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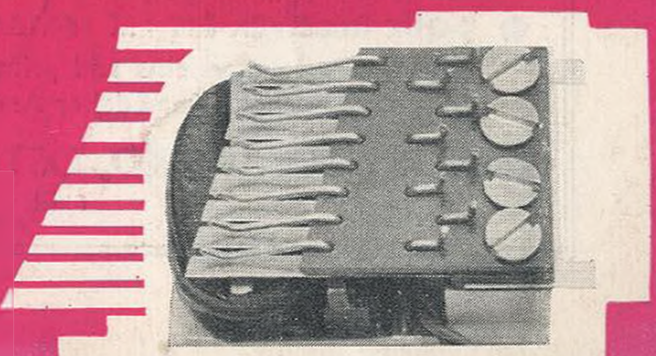

RADIO CONTROL MODELS & ELECTRONICS

FEBRUARY 1963

VOLUME 4 NUMBER 2

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CONTENTS

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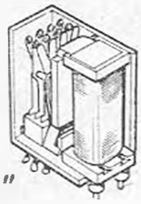

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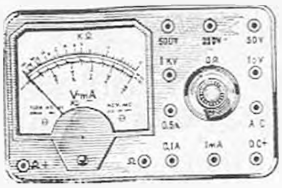

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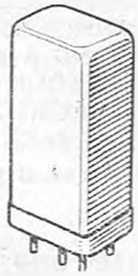

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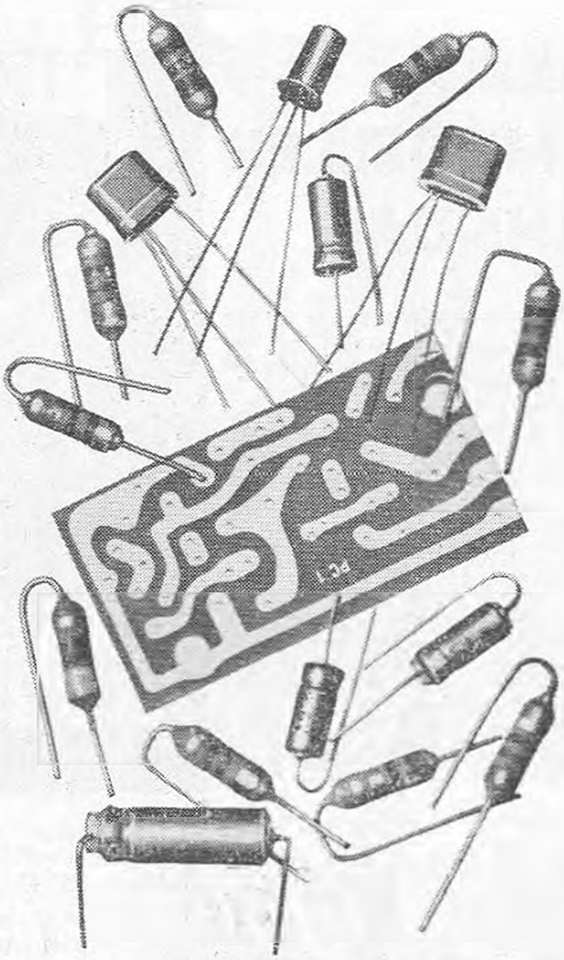

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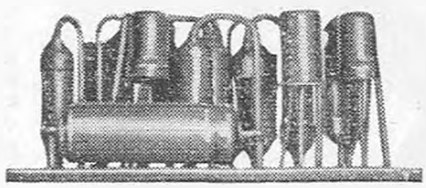

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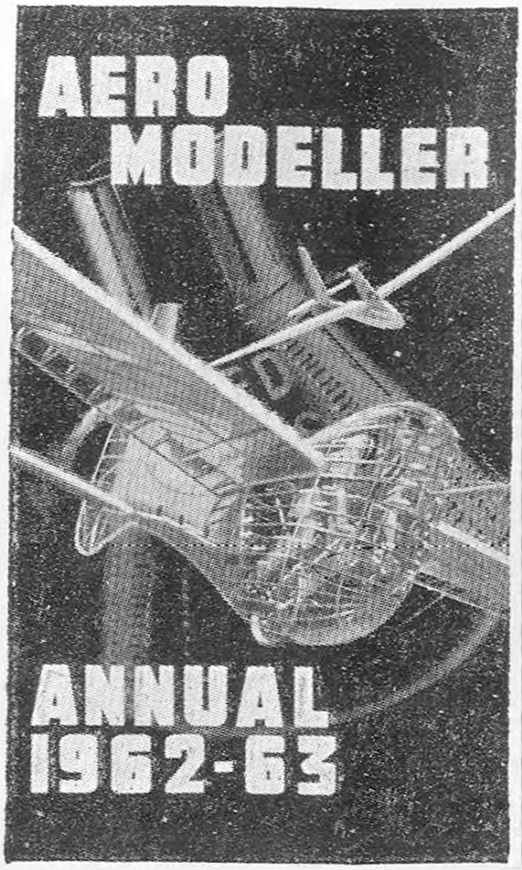

IN ONE YEARLY VOLUME is gathered the cream of the world's model plans, plus articles on subjects of special interest in the current year, plus a selection of practical and theoretical information that will help aeromodellers of all degrees of skill. The cover painting depicts man-powered "Puffin" against 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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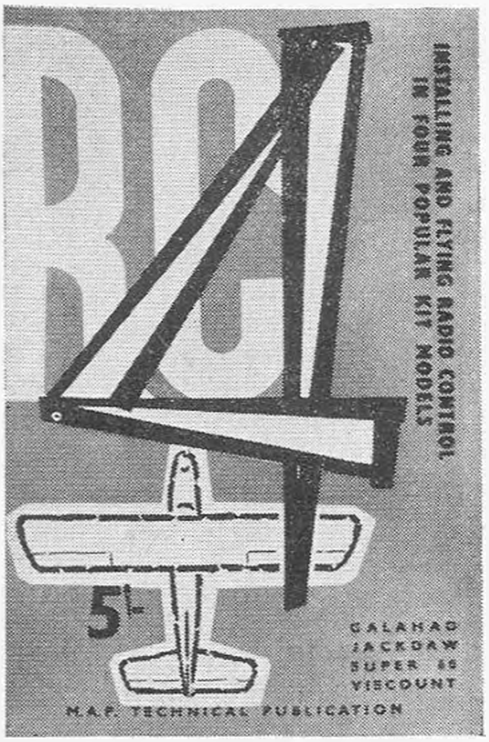
R/C BIG 4



RADIO CONTROL BIG FOUR is a new departure in model technical journalism that will fill a real need amongst newcomers to r/c flying. It caters for the man who has just bought, or is thinking of buying his first r/c kit in which to install and fly his first equipment. We approached the manufacturers and designers of the four British kits now on the market and invited them to tell us all about them. The result is a book which amplifies the building instructions supplied with the kits, tells why the designers did what they did, how they installed their equipment, how they flew the models, and snags they met and overcame, tips on better building—in fact it is nearly as good as having these expert designers and flyers standing with you as you progress. The kits covered are MERCURY GALAHAD; FROG JACKDAW; KEILCRAFT SUPER SIXTY; VERON VISCOUNT.

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It is with the deepest regret that we announce the death of Mr. C. S. Rushbrooke, who died in hospital on January 3rd, after collapsing in the snow on Boxing Day evening. He was 57 years old, and had been associated with Model Aeronautical Press since before the war.

"Rushy", as he was known to aeromodellers the world over, will be mourned wherever modelling is known — some measure of the affection in which he was held can be gauged by the many messages and enquiries we have received during his, happily, brief illness. Originally a keen and practical aeromodeller with a special fondness for Wakefield models, sports car and indoor models, in recent years he devoted much of his leisure to the organisation and administrative side of the S.M.A.E.

He was almost entirely responsible for the conception of the two World Indoor Championships at Cardington, including a great deal of the rule book suggestions, and in our readers' particular field had given freely of his special skill in committee work on radio control rules, acted untiringly as judge at these events, and represented New Zealand on the models commission of the F.A.I.

His work will live on and his memory stay green as a kindly man who worked so hard to improve the hobby he loved. Our sympathies go out to his wife Lily, who accompanied him so faithfully on so many competitive occasions, and to his son Peter and daughter Joan.

Keeping in Tune

Since the last Readership Survey, a few changes have taken place in the radio control field. More commercial gear is available and this has introduced many, many more modellers to the radio control side of their aeromodelling and boat modelling activities. So we conclude that the *average* readers may now have slightly different tastes.

Form filling at this time of the year (we need say no more) may seem a little irksome, but the particular pink form enclosed in this issue will, with your co-operation, enable us to retune if necessary and so provide something for the majority *every* month and something for everybody throughout the year. It will take a few issues to summarise the results of our questionnaire, but we will publish the basic facts so that everyone can have a clear picture of the interest in each branch of the hobby.

The Cakes are Still Hot

Mention of the fact that we still have some back issues of *R.C.M. & E.* has brought a rush of orders. We have decided therefore, in order to avoid disappointment, to publish a list of issues which are in stock at the time of going to press. This will appear frequently. Here is the present situation.

VOL. 1. June. August and December.
VOL. 2. January to March, in., July to November inc.
VOL. 3. February to April inc., June, July, October to December inc.
VOL. 4. January.

South Manchester Exhibition

The South Manchester Models Group held their first annual exhibition at the Stanford Hall, Altrincham, on October 5th, 6th and 7th. Over 1,100 visitors saw a varied selection of models including aircraft, railways, radio controlled boats, and land vehicles.

It is proposed to obtain a larger hall for next year and any local clubs who are interested in participating should contact the Exhibition Secretary: Mr. B. Billington, 18 Cholmondeley Avenue, West Timperley, Altrincham, Cheshire.

Putting our "Klompen" in it

We must apologise for incorrectly referring to "Robbedoes" as a Dutch magazine. It is, in fact, a Belgian publication and is produced by a member of the "Federation de la Petite Aviation Belge".

The draughtsman is a member of the "Balsa Birds" Club in Brussels, and is a successful radio control modeller.

How High are Your Sights ?

The increasing following of radio control and the appearance of many forms of circuitry in our pages has encouraged many modellers to embark on the construction of equipment which is way out of their normal line of modelling. We have the awkward situation of trying to classify a modeller's electronic skill. Unfortunately a number of readers full of confidence at the success of a simple piece of equipment which they have built from constructional articles in our pages feel that they can proceed immediately with something more advanced. though apparently not presenting any great problems in the light of their new found experience.

Now. when we state that a circuit is definitely not for beginners we mean that not only should it not be produced as a first attempt. but that the comparative expert who does produce it should be prepared to experiment a little to get the best results. Some circuits are published with the express purpose of stimulating experiments and interest for the expert section of our readers. without whom the progress of radio control would come to a halt.

Unless you have the experience of constructing equally complex gear and have the necessary test equipment. it would be inadvisable to raise your sights too high when selecting a circuit for construction. A long line of easy successes is far more rewarding in the early stages than one expensive flop and several bottles of Aspirin!

We hear of modellers who in an early stage of their electronics career have attempted the "Windy Kreulen Multi Transmitter", an example of quite advanced "model" circuitry. which demands good test gear and experience for the *best* results. Remember, this one was also published under the heading of "Not for Beginners".

However, we do publish elsewhere in this issue a little extra information which together with some corrections should help readers who have found difficulty in obtaining satisfactory results from their versions of this transmitter.

On the Cover

A confident smile from David Walker, supporting his "Miles Monitor" reported in last month's issue. Sad news, we understand that on fitting larger engines that old twin engine Gremlin "torqued" the model into an untimely end.

Moral: If it flys; fly, don't fiddle. Never mind. Dave, hats off to your pioneering flights.

The reed unit, one of P. T. Bellamy's, introduces a series of articles dealing with this important piece of multi equipment.

R.C.M.S Sailing Craft Fixtures

Here in good time for the 1963 season is the Regatta Programme for the R.C.M.S. Yachtsman. We invite other clubs (R/C power boat or aircraft) to supply their fixture lists in good time this year so that they will appear sufficiently far ahead for any pre-entry or practice.

Month	*Date*	*Event*	*Club*	*Place*
APRIL	27th & 28th	Regatta	Y.M.6m.O.A.	Hampton Court
JUNE	8th & 9th	Tamplin Cup Curry Cup	Gosport M.Y.C.	Gosport
JUNE	29th & 30th	R.C.M.S Cups Nanita Cup and others	R.C.M.S.	Rick Pond, Hampton Court
JULY	13th & 14th	British 'Q' Class Championship	M.Y.A.	Poole M.Y.C.
SEPT.	7th & 8th	Hogg Trophy Laidlaw Dickson Cup	Poole M.Y.C.	Poole
OCT.	5th & 6th	Regatta	Gosport M.Y.C.	Gosport

Selective Filter Switcher

- ★ EASY TO BUILD
- ★ ELIMINATES RELAYS
- ★ CONVERTS SINGLE TO MULTI
- ★ OPERATES TWO S/C MODELS FROM ONE Tx.

By J. H. BRUNT

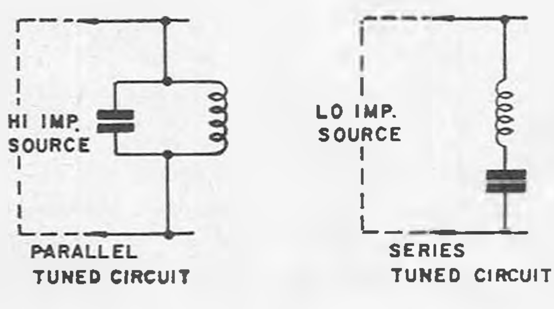
THE device to be described is the result of some months of development during which many ideas have been put into a practical form and tested. The basic switching circuit is derived from the circuit of the D.C. Amplifier used on my original four-transistor receiver.

The series tuned filter circuit has been employed for two main reasons, firstly it has proved more efficient than the normally employed parallel tuned circuits and secondly it is possible to feed many channels from one common low impedance source without using additional capacitors and resistors to ensure effective working. The example to be described is very sensitive; in fact only 1 milliwatt of A.F. tone signal is required at the input in order to switch up to 250 mA. in the output circuit using a 6 volt supply, this being sufficient to operate most actuator mechanisms. These facts should place the device ahead of any similar devices at present available commercially.

The Series Tuned Circuit

First we will compare the series tuned circuit with the generally employed parallel tuned circuit. Briefly, where as the parallel tuned circuit to give the highest possible selectivity, must be energised from a high impedance signal source; the series tuned circuit gives the best selectivity when the signal source is

FIG. 1



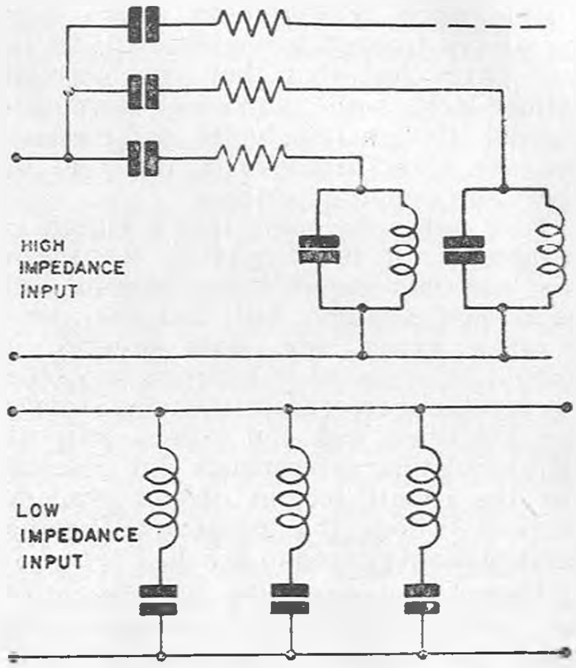


FIG. 2

of a low impedance. (The lower this impedance the higher the selectivity. and therefore the narrower the bandwidth). see Fig. 1. Further. as can be seen by referring to Fig. 2. parallel tuned circuits when used in multi channel circuits must be fed in such a way that the source impedance remains high. also they must be isolated one from another or they will not function correctly.

With series tuned circuits isolating resistors and, in some cases, capacitors also are unnecessary as series tuned circuits may be parallel on to the same low impedance source.

Providing a suitable low impedance source

Matching the series tuned circuit to the A.F. amplifier stages is a comparatively simple matter. Fig. 3 gives a practical circuit which will not only provide the required low impedance signal source, but will also give sufficient signal power to operate up to three or even four such units simultaneously without (providing the spacing of tones is carefully chosen) anv interaction between channels. The A.F. amplifier stage preceding the OC72 stage is normal in every respect.

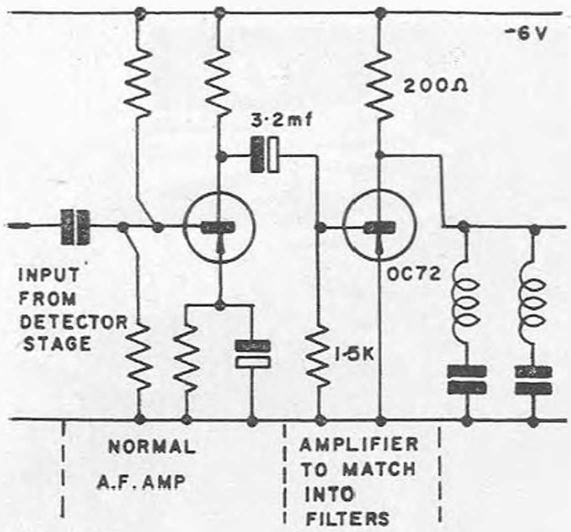


FIG. 3

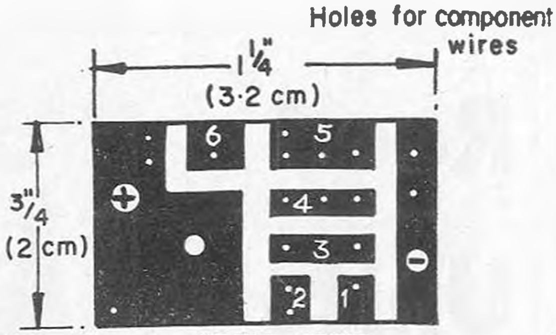
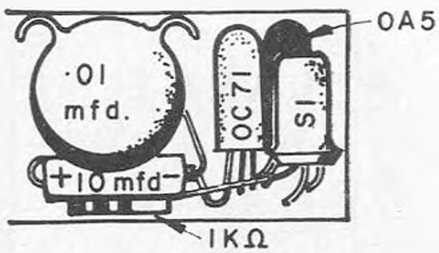
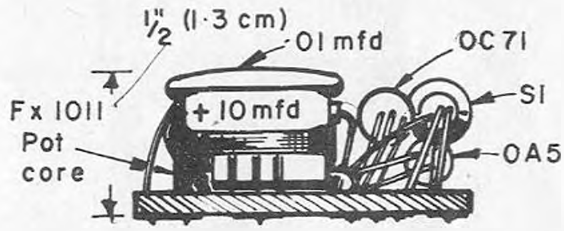


FIG. 5 FULL SIZE A

B





C

The Tone Switching Circuit

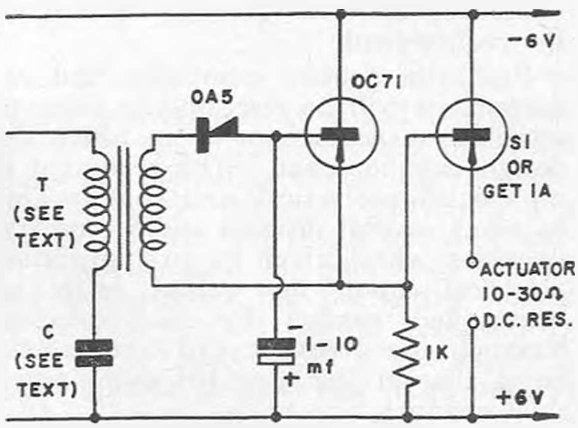
The theoretical circuit given in Fig. 4 is a practical circuit and as can be seen its simplicity is such that from the construction point of view it can be likened to the well known "Ivistor" switcher. The transformer with its primary forming the series tuned circuit is wound on a Mullard Fx1011 Pot core. Primary winding 600 turns of this winding with C the capacitor, having a valve of from 0.1 mfd. to 1000 pf. tunes the primary from 750 c/s. to 7500 c/s. approximately.

The secondary winding T., the transformer. is 100 turns of 46 s.w.g. enamelled wire, giving a ratio of 6:1. During tests it was found that the level of input required to actuate the circuit was reasonably constant throughout the frequency range specified above.

Construction Details

Examination of Figs. A, B and C will show how simple these are and how small the unit is. Note: Far less space is required than when using relays, also there are few components to give trouble.

FIG. 4



PRACTICAL SWITCHING CIRCUIT USING SERIES FILTER

These facts add up to two things — reliability and low cost. Now to the actual construction. First of all we must wind on the pot core spool, a 600 turn winding of 46 s.w.g. enamelled wire is required for the primary. leave approximately 1½ in. leads for connecting to circuit. The secondary should be wound over the primary 100 turns of 46 s.w.g. enamelled wire is required again leaving leads approximately 1½ in. long for connection to the circuit.

Next prepare the printed circuit board as shown in Fig. 5A. Mount the pot core assembly using a ⅝ in. 8 B.A. countersunk head brass screw with nut and washer. Connect the pot core assembly, lead out wires as follows:

PRIMARY; one lead to land 1, other lead to land 2.

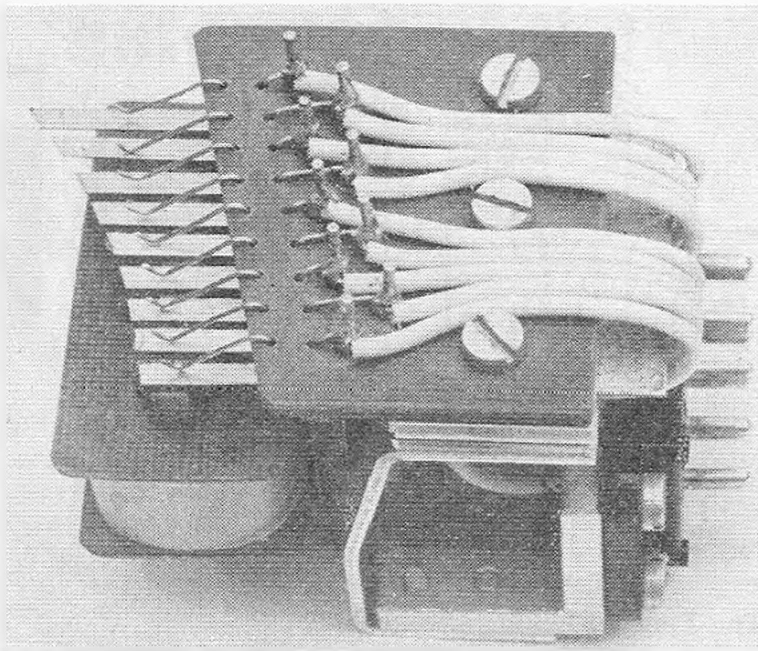
SECONDARY; one lead to land 1, other lead to land 4.

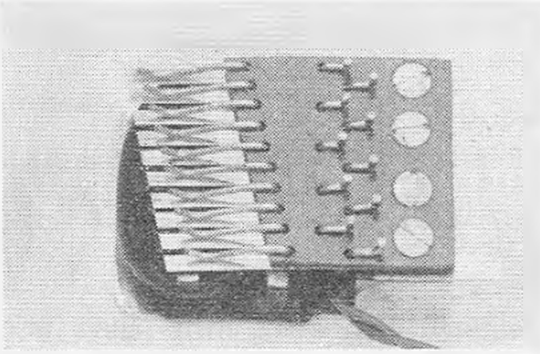
The components should now be fitted and wired, component location is shown in Figs. 5B and C.

(Continued on page 69)

Reed Units

★ LARGE





OR SMALL

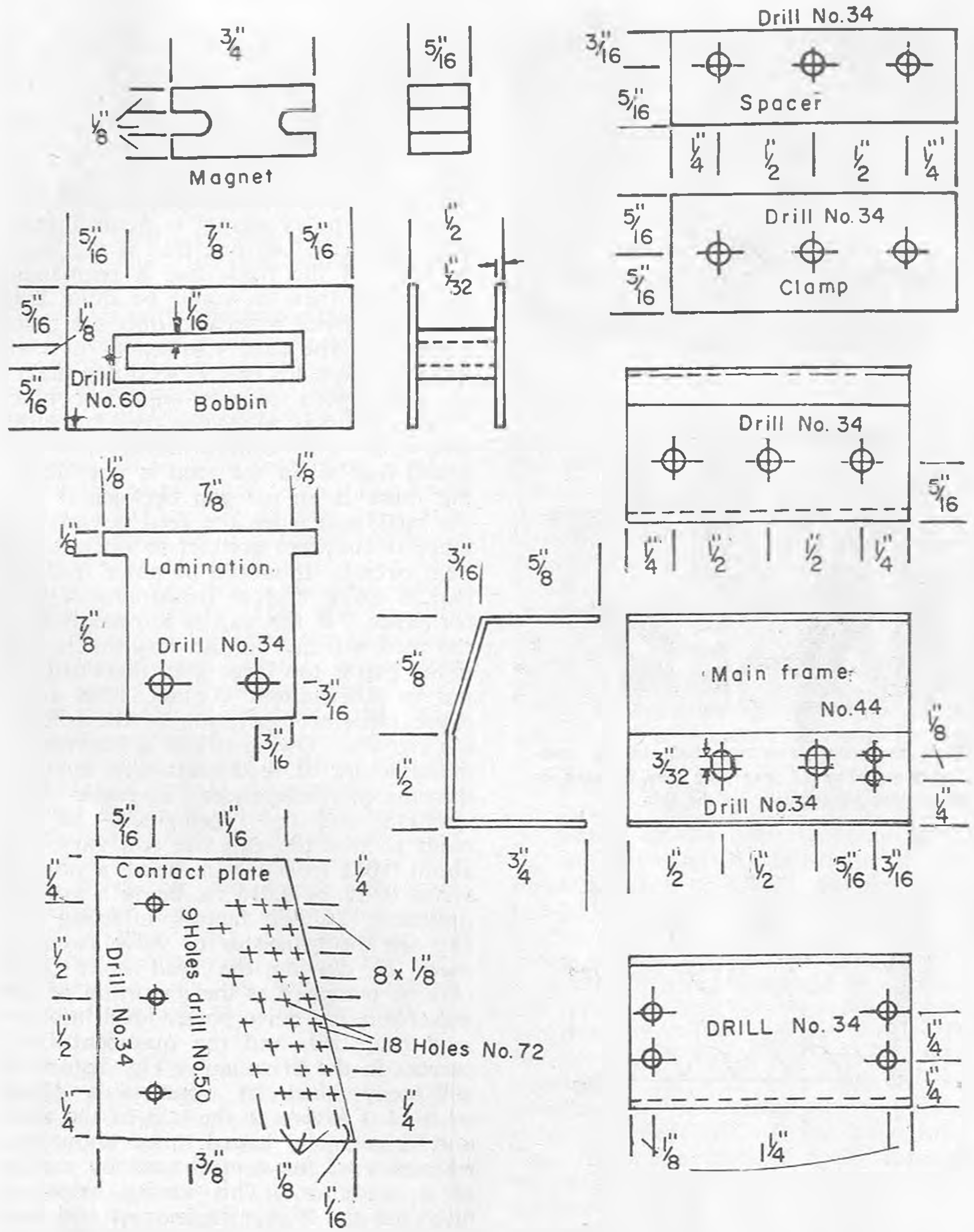
P. T. Bellamy, D.Tech.(Eng.) Describes his home built Reed Bank

THE reed unit is perhaps the simplest form of multi-channel selector that has so far been designed for radio control purposes. Its main advantages are that it is smaller. lighter and cheaper than other systems. and as a result is found to be quite reliable provided it is protected from mechanical damage and exposure to climatic extremes, salt spray perhaps being its greatest enemy. There are several commercial types available on the market but these tend to be rather expensive when one considers the total materials in the unit; of course the manufacturer must pay design, labour and overhead costs as well as make a profit. However, these costs can be eliminated if one is prepared to spend a few hours and some care, "Doing it oneself"! I have built several reed units, ranging from 3 to 10 channels. and so far not one of these has cost more than 4/- to construct — this assumes of course that in the "oddments and raw materials drawer" there are a few scrap pieces of aluminium, paxolin, etc., which can hardly be charged to the cost as they represent only fractions of pence.

Whilst for aircraft it is best to make a small compact reed unit, it is not necessary to go to the same extremes for a unit that will be used in a boat or land vehicle. the smaller the unit the greater must be the accuracy in manufacture. The two reed units described should meet most needs and if not, then dimensions can be suitably scaled to fit the requirement.

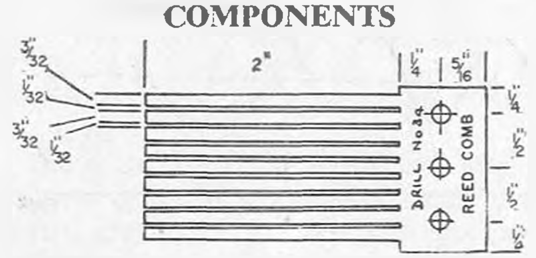
First the general principles and requirements will be discussed in order to establish a specification from which the design can be made. The reed unit is an electro-mechanical unit that is able to select several discreet audio tone frequencies, when driven by an appropriate electrical input, the output being an interrupted contact for each discreet channel, the frequency of interruption being that of the tone for each individual channel.

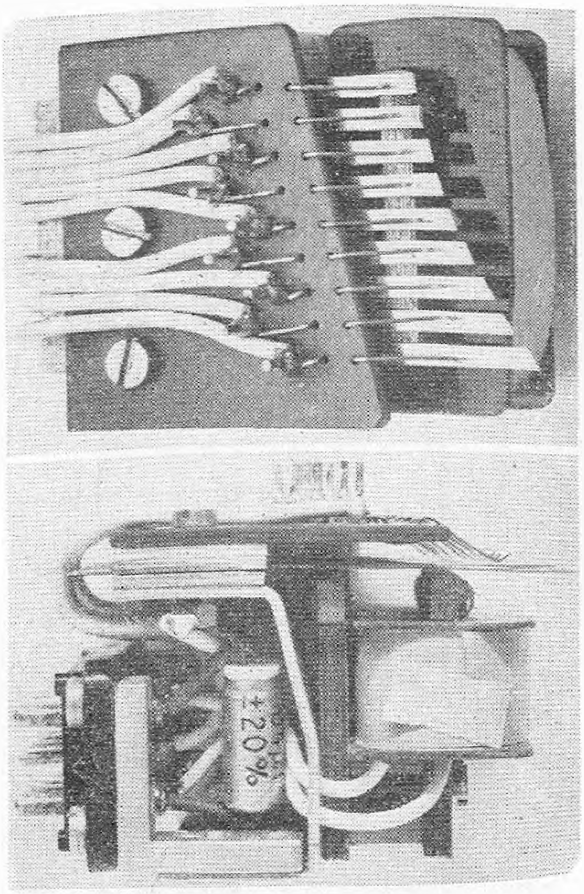
The electrical input is fed into a coil



which has an iron core and thus if the input current alternates. then there will be a corresponding alternating magnetic flux set up in the iron. However, it is simple to see that this alternating current will set up a flux maximum of twice the frequency of the alternating current —see Fig. 1. This would therefore try to make a reed placed in the magnetic field operate at twice the frequency. By polarising the magnetic circuit with a permanent magnet it is possible to make only one flux maximum per cycle of the alternating current—see Fig. 2 (Note: Without a polarising magnet the flux

COMPONENTS





Plan and side views may help in the construction. The 12 way plug may be seen in the lower photograph, on the left.

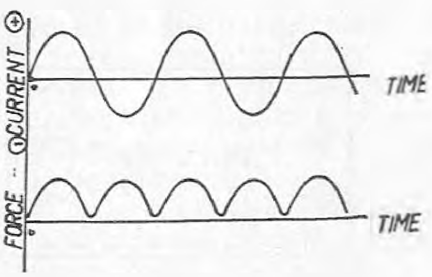
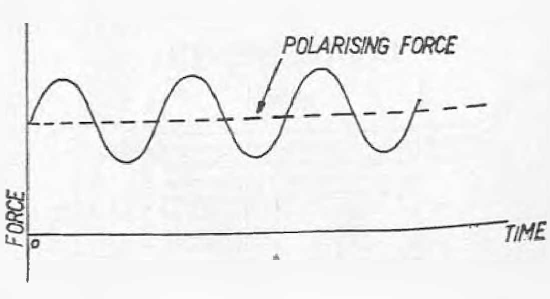


FIG. 1

FIG. 2



produces two maxima corresponding to +ve and −ve values, as shown on the graph, however this may be misleading to some readers as they might suppose at first that the −ve value would have a repelling action for the reeds rather than an attracting action. The +ve and −ve signs, correspond to the North and South poles of a permanent magnet, and thus both poles attract a neutral magnetic material, i.e., one that is not magnetised. If the reeds had a permanent magnetism then it would be quite true that "like poles repel and opposite poles attract"). The reed vibrates at its own natural frequency and in so doing makes an interrupted contact with a contact finger, part way along the reed from the free end. This contact finger is so adjusted that when the reed is not vibrating there is an air gap between it and the reed, and when the reed is vibrating there is sufficient contact to operate the next circuit. It should be noted that the gap is quite critical for optimum performance. If the gap is too small then the reed will not vibrate very much, and if the gap is too large then there will be no, or intermittent contact, both cases cause incorrect operation of the following circuits. Owing to the differences in manufacture of reed units, this includes dimensional tolerances, magnetic field strength, and the "springiness" of the reeds so that the gap size will vary, but about 0.012 in.-0.015 in. being a normal
about 0.0I2 in.-0.015 in. being a normal
optimum. Other factors affecting the gap are the transistor or valve circuitry used for driving the reed unit; these may be classified as the distortion of the waveform, the drive power level into the reed unit coil, and the quiescent D.C. current in the drive coil. The distortion will only have an appreciable effect when it is severe as the coil of the reed unit is normally broad tuned about the frequency of the central reed by means of a capacitor. This tuning helps to filter out the higher harmonics and just leave the fundamental frequencies for driving the reeds.

The reed unit therefore wants to be mechanically robust in order to maintain its frequency stability and should have some provision for adjusting the air gap between the magnetic circuit and the reeds and the air gap between the reeds and contacts. The first is dealt with quite simply by making the clamping holes in the body slightly elongated as seen in the drawings and by making the contracts from silver wire that can be bent sufficiently to adjust the contact gap. Using slightly springy silver wire for the contacts means that the time of contact is longer than with a more rigid type, and as there is movement of the reed and contact at this point, so that there is a self cleaning action which will prevent bad contact between the elements due to dirt, corrosion and oxidation.

To start with, the larger reed unit will be described as it is easier to construct. Nearly all dimensions have been made in fractions of an inch, however, it is quite a simple matter to convert to the decimal system if necessary. The choice of materials is quite important in order to get the best results. The magnet was taken from an old G.P.O. type telephone handset, it is actually inside the receiver that one holds to the ear. The aluminium alloy that is used for several of the pieces is to DTD 606 specification. Pure aluminium is not suitable as it is too soft and "Dural" is too hard as it cracks easily when bent at right angles. It should be noted that when bending any metal, the radius inside the corner should be one to two times, the thickness of metal, in order that severe stresses are not set up in the bend. which could cause a failure under vibration and shock. The laminations were taken from an old burnt out mains transformer and are silicon-steel about 0.014 in. thick—this is a standard size for such laminations; of course other thicknesses would be suitable, but the material should be approximately the same.

The reeds are made from 0.010 in. spring steel sheet. It is often used for shims and packing pieces and should be obtainable at a good ironmongers or garage. The plastic sheets used for the bobbin and the contact plate were actually Synthetic Resin Bonded Fabric (S.R.B.F.) but a paper laminate (S.R.B.P.) is equally suitable, however rather more care should be taken when using the S.R.B.P. as it tends to splinter and crack more easily when it is being cut or drilled. The bolts that are used for holding the laminations and magnet to the frame must of course be from a non-magnetic material, brass being quite suitable, the other bolts used for clamping the reeds are steel as they are stronger.

Now for the actual manufacture of the components. The bobbin presents a small problem as it should be made with care to ensure that it is square in all dimensions, in particular the thin checks on each side. If these are not square then difficulty will be experienced when winding the bobbin with copper wire after it has been finished. To start with, a piece of metal, steel, brass or aluminium is cut to the same size as the measurements of the core $\frac{7}{8}$ in x $\frac{1}{8}$ in., and is about 2 in.-3 in. long. Then $\frac{1}{16}$ in. sheet paxolin is cut to fit around this core to form a tube; it should not be cut to the $\frac{1}{2}$ in. length but left on the long side (about 1 in. long) the four pieces being Araldited together. It is best to coat the core with wax or some similar releasing agent before glueing so that the bobbin can be removed when it is finished. Next the side cheeks are cut out from $\frac{1}{32}$ in. sheet paxolin or S.R.B.F. and fitted over the core and $\frac{1}{16}$ in. sheet. It is best to cut the centre hole a little on the small side and file it out so that it is an exact fit, then to trim the outside to the dimensions shown in the drawing. When fitting the side cheeks it is easier if a small chamfer is filed on the ends of the $\frac{1}{16}$ in. sheet so that there is a slight lead. When the cheeks are finished they can be positioned on the central portion of the $\frac{1}{16}$ in core and Araldited to it, care must be taken to ensure that the cheeks are at 90 degrees to the core. When the Araldite is quite hard the excess pieces of $\frac{1}{16}$ in. paxolin extending on both ends of the cheeks can be carefully cut off—then the two No. 60 in. holes are drilled for the lead out wires. The bobbin is now ready for winding. The number of turns of wire will vary depending on the circuit being used to drive the reed unit. It has been found that for valve circuits 6,000 turns of 44 s.w.g. enamelled copper wire and for transistor circuits 2,000 turns of 38 s.w.g. enamelled copper wire give good results. It is obvious that depending on the circuit these figures may not give optimum results but are a general guide. The winding can be made very easily with the coil winder described in *R.C.M. & E.* April, 1961, which was constructed by the author for coils of this type.

The core is made from the laminations of a burnt out mains transformer which are 0.014 in. thick silicon iron. Sufficient laminations are cut to size to make two stacks of ⅛ in. thickness each. The space and clamp (two off) are made from a hard aluminium alloy, as is the main frame, the thickness of the material being 0.048 in. (18 s.w.g.). The main frame is first bent to the exact size, this is quite easily done with pieces of hard wood and a normal vice, then the holes are marked out and drilled to the sizes shown.

The contact plate is next made from S.R.B.F. $\frac{1}{16}$ in. thick sheet. It is best to cut the outline after drilling all the holes as shown. The easiest way of cutting this material is with a fretsaw—just a little oversize and then using a file to get the right dimensions. The same technique can be used for the aluminium alloy and has a great advantage over tin snips because the metal is not stretched and distorted by the shearing action. The nine holes which are drilled No. 50 have solder pins riveted into them, the pins used are Type H2101A made by Harwin Engineers Ltd., Rodney Road. Portsmouth. These are single sided pins, they also make double sided pins Type H2101.

Possibly the hardest piece to make is the actual reed comb. There are several techniques that can be used for its construction. A piece of 0.010 in. spring steel shim is cut oversize by about ½ in. all round — then the actual reeds are marked out carefully in the centre of the piece of metal. now with either a metal shear or a good sharp pair of tin snips the gaps are cut between the reeds. After this has been done the surplus material is removed on three sides the actual reeds being left too long — the reeds being trimmed to size after assembly in order to get the correct audio tones. The reeds should now be silver plated for a thickness of 0.0003 in. and then should have a gold flash. The gold flash serves two purposes, firstly it protects the silver—under normal circumstances gold does not tarnish, and secondly small contact pressure is required for a good electrical contact. It must also be noted that gold contacts are only suitable for small currents—for higher currents silver or platinum should be used. and currents of several amperes should be switched with tungsten contacts.

Assembly of the reed units is quite straight forward. The core is inserted in the coil and is bolted to the magnet, the other laminations and the frame with brass nuts, bolts and washers, on no account should steel be used for the bolts as they would short circuit the magnetic flux. Next the contacts are made and fitted to the S.R.B.F. contact plate. They are made from 22 s.w.g., gold. platinum or silver wire, which is obtainable from precious-metal dealers or Silversmiths. First the wire is threaded from the top of the plate through a No. 72 hole adjacent to one of the solder pins. First a right angle bend is made from the end protruding through the bottom of the plate, then a further right angle bend is made ⅛ in. away so as to form a flat bottomed "U" shape. The free end is now fed up through the hole near the edge of the plate, the other end being wrapped for one turn around the solder pin and securely soldered. The free end then has a $\frac{1}{16}$ in. radius bent into the end at $\frac{1}{16}$ in. — this bend actually forms the contact point with the reed.

Now the reeds, spacer and contact plate are bolted to the main frame with 6 B.A. screws and nuts. the reeds should be positioned centrally over magnetic laminations, the gap between the latter and the reeds being $\frac{1}{16}$ in. All bolts and nuts are now tightened and the whole assembly checked for squareness. It is most important to ensure that the reeds are so positioned between the clamp plates that the clamps overlap the gaps by $\frac{1}{16}$ in. minimum and that the clamps are made with sharp edges. The reason being that if this is not so then oscillation of one reed will cause interference with its neighbours.

Now an audio oscillator is coupled to the coil and the oscillation frequency of the reeds, which are as yet uncut, is found—this frequency should be between 100 and 150 c/s. Now with the aid of the oscillator the reeds are cut so that there is a separation of 20 c/s. each from 200 c/s. which is the longest to 360 c/s. which is the shortest for a 9 reed unit. The spacing can be 22 c/s. but over this means that the 9th reed is on the second harmonic of the first reed, i.e.. 400 c/s.

Finally the contact fingers are bent so that there is about 0.012 in. to 0.015 in. clearance between them and the reeds. It should be noted that during manufacture of the reed unit great care should be taken at all times and everything should be kept as clean as possible. by doing this a good reed unit will be made which should give long trouble-free service.

One refinement has been added to the basic reed unit and that is the 12 way plug on the rear. This was so that it is possible to use one transmitter with several boats. The reed unit and transmitter are matched for the audio frequencies. the receivers were also fitted with plugs. then only one control equipment was necessary for several boats. The 12 way plug is a Belling and Lee Unitor as is the mating socket—these are often found on equipment on the surplus market and may be bought for a few pence. However, this is only a refinement and is not necessary for the functioning of the unit as a whole.

SELECTIVE FILTER SWITCHER

(*Continued from page* 63)

C: (this tunes the primary winding) connect from + land to land 2.

OA5: from land 3 to land 4 observing polarity. (Red spot should go to land 2).

1-10 mfd.: from land 4 to + land observing polarity.

1KΩ: resistor from land 5 to + land.

OC71: Base to land 3, Emitter to land 5. Collector to − land.

S1 or GET114: Base to land 5. Emitter to land 6. Collector to − land.

BATTERY SUPPLY LEADS: Red positive to + land. Black negative to − land.

INPUT LEADS: Green (A.F.) to land 1, Red (Common) to + land.

OUTPUT LEADS TO ACTUATOR COIL: Orange to land 6. Red (Common) to + land.

The unit is now complete and ready to test. but as always. it is advisable to check all connections and soldered joints for correctness.

Testing

To test this point an A.F. oscillator having a low impedance output is required. also it should cover the desired frequency range. Procedure for testing is as follows:

Connect a 6 volt 200 mA. bulb across the output leads. connect a 6 volt battery to the supply leads. Set the A.F. output to give 1 milliwatt. If the output impedance is known and an A.C. volt meter is used to measure the voltage output. then the following formula will help calculate the level in milliwatts.

$$W = \frac{E^2}{R}$$

where E = Output Volts. R is the impedance (when terminated) and W = Watts.

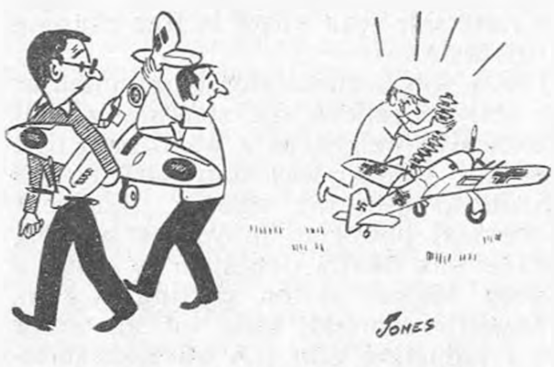
Assuming we have chosen C to tune the filter to 1000 c/s., then as we tune the A.F. oscillator from approximately 800-1200 c/s., so the bulb should light up at approximately 850-900 c/s. and remain alight till approximately 1100-1150 c/s. when it should go out. This indicated a bandwidth of between 200 and 300 c/s. at 1000 c/s.

Current Checks

Total standing current with No Sig.: 1 mA. or less. S1 or GET114 standing emitter current with No. Sig: 200 μA or less. Current in S1 or GET114 emitter circuit with Signal On: 100-250 mA. depending on D.C. resistance of actuator employed.

Conclusion

The unit described is so simple that it should be possible for even a beginner to construct it successfully. The frequency of operation may be altered to suit any requirement by varying the value of (C). as explained earlier. Further I am sure this device will also appeal to even the most experienced R/C fans. both from the point of view of simplicity and reliability as well as the ease with which a single channel receiver employing the circuits described can be converted to multi.



"Just how jealous can you get?"

R/C Police Car

An interesting 4 channel model employing electric propulsion

R/C Police Cars? Surely this is an ideal subject for a "P.C." layout, using the best "Copper" laminate of course. We do not often receive details of model vehicles, so this simple multi channel layout in a generous sized balsa body is all the more welcome. Quite large diameter toy wheels are available and the general layout and control system could be applied to many other subjects.

In fact with superhets likely to come to the fore, we just cannot wait to do a spot of radio racing. How about it car enthusiasts, care to cook something up? Now over to Mr. Swindelles for his description.

By R. SWINDELLS

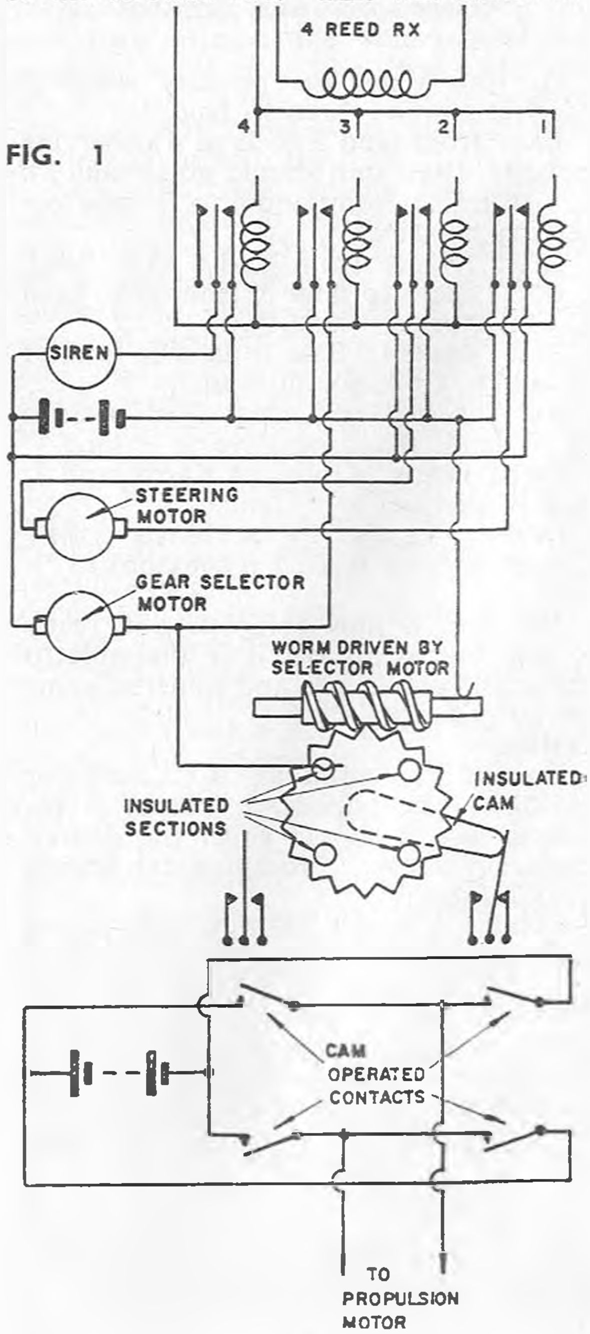
THE original idea in making the radio controlled police car was to provide a working land vehicle for a model exhibition held at Altrincham last October. Aluminium is used extensively in the chassis construction, and I do not propose to go into this in any detail, but would point out that a well made track rod and linkage mechanism is necessary for good control.

Propulsion is by a 6 volt ex-W.D. electric motor fastened to the underside of the chassis, the output shaft of which is fitted with a knurled boss and drives on to a small rubber tyre on a dummy brake drum on the offside rear wheel. The near side rear wheel in free running on the axle.

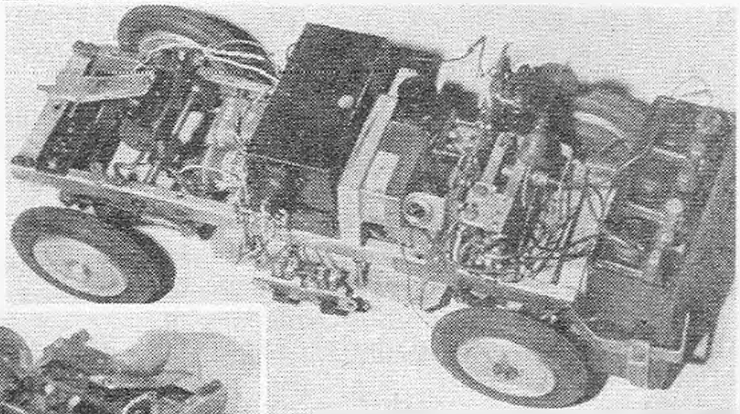
The 6 volt accumulator is mounted at the rear to relieve the steering wheels of excessive weight, as it was found that when the vehicle was stationary it was difficult to turn the wheels. Sufficient mechanical power to move the steering linkage was finally obtained by using a Mighty Midget motor, driving a $\frac{1}{4}$ in. Whitworth screwed rod, via an extra $2\frac{1}{2}$: 1 reduction gear. A traveller stabilised by an extension arm running along an $\frac{1}{8}$ in. guide parallel to the screwed rod, engages in a fork on the track rod.

The mounting of the Mighty Midget motor allows it to move slightly up or down without disengaging the gear drive to the screwed rod. This was found to

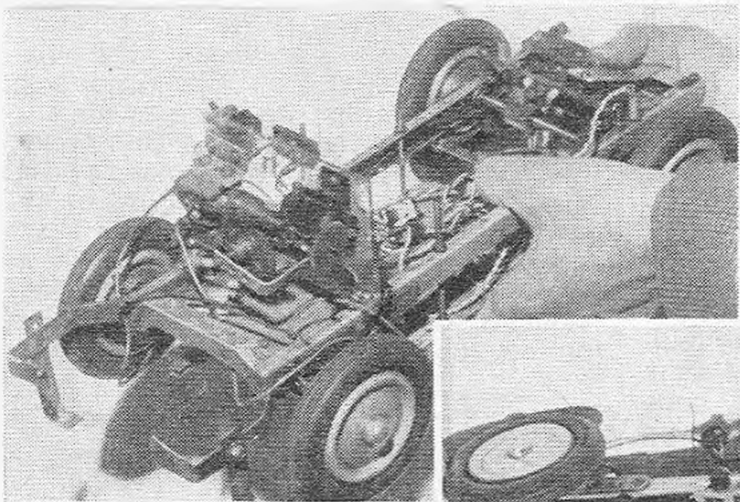
FIG. 1



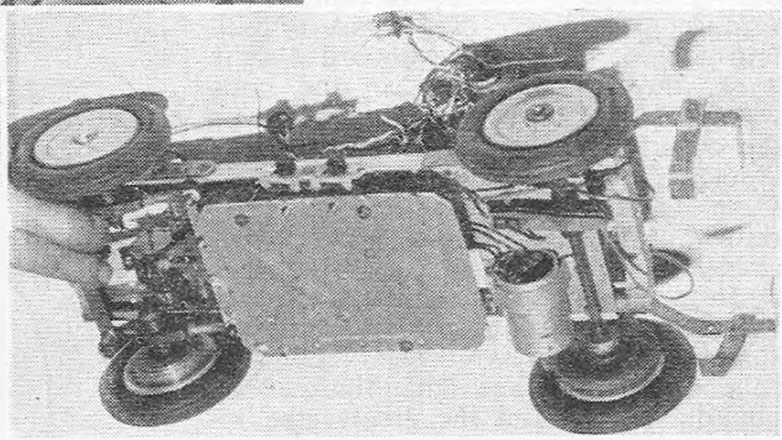
Left: Plenty of room in the estate wagon type of body, the switches can just be seen under the door.



Right: Quite a busy loking chassis; Left to right: Steering motor on its bracket, Rx. batteries, Rx., Reversing switch gear, Reversing servo and at the tail end (right) main supply accumulators.



Left: A more distinct view of the reversing servo to be seen near the rear wheels.



Right: Underside view shows the pan containing the main radio equipment, the fork and twin track rods on the left and the driving motor on the off side rear wheel (right). Just above this the light flashing switch may be seen on the axle.

be a necessary improvement, as originally the motor occasionally stalled when turning the wheels whilst the vehicle was at rest.

A four reed receiver is used, the four controls being Nos. 1 and 2 for steering, No. 3 for forward, stop and reverse in sequence, and No. 4 for the siren (Fig. 1). The gear selector motor has two sources of power, one is switched by relay No. 3, the other through a brass gear driven by a worm on the output shaft. This gear has four $\frac{1}{4}$ in. holes drilled at equal distances from the centre and at 90 degrees to each other. These were filled with Araldite which after it had set, was smoothed down level with the face of the wheel, providing four insulated sections. A phosphor bronze contact rests on the gear in such a position that when it revolves the insulated sections pass underneath. From this it will be seen that when the contact is not on an insulated section, the secondary source of current will drive the gear selector motor and hence the gear wheel until an insulated section moves under the contact. When relay 3 closes momentarily, the motor will move

(*Continued on page* 73)

Do You Need to Haul a Keel?

HOW TO GET THE BEST OUT OF R/C BOATS

By VIC SMEED

MANY model boats of the launch type carry an external keel, usually a ply extension of the keel itself, as in Fig. 1. Why? Does it serve any useful purpose? In a straight running boat there may be a case—it provides additional side area which may assist in maintaining a straight course—but in an R/C craft it has no point and is, in fact, a handicap, particularly if you are after speed.

Drag is the big factor in retarding forward motion, and in the first place wetted area causes drag. The bigger a wet area, the more force is needed to move it through the water. Imagine a 4 ft. length of $\frac{1}{8}$ x $\frac{1}{2}$ in. wood pulled through the water vertically and edge on. There is a certain amount of resistance to motion. Now think of pulling a sheet of $\frac{1}{8}$ in. hardboard 4 ft. x 8 ft., through the water in the same way. There is no greater area facing the water stream—6 sq. in. in each case—so the reason for the greatly increased force required to keep it moving is simply wetted area. This is largely because water tends to stick to a surface to form a boundary layer, and the friction between the boundary layer and the surrounding water is considerable. The rougher the surface, the thicker the boundary layer and the greater the resulting turbulence. Hence a smooth, glossy surface, preferably waxed, gives least resistance, and the smaller the area immersed the less the drag.

More important, however, is the fact that we are not moving a keel through the water straight. Propeller torque tends to turn a boat, and opposite helm is needed to maintain a straight course. It would be nice to think that the helm cancels the torque effect, but in fact it seems more likely that the two forces interact to provide "straight" travel, but with the boat crabbing. Fig. 2 shows the result; it may be only a degree or two, but the drag is considerable.

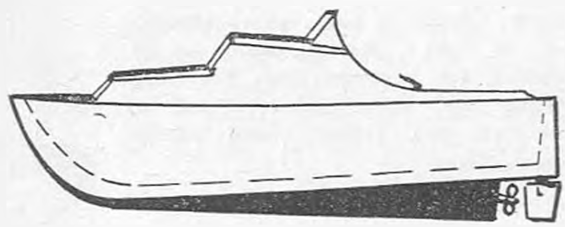
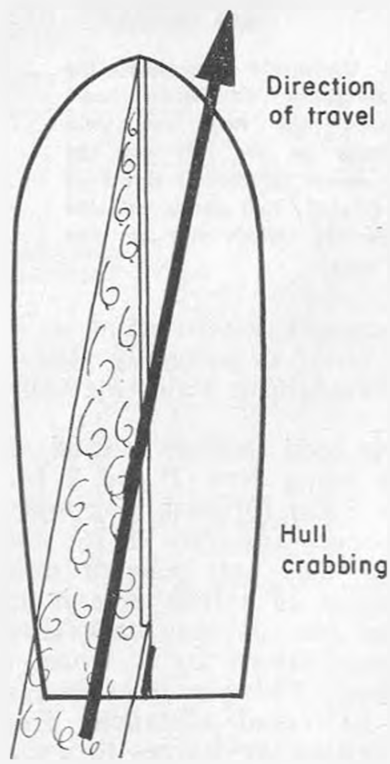


FIG. 1

Evidence supporting this is a gain of up to 2 m.p.h. in several boats whose owners have been persuaded by us to remove most or all of the exterior keel.

Certain full-sized boats have such a keel, often called a beaching skeg, which explains its primary function, i.e., to protect the screws on a beach or slip.

FIG. 2



It probably has some value too in preventing interaction between the waterstreams of two propellers, but for a normal R/C model these uses are not required; at best one can admit that a keel or skeg might prevent or reduce damage to a prop. if the model jumps a log or similar floating obstruction. And, we had better add for the benefit of those who witnessed two incidents involving our own models at Paris and Fleetwood, it may prevent a broken prop if the model runs up the bank! The decrease in performance seems a high premium to pay for so dubious an insurance.

A keel of this nature must have some effect on the turning characteristics of a hull, and it might be argued that for a steering boat there are advantages. Such a keel, however, is likely to slow the rate of turn, calling for larger rudder area and for more travel, which slows the boat itself. Slowing the boat alters to some extent the waterstream spiral/rudder blade combination, discussed last time, and thus alters the characteristics of the turn; this is hardly likely to prove advantageous. If fin area is needed to stabilise a turn, this should be in the form of a tiny dagger plate set where it will do the most good—usually either beneath the centre of bouyancy or at the low waterline ending when planing at speed. We have always felt that such a plate is an admission of defeat.

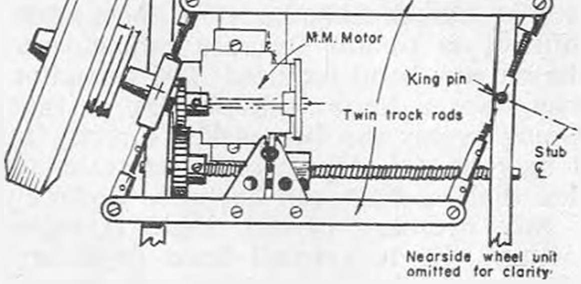
The only good things we can find to say about a keel is that it can prevent sliding in a turn and provide a side force righting the tendency of a hull to overbank in a turn. Unfortunately we believe that sliding turns (within limits) are essential for speed maintenance, and if you need to prevent a hull from overbanking there is something faulty in the basic design. A dagger plate in the right place would be as effective and far less of a handicap to performance. Even if you're not interested in speed, think of the fuel you waste lugging a useless appendage around!

R/C POLICE CAR

(*Continued from page* 71)

the gear far enough for the secondary circuit to take over and continue to the next position.

On the same shaft as the gear wheel is mounted an insulated cam which in turn closes two sets of contacts with two



Underside view of the chassis in sketch form to illustrate the twin track rods and steering mechanism more clearly.

off positions. The wiring diagram (in Fig. 2) shows how the power from the 6 volt accumulator is reversed by one set of contacts to drive the model in reverse. The sequence is from neutral to forward, then neutral and finally reverse. With practice it is simple to skip either forward or reverse if necessary.

An additional gimmick was a flashing blue light on the top of the body switched on by the cam when the car was moving forward, the flashing obtained by a second cam on the rear axle which operated a pair of spring contacts. This method of controlling a land vehicle has now been used in two of the larger plastic models now easily obtainable, one of which was a bulldozer which after a demonstration, ran up a 40 degree slope on to the exhibition stand and by reversing one of the tracks spun in its own length to face the public in its original position.

Meter Monitor

By F. G. RAYER, Assoc.Brit.I.R.E.

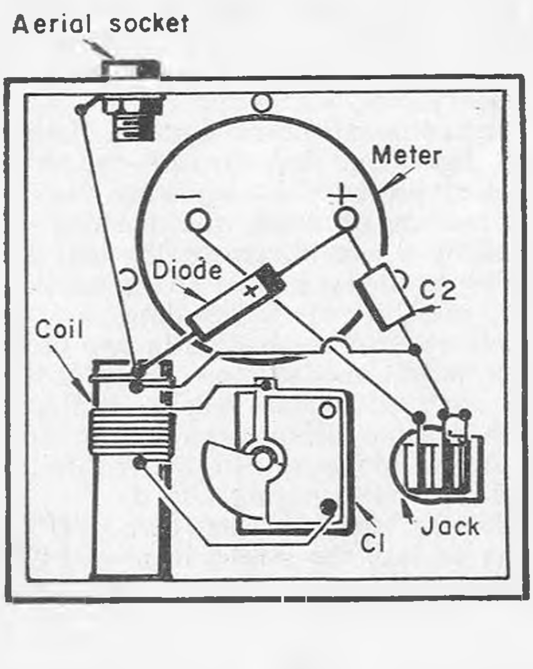
FIELD STRENGTH AND TONE MONITOR

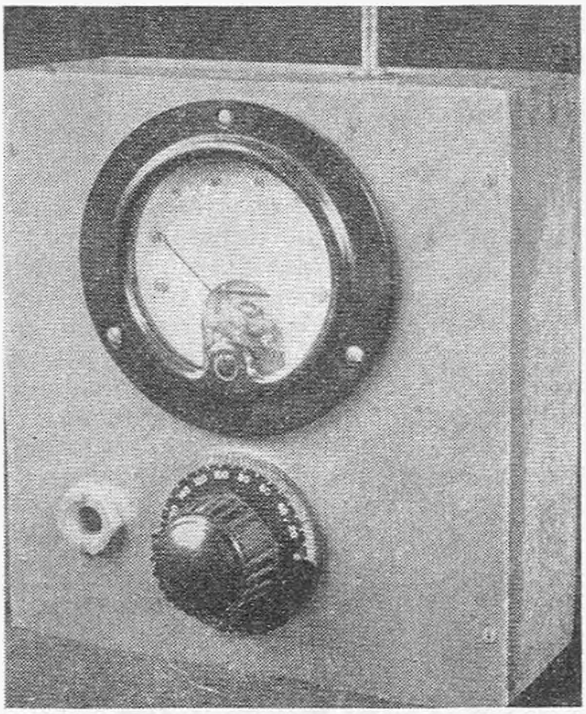
THIS small instrument is extremely easy to build. only needs a few components. and can be used as a transmitter monitor. field-strength meter, or wavemeter.

If a tone modulated transmitter is used, the audio tones may be heard with headphones, a single earpiece, or a miniature earpiece, plugged into the instrument jack. This furnishes a check that the usual modulation is being produced by the transmitter. The monitor may be fairly near the transmitter, no aerial being used on the monitor itself; or it can be at some distance, if preferred, and equipped with a short aerial.

For use as a field-strength meter, the phones are not required. and a short vertical aerial rod is inserted in the socket on the instrument. Field-strength (that is, the strength of the radio frequency signal radiated by the transmitter) will then be shown on the meter. This shows if the transmitter is radiating with normal power. It also allows tuning up for maximum power output. if necessary, or permits comparison of one transmitter or aerial with another.

For use as a wavemeter or frequency meter, the tuning dial of the instrument





Above: Simple exterior, quite large "surplus" components may be used, diagram on the left shows the simple layout inside.

must be calibrated. and it is employed without an aerial. The tunable type of by adjusting the transmitter for maximum meter reading.

Parts and Case

The circuit is shown in Fig. 1, and C1 is a midget variable tuning capacitor of around 15pF to 25pF. A larger capacity is less suitable, as it is then more difficult to obtain accurate tuning over the narrow band required. The capacitor may have a knob with pointer, so that tuning points can be marked direct. Or it may have a degree or other scale, so that dial readings can be noted down.

Any ordinary crystal diode is satisfactory. C2 is a small fixed capacitor, of around 100pF to 500pF, the actual value being of no importance.

The actual size of the meter is unimportant, and depends on what is to hand. Miniature meters can be purchased, and the whole monitor can then be very small. Surplus 2 in. or similar meters will do very well. If used for field-strength checking, the meter should be a fairly sensitive instrument—say 100μA full-scale. With a less sensitive meter the readings, or distance to which the instrument can be taken, will be proportionately reduced. If the meter is sufficiently sensitive, there is no real need to know its actual full-scale reading, so various surplus instruments can be brought into service.

The jack has contacts which are closed, completing the circuit, when the jack plug is withdrawn. If the instrument will be used with CW transmitters only, monitoring will never be required. The jack can then be omitted.

Any case large enough to hold the parts, with a little clearance, will do. One can readily be made from 3-ply, if required. A back is screwed on before calibration.

Construction and Coil

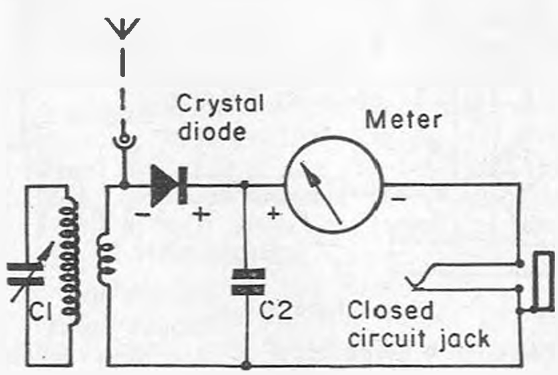
Any coil tunable over the 27 mc/s band is satisfactory. If the instrument is to be retained for use as an accurate frequency meter, all construction must be rigid, leads must be stout and direct, and the coil turns must be cemented in place, or tightly wound on a grooved former. For audio monitoring and field-strength tests, accurate frequency settings are not needed, however.

Exact details of the coil will depend somewhat on C1, gauge of wire, turn spacing, and whether the former is smooth or ribbed. About 12 turns of 20 s.w.g. wire, occupying 1⅜ in. on a 1 in. dia. ribbed former, will normally be satisfactory. There is, however, no need at all to adhere to this size, or wire gauge. Enamelled wire can have turns closely side by side, and fewer turns will then be needed. If there is any doubt about how many turns to use, the simplest solution is to provide two or three more than expected, then remove a turn at a time, until the middle of the band is obtained with C1 roughly half closed. The actual windings are clear of the case side and bottom, as in Fig. 2. The small winding is about 2 turns, roughly ¼ in. from the tuned winding.

All connections are shown in Fig. 2. Everything should be tightly secured, or calibration may be lost. The coil can be cemented down, held with brackets, or pushed on a disc of wood screwed in place.

For the aerial, a rod, or number of rods, about 12 in. to 36 in. long may be use, and the socket is of the correct size to take this item. The instrument is not used as a frequency meter with the aerial in place, because the exact length and position of the aerial will slightly alter tuning.

FIG. 1 THEORETICAL CIRCUIT



Use as a Monitor

For monitoring a tone modulated transmitter, plug in the phones or earpiece, and tune C1 for maximum volume, keeping the monitor at a suitable distance from the transmitter. Medium and high impedance phones are most suitable, and the monitor should not be so near the transmitter that there is any chance of the meter going beyond its full-scale reading. Should low-impedance phones chance to be available, they can be used, but it is then preferable to fit a jack with change-over contacts, wired so that the meter is shorted out when the phones are plugged in. If not, volume may be rather low, even with the meter reading around full scale, unless the actual meter fitted is relatively insensitive (say 0.5 mA or 1 mA).

Field Strength Meter

To use as a field-strength meter, insert the aerial, and place the instrument some distance from the transmitter. Adjust C1 for maximum indication on the meter. Modifications at the transmitter or its aerial, which cause a stronger signal to be radiated, will increase the meter reading. If the distance and reading are both noted, this will form a reference against which the transmitter can be tested at any time.

(Continued on page 77)

Four From Three

G. G. SHORT DESCRIBES HIS TONE OMISSION CIRCUIT FOR FAIL-SAFE AND THROTTLE CONTROL

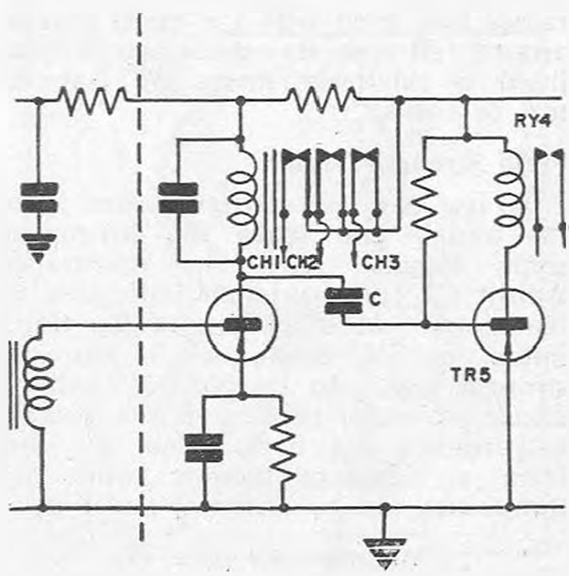
AFTER several years' activity on Model Aircraft Radio Control, and not without my fair share of fly-aways resulting in the complete loss of two models, I decided that a system must be used that would provide 100 per cent fail-safe, to operate in the event of failure at the transmitter *or* receiver and if the model should go out of range.

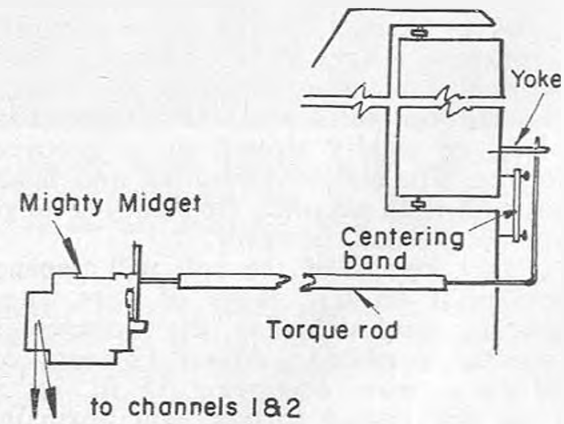
Before we consider the arrangement, a few other points will not be amiss. As cost was of prime importance, the idea of obtaining an extra channel (apart from the fail-safe feature) was attractive. Of secondary importance to the cost, the fail-safe feature must operate despite the reason of failure of the control link. To obtain maximum reliability a separate battery is used to supply the engine control servo.

Now to explain the set-up. The receiver, as can be seen from Fig. 1, is a standard all-transistor arrangement driving a 3-reed unit, 250 ohm., each reed being followed by an OC72 amplifier into low-impedance relays. The extra channel, it will be noted, is provided by Pot 4. The tone frequency is fed (this being outside the range of the reed unit) to the base of TR5 providing bias to this stage, removal of this tone results in TR5 conducting, RY4 closing, engine control servo to slow-run position.

To refer to the transmitter control box (Fig. 2) it will be noticed that an easy arrangement has been adopted, the requirement of this system is the transmission of a tone signal throughout the operation of the model (here we should

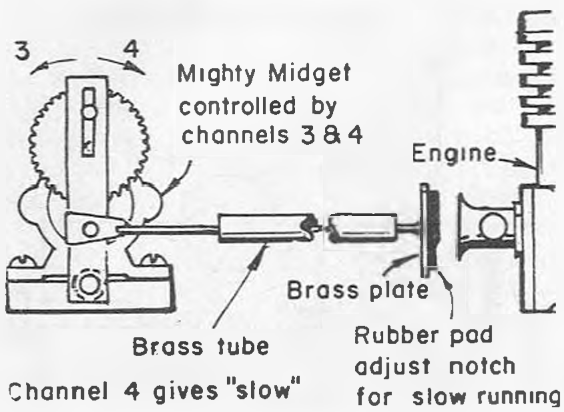
FIG. 1





Rudder Linkage

Throttle Linkage



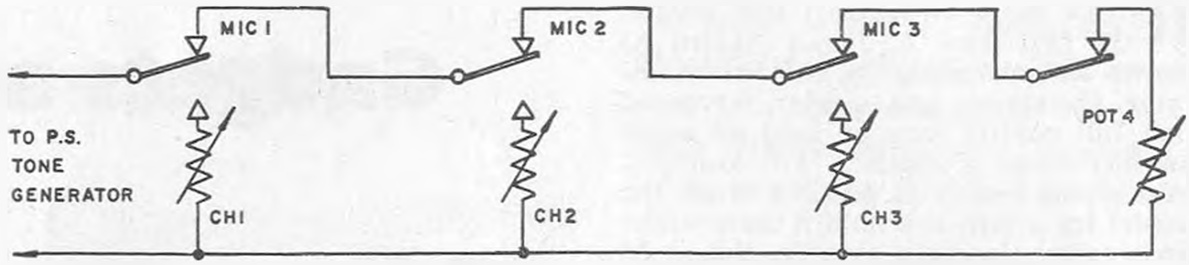


FIG. 2

note a distinct advantage — constant modulation results in battery saving, providing of course that grid modulation is used). Instead of a separate modulator with its attendant problems of mixing, the single "Phase Shift Oscillator" was retained. Micro switches of single pole changeover type are used, operation of 1, 2 or 3 disconnects Pot 4 and brings in the selected tone. Operation of channel four micro switch, stops the oscillator resulting in operation of TR5 and its control circuit. From this you will note that any command tone brought into use replaces the constant frequency radiated, so providing the bias for TR5. The extra channel can be used at all times, there are no time lags, it is 100 per cent fail-safe.

Should any fault develop in any stage of the transmitter or receiver, the tone signal which provides the bias to TR5 will be removed and circuit will close. Another very useful feature of this arrangement is that it is impossible to let the model take-off with the radio faulty, as the engine servo will be returned to the slow run position.

I am using this equipment with a modified "Super 60", powered with a "Nordec" 10 c.c. glow motor. I am convinced that the best intermediate approach to multi flying is four channels, using two for rudder and two for engine control. Good engine control will add a remarkable degree of control over the aircraft.

In conclusion, mention of the servo used for rudder (and the plane has now done over 100 flying hours with no trouble) just a M.M. motor on a torque rod direct (Fig. 4), held central with a rubber band—yes it stalls on each turn, but the S.C. is only 350 mA. and the M.M. does not seem to mind. A pair of 4.5 v. flat batteries supply the power, and I have done over six flying hours on one set of batteries.

One final tip; spend a bit of extra time building the model, make it good and strong. Fit a powerful engine—I can remember more damage from under power than any other cause.

MONITOR METER

(Continued from page 75)

Wavemeter

For use as a wavemeter, remove the aerial. The instrument is brought near enough a correctly tuned transmitter, to obtain a reading, and C1 is rotated for maximum meter deflection. At the same time, keep the instrument reasonably far from the transmitter, so that the meter deflection, with correct tuning, is only small. This point can be marked, so that it can be returned to. Another transmitter can then be tuned to frequency, by setting the wavemeter to the mark, and tuning the transmitter. If means are available, the limits of the control band can be noted or marked. Otherwise, one tuning point, near the centre of the band, will do. If construction is rigid, and C1 and its dial or knob securely locked in place, a good standard of accuracy can be retained.

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.

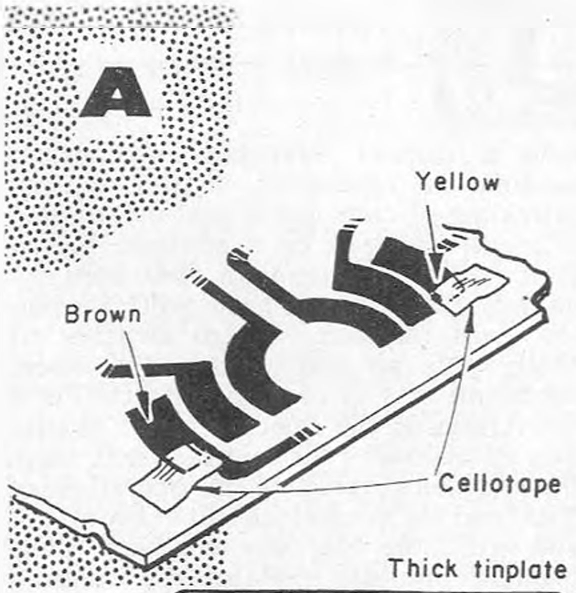
Gadgets and

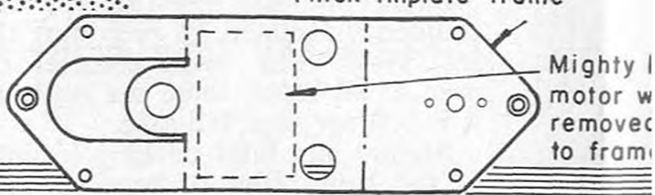
Rather more switchcraft this month, the first from A. James (Sketch **A**) shows an interesting method of modifying Duramites and similar servos so that full control may be held on while another signal is applied. For example; in a model boat it is possible to set the model for a turn and hold it there whilst opening or closing a throttle, this is of course possible with bi-simultaneous transmitters but this idea permits normal four channel outfits to be used. The alternative to this arrangement is to use a progressive rudder servo, but this of course does not give "spot-on" neutral.

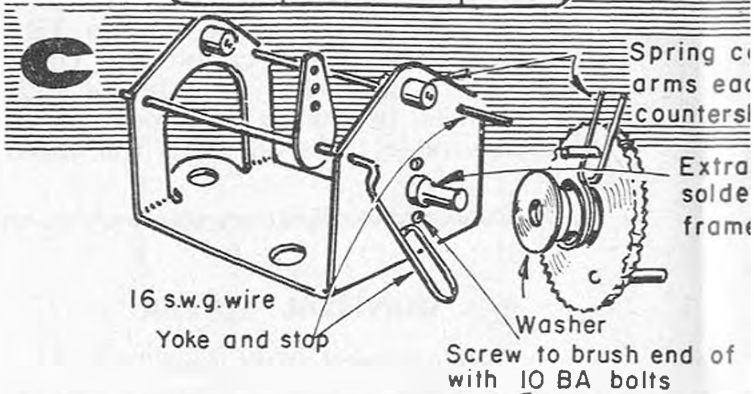
The contact tracks on the servo have been identified for the sake of clarity, and it will be seen that by insulating the ends of the return tracks the servo will run to full position but will not centre when control is released. Only by giving a quick opposite signal will the servo run off the insulated part and drive back to neutral in the normal way. Short signals given for small rudder deflections do not take the wipers on to the insulated sections so that the important fine control is not sacrificed by this method.

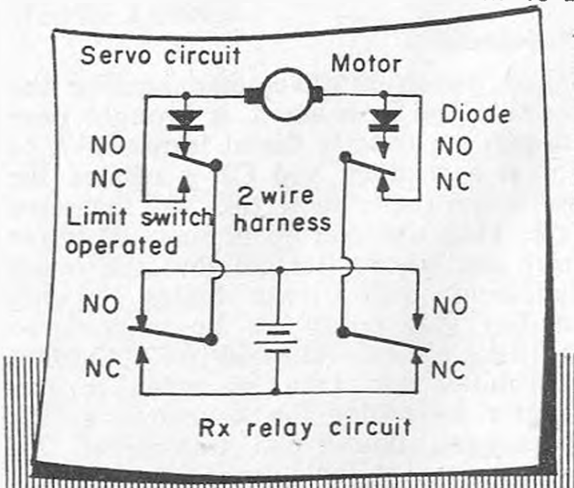
Proportional Servo (Sketch **B**)

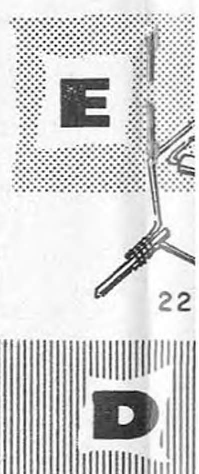
Whilst searching for a suitable magnetic servo for a boat (it would probably work quite well in an aircraft), J. Birch came across an old "Graham Farish" locomotive mechanism in the junk box. There may be quite a number of others still around in perfectly good working condition. If one feels canibalistic, the mechanism may be modified in the following manner. The design features a permanent magnet armature and a two coil field winding which is surrounded by a metal clip, presumably this is the field pole piece. The clip must be slid gently off the winding so as not to damage the wire in the process. This gives access to the connection between the two coils which must be joined to another lead going to the armature of the relay (via the battery). Each of the existing connecting leads is then taken to the other two relay contacts so that when the relay is energised the battery feeds one coil causing the armature to deflect in one direction. When the relay is released current is supplied via the other contact to the other winding, swinging the armature in the opposite direction.





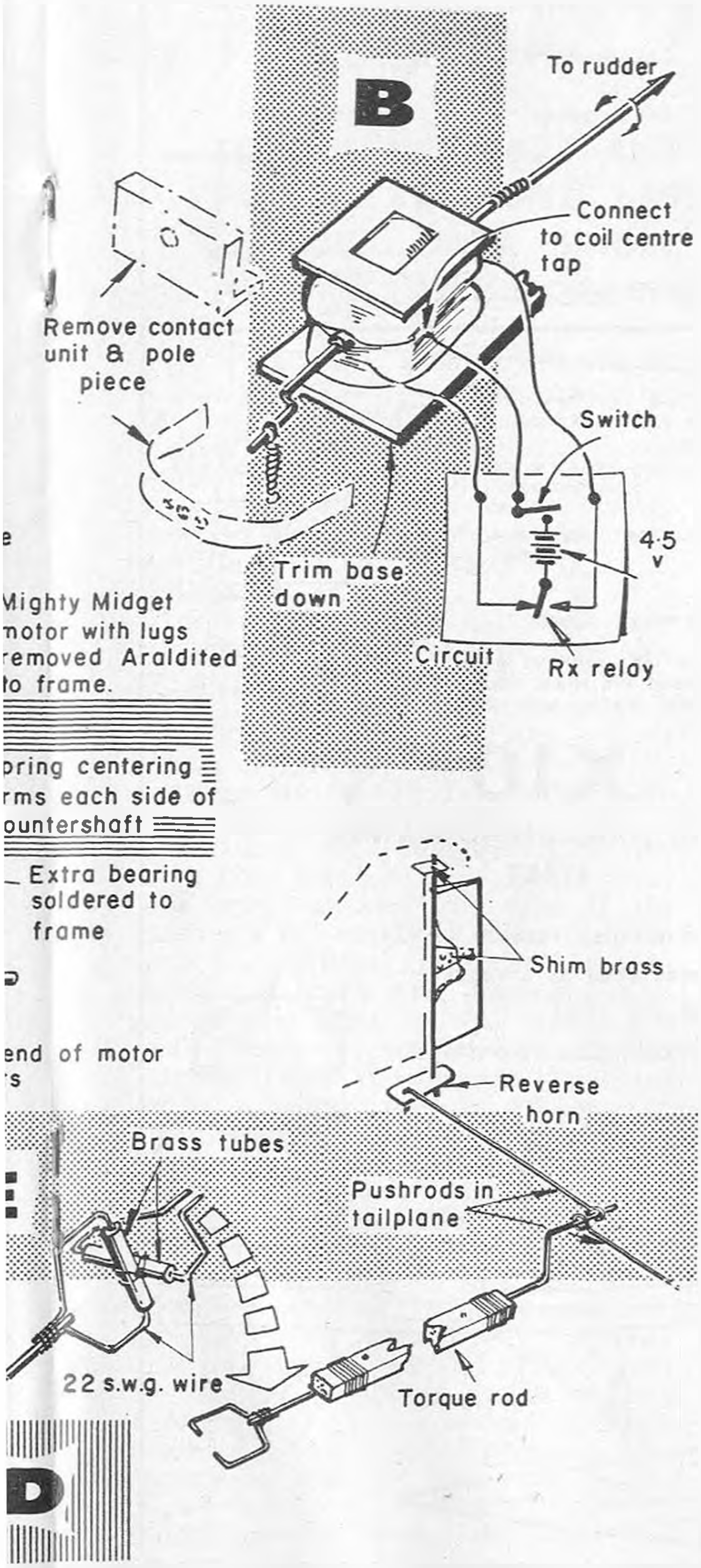






d Gimmickry

We invite readers to submit their Gimmicks for publication. All we need is a clear description and a rough sketch, we do the artwork for those selected and you get paid!



Motorised Proportional Servo (Sketch **C**)

"MARS Pulse" provides an informative drawing which we reproduce here. This may be modified to suit individual requirements, but the arrangement shown is quite compact and gives double gearing to the popular Mighty Midget motor. Tinplate is used for the main frame and this should be of fairly heavy gauge, a little brass tubing inserted and soldered in place should reduce the amount of wear on the bearings.

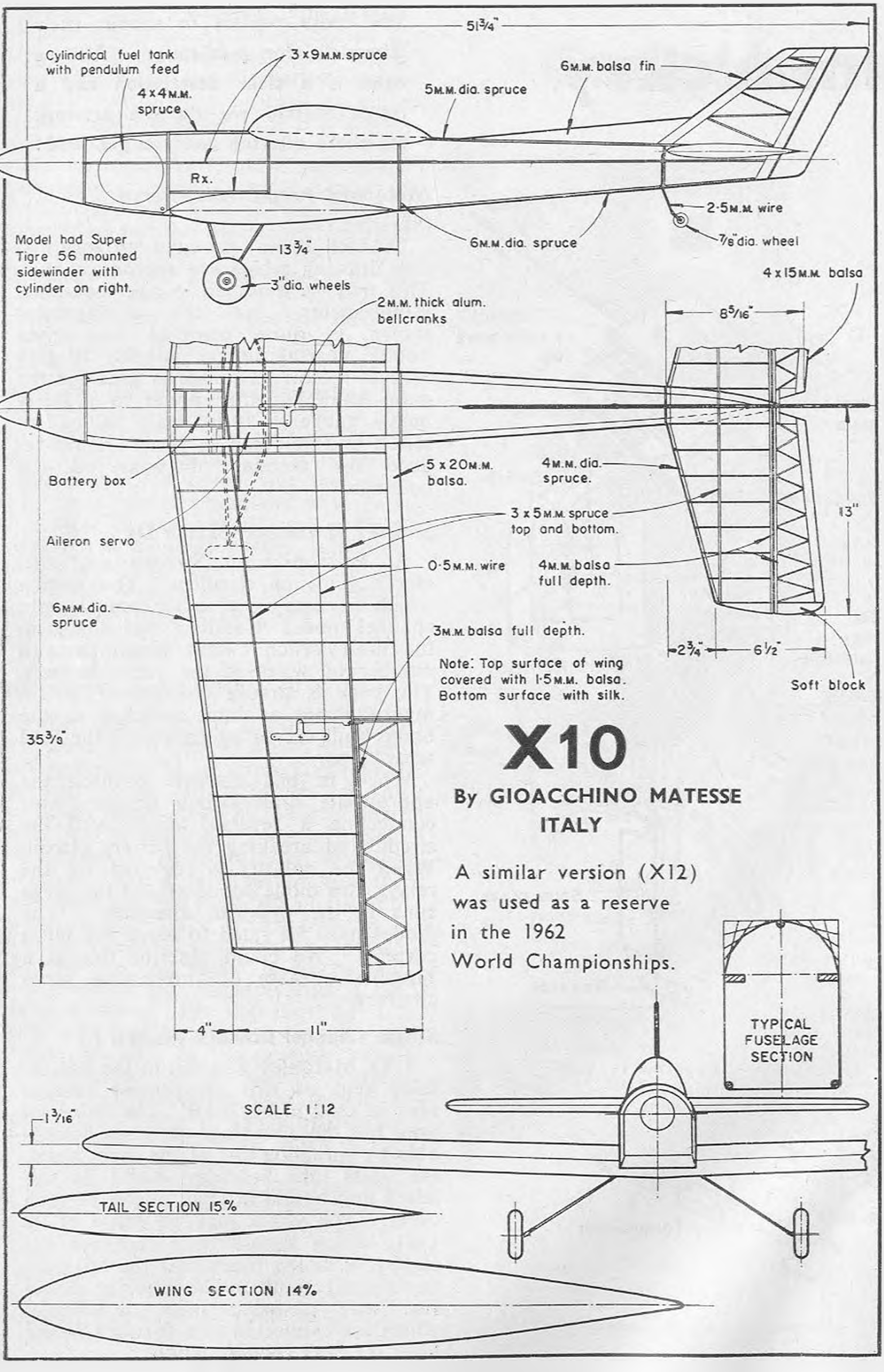
Simpler Harnesses (Sketch **D**)

A. Persson from Sweden sent this clever piece of circuitry. The system which he uses in a radio control eight channel model "Cadillac" has diodes in the limit switch circuit which saves a number of wires in the servo harness. The trick is to use changeover Bulgin microswitches as limit switches in the home built servos which are of the lead screw type.

When in one extreme position the appropriate limit switch changes over connecting a reversed diode into the circuit and breaking the battery circuit. When the polarity is reversed via the relays, this diode conducts and the servo runs in the opposite direction. The diodes must be rated to carry the servo currents. We could describe this as a progressive piece of progressive servo circuitry.

Single Channel Linkage (Sketch **E**)

J. D. Macauley way out in the Isle-of-Islay sent us this escapement linkage idea as used in his R.6B. The universal joint has the advantage of being detachable by springing one of the forks apart, the brass tube bearings should be soldered and bound at right angles to each other. The yokes may be made of 22 s.w.g. which should be a free but not sloppy fit in the tubes. At the tail end: an internal crank in the fuselage drives two wire pushrods (also detachable) which are connected to a forward facing lever on each rudder spindle.



X10

By GIOACCHINO MATESSE ITALY

A similar version (X12) was used as a reserve in the 1962 World Championships.

Champion Transmitter

By P. CHAMPION Part 2

TONE GENERATORS AND FITTING OUT THE CASE. PART 1 PUBLISHED LAST MONTH PROVIDED THE MAKINGS OF A SINGLE CHANNEL Tx., NOW WE PROGRESS TO 10 CHANNEL BI-SIMULTANEOUS MULTI

THE modulation amplifier previously described has a high impedance input, this only requires a small voltage to drive it and so any transistor audio oscillator will have sufficient drive for the modulator without being heavily loaded. Heavy loading can adversely effect the stability of certain types of oscillator.

Three different audio oscillators have been used and all have proved suitable for driving the modulation amplifier. These are: the Dave McQue phaseshift, the Transitone T.G.1. and the writer's version of "Windy" Kreulen's oscillator. All three are suitable for reeds or s/c tone (The T.G.1 is less stable at extreme temperatures but would be suitable for tuned filter Rxs.), a more simple oscillator may be used for tone if the stability is not important. For use with reeds, the oscillator given here is recommended. If built with the components and layout given, it will maintain a reed frequency between 30 degrees Farenheit and 130 degrees Farenheit and/or a voltage drop of 25 per cent. This means an overall stability of under 1 per cent. It must be stressed however, that if this order of stability is required, the components specified must be used. This applies particularly to the transistors, use the OC45's specified, audio transistors of the normally available types will allow considerable frequency drift with temperature (2-5 per cent over 30 degrees Farenheit — 130 degrees Farenheit). It is also advised that high grade pots and Mullard polyester condensers are used for tuning the chokes, as any change in resistance, capacity or inductance will change the audio frequency.

Construction

It will be noted that two oscillators and the modulation amplifier are built on a P.C. board $1\frac{1}{2}$ x 4 in. The board is made $1\frac{1}{2}$ in. wide so that when fitted back to back with the R.F. section, and the case is the same depth as the R.F. section say $2\frac{1}{2}$-$2\frac{5}{8}$ in. it leaves 1 in. under the modulator panel and its components. This enables the key switches and modulation choke to be placed under the panel. See Fig. 5.

The P.C. layout is designed for ease of construction and neatness, for one offs using the simplest tools. Cut out a piece of P.C. board to size, clean the copper gently with Vim or Ajax. The dimensions given may then be drawn on to the board with a pencil and 6 in. steel rule. When the outline of the conductors has been drawn on with pencil (layout Fig. 2) take a draughtsman's adjustable drawing pen filled with about two drops of Humbrol enamel and paint in the conductor outline over the pencil outline. It will be found quite easy to adjust the pen and draw a clean paint line $\frac{1}{32}$-$\frac{1}{64}$ in. wide. When the outline has been painted in, the body of the conductors is filled in with more Humbrol enamel on a small paint brush.

When drawing, the paint dries on the P.C. board, raise the rule above the surface of the board by means of two strips slightly thicker than the board, thereby preventing smudging when drawing in the lines at 90 degrees to those already drawn. If any mistakes or runs occur at this stage don't worry, put the board in a warm place for 12 hours for the paint to dry. If any mistakes or ragged edges have been made, these may now be corrected by laying the 6 in. steel rule over the point and scraping away the unwanted paint with a modelling knife or penknife.

The board is then etched in the same solution as was used for the R.F. section. after etching, washing and drying, the enamel may be removed with cellulose thinners. A neat P.C. board with straight clean conductors should result. As an alternative, the circuit can be cut and peeled with a modelling knife.

Drill the board and solder in the components as indicated in Figs. 3 and 4, observing the usual precautions with delicate components. The tuning chokes (L6) are wound on Mullard LA 25 (1) pot cores, if wound as follows the inductance will be suitable for the range 200-500 c.p.s. by suitable capacitance across the coil. The inductance is such that a true sine wave will be produced

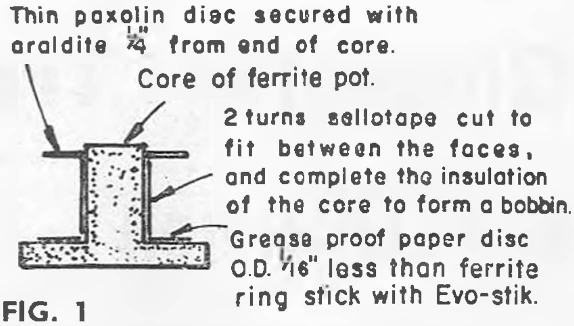
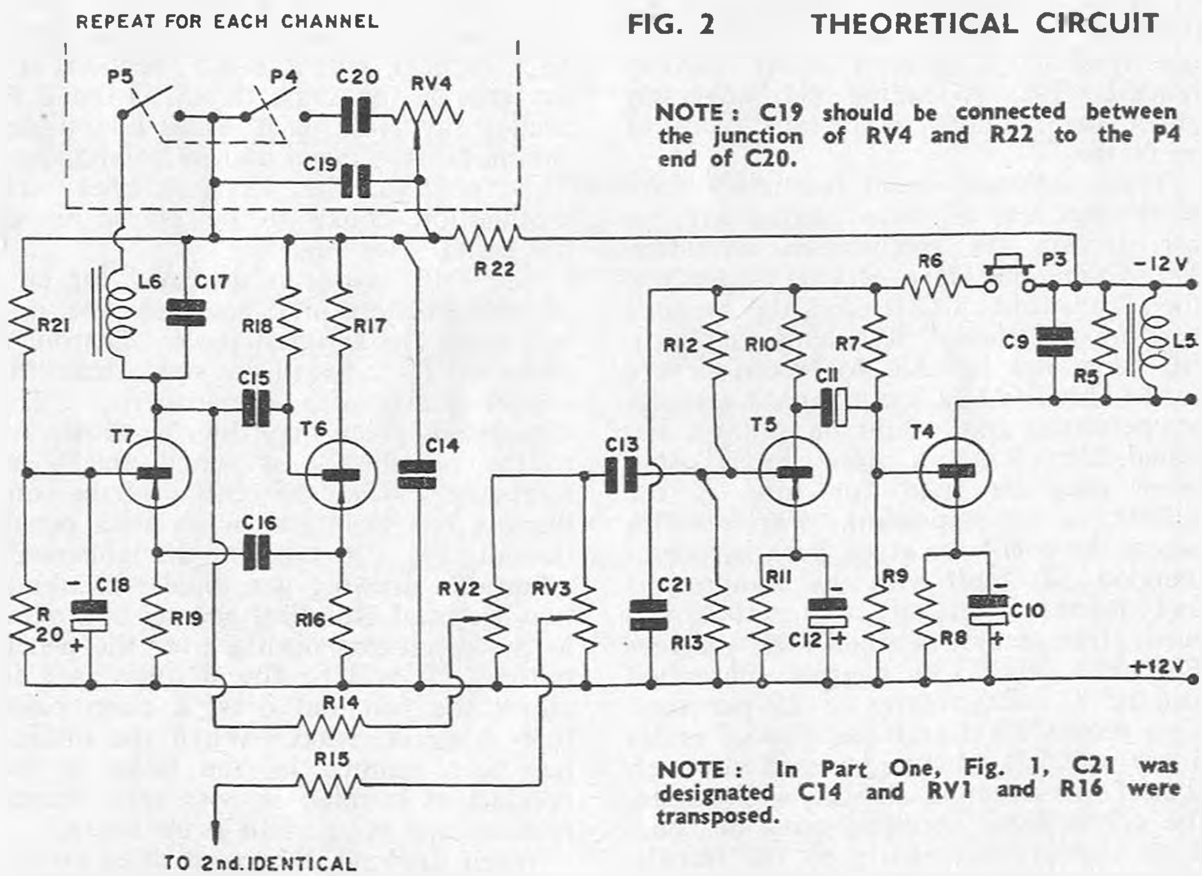


FIG. 1

over this range of tones.

Discard the coil bobbin, cut out a circle of grease-proof paper with a hole to fit snugly over the core, and O.D. to be $\frac{1}{16}$ in. smaller than the ferrite ring. This disc is then stuck on with a smear of Evostick (see Fig. 1). Another similar disc is cut from thin paxolin and pushed on to the core so that it pro-

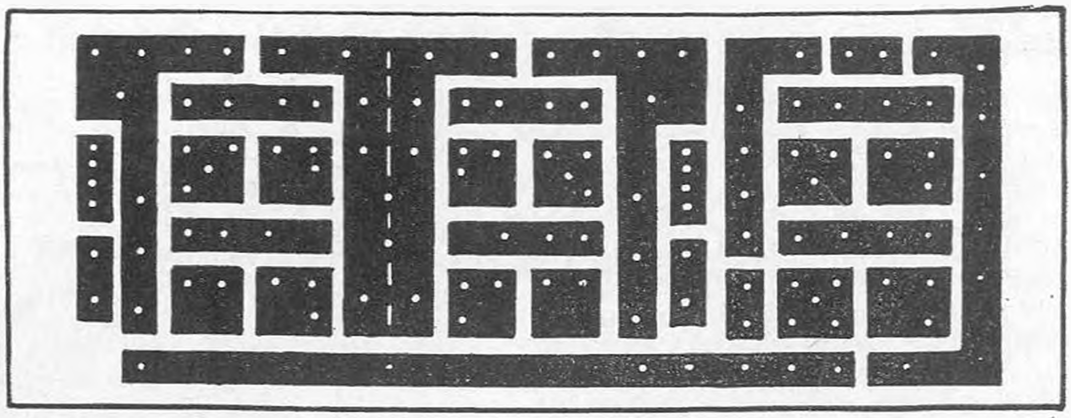
FIG. 2 THEORETICAL CIRCUIT



COMPONENTS REQUIRED (See List for Details)

R5	1.5K	R16	4.7K	C9	1000 Pf	C20	0.02
R6	220 ohms	R17	2.2K	C10	100 mfd	C21	40 mfd
R7	10K	R18	470K	C11	10 mfd	T4	OC76 OC81
R8	100 ohms	R19	27K	C12	10 mfd	T5	OC71 OC75
R9	1K	R20	4.7K	C13	0.01 mfd	T6	OC45
R10	3.3K	R21	68K	C14	40 mfd	T7	OC45
R11	1.5K	R22	3.3K	C15	0.1 mfd	P3	R.S. Min. Plug
R12	56K	RV2	1M ohms	C16	2 mfd	P4	Key Switch
R13	10K	RV3	1M ohms	C17	0.068 mfd	P5	Key Switch
R14	330K	RV3	10K	C18	25 mfd	L5	100 ohm Choke
R15	330K			C19	As Reqd.	L6	Pot Core

Full Size Printed Circuit **FIG. 2**



Components required for Two Tone Generators and Modulation Amplifier

Capacitors (Mullard)

3 off	40 mfd.	16v.	Electrolytic	C426 AM/E40	Mullard ref.
2 ,,	10 ,,	,,	,,	,, /E10	,,
,, ,,	25 ,,	4v.	,,	26 /B25	,,
1 ,,	100 ,,	,,	,,	,, /B100	,,
2 ,,	2 ,,	10v.	,,	C426 AN/D2	,,
,, ,,	0.1 ,,	30v.	Foil	C 28OAA/P100K	,,
,, ,,	0.68 ,,	125v.	Polyester	C296 AA/A68K	,,
,, ,,	1 ,,	,,	,,	,, A22K	,,

Capacitor (Radiospares, Erie, etc.)
1 off 1,000 Pf. ceramic (disc or tubular).

Resistors (Radiospares miniature ½ watt)

2 off — 68K	2 off — 10K
4 off — 4.7K	3 off — 3.3K
2 off — 27K	2 off — 1.5K
2 off — 470K	1 off — 220 ohms
2 off — 2.2K	1 off — 100 ohms
1 off — 56K	2 off — 330K
1 off — 1K	

One 10K miniature potentiometer for each channel. (Plessey sub. min. skeleton Henry's Radio). One Arrow or similar double-pole key switch for each two channels.

To tune the oscillators to the correct frequencies to suit the reed bank used a selection of Mullard polyester condensers of 0.1 mfd. to 0.02 mfd. will be required. The Mullard and Radiospares items may be obtained through retail radio shops. The writer's components were obtained from Guerneys (Radio) Ltd., 109, The Broadway, Southall, Middx.

Other Components Required

4 off OC45 transistors Mullard.
1 off OC71 or OC75 transistors Mullard.
1 off OC76 or OC81 transistors Mullard.
2 off LA25 Ferroxcube Pot cores Mullard.
1 off miniature Radiospares transformer.
2 off 1 Megohm Plessey pots (MIN).

---

trudes $\frac{1}{64}$ in., the disc may be held in place with a spot of Araldite. A turn of Sellotape round the core completes the job ready for winding.

The core may now be wound full of 42 s.w.g. enamelled wire, the ends of the coil being terminated with flex. The core may now be assembled the flex leads being brought out through the slot provided in the ferrite ring. Gramophone pick-up lead stripped of the outer covering and screening will be found ideal for this type of coil termination.

The number of 10K pots to cover the number of channels can now be fitted to a panel, if eight or ten channels are being used it will be found that the small skeleton Plessey pots from Henry's Radio, are ideal. The suggested transmitter layout is shown in Fig. 1.

Setting Up

When the oscillators have been wired up to the chokes and key switches, the oscillators may be checked, C19 and C20 need not be used at this stage. C17 will give a frequency approximately 500

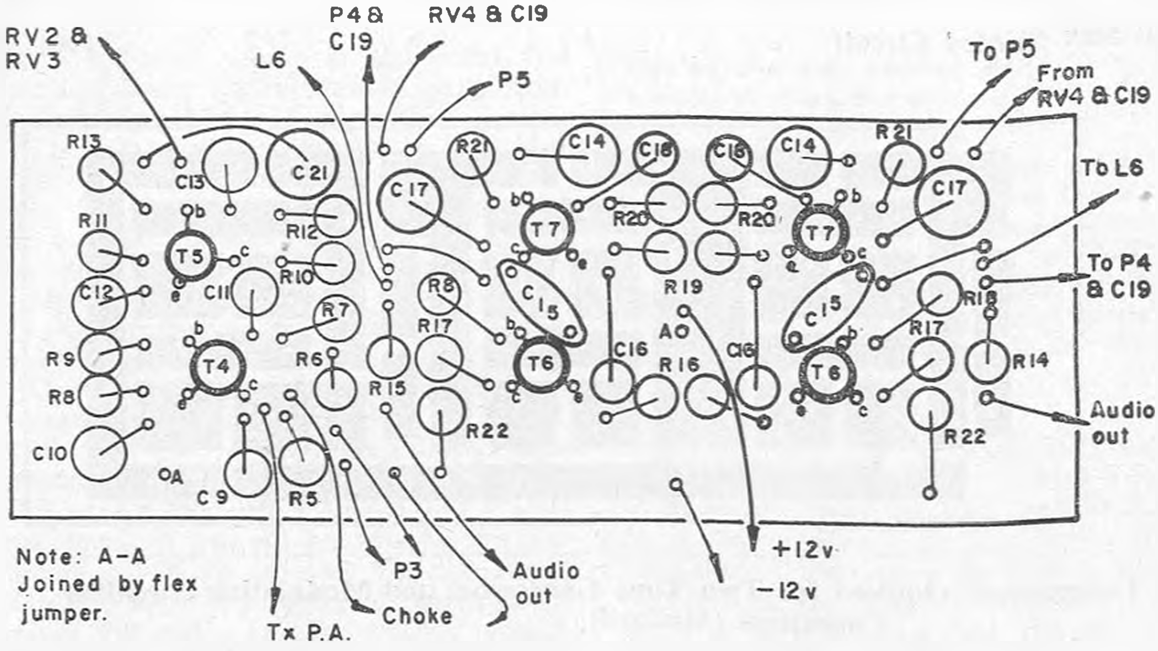


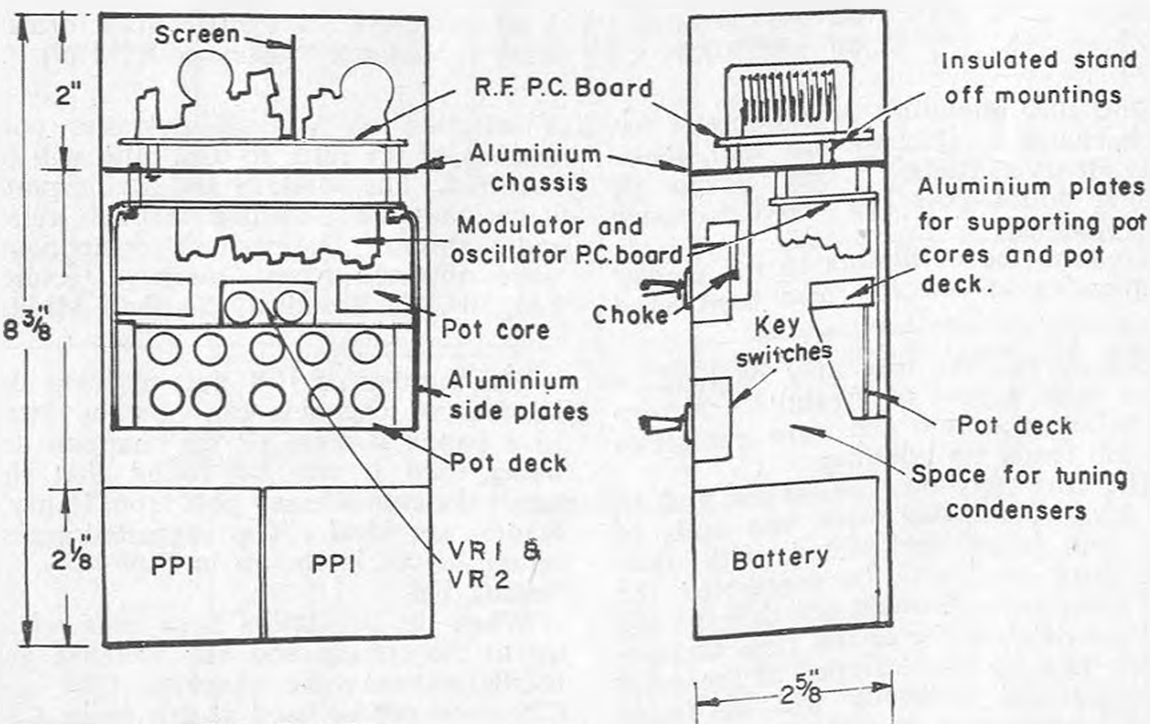
FIG. 4 **Placement Diagram**

Hold page up to light to register with lands

c.p.s. C17 + 0.1 + 0.02 gives approximately 300 c.p.s. To test, connect oscilloscope or phones to the output side of R14 or R15 with RV2 and RV3 turned to maximum resistance to earth. Phones will indicate if the oscillators are working. If a 'scope is available the waveform and the frequency may be checked. (Lissajous figures using reference oscillator or mains).

If the unit is now coupled into the transmitter, and either aerial or bulb load placed on the R.F. section, the transmitter can now be set up for cor-

(Continued on page 86)



Case Details

Tick - Tick - Tick . . . Help !

A Delay Rescue Idea by B. R. CASBOURNE

ALTHOUGH the title may seem a little odd, the operating factor in this device is in fact "time". The author has often considered the possibility of retrieving a craft should its propulsion system fail or become fouled in mid-stream. Apart from the obvious method of getting wet, fresh thoughts were prompted by a previous article on a radio control retriever craft which carried a line out to the vessel and back to the shore. This article describes the development of a version with the rescue launch originating from the parent vessel.

The system depends for its operation on the main drive motor circuits, which if they failed would render the boat virtually useless. Basically it comprises a relay in the motor circuit, time delay circuit and the rescue launch operating system. Fig. 1 shows the schematic of the layout. The uniselector contacts are optional refinements.

Circuit Operations

The relay in the main drive system is normally closed when the motors are running and drops out when the current ceases. Care must be taken in the choice of relays for this purpose in that they do not unduly deprive the motor of any current if the relay is across the motor the value should be consistent with holding in at the lowest applied voltage to the main motors. The relay contacts are used to actuate the delay network given in Fig. 2A. The opening of the relay contacts RY1 allows the capacitor C1 to discharge via R1 into the base/emitter resistance of the OC71 which in turn causes the collector current in the OC72 to drop from about 12 mA. to approximately 100 μA, the relay RY2 changing over at about 3 mA. The delay in the circuit given is about 4½ minutes. By varying R1/C1 the timing circuit cycle can be varied. There is a limit to the value of R1 as this not only affects the delay time but also the standing current through the OC72. If a relay of differing value were used in place of RY2 the best value for R1 should be determined by experiment using a 1.5 M ohms pot and substituting with an equivalent value fixed resistor. An alternative circuit is given in Fig. 2B using one OC71 and a 3700 ohms Siemens H.S. relay which responds to a change of about 1½-2 mA.

The delay is most useful when of the orde 4-5 minutes, as it is sometimes desirable to station the vessel and run through a routine. During the delay period the circuit will of course be running down but on the resumption of motor current the delay will cancel and

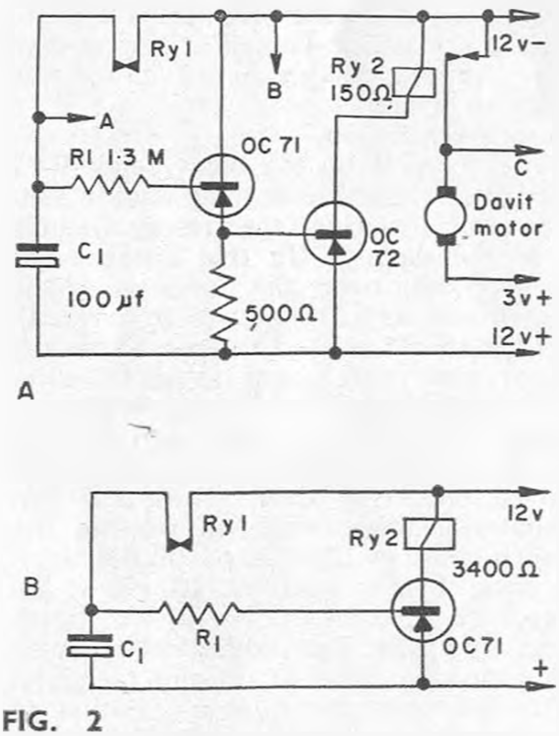


FIG. 2

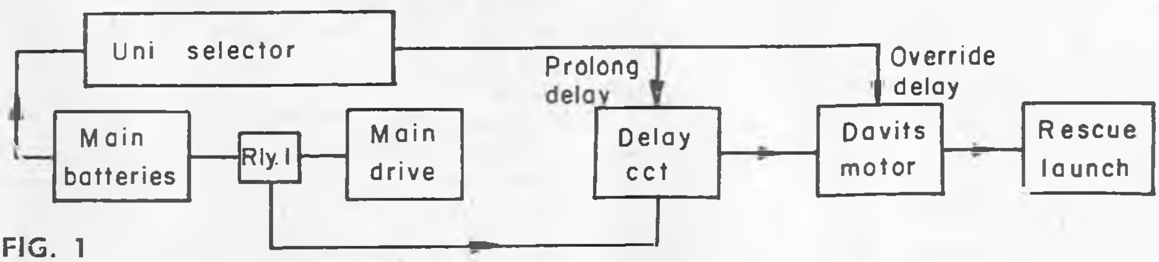


FIG. 1

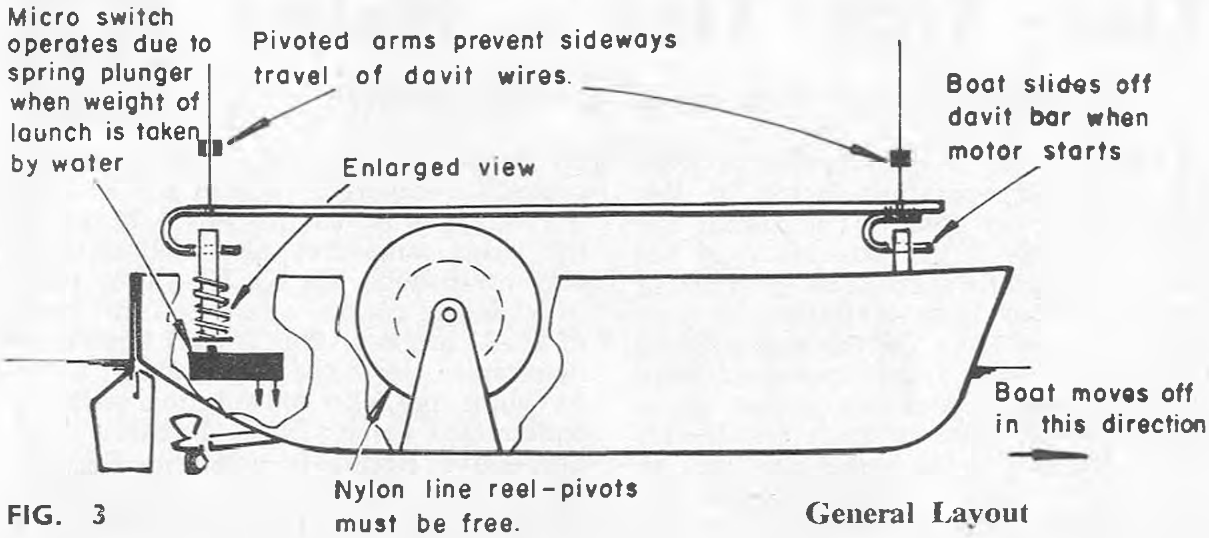


FIG. 3 General Layout

reset itself. In the event that the vessel is required to "stand off" for some time a contact on the main uniselector is used to hold off the delay for any length of time. This, however, reduces the safety factor in that in the event of the uniselector failing in this position the delay portion of the system will be inoperative. A further contact is used to actuate the rescue launch at any desired time without having to wait for the delay to operate.

Launch Operation

The contacts on the delay relay RY2 are used to operate a small motor suitable for lowering the rescue launch from the davits. (In this instance the davits were over the stern and the launch was approximately 8 in. overall). A limit switch is used to ensure that the motor does not mend the davit wires back up again after lowering. The arrangement within the launch is that on settling in the water the weight is removed from the davit wires and this actuates a microswitch to operate the launch motor. The shape of the davit securing bar is such as to allow the launch to slide off the bar as the motor picks up speed. Two additional restraining arms are fitted to prevent the davit wires following the sideways motion of the launch as it pulls away from the stern. Fig. 3 shows sketches of the davit securing bar and launch microswitch arrangement.

The reel of nylon cord is fitted within the launch and must be very free to rotate. A pulley and guide is advisable where the nylon line passes over the stern of the launch. The securing position on the parent boat is best determined by experiment. It is not advisable to mount the reel on the parent boat and allow the rescue launch to drag it off as sometimes this causes an undue load to be placed on the rescue launch due to the friction of the line in the water.

The rudder of the launch was set to about 0.5 degrees so that on moving off it would lead in a very wide circle, eventually (?) hitting the bank.

CHAMPION Tx.

(Continued from page 84)

rect operation. If a 'scope is not available, the transmitter can be set up with a receiver, and tuned for modulation depth and reed frequencies by trial and error.

RV2 and RV3 are used to set the depth of modulation and balance the two audio oscillators. The 'scope may be connected at xx and battery + to balance the modulator outputs. If the modulator is overdriven, the waveform will be clipped.

The final tuning to the reed bank is done exactly as described for the "Duo Ten Transmitter". Capacitors are connected as indicated in the circuit diagram. C20 should be from 0.01 to 0.03 mfd. to give fine tuning for the reed and the make up capacitance C19 will range from 0.01-0.03 mfd. for the highest frequencies to 0.1 for the lowest.

A final setting up working two reeds simultaneously should complete the transmitter.

● *Aerial details next month.*

Metz Mecatron 3 Channel Tx., Rx. and Mecatronic 2 Servo

TEST REPORT

By J. H. BRUNT

THIS three channel equipment is composed of the following items, 3 tone Mecatron Tx.. 192/1, 3 tone Mecatron Rx., 192/2, Mecatronic 1 motorised actuator (Green Channel) and Mecatronic II electronically switched actuator /servo (Red and Yellow Channels). Mecatronic II has a double motor (common field. double armature).

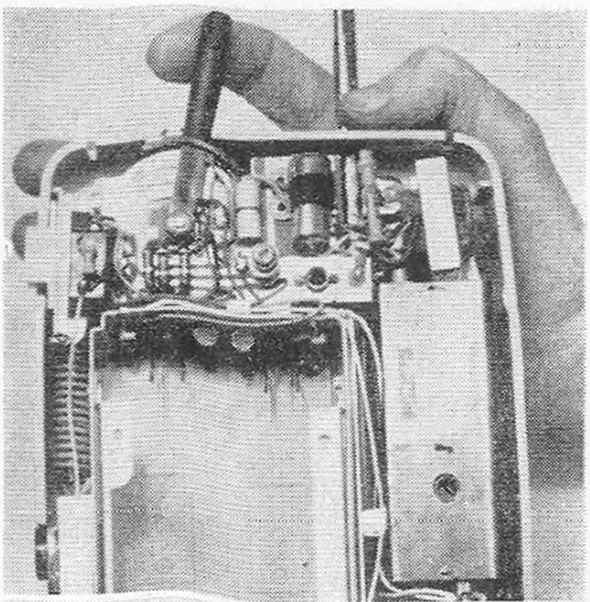
Mecatron Rx. 192/2

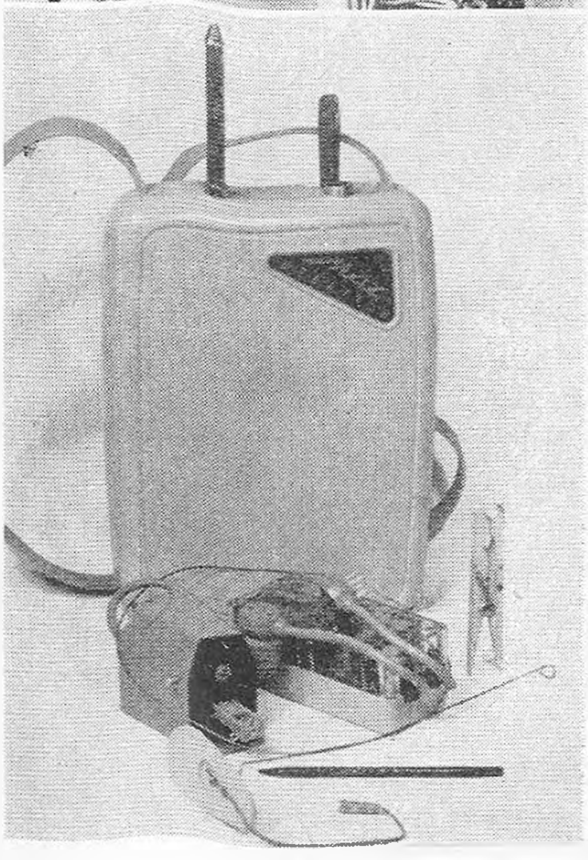
The Rx. is an all electronic unit. no relays being employed. Eight transistors are employed in the Rx. as follows, AF115 as an Ultra-Audion Super-regenerative Detector. (This circuit is identical with the detector used on the Metz "Baby" Rx.). 2—OC75 in an A.F. amplifier circuit which feeds to the tone filters, the Red and Yellow channels each employ 1—OC80 and the Green channel employs 3—OC80 in an electronic change over relay circuit. Five diodes are also employed in various rolls. The Rx. is housed in a plastic case, one half of which is transparent. The construction is in unit form. the four units being linked by their lead out wires to the main P.C. board. These units are as follows:

(1) The Detector, which has a P.C. board, is of normal type construction.
(2) The A.F. Amplifier is also a P.C. board type. but in addition it is encapsulated.
(3) The YELLOW and RED channel tone filter and electronic switch circuits also on a P.C. board and encapsulated.
(4) The GREEN channel tone filter and electronic change over relay circuit again on a P.C. board and encapsulated.

The encapsulation is of the epoxy resin type. e.g., "Araldite".

The aerial is connected by a plug and





Upper photograph shows the wiper contacts on the Red and Yellow channe's. The push button (behind the lever) operates a micro-switch. The transmitter is partly screened and wrapped around the battery box.
Below : Transmitter and receiver and Mecatronic 2 servo with a clothes peg to ind:cate scale.

socket and the supply and actuator units are connected by means of B7G plugs. The Rx. is very neatly constructed and very compact.

Comments

The encapsulation undoubtedly provides excellent protection. the only thing against this is if a component should fail. the whole encapsulated unit will have to be replaced: further. encapsulation does add quite a bit of weight. in this case the Rx. is obviously intended for use in larger planes and boats. The plug and socket arrangements are good and the plugs and sockets are very clearly marked.

Electrical Tests

Total Currents with 6 volt supply
No Signal Condition 7.5 mA.

Signal On GREEN CHANNEL

	mA.
Actuator moving to position	90-110
In held positions	22
Mechanism stalled	350

Signal On RED CHANNEL

	mA.
Actuator moving to position	200-250
In held position	78
Mechanism stalled	450-550

Signal On YELLOW CHANNEL

	mA.
Actuator moving to position	200-250
In held position	75
Mechanism stalled	450-550

The above tests conducted at close range using Tx. with aerial closed down.

Sensitivity

Better than 15-25μ V input modulated at 80 per cent with modulation frequencies of 2.3 Mc/s. (RED). 2.7 Mc/s. (YELLOW) and 3.3 Kc/s. (GREEN). These levels were found to be sufficient to operate the respective channels.

Filter Bandwidths and Responses

For these tests an R.F. input level of 30μ volts was used. the modulation level was held constant at 80 per cent while the modulation was varied from 500 cps. to 7.500 cps.

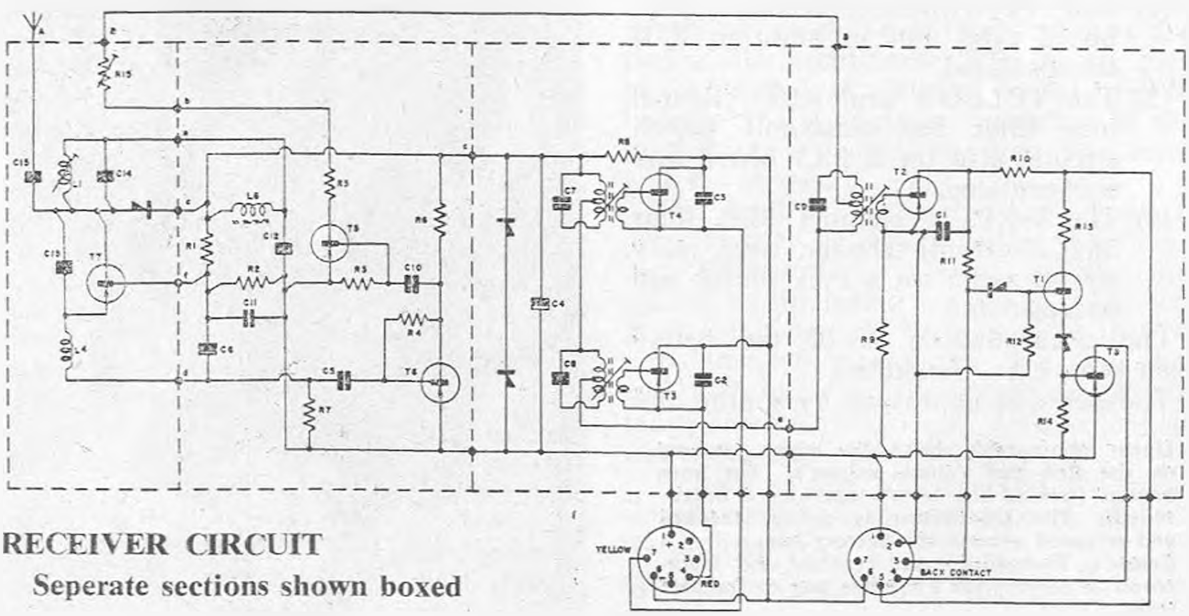
Filter Bandwidths

RED	YELLOW	GREEN
350 cps. 2.15 Kc/s. to 2.5 Kc/s.	350 cps. 2.6 Kc/s. to 2.9 Kc/s.	400 cps. 3.1 Kc/s. to 3.5 Kc/s.

In the course of this test it was noted that certain sub-harmonics also gave strong response. they were as below.

Sub-Harmonics	1100 cps.	1360 cps.	1650 cps.
Channels Responding	RED & GREEN	YELLOW	GREEN

This. even though modulation, was pure (sine wave). There were no spurious responses below 1 Kc/s. or above 3.5 Kc/s., the RED. GREEN and YELLOW channels all still worked even with the modulation level reduced to 50 per cent.



RECEIVER CIRCUIT

Seperate sections shown boxed

Interference

The Rx. does not readily respond to impulse interference of the type caused by sparking contacts or ignition systems.

Comment

The sensitivity is quite adequate, the band pass of the filters is good. The writer does not like the response to the sub-harmonics, but this should not give trouble except from other tone Tx's. operated in the same area. The operation of the receiver is very good and the standing currents in the signal and Signal On. Position Held are quite low.

Mecatron Tx. 192/1

Mechanical Examination

This unit is well built and the layout is very compact, perhaps in the case of the valve location too compact. The controls are easy to manipulate. The supply comes from four U2 type cells in series. The access to the battery compartment is by way of a small panel held in position by a catch. The line up is as follows; D.C. Converter consisting of a one transistor "sine wave" oscillator driving a power transistor operating as a class "C" amplifier. The unrectified A.C. output is applied as H.T. to the E.C.D./R.F. Stage which is similar to the one used in the Metz "Baby" Tx. Only a single telescopic aerial is used on this Tx.

The tones are selected by switching different capacitors in the "sine wave" oscillator circuit of the D.C. Converter. The filament supply to the valve is dropped to the requisite voltage by a lamp. resistor and rectifier diode circuit from the 6 volts supply.

Comment

Very well built and compact. the separate oscillator on the D.C. Converter. is particularly good as in this case the tones must be stable. The battery compartment cover is a little difficult to remove without a thin blade to ease it up slightly. A slot for the thumb-nail would help here. The external connecting sockets for a remote control unit and a lead to a car battery are useful refinements. The RED and YELLOW indications on the lever switch are a good idea, but why not a green coloured push button?

Electrical Tests

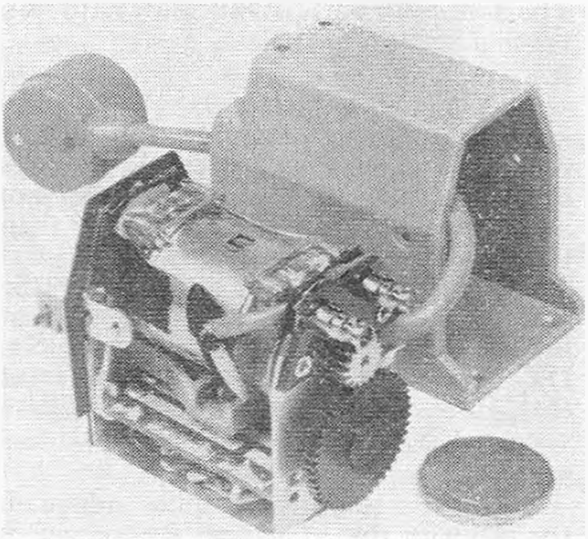
Total Currents with 6 volt supply

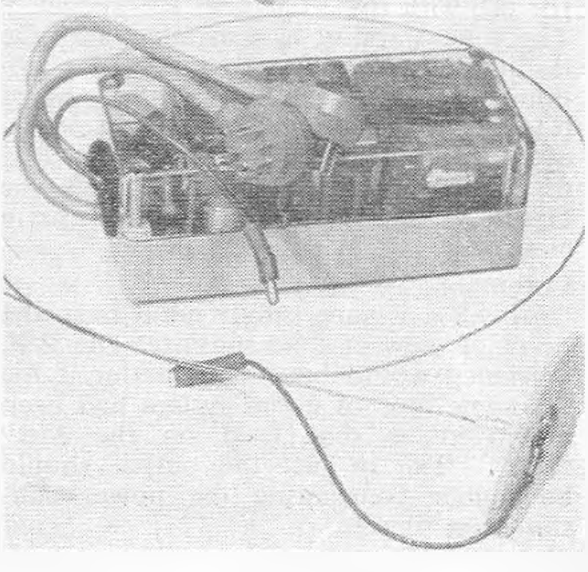
Battery Volts off load 6.2v. (new batteries)

Condition	Current	On Load Volts
L.T. on (Filament Only)	55-58 mA.	6.1 v.
Button Depressed (Green Channel)	370-380 mA.	5.4 v.
Lever pushed over to Red	360-370 mA.	5.4 v.
Lever pushed over to Yellow	350-360 mA.	4.5 v.

The lower current readings were indicated when the aerial was fully extended.

With battery volts down to 4.5 volts off load and falling





Upper photograph shows the servo removed from its case, note the brush connections at each end and hefty gearing.

Lower photograph shows the receiver and its whip aerial.

Condition	Current	Off Load Volts
L.T. on (Filament Only)	47 mA.	4.4 v.
Button Depressed (Green)	235 mA.	4.1 v. and falling
Lever (Yellow)	215 mA.	4.1 v. and falling
Lever (Red)	205 mA.	4.1 v. and falling

No change in tone frequency was noted.

H.T. Volts

This was measured using an A.C. meter on the 300 volt range 1000 ohms per volt. Measured from common line (LT+) to junction of L_2, L_3, Dr3 and C15 plate circuit of valve. The reading obtained was 115 volts (R.M.S.) with 6 volts supply, this fell to approximately 85-90 volts with the 4.5 volts. Some output (R.F.) could still be obtained with only a 3 volt supply, this is *not* recommended.

Tone Modulation

The frequencies were found to be within a few cycles of those specified. The tones are surprisingly stable for this type of circuit.

R.F. Output

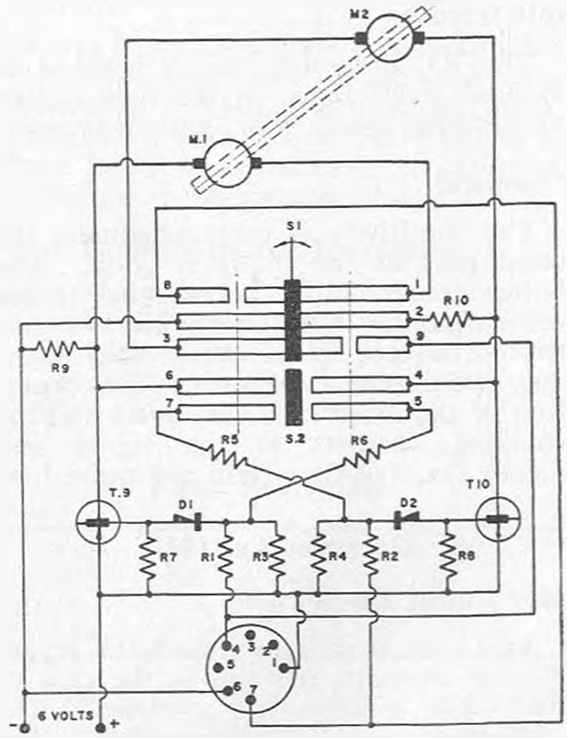
This, like the Metz "Baby" Tx., was not accurately measurable for similar reasons.* The Field Strength readings obtained for the 3 Channel Tx. are approximately 15-20 per cent lower than those obtained with the "Baby" Tx. This appears to be partly due to the aerial system and partly to the fact that the wave-form from the 3 channel Tx. D.C. Converter is a sine-wave, whereas that from the "Baby" Tx. is a square wave. (*See Metz "Baby" report).

Stability

The R.F. stability is quite adequate for use with the 3 Channel Rx. specified. The tone stability is also adequate. On testing, it was found that the tone obtained when the button was depressed (Green Channel) was the tone selected even if the lever was operated to Red or Yellow at the same time, thus the Green Channel button is the main control.

Comment

This Tx. is surprisingly good from the point of view of tone stability. The R.F. efficiency would have been better if the the same type of aerial system had been employed as that used on the Metz "Baby" Tx., in fact the output should be higher considering the power consumption figures.



MECATRONIC 2 CIRCUIT

Metz Two Channel Steering Mechanism—Mecatronic 2 (192/3)

The two channel steering mechanism Mecatronic 2 is a transistorised mechanism with power centring which is carried out by built-in transistors. Connection to the receiver is by means of the YELLOW/RED connector. On the Mecatronic 2 are two press contact terminals (RED positive, BLUE negative) to connect the working voltage supply for the mechanism and the receiver. These terminals are paralleled with pins 1 and 6 of the seven pin connector. When both steering mechanisms are used, Mecatronic 1 and 2, then the supply voltage need only be connected to one of the mechanisms RED and BLUE terminals.

The steering servo has a precision-built double-motor which has two windings on its armature and two sets of brushes. This motor is switched to one or the other section M_1 or M_2 by the control transistors T_9 and T_{10} (see circuit diagram). Only one set of batteries are needed saving both weight and cost.

The motor drives a lead screw via spur reduction gears. The lead screw carries a slider to which the pushrod may be connected. The sliding contacts S1 and S2 are carried on this slider.

In the NEUTRAL position the slider is positioned so that S1 makes contact with the contacts I, II, and III. S2 is disconnected from contacts IV, V, VI, and VII. When a signal is sent via the RED channel a negative voltage appears on pin four of the connector, this voltage switches, through R_1 and Gr_1, the transistor T9 and the section M_1 of the motor is energised, and the slider moves to the left, moving the sliding contacts S1 and S2 until the contact with II and I is broken and no more current can reach M1. In the left position, contact is made between VI and VII and the base of T10 is connected through R6 and Gr2 with the collector of T9 which is connected to the negative pole of the driving voltage. As long as the signal is held, T9 remains switched and the voltage on the collector of T9 is practically nil. If the signal is cut off then (due to resistance in the circuit) T9 has a negative voltage on its collector, and the transistor T10 switches in the other motor section (M2) and moves the slider until the connection between tracks 6 and 7 through S2 is broken. (Position again NEUTRAL.)

With a signal in the YELLOW channel the direction of movement/operation is reversed, the motor section M2 and T10 being energised, the slider moving to the right, and with the signal off, T9 and M1 are energised until the slider returns to the NEUTRAL position. Tracks 8 and 9 act as braking contacts for the motor, holding the corresponding transistor such that the motor cannot run back from the selected position. Besides the advantages described, the steering mechanism requires only "feather power" to operate and in the selected position the motor draws no current.

Accessories

Battery: DEAC accumulators may be used for the receiver supply voltage. For short duration operation; DK225s are suitable, for longer duration the larger DK500s are necessary.

Aerial: A "whip" aerial is supplied with the receiver, complete with connector and mount, which fixes to the model.

Additional Relay Unit (192/4)

To use the three channel receiver with other types of multi servos requiring a relay output, an additional relay unit (192/4) is available and may be connected to the YELLOW/RED and GREEN plugs. This will connect a relay in each channel output circuit.

Additional Connector (192/3a)

In order to connect the Metz two channel steering mechanism to the old Metz Mecatron 190/2 type three channel receiver without soldering the YELLOW/RED connections of the Mecatronic 2 and the two single connecting plugs may be made by means of an adaptor which connects the two YELLOW and RED plugs to the single plug of the Mecatronic servo.

Complete Equipment Tests

For these tests the equipment was connected as specified in the instruction booklet. The Tx. button (Green Channel) operates the Mecatronic I motorised actuator, this channel is comparable for results with the Metz "Baby" equipment, operation is very smooth the only difference is the lower current consumption in the "held" position. The lever on the Tx. (Red and Yellow Channel) operates the Mecatronic II actuator/servo, the control being affected by a push and pull action. There is very little "hunt" at the extreme travel positions, and none when centring. The response is very good, it was found that the travel could be held at the half-way mark for short periods by "blipping" the lever to Red or Yellow, this could be used to advantage (with some practice) to correct small defects in flying altitude. The held position current consumption is somewhat higher on the Red and Yellow channel positions (75-78 mA.).

Range

The ground to ground checks indicate that a range in excess of 500 yards is obtainable which means well over 1,000 yards ground to air! With low Rx. batteries or at extreme range the Green Channel will be the most likely to give trouble by not holding. The equipment is very well suppressed to reduce interference from the actuator motors. No trouble was experienced either with impulse interference.

Comment

The whole equipment forms an ideal combination for a large aircraft or boat,

(Continued on page 99)

Commercial Developments

By
TONY
DOWDESWELL

CONSUMER STAFF MEMBER SAMPLES NEW PRODUCTS AT HOME & ABROAD

JUST arrived at the review desk is a brand new and sparkling blue **F & M Matador** 10 channel all transistor multi transmitter and matching **Midas** superhet relayless receiver featuring the now standard Medco reed bank. Transmitter measures $8\frac{1}{2}$ x $6\frac{1}{4}$ x $2\frac{3}{4}$ in., a comfortable size to handle. The front face has the usual five. two-way lever switches, two on the right hand side for rudder aileron and three on the left for motor, elevator and trim. Trim lever is positioned below the elevator lever, a point of considerable office discussion, some favouring elevator and trim levers side by side on the left. In the centre of the case is a test button, which when depressed provides a simulated "under load" reading of the battery state on the test meter above it. This is a clever ready check on battery state and is a worthwhile addition in this age of gimmicks. On the bottom of the case, a rubber stop at each corner protects the anodising against scratching, and the "innards" against jarring, a practical point indeed. The 58 in. chrome plated telescopic aerial is without a centre loading coil and passes through the top of the case threading on to an aerial coupling inside. On extracting the four self tapping screws and removing the back cover one is confronted with an extremely neat photo-etched glass fibre circuit board, on to which all components other than the two toroids and those already mounted on the front face of the case, are soldered direct. This includes the lever switches, soldered in by connection tags at their unexposed extremities. Ten adjustment pots on the exposed side of the circuit board are identified for control allocation by adjacent inscriptions etched into the copper; another commendable feature.

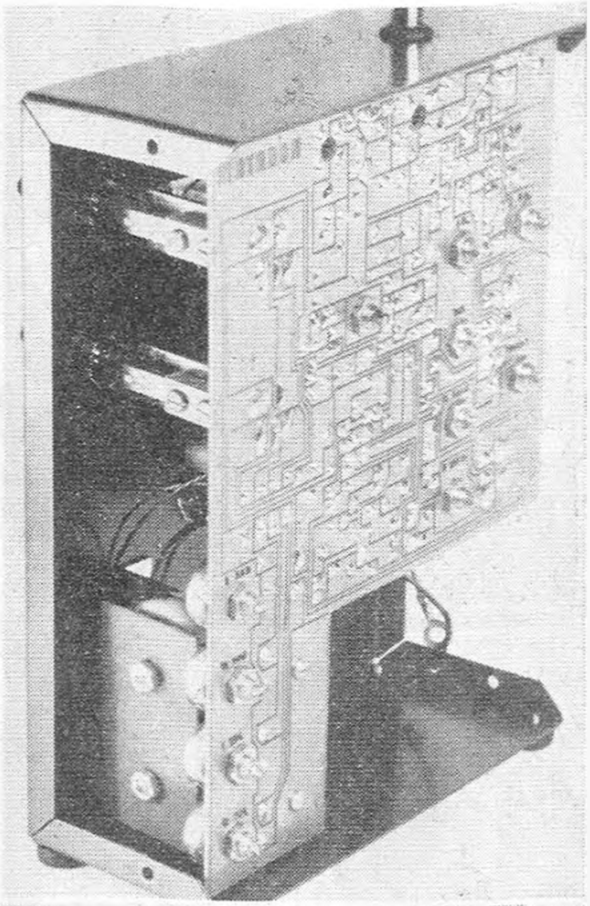
The Matador's Master Oscillator Power Amplifier circuit, employs transistors. Tone generators are stabilised by torriod coils to provide modulation in excess of 95 per cent. Power supply for this bi-simultaneous transmitter should, according to the recommendations of F & M importer Harry Brooks, be two 6 volt packs of 500 DKZ DEACs wired in parallel. Having seen the Matador in action at the close of the 1962 season, we are more than convinced of its reliability. In all, a very fine unit with many practical features which far outweigh those personal distastes like trim lever position. Matador costs £49.17.6d. from Southern Radio Control.

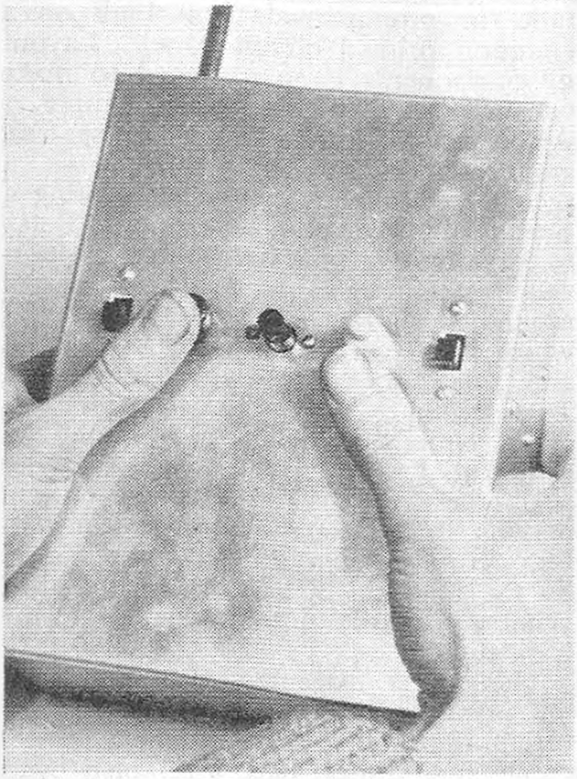
Matching the Matador is the Midas 10 channel relayless receiver. This is a superhet, working off 6 volts supply. Again in a blue anodised metal case, the receiver measures $3\frac{1}{4}$ x $2\frac{1}{8}$ in. overall and weighs $4\frac{1}{2}$ oz. Protruding from the case are six clusters of leads, one of five leads from power input and the other five clusters, consisting of six wires each, colour coded to hook-up direct to Bonner Transmite servos. Any Superhet receiver must be properly matched to its transmitter and the receiver supplied was so matched, the tuning slug and I.F. cans plugged with sealing compound to prevent tampering. Main feature of the receiver is its *Vibro-Loc* circuit which prevents a vibration triggered reed from switching a servo until a transmitter signal is received. Midas is priced at £39.10.0d. bringing the total transmitter/receiver cost to £89.7.6d. However five suitable transistorised servos will cost in the region of £55.0.0d. extra.

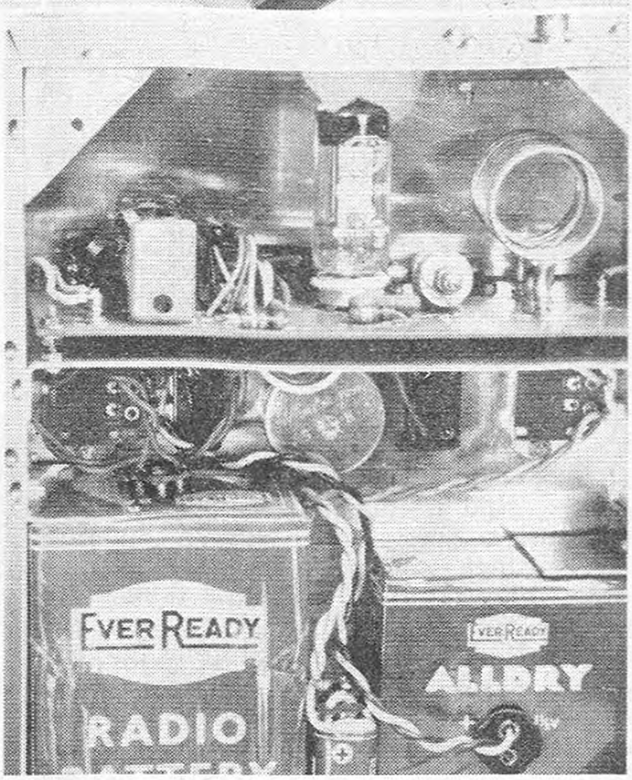
We have yet to test the Matador/Midas and await with interest, the opportunity. It is worthwhile to note that although the instructions reveal the receiver circuit, the transmitter circuit is not disclosed.

A **Du-Bro Trim Bar** was another item received from Southern Radio Control. Supplied in card backed polythene bag, this is virtually made up from Du-Bro clevis ends and control horns, and thus a clever application of existing parts, but rather pricey at 15/6d.

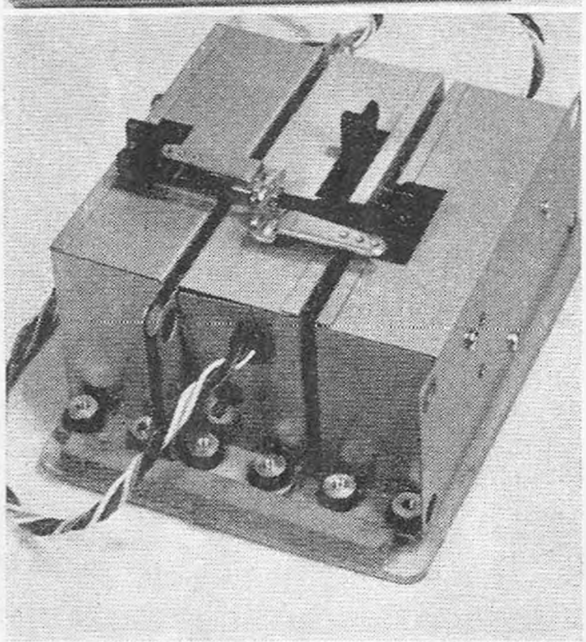
Cosmic Hobbies are offering a line of caseless transmitter chassis, ready to operate at the very reasonable price of







Top left : View of the front face of the F & M Matador Transmitter. All control lever positions are identified. Test button in centre of case keys the test meter above it to provide simulated "under-load" reading. Top right : Extremely neat etched circuit board. Control indentifications can just be discerned etched into the copper above each pot. Bottom left : Front face of the A.B.C. single channel pulse transmitter. Slide switches at far left and right are for transmitter and pulser. Full and No Signal buttons are placed either side of the mark/space variation control in the centre. Bottom right : View of component layout with the back removed. Pulser relay is situated at left.



Top : F & M Midas 10 channel superhet receiver, with case top removed to reveal component layout and Medco reed bank. Square I.F. tuning cans and R.F. tuning choke are plugged with sealing compound. Below : Du-Bro Trim Bar mounted across a bank of three Bonner Transmite servos.

97/6d. These units are crystal controlled with a chassis size $3\frac{1}{2}$ x 3 x 1 in. deep. Stable enough for multi channel operation, these are equally suitable from single channel. Power supply is 135 volts, though 90 volts is quite adequate for single channel we are informed. Sounds like a genuine bargain to us, stocks are limited though.

As this is written, Cosmic anticipate a delivery of **M.K. Multi Servos** from Japan. Both relay, and transistor amplified versions will be available, case size of each being 3 x $1\frac{1}{4}$ x 1 in. A narrow width, 1 in. in this case, we regard as one of the prime tests for any servo. The ability to fit two or three abreast inside the slender fuselage of the modern multi channel model can so often be the deciding factor in choice of servos. The relay version weighs $2\frac{1}{4}$ oz. and works off 3 volts (3 + 3 v.) and the transistorised type which weighs $3\frac{1}{2}$ oz. features a six transistor fail safe circuit, requiring 4.8 volts DEAC supply, or 4.5 volts dry battery. We hope to examine and test samples shortly. Meanwhile the relay version costs £4.10.0d. and the transistorised servo is priced at £8.15.0d.

The **A.B.C. Transmitter** by Alan Nicholls (Radio and Model Engineers), 151-153 Lees Road, Oldham, certainly fills a gap in the range of single channel equipment. This excellent kit makes up into an all enclosed pulse proportional Carrier Wave transmitter, which uses the well tried 3A5 multivibrator circuit and has a transistorised pulse unit for proportional control all on a common printed circuit panel. Layout of components is so arranged to make construction by any novice as simple as ABC, hence the name. The Pulse Unit employs two OC71 transistors as a second multivibrator circuit operating a Siemens Miniature High Speed Relay to key the transmitter signals. Proportional commands are made via a pot mounted in the case, either side of which is a keying button, one for "Full" and one for "No" signal commands. Two switches cover the Carrier and Pulse circuits so that by switching on only the Carrier circuit, keyed carrier is obtained via the "Full" signal button, making this a double purpose transmitter. Tone modulation may be achieved by the addition of a transistorised tone generator, easily accommodated in the transmitter case.

The kit is extremely well prepared, the printed circuit base board has pictorial indication of component placement and comes part assembled with valve holder, turret tags and relay ready mounted and soldered into position. Components supplied are high quality and with the aid of the instructions, the chassis should assemble without any difficulty. Price of the complete kit is

£4.19.6d., though aerial and case are extras. Pulse unit or transmitter are available separately if required, the pulse unit at £2.17.6d. and the transmitter costing £2.7.6d. each on a separate circuit board. Price of the tone generator is not yet announced.

Babcock's four position **Hyper-Compound Mark V escapement** was first mentioned in our July, 1962, edition, where we described its operation. We have now received a sample from the manufacturers. Briefly, this is an improvement on the earlier Babcock Super Compound escapement to provide Left Right, Rudder, Up, Down Elevator positions plus engine control via auxiliary escapement. Roland Scott has this in stock at £4.5.0d.

The latest Hyper-Compound has the following sequence of operations; and when keyed via the receiver gives Right, Up Elevator, Left, Down Elevator and on to Neutral. This is a rather unusual sequence and could be confusing to modellers who are more used to flying in the following sequence; Right. Left. Up and Down.

Several modelling friends expressed a dislike for this new sequence.

Supplementary to the Hyper-Compound is the **Babcock BCC-6 Double Decker** supplied separately. This is a three transistor switching network decoder designed specifically to operate a Babcock Mark V or similar 8-10 ohm escapement. in circuit with any relayless receiver. Upon command, audio receiver output triggers the Double Decker, which provides a strong flow of current to the escapement coil. The third transistor is part of the circuitry necessary to provide "quick blip" engine control.

Double Decker bolts on to the Babcock Mark V escapement as our sequence illustration shows, but it may be bulkhead mounted with equal success. Wiring the circuit board to the escapement should not be attempted before the instructions have been thoroughly read and absorbed. No British importer yet for this U.S. product, but British price would be approximately 55/-.

There's always something new from **Min-X** it seems. This time they announce their line of **Powermite** all transistor transmitters. The single channel version measures 2 x 4⅜ x 6 in. and weighs 2 lb. with 9 volt battery. The 10 channel transmitter is larger at 3 x 7⅜ x 7½ in. and heavier too at 3 lb. but still works off 9 volts supply. Six and 12 channel versions will also be available shortly. Both transmitters use centre loaded aerials. An all new multi-channel superhet receiver in 6, 10 and 12 channel versions is also announced by Min-X. This is basically a relayless unit. but relays are available for the six channel version only. Size is 1 x 2⅛ x 2¾ in. and it weighs 4 oz. and works off 6 volts. Each has a gold anodised case like other Min-X products. Ed. Johnson will have these Min-X lines shortly and quotes £43.0.0d. as the price for the 10 channel transmitter, £36.0.0d. for the 10 channel superhet and £39.4.0d. for the 12 channel superhet receiver. British prices for the other transmitter and superhet receiver variants are not yet announced.

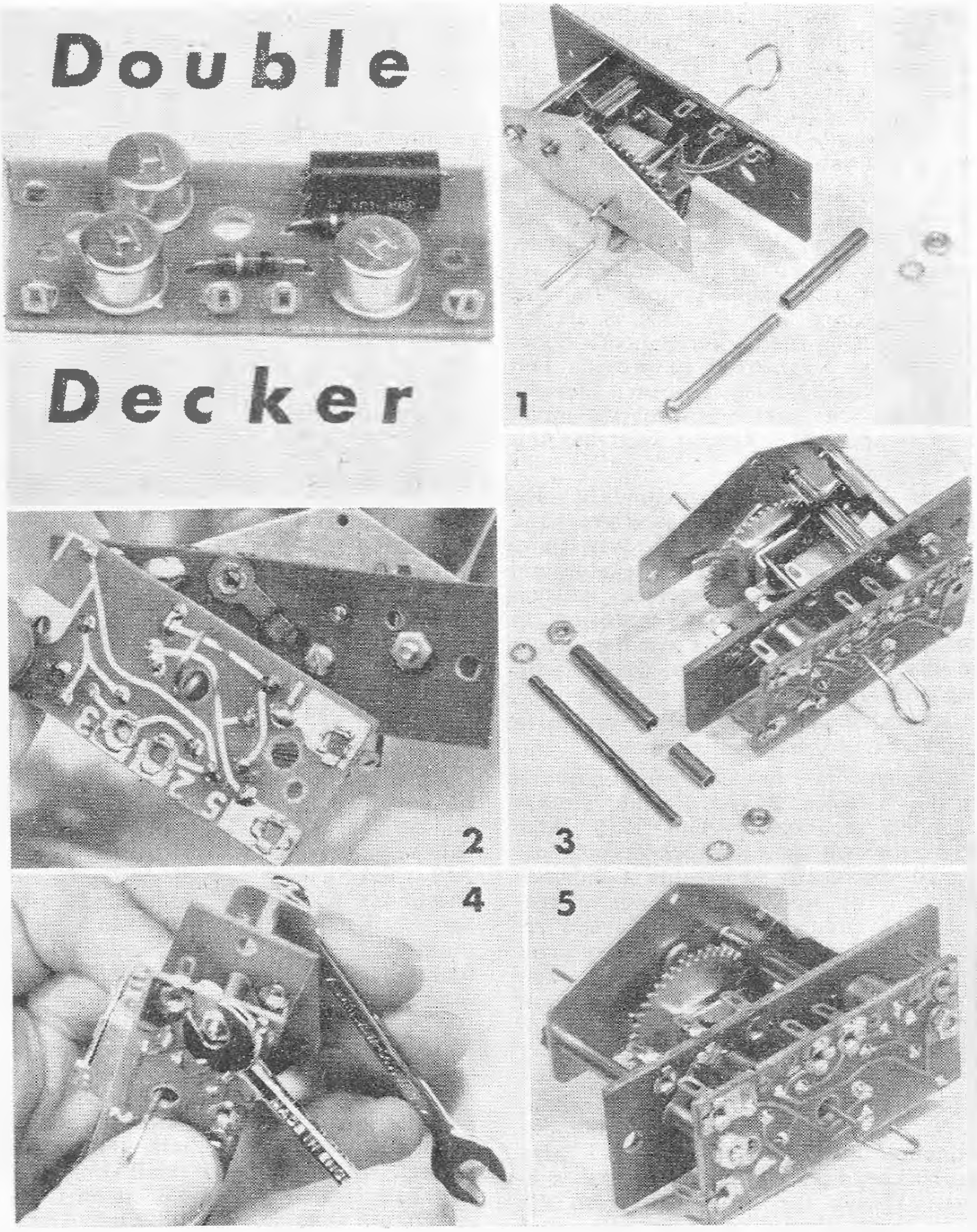
From **Top Flite models Inc.,** Chicago, U.S.A., came two of their **R/C Compacts,** miniature R/C models for ⅛ A and ¼ A (0.010 and 0.020 cu. in.) engines. Both are designed by that ace of single channel radio control, Ken Willard. (Who. incidentally, writes in February *Aeromodeller* on miniature scale radio control models).

First the **Schoolboy.** This high wing chick spans 29 in. with a wing area of 163 sq. in. Simple all-sheet construction cuts building time to the bare minimum. All wood parts are beautifully die-cut and the plan is very clear indeed with an excellent stage-by-stage illustrated building sequence. Wooden wheels, foam plastic for receiver mounting and escapement rubber are all provided.

The **Roaring 20** is even smaller at 21 in. span, an equally well prepared kit. and just as complete as the Schoolboy. A booklet supplied in each kit contains Ken Willard's advice on operating and flying these small field fliers. Naturally as these models are so small, only the tiny relayless 3 volt single channel receivers are suitable. Equally, only compact escapements, like the Babcock Hyper-compound reviewed here are suitable. It has been our pleasure to construct the Roaring 20, which can be put together in a couple of evenings. Given a calm day and a small field, we feel that these radio control miniatures will be hard to surpass for pure fun-flying. Schoolboy costs $3.50 and

(*Continued on page* 99)

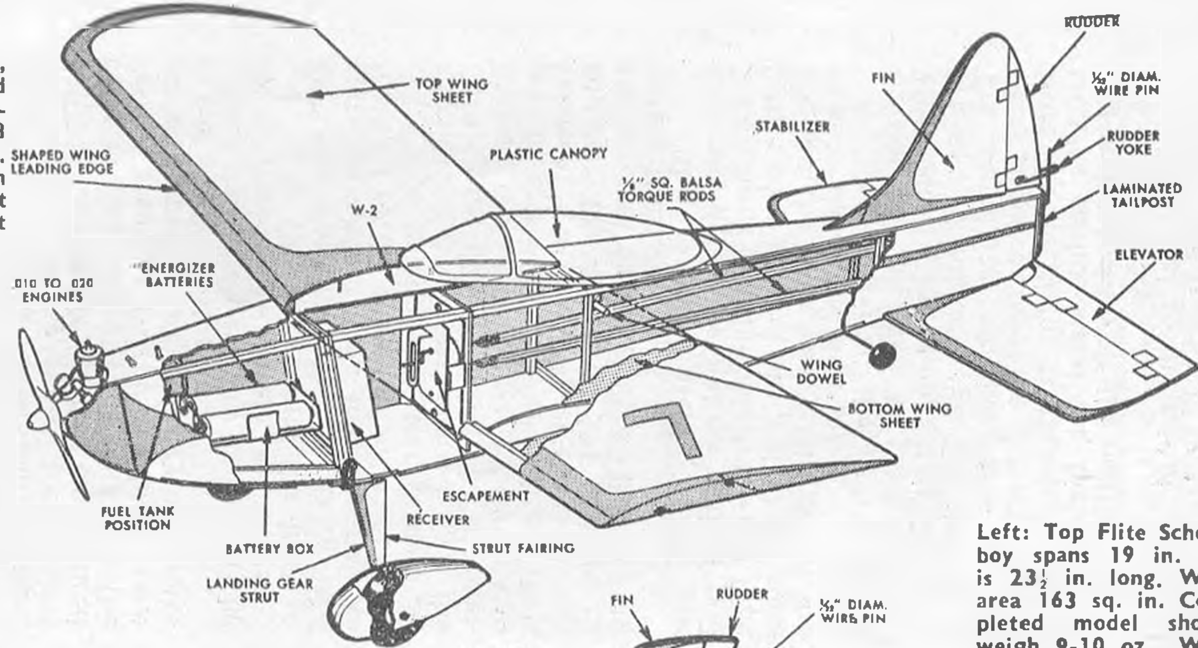
Double Decker



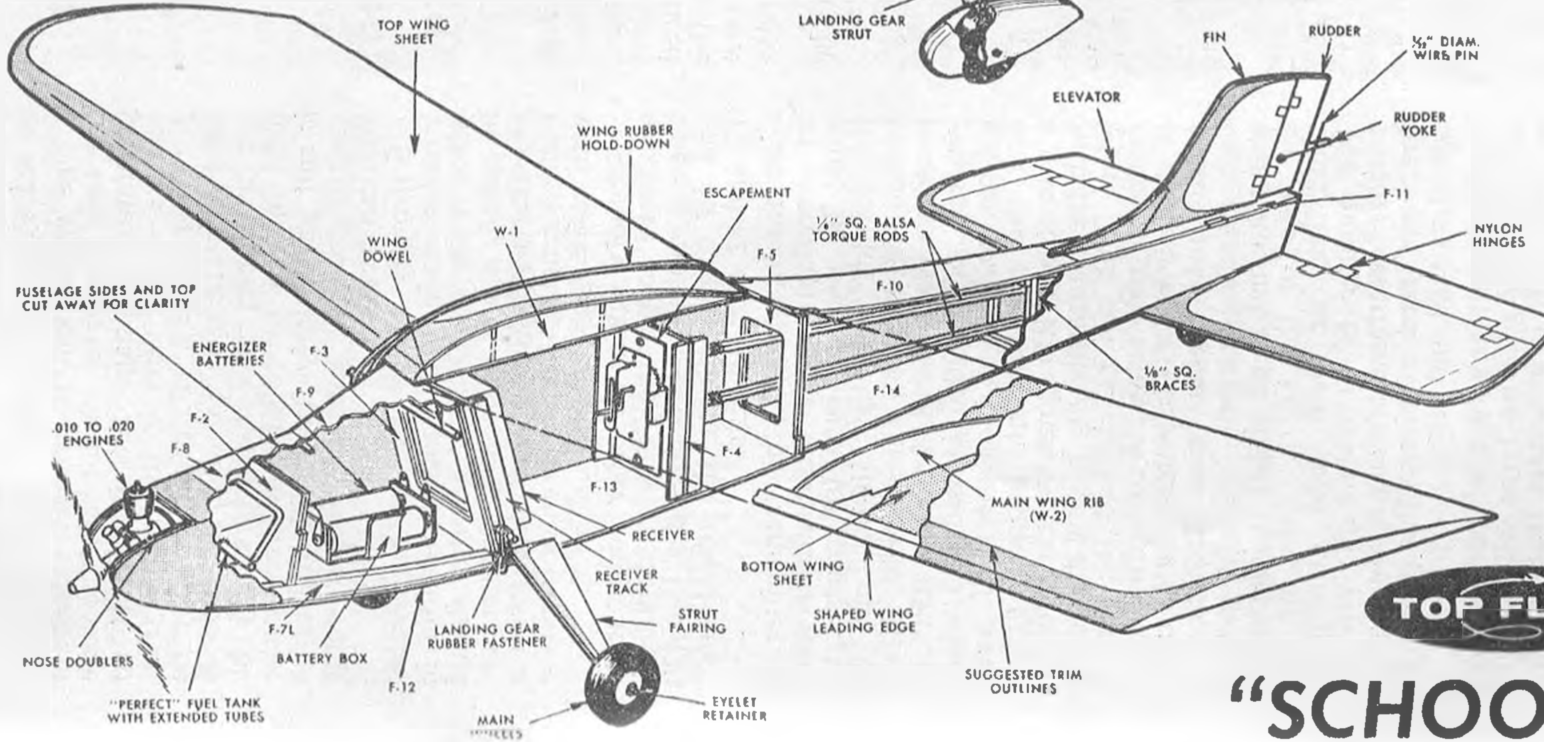
Five stage assembly of Babcock Double Decker transistor escapement booster to the Babcock Mk. V Hyper-Compound escapement. 1. Remove one of the two assembly bolts from the escapement and set aside in a safe place. 2. Twist the Double Decker over the motor hook at the escapement tagboard end, so that tags of the Double Decker correspond to those on the escapement board. 3. Take studding with extra brass spacer, nut and lock washer and replace on the escapement with brass spacers to clamp escapement and Double Decker Board together. 4. Tighten nuts at each end with spanners. 5. Repeat sequence for second bolt. Note that only one escapement bolt should be removed at a time. If both are removed, the whole escapement will fall apart. Following assembly of the Double Decker to the Escapement, a tag-to-tag wiring sequence is necessary which should not be attempted before the instructions have been thoroughly read and comprehended. Although some have expressed the opinion that the effect of the Double Decker is akin to "cracking a nut with a sledge hammer" the operation it performs cannot be under-estimated. The power output to the escapement from some direct drive all-transistor receivers vary directly with range. Double Decker boost provides the answer to such a problem and gives electronic "quick blip".

Right: Cut-away diagram of Top Flite Roaring 20, span 21 in., length 19¾ in. Test model, equipped with Cox 0.010 engine, Otarion Receiver and Babcock Mk. V Hyper-Compound escapement, weighs 8 oz. Receiver power used is two Ever-Ready U7 cells. Wing is completely sheet covered top and bottom to provide extremely rigid surface. Important point with these tiny models is to mount R/C equipment well forward to preserve C.G. position.

ROARING "20"



Left: Top Flite Schoolboy spans 19 in. and is 23½ in. long. Wing area 163 sq. in. Completed model should weigh 9-10 oz. Wing again completely sheeted top and bottom to be extremely warp resistant. It is important to replace batteries often with small all-transistor receivers, and to carry spare battery packs on the flying field. Energiser batteries, though most suitable for small receivers, due to their higher capacity, are not available in Great Britain.



"SCHOOLBOY"

"Windy" Kreulen Multi Transmitter

The Author makes some corrections and offers further advice

THE all transistor multi transmitter described in September and October, 1962, issues has interested many readers. The article was intended for experts only, so a number of less experienced builders had difficulty in obtaining the desired results. We now publish some advice from the author to try and make things a little clearer.

Page 505 shows a few errors in the circuit drawing, which are as follows:

1. The Capacitor from the base of OC71 is wrongly polarised. This 10μf capacitor should have the +ve side to the base of the transistor.
2. The windings of transformer T2 should *not* be interconnected. In the drawing the coil 420T and 50T are connected, *this is incorrect.* As one can see, in this way there is a direct short between +ve and −ve of the 13.5 volt supply. The 420T and 50T coils go to emitter and collector of the AF118 output transistor.
3. The 15 pf. capacitor is the one that runs from the *bottom* end of coil 2 x 10 turns (oscillator-coil) to +ve. The 2 turn coupling-coil has a 2000 pf. capacitor to the +ve lead. This is not too clear in the circuit drawing.
4. The *emitter* of the OC170 has a resistor of 150 ohms to the +ve line. This value is optimum. It is *better* to use one of higher value for first tests. Try something in the region of 600 ohms. Reduce the value if more "drive" from the oscillator is required. Some OC170s cannot stand the high current and will "blow-up" if the oscillator does not start at once.
5. The Xtal in the circuit is a third overtone type for the 27.12 Mc/s. band. Our original uses a 27.145 Mc/s. 0.005 per cent accurate. The type that is used in R.E.P. outfits is quite alright.

One component is wrongly valued in the tone generator circuit, but the tone generator on page 506 is correct so readers should refer to this circuit (Fig. 3). NOTE: A 2 μF. capacitor may be used in place of a 1.6 μf if the latter is not available; 80μf capacitors may be used instead of 100μf; this transmitter is not particularly fussy with regard to electrolytics, so use the nearest value you can obtain.

I *strongly* advise that the home constructor should build this transmitter in parts. First the Xtal stage; this should be tested, it will transmit a quite noticeable carrier. Measure or check with a Field Strength Meter or monitor (receiver with earphone).

Secondly solder all other components on board to get the "Power Amplifier" stage complete. This includes the 420 and 50 turns coils of the transformer T2 and 82 ohm. to +ve.

So far completed, the transmitter is an excellent carrier transmitter and could be used as such (of course the transformer windings should not be needed) take the 82 ohm. resistor direct to emitter of AF118, and the RFC to −ve rail. (The 2000 μf and 420 winding can be left out altogether). If, however, this part functions properly giving a nice strong RF signal, we can proceed with the transmitter by adding the modulator. This can be checked for performance by measuring the collector current of the pair of OC72s. Adjust the 18 ohm. resistor to a higher value, if there is a high standing current. 2 or 3 mA. is about normal if no signal is injected at the base of the OC71. Now we can build one or both tone generators. The number of turns and the type of potcore, determine *the audio* you require for *your* reed receiver, this must be found by trial and error.

In general; any type of potcore with any number of wire turns will *produce* a "tone". It is important that you find out what audio your receiver actually requires before making the potcore.

One can also connect an earphone to the *tone-generator* and listen to the tone it produces. Here is the general rule; for low tones—plenty of turns, this may mean using a thinner gauge of wire or a larger pot core. A large value capacitor is necessary.

For high tones—fewer turns and/or a smaller pot core used with a low value capacitor. Avoid too small a pot core with too few turns, and a large value capacitor to give the required tone. This is a bad procedure; leading to instability and poor wave form. The wire diameter was not specified in s.w.g. On the original Tx. a pot core of about I Hy with a 0.1 mfd. capacitor across gives about 400 c/s. audio. in this tone generator of mine, However, the transistors used in the circuit may influence the result, hence the trial and error.

METZ REPORT

(*Continued from page* 91)

it is easy to operate and reasonably economical on batteries. For tests carried out (and to be recommended for use in the model) four Ever-Ready U10 cells were employed to give 6 volts, these should give approximately the same length of life as will be given by the four U2 cells needed for the Tx. The makers quote 16 hours for the batteries. The instruction booklets are very good.

COMMERCIAL DEVELOPMENTS

(*Continued from page* 95)

Roaring 20 $2.95 in U.S.A. We hope that some enterprising British importer will have them in stock soon.

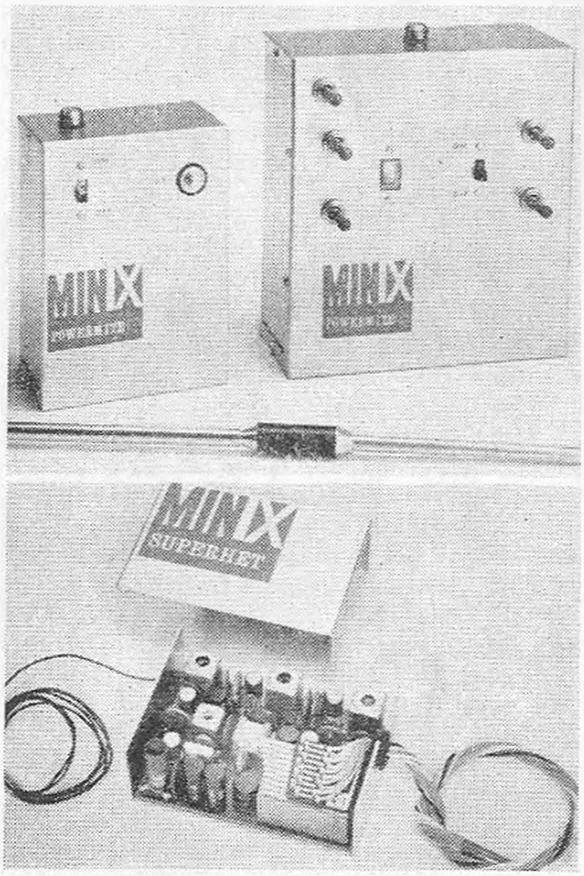
IN BRIEF

- **Top Flite** have announced their kit for Ed. Kazmirski's *Taurus* multi channel aerobatic model (Plan, October, 1962, *R.C.M. & E.*). U.S. price is $29.95, the kit will be available in Britain shortly.

- **Orbit Electronics** have a twelve channel superhet multi set in the last stages of development. This will use a Medco 12 reed bank. Ed. Johnson quotes the following British prices, tax and duty paid. U.S.A. prices in brackets. Orbit 12 channel transistor transmitter £61.0.0d. ($133.50). Orbit 12 Superhet relayless receiver £47.0.6d. ($99.95). Ed. will convert existing Orbit 10 channel transistor transmitters to 12 channel standard with parts supplied by Orbit Electronics for £8.10.0d.

- **A new Orbit** single channel outfit is on the stocks, completely transistorised we are informed. This comprises an all transistor transmitter and a 3 volt transistor relayless receiver. Reputed to weigh only 2/3 oz. including case.

- For those who find it difficult to obtain, **Foam Rubber** can be bought in size 12 x 12 x 1 in. price 4/6d. from Henry J. Nichols, 308 Holloway Road, London, N.7.



Top: Single channel and 10 channel Min-X Powermite all transistor transmitters with centre loaded aerial in foreground. Above: New Min-X 10 channel superhet receiver, which also features a revised reed bank.

Query Column

WE WELCOME GENERAL INTEREST PROBLEMS. SETS SHOULD NOT BE SENT TO US UNLESS SPECIFICALLY REQUESTED.

HAVING built your new Ivy receiver with success, I am intending to build your Ivy/A.M. transmitter, but I would like to ask you if it is possible to insert a 27.225 Mc/s. crystal in the oscillator circuit? Where would I have to place this crystal, and what changes would have to be made to the circuit? Also, what value would the H.F.C. have to be in mille or micro Henries?

T.V.K., ONTARIO. CANADA.

The Ivy/A.M. transmitter is a free running oscillator with a cross coupled circuit, which would make it extremely difficult to crystal control. The feedback in a crystal controlled circuit has to be reduced if the crystal is to do its job and I doubt whether this circuit would lend itself to such modification. Also, where the crystal oscillator is connected directly to the aerial circuit, the load imposed by such a circuit (which varies with conditions under which it is used) would make it difficult to ensure that control was effective.

In the circumstances I think you will agree that the propect is not one to be recommended.

I HAVE just made up the Hill Mark II receiver as described in your excellent handbook 'Simple Radio Control". The one small point I am unsure about is the Quench coil. The one I have used is the type Macgregor Industries fit in their "Ivy Rx." kit. This coil has one tag from each winding marked with a red spot, this being the end of the winding nearest the centre of the coil. I have bridged these two tags to provide a centre tap, there is no centre tap mentioned in the text or shown on the illustration at the end of the article, one tag of the Quench coil (No. 3) having no obvious connections. However, the theoretical circuit shows a centre tap, and I would like a little more information please as to whether I have made the right interpretation. The circuit appears as Fig. 1 on page 47, and the illustration on page 49.

I have taken my centre tap connections to H.T. Pos. via 22k resistor and 0.01 mf condenser to H.T. L.T. Neg.

M.E.B., BIRMINGHAM.

Super-regenerative receivers are sensitive to quench frequency changes, and the Hill Tx. is no exception. I have no doubt that Eric Hill decided on the type of quench coil used, and results with any other type would not be guaranteed. However, as you have a different coil, you may well try this effect before you discard it. The inclusion of a quench coil is for the purpose of providing a frequency at which the RF is quenched which ensures a high Q in the circuit. This gives a very sensitive state and the receipt of a signal of quite small amplitude will trigger the valve into a state of fierce oscillation at RF. This provided the change of current necessary to control the second valve.

In order to provide this quench frequency. it is necessary for the two windings to be connected in circuit to provide the phase reversal necessary for oscillation. In the "Ivy" receiver the two coils are separate. but the effect is the same. You must. therefore. regard the two coils as separate and they must be connected the correct way round in order to ensure oscillation.

When used in the "Ivy" circuit, the connection to negative LT and positive HT (which is also through a capacitor to negative LT) is made to adjacent tags, and if used in the Hill Rx., these same tags must be connected together. As you have "Simple Radio Control", you can see from the "Ivy" article which two tags to connect together, and the circuit should then oscillate at Quench frequency. To test for oscillation. short the grid coil of the quench coil (points 4 and 7 in the drawing on page 43) and there should be a current rise in the anode circuit of V1. If there is no sign of a current rise, reverse the connections of one winding and test again. If still no sign, there is a fault in your Rx. The sensitivity of the Rx. may not be the same, however, with the "Ivy" coil in place of the specified one.

CORRECTION

New 305 Rx. (November. 1962), the 10 pf capacitor between emitter and collector of T1 is not electrolytic. Coil former is ¼ in. dia. 22 pf should read 24 pf in supply list.

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