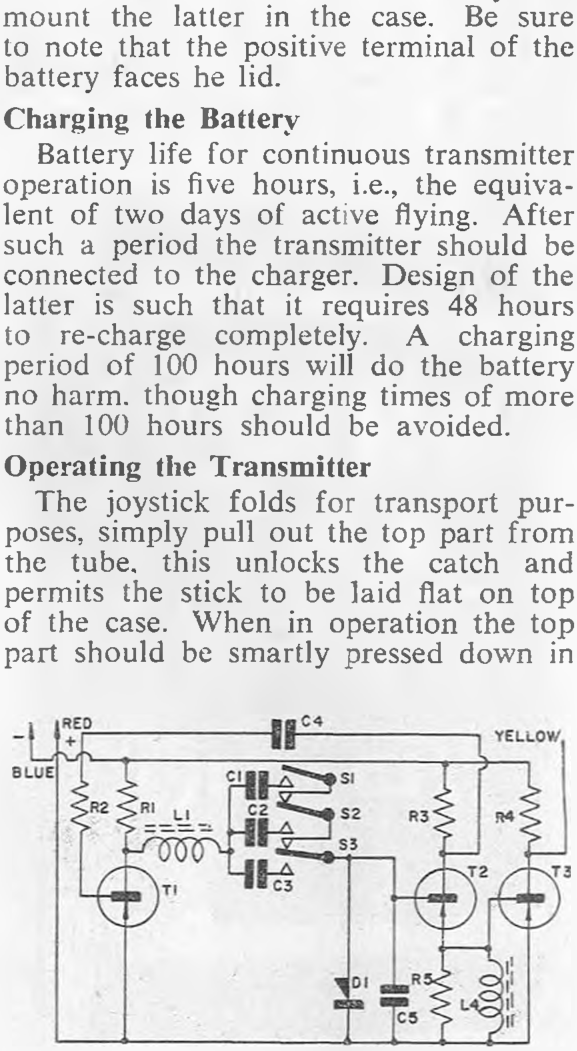
The transmitter comes with the battery installed, ready to operate immediately. The battery is not removed from the transmitter whilst being charged. The transmitter is then simply wired to the charger L.2. The rotary switch of the transmitter is tuned to position "laden" (charging). If for some reason the power supply needs replacement, remove the back-plate of the transmitter, unscrew the grub screw which secures the circular cap on the side of the case, the battery can then be easily removed from the case. Solder the leads, red one to +ve terminal, blue one to −ve terminal of the battery and mount the latter in the case. Be sure to note that the positive terminal of the battery faces he lid.

Charging the Battery

Battery life for continuous transmitter operation is five hours, i.e., the equivalent of two days of active flying. After such a period the transmitter should be connected to the charger. Design of the latter is such that it requires 48 hours to re-charge completely. A charging period of 100 hours will do the battery no harm. though charging times of more than 100 hours should be avoided.

Operating the Transmitter

The joystick folds for transport purposes, simply pull out the top part from the tube. this unlocks the catch and permits the stick to be laid flat on top of the case. When in operation the top part should be smartly pressed down in the tube so that it is locked again by the catch and forms a rigid lever.



The Antenna

This is plugged into the transmitter from outside the leather case. The top portion folds for transport.

The S-1 Tx. is carefully factory tuned and is unaffected by possible outside interference. Thus no tuning what-so-ever is required.

E1 Receiver — Three Channels

(No. E1-7602)

Technical Data

RF: 27.12 Mc/s.

Relay: S.P.C.O. channel 4. 5 and 6.

Demodulation: 3 channels. 4-7 Kc/s. selection by tone circuit stages.

Power supply: 6 volts.

Sensitivity: approximately 3μ volts.

Current drain: idling 5 mA. (25 mA. under load).

Transistors: 1 x OC 615 HF: 2 x TF 65 NF (LF); 3 x TF 65 switcher.

Diodes: 3 x OA 91.

Relays: 3 x Kaco, shockproofed.

F.T.Z. NO.F. — 537/62.

Description

The E1 receiver may be operated with any of the transmitters in the Telecont range. It is fully transistorised and uses highly stable series resonant circuits *wired in parallel for tone selection.* The rudder servos are actuated via relays. These relays are specially shockproofed for this receiver, which makes them less liable to damage in the event of a crash.

The Relays

All relays are equipped with a single pole change-over contact which can carry a switching current of 2 Amps. This has been achieved by removing the contacts and substituting high voltage flat contact springs with silver and gold contacts instead.

The Electrical Components

Printed circuit construction is used and partial encapsulation of components renders them crashproof.

3 Channel Tone Generator Values

R1 4.7 kOhm	C1 1500 pF	T3, TF66
R2 47 kOhm	C2 1000 pF	L pot core
R3 3.3 kOhm	C3 700 pF	(4000 cps
R4 12 kOhm	L4 LF winding	with C1)
R5 470 kOhm	T1, T2-TF65	D1 OA91

permits easy removal of individual sections. Making for fast and inexpensive repair work.

The Antenna

The antenna of the E1 receiver is a separate unit with leads and socket. The plug supplied with the set is soldered to the antenna mounted in the model. Length of the antenna is not particularly critical (length 12-24 in.). When using the set for the first time a quick range check should be made. With the transmitter antenna fully extended a ground range of approximately 200 yards ought to be available. If the range turns out to be much less then the primary circuit of the receiver is probably out of tune, due to a badly matched antenna. It can easily be cured by turning the copper tuning slug of the receiver (hole in the side of case) using a small screwdriver for turning the slug. The procedure used is the standard one; while tuning the receiver with the transmitter at long range, slug is turned until the receiver relay drops out. This tuning procedure is only required if the set is installed in a new model, or if a new antenna is fitted. (As with all Telecont receivers the connections of batteries and rudder servos are made with the aid of the special patented plug-in system, with plug-in "Pattern Cards"). All batteries and rudder servos are plugged in with their miniplugs at the indicated positions on the receiver socket plate. The Mk. E1 provides a choice of two programmes. The three channels available can be used for:

programme 1-3 single channel rudder servos;

programme 2-1 single channel and 1 two channel rudder servos.

Position of the plugs is shown in the wiring diagrams for the rudder servos. All plugs are marked by arrows. Their pointed ends must point in the same direction as those printed on the pattern cards. The pattern cards that come with the set are simply placed on same and the plugs are inserted at the appropriate positions. This eliminates any soldering and wiring. In order to permit the hook-up of rudder servos of other makes, adapter plugs and leads are supplied.

Right : The Tx with back removed. Separate panels are fitted, the one shown has the 3 channel tone generator in place with the R.F. part at the top.
Top of page 39 : Transmitter and charger.

TEST REPORT

The equipment received for test consisted of the following:

Telecont Receiver Type E1
(three channels)

OC615 Super-regen Detector. 2 x TF 65 A.F. Amplifier followed by filters having three tone channels each consisting of:

Pot-core filter unit and "Diode pump" switching circuit using OA91 and TF65 operating a KACO S.P.C.O. relay.

Leads for connecting receiver to batteries and actuators

Telecont Transmitter Type S1
(three channels)

Using six transistors as follows:

3 x AF113L crystal oscillator and Push-Pull R.F. amplifier.

2 x TF65 tone generator

TF66 switch-modulator } Modulator
OA91 } unit.

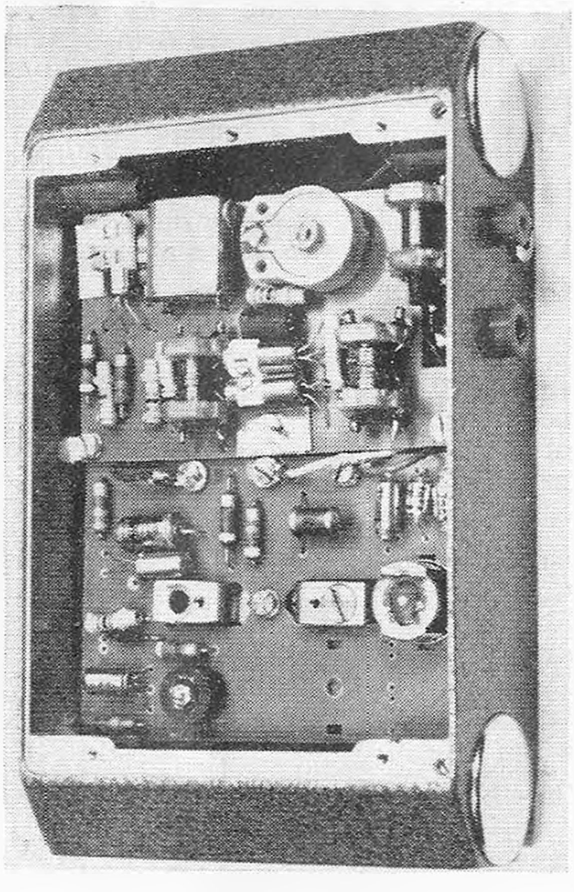
Telecont Charger Type L1

This is a "trickle" charging unit for use on 220 volt A.C. mains.

MECHANICAL CHECKS

Receiver

Housed in a plastic case, constructed in a compact form using printed circuit boards. Connections being made by means of 20 sockets on the top panel of the case.



Comments

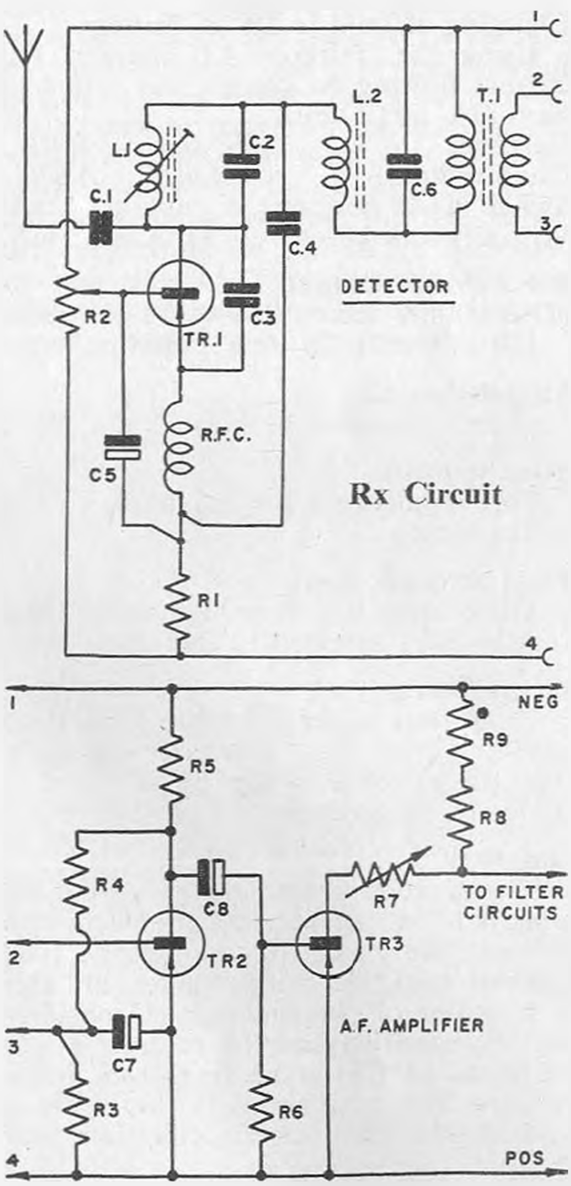
Well designed and neatly constructed. One item that has been overlooked in terms of making the unit foolproof is the fact that the supply connection can. unless care is taken, be inserted in the incorrect polarity.

Transmitter

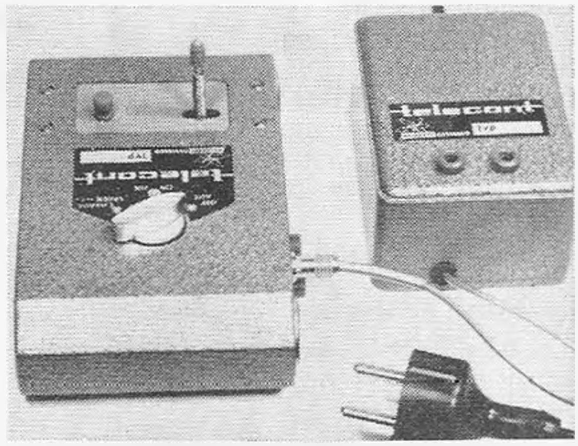
No doubt this transmitter is the most compact unit of its type on the market, to date. It is well constructed and housed in a die cast alloy case which should stand a lot of hard wear and tear.

Charging Unit

A normal unit. the one supplied for test is made only for a 220 volt supply. It has now been made more universal, namely covering 200-250 volts and with outputs for 6 and 12 volts.



Rx Circuit



Preliminary Electrical Check

No problems were experienced here. and the equipment worked first time. WARNING! make sure the supply plugs and sockets to the receiver are inserted in the correct polarity.

Electrical Performance Test of Receiver

Indicator lamps were wired into the relay output circuits for this test.

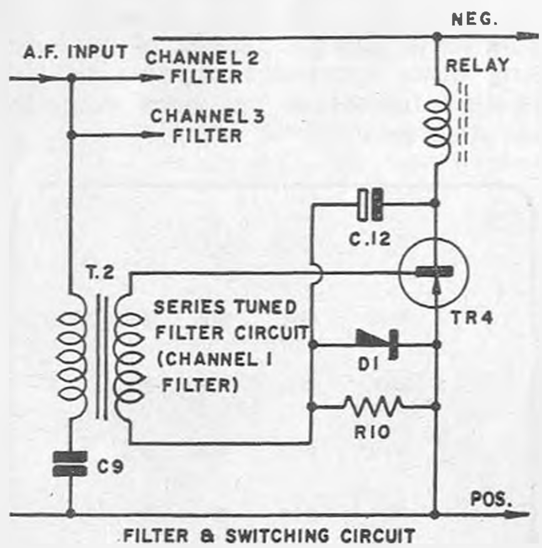
Rx Values

R1 12 kOhm
R2 Pot 10 kOhm lin
R3 3,3 kOhm
R7 Pot 500 Ohm
R8 82 Ohm
R9 Varistor B8 320 01/P
C1 15 pF
C2 17 pF
C3 47 pF
L1 1,5μ H (with 17 pF cap).
L2 HF winding
Tr1 LF-Trans 4:1

R4 47 kOhm
R5 4,7 kOhm
R6 1,5 kOhm

C4 47 pF
C5 10 MFD
C6 1 MFD
C7 2 MFD
C8 2 MFD

T1 OC615 T2, T3, TF65



FILTER & SWITCHING CIRCUIT (CHANNEL I ONLY)

Filter Unit

Ls1 Pot core with Cs 9:1500 pF (series tuned).
C12 2 MFD R10 510 Ohm
Kaco Relay modified.
Di1 OA91 T4 TF65.

Consumption Checks

Total Currents taken

Standing Current NO SIG.	4.5-5 mA.
Current with carrier only	1.7-1.8 mA.
Current rise with modulation same on all channels	25-30 mA.

Relays make at 20-22 mA. and break at 12-14 mA.

Bandwidths and Frequency of A.F. Filters

Filter Frequency	Bandwidth
5.3 Kc/s.	200 c/s.
6.4 Kc/s.	200 c/s.
7.6 Kc/s.	300 c/s.

NOTE: On very strong signals, a 3.8 c/s. tone will also trigger the 7.6 Kc/s. channel.

Sensitivity

5μ volts modulated at 100 per cent (pure sinewave) will operate the receiver on any channel.

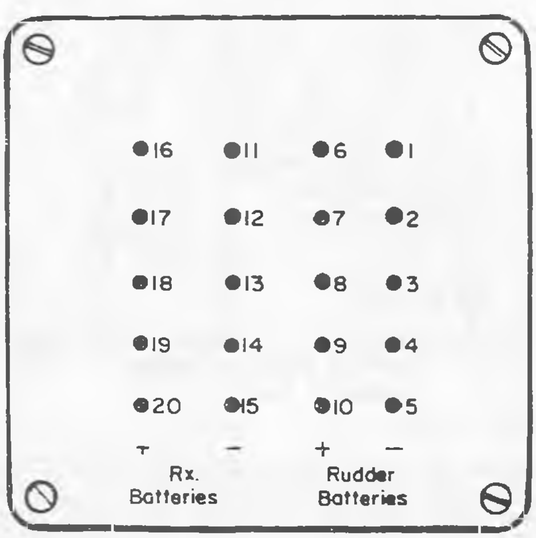
NOTE: Test shows that modulation percentages below 100 per cent will not trigger the channels reliably with used sine wave modulation. Pulse modulation is obviously required, this the matching transmitter provides.

Comments

The receiver is not as compact as some that have been tested, but it performs very well. Tone discrimination is very good and it is not prone to interference despite its sensitivity.

From tests made, it would be advisable to use a DEAC supply rather than Dry-cells, as DEACs give a more constant voltage.

The programming cards are a good idea providing Robbe actuators are being used. For the benefit of modellers using other types of actuators the following information has been compiled. (See diagram).



Socket Nos.	*Connection*
1, 5 & 9	Centre Contact RL5 and Rudder Battery negative
16	Back Contact RL5
6	Make Contact RL5
2	Centre Contact RL4
17	Back Contact RL4
7	Make Contact RL4
3	Centre Contact RL6
18	Back Contact RL6
8	Make Contact RL6
4	Low impedance A.F. Output to additional filter circuits
9, 10, 11, 12, & 13	Rudder Battery pos.
14	Spare Socket (unconnected)
15	Receiver Battery neg.
20	Receiver Battery pos.

Electrical Performance Test of Transmitter

Charging of built in DEAC battery

Using the Telecont L1 charger, the current flowing on charge was found to be 6 mA. at 12 volts.

Current Consumption	*No Aerial*	*With Aerial*
Switch in ON position	8 mA.	8 mA.
With any tone keyed	24.5 mA.	25.5 mA.

R.F.2 Power Output

(This is only accurate to ± 10 per cent).

150 milliwatts in tone condition only.

Modulation A2

(This appears to be pulsed). I.C.W.

Tone Stability

This is adequate for the filters in use in the receiver.

Field Strength Tests

These indicate a very high signal level for the R.F. supplied to the aerial.

Range Check

From tests made ground to ground up to 500 yards, there is every indication that the range that can be achieved is perfectly adequate for all conditions.

Summary

A very good example of what can be achieved in terms of compact and efficient radio control equipment. The receiver could be made smaller, but this is a matter of personal taste. Considering the sensitivity of the receiver I was surprised to find it so free from interference. The relay action is very positive and should stand up to vibration very well.

Contest Collection

PHOTOGRAPHS FROM BOAT AND AIRCRAFT MEETINGS

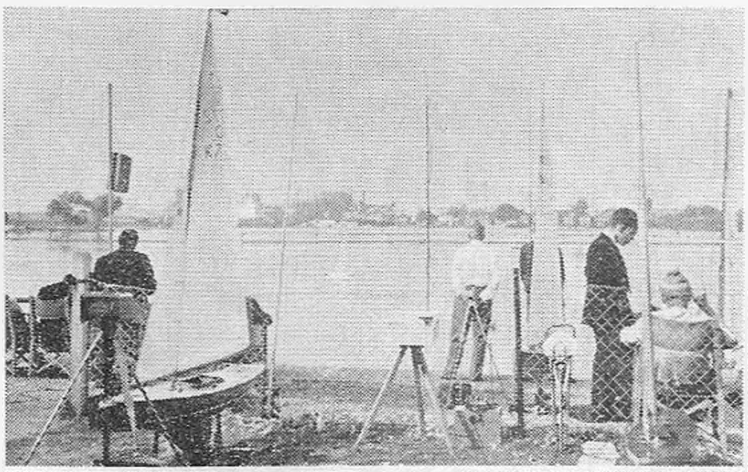
including news and views by "The Commodore"

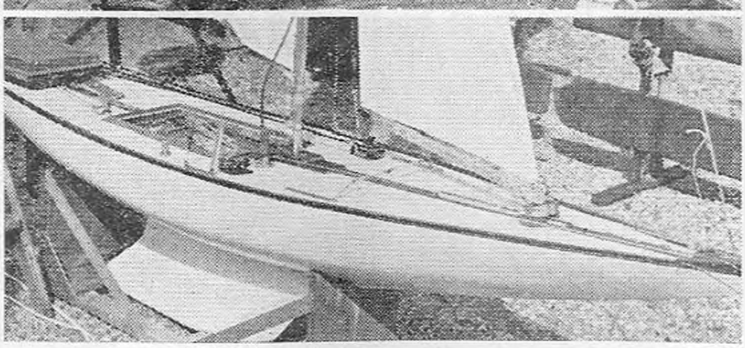
THERE was nothing uncomfortable about the weather at Poole on the 1st and 2nd of September this year. In fact it was delightful to sit in the sun in the mild warm S.E. breeze, and watch the radio-controlled yachts jockey for position at the starting line. The spectators were very tense, and the writer thinks the competitors all lived an ulcer forming moment as the O.O.D. counted out the seconds down to the starting gun, and they were trying to position their boats to pass over the starting line within a split second of the gun. Of course, when an impetuous competitor did push his bows over the line before the zero count he had to go back and re-enter the race by going over the line again, in the meantime his opponent was forging ahead round the course.

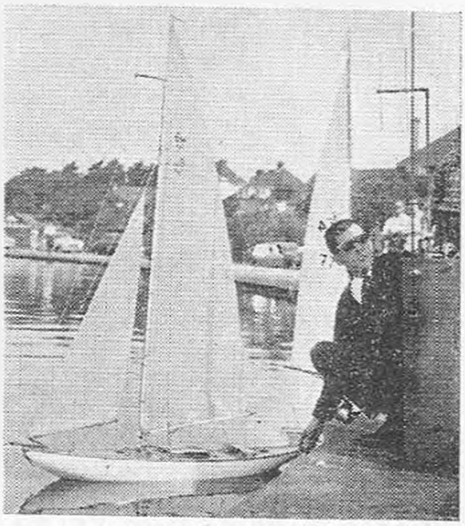
The Regatta programme covered three events. 1. The Hogg Cup, for R/C yachts under 56 in. 2. 'The Taplin Cup', for any boat above 56 in. 3. 'The Laidlaw-Dickson Cup', for any R/C yacht. There were three entries for the Hogg Cup, and 13 entries for both the Taplin Cup and the Laidlaw-Dickson Cup.

The Sailing Committee decided all events would be run off on the tournament system. This meant in the events where 13 yachts were entered, 78 races would have to run off to complete the tournament. Owing to the impossibility of forecasting the wind strength throughout the day, the committee safeguarded itself by ordering one lap round a three legged course, one minute to position for start, and also set a deadline for racing to 6 p.m. The result would then be calculated by totting up the points each competitor had collected at the close down of the last heat run off.

To attempt this programme meant some pretty smart marshalling of boats to the line, and no waste of time be-







Left top: The transmitter pound at Poole with a race in progress in the background.

Left bottom: Interesting winch detail on the deck of Mr. Tamplin's "Salema".

Below: Mr. Foster and his 6 metre "Cinderella".

Photos by C. S. Downes, Parkstone.

tween races. The alternative to this scheme had to be a knockout competition, which is most disappointing to the competitor who gets knocked out in the first race. He of course has then finished, and might as well go home. All the competitors agreed to the committee's proposals, and co-operated to the full in being smart to the line, and quickly off the water.

The marking was fixed at 6 points for a win, and 2 points for second if he completed the course within 2 minutes of the winner passing over the finishing line. The sailing rules were those of the Royal Yacht Association. All protests —quoting the rule number—had to be handed in to the O.O.D. in writing. The protests would be considered by the sailing committee before the results of the race were declared.

On Saturday three protests were received. On reference to the rule claimed to have been infringed, and the facts as observed by the judges all three protests were upheld. This seemed to have impressed the competitors that there was more in it than just racing round a course with a competitor when the R.Y.A. rules applied. The writer does not know how much midnight oil was burned on Saturday night studying the rule book. It was significant that the sailing on Sunday was meticulous in its observance of giving way when "Water" was rightly demanded. It was also exciting when one competitor was successful in rightly luffing his opponent away from his turn round a mark. On Sunday there were no protests.

In this tournament system the yachts are so frequently on and off the water that the spectators soon learn the names of the yachts, especially as at Poole they are called to the line by name over the loud speaker. This seems to hold the interest of the crowd which was expressed by many rounds of spontaneous applause when a close race was concluded.

Over the two days of the Regatta 106 races were run off, even so, time prevented a completion of a tournament of 13 boats. This means a two day regatta of 13 boats would use up all the time with only one event, especially if two laps per race was the order.

If this sport is to progress further it seems regattas of the tournament system must be of great assistance to the competitors. In this way each competitor 'good or bad', gets plenty of competitive practice. At the present stage of development, we at Poole feel it is of no help to the sport or industry to be too pedantic about a Class size of craft competing. Our policy at present is to throw them all together and give them plenty of practice in sailing against one another. This last regatta showed the big boat did not always prove faster than the small boat. In fact it is the writer's opinion, Foster's little 6 metre yacht would have won the Laidlaw-Dickson trophy if the skipper had chosen a spot on the starting line with a bit more wind in it for his last race.

When the competitors have had plenty of practice, and have learned how to sail under full sized rules, then they may demand a one class boat for the sport. The demand must come from the competitors themselves; they are the people who either have to make or buy them. In the meantime new designs can be put to the test in these 'free for all' tournaments, in that way, some day, someone will say, "That's the boat for R/C racing", and many will agree. This is much better than a committee presenting a blue print of a new class to the competitors and saying. "This is the design for your sport". The answer will always be, "Prove it on the water before we accept it".

After the President, Mr. L. S. Miller, had presented the prizes, many competitors said this was the best regatta Poole had ever put on. That remark to the biased mind of the Commodore is really quite a 'Bibful'.

The Results

THE "HOGG CUP"

1. R. T. Foster. Solihull, *Cinderella.*
2. D. Dehon. Poole. *Poolrad.*
3. J. Gascoigne, Middlesex, *Conrad.*

THE "TAPLIN CUP"

1. T. Carrington Wood. Middlesex, *Vanessa.*
2. G. Honnest-Redlich, Middx.,*Telata.*
3. R. T. Foster, Solihull, *Cinderella.*

THE "LAIDLAW-DICKSON CUP"

1. G. J. F. Stalkcart. Gosport, *Mimosa.*
2. R. G. Foster, Solihull, *Cinderella.*
3. T. Carrington Wood. Middlesex, *Vanessa.*

S. MIDLAND AREA RALLY AT CRANFIELD

A BREEZE which proved unhelpful to the MacGreggor Trophy entrants did not prevent R. Yates flying his well known "Rowdy" into first place. There were only 16 competitors for this event (over 400 invitations had been sent out).

There were a larger number of manually pulsed "Proportional" systems to be seen. the twin fin versions seemed quite docile to handle.

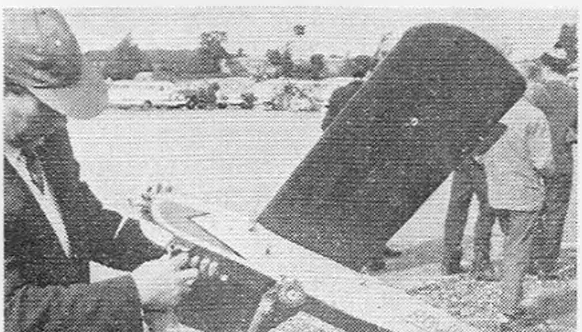
Multi had a somewhat better attendance; Harry Brooks won with 1.501 points closely followed by Chris Olsen (1.492). Jack Morton was third, scoring 1.332 with his "Mustang".

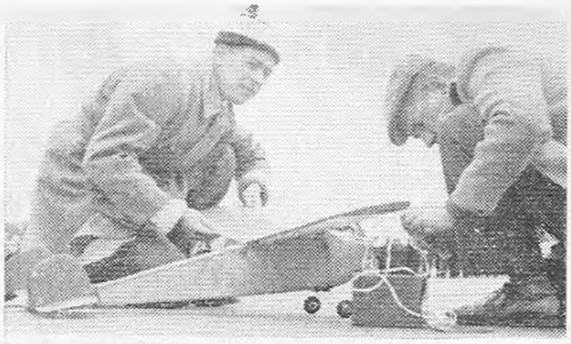
Aeromodeller Trophy at Odiham

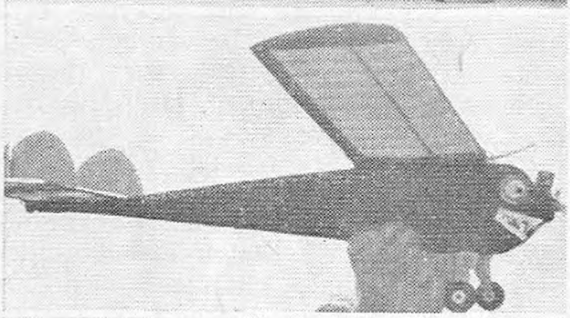
The attendance looked, at first too small to make the event an official one. However by the starting time a few more arrived.

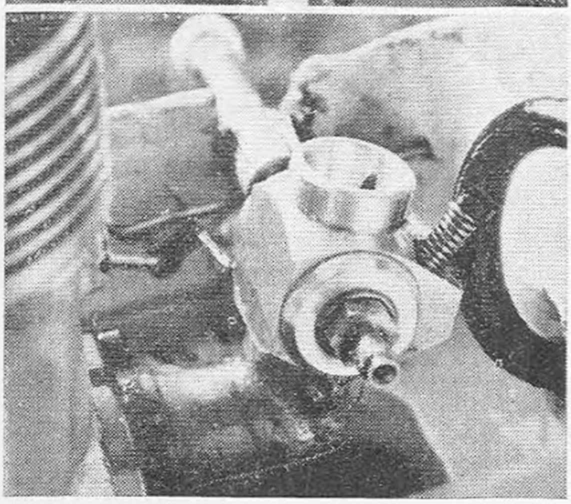
Ed. Johnson's motor cut *before* his landing approach. Frank Van den Bergh. using his World Championship scarred "Sky Dancer" won with 3.701 points, Harry Brooks was second (3,672) and David Walker (another "Reb") 2.559 for third place.

Below, Top: Winner of the MacGreggor Trophy displays the leaf/torsion bar U/C on "Rowdy". Bottom : Shot of "Big Daddy" shows the extreme nose down ground attitude of the Ed. Johnson model.









Above, T. to B.: J. A. Mountain with his pulsed rudder model, later to win the Luton slope soaring meeting.

Another twin fin, pulsed rudder model with a short, if amusing nose.

Harry Brooks assisted by David Walker prepares for his winning flight.

Carb. detail from Ed. Johnson's "Big Daddy".

Commercial Developments

By
TONY
DOWDESWELL

CONSUMER STAFF MEMBER SAMPLES NEW PRODUCTS AT HOME & ABROAD

PROTOTYPES of the **Wright Mark V** receiver and its new relaytor were first featured in our November, 1962, issue. British importers for Wright Radio Control equipment, Holt Whitney & Co., now have stocks of the new receiver, priced at £8/2/0d. The accompanying relaytor costs £3/1/6d. and the matching ground based transmitter (27.12 Mc/s.) is £8/14/3d. This provides a complete single channel outfit for under £20. The set operates on carrier wave and the receiver is relayless, which necessitates the use of the relaytor instead of the normal escapements.

We hear that Holt Whitney will shortly be importing a range of *Kraft* radio control equipment, we will publish more information on this later.

Malcolm Douglass sent along some more useful items. First, for proportional fans, the **Pro-Trol Control Stick Assemblies** come in two configurations for single and dual proportional systems. The single proportional unit consists of a drilled mounting plate to which are fitted a centring stop and two adjustable travel stops. The control pot must be attached to the plate, and the control stick is set screwed to the shaft of the pot. A centring spring is provided which fits in the pot shaft sandwiched between the mounting plate and the stick. Mounting plate is of light alloy and the stick is made from brass with a rubber grip at the top. It costs £1/1/6d.

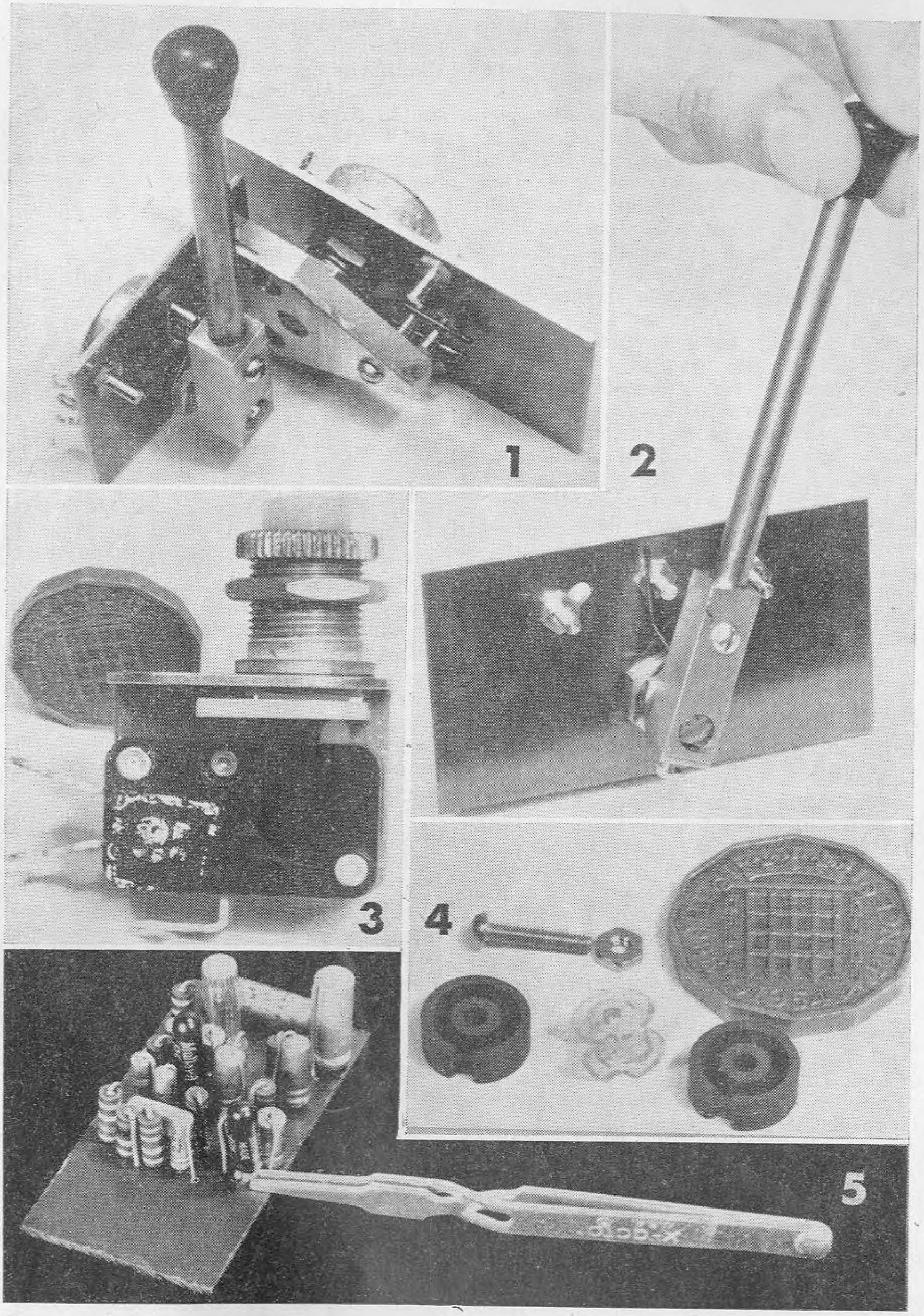
The dual proportional version has two light alloy mounting plates on which to mount the necessary two pots. The control stick is mounted to the smaller of the two plates together with its return spring. This assembly then attached to the pot shaft on the other mounting plate assembly so that when the "stick" is moved from side to side it turns one pot and when moved backwards and forwards turns the second pot with spring centring on either axis. Where dual proportional systems such as "Galloping Ghosts" are concerned, the necessity to interconnect the two pots on one control stick has in the past been the subject of much gadgeteering which the Pro-Trol eliminates. The built-in "feel" which the centring springs provide is a useful attribute. This one costs £1/15/6d. Both Pro-Trol units are supplied ready for assembly and pots are not provided since values vary with each system.

The **Burgess Micro Switch** is just about the most suitable we have seen for transmitter keying. The button plunger action is very light and free, making it ideal. It is quite small, so could be installed in most transmitters to advantage, being so much better than those plastic plunger buttons that make an uncomfortable dent in your thumb. There are three wiring tags and the diagram inscribed on the plastic body of the switch shows that it has both N.O. and N.C. contents and can provide the same action as a relay, so would be ideal for bench testing servos. 12/6d. may seem a little pricey for a keying switch, but we think it good value.

For the home constructor, the **X-acto Heat Sink** should prove useful. Made from aluminium, it has a spring grip action and is very reasonably priced at 2/-. Seems a small price to pay, to avoid damaging transistors or diodes and melting away the plastic bodies of multi-pin plugs and sockets.

CTC Coil Formers in $\frac{3}{16}$ in. and $\frac{1}{4}$ in. sizes. are specially for printed circuit work. $\frac{3}{16}$ in. size has four lugs, and while at the moment $\frac{1}{4}$ in. size has only two, four lug examples will be along soon. (At 1/8d. each). Formers seem to be made from a material rather like cardboard and our experience with these American items showed a tendency for the slug to wear loose in the former when put in the hands of "tune happy" fiddlers. The correct core locking compound should reduce the possibility of unwanted movement.

SM Coil Pot Core and Nylon Bobbin costs 13/-. These are used in several receiver power converters and tuned filter receiver circuits. It should be of interest to experimenters who will also be pleased to hear that Malcolm Doug-



1. Pro-Trol Dual Proportional Control Stick. 2. The single proportional version of the control stick from Pro-Trol. 3. Burgess Micro Switch attaches to case like a toggle switch. 4. Dismantled SM Pot Core is small indeed. 5. X-acto Heat Shunts designed to grip the work.

lass can supply a large range of Mullard Components including electrolytics and ceramics in sub-miniature sizes. That's all from Malcolm Douglass.

New lines from the Franklin Brothers come thick and fast. Another version of their **Steerable Nosegear,** featured last month, is for bulkhead mounting. This caters for those who prefer this mounting method instead of the floor mounted type. This latest version is similar in most respects to the earlier style, but has a different mounting flange. Price is £1/17/6d.

Yet another, as if to please all the modellers all the time, is a **Non-Steerable Nosegear** for bulkhead mounting. This has the twin wire legs common to all Franklin nosegears, which are locked with grub screws into its thick alloy mounting flange. At 10/-, this is very reasonably priced and should prove popular with those modellers just requiring "nosewheel" in their model aircraft without any of the fancy trimmings. Weight is 2 oz. which does not add much to the overall model weight, the unit is rugged and will withstand a great deal of punishment. Here's another thought; it could be used as double main U/C legs on scale models.

The **Franklin Universal Throttle** will convert your large engine to multi speed standard . . . We say large motor as it would require a large motor with a wide carburettor intake to accept the trunk of the throttle. Simplest method of setting the throttle in the carb. is with Araldite. Needle valve and jet assembly are made from brass, and the body from light alloy. It is a robust and neat unit with the most interesting feature of a wire gauze across the intake. Sells at £1/8/6d.

Another new Franklin line we are sure will prove popular with radio control fliers is a range of polythene bottle **Clunk Tanks** in 4, 6 and 8 fluid oz. sizes. These have the usual polythene bottles with plastic caps and set in each cap are two turned brass nozzles, on to one of these a curved brass air tube is soldered, the other is connected to the valve rubber feed pipe which has a turned brass clunk weight at its extremity. The washer in the cap prevents the bottle from leaking. Previously we and others preferred to make clunk tanks from polythene bottles and pieces of tube to save expense, but these tanks at 5/9d. (4 oz.), 6/6d. (6 oz), 7/- (8 oz.) elminate the effort involved, at a reasonable price.

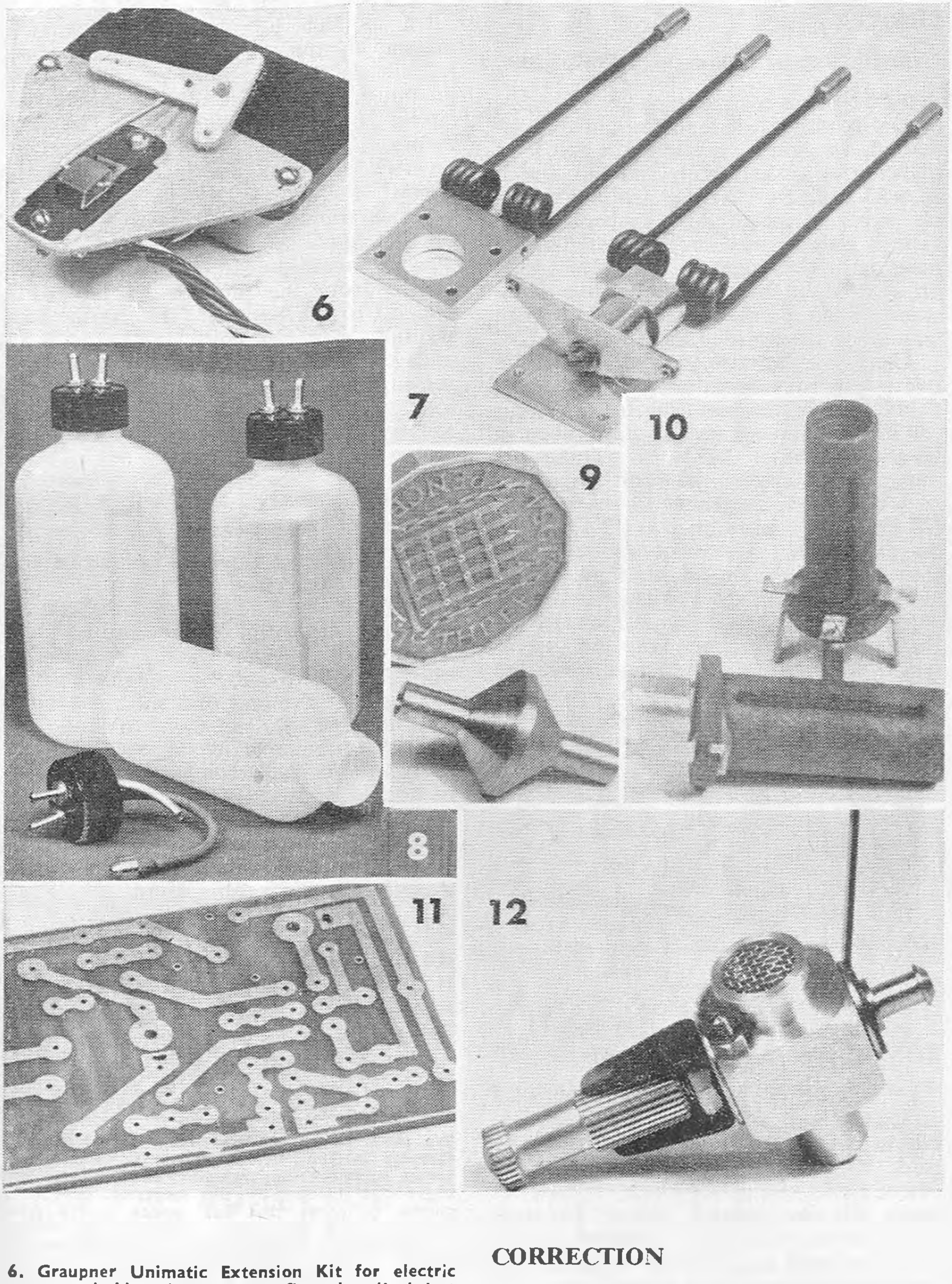
Yet one more new item from Franklin Brothers is a lightweight brass **Fuel Filter.** The makers say it proved popular with Combat fliers in Leicester and should be equally useful for radio control work where clean fuel is just as important. Price is 2/3d. That concludes the Franklin Brothers' list.

Constructors will welcome the service offered by Oakfield Radio, 121 Macclesfield Road, Hazel Grove, Stockport, Cheshire, who can etch and drill any printed circuit scheme up to a maximum size of 2 ft. x 2 ft. All circuits, unless otherwise specified by the customer, are done on high grade S.R.B.P. Laminate which has 1½ thou. copper as standard. Circuit can be to any of *R.C.M. & E.* readers' requirements to patterns supplied, which must be black where copper is to be retained and white where it is to be etched. A typical example works out at approximately 7/6d. for a 2½ x 4 in. with about 60 holes.

Control without radio, that is the function of **Gulton 1404 Ultrasonic Tranducers** manufactured by Gulton Industries (Britain) Limited, 52 Regent Street, Brighton 1, Sussex. These will provide ultrasonic remote control as mentioned in *Here, There & Everywhere* recently. Tranducers can be used for simple remote control without electrical cables or electronic links, two basic units only being required—a transmitter and a receiver. Besides their industrial application, they can be of particular interest for model work.

Method of operation is as follows—the transmitting Transducer is wired in circuit with a two transistor (OC71) Power Oscillator, so that this Transducer transmits an ultrasonic sound beam. If directed manually at a receiving Transducer wired in circuit with a five transistor (again OC71) relay receiver, the beam is detected and used to trigger a 400Ω relay up to about 100 ft. range.

A well illustrated brochure supplied with the set of two units, each weighing ⅝ oz., provides an informative, though not lengthy description of their function, together with typical 9 volt working transmitter and receiver circuits, directional sensitivity and receiver response data. The set of two matched Transducers costs about £7, but it is stressed that the whole system costs approximately the same as a conventional single channel radio control set.



6. Graupner Unimatic Extension Kit for electric motor switching (boats) was first described last month. 7. Two new nosegears from Franklin Bros. Lower example is steerable. 8. Franklin Clunk tanks in three sizes. 9. Franklin Fuel Filter. 10. CTC Coil Formers. 11. Fine example of etched circuitry from Oakfield Radio. 12. Franklin Throttle.

CORRECTION

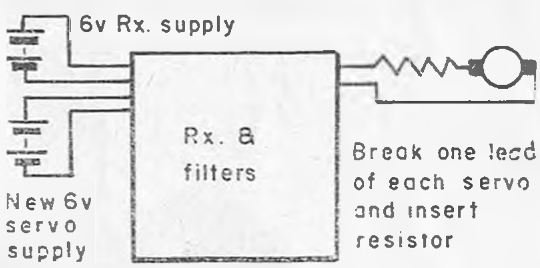
Southern Radio Control wishes to point out that the "Matador" transistor transmitter is not supplied with DEACs and a charging socket. The example we reviewed in the November issue had been modified by Harry Brooks for his own use.

ERRATA

Grundig Report (December, 1962, issue)

We feel that a paragraph on page 604 of last month's test report could be misleading to some, in that the plug in question is an extremely tight fit and it is most unlikely that any trouble would be experienced in this respect. The "snag" quoted by our tester under the heading "Comments" was, in fact, brought about by entirely alien circumstances, and we feel that this comment should be disregarded.

There are certain inconsistencies between the manufacturer's data and the data given in the test (the latter figures are correct and agree with data given in Grundig booklet RC.1/E). These are our printing errors, the most important of which is the frequency of the receiver (27.12 Mc/s.) misquoted as 12.12 Mc/s. on page 603. We must apologise for these errors, and in addition the circuit shown below should clarify the method suggested in the footnote for improving the speed of centring of the servos which should, of course, have read that a 7 ohm resistor be fitted in *series* with each Bellamatic II motor, and the supply increased to 6 volts.



TOMITOR (March, 1962, issue)

C7 5 mfd. is connected between VT2 collector and VT3 base, the practical circuit is correct. There is a further .01 mfd. between VT2 collector and base, (theoretical circuit correct). There is room on the printed circuit for two more holes, one on the collector land at the pointed end, and the other on the emitter land near the emitter hole.

On page 116 there are two curved lines coming from the coil hole near the 3.3K resistor. These are the coil ends, the one on the left near the aerial contact bracket is X., the one near the curved line from the 10 pf. is Y.

C5 at .005 is a middle value; C3 on the theoretical circuit is shown as 8.2 but on the layout 10 pf., either will do but 8.2 is preferred. The theoretical circuit shows C1 as 12 pf. The text mentions 22 pf. as connected straight on to the variable capacitor. This is correct.

R4 is shown as connected to emitter of VT1 in both theoretical and layout. This is *incorrect* and it should be connected from the junction of the HFC and C3 to the base of VT2. As the two positions are not close leave the long ends on the 3.3K and take it from the rectangular land where HFC and C3 join to the base hole of VT2 (the oblong shaped land with the pointed end).

MULTI-GEM Rx.
(December, 1962 issue)

The assembly sequence contained the following errors:—

The 0.01 mfd. capacitor in stage 11 (C4) goes from the yellow land to blue. The 6 mfd. capacitor has its +ve end to blue and –ve to red.

Stage 14 +ve end of 8 mfd. capacitor goes to blue, the top (–ve) to land 3.

The components list shows only one 0.01 mfd. capacitor, whereas it should, of course be two, as supplied in the kit.

The following component identification should prove useful when referring to the theoretical circuit.

R1: 2 Meg Ω	C1: 45 pf.
R2: 3.9 K Ω	C2: 0.01 mfd.
R3: 2.7 K Ω	C3: 6 mfd.
R4: 12 K Ω	C4: 6 mfd.
R5: 82 K Ω	C5: 0.01 mfd.
R6: 2.7 K Ω	C6: 8 mfd. 30 V.W.
	C7: 8 mfd. 30 V.W.
	C8: 0.03-0.05 mfd.

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