Radio Control Models & Electronics

FEBRUARY - - - - 1961

Free Inside

Inductive & Capacitive Reactance Data Chart

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R/C BOAT INSTALLATION

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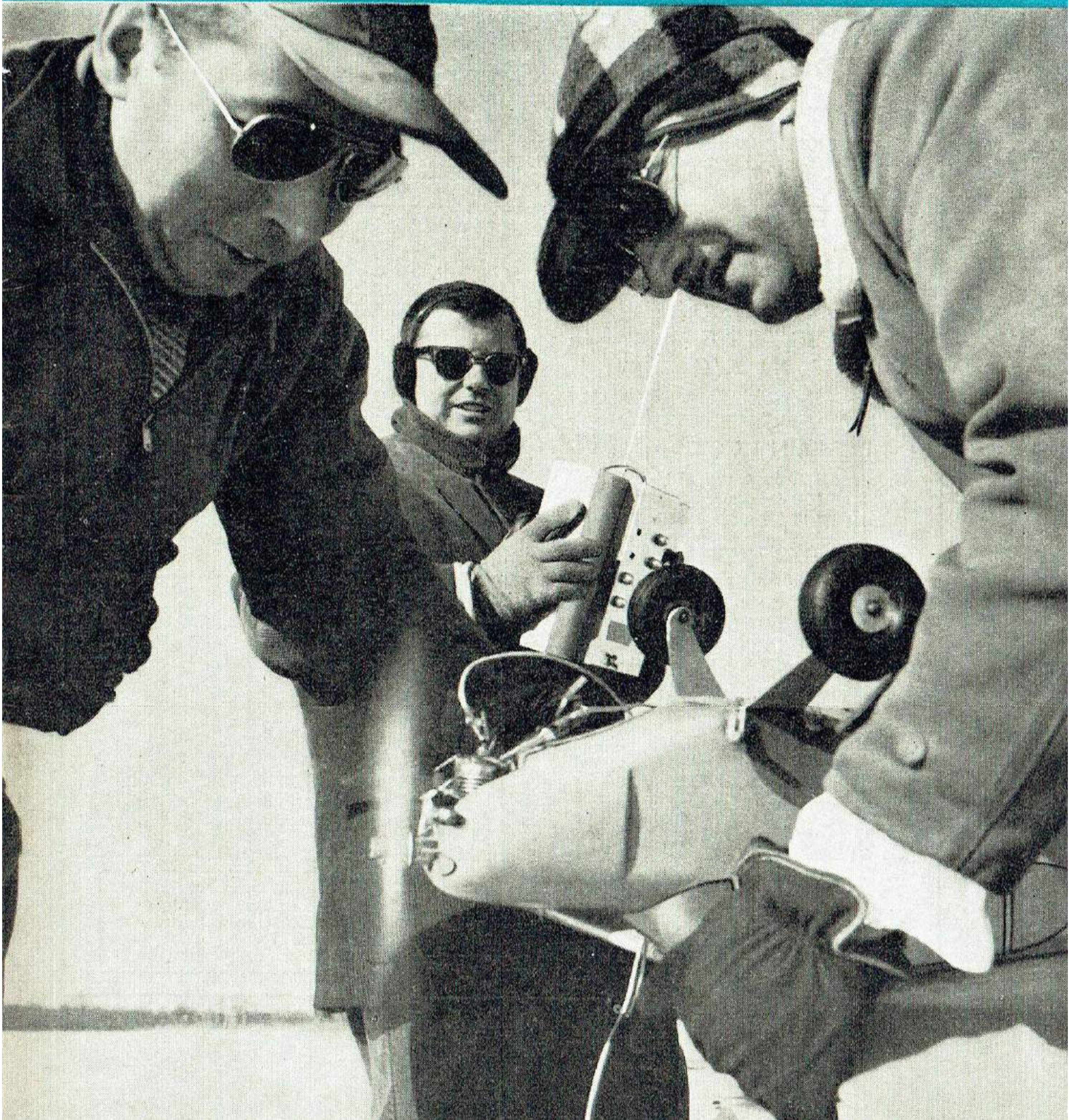
PRICE - - TWO SHILLINGS



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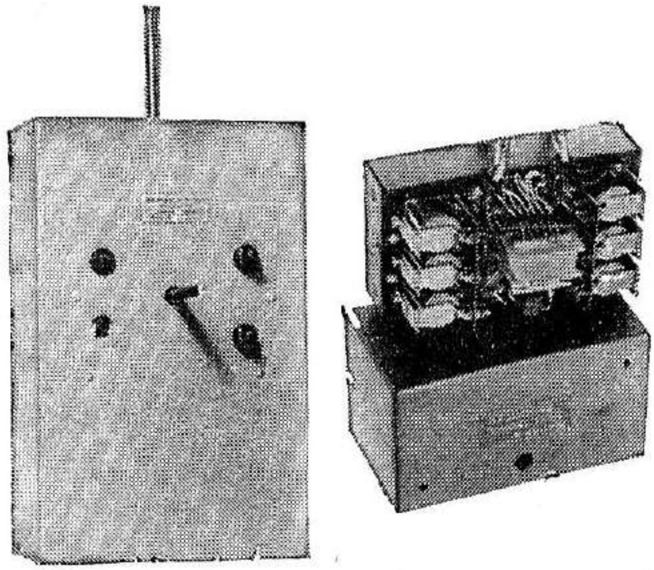

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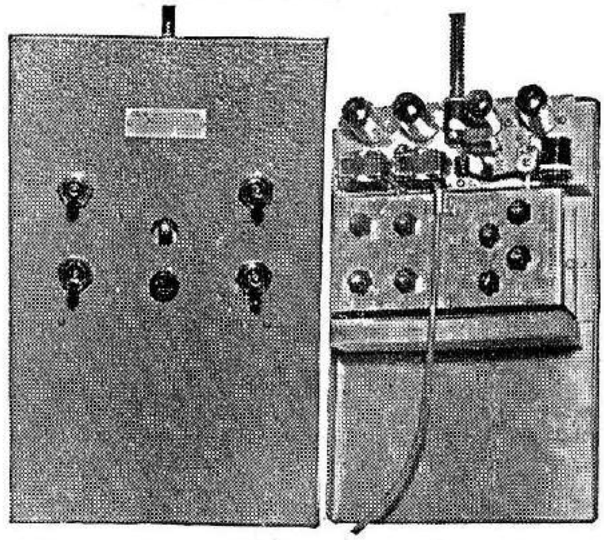
OCTONE



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VOLUME 2 NUMBER 2 FEBRUARY 1961

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Here, There & Everywhere

Review of Reviews

IN our constant struggle to improve this new baby of ours one of our special studies must necessarily be the subject of Trade Reviews. These are exactly what they purport to be, a factual description of new equipment on the market. Since it is new any long term test policy is obviously out and reports of that nature would be stale news by the time they reached our public. Comment on application and use, again, is brief, first, because we have not had much time to go into the subject exhaustively, and, second, for considerations of space, so that more items can be mentioned.

Test Reports are another kind of Trade Review, and normally applied to major items of equipment such as Receivers, Transmitters, or these two items plus ancillary equipment that comprises a complete outfit. They involve a great deal more work and we have been inviting an electronic expert to report on the basic circuit and a modeller to comment on its practical aspects. In other cases, where foreign equipment has not been readily available for the exhaustive purposes of test, we have used reports by native experts. Unfortunately, the supply of experts with time to devote to our work is limited and, very often, they are not *au fait* with modelling design or requirements, which still further limits our choice. We were, therefore, interested to receive a constructive letter on the subject from one of our leading dealers, who makes the suggestion:

"That equipment be reviewed and reported by a disinterested individual or firm, who could give, with Tx., for example, power output, RF stability, audio stability, in fact information of direct value to an OPERATOR trying to decide which Tx. to buy, and, because he is in the tropics, wondering which is effected by temperature, which not, etc. With receivers, some tests to determine sensitivity, selectivity, stability of reed unit, safe contact current of relays, tests with varying voltages and servos and vibration resistance . . . Do feel that the present series of tests do not give facts of a practical nature, and that nothing BAD is ever mentioned (for obvious reasons)".

That is a beautiful ideal, and one that we feel might be pinned up in the editorial office for inspiration! Alas, the problems of finding that "disinterested" person, who would still be a "gen-boy"

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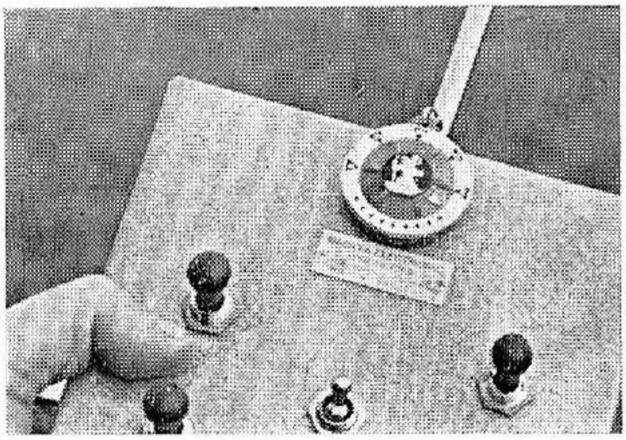
of standing enough for the public to accept his tests, are great. Will any potential tester meeting the high qualifications demanded accept this as an invitation to meet us and discuss terms? We shall certainly not be able to pay him what the job is worth, but we may be able to reach a satisfactory compromise for the good of all concerned. Then there remains only the problem of manufacturers. Would they be agreeable to such a disinterested report? Would they ever accept the criticisms actual or implied that must be found in such a report? To make a comparison, to our knowledge only one motoring magazine in this country (and one tester in U.S.A.) is ever so completely frank about the cars they test as to mention all and every defect as well as the good points. (To save speculation we name them: *Motor Sport* and Tom Cahill of U.S.A.). Can our young R/C industry permit free and open criticism? We welcome letters from manufacturers for or against.

American News

Our U.S. correspondent reports that the big rage over there is now relayless receivers, though the only one actually in the shops at time of writing (November) was the CG Midas. All the makers will have such sets, and several servo makers are coming out with the necessary items in that line. (Orbit are apparently using the regular Transmites, as previously reported by *R.C.M. & E.*) Howard McEntee's new R/C book should be ready by now, published by Kalmbach; and his earlier R.C. handbook, published by Gernsback (do you remember their now vintage

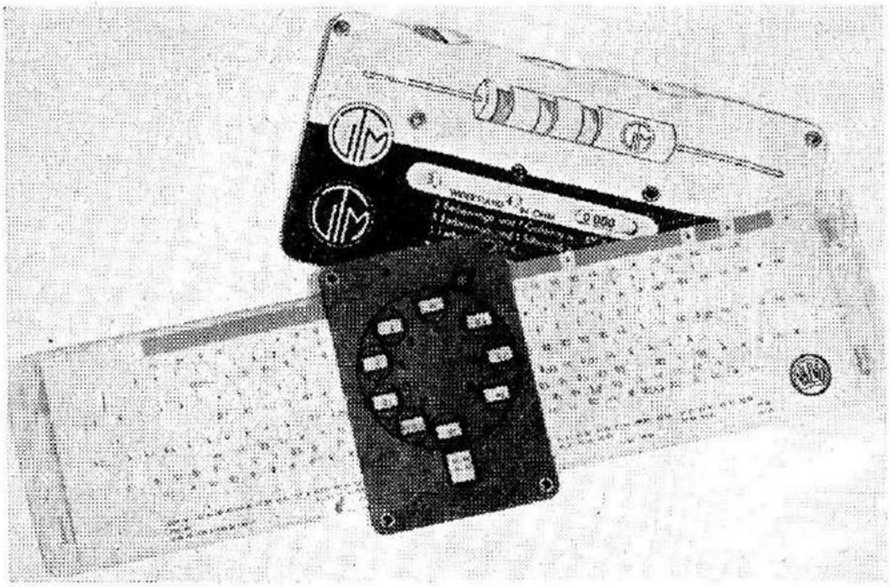


science fiction stories?) is due to come out in revised form early in the year.

Cold and windy Fall weather is upon them now, but good flying days are expected. When winter really arrives most enthusiasts retire to their workshops . . . but some fly all the year through. They have to put handwarmers in their battery compartments, use blow-torches to heat up the engines . . . You don't believe our American friend? Well, we have our cover picture to prove it, which portrays the following hardy annuals, left to right, John Krauer, Jim Northmore and P. B. Hatten starting the latter's De Bolt "Cub" (Veco 19, Min-X 6 channel Rx.) in 20 degrees weather. Plane started upside down to aid cold weather starting of inverted engine. This "Cub" has over 400 successful flights in two years. The blow lamp? Well, this is *mild* weather! . . .

New Use for Timers

About a year ago we mentioned in *Aeromodeller* the Venner audible parking reminder timer which had been produced to prevent forgetful meter



ABOVE: Venner parking reminder "pinger" installed on Tx. to check passage of time during flight schedule for slow flyers and forgetful ones.

RIGHT: Interesting German devices sent us by a service reader. One is the ever-popular colour code indicator, which operates on a facsimile resistor; the other, much more ambitious, indicates in windows all you want to know about any given valve . . . in this case a German valve. We must try to work out something similar for transistors!

parkers from overstaying their welcome. Roger Clark has pictured one put to R/C use by H. Brooks of Brighton, who sets it for about 12 minutes and attaches to his Tx. Then when the pattern period is running low, he is warned audibly that he had better get back to earth. This would have saved some heartburning at Dubendorf . . . and to think it is a development of the Swiss branch of Venners anyway!

More Radio Control Books

Our best-seller *Simple Radio Control* after a phenomenal run has now been scheduled for revision throughout. Tommy Ives is re-writing all the sections on Rx. and Tx. and bringing the book thoroughly up to date within its title of "Simple", including some reference to transistors, etc. Right up to date, it should be on sale again in the spring under the original title of *Simple Radio Control*. Another R/C book, not alas published by us, should shortly be coming on the market by Howard Boys. Knowing Howard, we recommend it unseen: when it is ready we hope to have an early copy for review.

"Potting Procedure"

Sqn. Ldr. Stan Sarll informs us that British Paints Ltd. now state that correct proportions for volume mixing of their encapsulating compound is 20:1 and not 15:1. This makes for further economy in use, but necessitates alteration in mixing container to be divided in sections 20/21 and 1/21 of its size.

Not Radiospares!

We have received a very charming letter from Mr. P. M. Sebestyen, Managing Director of Radiospares Ltd., who kindly refers to *R.C.M. & E.* as "your most interesting publication" in which he mentions the embarrassment occasioned to his company by those countless people writing to him for a McQue Versatile chassis, where in our parts list reference to Radiospares has slipped down a line to refer to the chassis, made in fact by Fred Rising of Whissendine. Radiospares do not, of course, make chassis at all! Mr. S. also mentions that his company are not anxious to enter the home construction market, so that readers requiring parts of his manufacture should remember that these must be ordered through dealers having an account with the company and not apply direct, any more than they would write direct to Fleet Street for a copy of their favourite daily! Sorry, Mr. Sebestyen that you have been troubled, we will try to follow the more regular channels in future!

Interference from Overhead Wires

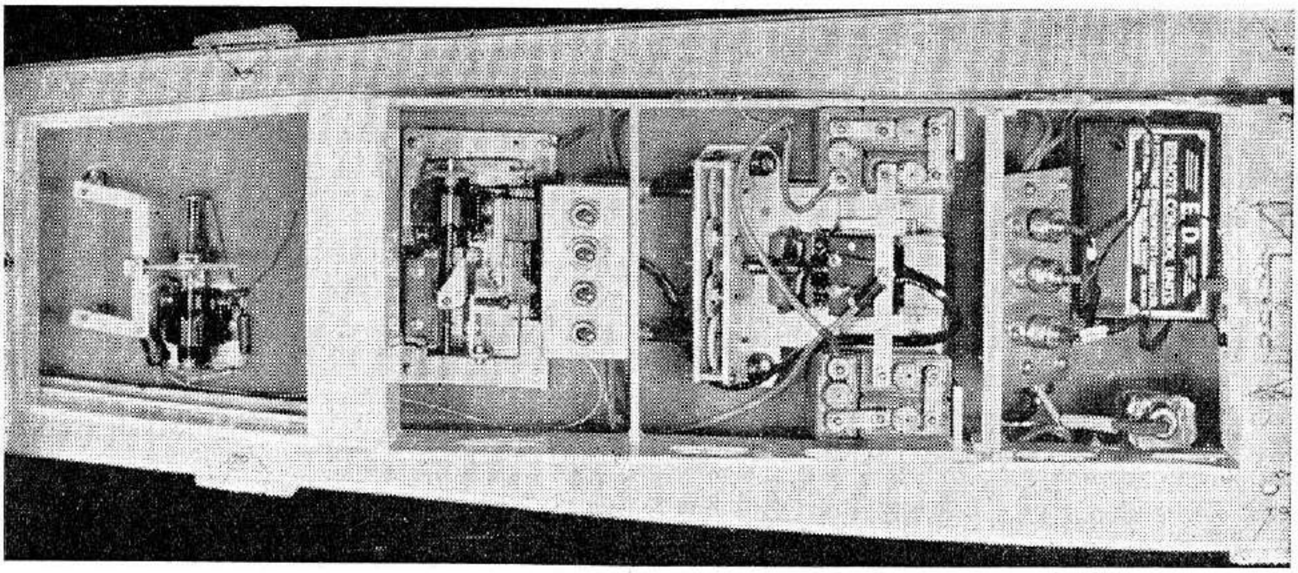
Howard Boys corrects our recent reference to his trouble with overhead H.T. wires at Darmstadt. They were, he writes, telephone wires. Continuing, he adds: "I have had similar trouble near telephone wires in two different localities in this country. In one case it was just one wire across a field with nothing else near. What I experienced was the effect of a carrier wave, and with a tone receiver, this could cause loss of control. Dick Higham did, in fact, lose right rudder in the vicinity of that telephone wire at Darmstadt. The local radio club tell me that they have had H.T. cables and pylons completely upset their direction finding by deflecting the beam from the transmitter. It is also possible for a wave to be reflected by such wires so that the reflected signal cancels out the direct signal with consequent loss of control".

How Small is Fast?

LARKS Newsletter reports the latest FAST Club development promoted by Ken Willard in the shape of Half A (.8 c.c.) R/C Pylon Racing! Some basic rules include 250 sq. in as maximum wing area, fuselage depth 4½ in. (min.), 2½ in. (widest point), wheel diameter 1½ in. Course rules provide for two pylons 264 feet apart, so that five laps of this one-tenth of a mile course make a half-mile race. Course to be laid out parallel to prevailing wind, giving one upwind and one downwind leg. Finish line at right angles to be same as start line, with models rounding downwind pylon and crossing finish line in an upwind direction. Models must land undamaged (broken props, minor scratches not counted) within three minutes of take-off. Other rules covering pylon judges, helpers, etc. follow usual pylon style.

It sounds great fun, and, since it requires very little in the way of a model, simple Rx., and so on, should be just the thing to stuff in an odd corner of the boot for impromptu contests.

R/C Boat Installation



David Connolly describes the installation of four-channel radio in P. Astridge's model of Aerokits kit of the R.A.F. Vosper Crash Tender.

THE radio installation in this model was designed to make use of the full capabilities of four-channel radio in a boat. Although by using sequential escapements it is possible to obtain four different controls from such a system, it was decided to use progressive controls to obtain greater flexibility of operation, such as variable turning circle and continuously variable motor speed. In this way any rudder setting and any motor speed from full ahead to full astern, including stop, is available. Commercially available equipment was used wherever possible, although the motor control servo was home made since none is at present available which will perform the necessary functions.

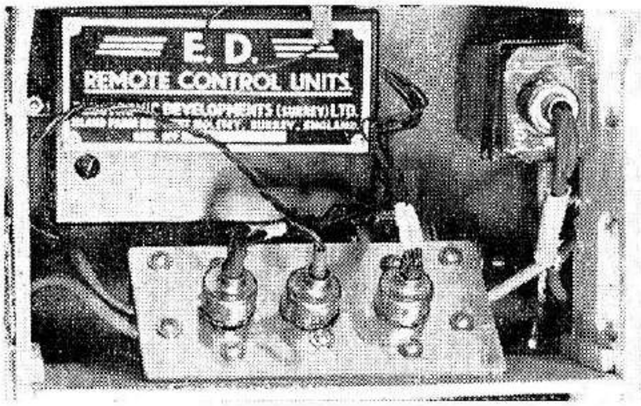
The installation is built around the recently introduced E.D. Black Prince/Black Arrow equipment which has behaved without fault ever since its installation, and is extremely reliable up to 300 yards at least (beyond this range it is difficult enough to see the model, let alone which direction it is going!).

The construction of the boat necessitates grouping the equipment between the various bulkheads, and due to the space restriction which these cause one was made removeable to obtain access to the Rx. batteries (see photograph). The grouping is as follows:

1. Receiver, Receiver batteries, and socket panel.
2. Main motor, gear box and accumulators.
3. Switch panel and main motor servo.
4. Rudder servo.

In addition the centre part of the cockpit roof is removable to obtain access to the aerial socket and the wiring to the navigation lights and searchlight. The compartments are all fitted with ⅛th ply false bottoms to which the equipment is screwed. These floors are covered with foam plastic which enhances the appearance of the interior considerably.

The receiver is mounted on ½ in. of foam plastic by two bolts fixed to the false bottom to avoid damage from shocks. The relay leads are wired onto two four-pin battery plugs as follows. The blue, normally closed (N.C.) leads are cut short and not used. The two remaining leads are wired onto half of a four-pin plug, with channels 1 and 2 (rudder) on one plug and channels 3 and 4 (motor) on the other. The four-pin plug supplied for battery connections is removed and replaced by a three-pin type. (This avoids accidental insertion in one of the relay sockets which could possibly damage the receiver valve.) The batteries used are Ever Ready B 119 30v. H.T. and D 19



Left : Battery compartment.

Below : Plug panel removed to show access to batteries ; motor control.

Bottom : The rudder linkage.

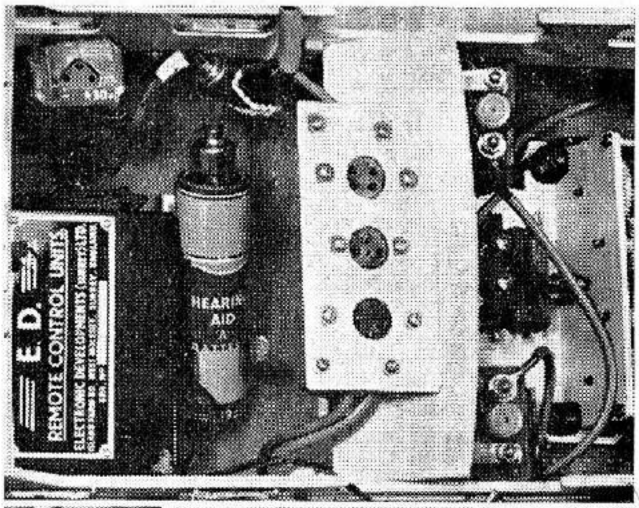
$1\frac{1}{2}$v. L.T. or equivalents. Both these types have socket connections which eliminates trouble due to bad battery contacts. The H.T. battery is mounted vertically in a clip screwed to the cabin wall, and the L.T. battery mounted flat in two terry clips screwed to the floor, access to this battery is by removing the bulkhead forward of the well.

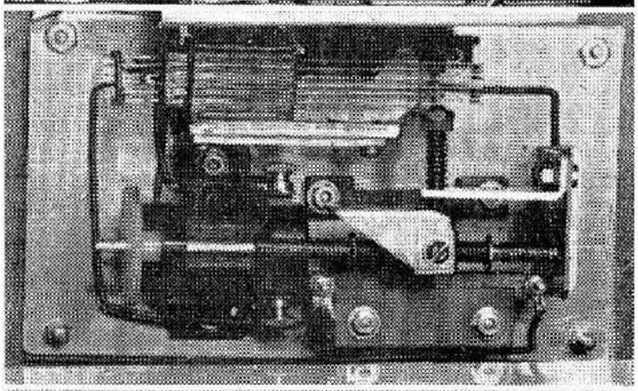
The motor used is the Basset-Lowke Marine, which although rather small for this type of model, gives a fair speed off 9 volts of accumulators driving twin $1\frac{3}{4}$ in. x $1\frac{3}{4}$ in. propellers through a $2\frac{1}{2}$ to 1 gearbox. A larger motor could be used, in which case the accumulators should be moved to the third compartment with the motor servo. The accumulators are six Venner type L6 grouped in two blocks of three. Originally only four were used, with complete success, and the other two were added simply to increase the performance of the model. The accumulators provide 9v. for the main motor, and $4\frac{1}{2}$v. +ve or —ve for the servo motors, which will run well off 3v. supply. The accumulators lift out for charging, and are held together by the 16 s.w.g. brass connecting strips. Incidentally, a model train control unit is excellent for charging these accumulators. A 0 to 1 amp meter is connected in series with the output and accs., and the 'speed' control acts as a charging current control.

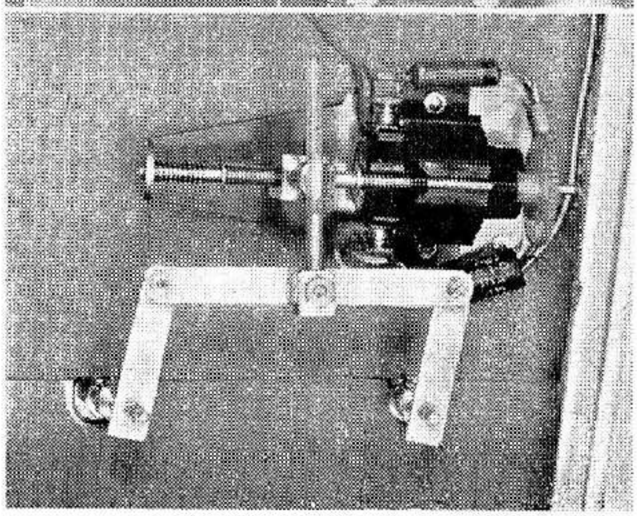
The third compartment houses the switch panel and motor servo unit. The motor servo will be dealt with in more detail later in the article. There are four switches mounted on a bracket fixed to the bulkhead. These are all mains type toggle switches, and where weight is not a critical factor their use avoids trouble due to dirty contacts sometimes associated with slide action types. Their functions are:

1. Receiver battery supply (double pole).
2. Main motor switch (single pole).
3. Motor servo switch (single pole).
4. Rudder servo switch (single pole).

The rear well houses the steering servo, which is the Ripmax R.M.A. steering unit. A simple twin tiller system is used for twin rudder operation. For boat use this type of servo with mechanical limit stops is probably superior to the limit switch type of progressive servo, especially in salt water,







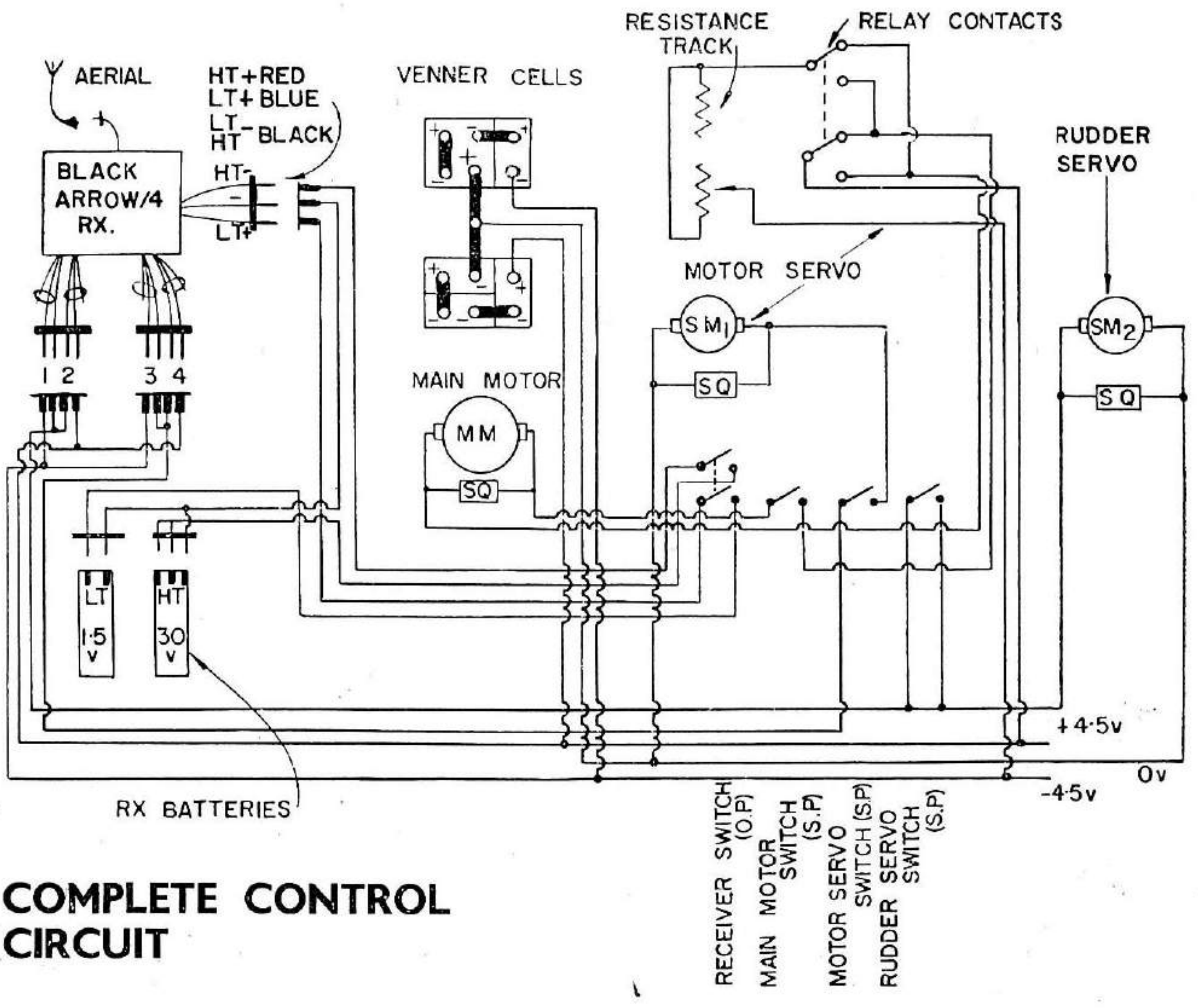
since the latter are liable to corrosion of the limit switches resulting in unreliable contacts.

The aerial is a piece of wire running from the cockpit mast to a flagstaff mounted aft of the well. Although this is a rather inefficient method of mounting, the range is adequate as previously mentioned with this receiver.

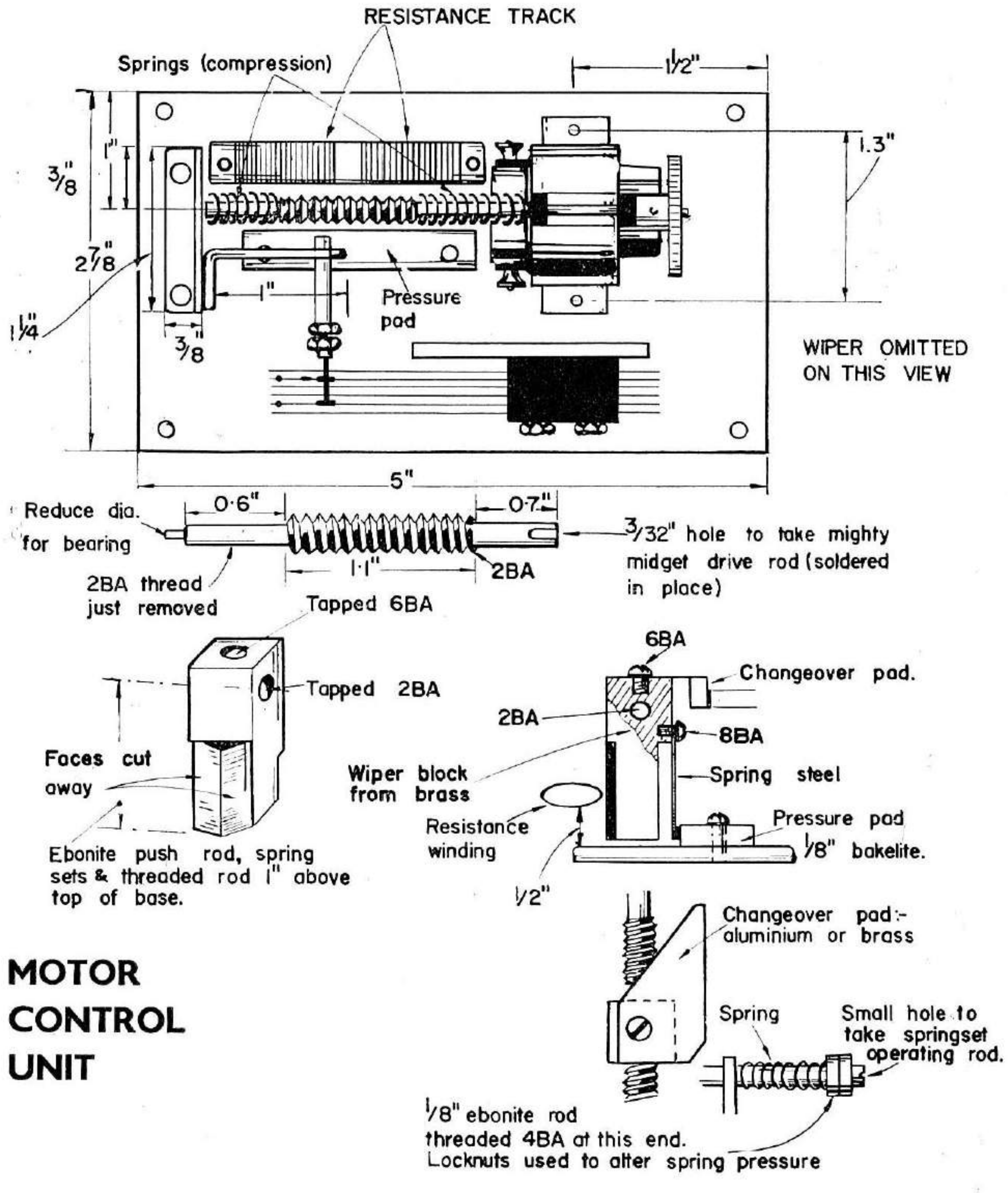
As a protection against radio interference, spark suppressors are fitted to the main motor and to the two servo motors. These consist of a 100 ohm resistor and a 0.1 uF. capacitor in series, placed across the motor terminals.

Motor Control Unit

This unit works on the same principle as the steering unit, but instead of the travelling block being connected to the tiller bar it now becomes the wiper arm on a potentiometer track. This track is wound from Eureka wire in two separate windings on a Bakelite or paxolin former. The wire used on the prototype was 30 s.w.g. but the wire size will have to be chosen for the particular power plant in question. (This is presumably why no such unit is available commercially.) The space on the former between the two windings corresponds to the 'off' condition, and as the wiper block travels across this space a set of relay contacts is switched and remains switched all the time the wiper block is on one section of the potentiometer track. This corresponds to the 'reverse' condition, and the position of the wiper block on the track determines the motor speed. The relay contacts are obtained from a Post Office 600 type relay with two sets of change-over contacts. For the Taycol 'Special' series of motors only a single set of change-over contacts is necessary, or alternatively a micro-switch could be



COMPLETE CONTROL CIRCUIT



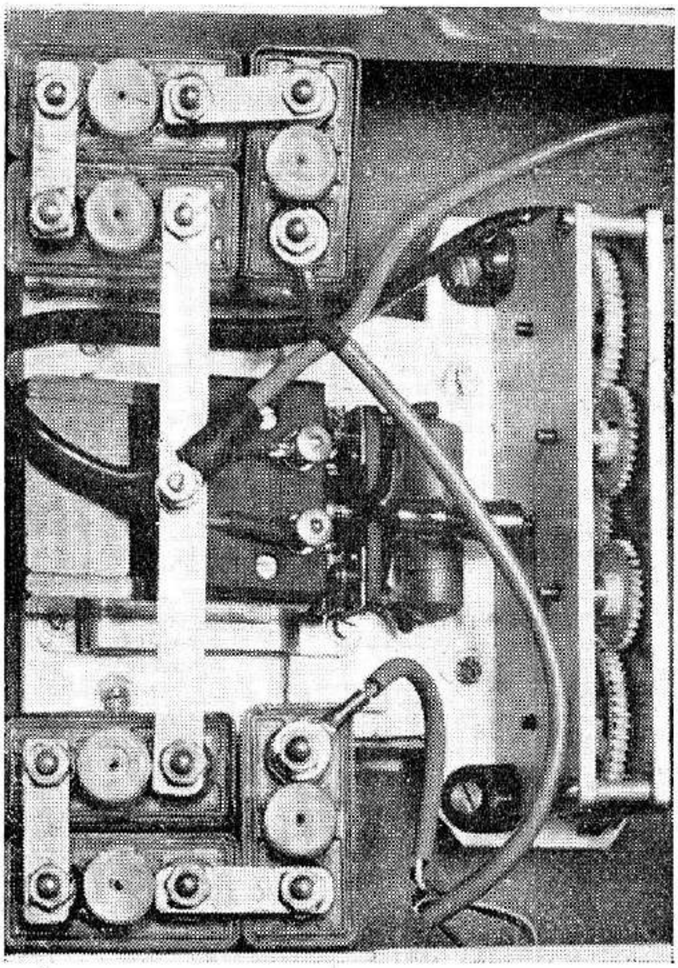
MOTOR CONTROL UNIT

used. The contacts are left on the relay yoke, which is cut from the coil and shortened by trimming off the excess material just beyond the porcelain spring set support. The yoke is then mounted on the base of the unit by a simple angle bracket. In order to maintain a reasonable pressure on the potentiometer track the wiper block is sprung against a pressure pad mounted on the base of the unit.

One criticism of the variable resistance type of motor control is that it is wasteful in power. However it should be remembered that the accumulators are also driving the servo mechanisms so that the 'tapped battery' system, which gives uneven discharge between the cells, would cause poor servo operation as the cells neared the fully discharged state. In any case it is a good idea to run Silver Zinc cells evenly as they can then be charged as a block without overcharging any one cell.

Under stall conditions the main motor is taking a heavy current which causes heating of the resistance track. If possible the former on which the track is wound should be of asbestos or glass fibre board, to avoid damage due to heating. This is more important for larger power plants.

We are interested to hear from readers with details of their particular approach to installation problems. Plenty of pictures please!



Accumulators ; note serviceable contact strapping and robust connections to the main motor (centre). The reduction gearbox using Ripmax plastic gears can be seen at extreme right.

Modulation Technique

By H. CUCKSON, A.M.Brit., I.R.E,

In Part 4 the author brings the subject to a close with discourse on De-Modulation, Filters, tuned and otherwise.

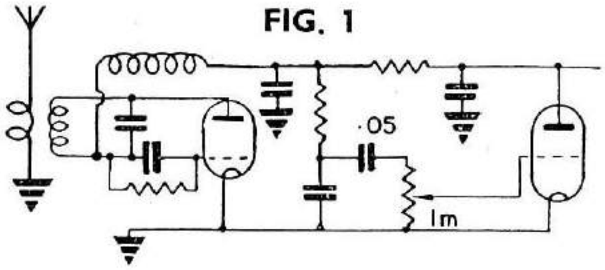
De Modulation

IN this series correct and incorrect methods of modulation have been discussed, but as in Part 1 however perfect the transmitter severe distortion can be introduced too easily in the receiver. It is possible from the equation governing the output of the superregenerative detector to obtain further information of the harmonic content of the output at modulation frequency compared to the modulation depth, and the results are given in graphical form in Fig. 1. It can be seen that as $M \rightarrow I$ the harmonic content especially the second and third harmonics assume large proportions and as well introducing harmonics of all the frequencies present in the output also produces frequency changing.

It will also be noted that even at low modulation depths the second order component is not completely absent which implies that there must not be a simple integral relationship between subcarrier frequencies or break through of harmonics can occur from one channel to another.

It is a fact that whenever non-linearity occurs frequency changing is inevitable and it is felt that the importance of a distortion free audio amplifier after the detector cannot be over emphasised. The most serious form of distortion is produced by having excess gain resulting in limiting at the output stage,

FIG. 1



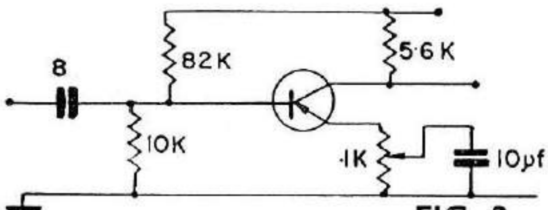


FIG. 2

whereas this has little effect when only one subcarrier is transmitted when several are transmitted the desired intelligence may well disappear. It is not suggested that the techniques of the communication engineer or H1 F1 enthusiast need be rigorously applied, but distortion levels could be held to reasonable amplitudes by the addition of a simple gain control (see Fig. 1 & 2).

Choice of Frequencies and Selectivity: Depends on the rate at which control intelligence is to be transmitted, clearly the higher the ϕ of the filters, the more channels can be incorporated in any given bandwidth.

On the other hand, the higher the ϕ of a filter, the lower is its particular bandwidth and thus the lower the speed of response or build up time, and this is an important consideration when a variable M/S system is to be used. For instance, to reproduce a rectangular waveform with a reasonable degree of accuracy requires a bandwidth of about ten times that of the fundamental switching frequency.

EXAMPLE 1. The loaded ϕ of a tuned reed operating at 300 c/s. is about 50.

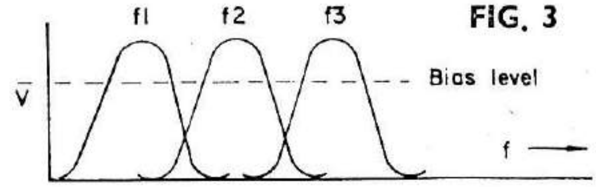
One definition of $\phi = \frac{fo}{2\Delta f}$ where f is the change of frequency either side of fo required to reduce the amplitude of its response by 3db, i.e. .707, of its maximum value. Thus the bandwidth is $2\Delta f = 6$ c/s. which defines the maximum upper limit at which it is possible to operate a reed, and the same reed can only operate under M/S conditions at the low frequency of .6 c/s. This explains why the tuned reed is unsuitable for pulse systems.

EXAMPLE 2. The pulse rate of the Bellaphon gear is presumably around 5 c/s., the lowest subcarrier is 1080 c/s. The required bandwidth of 50 c/s. implies a ϕ of 20 which is a reasonable value for a filter of that frequency.

EXAMPLE 3. The L.S.A.R.A. multi channel proportional system used subcarriers of 6.2 Kc/s, 8.5 Kc/s., 14.5 Kc/s. and 20 Kc/s. The pulse rate was 40 c/s. and the ϕ of the filters (loaded), was about 12. This gives a bandwidth for the lowest filter of about 500 which is quite sufficient to reproduce the M/S variations at 40 c/s.

It is possible to increase the bandwidth of a filter by degrading the ϕ but invariably this results in widening the skirts of the response curve so that cross talk results (Fig. 3).

FIG. 3



This can be offset somewhat by suitably biasing the stage to which the filter output is applied so that only the peaks of the filter response have any effect. Inevitably there must be a compromise because this method assures that the level of signals from the filters are constant which in turn requires perfect A.G.C. action in the receiver.

Filters (Discriminators)

1. *The tuned reed.*

There have been so many articles on tuned reeds over the years that it would appear that there is little to add. However an important factor which has been overlooked is that the energising force from an electro magnet is fundamentally a square law device and without the presence of a permanent magnet acting as a bias the magnetic force acting on a reed bank would contain no component at the fundamental frequency. It can be shown also, that the ratio of fundamental to second harmonic is proportional to the field strength of the permanent magnet. At the risk of tedium it will once more be stated that the square law produces frequency changing and is the reason why two or more reeds operate erratically under simultaneous conditions although they work perfectly well when each reed is operated separately.

The Tuned Filter

The principle of using tuned L/C circuits as frequency discriminators has been known since the beginning of radio, but only the introduction of modern ferites has made possible high ϕ tuned circuits at audio frequencies.

1. *The Series Tuned Circuits.*

At the resonant frequency $fo = \frac{1}{2TT}\sqrt{\frac{}{LC}}$ the impedance of the circuit falls to the low value R. The current flowing in the circuit is at the maximum and the voltages across the inductance and capacitance reach a value which is ϕ tries the applied voltage (Fig. 4b) and are in antiphase. It is possible therefore to utilize the large voltages occurring at resonance to operate a control provided that the voltage pick off does not materially load the particular circuit element. This is readily achieved with a valve, but unfortunately precludes the use of simple transistor circuits.

It is essential that the driving source has an impedance which is low compared to that of the tuned circuits at resonance otherwise the circuit possesses no selective properties whatsoever (Fig. 4c).

The parallel tuned circuit (Fig. 6a).

The impedance of a parallel tuned circuit and hence the voltage reaches a maximum at resource fo which is approximately $\frac{1}{2\pi}\sqrt{\frac{}{LC}}$ (Fig. 6b).

It's use as a frequency discriminator requires a high driving source impedance

FIG. 5

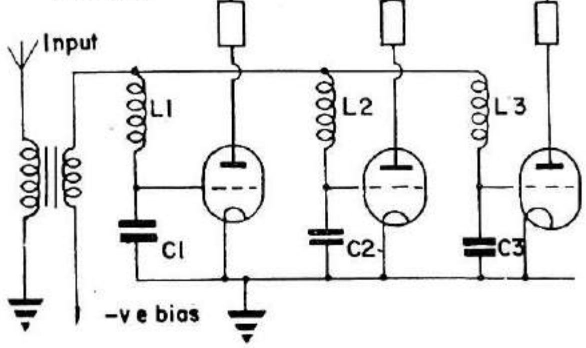
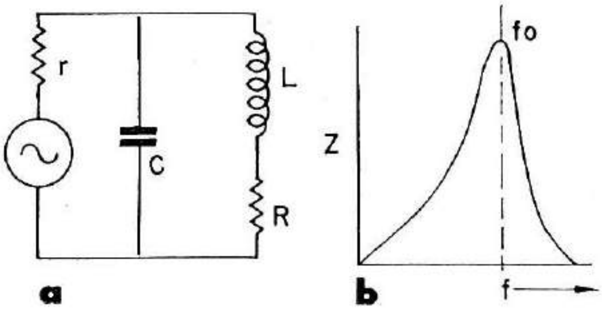


FIG. 6



and this requirement is easily met with either valve ar transistor.

A useful circuit arrangement is given in Fig. 7a, and a more developed form is used in the Bellaphon receiver (Fig. 7b).

It is usual to keep the L.C. ratios constant for all the frequencies employed so that the impedance $2 = \frac{L}{CR}$ (at resonance) is more or less constant for all frequencies employed so that the subcarriers are transmitted at the same level.

Coupled Circuits

There is so much design information available on coupled circuits that a list of references alone could occupy several pages, and a dissertion on them is outside the scope of this article.

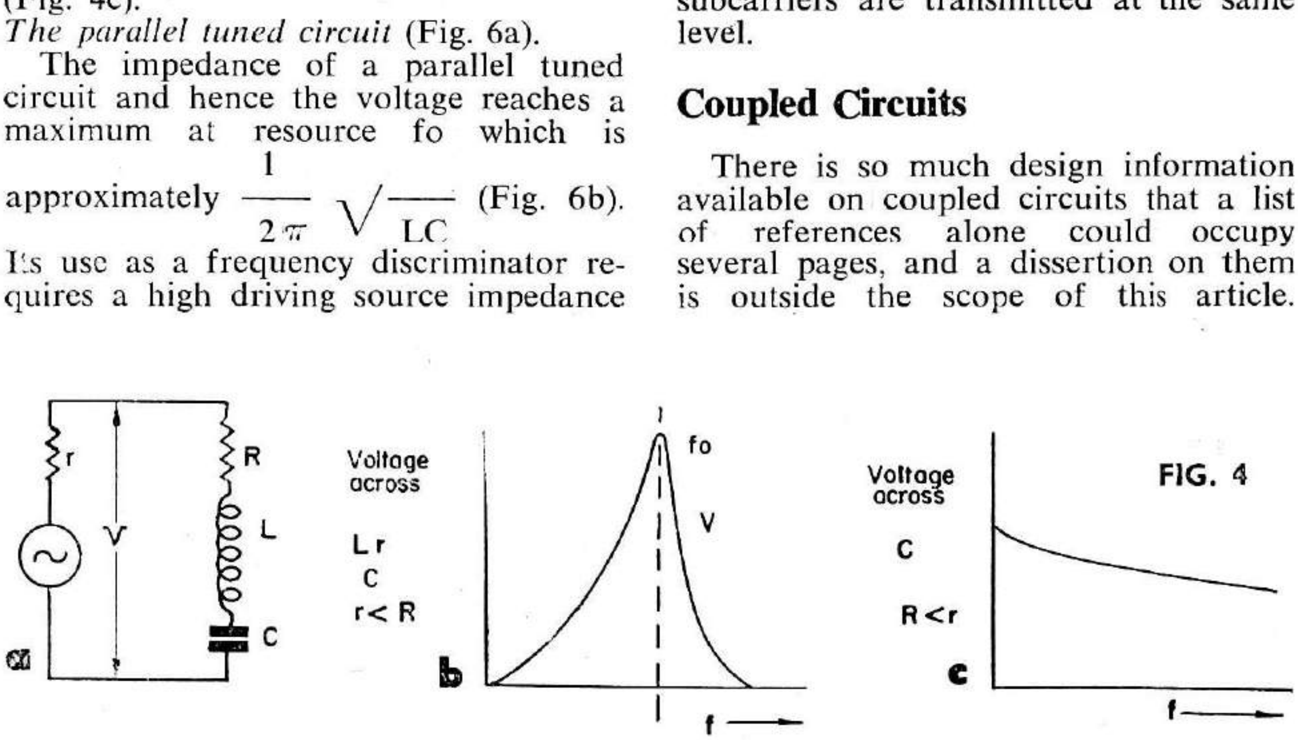


FIG. 4

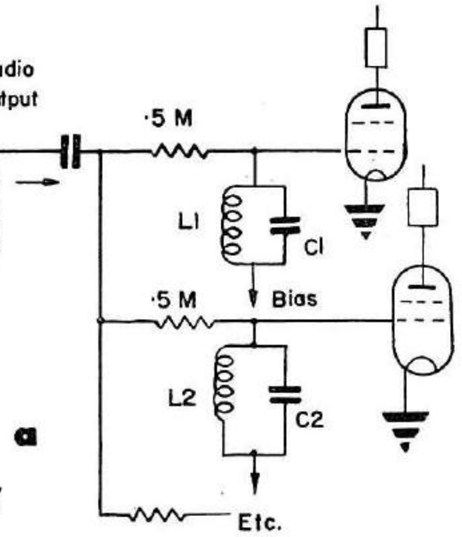
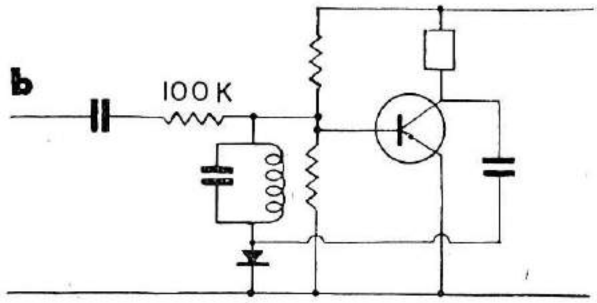


FIG. 7



There is, however, one circuit worthy of mention, i.e. the tuned secondary, untuned primary.

Unlike the tuned primary tuned secondary circuit which requires a critical coupling to obtain the desired response curve, this circuit uses the tightest possible coupling and so one winding can be wound on top of the other and incorporated in a pot core. This type of circuit was used as frequency discriminators in the L.S.A.R.A. flight control system by D. W. Allen, based on calculations by G. T. Herring who showed that theoptimum value of turns ratio, for maximum gain compatable with a high enough ϕ to eliminate cross talk, is 3.

A typical circuit using a series of these discriminators is given in Fig. 9.

Tuning condensers should be around .005 at 6 Kc/s, .002 at 8 Kc/s, .001 at 14 Kc/s. Inductance can be calculated from $f \frac{1}{2\pi} \sqrt{\frac{1}{LC}}$ and the number of turns required from the manufacturers data on the particular ferrox core used.

The Parallel T Bridge Amplifier

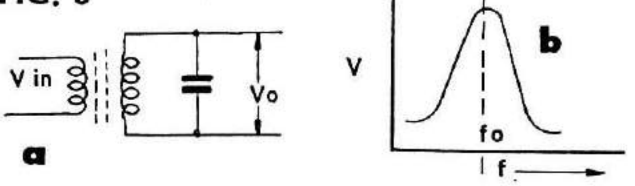
It is possible to construct a selective amplifier without the use of a tuned circuit. One method is to use frequency selective positive feed back which is the basis of resistance capacitance oscillators, e.g., Phase shift oscillator, Wien Bridge, etc. However the use of + ve F.B. in a circuit intended as an amplifier is undesirable because positive feed back renders the amplifier characteristics unstable. The same selective action can be achieved with negative feed back which possesses none of the disadvantages associated with positive feed back.

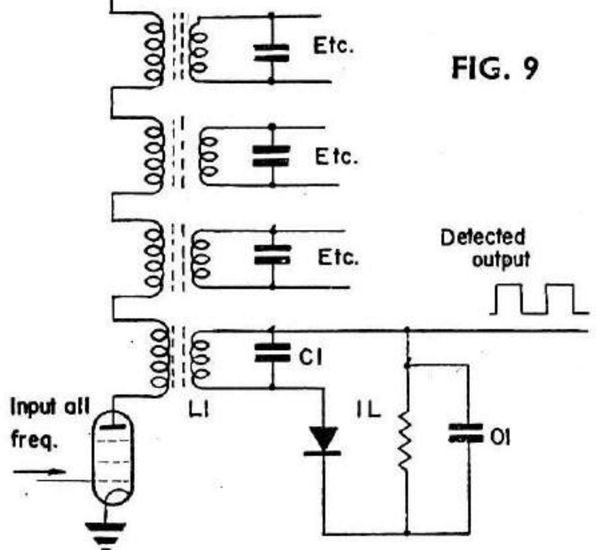
The most suitable network is the parallel T bridge (Fig. 10) which has a null in the transmission characteristic at a frequency $fo = \frac{1}{2\pi CR}$ and if this is connected in a negative feed back loop the amplifier will have its maximum gain at frequency fo (Fig. 11).

The valves give will tune to 640 c/s. It will be seen that it is possible to vary the selectivity by varying the gain. Important points to note are that the components in the bridge are accurately matched.

A practical circuit is given in Fig. 12.

FIG. 8





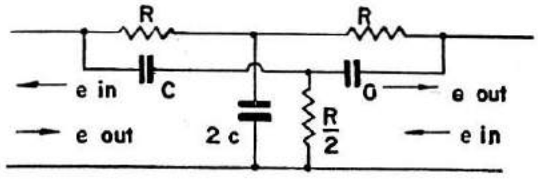


FIG. 10

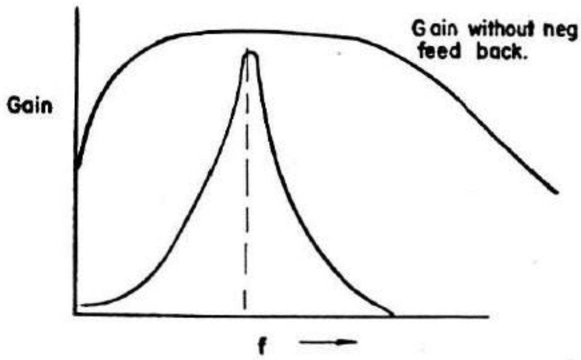


FIG. 11

Conclusion

It is realized that complete systems have not been described in this series it is hoped that these will be the subjects of future articles. However it is hoped that the do's and don'ts have been assimilated and the enthusiast is in a better position to improve his existing equipment if not to embark on new projects.

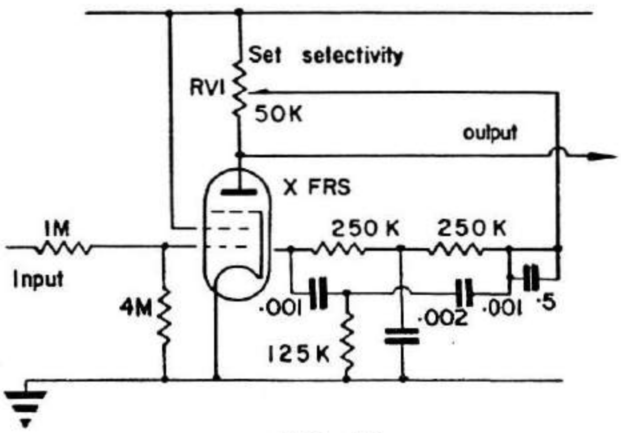


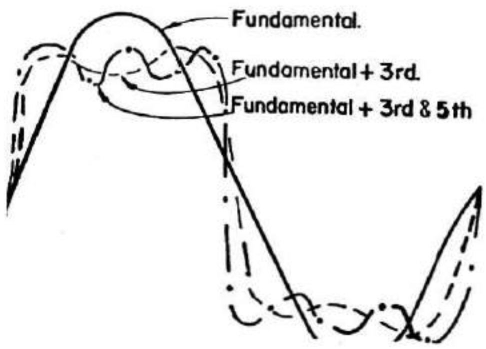
FIG. 12

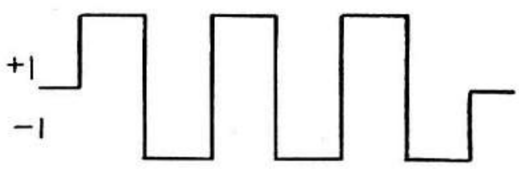
Addendum

Since the series started a query has been raised about the insistance of sine wave modulation when, quote, "It has been found both here and in America that square wave modulation gives better results".

This is quite possible when one tone is transmitted at a time, e.g.:

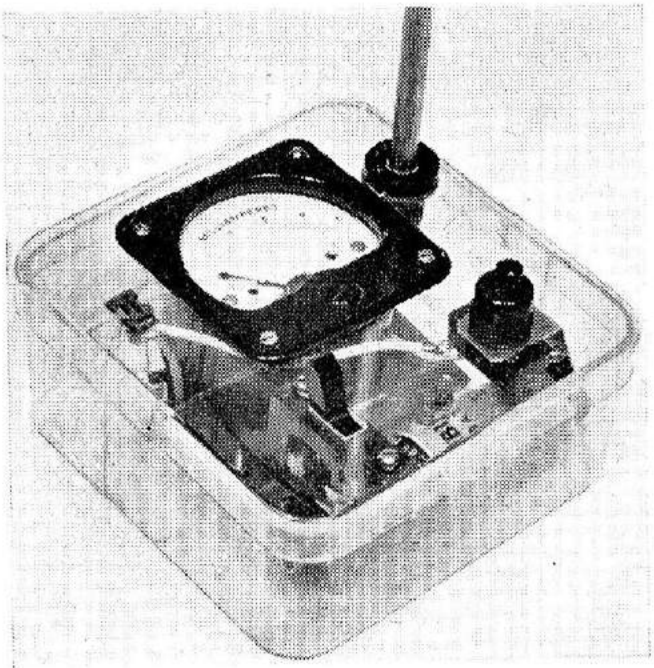
The Fourier analysis of a square wave having limits of ± 1 gives its composition as $\frac{4}{\pi}$ (sin ωt + $\frac{1}{3}$ sin 3 ωt + $\frac{1}{5}$ sin 5 ωt .... $\frac{1}{n}$ sin N ωt). If the individual components are reassembled graphically it can be seen that the square wave reappears but with an amplitude less than the fundamental sine wave, the ratio is in fact $\frac{4}{\pi}$.





Thus a square wave contains more of its fundamental than does the fundamental alone having the same peak amplitude, but remember over-modulation only works for single channel operation.

Previous parts of this series appeared in November, December and January issues. Back numbers are at present still available from these offices.

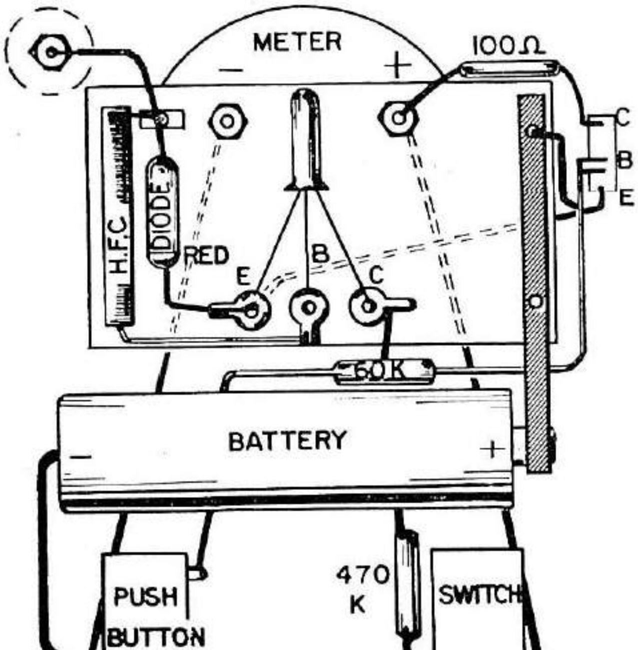


Field Strength Meter & Transistor Tester

By TOMMY IVES

A FIELD S.M. and T.R. tester are useful additions to any R/C modeller's kit. We have incorporated them in our instrument in order to save the cost of an extra meter. More flexibility can be arranged by connecting a socket to the meter terminals so that this meter may be used independently. If used for checking receiver installed in boat or aircraft however, the lead from the meter to the plug should terminate in a double wound H.F. choke (at the receiver end). The type of choke can be similar to that used in the Tx. keying lead.

A simple 3v. battery is incorporated in the case and should give quite a long life.



The case itself may be any metal or plastic box approximately 4 in. square and $1\frac{3}{4}$ in. deep. Plastic lunch boxes of this size would be ideal. If larger they could be cut down and rejoined with Araldite or similar adhesive.

In use this F.S.M. is invaluable for Tx. testing and tuning. It will show maximum radiation without affecting the tuning or output of the Tx. In the case of self-excited oscillators (e.g. the AM/Ivy) the correct L/C ratio is important for best efficiency and the F.S.M. can be very revealing in this respect.

Correct matching of aerial to Tx. is important and in this case of hand transmitters is not easy. When using a loading coil the F.S.M. is a great help in turning.

It also reveals whether modulation depth is sufficient in this case of tone Tx.s, this is very important if range is to be ample.

With crystal controlled Tx.'s it will show when the P.A. stage is correctly tuned and it just can be used for tuning the crystal oscillator stage.

The transistor tester has already been referred to (A.M. January, 1959, p. 19) and only a brief mention will be made here.

By plugging in the transistor it will show the leakage current.

On pressing the button a fixed current of 50 micro amperes passes in the base

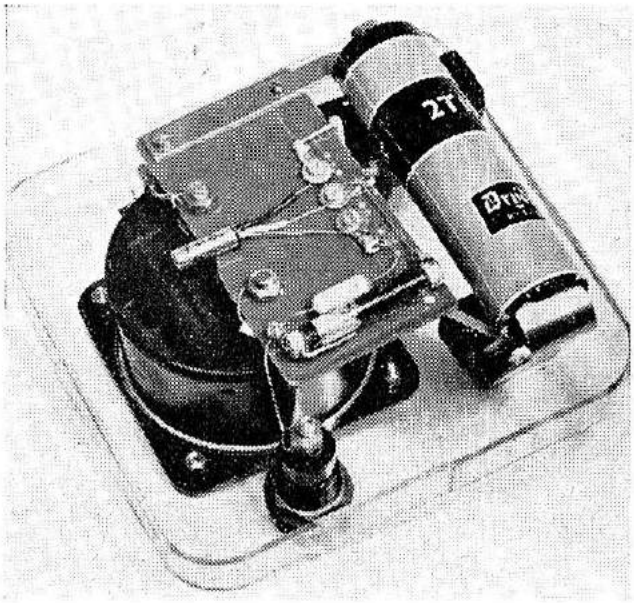
Photos, left and right, show Tommy Ives' elegant meter and tester. Box in this instance was cut down from a larger one, and recemented to suit.

current. The collector current will then indicate the small current gain. For example, if the current shown in this meter is 2 m.A. the gain is $\frac{2}{.05} = 40.$ It will be clear that for a base current of 50 micro amperes the meter reading must be multiplied by 20 in order to ascertain the gain.

With 3 volts the resistance required in the base circuit is 60 K Ω and in order to ensure accuracy the resistor should have a tolerance of no greater than 2%. If 60 K is unobtainable use a 50 K and 10 K in series. The theoretical circuit is shown in Fig. 1 and the practical wiring circuit at Fig. 2. With the help of the photographs construction and wiring should be quite easy.

Use a transistor in this F.S.M. circuit of reasonable gain (say 40).

The aerial length is not critical but the larger it is the greater the distance the F.S.M. can be placed from the Tx. under test, and a greater accuracy is the indication of R.F. output obtained. The writer for convenience uses two feet of ¼ in. aluminium tube.



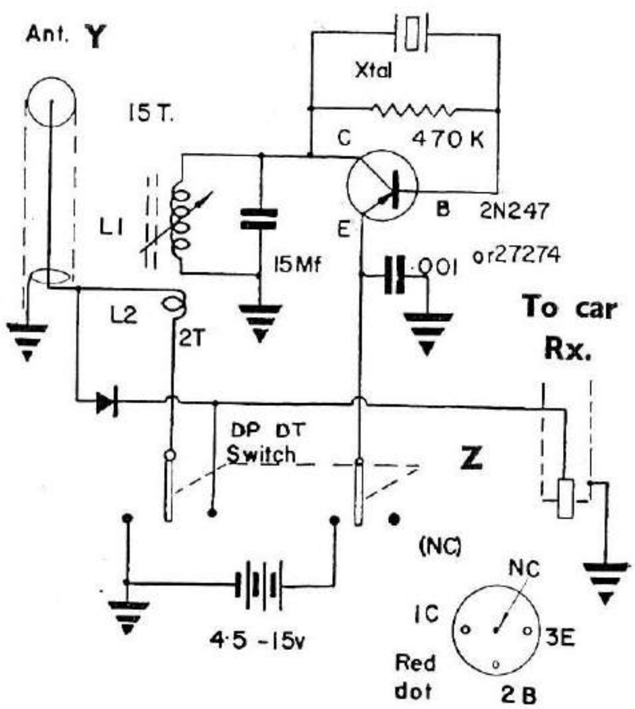
Car Radio Monitor

A low-priced converter for monitoring the 27 mc/s band through a standard portable or car radio, by Glen Chambers.

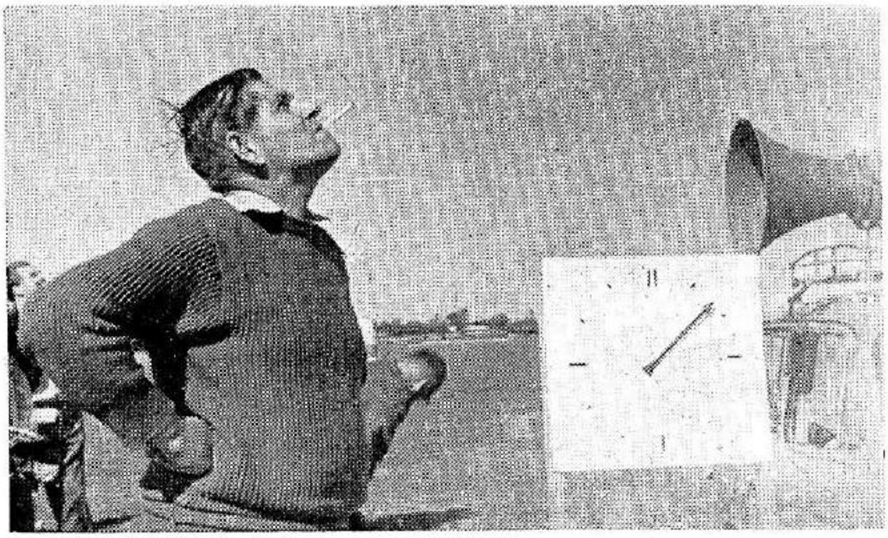
IT is reassuring to be certain of an interference-free spell of flying, true with some models nothing can be done if a pirate starts operating in the middle of a flight, but on the other hand the situation can sometimes be saved if one knows the nature of the interference.

Members of Kansas City Radio Control Association have developed the convertor circuit shown here. Choice of the crystal should put the 27 mc/s spot about in the centre of the receiver tuning range, the whole unit is inserted in the antenna lead of the broadcast receiver in use.

It would seem advisable to have as high as possible a position for the antenna, for whilst this unit should be more sensitive than the model receiver when the latter is at ground level, wide coverage is essential if one is to cover the "fringe area" of the model which may be some distance away. We may see monitors supported on kites (KC/RC suggest balloons) or indeed any method of getting away from ground level to make the most of the available sensitivity. (In passing, those without cars, can always use Sqn. Ldr. Stan Sarll's matchbox *Monitor* from December R.C.M. & E.!)



Crystal 26.200 mc/s can be from 25.5 to 26.4, but :
L1 : 26 s.w.g. enam. copper on slug tuned ⅜ in. dia. former.
L2 : 15T 2t hook up wire on earth end of coil.
Y & Z car antenna coax. extension cut in two pieces (Y : female; Z : male).



Timing Clocks

"Take a little time . . .

(Charles Dickens, Little Dorrit)

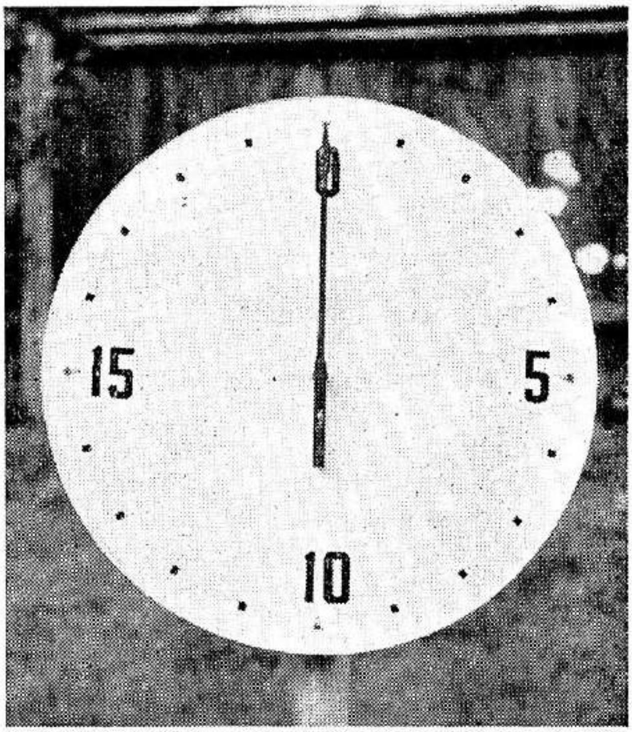
CLUB Secretary R. P. Brown built the interesting timing clock pictured, front and back on the right, for the South Coast Radio Controlled Model Society to be used at the R/C event at Tangmere in September last. Basically it consists of an alarm clock movement with the alarm mechanism removed and three gear wheels driven from the centre spindle to step-up the drive to the hand 3 to 1, giving 20 minutes for one complete revolution.

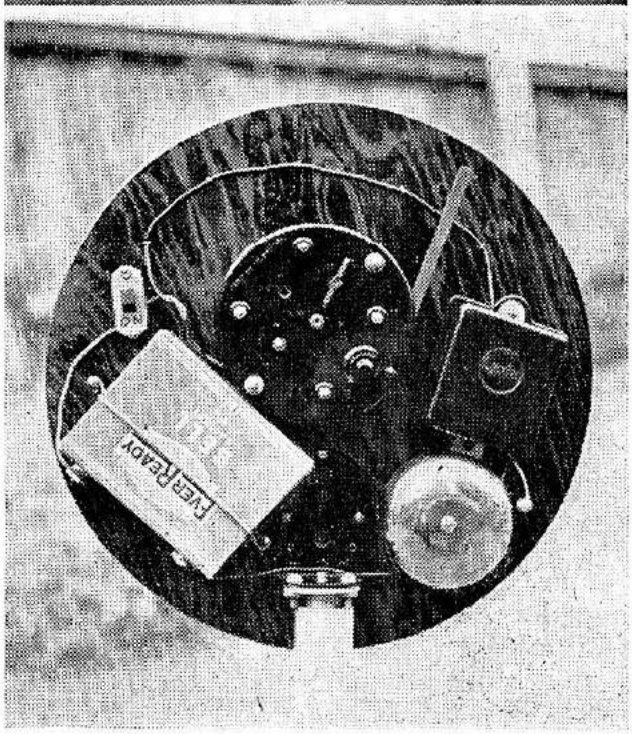
Stopping and starting are effected by the long lever at the back, to which is attached, at the lower end, a piece of light gauge piano wire bent so that it just touches the pallets in the off position.

The dial is 12 in. diam. on $\frac{3}{8}$ in. ply. backing and is marked off in minutes on "cartridge" paper; it is protected by a disc of $\frac{1}{16}$ in. perspex.

The bell is rung by means of an insulated cam with a brass insert which makes contact with a wiper blade pressing upon it. The hand has to be counter-balanced owing to its length and the complete clock is mounted on a telescopic stand.

Heading picture shows radio-control's best known "clock man" Rex. Franklin of A.R.C.C., who, alas, we wronged in urging to produce a visible timing clock for his club, since he had already done it a long time ago, and his product has been in regular use for several meetings. Howard Boys took this unposed picture and remarks on the identical angles of cigarette and clock hand; whether it follows the hand round at all angles is not recorded. Details of construction are not available at the moment, but, no doubt, it follows, in the main, that evolved for the South Coast people by R. P. Brown.





Gadgets and Gimmickry

News and notions from our readers' workbenches

HERE in the second of our reviews of "Gimickry", there seems to be quite a leaning towards Simpl Simul or Galloping Ghost ideas, perhaps the subject lends itself to constant experiment.

However for the sequential servo users, sketch "A" provides the answer to the overrun problem. It appears in a Dutch commercial servo, and was sent in by "Windy" Kreulen. The method of application of a standard "Maltese Cross" unit permits locking of the actuating crank in each of the four positions, two or three if a contact arrangement similar to the Ellis type is incorporated. For those who are not familiar with Maltese Cross mechanisms the sequence of operation is as follows: a pin "a" on the drive shaft engages in one of four slots in the driven "cross" "c" and rotates the latter one quarter of a turn, as the pin leaves the slot the plate "b" passes into the curved recess between the slots and locks the "cross" until the pin engages the next slot.

Readers will no doubt find numerous applications for this system, which normally does service in cine projectors.

Throttle control with a Simpl Simul control box prompted Mr. F. C. Saunders of Norfolk to produce "B". Trigger action on the control stick. A paxolin hand grip is carved to a comfortable shape and incorporates a press switch, made from two screws and a springy brass plate. Mr. Saunders finds it preferable to the button on the control box operated by the left hand.

Sketch "C" shows an interesting use of the printed circuit. End plates for the popular DEAC cell pack. Sgt. D. Weller of Feltham claims that an even pressure over the faces of the cells is assured, an important consideration on the use of DEACs. Needless to say all the nuts should be of uniform tightness.

From the "Printed Circuit" North Jersey R.C.C. newsletter we have a "Quickie" "D" in the form of a slider made from just two eyelets and used on a single elevator yoke on John Worth's G-G model.

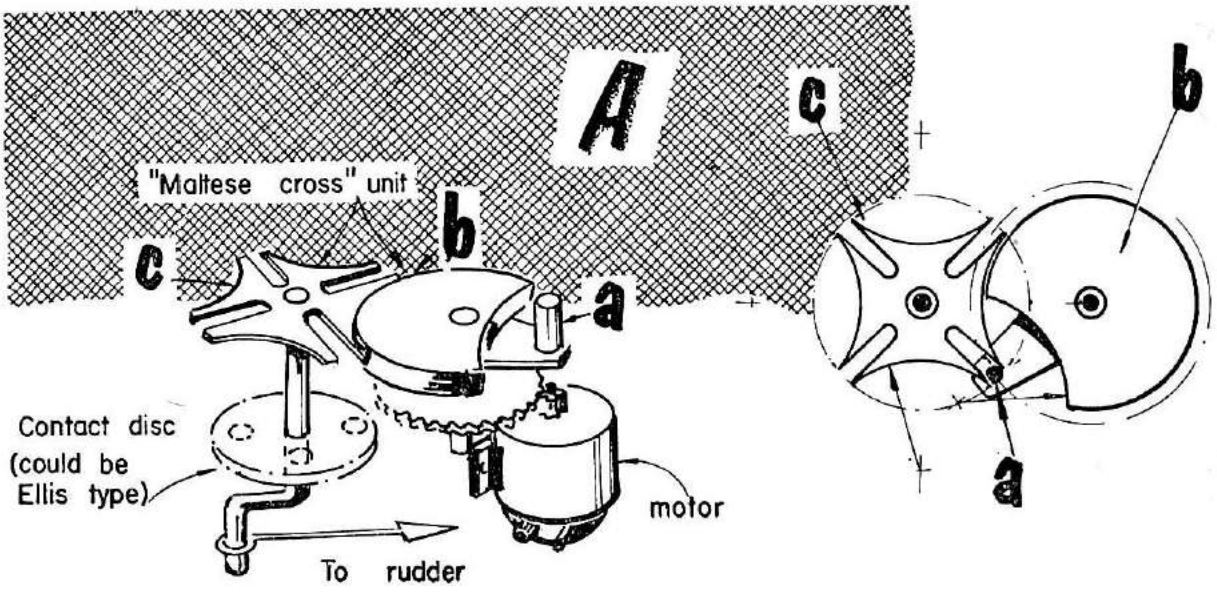
The LARKS newsletter provides Gimmick "E", Jerry Nelson's nose gear, giving plunger and torsion bar suspension, plus steering. Strict adherance to the wire sizes would be advisable, that leg takes heavy bending stresses, hence, we should think, the torsion members. Steering is accomplished by use of a parallel link mechanism. The modified bellcrank operated from the rudder servo is isolated from landing shock by the two spring couplings which allow for forward and upward movement of the control horn.

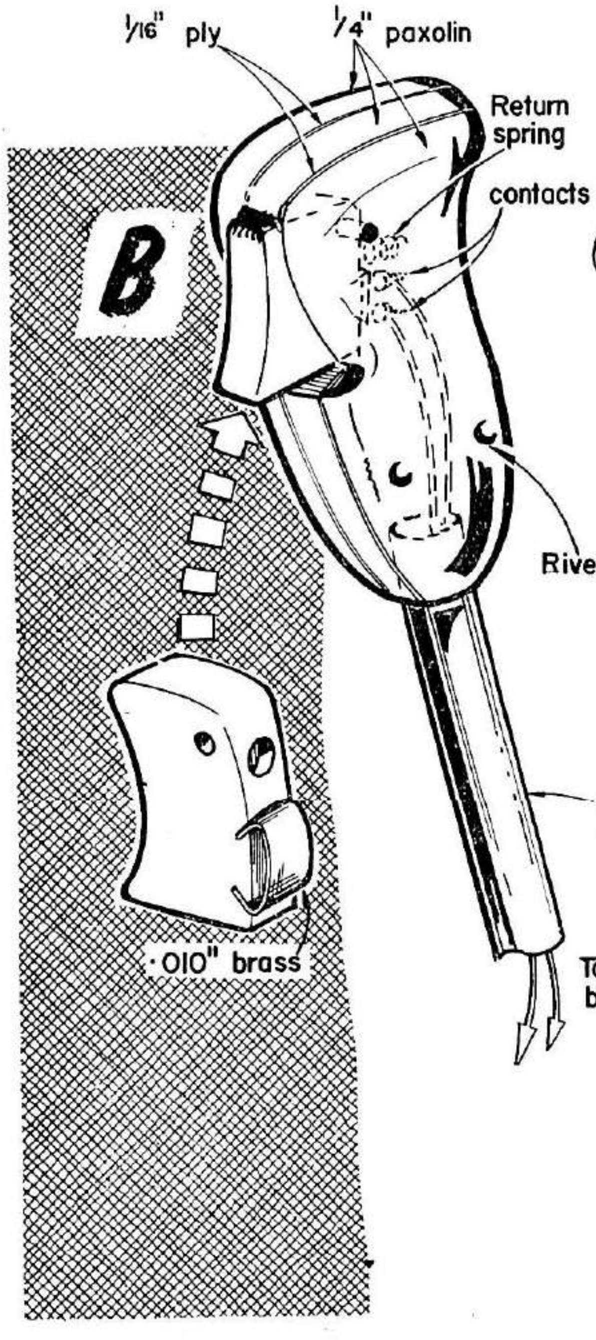
It is essential to have the double sided arrangement as shown and to ensure that both springs are matched, otherwise deflection of the leg from its normal position would give an unwanted rotary movement to the leg, just when one needs everything tracking dead straight.

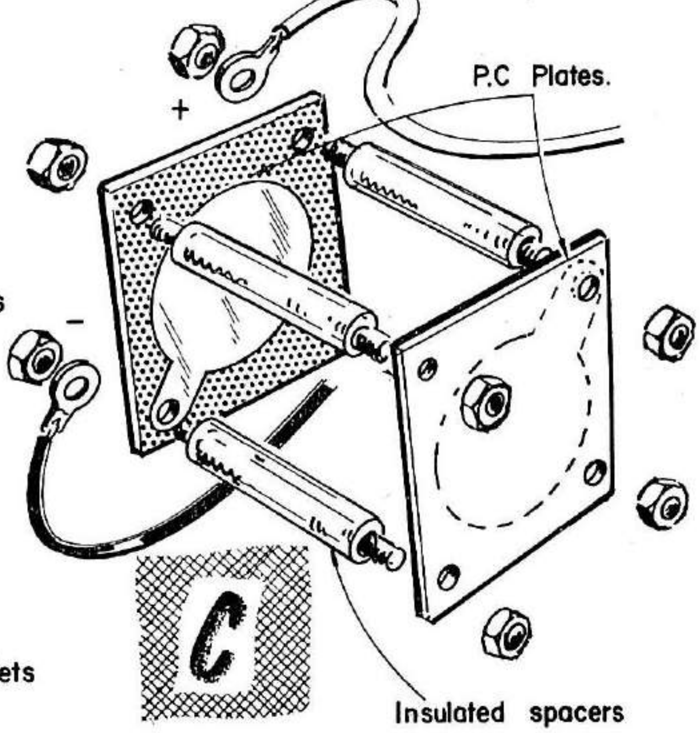
Back to Sgt. Weller for a further Simple Simul pulse box system "F". This time the left hand does some work. The whole set-up looks rather like a "Space Gun" but provides a nicely balanced unit designed to ease the physical as well as the mental loading of the pilot. The whole pulse box is mounted on a pistol grip handle, the lower part of which provides a "Flight Switch" and the upper part, which would normally house the trigger, carries a throttle switch. Both these are normal push button types, the lower one operated via a spring loaded pressure plate.

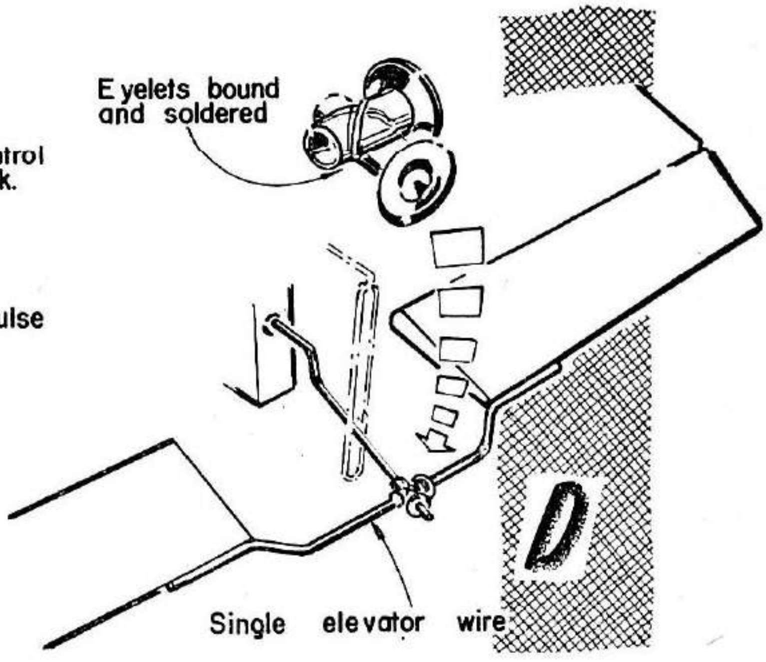
• • •

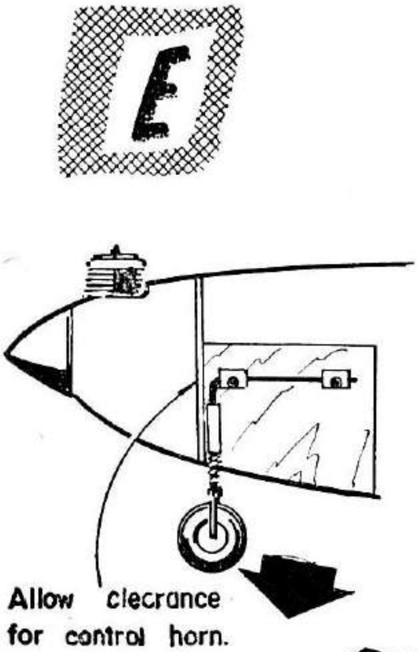
We welcome further contributions for this section. Sketches may be rough but understandable, and descriptions should be short and clear.

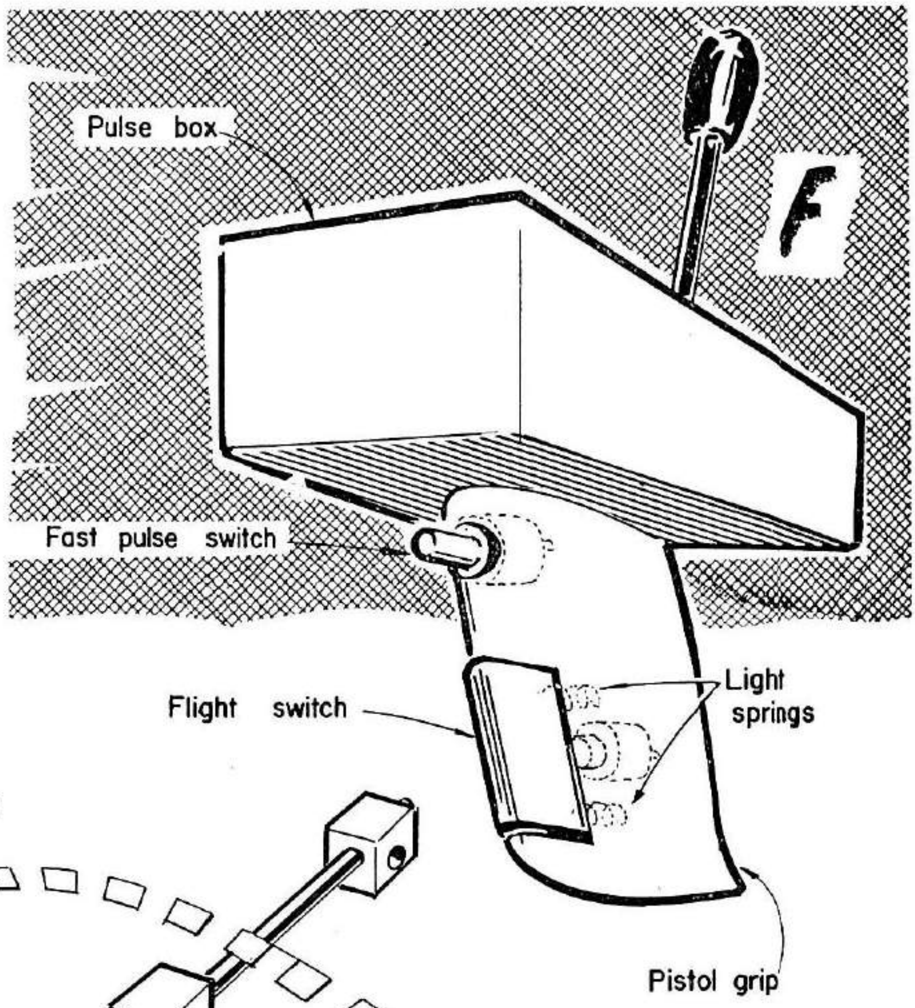

A
"Maltese cross" unit
c
b
a
Contact disc
(could be
Ellis type)
motor
To rudder
c
b
a

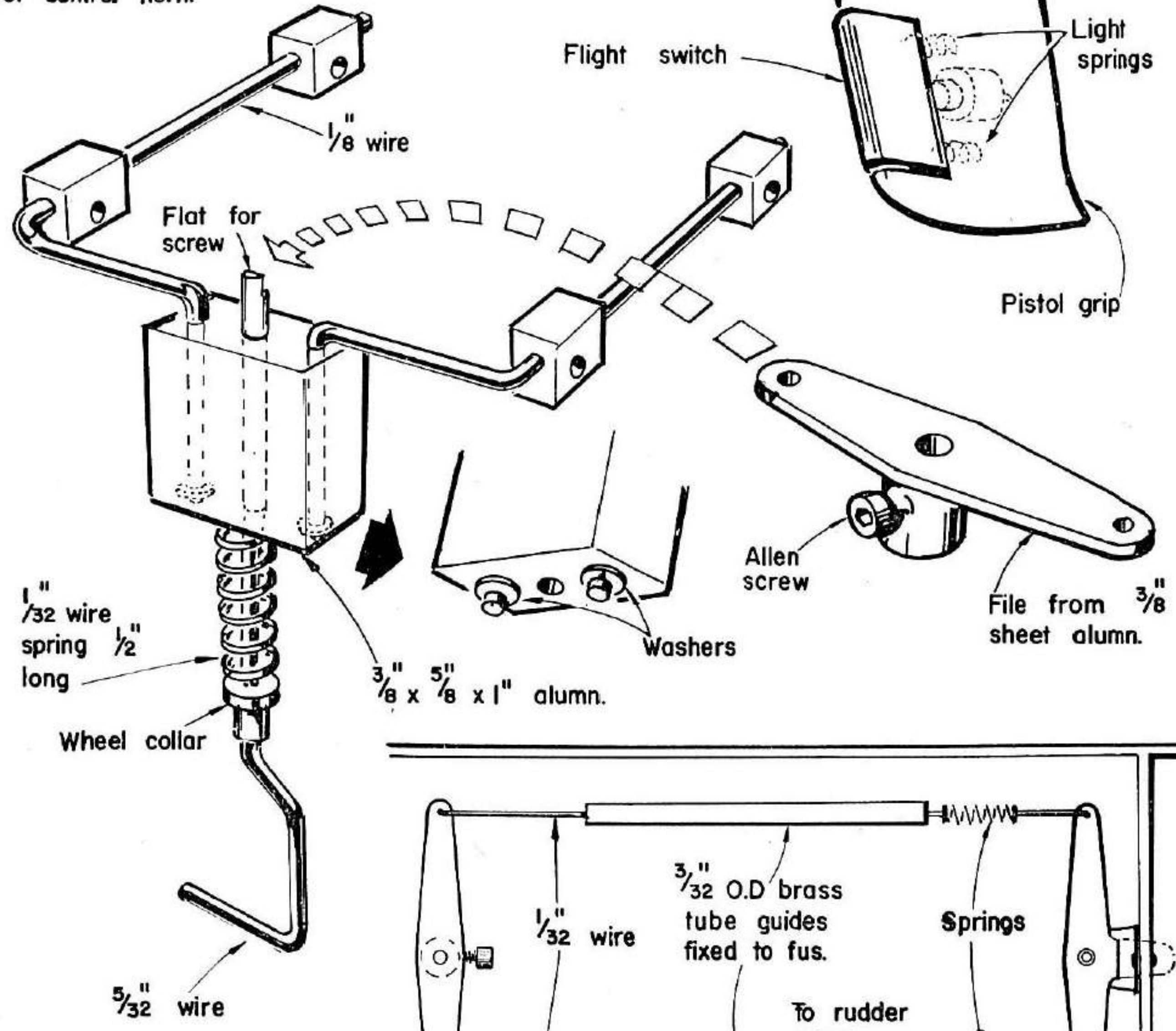

1/16" ply
1/4" paxolin
Return
spring
contacts
B
Rivets
Control
stick.
·010" brass
To pulse
box

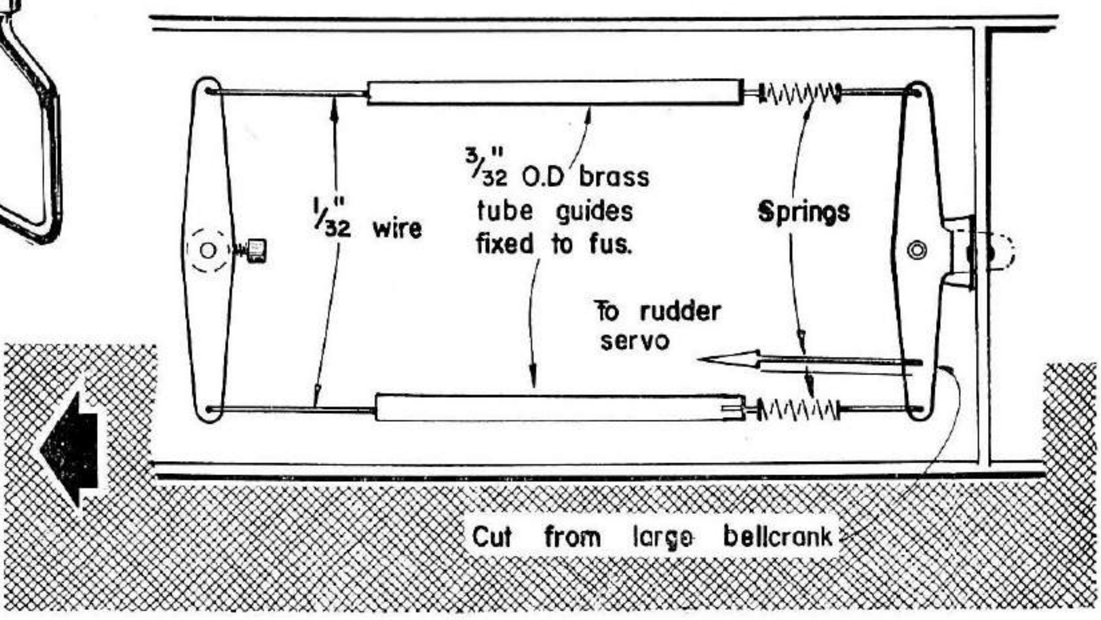

P.C Plates.
+
–
C
Insulated spacers


Eyelets bound
and soldered
D
Single elevator wire


E
Allow clecrance
for control horn.


Pulse box
F
Fast pulse switch
Flight switch
Light springs
Pistol grip


1/8" wire
Flat for screw
1/32" wire spring 1/2" long
Wheel collar
5/32" wire
3/8" x 5/8" x 1" alumn.
Washers
Allen screw
File from 3/8" sheet alumn.


3/32" O.D brass tube guides fixed to fus.
1/32" wire
Springs
To rudder servo
Flight
Cut from large bellcrank

Inductance of Air-Cored Coils

Correct matching of components for tuning in the 20-30 mc/s bands is made easy by use of these charts compiled by

R. H. Warring

THE inductance of air-cored coils can be calculated quite accurately from the geometry of the coil, although the mathematical formulas concerned are somewhat tedious to apply. They are:—

Inductance in microhenries =

$$\frac{0.2\,D^2\,N^2}{3D + 9l + 10r}$$

Number of turns for a given inductance L (microhenries):—

$$N = \sqrt{\frac{3D + 9l + 10r}{0.2\,D^2} \times L}$$

where D = mean diameter of coil in inches.
l = length of winding in inches.
r = radial depth of winding in inches.
N = number of turns.

The nomogram opposite has been designed to provide rapid solutions to these formulas and can be used directly once the appropriate 'K' value for the coil has been determined from the table. The sum of the 'K' value and three times the mean coil diameter is entered on the far left hand scale. Other values are simply inserted in the appropriate scales.

The scales must always be used in pairs—the two *outer* scales together and the two inner scales together. To find the inductance of a given coil, coil diameter and number of turns are first joined (the two inner scales) and the point where they cut the reference line noted. Project from the appropriate value of K plus 3 × diameter on the far left scale through the same point on the reference line across to the inductance scale and read off inductance in microhenries.

Example: Given a coil of 1.5 inches diameter and 35 turns where the 'K' value works out as 4.5.

To find the inductance, first compute K + 3 × diameter = 4.5 + 3 × 1.5 = 4.5 + 4.5 = 9.

Connect coil diameter (1.5) to number of turns (35).

Through same point on reference line, connect 9.0 on the far left hand scale to cut the inductance scale. Ans.: 61 microhenries, approx.

The nomogram can further be used to arrive at a suitable number of turns to wind a coil of given inductance, taking several plots, as necessary, to arrive at practical values consistent with the 'K' value required. The latter can, of course, readily be adjusted by altering the size of wire.

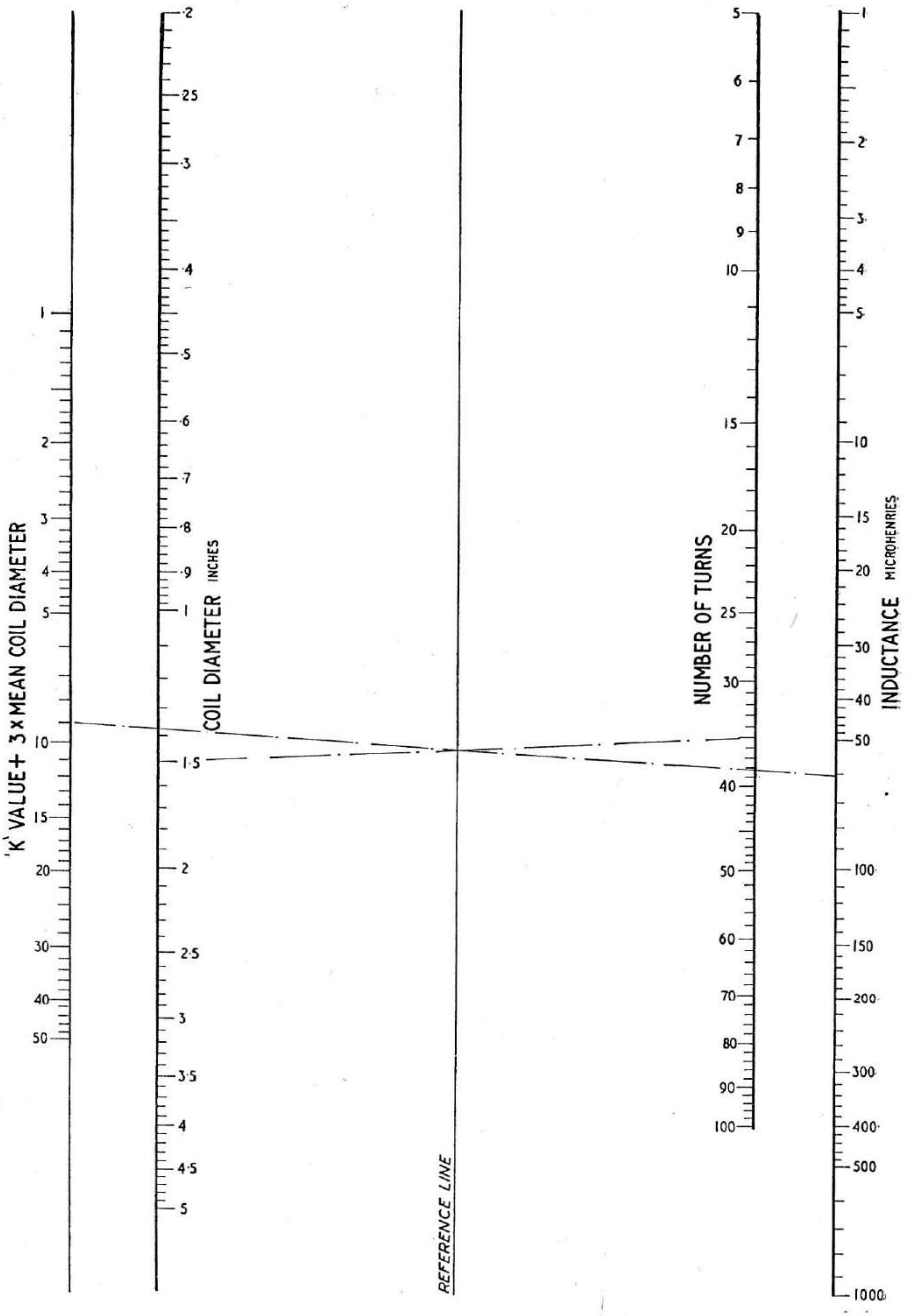
To find actual 'K' value for any given coil, multiply appropriate table figure by the number of turns.

Example: 25 turns of 18 gauge wire double silk covered.
Table value for D.S.C. 18 s.w.g. = .468.
Actual 'K' value = 25 × .468 = 11.7.

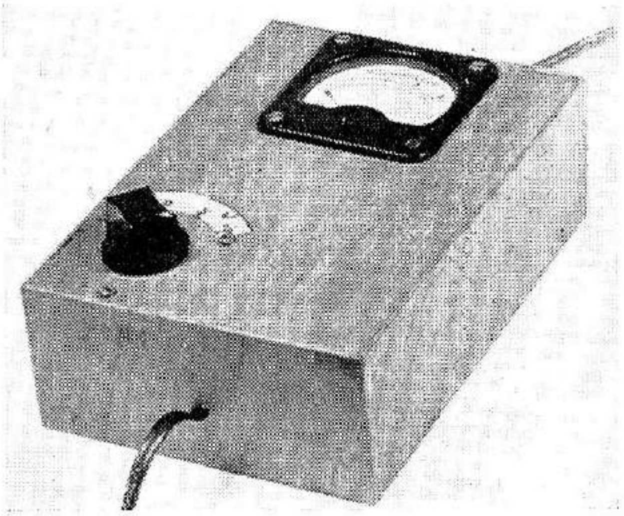
Note: For sizes of wire not covered by the table the corresponding 'K' value can be calculated as 9 x the actual length of the winding.

'K' VALUE FACTORS

Insulation	S.W.G. SIZE 16	18	20	22	24	26	28	30
S.S.C.	.602	.456	.348	.274	.213	.177	.147	.125
D.S.C.	.614	.468	.360	.286	.226	.166	.156	.135
Enamel & D.S.C.	.624	.476	.365	.292	.230	.192	.160	.137
Enamel & D.S.C.	.635	.487	.378	.304	.243	.201	.170	.147
Enamel	.605	.457	.350	.275	.215	.178	.148	.125
Lumex	.615	.470	.360	.287	.226	.167	.157	.136


'K' VALUE + 3 x MEAN COIL DIAMETER
1
2
3
4
5
10
15
20
30
40
50
COIL DIAMETER INCHES
·2
·25
·3
·4
·5
·6
·7
·8
·9
1
1·5
2
2·5
3
3·5
4
4·5
5
REFERENCE LINE
NUMBER OF TURNS
5
6
7
8
9
10
15
20
25
30
40
50
60
70
80
90
100
INDUCTANCE MICROHENRIES
1
2
3
4
5
10
15
20
30
40
50
100
150
200
300
400
500
1000

Simple Test Meter



BUILD this simple test meter submitted by A. T. Jeffs, utilising a standard 0-5 m.A. meter. Apart from the case, a straightforward 6 in. × 4 in. × 2 in. deep ply box, there are only two purpose-made components; a switch and a 1 Ω pot.

Switch

Cut a ⅛ in. ply plate to serve as a carrier for the contacts, see Fig. 2. A Meccano rod 1¼ in. long forms a spindle. A disc of ⅛ in. ply, which is a tight fit on the spindle, carries a pair of moving wipers, these are secured by bending the lugs down, passing them through slots in the ply disc and folding back on the opposite side. The main wiper is soldered to the spindle and should not touch the secondary wiper, the function of which is to bridge studs 5 and 6 when the main wiper is on stud 1.

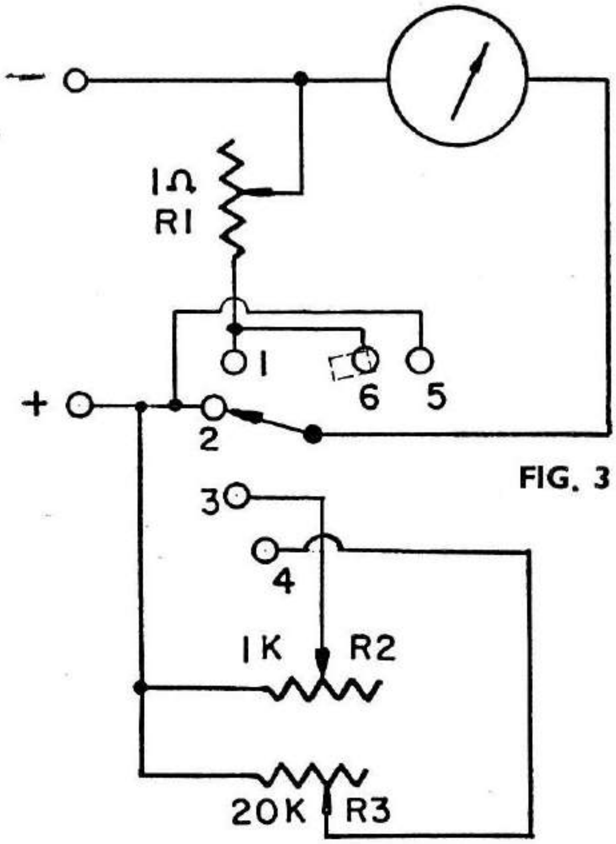


FIG. 3

SECONDARY WIPER SHOWN DOTTED.

A series of countersunk 8 BA brass bolts are used as contact studs, fitted so that the slots in the heads are radially disposed. This allows the "V" shaped ends of the wipers to click into place at each stud position.

Printed circuit enthusiasts could make up their contact plate from this material. Alternatively, a switch wafer may be obtained cheaply from a surplus dealer.

Connections are made via solder tags on the back face of the ply plate and a flexible lead to the spindle. Number the tags for reference when wiring later, drill the box top for the spindle and mounting bolts using the ply plate as a jig, and secure with three 6 BA bolts using nuts as spacers.

Potentiometers

R1 is a shunt resistance equal to ⅛ of the resistance of the meter. As potentiometers of 1 Ω or so are not readily obtainable one is made.

A ring of ⅛ in. ply, 1½ in. external diameter and ⅛ in. wide is cut out and wound with about 5 ft. of enamelled wire spaced about 1/32 in.

If the meter resistance is greater than 12 ohms, more wire is wound into the potentiometer. A 7 Ω meter requires about 0.8 Ω and 36 in. of 38 s.w.g. should prove sufficient. The wire wound ring is then cemented to a 1½ in. diam., ⅛ in. ply disc, one end of the wire fixed to a 10 BA nut and bolt. A contact strip of copper foil, about ¼ in. wide soldered to a 6 BA bolt forming a spindle through the centre makes con-

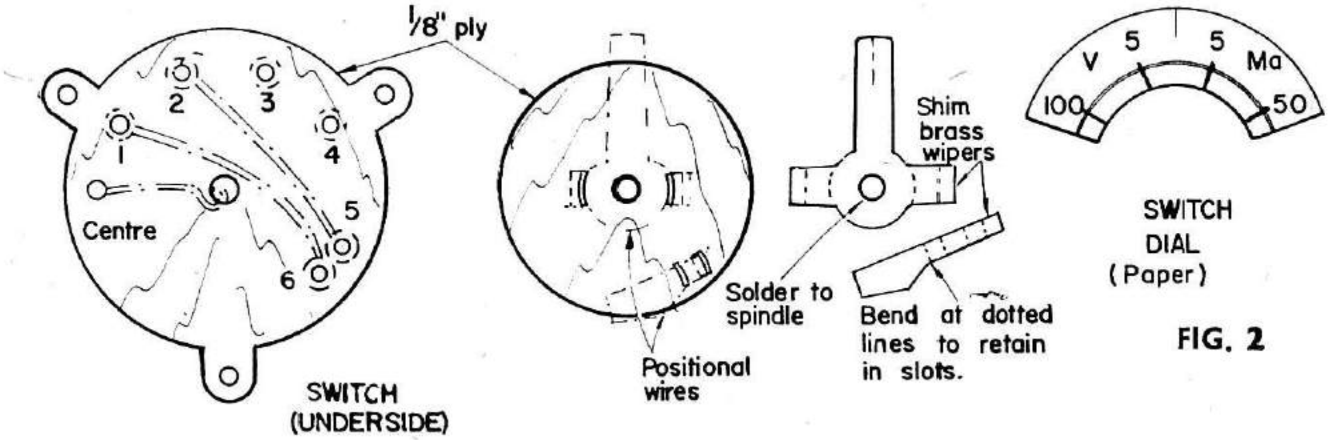


FIG. 2

tact on the wire track which should be scraped clean of enamel.

Alternatively, a 2 in. length of $\frac{1}{4}$ in. paxolin tube wound with the appropriate length of wire may be used. Find the correct tapping with a pin and make a permanent soldered connection.

For the 5v. and 100v. ranges, two potentiometers of 1 K (R2) and 20 K (R3) capacities respectively are used. These may, however, be replaced by fixed resistances of close tolerance, checked with the aid of a borrowed meter. Such a modification would enable a smaller case to be used, and there would be less change of accidental readjustment.

The potentiometers are fastened to an L-shaped board of $\frac{1}{8}$ in. ply, so that their shafts project from the bottom for subsequent adjustment.

Four 2 in. wide strips of $\frac{1}{16}$ in. ply are cemented round the 6 in. $\times$ 4 in. top for sides, the potentiometer board recessed so that the shafts are protected and the connections to the switch are made.

A paper dial is cemented round the shaft on the top of the box, the shaft turned until the ply disc is exactly in the position shown in the circuit diagram, a knob put on it to point to 5 m.A.

A $\frac{1}{16}$ in. ply base is then put on the case and the meter is then ready for use.

Adjustment

A meter capable of covering the m.A. and voltage ranges to be tested should be borrowed for this operation, voltage may be checked from new batteries, but the resultant readings might not be sufficiently accurate.

It will be noted from the circuit that in the 50 m.A. range, the meter is connected via the second wiper. This obviates any possibility of damage in the event of the switch contacts being faulty, ensuring that the meter whilst connected to the 1 Ω pot. in this switch position is not in circuit with the equipment under test unless the second wiper bridges the extra contacts (5 and 6).

Two sets of test leads were fitted to the original meter; one set terminating in wander plugs for voltage check, etc., the other set utilised a polarised two-pin plug for m.A. test while tuning. For this purpose the leads should be as short as possible or carry a choke at the plug end. A suitable choke would be of the type used in the keying leads of a Tx. and is made from a $1\frac{1}{2}$ in. length of $\frac{9}{16}$ in. paxolin tube with two separate windings, each of 28 turns of 22 s.w.g. E.C. wire.

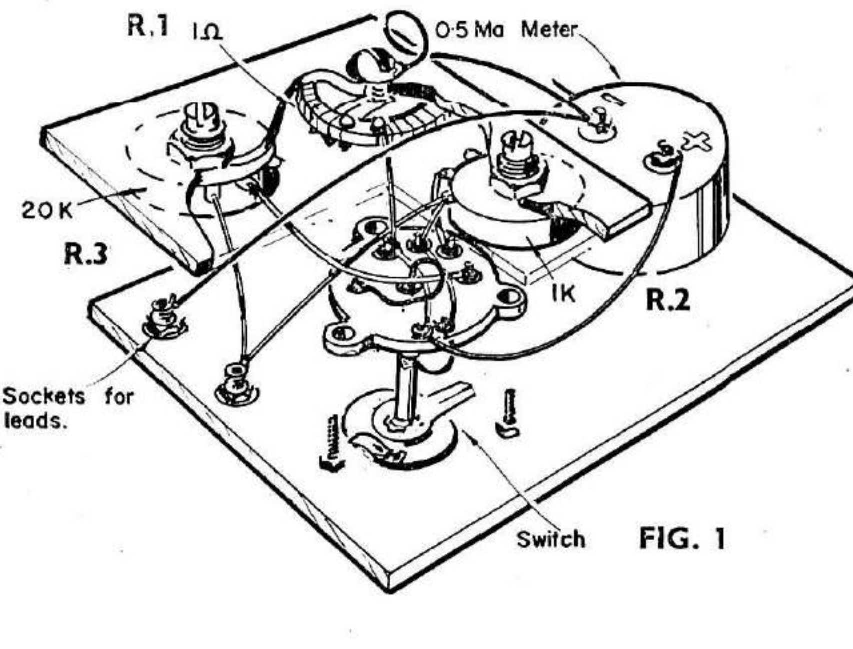


FIG. 1

Books . . .

MODEL RADIO CONTROL *by Edward G. Safford, Jr. Gernsback Library Book No.* 74. *New York. Size,* 8½" × 5½", *semi-stiff glossy cover.* 210 *line drawings and* 40 *illustrations.* 192 *pages.*

THIS BOOK deals with American radio control methods but is none the less interesting for that. It covers theory and practice in a straightforward and lucid manner and carefully avoids mathematics so that it will be very attractive to the average modeller who professes to have only an elementary knowledge of electronics. In spite of this it is not a book to be ignored by the more knowledgeable as it covers almost every aspect of remote control by radio and will undoubtedly suggest different lines of approach.

The first seven chapters deal with theoretical matters from the basic concept to transmitters, receivers and servo systems. Chapter 8 covers the various uses of transistors and the remainder of the book is given to practical systems.

Chapter 5 deals with the theory of decoding in all its aspects and includes systems not in general use for model control but which are none the less quite practicable. It is surprising that some of them, which can be used in single channel carrier work, have not been used before. Chapter 11 covers practical coding and decoding arrangements. All types are dealt with from the simple self neutralising escapement to complicated proportional control.

It would have been nice to have seen more information on reeds and some mention of super-het receivers but nevertheless the material covers such a wide field that the less knowledgeable will find the book a very useful addition to the bookshelf.

RADIO CONTROL FOR MODEL BUILDERS *by William Winter. Size,* 8½" × 5½". *Stiff card cover. A Rider publication No.* 235. *New York & London. Chapman & Hall Ltd.,* 37 *Enix St., W.C.*2. 220 *pages.* 53 *drawings and* 88 *illustrations.*

THIS BOOK, written by the former Editor of "Model Airplane News" is aimed at the R/C modeller rather than the electronic expert. The latter might, however, enjoy reading the book covering as it does a wide field of model radio control. The subjects dealt with are from the simple single channel transmitter and receiver with a self neutralising escapement to the crystal controlled transmitter, super-het receiver and the various multi-proportional and multi-channel systems.

Written in general terms without recourse to advanced theory and with a complete absence of mathematics it takes the reader through the various stages in understanding of remote control by radio. Some theory must of necessity be included but it is given in such simple language that most modellers will have no difficulty in understanding the explanations. It is accompanied by a wealth of illustrations and to a lesser extent by drawings where these are necessary in understanding the explanations.

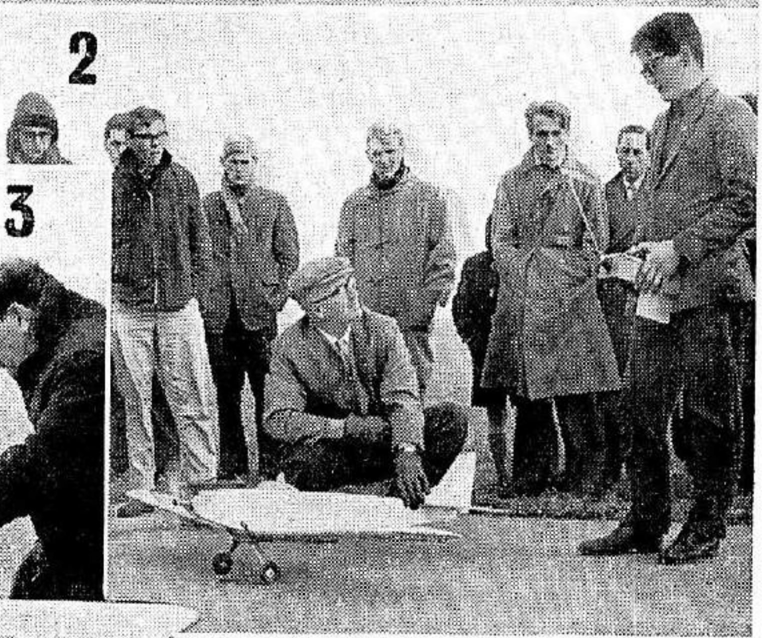
On the one hand it is descriptive and includes a large number of commercial systems with a clear description of their operation, etc., and on the other hand there is a great deal of material on the practical aspects of radio control. This includes care of equipment and batteries, installation problems and maintenance.

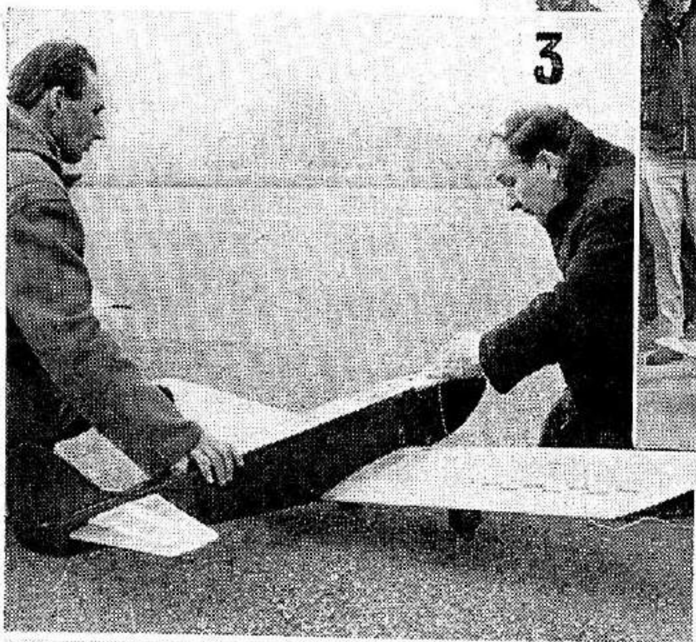
The glossary at the end will be particularly useful to the beginner who understands only a few of the terms, abbreviations and slangs used by the modern R/C modeller.

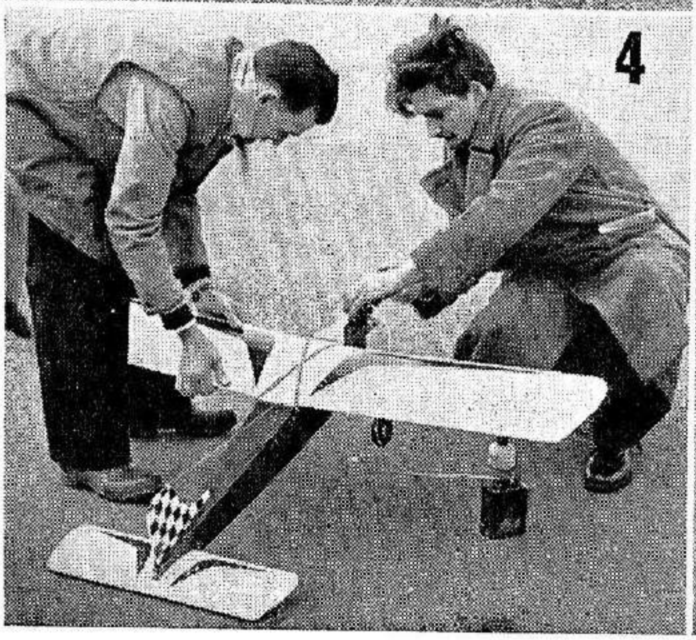
Odiham

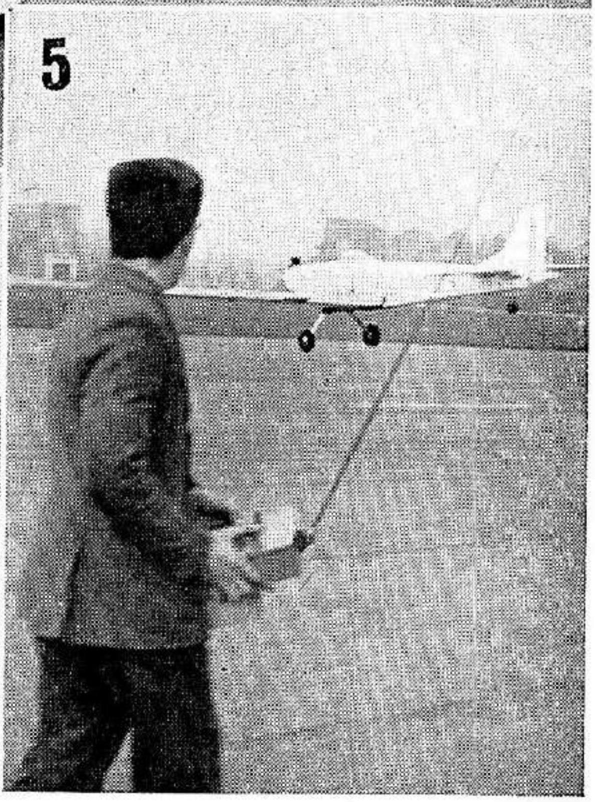
Photos by Roger Clark

1. Judges George Honnest-Redlich and Stewart Uwins watch as Frank van den Bergh's "Sky Duster" starts its run.
2. Rogers Father-and-Son team have a final check.
3. H. Brooks starts the "Rebel".
4. D. Knight of Wagtails & Bromley starts a "Reflex"; G. White holds: a high-wing model for a change!
5. Paul Rogers makes a close pass, note that fascinating aerial linkage.









Simultaneous Engine Control for Simpl Simul

By PETER LOVEGROVE and DAVE McQUE

SIMPL SIMUL (or Galloping Ghost; take your pick, we prefer the abbreviation of Simple Simultaneous Control), is a pleasant little system to fly and, because one can go out even in the windiest conditions, one soon accrues a fair number of flying hours. The natural outcome of this is that one gets thoughts on the theme, "How can I add extra controls to it?" Misguided types turn to ideas about how to clobber this twee system with ailerons, while sensible chaps content them with aspirations towards simultaneous engine control.

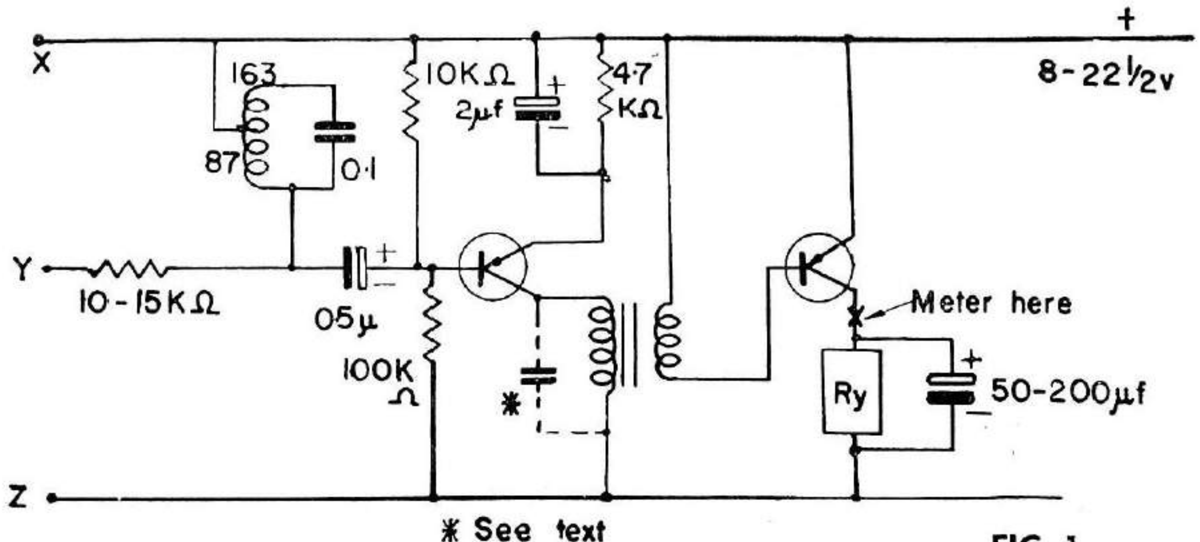
The article sets out a few of the ideas which have evolved from the co-operation of Dave McQue and your humble scribe!

The basic principles behind the systems described are as follows: (Note, however, that they relate only to tone equipment; if you use a carrier Tx. and Rx. you are restricted to schemes using a large change in pulse rate or in mark or space maximum length.) Most of the common tone receivers, e.g. Aerotone, Unitone, Quetone, tc., are so designed that any modulated 27 mc/s. carrier will energise the relay stage, provided that the modulation (tone) frequency is within the range that the amplifying stages can handle, usually somewhere between 250 c/s. and 2,000 c/s. To obtain the requisite pulse control for S.S. or proportional rudder, then, all you need to do is pulse the modulation using some acceptable note frequency. But to obtain the extra intelligence for engine control what is required is a separate tail-end to the receiver which will only be energised if the modulation frequency is at one particular value. Consequently at this special frequency, both the rudder-elevator relay and the engine relay will pulse simultaneously, but at all other frequencies within the bandwidth of your Rx. amplifier, only the rudder-elevator relay will pulse; the engine control relay stays out. One then slugs the engine relay, so that it holds in continuously if energised by "special tone" pulses but drops out soon after these cease.

This selection by a special tone can be done by three methods, viz.:

(1) A reed unit.
(2) A Vinkor pot-core filter.
(3) An R/C filter.

Of these (1) is the simplest and cheapest, but is fussy as regards tone frequency adjustment and does not like



* See text

Transistors OC 71 or equivalent

FIG. 1

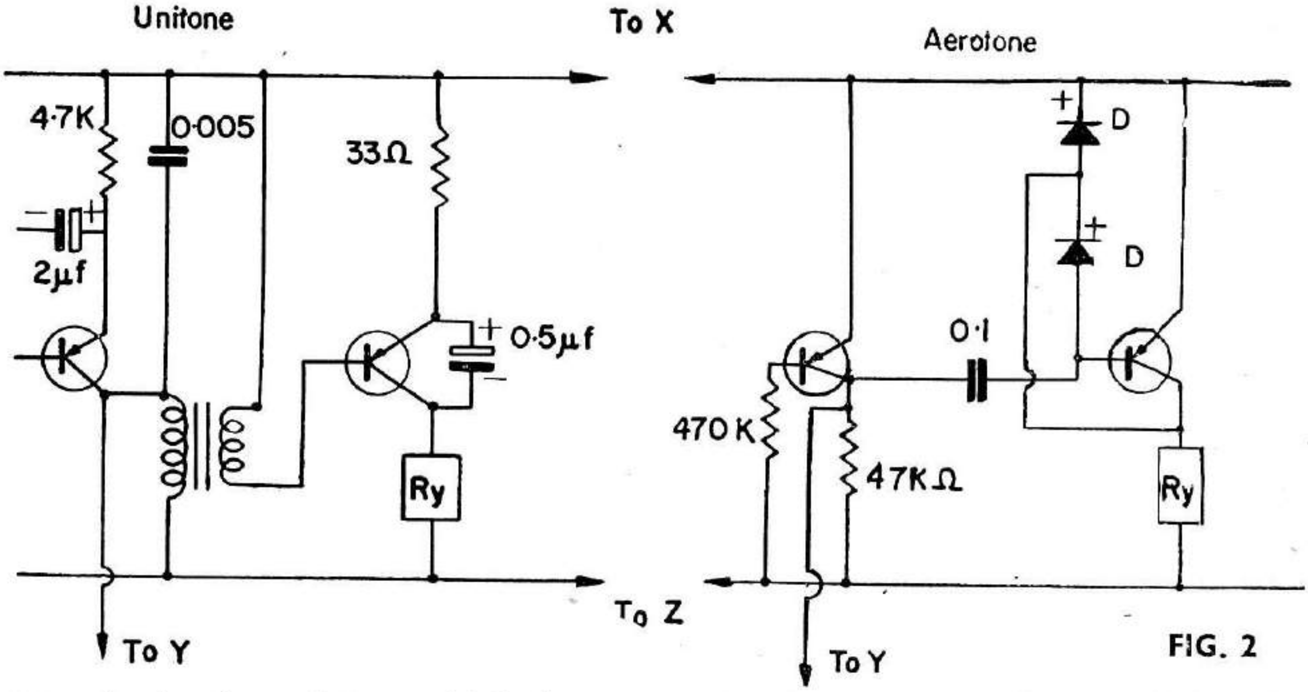


FIG. 2

very short pulses of tone which do not give the reed time to start vibrating.

(2) is more reliable and robust than (1) and lends itself to a precise relay slugging arrangement. Frequency adjustment is far less critical since the pot-core responds over a range ± 100 c/s. from its peak frequency.

(3) probably requires most experimentation and would not give better results than (2) in most cases.

It is not proposed to describe any scheme for the addition of a reed unit driving stage. George Honnest-Redlich has had considerable experience in that field and would probably advise, or better, do the job for you. Charles Riall has for many months given excellent demonstrations of the reliability of the R.E.P. dual function Unitone for S.S. work.

However, although a reed unit was extensively used in early days with S.S. the authors felt that something better and more reliable was needed, if the engine control gear was to be installed, tuned, and forgotten.

The pot-core filter system drawn in Fig. 1 was the outcome of our trials and tribulations. Fig. 2 indicates how this should be tapped into two typical tone receivers, namely the Aerotone and the Unitone.

The normal method of using this scheme in a Simpl Simul model is to arrange for the "special tone" pulsing to hold the engine control at high speed (i.e. engine relay is pulled in) so that loss of signal gives slow engine (relay drops out) and therefore at least some degree of fail-safe.

As the tone must be pulsed, but the engine control relay must stop in continuously, a slugging capacitor must be placed across this relay. A fairly large capacitor, about 25-200 mfd., is needed to bridge the gaps between tone pulses at slow pulsing and maximum space—minimum work. The capacitor required to slug the relay depends on the coil resistance and applied voltage as well as pulse form and frequency, hence the wide range quoted.

A far better arrangement of slugging is that shown in Fig. 3. This may be familiar to you if you read R.C.M. & E. avidly, for it has been mentioned before in other contexts. The smaller capacitor used means a much more precise control over the time constant so that the relay can be made to hold in just long enough to bridge the maximum spaces but release immediately that time is exceeded.

For those who follow the "Introduction to Transistors" series, the explanation of the working of this little circuit may be of interest.

With no tone, i.e. modulation or Tx.

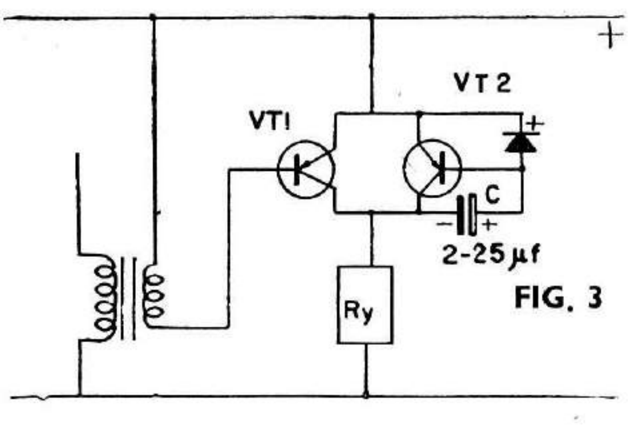


FIG. 3

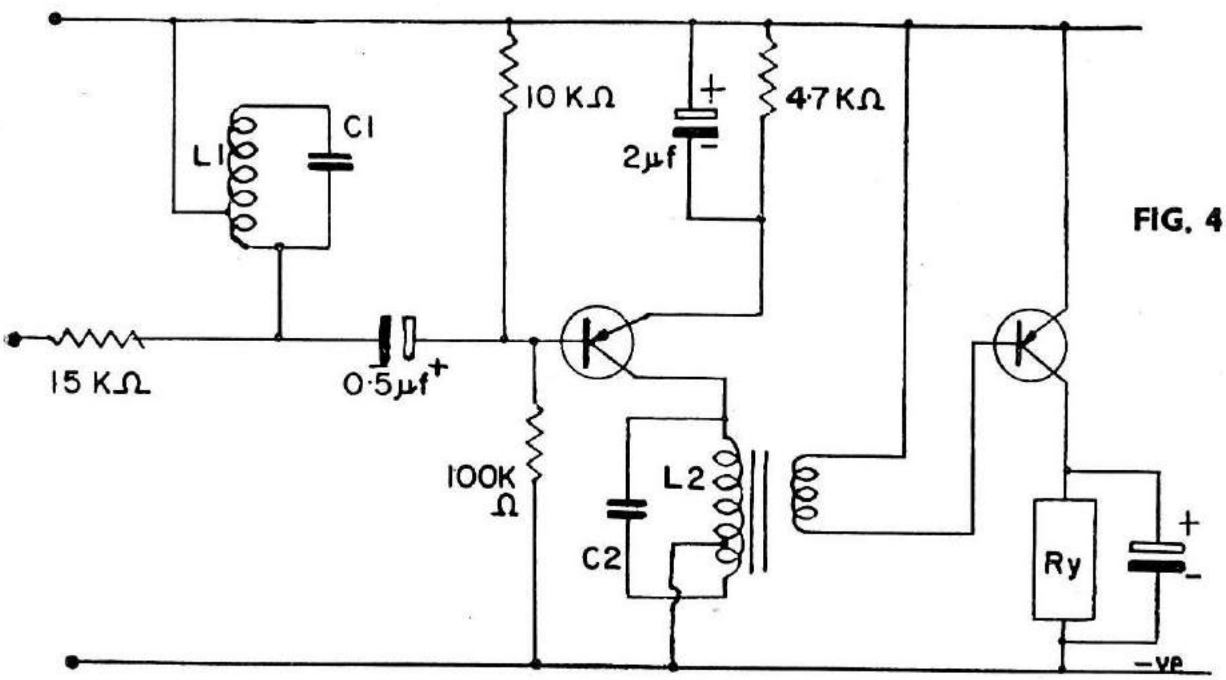


FIG. 4

Note: L1 and L2 both wound on Vinkor pot cores.

off, both VT1 and VT2 are off.

When the tone comes on, the first —ve half-cycle turns VT1 on. Its collector goes positive taking VT2 base positive; the diode conducts and the capacitor discharges. Tone at VT1 base goes positive and VT1 goes off. Its collector tends to fall taking with it VT2 base which turns VT2 on, maintaining current in the relay.

While the tone is on VT1 and VT2 conduct alternately. When the tone is off VT2 carries on conducting while the capacitor charges up. C is effectively (beta + 1) of VT2 times its actual value as the relay current is (beta + 1) times the base current. Hence a much smaller value of C can be used than would be needed across the relay to provide an adequate delay time and VT1 does not have to provide such a large discharge current during the first few "on" cycles every time the special ton comes on.

The frequency-selective coil is wound on a miniature Vinkor pot-core obtainable from R.E.P. The coil is wound with 250 turns of 40 s.w.g. enamelled wire tapped at 87 turns from one end. The tuning capacitor (about 0.1) is connected across the whole 250 turns, whilst the ends of the 87 turns section are taken as the points for coupling to the rest of the circuitry. The advantages of this tapped coil are that a small capacitor can be used and the coil wound with fairly thick wire, i.e. a few turns.

In adjusting such a filter (which is, incidentally, useful in any circuit requiring an electronic tone-selective unit) the object is to maintain the same impedance at resonance between the tap and earth. This is equal to:

$\frac{1}{n^2} \times \frac{L}{CR}$ where n is the ratio of $\frac{\text{turns to the tap}}{\text{total turns}}$ (in this instance $\frac{87}{250}$).

L is the inductance of the coil, fixed by the number of turns.

C is the capacitor used for tuning.

R is the effective resistance of the coil.

L and R can be taken as fixed for a given constant total winding of 250 turns so that:

n is proportional to $\sqrt{C}$,

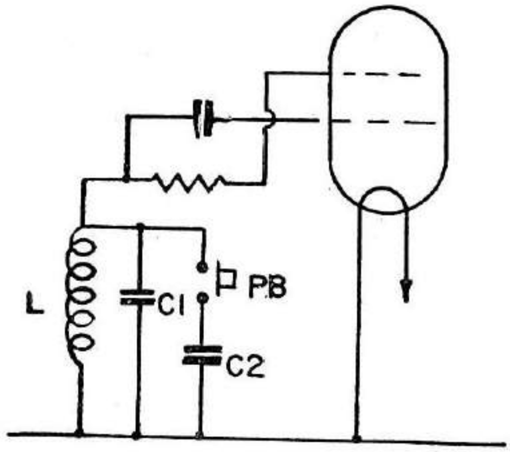
i.e. the smaller C the lower the number of turns to the tap.

If C is reduced to ¼ of its present value the resonant frequency will be doubled, and the coil should be tapped at 44 turns.

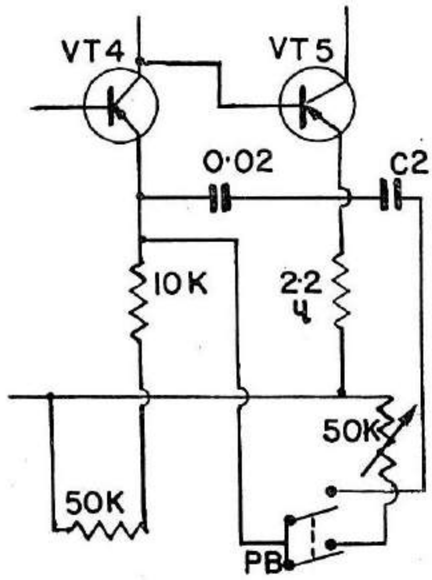
Once the coil frequency has been chosen satisfactorily, bolt the former inside the pot-core halves securely and lock the whole unit with Araldite to ensure absolute stability of tuning.

The system should be set up as follows:

Put a milliameter in series with the engine control relay coil (10 m.A. if a 3.5 K Ω coil, 5 m.A. if 5 K Ω or higher.) Hold the modulated signal on continuously and adjust the pitch to give the maximum output on the meter. The slugging capacitor need not be critically adjusted at this stage, but put in some value over 2 mfd. or you will always



UNITONE TX.



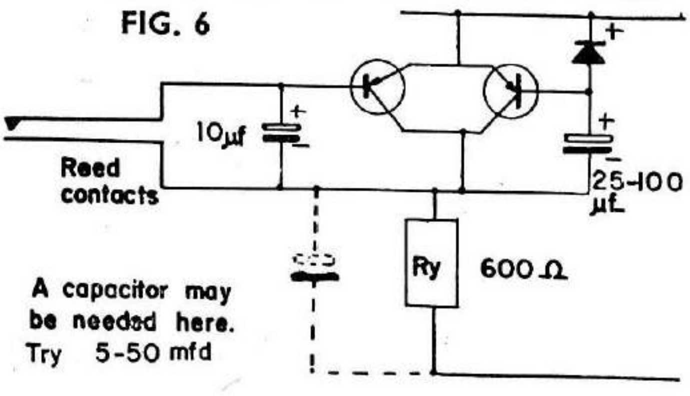
MᴼQUE PULSER

get negligible output.

Should you get several peaks of output increase the 15 K Ω feed resistance (this reduces the bandwidth) and try capacitors of 0.001 mfd. or greater across the primary of the transformer to cure instability.

Having set the modulation frequency to resonate in the L-C circuit you can adjust the relay slugging capacitor C to make the relay hold in continuously at all pulse-rates and mark-spaces on the correct tone. To change the modulation at the transmitting end you need to add a capacitor or resistor — con-

FIG. 6



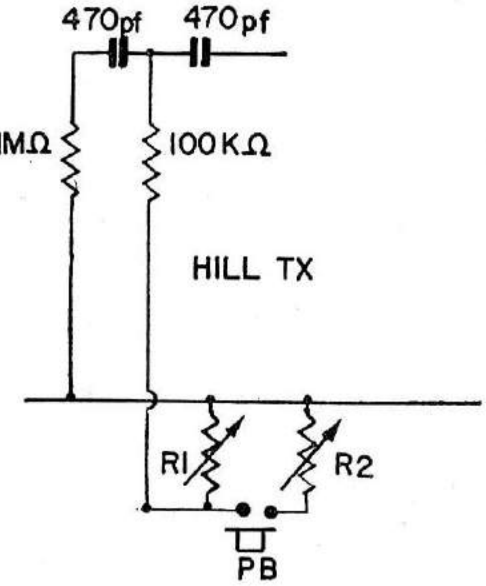
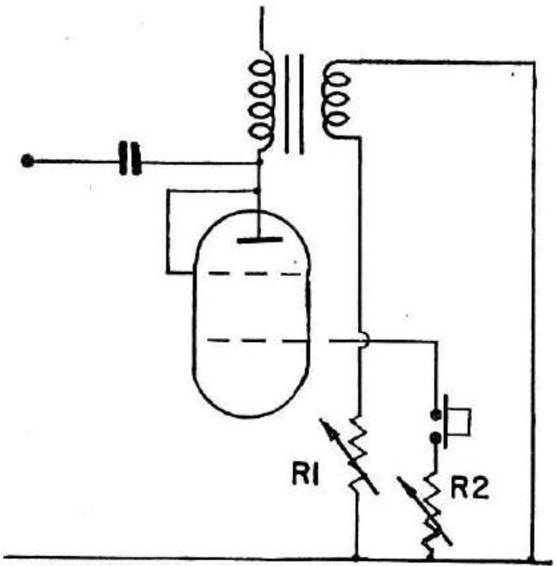


FIG. 5



BLOCKING OSCILLATOR
MODULATORS
(EARLY E.D, REP ETC.)

trolled by a push button—to the tuning components already in your modulator. Fig. 5 shows typical methods.

For greater selectivity (and for multi-control selectors), use a double tuning system as in Fig. 4. L2 and C2 are tuned to exactly the same frequency as L1 and C1, but the second pot-core has a few turns of 40 s.w.g. wire wound on top of the main winding to act as a secondary for feeding the switching transistor.

Finally, for those who wish to use a reed unit as selector the circuit of Fig. 6 shows how to drive and slug the engine relay from the actuator batteries. Another point about this triggered transistor system is that the reed contact is not called upon to pass large currents so burns and wears less.

The Complete Simpl Simul . . .

By D. McQue & P. Lovegrove

THE circuits described here can, by no stretch of the imagination, be considered as the simplest approach to Simpl Simul! But, taken stage by stage, they are really only a string of fairly straightforward units. Quite possibly, too, they could be tidied up somewhat and less bits could do the same job.

However, one glance will tell you that economy was not the object here; we were after a crash-proof, vibration-proof and, after initial development, a fool-proof system for Simpl Simul with simultaneous engine control. That object was achieved and so the circuits are offered to the enthusiasts who have the patience and find an interest in this control scheme. If nothing else, they may spark off some interest in full-transistorised controls other than reed-driven multiamplifiers.

Circuit Description

An SB345 (or SB305 possibly) super-regenerative stage feeds two transformer-coupled amplifying stages using OC 71's. Some "filling-in" circuitry couples the output of the second OC 71 stage to an OC 76 switch. This OC 76 in turn feeds a complementary symmetry switch which controls the rudder-elevator servo motor directly. Up to 500 m.A. can be passed through the motor by the V15/20IP transistors.

Note that four Magnatex cells are required to work the receiver section with the centre-tap "earthed". Four DEAC 450 D's provide the servo current, again with the centre earthed as well as connected to the servo. This coupling of the two sets of batteries is necessary to provide a circuit for the NPN-PNP switching current.

Also from the collector of the second OC 71 stage a feed is taken to another OC 71 amplifier which drives a tone-selective stage via a filter network. This latter stage only receives drive when the pulsed modulation is at one particular frequency. Under this condition it passes current through a second OC 76 stage by way of another "filling-in" network. But this time the network does not just fill in between cycles of the tone but fills in between bursts of modulation frequency, i.e. between pulses.

Since the OC 76 controls another complementary symmetry switch for the engine control servo, provision is made for adjusting the drive to the OC 76 so that it will hold the servo on 'high-speed engine as long as the "special tone" is pulsed but drives the throttles to 'slow' on other tones or no-signal.

Note that, although limit switches (L.S.) are fitted to the engine control servo, only two wires run to the servo from the amplifier and one to the 0 volts on the batteries, no other return leads being necessary.

Circuit Adjustment

The super-regeneration in the front end should be carefully adjusted by means of the 25 K pot. and then the appropriate fixed resistor put in, in place of the 4.7 K Ω + pot. value.

If on pulsing the signal, with headphones in the lead from VT4 collector to negative, you hear a "yodelling" instead of pulses, increase the value of the 0.003 in the VT1 circuit.

The silicon diode in the base circuit of T4 is for limiting and is a dispensable refinement.

The servo amplifiers are as described in the "Introduction to Transistors" series.

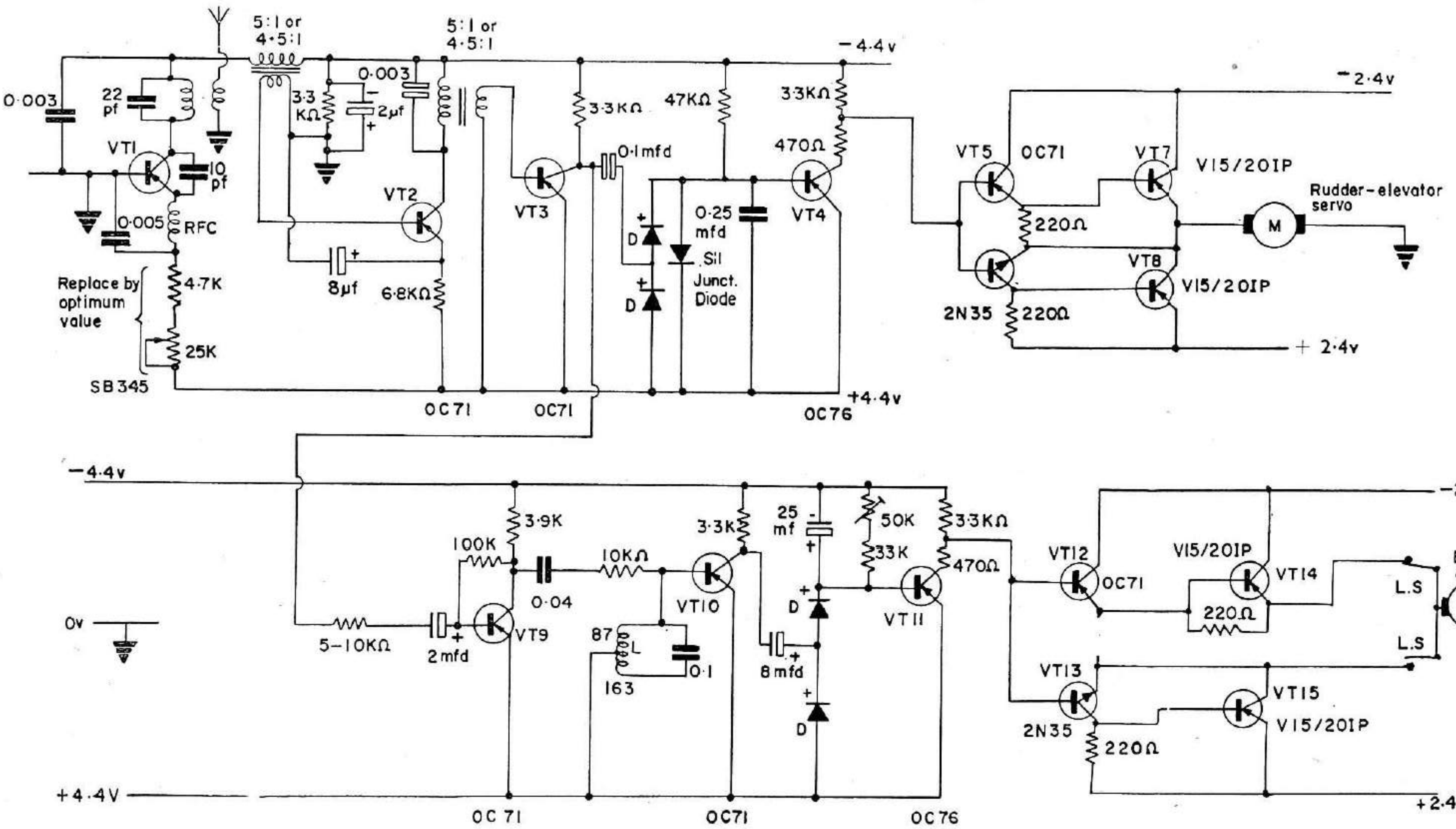
The feed resistor from T3 to T9 should be set to some value which allows both channels to function well. It can be increased above 10 K Ω if you wish, in which case a 0.1 or 0.05 will do instead of the series 2 mfd.

The filter L is a Vinkor pot-core (from R.E.P.) wound with 250 turns of 40 s.w.g. enamelled wire tapped at 87 turns from T10 base end. Connect this tap to positive rail. Bolt the pot-core firmly and Araldite it to ensure frequency stability.

Adjust the 50 K pot. in T11 base circuit to ensure that the servo is driven to 'high-speed' at all rates and mark-space if pulsing on the "special tone" but releases on all other tones.

Although good quality transistors have been used throughout it does not follow that selected surplus ones will not do. In any case, 10v. transistors are all that are needed and these are not too costly, even brand new.

If OC 44's are used for T2 and T3, it may be possible to omit T9 altogether.



Complete Simpl Simul Circuit

Basic Radio

By G. E. DIXEY PART IV

The Anode Characteristics

WHEN dealing with the triode we met the I_a/V_g characteristic, which we termed the 'mutual characteristic' of the valve. Another useful family of curves is the anode characteristics shown in Fig. 1. Here, the relationship between anode current and anode voltage is shown for different values of grid bias. These curves are typical for a triode. For tetrodes and pentodes they are rather different, as we shall see, although the mutual characteristics are the same.

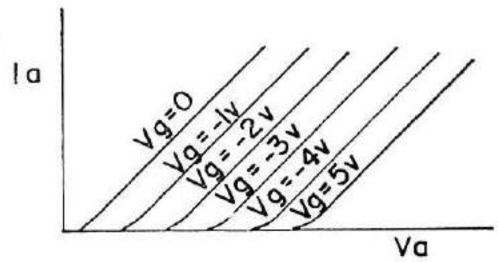


FIG. 1a

The Tetrode

The tetrode, developed from the triode, has a further grid between control grid and anode known as the screen grid (G_2). Often called the 'screen' for short, it is usually connected to a potential about two-thirds that of the anode.

Fig. 2 shows the symbol for a tetrode.

The effect of this extra grid is two-fold.

(1) The r_a is increased and hence μ is increased meaning greater amplification can be obtained. (The meaning of r_a, μ and g_m will be explained later).

(2) The capacity between anode and control grid is reduced which makes the valve more effective at higher frequencies.

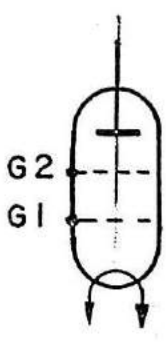


FIG. 2

The second point needs some explanation since it may not have been appreciated that there exists an anode-grid capacity. In fact a 'stray' capacity can exist between any two conduting objects. In a triode valve the capacity from anode to grid (C a g) may be about 5 pf. which at low audio frequencies is not troublesome, but at higher frequencies provides a low reactance path feeding back energy from the anode into the grid circuit causing the amplifier to oscillate. The introduction of the screen grid reduces the Cag to a fraction of a picafarad, and reduces the tendency to self-oscillation.

Anode Characteristic of Tetrode

In Fig. 3 the full line indicates the variation of anode current with anode voltage. It is seen that there is rather a curious kink in it. In fact the anode current rising with increasing anode voltage drops suddenly, and then rises again. Note that this occurs when the anode voltage is less than the screen voltage (Vg_2), and is due to an effect termed 'secondary emission'.

When electrons in the anode current strike the anode, they do so with high velocity and knock electrons out of the anode material. This liberation of electrons by bombardment of the anode is the secondary emission effect. The secondary electrons come under the influence of both the anode and screen potentials, and tend to move to the higher one. Thus, when the screen potential is higher than that of the anode the screen collects the electrons at the anode's expense. This accounts for the fall in anode current at this re-

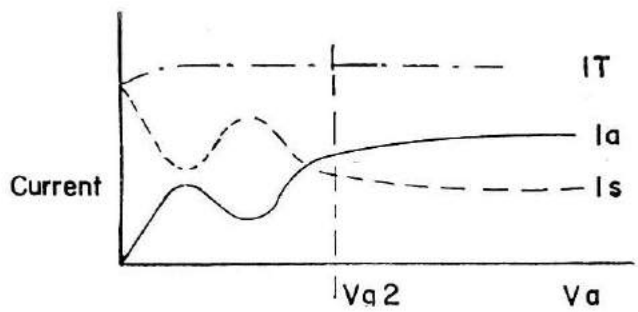


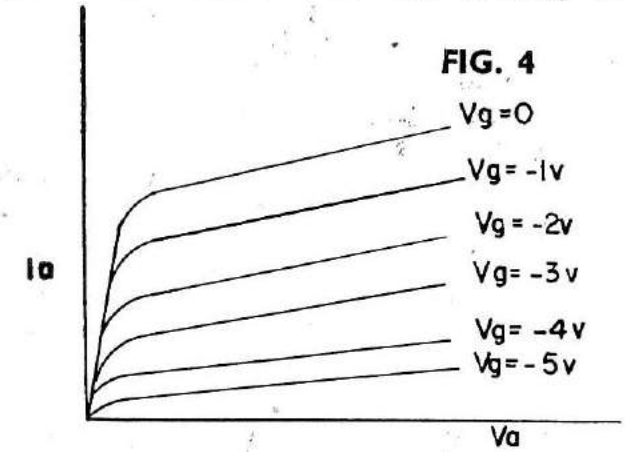
FIG. 3

gion and the rise in screen current I_s (shown in chain line Fig. 3). Notice that the curves of I_a and I_s are similar, but the I_s curve is inverted. This shows the sharing of the space current I_t (chain-dotted line Fig. 3) by the two electrodes as a function of their potentials.

The Pentode and Beam Tetrode

The presence of the kink in the anode characteristics of a tetrode proves an embarrassment in that it limits the portion of the characteristics that can be used without distortion being introduced. The pentode and beam tetrode are both designed to overcome this limitation. Their anode characteristic is shown in Fig. 4.

In the pentode a third grid is introduced between the screen grid and anode, and this electrode is termed the 'suppressor grid' (G_3). It is normally connected to earth potential, approximately, so that it is negative with respect to anode and screen grid. Electrons leaving the filament have sufficient velocity to pass through the suppressor grid wires and reach the anode, but



secondary electrons leaving the anode are deflected back to the anode by the repelling effect of the suppressor grid. The symbol for a pentode is shown in Fig. 5 (a).

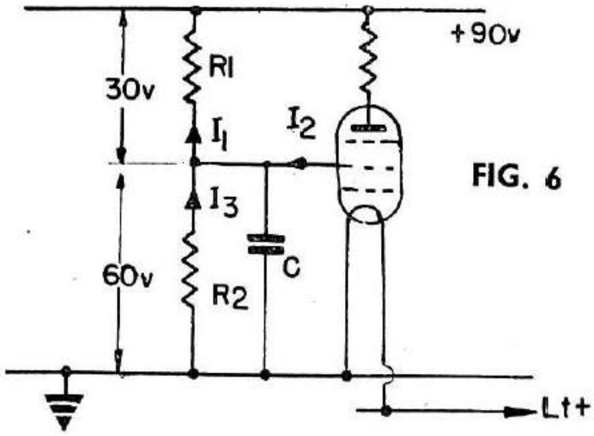


FIG. 6

The beam-tetrode is similar in action but uses, instead of a grid, a pair of beam-forming plates which produce an electric field pattern that deflects secondary electrons back to the anode. The symbol for a beam tetrode is shown in Fig. 5(b) where it can be seen that the beam forming plates are connected to the filament.

The Heptode

The heptode, having five grids, performs the specific function of a mixer valve in a superhet receiver. At the moment we won't go into the operation of this valve, as that will be covered later in superhet theory. The symbol is shown in Fig. 5(c) with the nomenclature of the grids.

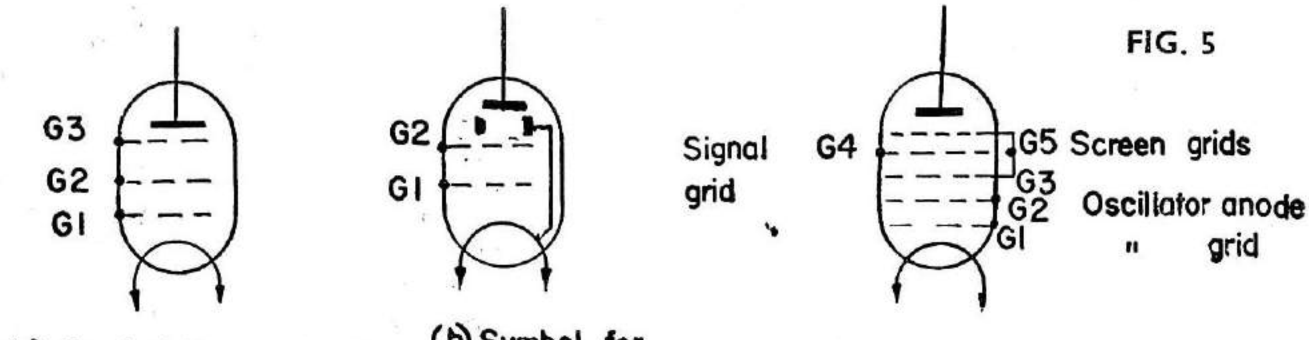
Supplying the Screen Grid

The screen grid gets its supply from a potential divider between H.T.+ and earth. This arrangement is shown in Fig. 6.

Resistors R_1 and R_2 form the potential divider and it is a useful exercise to calculate their value for a particular case.

Suppose that from valve data the screen current = I_s is to be 2 m.A. and the screen voltage is to be + 60v.

For good stabilisation I_3 should be several times this value, say five times,



(a) Symbol for pentode

(b) Symbol for beam tetrode

(c) Symbol for heptode

$= 10$ m.A.

The current I_1 flowing through R_1 is the sum of I_2 and I_3.

i.e. $I_1 = I_2 + I_3$ (Kirchoff's 1st law).

$\therefore\ I_1 = 2 + 10.$

$= 12$ m.A.

Value of $R_1 = \frac{\text{Voltage across } R_1}{I_1} = \frac{30}{12.30^{-3}}$

$= 2{,}500$ ohms or 2.5 K. ohms.

Value of $R_2 = \frac{\text{Voltage across } R_2}{I_3} = \frac{60}{10.10^{-3}}$

$= 6{,}000$ ohms or 6 K. ohms.

Thus it is quite a simple matter to calculate the values of our potential divider.

Because the screen voltage has to be maintained steady, any alternating voltage developed across R_1 must be shunted to earth by the capacitor C. The screen is then said to be 'decoupled' by C.

This just about completes our survey of valves and we are now ready to get down to the circuits using them.

However, having mentioned decoupling, it is as well to take things a bit farther and explain H.T. decoupling.

In a receiver or amplifier where there are a number of stages in cascade (one after another) a signal passing through

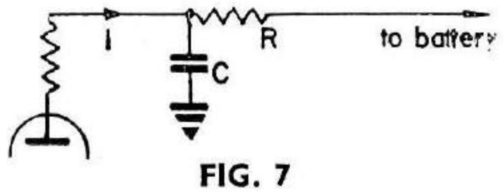


FIG. 7

the system causes anode currents in each stage varying according to the nature of the input to that stage. Because the H.T. battery itself has some resistance, it is possible for these currents, which are drawn from the battery, to develop alternating voltages across it. Because the battery is common to all stages voltages may be injected by it into other stages causing, possibly, self-oscillation and other undesirable effects. The early stages of the equipment are particularly prone to this and are usually decoupled to avoid it. This is illustrated in Fig. 7.

The decoupling components are R and C. The alternating current I flowing out of the valve reaches the junction of R and C. Here it has to make a decision—whether to go through R to the battery or through C to earth!

Since R and C are chosen such that the resistance of R is much greater than the reactance of C, it takes the easy path through C to earth. The D.C. current through the valve, of course, flows through R back to the battery.

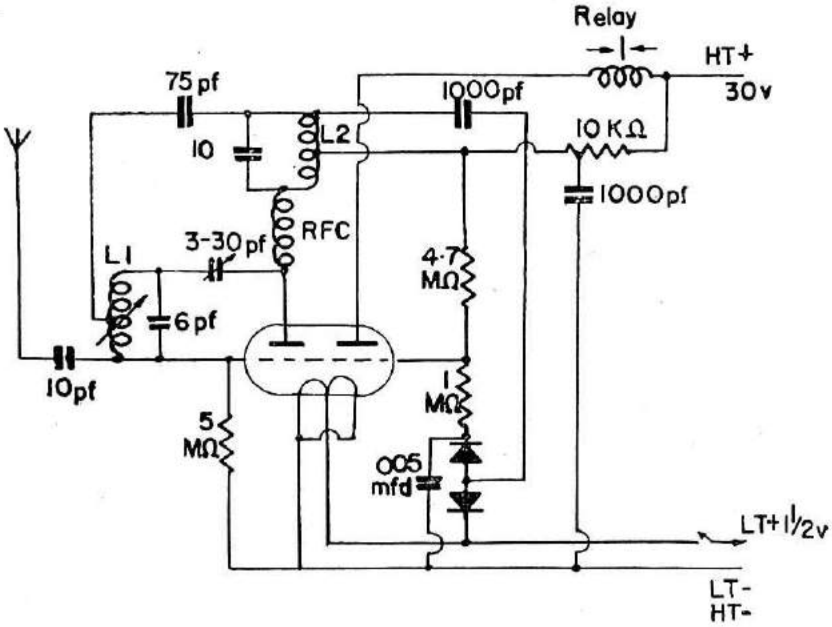
The next article deals with Voltage Amplifiers.

Modification of a Hill Rx.

MODS. BY C. R. WEBSTER DESCRIBED BY HOWARD BOYS

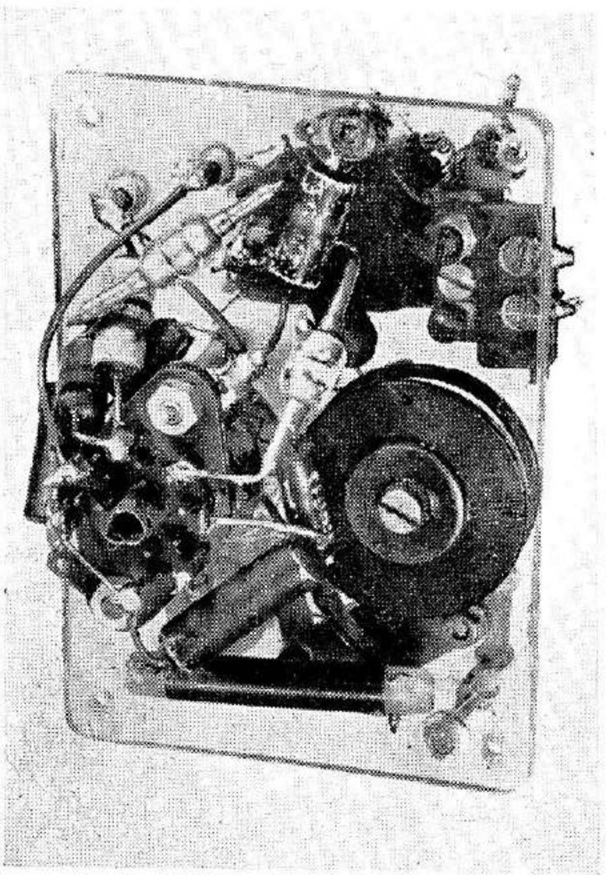
A NUMBER of Northampton Club members building and experimenting with Hill receivers came to the conclusion that, on their particular receivers, raising the H.T. volts to 45 was an improvement. C. R. Webster, being a "gen" man on radio in the club conducted a series of tests which indicated that the detector was not oscillating when on the lower voltage. As weight problems with the larger batteries had to be considered, it was necessary to redesign the chassis to make a lighter and more compact layout. Mr. Webster decided to try one D.C.C. 90 (3A5) valve. This worked very well, and a number of members built receivers to this new design all with first class results. Using 45 volts H.T. the standing current with no signal is 0.3 m.A., rising to 3½ m.A. with signal. This is a very satisfactory current change and does not put such a heavy drain on the small size H.T. batteries. The range

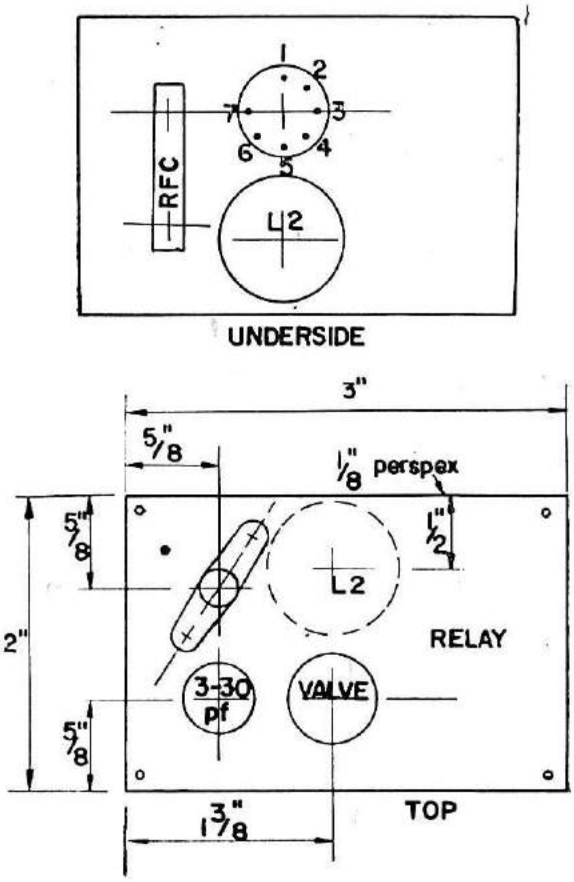
RIGHT : Theoretical circuit with half size dimensioned chassis details below. Photograph shows most of the components, thanks to the use of clear perspex. Home-made relay can be seen on the opposite side top right.



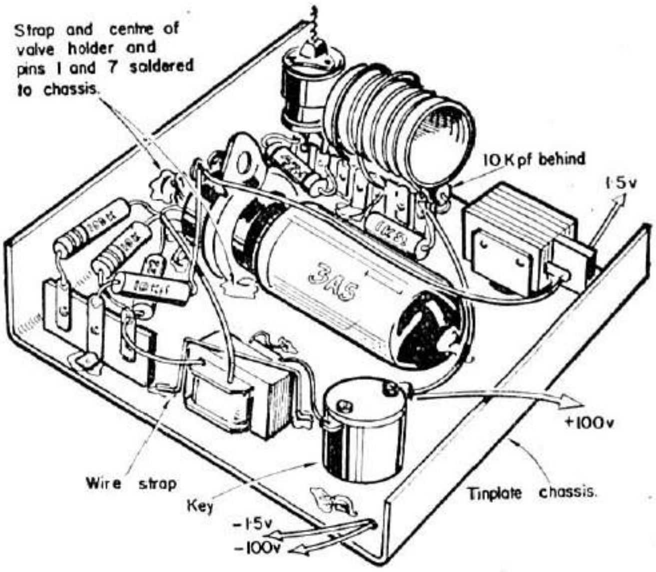
has not been tested further than half a mile on the ground as this was considered adequate. There have been two modifications on later receivers, the first grid resistor has been changed from 5 to 10 megohms, and the condenser from quench coil centre to H.T.—has been changed from 1,000 pf. to .005 mfd. The coil L1 is 15 turns of 28 s.w.g. wire close wound on a ¼ in. iron cored former, with a tap at eight turns from the grid end. L2 is 800 turns of 38 s.w.g. enamelled wire centre tapped on a ½ in. diameter $\frac{3}{16}$ in. wide former $\frac{7}{8}$ in. outside diameter. The relay is a home-made balanced armature type wound to a resistance of 3,500 ohms, the iron parts being coated with engineers blue to prevent rust. The diodes used in the receiver illustrated are OA56 but other types can be used.

It should be noted that the 3A5 has a filament drain of approximately 200 m.A., requiring a D18 or equivalent L.T. battery. Pen cells are definitely out.





Windy Kreulen's Transmitter

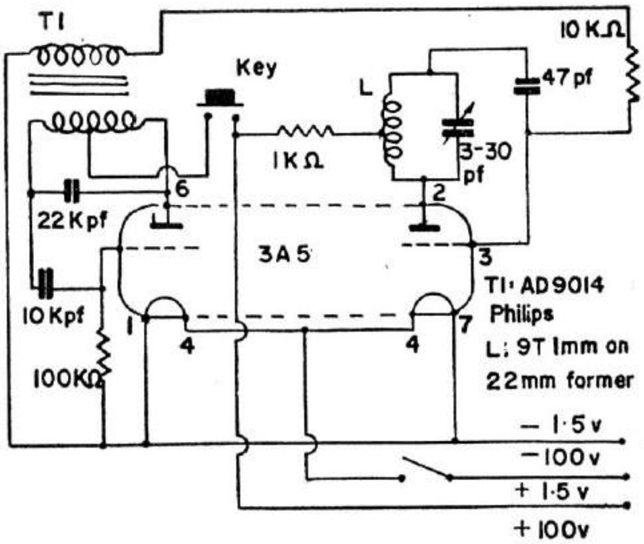


TAKE one valve, one transformer, three resistors and four capacitors, add a couple of switches a handful of tags and one piece of tinplate . . . This is the recipe for "Windy" Kreulen's simple little transmitter, and an example of the typical Dutch procedure to get as much as possible from a few components.

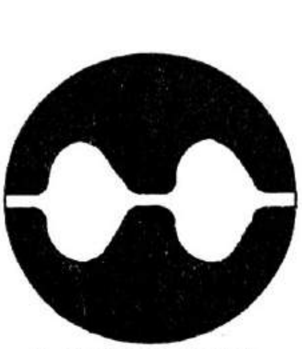
It is possible to substitute a crystal for the 47 pf. capacitor if one wants crystal control. One half of the valve, a D.C.C. 90 (3A5) is utilised to provide sufficient A.F. to modulate the R.F. produced by the other half. A push-pull output transformer (transistor type) proved after experiment to be the solution; the method of modulation used gives some additional output.

"Windy" claims it has more R.F. power than the "Reptone" according to his observations via a monitor. Oscilloscope display indicates the quality of modulation, see below.

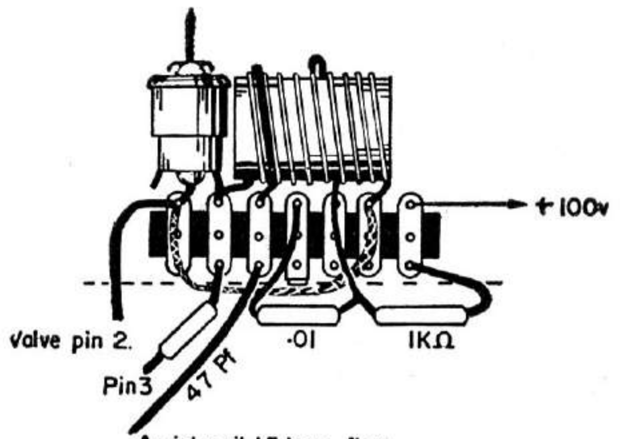
As regards construction there is very little tin bashing, no holes to cut for the valve holder, just bend up the ends for rigidity, modify the tags and mounting strap and solder directly to the chassis. Pins 1 and 7 are earthed in like manner.



Two paxolin tag strips form the sub-assemblies, the larger of which carries the tuning coil (see below). Both the tag strips are soldered to the chassis by their earth tags and the transformer, a Phillips A.D. 9014 is retained by a wire strap (more soldering). Now it is obvious why tinplate is specified for the chassis.



Oscilloscope display



Aerial coil 1·5 loop flex around coil and to earth.

McQUERY COLUMN

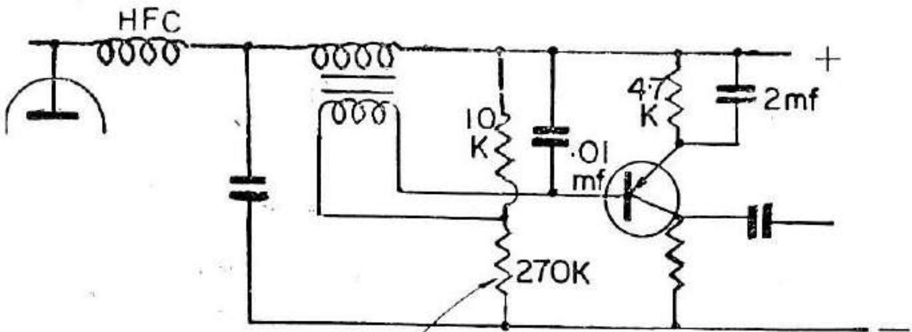
DAVE McQUE WILL ANSWER QUERIES THROUGH THIS COLUMN EACH MONTH, AND WE WELCOME GENERAL INTEREST PROBLEMS. AT THE MOMENT WE CANNOT UNDERTAKE TO ANSWER QUERIES THROUGH THE POST, NOR SHOULD SETS BE SENT TO US UNLESS SPECIFICALLY REQUESTED.

I HAVE recently built an "Aerotone" receiver and have incorporated a R.E.P. 3 reed unit in it. At the present moment the standing current in the absence of a signal is 2 m.A. instead of the specific 0.1 to 0.4 m.A. I have dismantled it twice and rebuilt it, but I still get the same result. I wonder if you could advise me as to what is wrong.

J. C. ROBBIE, BELFAST 5.

With reference to your enquiry I take it that you have incorporated the modification for reeds in your Aerotone Rx., so the standing current would be approx. 2 m.A. falling slightly on signal. It is only when used for single channel that a low standing current is required rising on signal.

Since the article on this receiver's faults have developed in the coupling capacitor in the first transistor stage, and we decided to modify the circuit in order to avoid this. Also within limits any transistor can be placed in the first stage without modifying the component values. Details are given below:



I HAVE built a SIMPLETONE transmitter as "Aeromodeller" March, 1960, all components are as parts list and I am using a Brooks 13.630 Kc/s Xtal.

The set worked perfectly at first, current being CW=4.2 m.A. and with tone 6 m.A., the range was checked at about 300 yards.

After a flying session the Tx. was left aside and when I returned about one hour later I found that the Tx. case was warm, on examination it was found out that the H.T. battery had heated up and was reading 60 volts. I then examined the Tx. for shorts, I couldn't find any, or any reason for above, so I renewed the battery, checked with m.A. meter and everything seemed O.K., but it was noticed that the meter reading was not steady on CW., e.g. with current at 4.2 m.A. it would flicker up to 4.3 m.A. for about ½ second every 10 seconds (checked with stop watch), tone still worked O.K.

Then I transferred the m.A. meter to the Rx. switched on and switched on CW, and sure enough the CW stopped every 10 seconds as above.

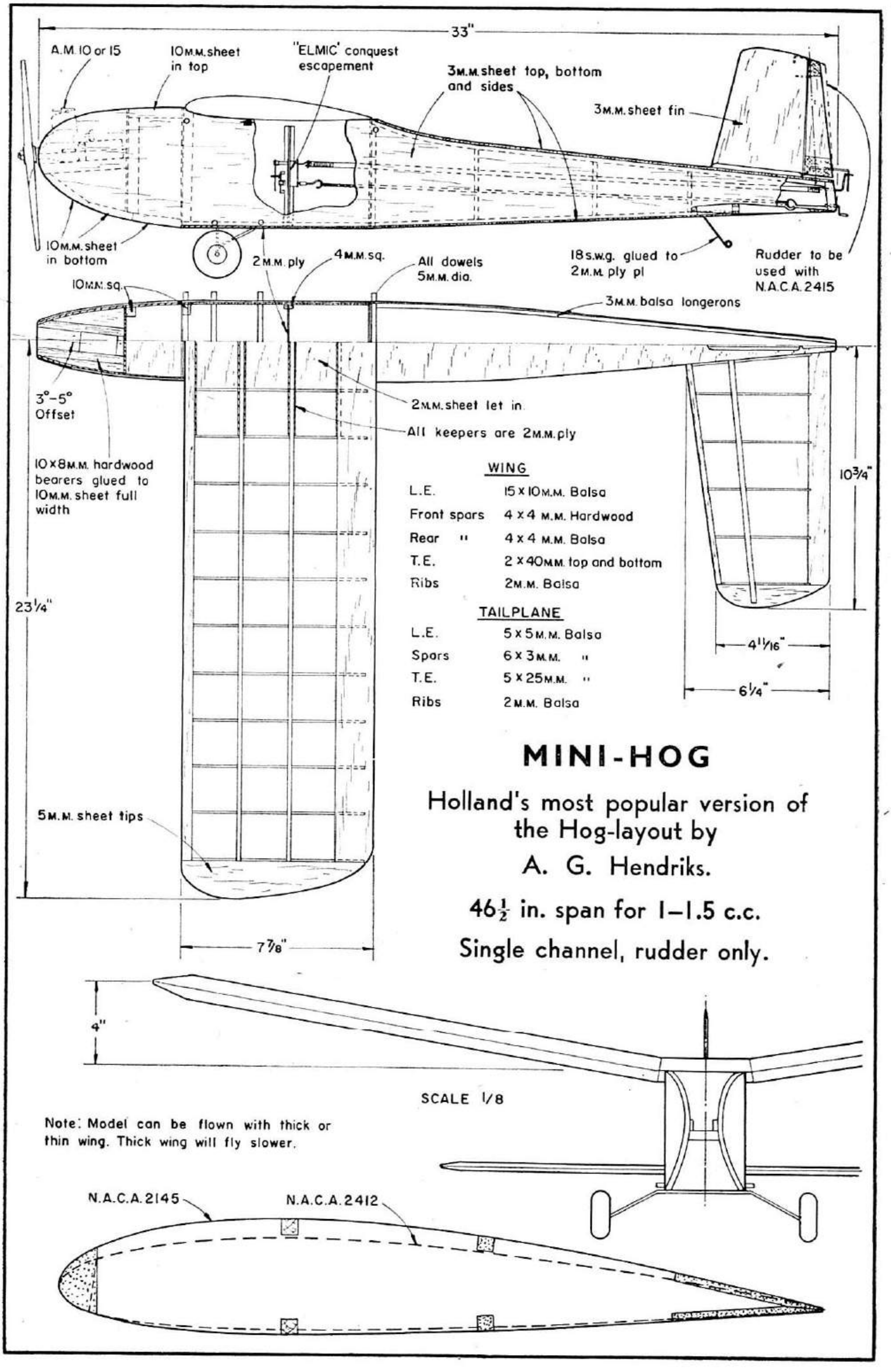
I thought above fault was caused by a faulty condenser, so I changed all the ones I had spares for but it was still the same. But on removal of V1 (tone valve) the CW is O.K. so I think it might have something to do with the tone unit. I had the valves checked, and they are 100%.

I enclose a s.a.e. if you can help.

—L. B., CO. ANTRIM.

The heating of the battery may have been due to an internal fault, or a short near the socket which you would remove when taking out the battery.

As regards the kicking this is quite normal with the grid block keying used. The tone osc. does one cycle every second or so but it takes several cycles to operate a Rx. If a burst of tone occurs then the valve is leaky or the transformer. To avoid replacing a valve which is otherwise O.K. the keying button can be shifted to the screen circuit of the tone osc.


33"
A.M. 10 or 15
10 M.M. sheet in top
"ELMIC" conquest escapement
3 M.M. sheet top, bottom and sides
3 M.M. sheet fin
10 M.M. sheet in bottom
2 M.M. ply
4 M.M. sq.
All dowels 5 M.M. dia.
18 s.w.g. glued to 2 M.M. ply pl
Rudder to be used with N.A.C.A. 2415
10 M.M. sq.
3 M.M. balsa longerons
3°–5° Offset
2 M.M. sheet let in
All keepers are 2 M.M. ply
10 x 8 M.M. hardwood bearers glued to 10 M.M. sheet full width
WING
L.E. 15 x 10 M.M. Balsa
Front spars 4 x 4 M.M. Hardwood
Rear " 4 x 4 M.M. Balsa
T.E. 2 x 40 M.M. top and bottom
Ribs 2 M.M. Balsa
TAILPLANE
L.E. 5 x 5 M.M. Balsa
Spars 6 x 3 M.M. "
T.E. 5 x 25 M.M. "
Ribs 2 M.M. Balsa
10¾"
4 11/16"
6¼"
23¼"
MINI-HOG
Holland's most popular version of the Hog-layout by A. G. Hendriks.
46½ in. span for 1–1.5 c.c.
Single channel, rudder only.
5 M.M. sheet tips
7⅞"
4"
SCALE 1/8
Note: Model can be flown with thick or thin wing. Thick wing will fly slower.
N.A.C.A. 2145
N.A.C.A. 2412

Aristo-Craft Cascade System

Bench tested by

H. T. IVES

"MADE IN JAPAN" used to be a marking which indicated cheap shoddy goods. In recent years, however, we have come to appreciate that the quality of goods from this country has improved tremendously at least in the case of model gear. The O.S. Max engines are an example and the beautiful little timer produced some time ago showed how improved techniques and miniaturization have been achieved.

The Code-a-matic controller and the Quad-trol selective escapement are no exception and form a useful pair giving four selective controls which for aircraft would give independent rudder and elevator and in addition a quick blip button which provides a signal to trigger an escapement for motor control.

The units are not cheap at £4 18s. 0d. for the Quad-trol and £5 19s. 6d. for the Code-a-matic but when compared with say a six reed outfit they compare very favourably.

The Quad-trol escapement is light in weight and functions on 3 volts (a slightly higher voltage is to be preferred in the interests of reliability) with a low current drain (approx. 200-300 m.A.).

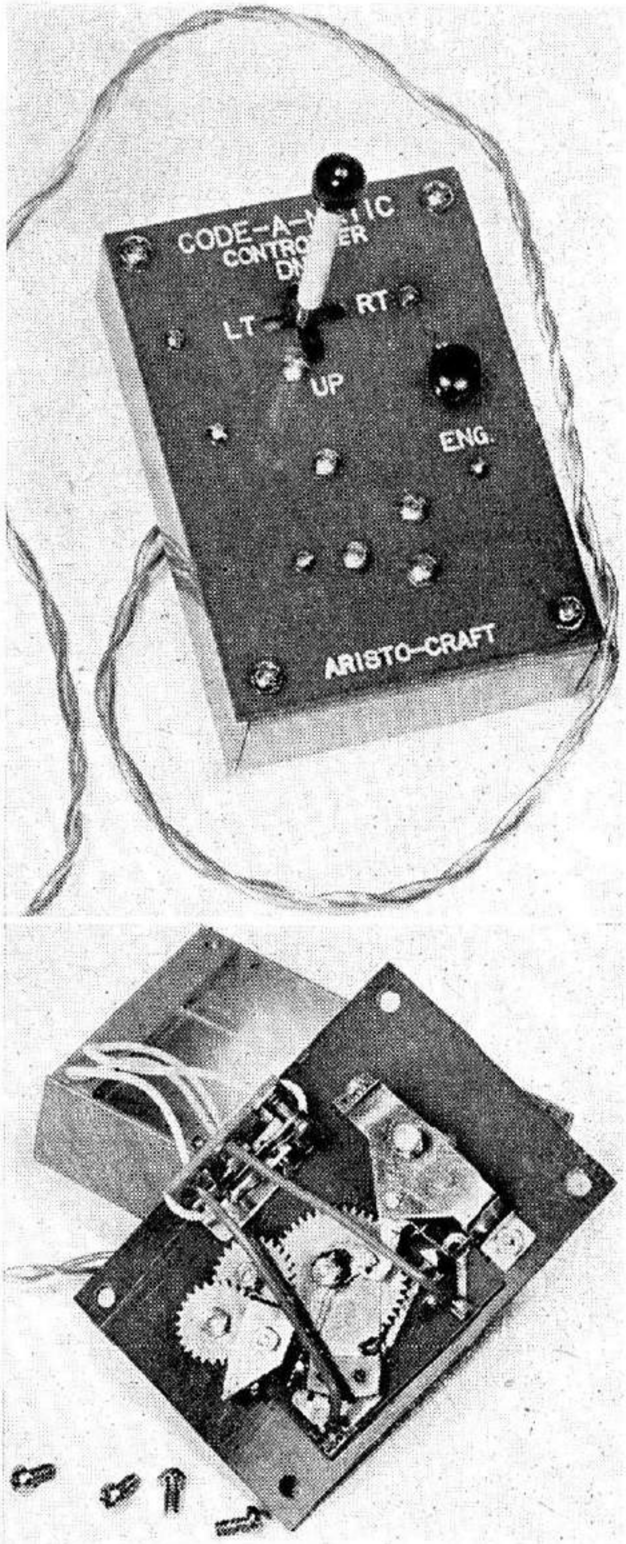
Code-a-matic

The control box is 3 in. × $2\frac{1}{4}$ in. × $\frac{7}{8}$ in. and might seem small for handling. As, however, precision positioning is not needed as in proportional control the size is adequate.

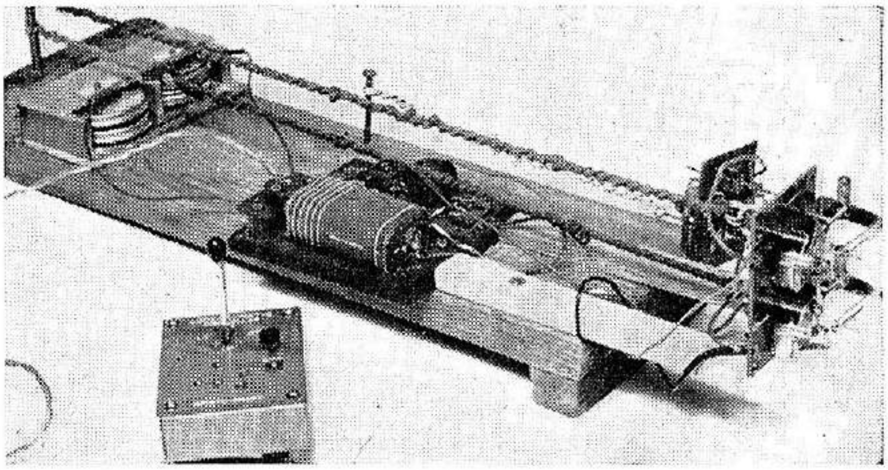
The panel is of bakerlised fabric and incorporates printed circuit switching of the pulse signals.

It has an extremely clever arrangement which provides pulses without having a clockwork mechanism which needs constant winding and which can get out of step when running down.

It utilizes the power applied by the operator when moving the control column. This movement winds up a



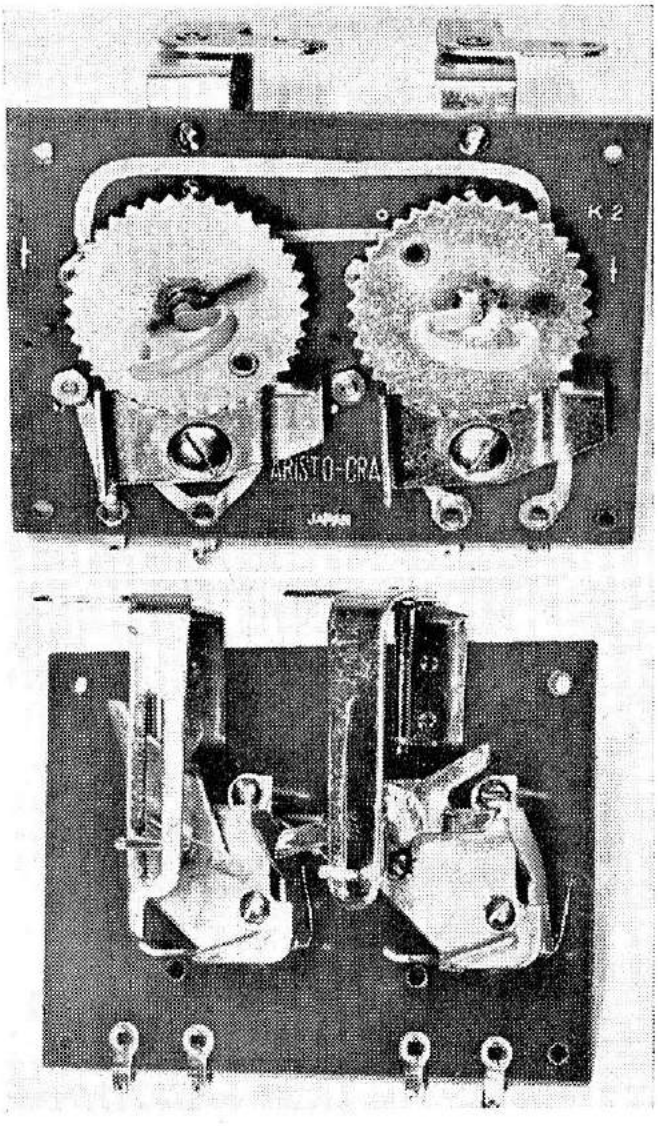
TOP : Pilot's view of the control box, which may be secured to the Tx. case by drilling a ½ in. hole in the latter and utilising a large bush in the back of the controller through which the leads pass. BOTTOM : The "works", Tx. wiper switch may be seen in the bottom corner.



RIGHT : The Quad-Trol on test at the right hand end of the "bread board". An O.D. throttle escapement is visible just behind.

BELOW : Lower and upper illustrate front and rear faces respectively. Rudder and elevator operating arms appear at the top, total throw of rudder arm is 5/16 in. and elevator 7/16 in., there is slightly less throw for left rudder, presumably to accommodate motor torque.

small spring and the spring applies the power to drive a gear train and moves the switch arm. By an ingenious arrangement of shaping the operating arm which controls the movement of the switch this arm always moves in the same direction whatever the direction of movement of the control column. The shaping also controls the length of movement of the switch arm and hence the number of pulses.



Due to the follower action of the operating arm and the automatic winding of the spring the pulses are always constant in length and timing. To ensure 100% reliability therefore all that is necessary is to have the correct voltage for the escapement, the correct rubber motor and to see that the escapement motor is not allowed to run down unduly.

The switch arm slides over the printed circuit switching and gives the following signals.

Control column moved to the right—continuous signal. Control column moved to the left—on-off-on. Column moved back (up elevator)—on-off-on-off-on. Column moved forward (down elevator)—on-off-on-off-on-off-on. On the return journey a switch incorporated in the operating arm breaks the Tx. circuit and no pulses are transmitted. The actuator then returns to neutral.

Motor control is provided by the inclusion of a button which on pressure causes an arm to flick across a V-shaped piece of springy brass giving a quick blip. On the return journey a switch is broken and no blip occurs. The blip occurs therefore only on the forward movement of the arm.

Quad-trol

The escapement panel is of bakerlised fabric (Tufnol) and incorporates a printed circuit switching for the twin actuators.

Size of panel is $2\frac{3}{4}$ in. × 2 in. and weight is 2 ozs.

The control functions are as follows:—

(1) Right turn—signal on and held.
(2) Left turn—signal on-off-on.
(3) Up elevator—signal on-off-on-off-on.

(4) Down elevator—signal on-off-on-off-on-off-on.
(5) Motor control. Press button gives quick blip.

The signals off are all quick blips which give the escapement armature just time to release the claw and return to the on position.

For (1) the primary actuator arm rotates approx. 60 degrees from neutral; (2) the primary actuator arm rotates approx. 240 degrees from neutral; (3) the primary actuator arm rotates approx. 350 degrees from neutral.

At (3) it also makes contact on the switch plate thus energising the secondary actuator (elevator) which then moves approx. 85 degrees. The secondary actuator breaks the circuit of the primary actuator which returns to neutral. The secondary actuator remains in the control position until the signal ceases.

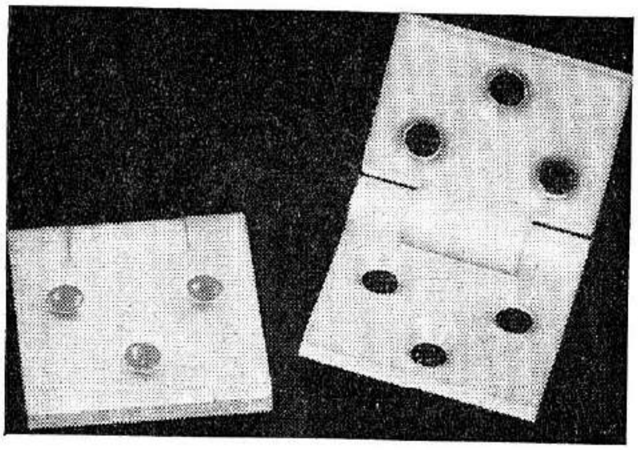
(4) The actions in 3 are repeated and in addition the extra pulse, which does not affect the primary actuator because it is switched off by the secondary, moves the secondary a further 180 degrees.

In both (3) and (4) the primary actuator is switched off and cannot be operated until the secondary returns to neutral. The secondary actuator is only operated at one position of the primary and when giving rudder signals the primary passes too quickly over the elevator switch point to allow the secondary actuator to be released.

Movement of the control surfaces is obtained by the use of a slotted arm which engages with the crank and changes the direction of movement so the push rods can be used for linking.

The motor control operates on the principal that if the relay receives a quick blip and returns to its back contact before the actuator reaches the first position the motor escapement receives a brief signal through the primary actuator switch plate. It can only do so if the relay armature is resting on its back contact. For all other signals therefore the relay armature is on its forward contact for the first movement of the actuator and no blip can be sent.

In use provided sufficient voltage was applied (3.6 from say 3 DEAC cells would appear to be the minimum for absolute reliability), the control responded with unfailing regularity. Provided the recommended size of rubber is not exceeded the units can be recommended with every confidence.



New Equipment

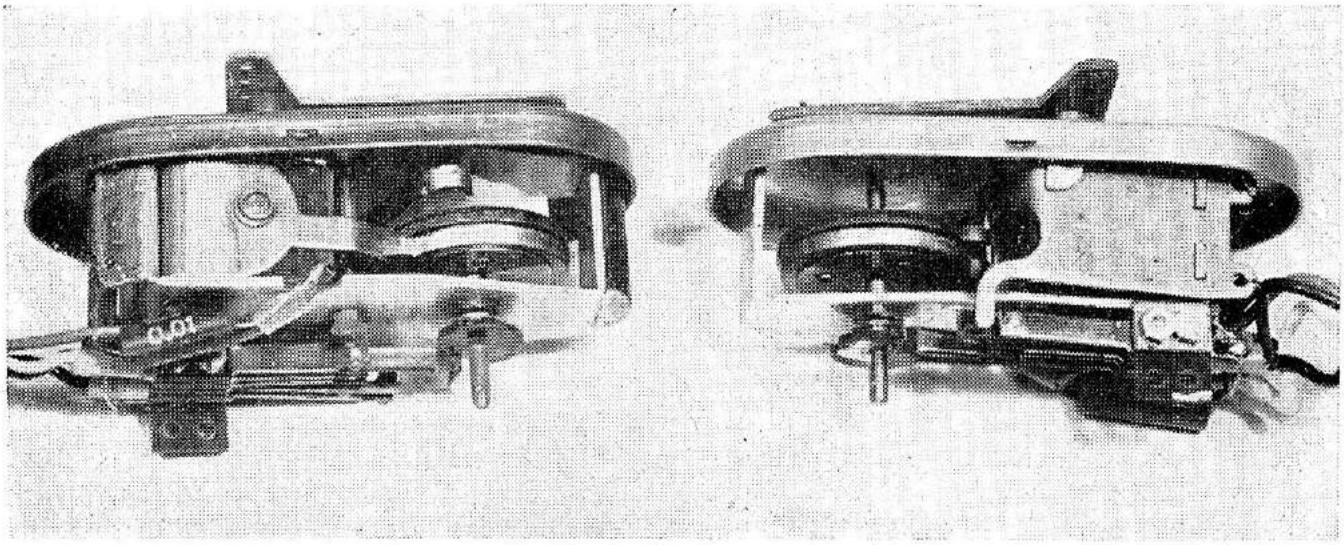
ITEMS OF INTEREST TO OUR READERS WITH PARTICULAR EMPHASIS ON THEIR RADIO CONTROL USE. WE WELCOME SUCH NEW PRODUCTS FOR UNBIASED COMMENT

Handy Hinges

OUR local hardware store yielded some very useful nylon hinges in the ready packaged range. Ideal for control surface use, the examples illustrated are back flaps and are shown slightly less than full size. The material allows for slight deflection and would obviate frictional losses which might otherwise be incurred when flight stressed. Price of our set of two, plus screws, was 1s. 2d.

Miniature Plugs and Sockets

Now for a "plug", or more correctly, a multi-pin plug and socket series; marketed by both Roland Scott and Ed. Johnson, Crescent industries manufacture very neat, ultra small sets for 7, 9 (shown assembled) and 15 pin types. One has to squeeze the socket components gently to assure good electrical contact, and press them into holes in a plastic block, the pin assembly being already complete. Tweezers are a



"must" as a heat shunt when soldering the wires in place.

We advise placing the plug in the socket before soldering; and, as the wires have no support within the plug or means of clamping them to the socket, that, after soldering, the cap should be filled with potting compound or wax and a clip should be incorporated in the socket, i.e. a pinch plate retained by the mounting bolts.

"Telematic" Twins

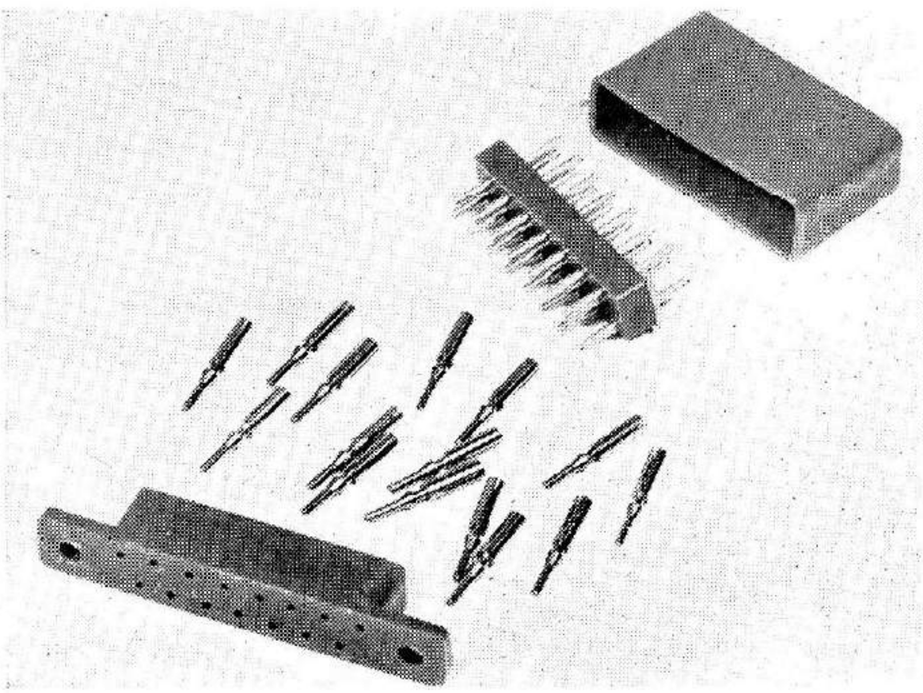
Graupner Bellaphon "Telematic" servos provide two position, self-neutralising control in response to signals comprising one for LEFT and two for RIGHT. Photograph shows "Alpha" on the left and "Beta" to the right, the latter has positive mechanical stops and is vibration proof, an essential requirement of a servo to be used in power models.

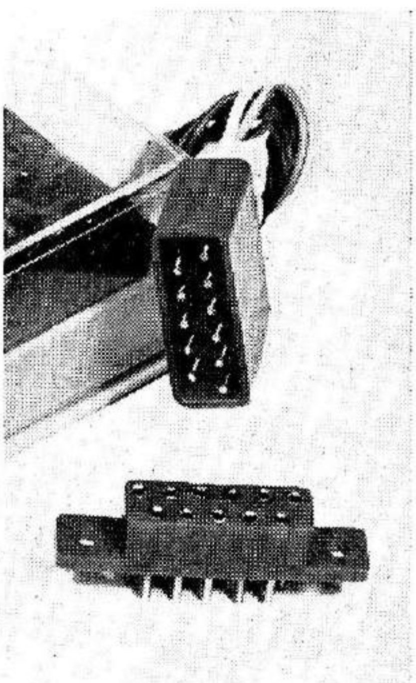
New Min-X Rx.

Min-X Radio, Inc., advertise a new six-channel all-transistor receiver and separate relay pack.

The Min-X transmitter is non-simultaneous and 100% tone modulated. Gold anodised case is $8\frac{1}{4}$ in. × $6\frac{3}{8}$ in. × 3 in., lever switches. The receiver is powered by two pencells and is temperature compensated, fibreglass-epoxy P.C. board is silver plated. Size of the Rx. is $2\frac{3}{8}$ in. × $2\frac{1}{16}$ in. × $1\frac{1}{16}$ in.; weight 3 oz. Relay pack brings the weight up to $6\frac{1}{4}$ oz. and is 3 in. × $1\frac{13}{16}$ in. × $1\frac{1}{4}$ in.

An advantage if separating the relays from the Rx. is that relayless servos or "Servistors" may be used. Min-X supply a conversion kit to enable owners of their single channel receivers to convert to six channel.





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TRADE : Minimum 18 words 6s. and 4d. per word for each subsequent word.
Box numbers are permissible — to count as 6 words when costing the advertisement.
COPY should be sent to the Classified Advertisement Dept., "Radio Control Models & Electronics", 38 Clarendon Road, Watford, Herts.

MARBLEHEAD Class HULLS in glass fibre. "Jemima Duck" and "Doris-H" designs available immediately from stock. Price £6.10.0d. each, includes Assembly Plans and Free Delivery. Trade enquiries invited :- ROBERTS, 'The Gables', Dragons Green, Shipley, Horsham, Surrey.

TERYLENE and Cloth SAILS for radio—controlled yachts.—ROBERTS, 'The Gables', Dragons Green, Shipley, Horsham, Surrey.

SEXTONE Tx. converted to 8 channels, £12.0.0d. R.E.P. 6 & 8 reed units, 1 of each, 25/- and 30/-. F.R. compound and clockwork escapements, 1 of each, 25/- and 20/-. 6 R.E.P. relays, 13/- each. 2 miniature Siemens relays, 5,000 and 100 ohm coil, 1 of each, 16/- each. Frog 1.5 c.c. diesel, 20/-. 1 Siemens H.S. relay, 10/-.—J. A. PARTON, 15 Imber Avenue, Boscombe Down, Salisbury, Wilts.

ESSCO Twin Miniature tube 27¼ mc. cw. Rx., 45 volt battery, switch, plug. Excellent for pulse. Price £4 (pounds) post paid.—E. C. HAYDEN, 22 New Street, East Islip, L.I., N.Y., U.S.A.

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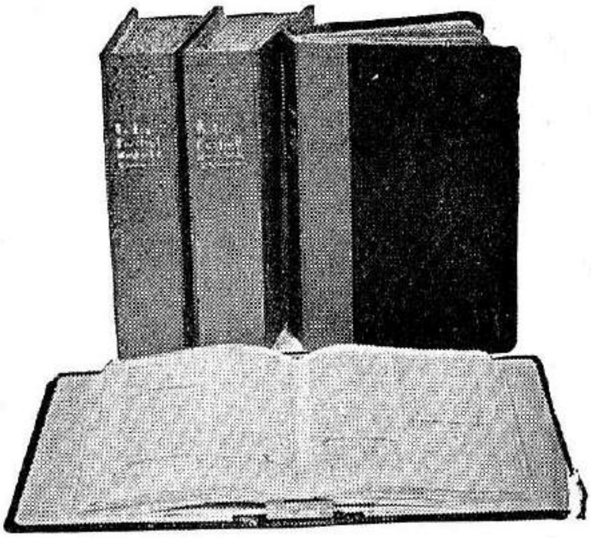

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With this re-tooling achieved we shall then be turning our minds to a regular series of products angled specifically towards the home-constructor and designed to ensure finest results with super-sure constructional methods.

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British Patent No. 747742

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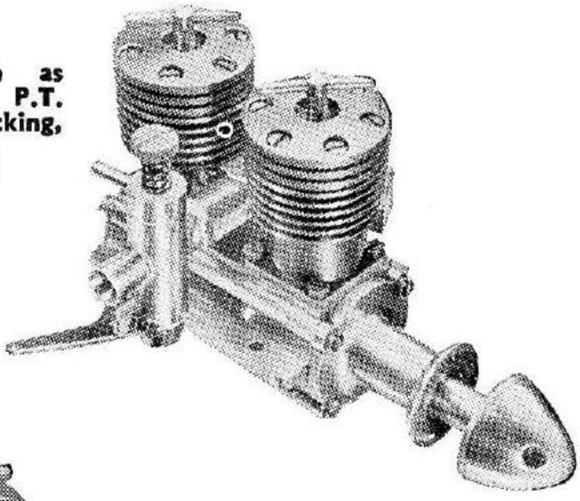

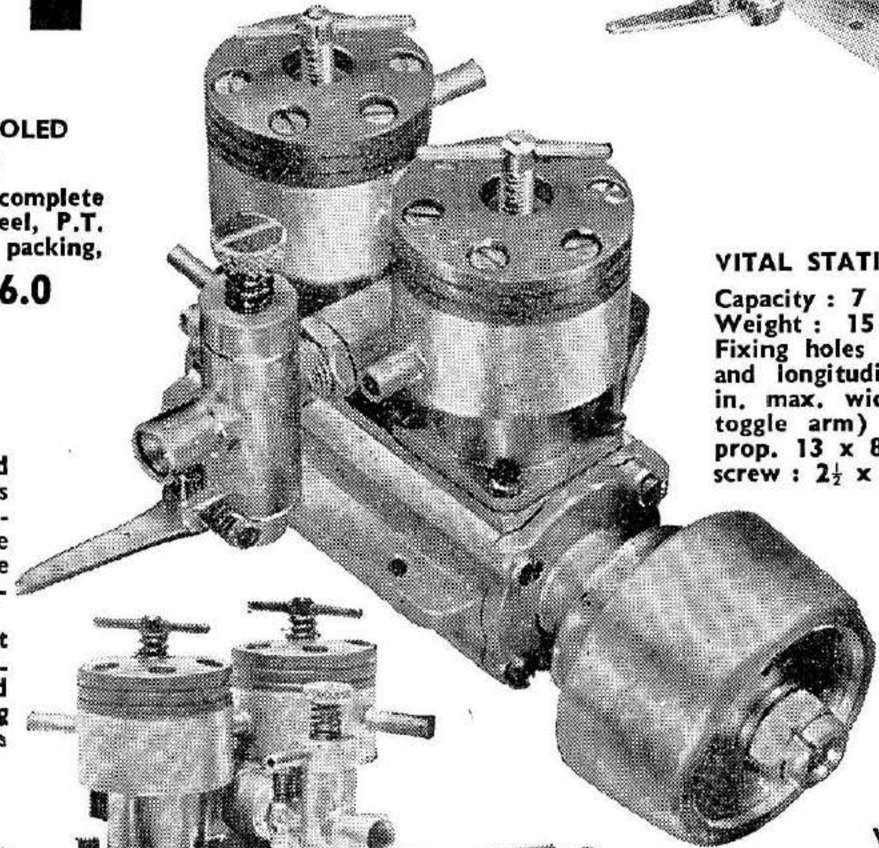

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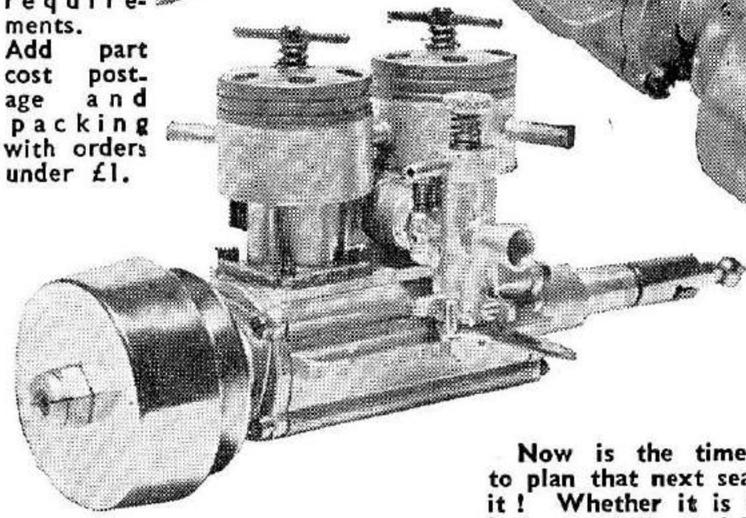

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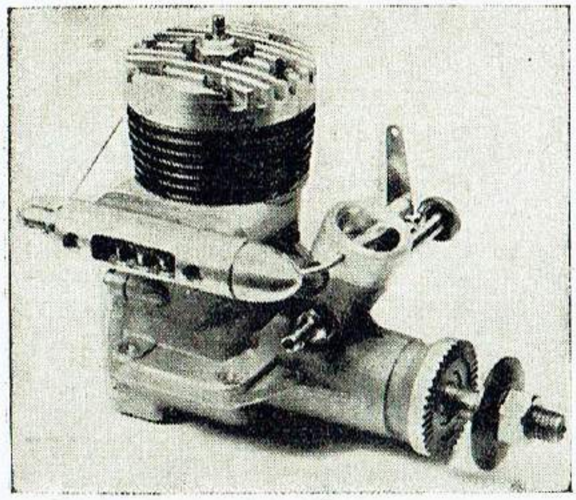

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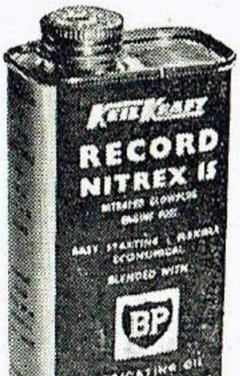

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(i) Reactance of a capacitor can be read directly for any frequency by selecting the appropriate (right to left down slanting) diagonal corresponding to the capacitor value and reading the reactance in ohms on the bottom scale where this diagonal cuts the frequency.

(ii) Reactance of an inductor can be read directly for any frequency by selecting the appropriate (left to right down slanting) diagonal corresponding to the inductor value and reading the reactance in ohms on the bottom scale where this diagonal cuts the frequency.

(iii) Matched values of capacitance and inductance for resonance at any particular frequency can be read directly. For resonance at any particular frequency the corresponding capacitance and inductor diagonals must cross at that frequency.

(iv) Resonant frequencies of any particular capacitor, inductance combinations can be read off directly. The resonant frequency corresponds to the frequency value at which the diagonals cross.

(v) Approximate variable capacitor range required for tuning an inductance at a given frequency or frequency range can be read by determining the upper and lower values of capacitance required given by the two diagonals crossing the inductance diagonal above and below the desired frequency range.

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Where necessary, intermediate values can be interpolated.

INDUCTIVE & CAPACITIVE REACTANCE CHARTS