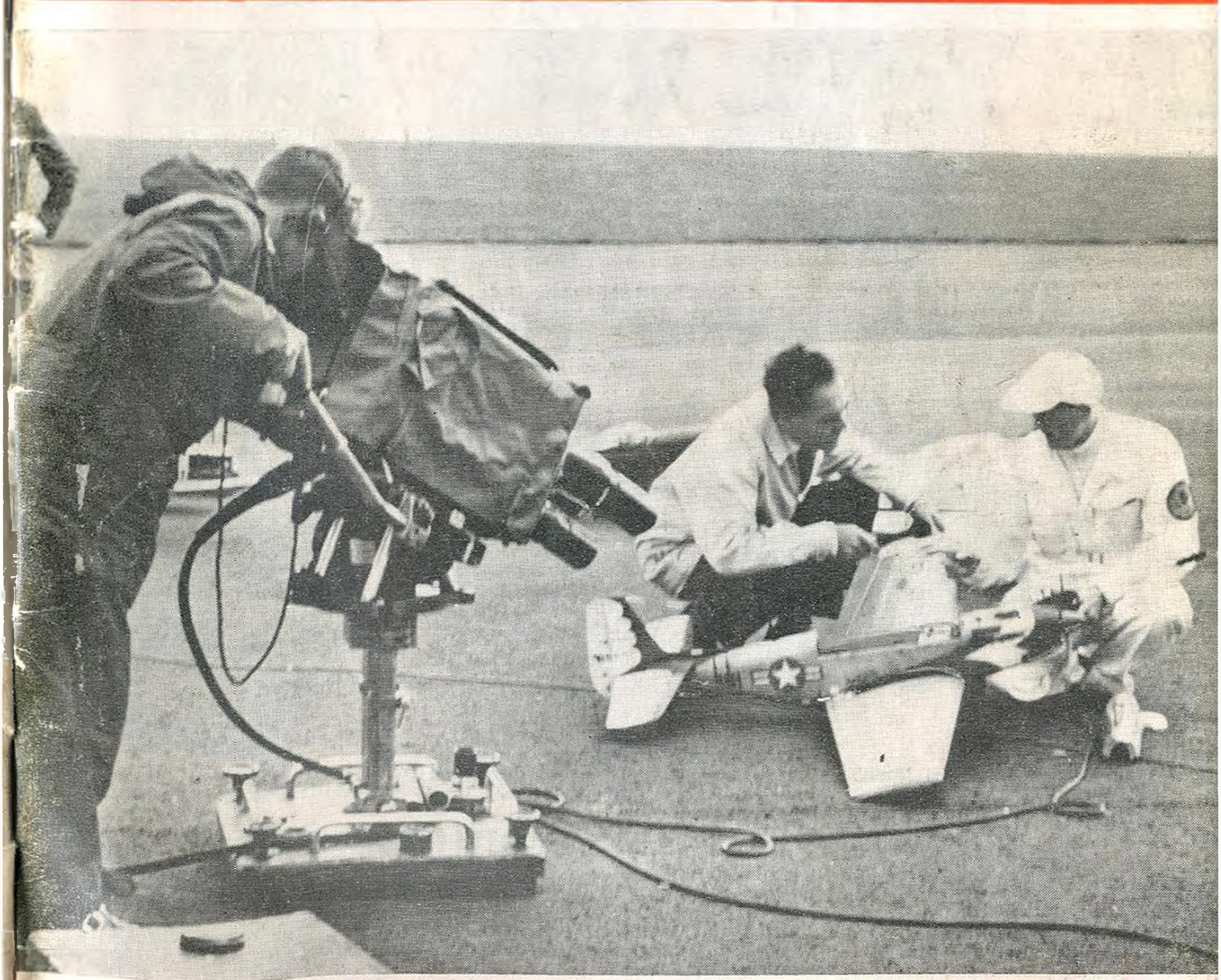
NOVEMBER . . . 1962

RADIO CONTROL MODELS & ELECTRONICS

PRICE 2s

USA AND CANADA 40 CENTS

DETAILS OF ALL THE WORLD R/C CHAMPIONSHIP MODELS



★ FEATURING THE NEW 305 Rx. ★

THE R.E.P. STORY ★ SINGLE BATTERY SERVOS

METZ BABY Tx. & Rx. REVIEW ★ BIG GADGET SECTION

RADIO CONTROL MODELS & ELECTRONICS

NOVEMBER 1962

VOLUME 3 NUMBER 11

Editorial Director
D. J. LAIDLAW-DICKSON
Advertisement Director
C. S. RUSHBROOKE
Editor
W. P. HOLLAND

Editorial and Advertisement Offices :
38 CLARENDON ROAD
WATFORD, HERTS
Telephone :
WATFORD 32351/2
(Monday to Friday)

CONTENTS

NEXT MONTH . . .

Highlights of the issue include . . .

MULTI Tx. FEATURE
"SIX GUN" (the Nats. single winner)
"GYPSY MOTH" CONVERSION
SIMPLE BOAT CONTROL
CHRISTMAS CONCOCTIONS
LATEST EQUIPMENT ON TEST
COMMERCIAL DEVELOPMENTS
GADGET PAGE

Plus the usual favourites

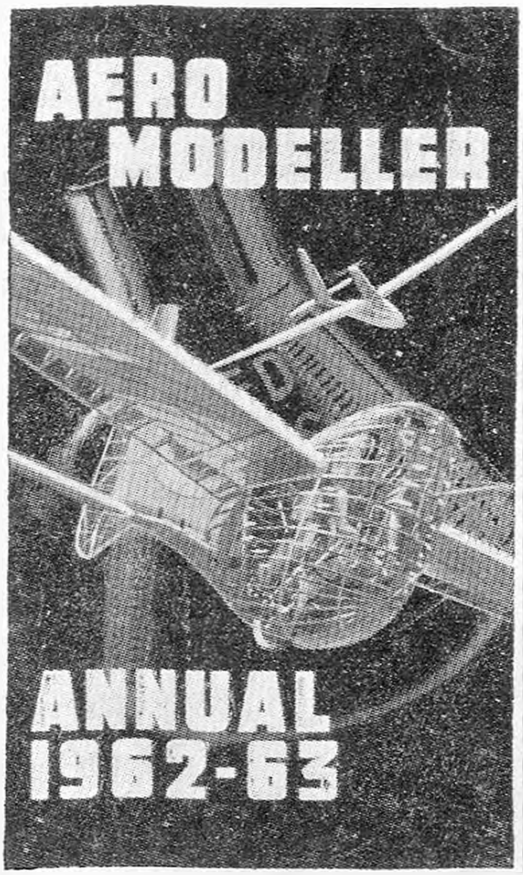
CORRESPONDENCE anticipating a reply to addresses within the United Kingdom, must be accompanied by a stamped and self-addressed envelope. Photographs should be accompanied by negatives where possible and can only be accepted for use on an exclusive basis for British copyright.

Second class postage rates paid at New York, N.Y. Registered at the G.P.O. for transmission by Canadian Magazine Post. American enquiries regarding subscription, news stand sales and advertising should be sent to : RADIO CONTROL MODELS & ELECTRONICS, Eastern News Distributors Inc., 255 Seventh Avenue, New York 1, N.Y., U.S.A.

Direct subscription rate (Inland) 28/-, (Overseas) 27/- per annum including index. U.S.A. and Canada direct rate $4. RADIO CONTROL MODELS & ELECTRONICS is published monthly on the second Friday of each month prior to date of publication by :—

MODEL AERONAUTICAL PRESS LTD.

AERO MODELLER ANNUAL



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

160 pages, size 8½ x 5½ in., with full colour cover painting on high quality gloss paper, 36 model plans, hosts of articles, sketches, photos.

PRICE 10/6

Booklets a

RADIO CONTROL WITH VIBRATING REEDS
By R. H. Mapplebeck
Covers complete instructions for building 3-valve Rx. and 3-valve handheld Tx. to suit, including making of reed bank. Not miniature equipment but ideal for boat use. 16 pages of detailed information. **3/6**

HILL 2-VALVE RECEIVER
By E. R. Hill
Eight-page booklet gives full constructional data for both standard and miniature versions of most successful carrier-wave sets for aircraft, current rise 0.4 m.A. to 4.0 m.A.
RC/664 2/-

GALLOPING GHOST and pulse proportional data
All published information on single channel proportional radio control summarised in special booklet. Includes top-line U.S.A. and British expert advice with installation circuits for pulsed rudder, Galloping Ghost Rudder/Elevator with or without engine control and simple dual proportional.
RC/735 3/6

AEROTONE
By Tommy Ives & P. Lovegrove
A single- or multi-channel tone set for modulated transmitters. Temperature stable, can be built for £4, weighs 2½ ounces, needs only two small batteries and measures 3 in. x 1½ in. Current rise from 0.2 m.A. to 4 m.A.
RC/728 2/-

SIMPLE RADIO CONTROL

CONTENTS : BASIC PRINCIPLES : THE TRANSMITTER : THE RECEIVER : THE RELAY : ACTUATORS & CONTROL GEAR SOLDERING : MULTI-PURPOSE METER : THE "AEROMODELLER" TRANSMITTER : THE AM/IVY TRANSMITTER : THE NEW IVY RECEIVER : THE HILL Mk. II RECEIVER : THE "AEROMODELLER" TRANSISTOR RECEIVER : PROPORTIONAL CONTROL : THE MODEL : INSTALLATION : TUNING : PRE-FLIGHT PREPARATION RANGE CHECK & FLYING ROUTINE : FAULT FINDING APPENDICES, USEFUL CHARTS & PLANS.

Size 8½ x 5½ ins., 96 pages, bound in two-colour card cover drawn on, plus 8 pages of art plates covering equipment and models, innumerable clear circuit drawings, wiring diagrams and sketches . . . .

PRICE 6/-

MAP The Finest Range of Model

MODEL AERONAUTICAL PRESS LTD.

nd Circuits

AEROMODELLER TRANSISTOR Rx.
By Tommy Ives
Popular carrier wave set for small models, follows fast pulsing has lightweight and low battery drain virtues.
RC/736 2/-

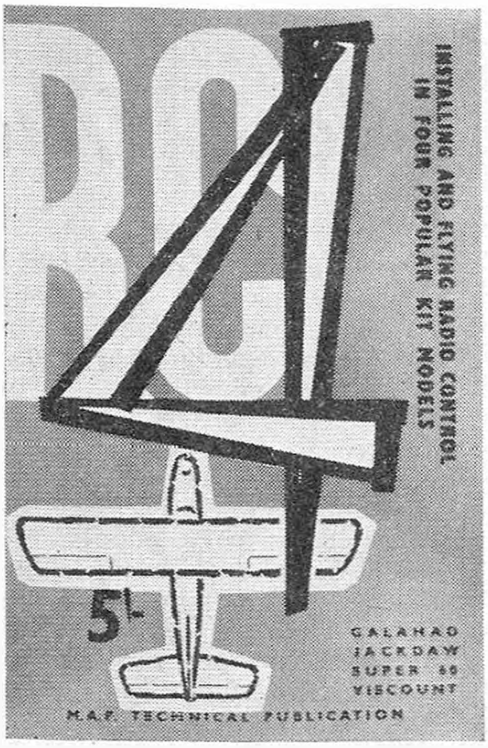
IVY-AEROMODELLER CARRIER WAVE RECEIVER
Ideal and inexpensive project for the beginner. Well-tried Ivy circuit brought up-to-date. Full stage-by-stage instructions in six-page leaflet.
RC/795 2/-

IVY-AEROMODELLER CARRIER WAVE TRANSMITTER
Simple single channel C.W. Tx. for use with Ivy Rx. Suitable for beginners. Hand-held with telescopic aerial. Eight-page leaflet.
RC/794 2/-

IVY-AEROMODELLER TONE TRANSMITTER
Development of the Ivy/AM CW. Tx. P/C technique makes it as simple as C.W. version. Suitable for "near" beginners. Six-page leaflet.
RC/801 2/-

HILL TRANSMITTER
A X-tal controlled Tx. by Eric Hill is recommendation in itself. Can be simple or Incorporate Tone, Control Box for tuned reeds, etc., in fact it should last a modelling lifetime. 10-page leaflet.
RC/802 2/-

R/C BIG 4



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

Sixty-four pages, size 8½ x 5½ ins., with two colour carc cover. Copiously illustrated with plans, drawings, photos and text by Tommy Ives, Frank Knowles, Stewart Uwins, Ernie Webster, Phil Smith, Tony Dowdeswell.

PRICE 5/-

USE THIS COUPON

Postage: Add 1/- up to and including 12/6; above that post free. Booklets: 1—4d.; 2 or more—6d.

AIRCRAFT IN MINIATURE	12/6	MODEL CAR RAIL RACING	5/-	CARDBOARD ENGINEERING	5/-
FLYING SCALE MODELS	10/-	MODEL MAKER MANUAL	10/-	BOAT MODELLING	5/-
SIMPLE RADIO CONTROL	6/-	SECRETS OF SHIPS IN BOTTLES	4/6	POWER MODEL BOATS	12/6
MODEL BOAT RADIO CONTROL	7/6	AEROMODELLER ANNUAL 1962/3 Edition	10/6	MODEL AERO ENGINE ENCYCLOPAEDIA	12/6
CONTROL LINE MANUAL	15/-	PLANS HANDBOOK	2/-	AEROMODELLER POCKET DATA BOOK	5/-
DESIGN FOR AEROMODELLERS	5/-	GLASS FIBRE FOR AMATEURS	7/6	R/C BIG FOUR	5/-
SCALE MODEL CARS	5/-			BOOKLETS (Insert ref. no.)	

Name

Address

Sum enclosed £ s d

Technical Books in the World!

38 Clarendon Road, Watford, Herts

Here, There & Everywhere

Editorial Staff Changes

FROM the first issue of *R.C.M. & E.* in May. 1960. T. H. ("Tommy") Ives has been our Consulting Editor. which has meant exactly what it says. that we have consulted with him on articles and policy. and. nearly always. taken his advice. In addition he has contributed original articles and developed new equipment along lines we have considered likely to be popular. All this we should emphasise has been a part-time job for Tommy; he would not sacrifice the first years of his retirement by taking up other full-time employment.

Now *R.C.M. & E.* has established itself. and we should like to place on record our very great debt to Tommy for the work he has put in to help make this possible, but its very expansion has made a whole-time Editor essential. So we must bid him a very cordial farewell in his capacity as Consulting Editor. We hope he will still find time to contribute to our columns with those special features that he does so well. He will. we understand. continue to be associated with radio control modelling on the development side of Macgregor Industries who have produced so many of his brain children commercially. and in common with our readers wish him many bright ideas for our mutual benefit and no cold joints!

Meanwhile. W. P. ("Peter") Holland. who has been acting as Assistant Editor since March. 1961. now takes possession of the Editorial Chair. He needs no introduction as a practical modeller in many fields. and his spare, bearded figure is a familiar sight wherever models are flown or floated under r/c. He is also something of an artist. so that *R.C.M. & E.* must be one of the few technical magazines where articles are both written and illustrated by the editor. We shall continue to call upon the services of the editors of *Aeromodeller* and *Model Maker* to make up an editorial committee to advise on content of this magazine. but Peter Holland will be steering the boat!

Do It Yourself Runways

The East Grinstead (Lingfield) band of Radio Control modellers, few in number but progressive in outlook have stripped the turf from a 200 ft. x 60 ft. section of their official flying area and use the consolidated dirt strip as a runway. They now need a few more members to take advantage of the new facilities and plan to limit their number to 24 so that the take off queue would not become too lengthy. Interested multi flyers should contact G. A. Kemp, "Wentworth", Smallfield road, Hawley. Surrey: Tel.: Hawley 326. The probable annual subscription will be around £2. it should be stressed that only multi modellers should apply.

Practical Instruction

Readers in the Wigan area will probably have noticed an advertisement by the Technical College for instructional courses on radio. This evening series includes practical work on model radio control equipment for the modeller who wishes to know more about his type of radio. this is an opportunity which definitely should not be missed.

By the time you read this the course will be well under way as enrolments were taken from September the 5th, as readers in the district were probably aware and are now enjoying expert help with the construction of some simple radio gear. Wigan Tech. is to be congratulated on their choice of subject. let us hope that similar facilities will be available in other districts.

Remember chaps, if you want a course like this, you might be able to get your way if a sufficiently large number of you give the appropriate professor a combined dig in the ribs.

It's the Limit

There appears to be a certain lack of awareness concerning "Model" limitations as required by the Government. L. Watson's 14 ft. 9 in. "Goliath" enlargement (which we illustrated last month) has prompted several enquiries and for the record we have investigated the possible official action which might be taken under the Air Navigation Order, 1960, which is the law for all civil flying over this country.

It is clear from Article 81 of the Air Navigation Order. 1960, that if an aircraft weighs over 11 lb. without its fuel. all relevant articles of the Air Navigation Order apply to it unless special exception is obtained from the Ministry of Aviation. That is to say, without such exemption an aircraft would have to be registered and issued with a permit to fly or a certificate of airworthiness.

There are various provisions in the Order for what we call "Model" aircraft of all types, including balloons, kites and airships. However, for model gliders and powered aeroplanes which come within the 11 lb. weight limitation, the only applicable part of the Order is Article 38 which applies to all aircraft and which states: "A person shall not wilfully or negligently cause or permit an aircraft to endanger any person or property". *It would be a good thing for our hobby if all modellers were to bear this in mind.*

. . . What was that ?

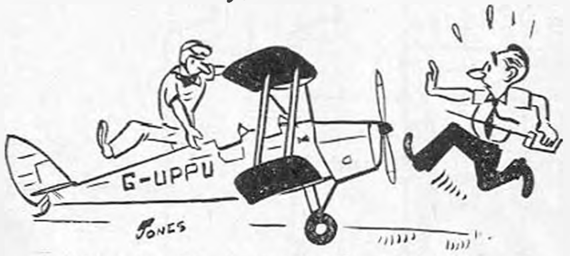
Why ultrasonics of course! Our preliminary peeps at forms of control other than by radio under the heading of "Why Use Radio?" in June, 1962, issue may have prompted Messrs. Gulton Industries (Britain) to tell us they have applied their ultrasonic Transducers to control a model railway circuit.

Anxious to investigate the possibility of other applications, we have asked for further gen. At first sight, the Transducer is an extremely compact little item, and may be used as a transmitter or receiver for short range work. With a commercially available piece of equipment such as this we can foresee a much wider application of control systems to gladden the heart of the experimenter.

Are we to see a new era in the remote control field? Perhaps we are pipe dreaming, but you may rest assured just as soon as we have a foolproof application, it will appear in our pages.

Great Minds Think Alike

Proof that one is on to a good thing is often brought home to us in a rather backhanded way, when one discovers



Stop! You can't fly that . . .
It's my new scale job!

that someone else has an almost identical solution to the same problem. It is even more disconcerting to discover that the other bod "got there first".

However, these things happen today, when logical solutions to a given problem are, naturally enough, similar if not identical. It is no less an achievement on the part of the second experimenter if he independently arrives at the same answer.

Now "Windy's" transmitter turns out to be one such instance. The circuit which "Windy" together with other Dutch modellers arrived at in the course of their experiments is, with the exception of the tone generator part, almost identical with one which was published in "Funkschau" by Helmut Bruss last year. This is a German technical publication which deals primarily with the more advanced domestic equipment. We had hoped that *R.C.M. & E.* had a "first", however, the sharing of the gen is one of the things which keep experimenters the world over on their toes and results in constant improvement of *everybody's* equipment.

On the Cover

Roy Norris Reports . . .

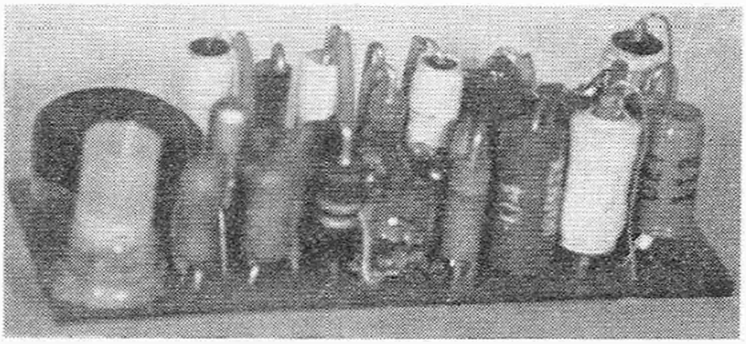
On August 28th the Bristol R/C Model Aircraft Club tele-recorded, for the B.B.C., the programme "Under Control", which was screened all over Britain the following Tuesday at 5.30 p.m., produced by Brian Johnson.

This 30 min. programme, although recorded, was produced as a live show.

The programme opened with some flying shots of the writer's Mustang, with an introduction by Tom Salmon. He went on to show how the beginner could start, with a kit, an uncovered airframe, and the finished aircraft with a brief explanation of simple radio equipment. Bill Bellinger then flew his rudder only model, and Tom tried left and right turns on it for himself. Doug. Sheppard, chairman of the club, was interviewed concerning the advantages of joining a club. The equipment of the Mustang was demonstrated, and scale discussed with Jack Morton, who then flew his Gypsy Moth. Mike Barnett demonstrated some F.A.I. multi manoeuvres. The programme ended with a formation take-off of two Orions, followed into the air by the Mustang.

Thanks must go to all who helped, especially the B.B.C.

The New 305 Rx.



By J. W. MATTHEWS

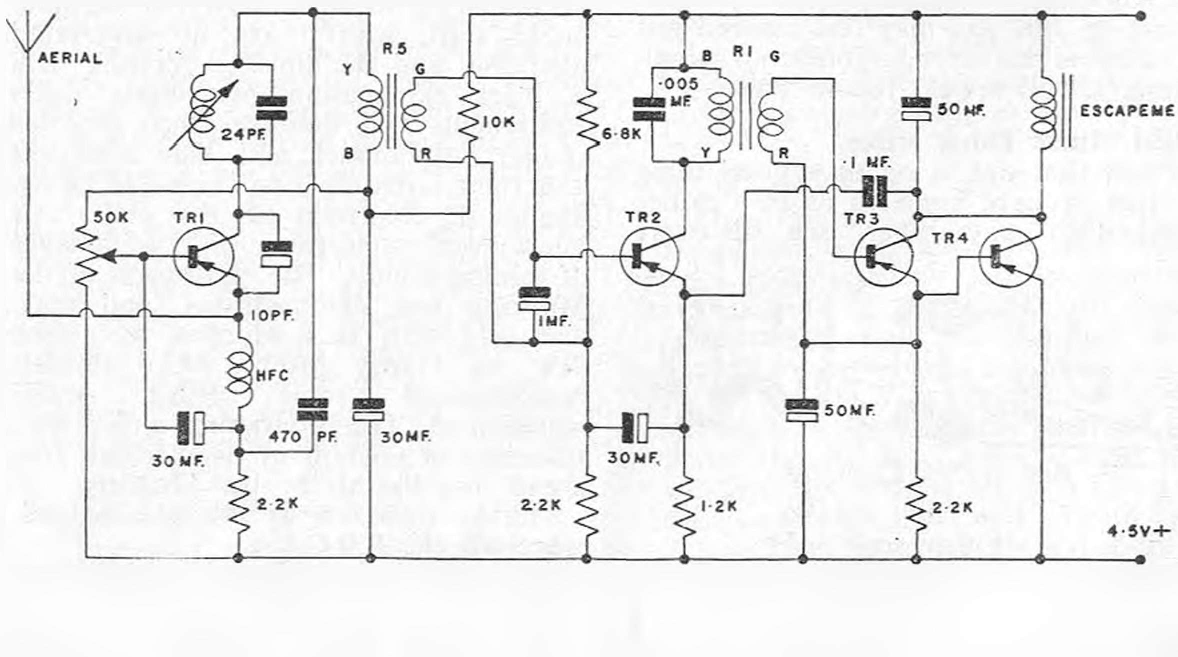
The "305" was originally designed by Dave Cuttriss and Tom Taylor and made its appearance in July 1960, R.C.M. & E., *long since out of print. T. W. Matthews has retained the best points of the original Rx. and condensed it to suit a p.c. layout. This is an excellent little relayless S/C tone circuit for a small model.*

THE author has been interested for some time in models for small field flying, but there has always been the problem of finding a receiver small enough to fit in a fuselage of small cross-section. After operating a "305" receiver in its standard form for some time with great success this seemed to be the ideal receiver for miniaturisation. As can be seen from the photograph and p.c. board, this version is quite small and at only 1¼ oz it is light enough for the smallest of Pee Wee powered models, yet it has plenty of range for use with large models.

When building a set of this nature with the components crowded closely together, it should be borne in mind that replacement of faulty components is quite a tricky business, due to the difficulty in placing heat sinks, etc. It is essential, therefore, that every component should be first class and completely above suspicion; tuning coil, R.F. choke and transformer windings should be checked for continuity before and after installation. Here is a point worth remembering about the electrolytic capacitors: When they have been in storage for some time, a deterioration in the dielectric film takes place due to the absence of a polarising voltage. This reduces the thickness of the film and causes increased leakage current which can cause permanent damage if such a capacitor is put into service. It is a good idea, therefore, to ensure that the capacitors are completely re-formed before installation. This can easily be done by applying the rated voltage (observing polarity, of course) in series with a 10KΩ resistor re-formation should be complete in about 10 minutes.

A word now about the transistors. I have always thought that the SB305 with

FIG. 1



a cut-off frequency of 30 Mc/s. will give marginal reliability on 27 Mc/s. Some specimens may be O.K. if carefully selected but it would be advisable to use an SB231R in the first stage. this is a bit more expensive but well worth buying. Any transistor may be used for TR2 providing the gain is not less than about 50. i.e., OC71. GET113, NKT203SF. It is difficult to pick a particular type of transistor for TR3 as this must have a gain of not less than 200 and transistor gain figures vary over a very wide range. If a gain-leakage tester is available it would be very useful here. The OC76, GET113 and NWTE02SH have been used for TR3. Any $\frac{1}{2}$ amp. switching transistor may be used for TR4, i.e., GET114, S1, etc. We will not dwell on printed circuit technique as this has been adequately covered in previous *R.C.M. & E.* articles but one of the easiest ways of making the board is to stick the pattern on to a piece of laminate with Sellotape and lightly punch the hole positions and the position of the board edges through on to the laminate with a scriber. It is then quite easy to saw the board to size and paint the pattern by joining up the required punch marks with a fine paint brush. The punch marks then serve to centre the drill after etching is complete.

Construction

Start by cutting the coil former down to about $\frac{5}{8}$ in. long and shorten the slug to $\frac{1}{4}$ in. long. (Careful work with a junior hacksaw.) Use a piece of $\frac{1}{32}$ in. square synthetic rubber or wool to lock the slug in the former. Using Araldite. fix the former in the $\frac{1}{4}$ in. dia. hole and the transformers in the position shown. (If ardente D1101's are used they will have to be stood up on end), leave these to dry overnight. The remaining construction must be done in the following sequence to facilitate the placing of heat sinks which must be used on *all* wires and unplug the soldering iron when soldering the transistor leads. Use plastic sleeving on all bare wires.

Assembly Sequence

(1) Scrape and tin the end of a 9 in. length of 30 s.w.g. enamelled copper wire and solder into hole 1.

(2) Wind 10 turns closewound on the coil former. tie the top turn in place with a piece of embroidery silk and cut off to $\frac{1}{2}$ in. length. Scrape, tin and solder this end into hole 3. Give coil a liberal dosing of low loss polystyrene cement.

(3) Transformer T1 yellow lead to hole 8.
(4) ,, T1 blue ,, ,, 28.
(5) ,, T1 red ,, ,, 35.
(6) ,, T1 green ,, ,, 38.
(7) ,, T2 yellow ,, ,, 44.
(8) ,, T2 blue ,, ,, 45.
(9) ,, T2 red ,, ,, 60.
(10) ,, T2 green ,, ,, 59.

Lock all transformer leads in place with a good coating of polystyrene cement.

(11) TR4 collector to hole 57, base to hole 55, emitter to hole 56.
(12) TR3 collector to hole 53, base to hole 58, emitter to hole 57.
(13) 2.2KΩ over hole 62, lead to hole 63.
(14) 50μ F negative over hole 61, positive lead to hole 64.
(15) 0.04μ F over hole 49. lead to hole 54.
(16) 0.04μ F over hole 48.
(17) 0.02μ F over hole 47, join tops of 0.02μ F and both 0.04μ F together.
(18) 50μ F positive over hole 50, negative lead to hole 52.
(19) 0.005μ F over hole 43, lead to hole 46.
(20) 1μ F negative over hole 39, positive lead to hole 36.
(21) 6.8KΩ over hole 34, lead to hole 37.
(22) 30μ F negative over hole 41, positive lead to hole 32.
(23) 1.2KΩ over hole 31, lead to hole 30.

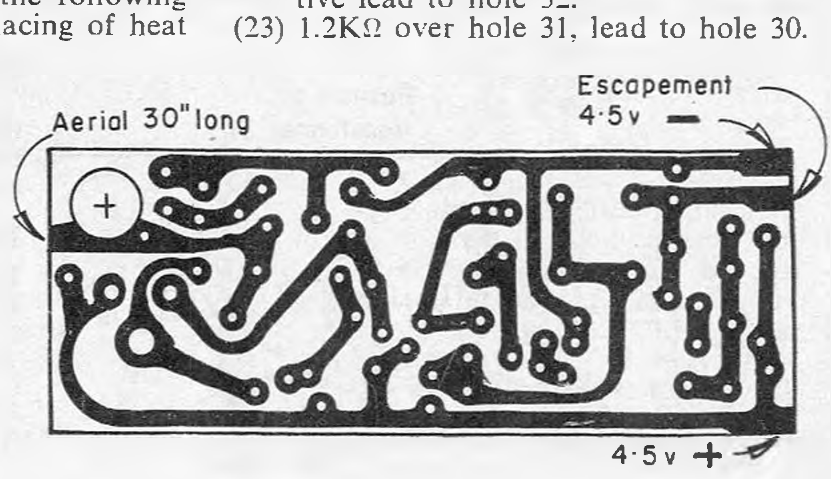


FIG. 2
Full Size Printed Circuit Panel

(24) TR2 collector to hole 42. base to hole 40. emitter to hole 33.
(25) 10KΩ over hole 9, lead to hole 27.
(26) 2.2KΩ over hole 24. lead to hole 23.
(27) 30μ F positive over hole 22. negative lead to hole 23.
(28) RF choke in holes 12 and 26. Give a good coating of low loss polystyrene cement.
(29) 470 pf. ceramic disc in holes 7 and 25.
(30) 2.2KΩ over hole 21. lead to hole 20.
(31) 30μ F negative over hole 18. positive lead to hole 19.
(32) TR1 collector to hole 5. base to hole 13, emitter to hole 11.
(33) 10 pf. ceramic over hole 6. lead to hole 10.
(34) 24 pf. ceramic over hole 2. lead to hole 4.
(35) Solder pot into holes 14. 15 and 16.

Aerial Connection

The p.c. board is as shown for emitter aerial connection which is found simplest and very successful. If, however. inductive aerial coupling is preferred. break the p.c. land somewhere between the aerial connection and hole 10 and drill hole A. Then solder one end of a piece of thin plastic covered flex into hole A and wind 1½ turns on top of the tuning coil (clockwise) and solder the other end into hole 17. Lock in place with low loss polystyrene cement.

Tuning

Turn pot fully clockwise, connect a new 4½ volt battery and escapement and switch on. Rotate pot *slowly* anti-clockwise until escapement chatters and a 6v. .04a. bulb clipped temporarily across the escapement flashes (it will not be very bright), then turn pot clockwise again until flashing ceases. Now key the Tx. and tune dust core with a plastic tool until escapement closes firmly and bulb stays steady. Tune for max. bulb

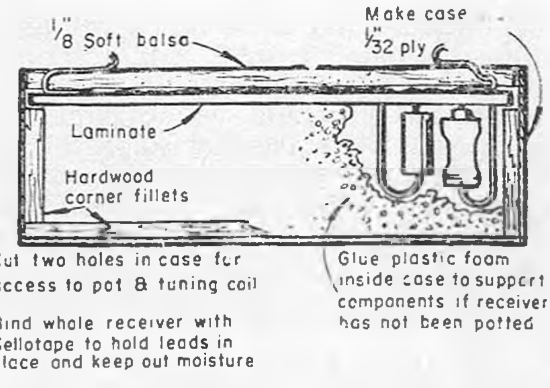


FIG. 4 Case Detail

brilliance and also re-set the pot for max. brilliance. Repeat at range for accurate adjustment. We found the bulb method better than a meter because most meters are over or under damped for field use. It is most difficult to tune a set with the meter needle swinging wildly about despite efforts to hold the model steady. The 6v. bulb only takes about 30 mA. on 4½ v. so there is no risk of overloading the output transistor.

Tx. Requirements

Carrier and modulation must be keyed together. Receiver works but with 100 per cent modulation, about 50/50 mark-space ratio, square wave. Adjust modulation frequency for best results. it will be about 500-800 c/s.

Installation

Finally, here are a few tips on the operation of the set: As would be expected with a receiver of this type it is very sensitive to electrical noise, so insulate all metal-to-metal rubbing surfaces (i.e.. slip a piece of P.V.C. sleeving over the rudder crank) and don't use plugs and sockets unless they have good quality contacts. as these tend to work

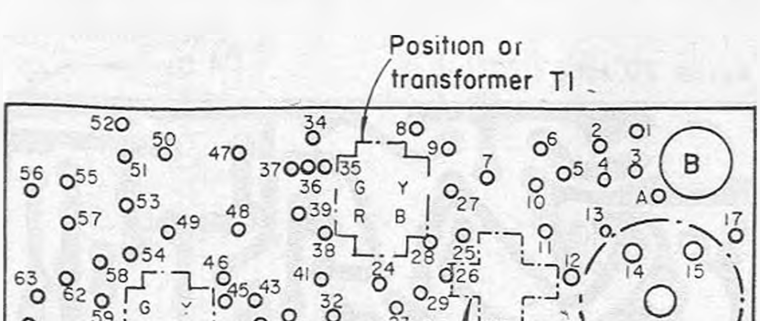


FIG. 3

HOLE DIAGRAM COMPONENT PLACEMENT

Drill as follows:
B: ¼ in.; 14 and 15 1/16 in.
16: No. 32 (For M.P. Pot.)
No. 41 (For G. Pot.)
All other holes 1/32 in.

Hold page up to the light to register with lands.

loose with engine vibration and produce noise. The author is a firm believer in soldering everything permanently in the model (see *R.C.M. & E.*, October. 1961. page 493). This method only leaves one weak link which is the switch. The author has not yet found a really reliable noise-free switch but this problem can be minimised by using a double pole switch with the poles wired in parallel and mounting it on the fuselage side opposite the exhaust stack where it will be reasonably safe from the ingress of oil.

If a sequential escapement is used and a glo-plug motor. always check for next operation AFTER the engine has been started. because the noise generated by the glo-plug clip will almost certainly make the escapement skip a few positions. Do not economise on batteries. the set does not like low volts so always see that the batteries are fresh. change them every two or three flying sessions.

List of Components

¼ in dia. polystyrene coil former and slug.
47K Plessey sub-miniature pre-set pot—three alternatives; i.e.. Type MP (dealer knob). Type G Mk. 6 or Type G Mk. 5. If the receiver is to be "potted" Type G Mk. 6 should be used. This has an integral masking skirt which prevents the potting compound from getting on to the resistance track.
2 Transformers—Ardente D1001
1 Miniature pile wound R.F. Choke—Henry's Radio.
2 0.04μ F tubular capacitors—Hunt's 150v.
1 0.02μ F tubular capacitor—Hunt's 150v.
2 50μ F electrolytic capacitors (6v.)—Plessey CE 24/1.
3 30μ F electrolytic capacitors (6v.)—Plessey CE 3/1.
1 1μ F electrolytic capacitor (15v.)—Radiospares.
1 470 pf. ceramic disc—Radiospares.
1 10 pf. ceramic—Radiospares.
1 24 pf. ceramic—Radiospares.
Radiospares midget ½ watt resistors:
1 1.2KΩ Brown-red-red-silver.
3 2.2KΩ Red-red-red-silver.
1 6.8KΩ Blue-grey-red-silver.
1 10KΩ Brown-black-orange-silver.
Transistors—see text.
1 ft. 30 s.w.g. enamelled copper wire.
1 ft. 1 mm. plastic sleeving.
Coloured plastic covered flex for aerial, battery leads and escapement leads.

SOURCES OF SUPPLY FOR COMPONENTS

Component	Supplier(s)
¼ in. dia. polystyrene coil former and slug	A & B
Plessey pots. 47KΩ (all three types)	C
Ardene D1001 tranformers	A & B
Miniature pile wound R.F.C.	A
0.04 μF 150 V. Hunts	A & B
0.02 μF 150 V. Hunts	A & B
50 μF elect. capacitors	A & B
30 μF elect. capacitors	A, B & C
1 μF elect. capacitors	A & B
470 pf ceramic capacitors	A & B
10 pf ceramic capacitors	A & B
22 pf ceramic capacitors	A & B
All resistors	B
30 s.w.g. enamelled copper wire	B
SB231R transistor	A & B
Plastic sleeving	A
GET114 Transistor	B
S1 Transistor	B
TR2 transistor (50 + gain)	A
TR3 transistor (200 gain)	A
Paxolin and Epoxy glass P.C. board	B

Supplier A

Henry's Radio Ltd.,
5 Harrow Road,
London, W.2

Supplier B

Harrogate Radio Co.,
16 Regent Parade.
Harrogate. Yorks.

Supplier C

Radio Clearance Ltd.,
27 Tottenham Court Rd.,
London. W.1.

Henry's and Harrogate Radio may supply different makes of component. but they will be small enough to fit on the P.C. layout. 35 μF may be supplied in lieu of 30 μF but these values are not critical

The R.E.P. Story

"Radio & Electronic Products" or "REP" as it is more widely known is the subject of this month's peep behind the scenes

THE name R.E.P., now firmly established in the British and indeed overseas radio control market, seems worthy of investigation. Accordingly, we paid a visit to the home of Radio & Electronic Products at their Mortlake factory and spent an informative afternoon collecting the gen which we now present in the form of "The R.E.P. Story".

Mister R.E.P.

George Honnest-Redlich is a familiar sight at many radio meetings where he may often be seen officiating as a judge. George started this radio game many years ago and his background as an electronics man proved invaluable. His first move as a young man was in Germany, he spent 10 years of his life there and between years in the 1920's after he left school, he studied radio (obviously broadcast in those days) for two years at the Berlin Technical University followed up by a year's practical work in a radio factory in Berlin. Then he came back to England also in the radio business, and remained in that until the end of the war.

Experimental Modelling

George's first introduction to the control of models started at Hounslow Heath when he saw people playing about with model aeroplanes, being an electronics engineer he thought it would be a good idea to try and control them. He had heard of various experiments by the Americans before the war, and also during the war by Squadron Leader Hunt. He thus thought he would see what he could do. George's first equipment was, by present day standards, very unwieldy; the single channel equipment in the model weighed somewhere in the region of 3-4 lb. including batteries, the model itself was about 8 or 9 ft. wingspan with 15 c.c. Magpie petrol engine. Shortly after this, which could have been the very first flight of any reliability of radio controlled craft in England from an amateur point of view, he was contacted by Ted Hemsley, a well known modeller even in pre radio days, who was interested in radio control in his aircraft. His was probably the first commercial production job and he continued flying by various equipment for some years, winning quite a few contests. Shortly

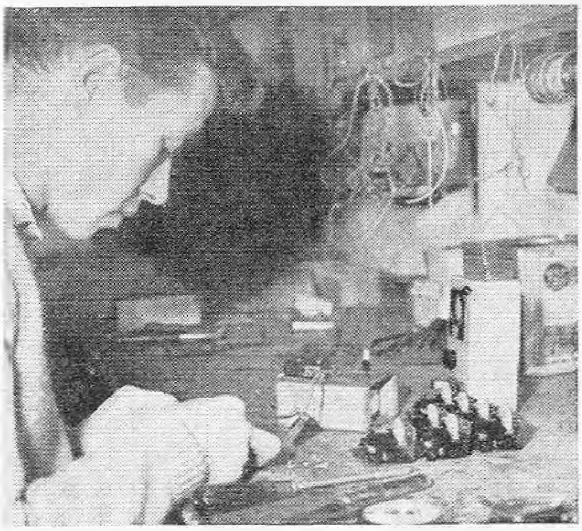
George with the inevitable pipe dispensing helpful gen to a customer.

after that time, Messrs. E.D. contacted George and he passed over his designs to them. Their production went on for quite a time with George's help, and it is only over the last five years that he has started up himself under the name of Radio & Electronic Products known now as R.E.P.

Originally R.E.P. produced hand-made equipment, components and sub-assembly kits for the "make yourself" type people. George slowly built up the business, and within a short time had produced in England modern lightweight equipment, using hand-held transmitters with the option of crystal control. At the same time certain industrial applications of control were being produced for larger firms, the first one being radio control equipment for a 1/5th scale Javelin which was used in free fall to check or test the spinning trouble given by this design. This was for the R.A.E. at Farnborough, and the equipment used successfully gave them all the information they required to cure the spin trouble. After that, George radio controlled a full sized Centurion flail tank for the Ministry of Supply, the engineering and installation work being done by another firm on contract. This job took approximately two years which is easy to imagine, as the control of two 350 h.p. Merlin engines is quite a problem; one being a sequence arrangement, for letting in the flail engine. This consisted of increasing the engine speed, withdrawing a clutch, engaging a dog gear and increasing the engine speed again while the clutch was slowly let in. The sequence took 20 seconds, and was done by an automatic motorised sequence arrangement which George designed himself. The flail tank was a full success and was used in Germany as well as in England for live minefield clearance, without casualties. Though it nearly spoilt its record while George was demonstrating it for some brass hats, when he swung the tank around and drove it up to them, stopping it 2 ft. short—they were getting ready to hop.

The flail tank was used further to test fire and heat on tanks, was Napaln bombed, had flame throwers directed on it from a tower. The radio equipment stood up to this perfectly but the tank was less fortunate.

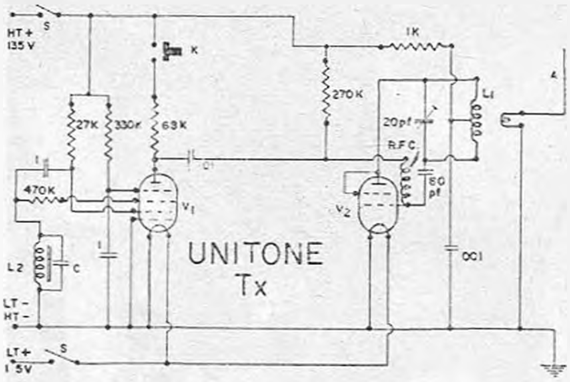
Vickers Armstrong also commissioned him to supply radio equipment for tank testing of their boat hulls at Barrow-in-



Remtrol servos being wired up. Test unit in the background indicates efficiency of the switching circuitry.

Furness. Rather than drag them through the tank on the end of a beam, they wanted to be able to test them entirely free. For Standard Telephones George produced quite a few reed units of specialised design; which were used for channel selection, being a much more simple and cheaper method than tuned filters would have been. For example, several of the reed units they had been using had only three reeds on them, one being tuned to 300 cps and the other two were 2 cps above and 2 cps below, the contacts being in parallel, this must have been because they didn't trust their note stability of the circuitry feeding into the reed units.

The major job George has done commercially was for the Ford Motor Company—Tractor Division and in all he produced six fully radio controlled tractors. These have been used all over the world, mainly for publicity, and there does not seem to be any practical application or remote control farming. The circuitry of all this equipment has been basically the same as model equipment. The Javelin and the Centurion flail tank were both superregen receivers feeding into reed units obviously with very much larger output relays to break or make the five and twenty ampere allowance required to operate the mechanical devices. The Ford equipment has always been Superhets and the reason for that being to be able to operate two or three models simultaneously without interference. All of this heavy equipment has been fitted

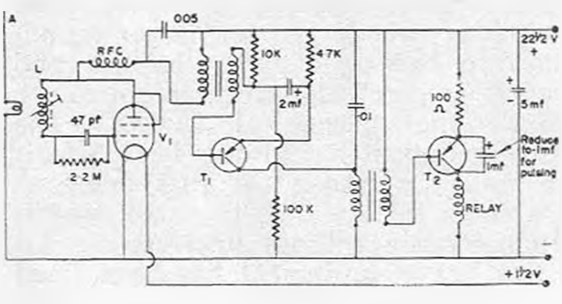


Unitone Tx.

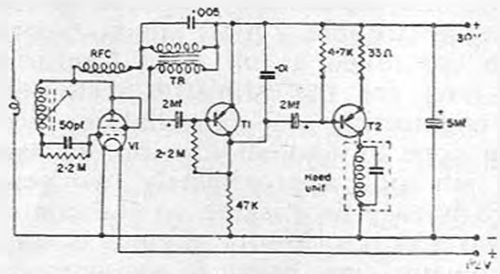
V_1 = DK96 (or DK 92) V2 = 3V4
L_1 = 10 turns $\frac{7}{8}$ in. dia.; Aerial coil $1\frac{1}{2}$ turns
RFC = RF Choke L2 = 4H
C = To tune to 400 c. approx. .01
K = Operating switch
S = Double pole on/off switch

with a failsafe device which automatically would cut the engine on any failure of radio. transmitter or receiver and batteries as there is more likelihood of breakdown of battery or wiring connections than in a transmitter or receiver. This failsafe is quite simple and works remarkably well.

George, even in those days, felt that radio control had a future from a model point of view. and has always gone ahead in design looking to the future. He fully anticipated some years ago that radio control would be a fad not only in the hands of experts but would sweep the world. At the present moment just this is occurring. Even free flight and control line people feel that they would like to radio control the models they make. In fact, in a book written by George twelve years ago for Model Aeronautical Press, the point was stressed that the person who spends six weeks or six years making a model soon gets tired with it when he loses all control after it has left his hands. whether it just circles in the air or on a lake. The interest is revived when he has full control of it. The upswing of radio control over the years has proved this prediction.



Every transistor is checked for gain before it is inserted in the receiver. A production line of 2/10 receivers can be seen on the right.



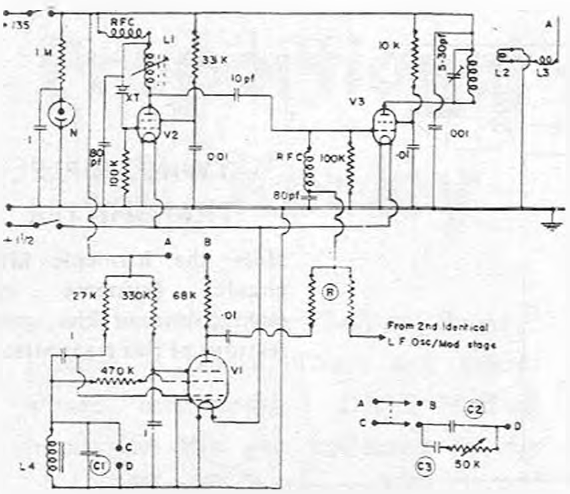
3-8 Channel Valve/Transistor Rx.

R.E.P. Today

Now taking the growth of R.E.P. in the earliest days. manufacturing began in very small premises—a cubby hole in fact. The only help at the time was John Dumble. who is still with the firm in a senior capacity. and has been no doubt observed in recent model competitions. After the first year, the firm moved to larger premises and the demand for more space has never been satisfied. A year or two later the firm moved to even larger premises and the expansion rate, if it can be measured in percentage at all. is in the region of over 100 per cent a year. Output over the last 12 months has averaged 150

R.E.P. Unitone Rx.

L = $\frac{1}{4}$ in. Aladdin 33 turns 28 s.w.g.
Aerial $2\frac{1}{2}$ turns
V_1 = XFY34 T1 = HIGH GAIN
T = LOW OR MED. GAIN Relay = 5K
Relay current off signal, O mA. on signal, 4 mA.

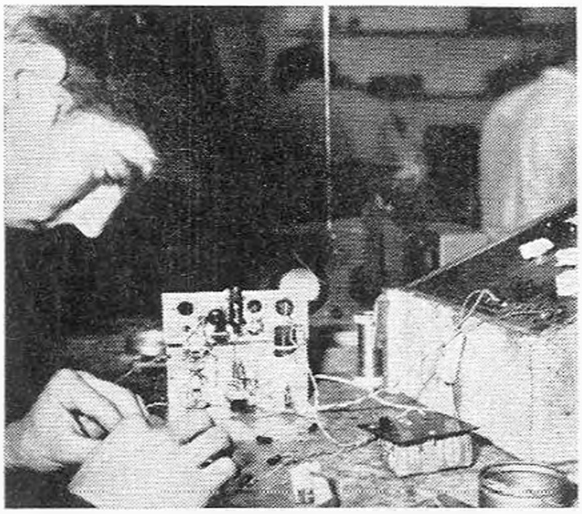


Simultaneous 8-channel Tx.

V1 = DK92
V2 = 1T4
V3 = 3V4
L1 = 22T 28G Aladdin ¼ Former
L2 = 10T 18G ¾ dia. 2T aerial at HT + End
L3 = According to length of aerial fitted. For 5ft. A = 10T 20G ¼ dia.
L4 = 2.5 H LA1 Pot core choke
(C1) = Choose to resonate just above highest reed Fc usually .05 mfd.
(C2) = Choose for individual reed Fc.
(C3) = Highest four reeds .01 Lowest four reeds .02
XT = Overtone Xtal in 27 Mc/s. band
(R) = Choose to give same mod. depth from both stages. Usually 47 K

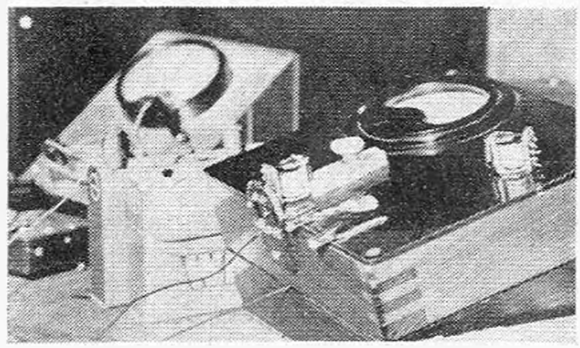
complete sets a month. not counting components and actuators. Being radio experts. they have concentrated on this section. leaving the mechanical pieces — such as actuators. to other firms to produce for them. In the past a few outside actuators have been made to R.E.P.'s design. the "Uniac" being the first motorised actuator in England. Quantities of those were sold in U.S.A.. before the days of motorised actuators there. and are still found in several boats. Following this was a linear Uniac and a miniaturised version. then the Olsen actuator.

Production-wise. R.E P. started off with a Unitone and Tritone. single channel and three channel, which are still running today. George is not a great believer in continuing a line simply because customers still ask for it. but these have hardly been surpassed. The Tritone is the only three channel equipment which is available in the U.K. at a

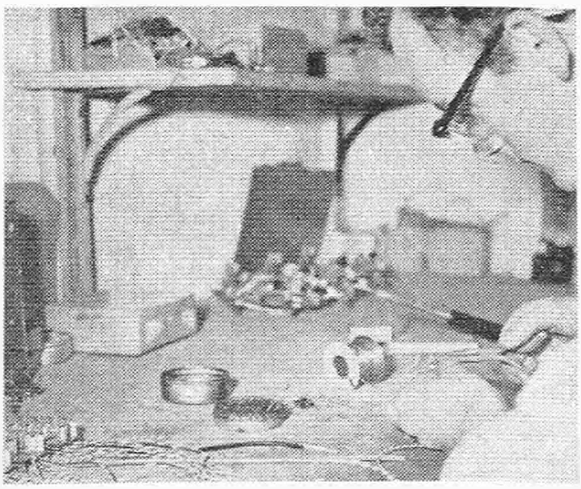


Multi transmitters being set up for tone with a standard reed bank and special tester which indicates the correct value of capacitor to be used.

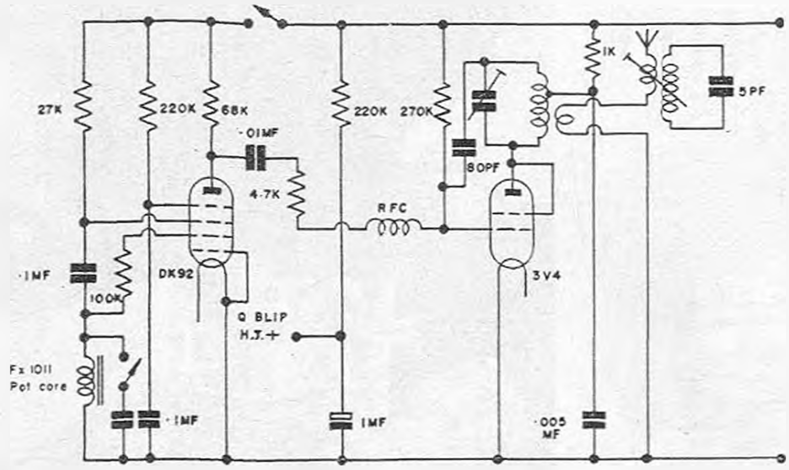
reasonable price. and the Unitone's excellent range still attracts people. In fact a recent supplier of pulsing equipment is using an R.E.P. Unitone as a basis for his receiver layout. The "Tritone" has still continued



A relay clamped into a tester, George's workshop is full of specially developed test equipment.



Wiring up the relay banks for a Dekatone.



TWIN TRIPLE TRANSMITTER

Note the harmonic filter circuit (extreme top right), one of the useful features of this transmitter.

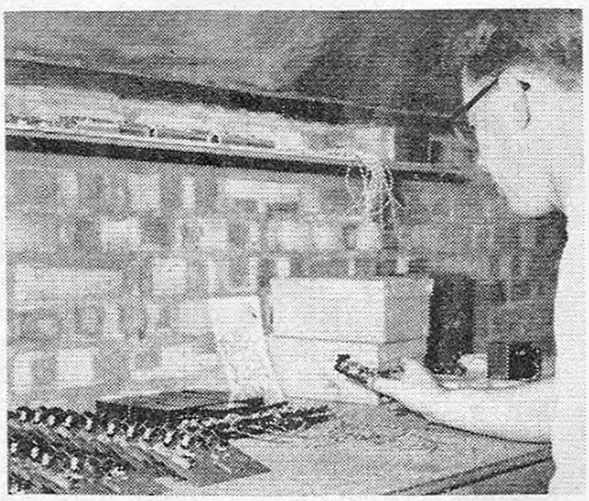
and there is a big demand for it, mainly, among boat people who wish to use an escapement operated engine control and a two channel rudder servo. This is a simpler form of three channel equipment.

From here the firm went on to a complete range of six and eight channel equipment — the Sextone and Octone. The Quadratone was bypassed because the majority of people were at the time using three on boats and six on aircraft. After a year of these, the Quadratone was added for people with faster boats who wanted progressive engine control on two channels. In the last year the Dekatone 10 channel equipment has been brought out. This supplies all needs of radio control modellers, in fact, it is believed that R.E.P. have the greatest range of equipment in the world.

All Transistor Receivers

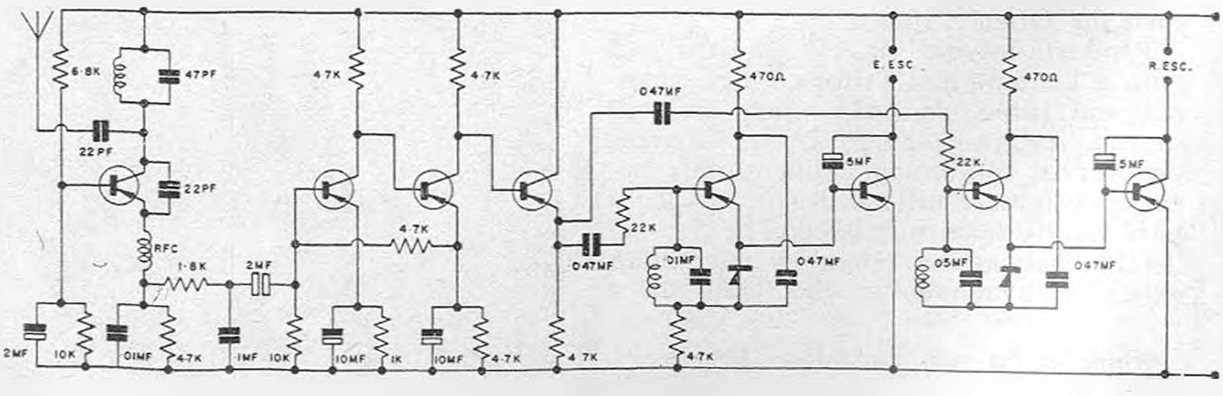
In the last year a radical change has been made and George has brought out the Twin Triple, a two filter outfit operating special twin escapements to give three controls from two channels. It is not thought that the filter is likely to sweep the reeds away. as was believed a couple of years ago when filters first hit the market. Reeds will still hold sway for a number of years to come. The Twin Triple filled a need.

(To be continued)



John Dumble places yet another Twin Triple on the stack of these popular outfits.

TWIN TRIPLE RX.



Proportional at Kenley

. . . Remember the "Boffins' Corner" picture in "Here, There and Everywhere" last month ? DAVE McQUE passes on the gen collected at the World Championships

So far as the technical side of Kenley is concerned, the two things of interest to me were the fine crop of "Bullrushes" (aerial centre loading coils) in the Tx. Tent and one of the few pulse proportional systems amongst the almost universal 10 channel reed set-ups. In conversation with Don Brown, of the U.S.A. team, the following details of his system were revealed. The system uses three independent mark/space channels operating at about 8 c/s to give proportional control of elevator, rudder and ailerons. The actuators used have doubled geared Mighty Midgets with a special centring spring arrangement, and were described in an *R.C.M. & E.* test report in the August, 1962, issue. (Dee Bee "T.T." proportional servo, by T. H. Ives.)

Two position engine control is achieved by means of a pulse omission detector on the rudder channel, i.e., the pulsing on this channel is stopped for a fraction of a second then if space is held the throttle is closed, or if mark the throttle is opened. When the interrupted pulsing is resumed the throttle stays in its new condition. At the Tx. three multivibrators are used to control three tone oscillators on 4, 5 and 6 Kc/s. These comparatively high frequencies are used so that the filter units in the receiver can be of high Q and at the same time small and light. Don works on the 50-54 Mc/s, an amateur band back home, but proposes to use lower frequencies for a legal version for the American spot frequencies around 27 Mc/s where modulation frequencies are limited to 4 Kc/s. Each tone modulates the transmitter to about 25 per cent making 75 per cent total for all channels and at this modulation depth a Superegen detector is successfully used without intermodulation problems. Now there has been a lot of discourse on both sides of the Atlantic about multi channel proportional, but little success for this type of gear of late in national and international contests with this notable exception and Space Control placings at the 1962 U.S. Nationals.

Anyone at Kenley can vouch for the smoothness of Don's flying and the obvious full range of control. Had his motor not cut in the tail slide on his third flight, his placing would have been much higher.

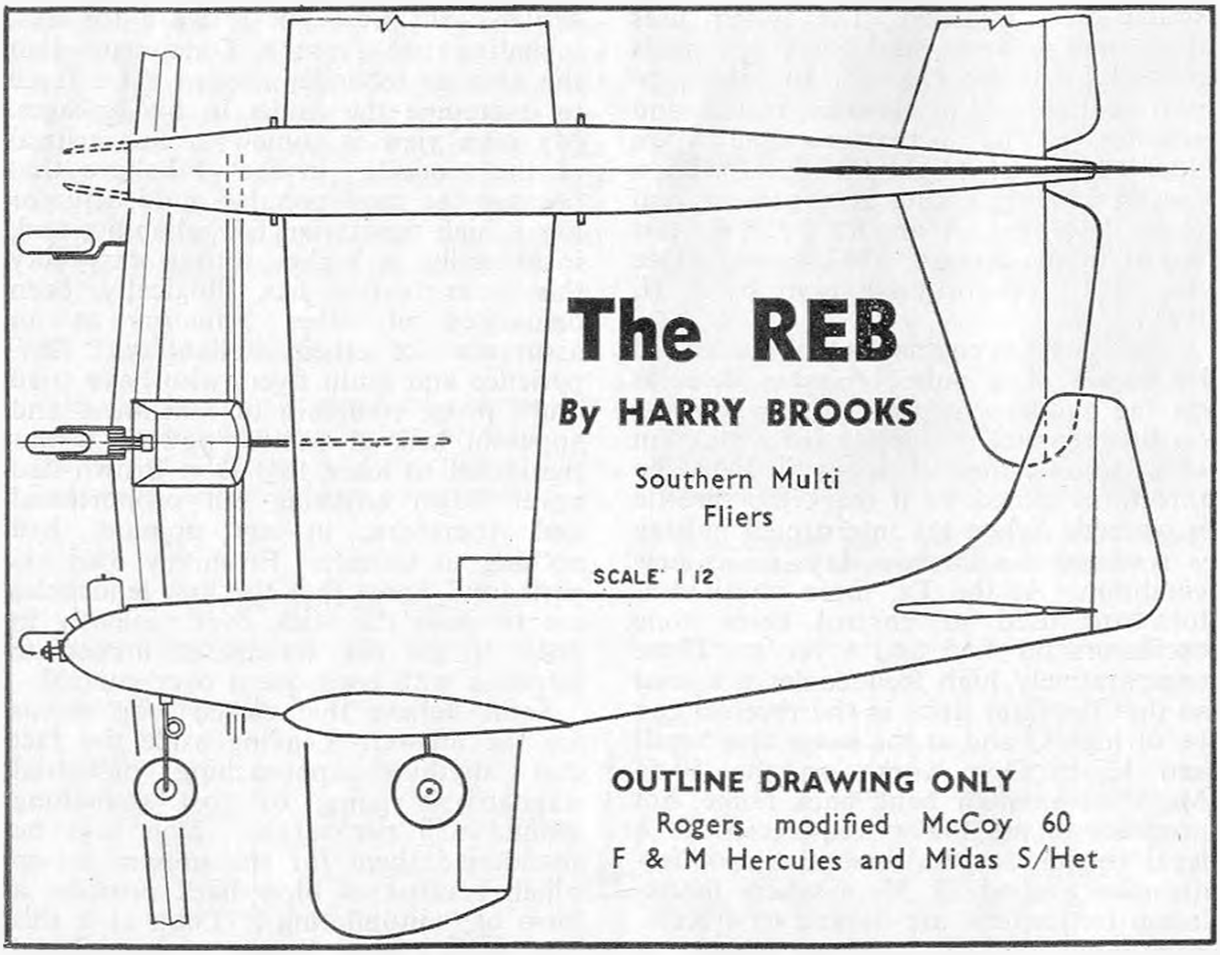
Why is proportional not more popular? Don's model was not all that different from any other top class multi designs. His control surfaces were not balanced to reduce servo loading and yet the quarter of an ounce inch of torque available from his servos was adequate. A well known British actuator manufacturer was heard to declare that he could not sell a servo with only one pound pull. It had to have *over* two pounds to satisfy the customers! Various explanations were put forward for this, including one from a Dutchman—that the average modeller needed extra force to overcome the faults in his linkages. My own view is somewhat less critical of the modeller, in that I believe that because the most popular multi actuator has a high reputation for reliability and, incidentally, a higher torque capability this latter feature has, illogically, been demanded of other actuators as an assurance of their reliability. Experience and multi flyers who have tried multi prop, complain of mushiness and apparent lack of control power. It was significant to learn that Don Brown had never flown anything but proportional and, therefore, in my opinion, had nothing to unlearn. From my own experience I know that the first tendencies are to push the stick over violently in order to get the anticipated immediate response with consequent over control.

Some believe that closed loop servos are the answer. Leaving aside the fact that anything approaching industrial standard is going to cost something around £50 per servo. Don says he abandoned them for the present set-up which because of blow back provides a form of "autopiloting". Look at it this way—with a bang bang or even a closed loop servo, the position of the control surface is independent of model speed, but the control force for a given deflection varies as the square of the speed of the model, i.e., the faster the model the more violent the manoeuvre, and the more strain it has to withstand. With a servo like Don's it is the control surface force which is controlled and as this is opposed by a moment roughly proportional to the square of the model speed. The control force, and hence acceleration in manoeurves, is the thing that the ground pilot controls—hence the greater smoothness. Whether we shall now see an upsurge of interest in proportional is doubtful. It requires more skill in construction, understanding in operation, patience in learning, than is generally possessed. It is to be hoped, however, that now commercial pulse gear is being made available, more will be encouraged to have a go.

World Championship Models

Details of every Model flown in the 1962 World R/C Championships at R.A.F. Kenley

ALL THE DETAILS IN THE NEXT THREE PAGES.
TOP BRITISH MODEL BELOW . . .



2-sheet plans available, 15/-, from Southern Radio Controls.

WORLD CHAMPIONSHIP MODEL ANALYSIS

Name & Country	Model	Span in.	Area sq. in.	Wt. oz.	Wing Section & Thickness Ratio	Engine	Prop.	Tx.	Rx.	Control System	U/C	Remarks
1 T. Brett U.S.A.	Low wing original "Apogee"	60.9	570	84	15%	K & B 45 R/C	12 x 6 in. wood	Orbit 10 Transistor	Orbit 10 Superhet relayless	R.E.M.A.T. 4 Transmites & 1 Hillcrest motor ser.	Tricycle	Full span strip ailerons $1\frac{1}{8}$-1 in. taper ; brakes & steerable nosewheel
1 H. Brooks G. Britain	Low wing original "Reb"	68	692	122	15%	Rogers/ McCoy 60	12 x 6 in. nylon	F & M Hercules 10	F & M Midas 10 Superhet relayless	R.E.M.A.T. 5 Transmites	Tricycle	Steerable nosewheel & brakes; Johnson Auto-mix throttle
3 C. Olsen G. Britain	Shoulder wing "Uproar"	66	730	94	12% Sym-metrical	Merco 49 R/C	11 x 6 in. nylon	R.E.P. Dekatone 10	Homebuilt 10 relays	R.E.M.A.T. 5 Remtrol Servos	Tricycle	Servos & R/C gear designed by competitor
4 F. Van den Bergh G. Britain	Low wing original "Sky Dancer"	60	690	102	$12\frac{1}{2}$% Sym-metrical	Merco 49 R/C	12 x 6 in. nylon	Orbit 10 Transistor	Orbit 10 Superhet relayless	R.E.M.A.T. 5 Transmites	Tricycle	Steerable nosewheel & brakes
5 D. Brown U.S.A.	Shoulder wing original "Ambassador"	74	768	103	N.A.C.A. 2415 15%	Merco 49 R/C	12 x 6 in. wood	O/D Quadruplex proportional & 'in-flight' trim	O/D Quadruplex proportional	R.E.M.A. 4 Dee Bee proportional servos	Tailwheel type	
6 F. Bosch Germany	Low wing "Voltswagon"	69	650	120	8% Sym-metrical	Super Tigre 51	11 x 6 in. nylon	O.M.U. 10	O.M.U. 10 relayless	R.E.M.A.T. 5 Transmites	4 point U/C	Wheels at nose & tail of model; Tx. tones stab'sd. by tuning fork
7 J. M. Malherbe S. Africa	Shoulder wing "Stormer"	64	720	84	15%	Veco 45 R/C	11 x 6 in. wood	Orbit 10 Transistor	Orbit 10 Superhet relayless	R.E.M.A.T. 5 Transmites	Tricycle	Stearable nosewheel & brakes; full span strip ailerons $1\frac{1}{8}$ in. wide.
8 G. Samaan Germany	Shoulder wing original	70.8	806	81	14%	Merco 49 R/C	11 x 6 in. nylon	Bellaphon 10 proportional	Polyton 10 proportional	R.E.M.A.T. 5 Bellamatic servos	Tricycle	Very fast. Motor, wing & tailplane on common datum line
9 W. Robinson U.S.A.	Original low wing	72	756	100	17%	K & B 45 R/C	11 x 6 in. wood	Orbit 10 Transistor	Orbit 10 Superhet relayless	R.E.M.A.T. 5 Transmites servos	Tricycle	Brakes & st'able nose-wheel; top surface ail'n hinge homemade brakes
10 C. Teuwen Belgium	Low wing "Valkyrie"	72	720	114	N.A.C.A. 2415 15%	K & B 45 R/C	12 x 6 in. wood	Orbit 10 Transistor	Orbit 10 Superhet relayless	R.E.M.A.T. 5 Transmites	Tricycle	Stringered fuselage construction
11 H. Gast Germany	Flat top Stormer	64	720	84.6	15%	K & B 45 R/C	12 x 6 in. wood	Bellaphon 10 proportional	Polyton 10	R.E.M.A. 4 Bellamatic servos	Tricycle	Tx. modified for triple simultaneous operation

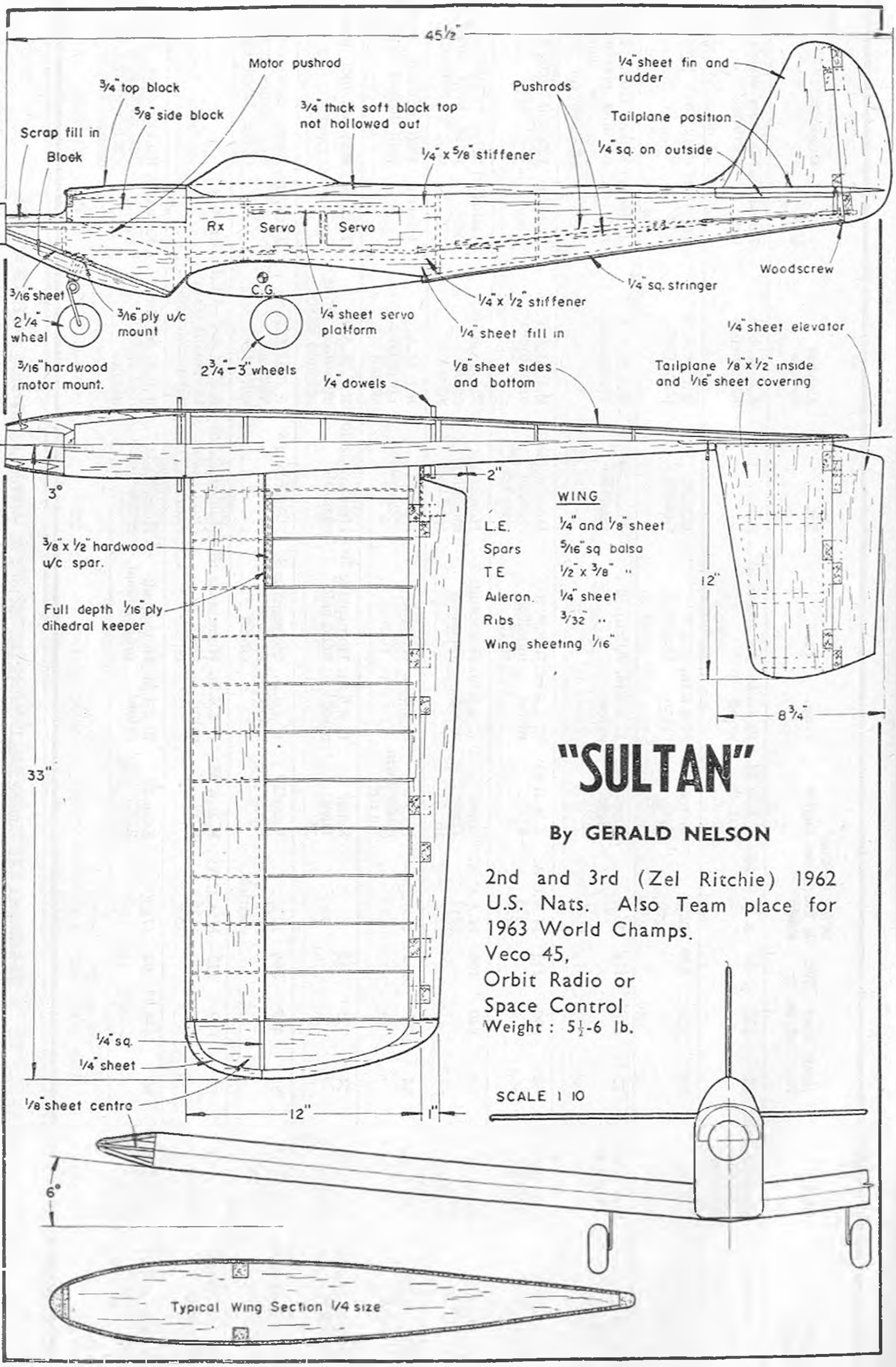
Definitions : R, Rudder ; E, Elevator ; M, Motor ; A, Ailerons ; T, Trim.

WORLD CHAMPIONSHIP MODEL ANALYSIS *(Continued)*

Name & Country	Model	Span in.	Area sq. in.	Wt. oz.	Wing Section & Thickness Ratio	Engine	Prop.	Tx.	Rx.	Control System	U/C	Remarks
12 A Bellochio Italy	Low wing original "Tian 40"	67	666.5	113	16%	K & B 45 R/C	12 x 6 in.	Orbit 10 Transistor	Orbit 10 Superhet relayless	R.E.M.A.T. 5 Transmites	Tailwheel type	Sharp wing taper; balanced rudder
13 E. Corghi Italy	Low wing original	71	852.5	98.7	17%	Super Tigre 56	11 x 6 in. wood	Controlaire 10	Controlaire 10 Superhet relayless	R.E.M.A.T. 5 Transmites	Tricycle	Slightly swept wing
14 M. Kato Japan	Low wing original "Thunderchief"	68	682	88	N.A.C.A. 2415 15%	K & B 45 R/C	11 x 6 in. wood	Orbit 10 Transistor	Orbit 10 Superhet relayless	R.E.M.A.T. 5 MK servos	Tricycle	Steerable nosewheel
15 P. Eliasson Sweden	Low wing original "Mustfire"	68	790.5	103	12%	Merco 49 R/C	12 x 5 in. nylon	Kraft 10 Transistor	Kraft relayless Superhet	R.E.M.A.T. 5 Transmites	Tailwheel type	Designed by J. Von Segebaden
16 C. Sauthier Switzerland	Low wing original "Horus"	69	772	109	12%	K & B 45 R/C	11 x 6 in. nylon	F & M Hercules 10	F & M Midas 10 Superhet relayless	R.E.M.A. 4 Transmites	Tricycle	Steerable nosewheel; constant chord wing; full span strip ailerons
17 P. Louis Belgium	Low wing "Nimbus"	72	716	104	15%	K & B 45 R/C	12 x 6 in. wood	Orbit 10 valve Tx.	Orbit 10 Superhet relayless	R.E.M.A.T. 5 Transmites	Tricycle	Model was 'Nimbus I' with strip ailerons as for 'Nimbus II'
18 R. Dilot Sweden	Low wing "Orion"	68	690	112	17%	K & B 45 R/C	12 x 5 in. nylon	Bramco 10	Bramco 10 relayless	R.E.M.A.T. 4 Transmites	Tricycle	Pike 'five position' el. servo; rub. band shock ab. to n'wheel U/C leg
19 A. Matthey Switzerland	Low wing "Orion"	68	700	120	N.A.C.A. 2415 15%	O.S. Max. 49 R/C	12 x 4 in.	F & M Hercules 10	F & M Midas 10 Superhet relayless	R.E.M.A. 4 Transmites	Tailwheel type	Lengthened nose
20 J. De-Dobbeleer Belgium	Low wing "Orion" modified	68	690	109	N.A.C.A. 2415 15%	K & B 45 R/C	12 x 6 in. wood	Orbit 10 valve Tx.	Orbit 10 Superhet relayless	R.E.M.A.T. 5 Transmites	Tricycle	Top surface aileron hinges; castoring nosewheel
21 A. Bicknel Switzerland	Low wing original	74.4	821.5	130	14%	K & B 45 R/C	12 x 4 in. nylon	Home made 8 Nievergelt	Homemade 8 Nievergelt	R.E.M.A. pneumatic servos homemade	Tricycle	Long U/C legs
22 H. Oki Japan	Low wing original	70	705	106	15% Symmetrical	Enya 45 T.V.	11 x 6 in. nylon	Chimitron 10	Chimitron 10 relays	R.E.M.A.T. 5 Duramites	Tricycle	St'able n'wheel; etched cir. board for Rx. connectors & servos elim. wiring harness. Used as baseboard mount for servos and Rx.

Name & Country	Model	Span in.	Area sq. in.	Wt. oz.	Wing Section & Thickness Ratio	Engine	Prop.	Tx.	Rx.	Control System	U/C	Remarks
23 F. Plessier France	Shoulder wing original "GRRR"	62	682	80	R.A.F. 30	K & B 35 R/C	10 x 6 in. wood	Bellaphon 10	Polyton 10	R.E.M.A. 4 Bellamatics	Tailwheel type	No wing dihedral; strip ailerons
24 J. Levenstam Sweden	Debolt "Sonic Cruiser"	68	830	110	12%	Merco 49 R/C	12 x 4 in. nylon	R.E.P. Octone 8	R.E.P. Octone 8	R.E.M.A. 4 Duramites	Tailwheel type	Only high wing
25 V. Miliani Italy	Low wing "Astro Hog"	72.5	816	134	15%	Super Tigre 56	12 x 6 in. nylon	Alletti 10	Alletti 10 relayless	R.E.M.A.T. 5 Transmites	Tailwheel type	Spike from underside of nose prevents nose-over on landing — effective for braking
26 F. Martens Holland	Low wing "Orion"	68	690	113	N.A.C.A. 2415 15%	K & B 45 R/C	12 x 6 in. nylon	R.E.P. 8 modified to 10	Homemade 10 channel relayless	R.E.M.A.T. 5 Transmites	Tricycle	Efficient plug-in main U/C legs
27 P. Marrot France	Shoulder wing original	70	840	106	N.A.C.A. 2412 12%	Super Tigre 56	12 x 6 in. wood	Homebuilt 9 Channels	Homebuilt including reed unit	R.E.M.A. (9 channel relayless)	Tailwheel type	Servo t'sistorised with relay built into servo case for centring
28 A. A. Arler U.S.S.R.	Low wing original	94	1080	135	11.6%	Webra Boxer Twin 7.6 c.c.	13 x 6 in.	RUM-1	RUM-1 7 channels	R.E.M.A. pneumatic servo system	Tricycle	Two position throttle; high aspect ratio wing
29 P. Velichkovsky U.S.S.R.	Low wing original	74	775	113		Super Tigre 35	11 x 6 in. wood	Homemade 10 hand held	Homemade 10 channels	R.E.M.A.T. motorised spring centered servos	Tricycle	Balloon fuel tank
30 W. van de Hoek Holland	Low wing original	63	450	846	12% Sym-metrical	Veco 29 R/C	11 x 4 in. nylon	Homemade 8 to Orbit circuit	Homemade 8 to Orbit circuit	R.E.M.A.T. Vacuum system	Tricycle	Extra vacuum drive by elec. motor provides s. power when eng. stops
31 W. de Mulder Holland	Low wing "Orion"	68	690	113	N.A.C.A. 2415 15%	K & B 45 R/C	12 x 6 in. nylon	Homemade to Orbit 10 circuit	Homemade to Orbit circuit relayless	R.E.M.A.T. 5 E.D. Duramatic servos homemade ampli.	Tricycle	
32 P. Stephansen Norway	Shoulder wing original	60	635.5	92	17½%	Enya 29 R/C	10 x 4 in. nylon	Homemade proportional	Homemade proportional	R.E.M.A. Micro-max servo motors	Tailwheel type	Rudder con. trans. to full span strip ailerons when required via tone change switch on Tx.

Definitions: R, Rudder ; E, Elevator ; M, Motor ; A, Ailerons ; T, Trim.



Full size plans available from Nelson Speciality Corp., 440 Peratta Ave., San Leandro, California, U.S.A. Price $3.50.

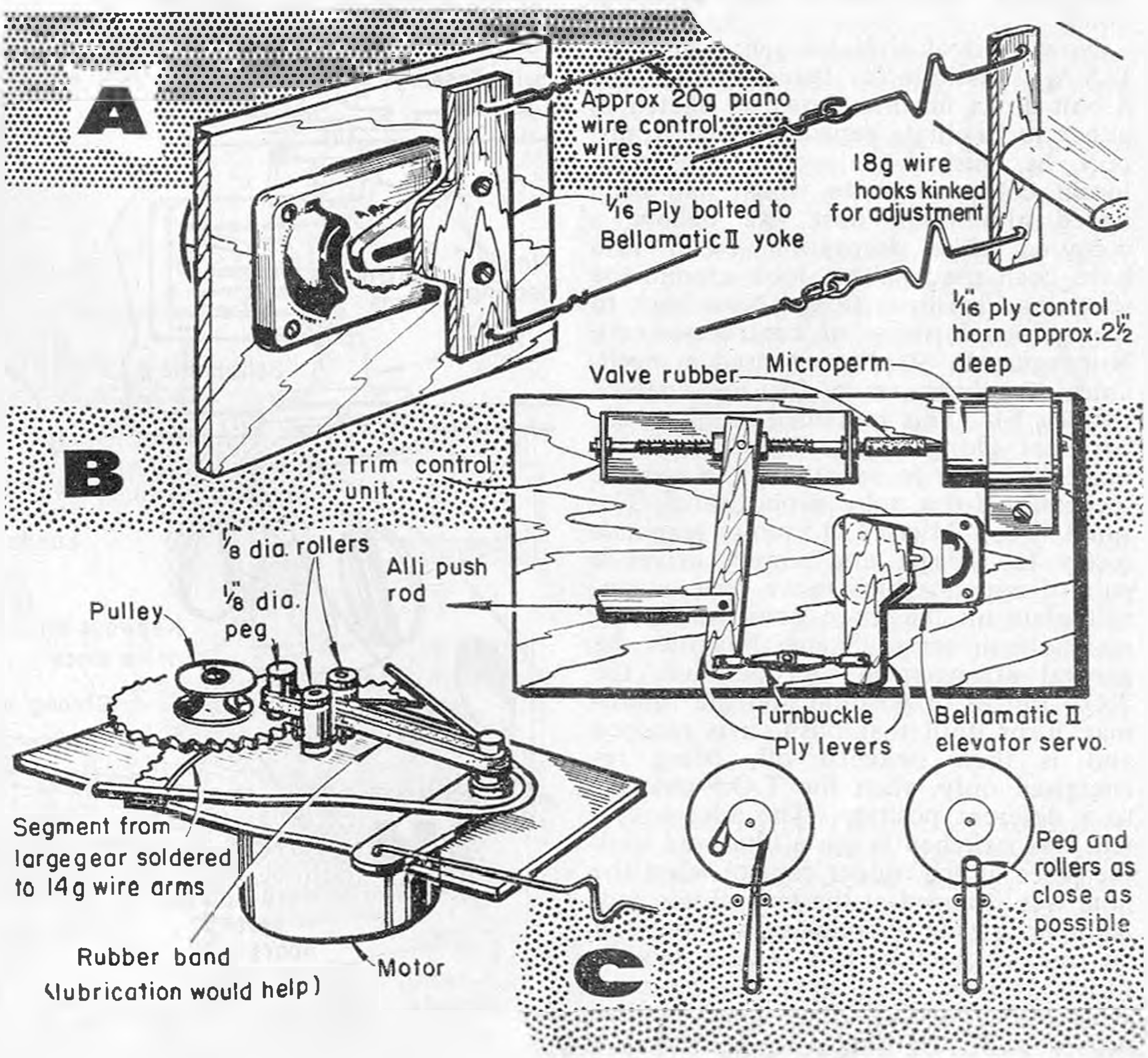
International Gimmickry

WHILST at R.A.F. Kenley for the World Championships we took the opportunity of studying most of the models whether first string or reserve, with a view to compiling a bumper Gadget Page such as you now see before you. Variations on the electro mechanical theme took many forms, some born of necessity, others of the designer's desire to experiment; we have collected the most interesting gimmicks for the next few pages and hope that readers will be able to find inspiration from the brain-boxes of the champions.

First, a visit to France: F. Plessier has numerous gimmicks in his series of "Grrrrr's". Sketch **A** illustrates a twin control wire linkage which uses thin (about 20 gauge) wires from a plywood yoke screwed to the existing plastic yoke on the Bellamatic servos and connected to very large plywood control horns on the surfaces via kinked wire adjustors. Sketch **B** shows the elevator trim system. Note the use of a turnbuckle (possibly from a model yacht mast stay) and the large plywood extension to the Bellamatic.

This must reduce the torque considerably, but by providing a larger throw minimises the effect of any float in the bearings. The trim servo could be knocked up in a very short space of time!

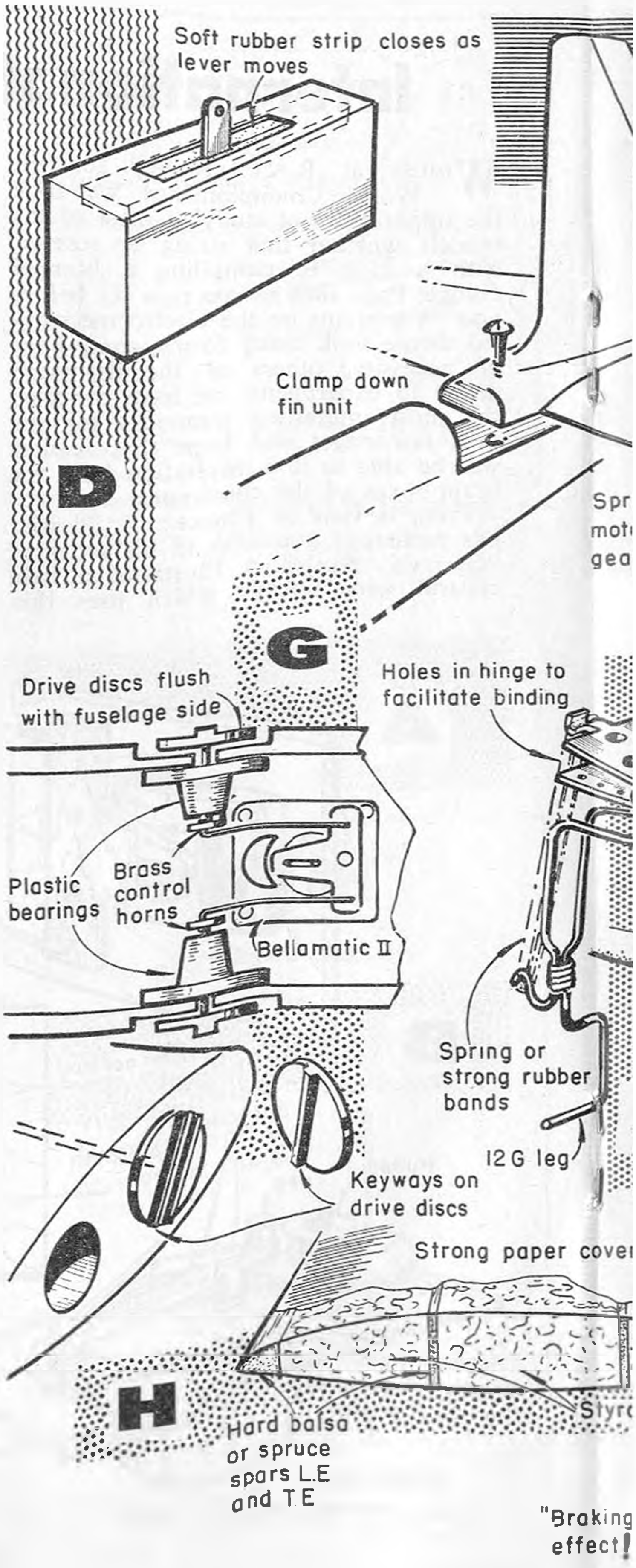
Now way over to Russia, P. M. Velichkovski has the most interesting self

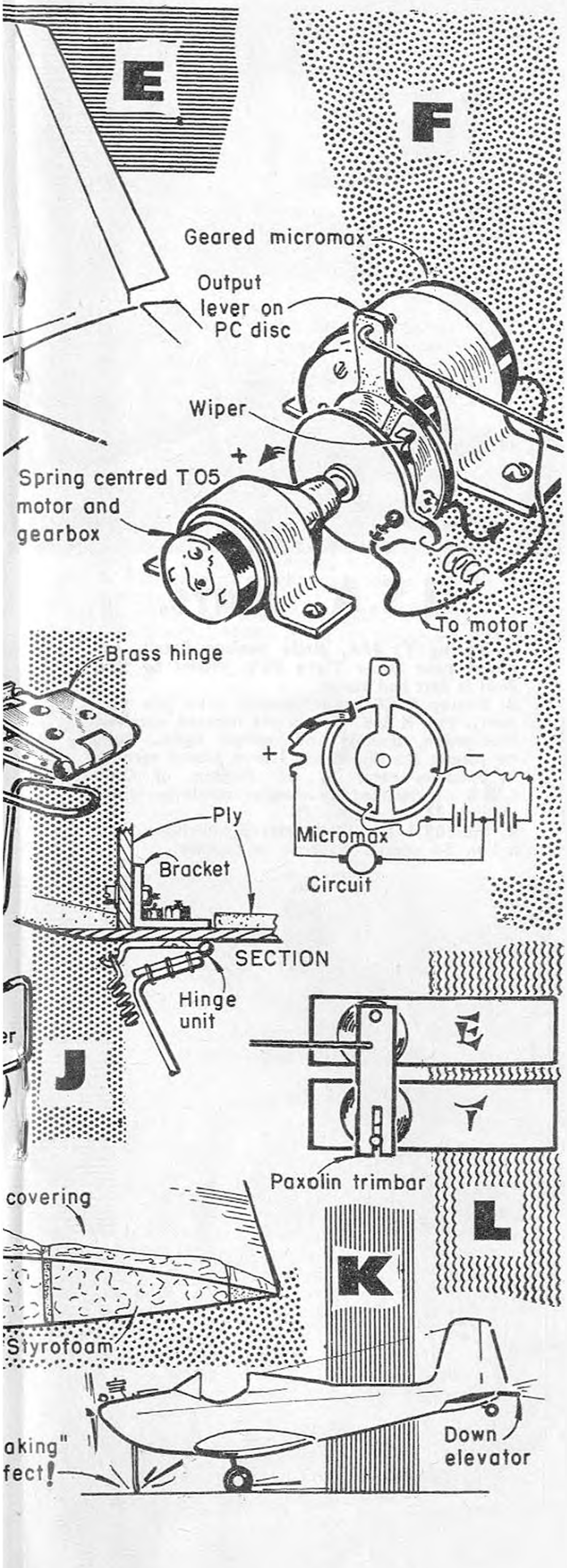


centering servos shown in Sketch **C**. The centering arrangement is definitely worthy of application to bang bang *and* proportional servos. The centering device is on the penultimate gear and a clever arrangement of guide pegs and a winding drum permit a simple rubber band to provide really positive centering without imposing too high a load at the ends of the travel. Scrap views clearly indicate the centre and limit positions respectively. Note the short length of band between the guide pegs at neutral, this prevents wandering at this point, and the reduced moment provided by the pulley at full throw position.

P. Marrot had dirt excluders fitted to the clearance slot in his home built servos (we shall be publishing some gen on these interesting items later). Sketch **D** shows the general idea which might be applied to other mechanical bits and pieces with the idea of protecting the vital printed circuit switching gear from dust (and salt water. skippers please note).

Now a bit of airframe gen; Robinson. U.S.A. (substitute for Doug Spreng) had a bolt down fin unit shown in Sketch **E**, either to facilitate replacement or transport. he finished the model with translucent colour dope to which had been added aluminium dust (we believe a coloured cake decoration could also have been used, take a look around the shops at Christmas time). Now back to the serious business of control systems, Norwegian P. Stephansen used a mechanical feedback servo for his ailerons (Sketch **F**). This reminded us of an experiment along similar lines which we made last year in an attempt to remove the gallop from pulse proportional. The small 47 to 1 Micro T.O.5 motor responds nicely to pulsing and simply drives a pair of wipers which move over a contact plate on the more powerful micromax aileron servo; Sketch **F** shows the general arrangement, in operation, the T.O.5 moves to position and the Micromax turns until that position is reached and is then switched off, being re-energised only when the T.O.5 changes to a different position. The aileron system was switched in via a filter and took the place of the rudder control when the note was changed at the transmitter end. Another aileron gimmick was to be seen on one of the German reserve models which boasted plug in mid-wing construction. Paxolin tubes, 1 in. in diameter, took the flight loads and the





aileron servo located in the fuselage moved a pair of driving dogs which located in plates fitted to the end of torque rods in each wing half. Sketch **G** explains the details.

Another of these models had a thin section "Styrofoam" plastic wing with full depth spars and paper covering. Apparently the paper is adequate for strength requirements as it takes the tensile load adequately and prevents the surface of the "Styrofoam" buckling under compression. Of course, special glues have to be used as dope simply dissolves the plastic. Sketch **H** shows our "guestimated" section.

Now for two undercarriage ideas. First, from R. Dilot uses a back flap hinge to provide a non steerable knock-back nosewheel unit for the do-it-yourself addict. Sketch **J** shows how the wire is bent, bound and soldered to the hinge and the tensioning band or spring give a large measure of rearward shock absorbtion. In a really heavy landing the wheel could fold right back against the fuselage without permanently elongating the spring and rubber bands are expendable anyway.

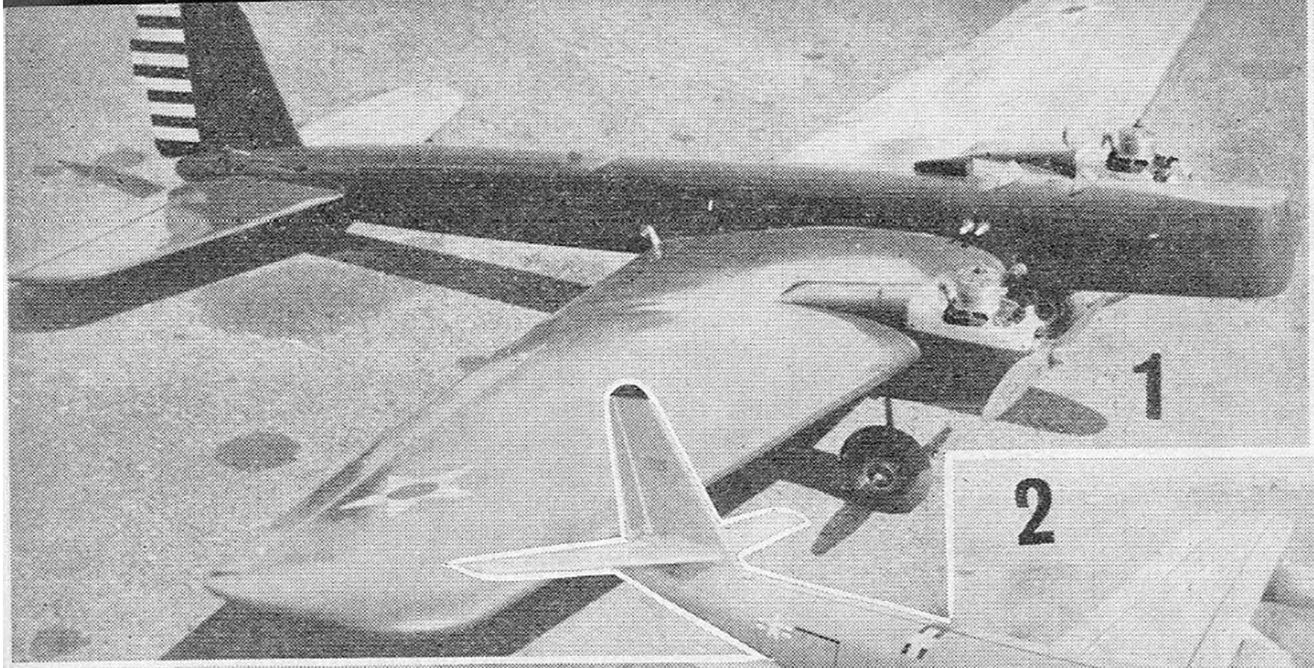
Talking of rubber bands, the Japanese contingent retained the wings on their models with lengths of braid covered elastic of the type usually used for keeping female undergarments in place. This proved very effective in that the silk covering took the strain when the rubber was stretched tightly and reduced the possibilty of the attachment failing should one strand of rubber break.

Another nose wheel arrangement, or perhaps more properly termed a nose peg on V. Milani's Astro Hog, of Italy (Sketch **K**), prevented nose-overs and was used as a brake by applying down elevator to tip the model forward and bring the peg leg down on the runway.

M. Kato of Japan had a very simple trim link which took advantage of the rotary output of his own commercial servos. Sketch **L** shows the general proportions.

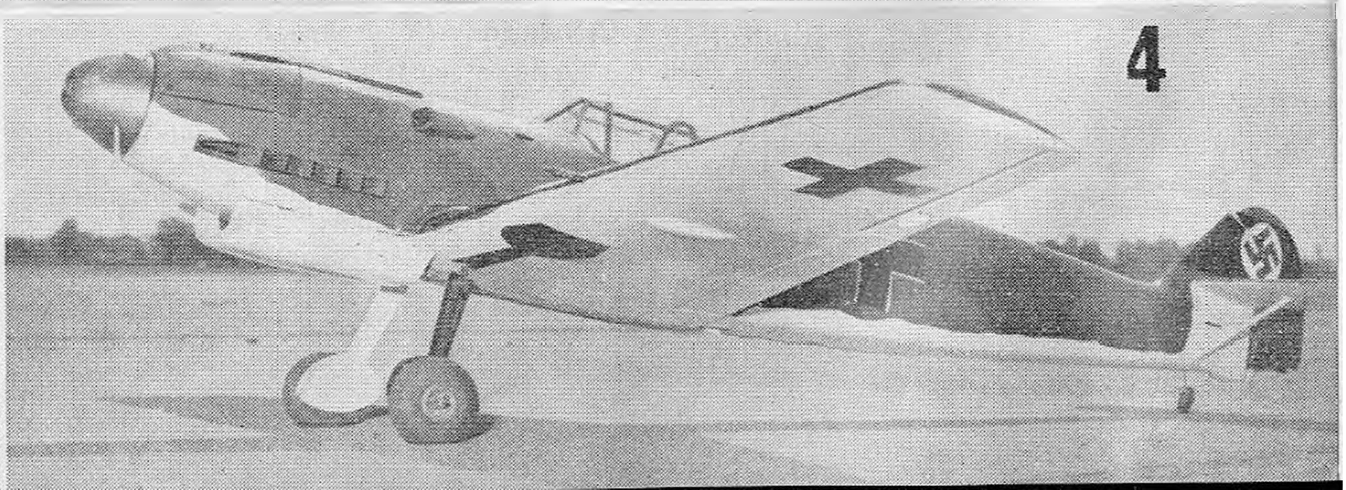
Conclusion

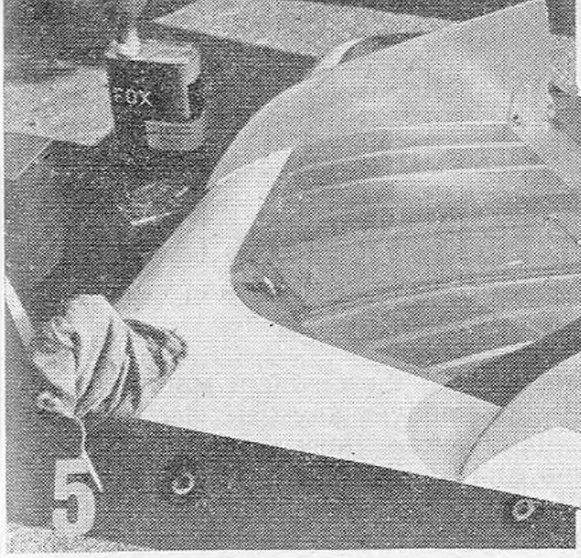
Quite a large number of modellers used installation plates, the French particularly; their whole linkage system with servos, trim bars, plugs, sockets and separate amplifiers fitted on horizontal or vertical ply panels. Bellamatic servos were used in a large number of installations and for a variety of applications, pulsed or bang bang.



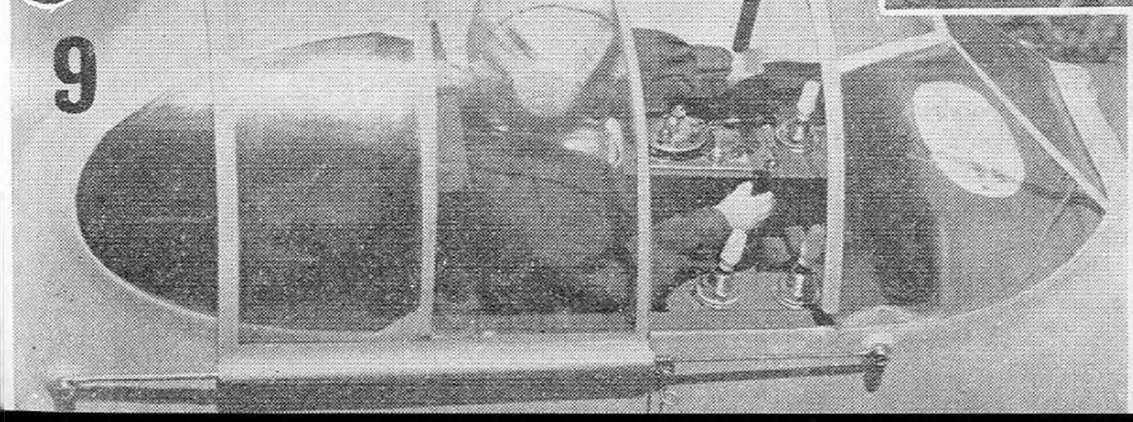
U.S.A. Nats.

1. Boeing Y1 B9A, little surface detail, exposed twin Super Tigre 56's. Model by Don Neil is fast and stable.
2. Boeing B 47 (experimental prop jets version), two K & B 45's in the inboard nacelles. Navigation, landing and cockpit lights. Built by Joseph Martin, Rhode Island, placed second.
3. Caudron racer by Al. Masters of Ohio K & B 45 dwarfed by massive cowling—wing-loading 37 oz. per sq. ft.
4. ME 109 E by Bill Bertrand, Michigan, has a Fox 56 cooled via hole in spinner.





5. Bob Baldwin flew a new version of his original XD7 "Hustler". Interesting "Velcro" fastener hatch.
6. Bensen Gyro-Copter, Merco 35 and Duramites out in the wind with Citizenship 6. Joseph Pasquito built this 72 in., cyclic pitch rotor model. Short take off ($5\frac{1}{2}$ lb. wt.).
7. Dr. Ralph Brook, Seattle, Washington with 62 in. Whistler (6 lb. 2 oz. —he says 4 lb. 34 oz.). Veco 45, Orbit 10. In 1963 Team. Very smooth.
8. 15 year old Nicky Moore, East Point, Georgia, started when only 12, seen with Taurus, Veco 45, Bramco 10.
9. Bud McNatt's Mustang cockpit. Pilot's hands on timer (for ejection?)
10. Corn cob smoking driver in cockpit of Harold De Bolt's "Viscount". Model has a retracting undercarriage.



Tuning Fork Tones

By P. T. BELLAMY, D.Tech.(Eng.)

PART 2

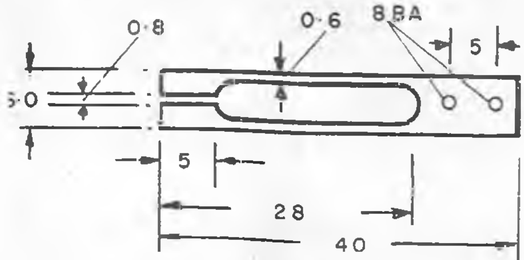
The introductory article last month showed the difficulties of designing rock stable tone generators for transmitters and illustrated the Nievergelt "tuning forks". Unfortunately, due to lack of space we were not able to publish the complete article in one issue so we continue with the constructional details with the vital fork and coil drawing re-printed to save referring back to the previous issue.

I HAVE always favoured using inductance-capacitance oscillators myself as I have been able to manufacture the circuits to give the required temperature stability, however, there are few enthusiasts who have all the facilities necessary to produce this rather more complex equipment. While in England, I had no trouble with stability, however, now that I live in Switzerland I find that I must design for a much wider temperature range, and as a result have had to look to new techniques.

Tuning fork stability

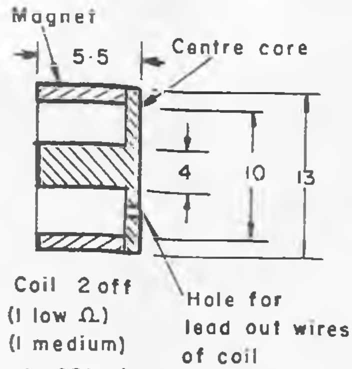
I have been very fortunate in meeting Mr. Nievergelt and having many talks with him on the problems of radio control together with Mr. F. Bickel from one of the most formidable radio control teams in Switzerland—in fact in Europe. From these talks, I found out that all the tone generators now used by Mr. E. Nievergelt are electrically maintained tuning forks and therefore I owe much to him for allowing me to write up basically his ideas. The stability of the tuning fork is such that frequency deviations of less than .25 c/s have been measured over all conditions during a period of some four years. Of course, a certain amount of care must be exercised when making these oscillators, but surely it is worth a little time and trouble to produce generators with this order of accuracy.

I have manufactured tuning forks now and find that the resultant stability is equally as good as any "all electronic" oscillator except those using quartz oscillators and similar frequency determing elements. The only drawback is that one tuning fork oscillator must be manufactured for each reed frequency. The problem of stability is also tied up with what is known as the quality or Q factor of the given circuit, and the higher the value of Q, expressed as a pure number, the more stable the circuit from a frequency point of view. However, the Q also effects the time taken for the circuit to build up to a

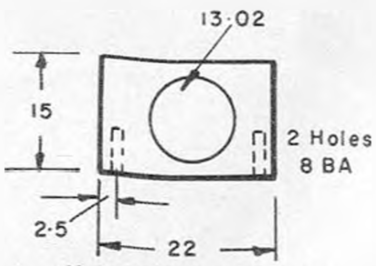


Material : 6mm square
1 off mild steel

2. TUNING FORK



4 COIL/MAGNET ASSEMBLY



Material: 5mm dural
2 off

3 COIL HOLDER

ALL DIMENSIONS IN MILLIMETRES

stable amplitude of operation, as the higher the Q, the longer the time for this build up from the instant of applying battery power to the circuit. These two conditions are conflicting, so the only solution to the problem is to leave the oscillators running all the time and just keying the output to the modulator. The principle of the oscillator is very simple indeed. The frequency determining component is a tuning fork, which takes the general shape of a "U" and is fixed at the base thus leaving two "free" ends. On either outside of the two free ends are mounted two coils, one of medium impedance, the other low impedance. The medium impedance coil is connected in the collector circuit of a transistor and the coil of low impedance is connected in the base to form the feedback circuit. It the coils are correctly connected and adjusted, then the circuit can be made to oscillate and produce a good sine wave at the base of the transistor. The drive coil must have a polarising magnet and likewise the feedback coil; this is so that the frequency of the electronic circuit is exactly the same as that of the mechanical circuit resonator, i.e., the tuning fork, and not of the second harmonic. This is also true for reed units, and thus have a magnet to give similar polarising effect.

The Fork

The construction of the tuning fork can be seen from the drawings, however, a few comments will probably make the task easier. The actual tuning fork is made from mild steel and can either be machined from the solid as mine are—or fabricated from small pieces. Firstly to machine the fork take a piece of standard 6 mm. sq. bar stock and mill out the centre as shown in the drawings. Cut a 0.8 mm. slit in one end, and drill and tap the other end 8 B.A. Of course, to cut out the centre it is possible to use a drill and file rather than mill it out. Care should be taken to ensure that the two "prongs" of the forks are symmetrical in all aspects in order to obtain the highest accuracy and stability of the final oscillator. The length of the fork, the mass of the ends and the thickness of the "walls" of the cutout determine the final frequency of the oscillator. Fabrication of the forks are made to the same dimensions as those machined from the solid, and all joints should be brazed. It is simplest to join both ends of the forks to solid blocks and then split one end, also to avoid distortion it is essential to heat up all parts together and do the brazing in one go. Ideally the forks should be brazed in a salt bath or vacuum furnace, however, this may be beyond most modellers, but there are several firms who do this process at quite reasonable cost.

Coils

The coils are wound on small circular formers to give resistance of 20 ohm and 200 ohm approximately: the exact values are not critical but the turns should be around 450 and 1500. The magnet is outside the coil and is polarised axially, the centre core is just mild steel and is machined to be the same diameter as the magnet and have the centre pole the same length as that of the magnet. Mechanically the coils are identical in construction and are Araldited to a piece of 3 mm. foam rubber backed 2 mm. glass fibre board—this is to prevent cross modulation between channels. It is necessary to adjust the spacing of the coils and tuning fork to obtain the best oscillation to adjust the frequency the tuning forks are filed either on the ends of the prongs to increase the frequency or along the thickness of the prongs to reduce the frequency.

Do not try to obtain a sine wave from the collector of the drive transistor because the waveform will be that of the drive current needed to make the fork oscillate. However, at resonance the fork oscillates with a simple harmonic motion and will thus induce a sine wave in the feedback coil. While it is not necessary to use real high precision to make the tuning fork oscillators, obviously the more care and precision used the better the overall stability and reliability. The dimensions given will produce a frequency of approximately 400 c/s, but this is only a guide as the frequency is dependant on the type of steel used. It is best to make an experimental fork first in order to find the exact sizes needed for the range to be covered. The frequencies may be chosen to lie between 20 c/s and 10 kc/s, using the same basic components except for the dimensions of the fork itself.

Pack With Care!

FURTHER THOUGHTS ON VIBRATION BY E. A. FALKNER AND J. H. AYRES

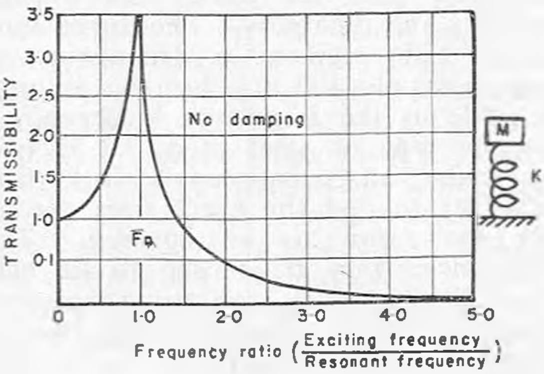
Our "Gremlin War" on Vibration in the April, 1962, issue shook a few brain boxes into action and after a spot of research E. A. Falkner and J. H. Ayres came up with another practical solution complete with supporting theory.

An average size R/C engine running at 10 to 15,000 r.p.m. must generate very severe vibration in the range 150-250 c.p.s. and probably a considerable amount at multiples of those frequencies. Vibration is prejudicial to the long life and stability of any piece of equipment, but in the case of a receiver using reeds the result can be much more immediate. If the vibration frequency is anywhere near that of one of the reeds, then it may well produce an unwanted response of one of the controls.

The remedy is to isolate the wires from the frame by some form of resilient mounting, but an unsuitable material may do little good and can actually multiply the trouble.

The receiver on its resilient mounting is like a simple mass m on a spring of stiffness k. This system will have its own resonant or natural vibration frequency Fn (given by $Fn = \tfrac{1}{2}\pi \sqrt{\frac{k}{m}}$) and will tend to move at this frequency and no other when it is caused to intrate.. Diagram A shows how the system responds to applied vibrations over a range of frequencies (see Fig. 1).

FIG. 1



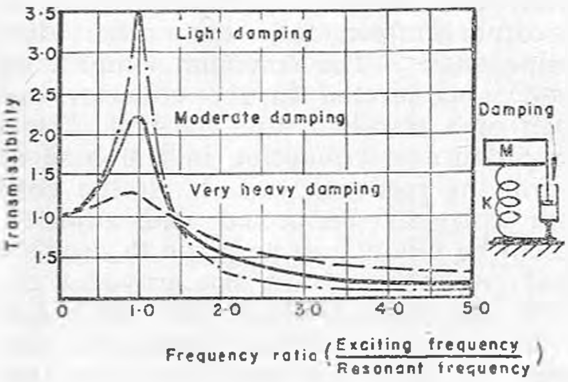


FIG. 2

Transmission

The transmissibility is the ratio of the vibration of the mass on the spring to the vibration applied to the system. At high frequencies, much greater than Fn the vibration is reduced, but at the resonant frequency it actually amplifies the vibration many times. In fact, such a system, having no energy losses (or "damping") would have unlimited gain at resonance, and a vibration, once started would never stop. The low transmissibility at high frequencies is just what is needed for vibration isolation but the very high gain is dangerous as shocks, etc., would initiate large and damaging vibrations at the resonant frequency.

A practical system always incorporates a certain amount of damping or energy loss. This flattens out the response, reducing the gain at resonance but increasing the transmissibility elsewhere. The effect is shown in Fig. 2.

It is now possible to decide on the last system to use under given conditions. Clearly to get a reasonable amount of vibration reduction the system must resonate well below the expected vibration frequency. The damping must be just sufficient to present excessive oscillations, but must not be too great. In addition the systems must locate the receiver in a fairly positive manner and properly, should protect it from impact under crash conditions.

Rubberised Hair

The materials constantly in use fall short of the ideal in many respects and so an idea was borrowed from the packaging industry and rubberised hair was tried.

Low-density rubberised hair (2-3 lbs./cu. ft.) would seem to have the ideal characteristics for packing the receiver and the following comparative test confirms this beyond doubt.

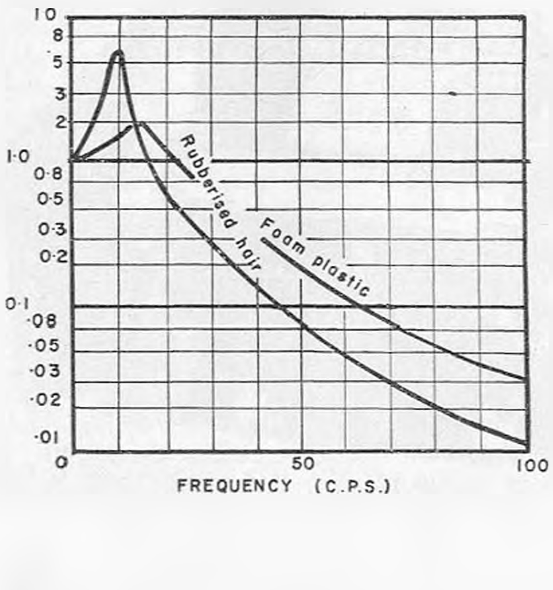
A receiver weighing 6 oz. was supported (A) on 1½ in. of foam plastic, (B) on 1½ in. of rubberised hair, and (C) on elastic bands, and then subjected to vibration at frequencies from 5 to 1,000 c.p.s. Fig. 3 shows the result.

Foam plastic is much too damped for this application and has relatively high transmissibility at 50 and 100 c.p.s. The resonant gain is 2.

Rubberised hair has less than one quarter the transmissibility while the resonant gain is still very low at 5.5.

Rubber bands are not included because although they have a sufficiently low transmissibility they can produce resonant gains of over 15, and also in the event of a crash or other shock they promote no protection for the receiver.

FIG. 3



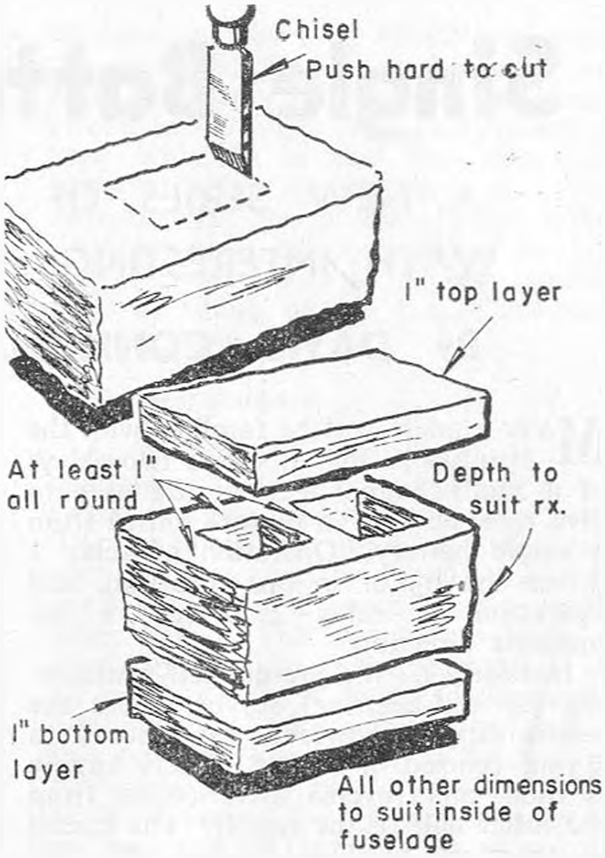


FIG. 4

Installation

Rubberised hair of 2-3 lbs./cu. ft. density is easy to use, provides very good shock protection and is light. Any thickness above 1 in. will produce adequate attenuation to frequency above 50 c.p.s. (engine speeds of down to 3,000 r.p.m.) with proportionally better performance at higher revs.

For the best results the receiver should not be too tightly packed, i.e. the rubberised hair sheet should not be pre-compressed. The effective thickness "in situ"—not before insertion.

The best practical arrangement is shown in Fig. 4 and the recommended method of cutting is with a sharp ½ in. wood chisel.

In conclusion, this method of vibration suppression has been used by several experts in recent months, and has fully substantiated the theory outlined in the text.

Single Battery Servos

A NEW SERIES OF HOME BUILT SERVOS WITH INTERESTING SWITCHING CIRCUITRY

By DAVID CONNOLLY **PART 1**

MANY readers will be familiar with the circuit in Fig. 1, where two relays of a multi-channel receiver are used to give reversible servo motor control from a single battery. Operation of relay 1 drives the motor in one direction, and operation of relay 2 drives in the opposite direction.

In nearly all the present self-neutralising (or self-centring) servos where the neutralising is powered, as opposed to spring centred, a tapped battery supply is used, and reverse drive comes from the other half of the supply. The circuit is then as in Fig. 2, and the self neutralising action is obtained from the normally closed contacts. The operation is as in Fig. 1, i.e. relays 1 and 2 give drive in opposite directions. Some manufacturers even advise the use of the Fig. 2 circuit for progressive controls, where self-neutralisation is not required, whereas the single battery circuit can be used to advantage.

The advantages of a single battery circuit can be summarised as follows:

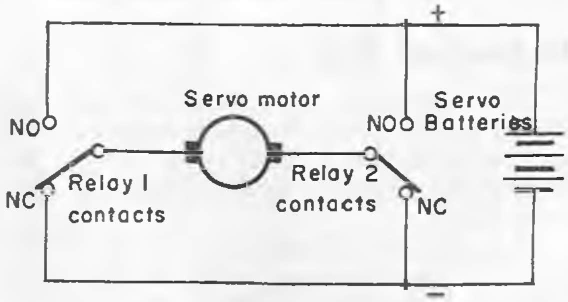
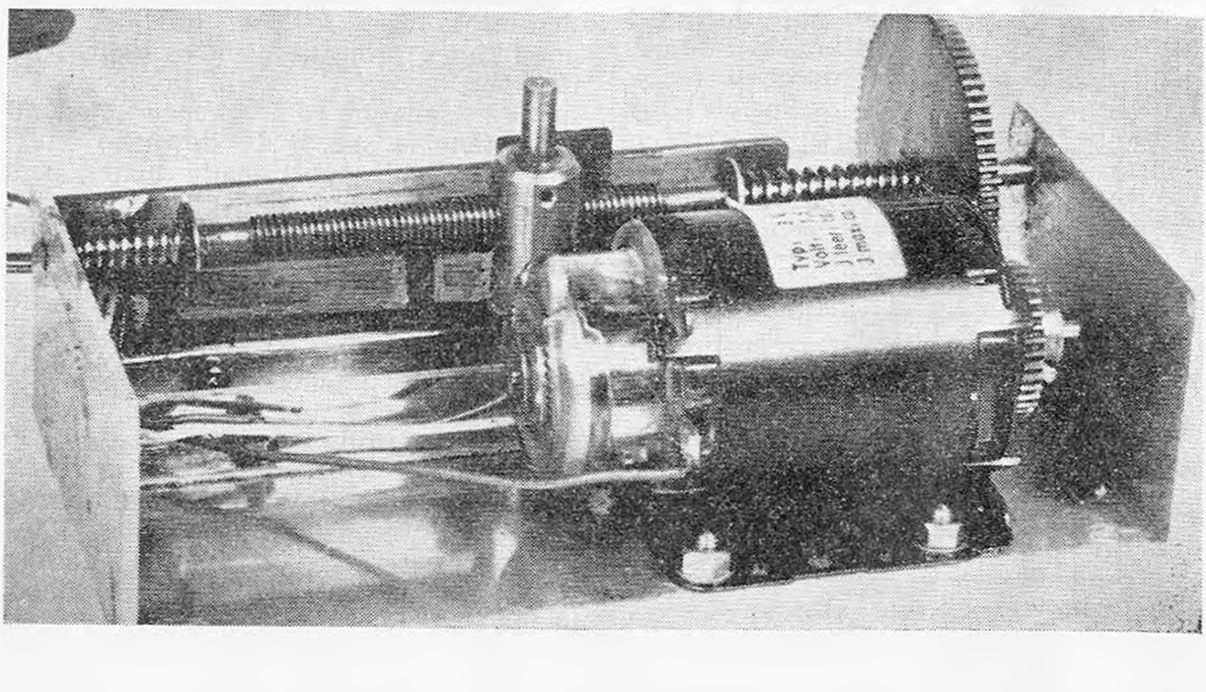


FIG. 1

1. Half the number of cells are required. Although the capacity of the cells must be doubled compared with those in a tapped battery system for equivalent performance, the single battery system nearly always has the advantage where weight and initial cost are concerned.

2. Since the cells are used for drive in both directions, the same drive speed is

Home built steering servo using a large version of the "Milliperm". The p.c. track may be seen at the back.



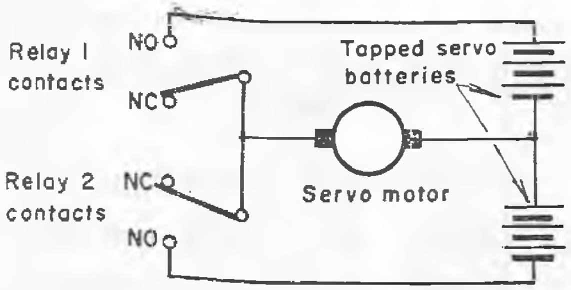


FIG. 2

obtained in each direction, and the unfortunate case of 'all Right and no Left' cannot arise as it can in the tapped battery circuit when half the supply goes down. Also, since the cells are all discharged by the same amount, they can all be charged in series.

3. The circuit of Fig. 1 gives immunity from both relays operating at the same time. If this happens in Fig. 2, the cells are discharged through the relay contacts, and can easily become completely discharged in a second or two. The resultant heavy current can easily damage both the relay contacts and the cells. This is admittedly a rare occurrence, but if it happens it is disastrous, and it is worth making the circuitry foolproof in this respect.

4. With very efficient and high inertia motors, the overrun of a servo when used in the circuit of Fig. 1 is much reduced. This is because the motor is automatically short-circuited as soon as the drive is taken off, resulting in electrodynamic braking.

5. A single pole on/off switch can be used for the supply, as opposed to the double pole type necessary in tapped battery circuits.

The single battery is, therefore, very desirable, but when self neutralisation is required the circuitry must necessarily become more complicated. Whereas in the tapped battery circuit there are spare contacts on the relays which can be used for neutralisation, in the single battery circuit all the contacts are used (to advantage) and other means must be found to obtain neutralisation. Of course, it is possible to eliminate the relays altogether and to use transistor amplifiers (TASAs), but if you have a limited supply of cash or transistors, this proposition is not very attractive. I am concerned here with relay receivers, which are anyway in the majority.

An economical solution to the problem is to apply the neutralisation to the relay coils rather than the relay contacts. In other words, it is possible to retain the circuit of Fig. 1 for the motor and relay contacts, and to wire a printed circuit board fitted to the servo into the reed circuitry so that the relays are operated either by the reeds or by the switching on the printed circuit board. This principle can be applied to both the screwed rod (e.g., Ripmax steering unit) or rotary output (e.g., Duramatic) type of servo.

3 Channel Rudder

An example of the principle is the 3-channel rudder, a type of control well suited to slow and medium speed boats. Two channels are used in the normal way as a progressive rudder, and the third channel will neutralise the rudder when keyed. This system has been unkindly referred to as 'Panic Neutral', and an article by G. F. Batho in September, 1961, *R.C.M. & E.* describes a unit of this type when used with a tapped battery supply. For boat work, the system is far superior to ordinary progressive rudder, and is far more than a panic measure. Of course, five channels are necessary, assuming two for engine control, but if the extra one is available it is well worth fitting. The single battery system has now been fitted successfully to a Gannet powered Sea Queen, a Taplin powered 'Bonito', and a Taplin powered 'Barracuda', in each case using E.D. 6-channel radio.

The circuitry for the single battery is shown in Fig. 3, and a 3-channel servo is shown in the photographs. As can be seen, this is a straightforward screwed rod type, with a simple printed circuit board attached. A short circuiting wiper is mounted on the tiller block, and contacts the appropriate parts of the p.c. board. Operation of the circuit is as follows. Suppose right rudder is keyed, then relay 1 will operate through reed 1, and the wiper block will move as shown, until keying stops (progressive operation). The rudder then stops in the set position. When the centring control is keyed, relay 4 closes and this in turn will operate relay 2 through the p.c. board and the wiper contacts. Thus left rudder is automatically applied, and the travelling block moves back to centre until the shorting wiper is open circuited, and relay 2 drops out, stopping the motor. The same applies for centring from left rudder, and if the travelling block overshoots the gap in

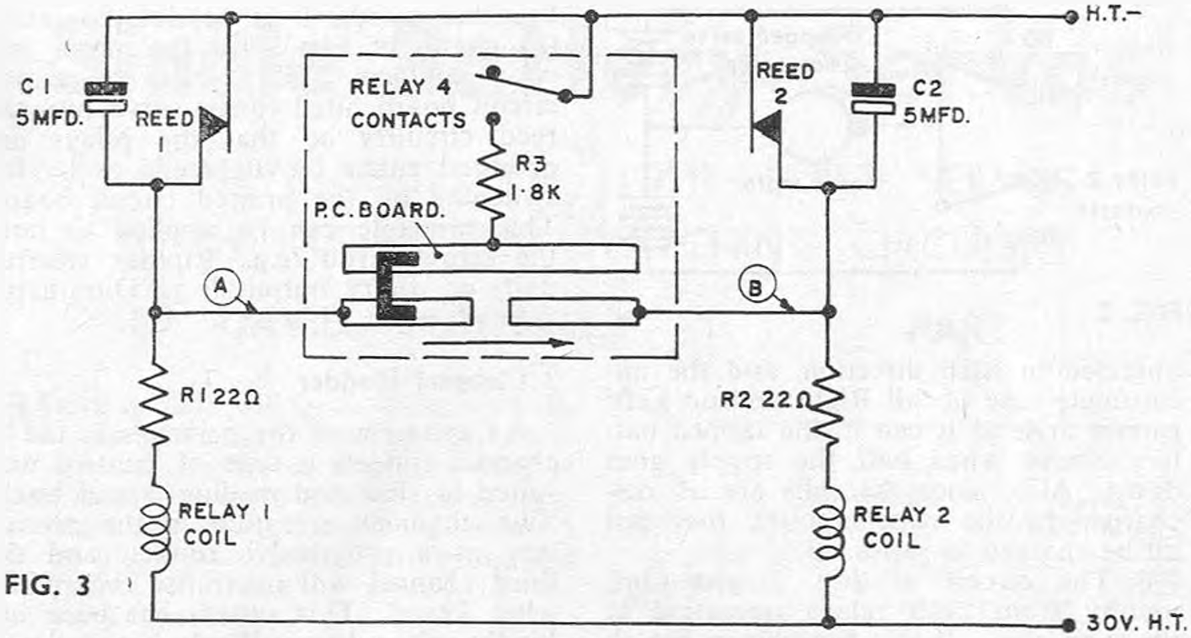


FIG. 3

the printed circuit board, the motor will be momentarily reversed to give 'sniff back' so that an exact centre is obtained every time. It should be pointed out that if the gap in the p.c. board is too narrow, the 'sniff back' will become an oscillation, so that an optimum gap width must be found.

There is a remote possibility on simultaneous gear that relays 1 and 4 could operate together, and this could lead to simultaneous operation of relays 1 and 2 in some cases. However, this cannot short out the batteries as has already been explained.

The printed circuit board is only required to switch the relay current which is about 7-10 mA. so light wiper pressure is sufficient and no arcing can occur, unlike many servos.

The modification to the receiver is very simple, and requires two extra

(*Continued on page* 563)

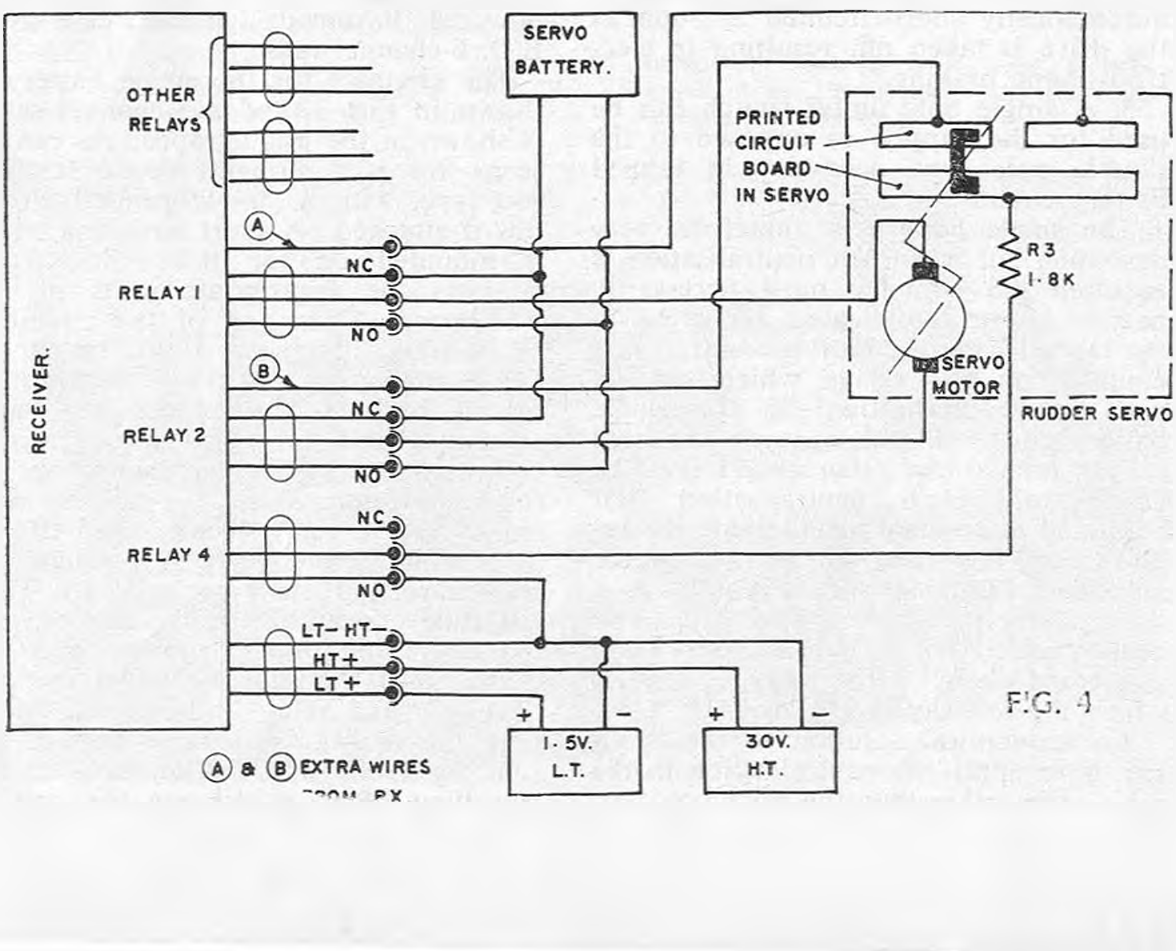


FIG. 4

Metz Mecatron On Test

J. H. BRUNT CONDUCTS TESTS ON THE METZ "BABY" Tx., Rx. AND MECATRONIC I ACTUATOR

THE complete radio control system for single channel working consists of the following Mecatron Transmitter 191/1, Mecatron Receiver 191, Mecatronic 1. 190/16 Single Channel motorised actuator and Aerial mount and spring wire aerial for the Rx.

Manufacturer's Description of the Transmitter

(Note: The circuit references apply to the Metz circuit drawing and are therefore bracketed.)

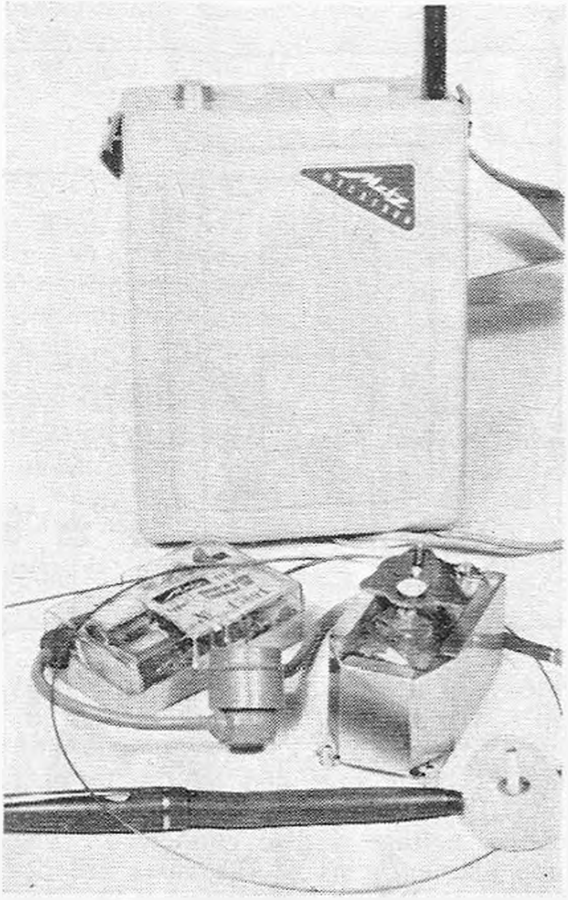
THE Mecatron "Baby" Tx. is intended for use with radio controlled models fitted with the Mecatron "Baby" Rx. The Tx. works on a frequency of 27.12 Mc/s. with tone modulation from 2.3 Mc/s.-3 Mc/s. The modulation frequency is approximately 2,500 cps. The Tx. cannot be used with the larger Mecatron Rx.

Due to long and intensive work on the Mecatron "Baby" Tx., it is an enormous advance in the field of valve transmitters. The unbelievably high output with a minimum current consumption gives a performance that was hitherto not possible with radio control transmitters.

The supply voltage of 3 volts is obtained from two single cells of the U2 type or equivalent. The switch (S) closes the circuit to the valve (Rö1) filament. The push-button (S2) switches the D.C. Converter. The current consumption of the Tx. is approximately 500 mA. when the push-button (S2) is depressed. The D.C. Converter which consists of; the transformer (Ue), the transistor (T1) and resistors and capacitors (R2), (R3), (R4), (C9) and (C10), works on the "Flux-converter" principal.

NOTE: *"Fluss-Wandler"; Flux is the nearest suitable word.*

The feedback being applied to the base of the transistors (T1), a mixture of voltage and current feedback is obtained from the lower secondary winding of the transformer (Ue) in that the lower ends of the secondary windings are connected to the base of the transistor.

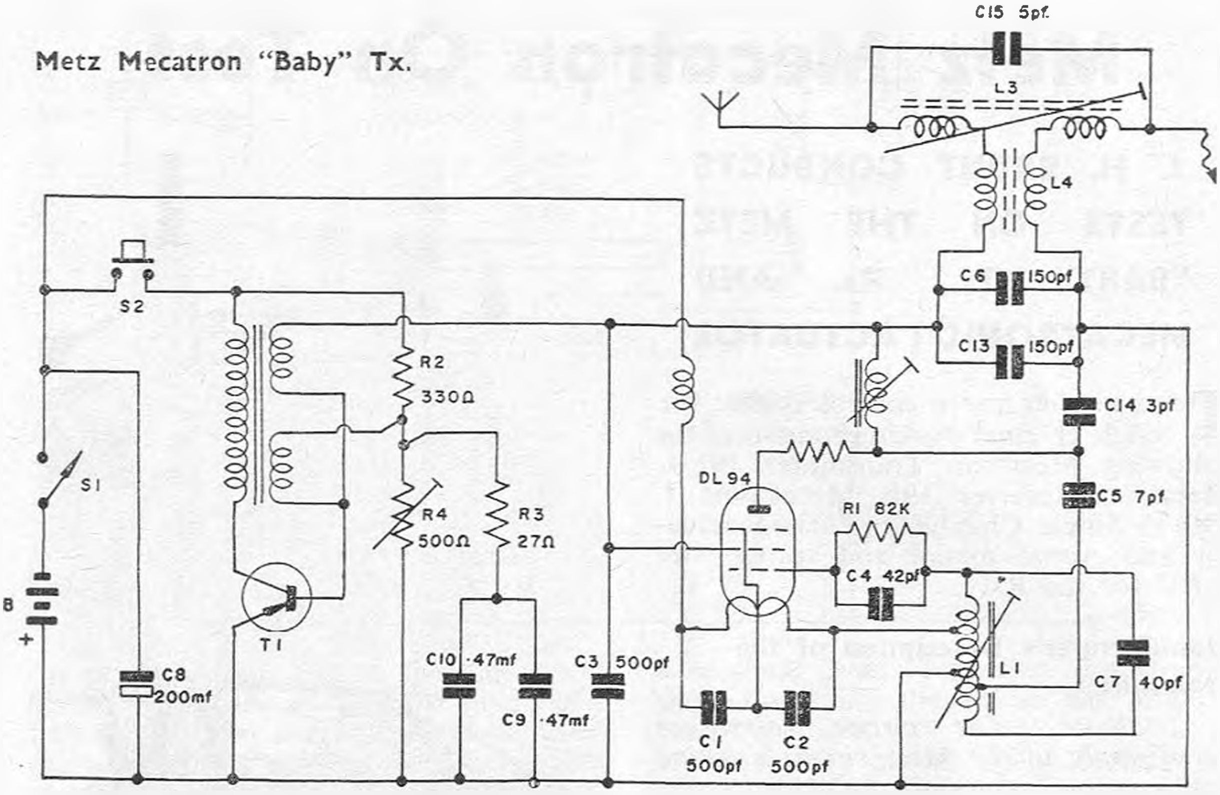


Small size of the complete outfit is emphasised by the pen. Note the piano wire arial.

The working point of the transistor (T1) is set by the potential divider (R2) (R4), the value of (R4) governs the converter frequency. The R/C network (R3) (C9) and (C10) controls the amount of feedback, so that the output of the transformer is approximately a 50-50 square-wave pulse with a peak voltage of 150 volts at a frequency of 2.5 Mc/s. This output voltage provides the H.T. supply to the Tx.

The R.F. stage of the Tx. using the valve type DL94 (Rö1) works with the screen-grid "earthy" or decoupled by (C3), the grid, and filament being wired in an E.C.O. (Electron Coupled Oscillator) circuit with (L1) and (C7) as the frequency determining components

Metz Mecatron "Baby" Tx.



which are tuned to 27.12 Mc/s. (R1) and (C4) providing the working bias for grid 1, the feedback between grid and filament being provided by the tapping on (L1), through which the filament positive voltage is also connected. The three filament pins of the valve are decoupled to R.F. by (C1) and (C2). The negative H.T. connection is through the R.F. choke (Dr1) this eliminates R.F. from the supply. To reduce feedback from the anode to grid circuit, (C5) provides a degree of neutralisation by means of an antiphase voltage.

The anode circuit of (Rö1) is tuned by the TT filter network (C14), (L2), (C6) and (C13). The H.T. supply to the anode is fed to the low resistance (to R.F. that is) side of the TT filter network.

This filter network serves to match the output impedance of the valve to the impedance of the aerial and also to filter out the harmonics present in the signal. The aerial system consists of a telescopic aerial of 830 mm. in length and a flexible lead of 660 mm. length, which forms a counterpoise aerial. (L3) is a double loading coil which tunes the aerial system to 27.12 Mc/s., by this means the aerial and counterpoise aerial are made to work as a shortened unsymetric dipole with vertical polarisation. The "dust core" or ferrite cored choke (L4) in the aerial circuit works as a further harmonic filter. The plastic case housing the Tx. is to all intents and purposes neutral to R.F., and has no detrimental effect on the Tx. or aerial.

* * *

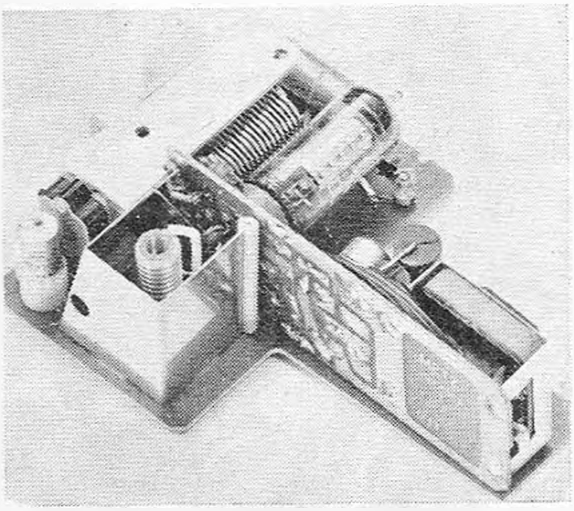
Translated from the German text by J. H. Brunt and R. Brunt.

NOTE: *It appears that the "modulation" is derived by virtue of the H.T. being unrectified and unsmoothed, i.e., switched on and off at the pulse frequency of the D.C. Converter. This means that while the transmission is of the A2 type, it is I.C.W. (or pulse) as opposed to the normal M.C.W. type of A2 transmission.*

TEST REPORT ON TX.

Mechanical Examination

This unit is neat and compact, also easy to handle and operate. The fitting of batteries (U2 size) is a simple operation. Access to the 'innards' and battery compartment is had by removing the securing screw in the centre of the plastic case rear cover. The circuit which is very ingenious, consists of a D.C. converter using one TF78 Seimens Transistor and a one valve E.C.O. Transmitter using a DL94 valve. The E.C.O. portion of the circuit is well screened, and the Anode circuit is tuned and matched to the aerial by a double TT



The compact Tx. unit removed from its case. Batteries fit each side of the central panel.

coupling system to reduce harmonic radiation.

Electrical Test

Total Current Consumption

Condition	Current	Battery Voltage
Switch On (Filament only)	50 mA.	3.05v.
Button Depressed (Tx. On)	510 mA.	2.6v.

Off load voltage of battery—3.1v.
H.T. applied to valve anode.
NOTE: This can only be conveniently measured as follows:

An A.C. meter is required, and must be connected from the battery negative to the telescopic aerial. The D.C. path being completed to the anode through the coils in the anode circuit. The meter used had a sensitivity of 1,000 ohms per volt and was set to the 300 volts A.C. range. A reading of 100 volts R.M.S. value was obtained. NOTE: The makers quote 150 volts peak value (see notes on modulation).

The life of the batteries is quoted as 15 hours, tests indicate that this figure is approximately correct with intermittent use. The Tx. will work with the battery volts down to 2.25 volts on load, at this point the total current is 400 mA. and the tone frequency falls slightly. When the battery volts on load fall to 2.15 volts, the Tx. will not operate correctly. This is indicated by a "motor-boating" effect and erratic operation indicating the need for new batteries. The tests normally applied to Tx.s could not be carried out, as the following notes will show.

Modulation

Due to the fact that the D.C. Converter output is not being rectified (Square Ware output with 50-50 pulse width ratio) the Tx. is in reality an interrupted carrier wave or pulsed Transmitter. The carrier is switched on and off at a rate of approximately 2,500 cps. being the frequency of operation of the converter.

Power Output R.F.

This would be difficult to measure as the D.C. Converter pulses also appear on the aerial and make accurate estimation impossible, let alone measurement with the normal type of instruments. However, the following notes on what approximately happens to the battery power consumed, may help. From measurements and study of the circuit.

Input to D.C. Converter 1.35 watts.

Allowing 80 per cent efficiency for the converter, and realising that only the positive going output pulses will be used by the valve.

Input to Valve 0.54 watts.

It is reasonable to assume a 50 per cent efficiency and just over 0.25 watts R.F. output may be expected. Field Strength Meter readings indicate that this assumption is in fact correct.

Frequency Stability

This appears to be adequate, but the E.C.O. (Electro Coupled Oscillator) is not at its best at 27 Mc/s., 7 M/cs. being the normal frequency limit for high stability. Also there is a fair amount of F.M. present on the carrier due to the H.T. supply, this is not detrimental to super-regen detectors which will accept both F.M. and A.M.

Tone Modulation Stability

This is surprisingly good for a source of the nature employed; namely the D.C. Converter oscillator. *Comment*—a very ingenious piece of circuitry, the construction of which can only be faulted on one point—the placing of the valve. It is in a difficult position from the point of view of replacement. The π filter networks are a good thing, especially with an E.C.O., as this type of oscillator is very rich in harmonics, which must be filtered out to avoid T.V.I. The high efficiency of this Tx. is largely due to the fact that it is pulse modulated rather than tone modulated.

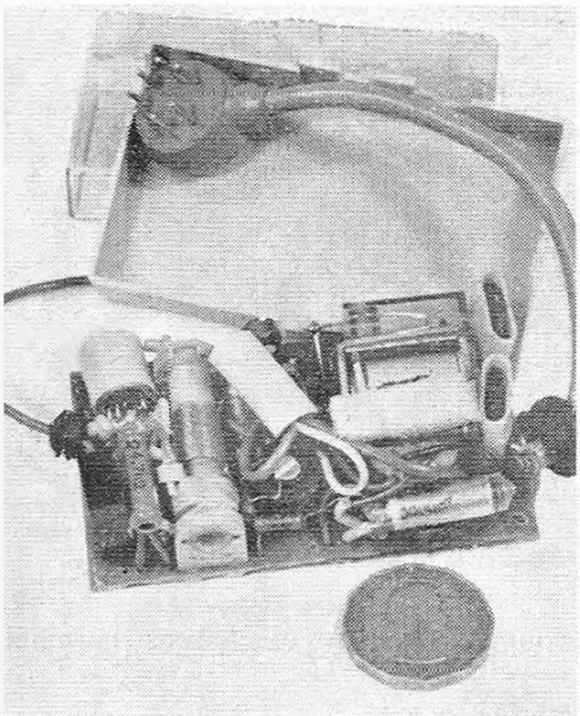
Manufacturer's Description of the Receiver

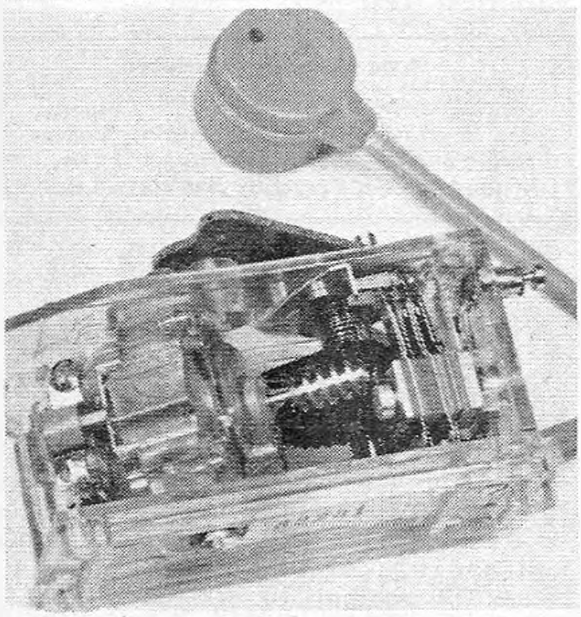
THE Mecatron Baby Rx. is a very lightweight unit designed to work with the Mecatron Baby Tx., or with the larger Mecatron Tx. The receiver frequency is 27.12 Mc/s. The tone modulation of the transmitters must be between 2000 cps and 3500 cps. (The modulation frequency of the Baby Tx. is approximately 2500 cps and that of the larger Mecatron Tx.'s, 3300 cps, 2730 cps and 2280 cps.)

The receiver is intended to work on a tone modulated signal, rather than a carrier suppressing the receiver noise. The line up of stages is as follows: (T1) OC170 H.F. Transistor is an Ultra-audion super-regenerative detector, transformer coupled to (T2) OC80 A.F. transistor, which is reflexed to serve as both A.F. amplifier and D.C. amplifier to operate the relay (Rs1).

The R.F. signal is fed from the aerial through (C4) to (L1) and (C3) which are tuned to 27.12 Mc/s. This tuned circuit is in the collector circuit of (T1). (C11) provides feedback capacity between collector and emitter, causing the circuit to oscillate. (L4) is an R.F. Choke in the emitter circuit of (T1) (L6 and C5) also in the collector circuit are tuned to the quench frequency which stops and starts the R.F. oscillations. By this means the R.F. signal is demodulated and the tone modulation components of the signal which appear in the collector current, is fed to the transformer (Tr1). (C7) is across the primary of (Tr1) and serves to tune the transformer primary to a wide resonance between 2000 and 3500 cps, thereby filtering out the quench frequency. The resistor and capacitor network R1, R2 and R3 and C1, C2 and C6 fixes the working point of (T1) and provides decoupling.

In order to stabilise the quench frequency voltage level and improve the performance of the receiver, the working voltage level of the quench frequency are stabilised by means of (R4) and (Gr2). The tone frequency is fed from the secondary of (Tr1) to between base and emitter of (Tr2) through (C10), the amplified tone frequency voltage appears across the relay coil (Rs1). This amplified tone frequency voltage is fed through (C9) to (Gr1), a voltage doubling rectifier, the rectified D.C. voltage appears across (C10). The D.C. working point is normally held by the bias network (R6 and R10), but the voltage developed across (C10) on receipt of a signal causes the current through the relay to rise and the relay closes. (R8) connects the emitter to pin five of the plugs to enable an earphone to be connected, thus enabling the tone to be heard when trimming the receiver. The contacts of the relay are bridged over with varistors (V1 and V2) to suppress sparking at the contacts.





Top : Rx. removed from the case ; components well protected with plastic sleeves. Bottom : Switching mechanism of the "Mecatronic I".

TEST REPORT ON RX.

Mechanical Examination

The unit is very small, neat and well constructed. For a set using only two (YES. TWO!) transistors the performance is remarkable. First OC170 is a Super-regen Ultra-audion Detector (the circuit is rather advanced in design) which is coupled to an OC80 with an AF Transformer. This second Transistor is in a reflex circuit and serves both as an A.F. and as a D.C. Amplifier. which switches a relay (Gruner 300 ohms). The relay contacts switch the actuator. the spark suppression at the relay contacts is achieved by the use of two varistors (Metrosils). The Rx. is housed in a plastic case. The supply and output leads go to a B7G plastic plug. the aerial is connected by a plug and socket. An aerial mount and spring wire aerial being supplied.

Electrical Test

Total Current Consumption (Rx. only with 6v. supply).
No. Sig. 5 - 6 mA.
Sig. On 30 - 45 mA. Depending on signal level.
(50 mA. MAX on large signal).
Relay MAKES @ 28-30 mA. } Total Rx.
BREAKS @ 18 mA. } currents
Quench frequency approximately 150-200 Kc/s.

Sensitivity

30-40 μV input modulated 80 per cent at 3.000 cps gives a current rise of from 6-30 mA. NOTE: Relay makes at 30-40 μV input and breaks when the input is reduced to 20 μV and below.

A.F. Response Test

With the R.F. level of the signal generator set to 50 μV (at this level the super-regen hiss is completely suppressed) and the modulation maintained at a constant level of 80 per cent, the modulation frequency was varied through the range 200 cps to 10 Kc/s.. on the upwards sweep the relay pulled in at 4 Kc/s. and dropped out at 2 Kc/s. From this it can be seen that the range of acceptance of the tone frequencies is quite wide. approximately from 2-6 Kc/s.

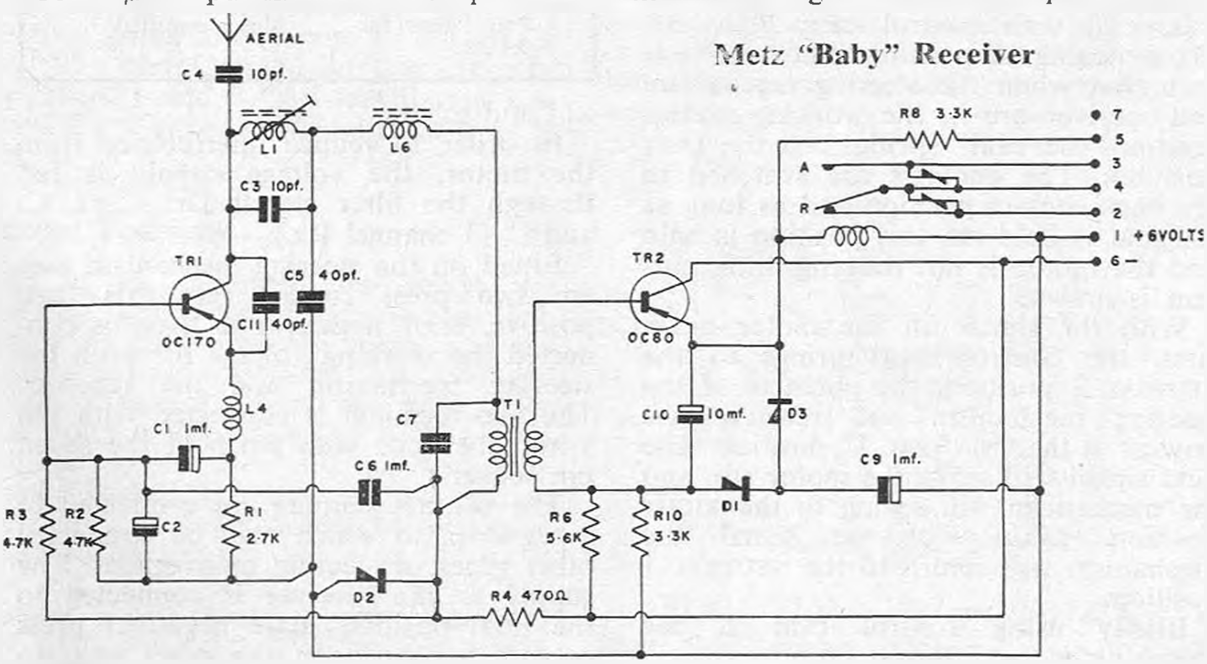
Reduced Voltage Operation

With only 4.5 volts applied to the Rx.. an input of 300 μV was required to give results in output equal to those in the sensitivity test. This represents a loss of 20 dB in sensitivity at the lower voltage.

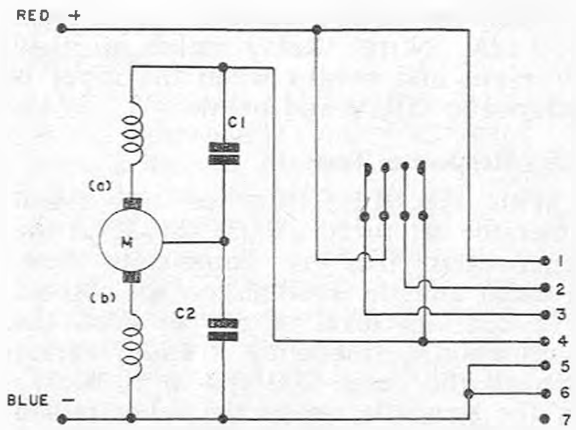
Manufacturer's Description of the "Mecatronic I"

The Metz One Channel Steering Mechanism—Mecatronic 1 (190/16)

This unit is universal and may be connected to all receivers with a relay output (providing a seven pin socket. connected in the same manner as those on the Mecatron receiver. is used) or the switching transistor output of the



Metz "Baby" Receiver



"MECATRONIC 1" CIRCUIT

Mecatron three channel receivers. When this receiver is used with the Mecatronic 1, in one channel working, only the GREEN channel is used. With three channel working using the Mecatronic 2 (two channel steering mechanism) this mechanism is connected to the YELLOW/RED channel. It is, naturally, also possible to have two channel working when the Mecatronic 2 only is connected.

The motive power to drive the Mecatronic 1 comes from a powerful electric motor and worm gear mechanisms. By means of a spring mechanism used in conjunction with the mechanism, four positions are possible (NEUTRAL 1, LEFT, NEUTRAL 2 and RIGHT). Further, by means of three interchangeable "control cams" (Contact control cams 1, 2 and 3) the contact arrangements of the steering mechanism can be changed to give different control positions. To illustrate this, e.g., with control cam 2 in use, the switching in position (NEUTRAL 1) is such that when the steering mechanism and receiver are in the working-contact position, the cam "springs" to the LEFT position. The contacts are switched to the back-contact position and as long as a signal is held on, this position is held and the motor is not running, little current is drawn.

With the signal off the motor again runs. the control cam springs to the NEUTRAL 2 position. the contacts of the steering mechanism and receiver are now as in the "NEUTRAL 1" position. The next signal will make the motor run and the mechanism will spring to the RIGHT position. again with no signal the mechanism will return to the NEUTRAL 1 position.

Briefly using control cam 2, the switching is as follows:

Tx. Condition	Action of Mechanism
Button pressed (Sig. On)	Rudder LEFT as long as button is held
Button released (Sig. Off)	Rudder NEUTRAL
Button pressed (Sig. On)	Rudder RIGHT as long as button is held
Button released (Sig. Off)	Rudder NEUTRAL

With control cam 1 in use, the following switching order is required:

Tx. Condition	Action of Mechanism
Button pressed (Sig. On)	Rudder left as long as button is held
Button pressed for approx 0.4 sec.	Rudder right, as long as button is operated as indicated then held
Button released for approx. 0.4 sec.	
Button pressed and held	
Button released	Neutral Position (This is always the same whether LEFT or RIGHT has been selected)

To use the steering mechanism to control the motor throttle and exhaust flap. the control cam 3 should be fitted; the mechanism now works as follows:

Tx. Condition	Action of Mechanism
Press button for 0.4 sec. (short sig.)	Motor throttled
Press button for 0.4 sec.	Motor full on (Throttle open)
Press button for 0.4 sec.	Motor throttled

. . . and so on.

In order to reduce interference from the motor, the voltage supply is fed through the filter circuit Dr1, Dr2, C_1 and C_2 (3 channel Rx.).

Fitted on the steering mechanism case are two press contact terminals (RED positive, BLUE negative) to these is connected the working voltage for both the steering mechanism and the receiver. The RED terminal is connected with pin 1 and the BLUE with pin 6 of the seven pin socket.

The contact outputs are connected to a tag-strip, to which may be connected other types of steering mechanisms. The supply to the receiver is connected to the (RED positive, BLUE negative) press contact terminals on the relay unit, to which the 6 volt receiver battery should be connected, in this case, to reduce interference from the steering mechanism(s) a separate battery is recommended.

TEST REPORT ON THE "MECATRONIC I"

Brief Examination and Comments

This unit is very neat and well constructed, it is connected to the Rx. by means of the B7G socket, the supply voltage for both actuator and Rx. being connected to the two terminals mounted on the actuator case, which is part plastic, part metal. The motor is fully suppressed for sparking at the commutator. Range Check with Rx.—ground to ground—500 yards.

Receiver Tests with motorised actuator in circuit

For these tests the Tx. was used at 10 ft. with the aerial closed down. Supply voltage—6 volts.

Max. Current drawn.
No Signal 7.5 mA.
Signal On Motor running to position 100 mA.
Signal On Motor stalled 350 mA.
Signal On Position held for L and R 58 mA. both positions. (Left and Right)

Comment: This little Rx. is really surprising in performance and sensitivity, it represents a great advance in performance of super-regenerative detector circuits using a transistor. The tuned circuit at the quench frequency no doubt has much to do with this. The circuit is fully stabilised to temperature changes. The use of varistors across the relay contacts to suppress sparking is very effective.

Summary

The complete equipment is very good apart from points noted in comments. The handbook supplied is very good (for those who can cope with technical German) a knowledge of German is necessary apart from the circuitry which needs no explanation. Perhaps with the Common Market in the offing we shall see English translations provided. (U.K. manufacturers please note: German, French and Italian versions of our handbooks will no doubt also be required and appreciated.)

SINGLE BATTERY SERVOS

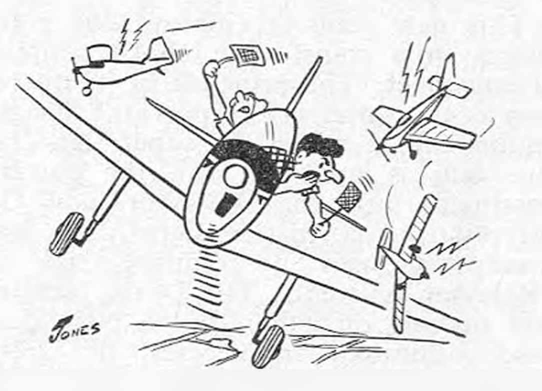
(*Continued from page* 556)

wires to be connected in the relay circuits. In the Black Arrow/6 Rx., this involves connecting a wire to the top of the 22 ohm surge limiting resistor on relays 1 and 2. An installation diagram for 3-channel rudder is shown in Fig. 4.

Current Economy

In a reed receiver, the relays are switched intermittently across the H.T. supply by means of the reeds, and the current pulses so obtained are averaged by the capacitors across the relay coils. The voltage appearing across the coils will be about 20v. for a 30v. H.T. supply, and this is sufficient to operate the relay. However, when the relays are operated by the p.c. board in the servo (see Fig 3) the full H.T. supply of 30v. appears across the relay coils. This will not harm the relays, but in this condition more current is taken from the H.T. battery than is necessary, and a resistor R3 of 1.8K or 2.2K can be inserted as shown, to reduce the relay current. For 9 volt Rxs., R3 should be omitted.

The second part of the article will deal with the single battery self-neutralising circuit, operating off two channels, and also some unusual variants for 'progressive self - neutralising' operation.



. . . O.K.! O.K.! We can take a hint. We'll find another field.

Commercial Developments

By
TONY
DOWDESWELL

CONSUMER STAFF MEMBER SAMPLES NEW PRODUCTS AT HOME & ABROAD

WHEN photographing goods for this review we often add a threepenny piece with the picture for size comparison. We were, therefore, most gratified to see overseas visitors at the recent World Championships busy measuring Threepenny Joeys!

We have to thank David Skinner of Dunedin, New Zealand, for this month's scoop. Eight years ago, Les Wright marketed the first New Zealand made radio control unit. In those days of temperamental single soft valve receivers (a mighty ½ mA. current drop and all that) Les Wright's Mark 1 was the answer to a modeller's prayer. Using two hard valves coupled to a unique "Relaytor" escapement, eliminating the intermediate relay, a feature revolutionary then, this unit was destined to become the best selling radio control system in New Zealand and Australia, a little later gaining great popularity here in Great Britain and in the U.S.A. Even now it is still popular, remember Dennis Thumpston used this equipment in his "Sopwith 1½ Strutter" to win the R/C scale competition at this year's National Championships.

However, once the novelty of trouble free equipment had worn a little thin, modellers being modellers began to pester for a less weighty transistorised unit for use in smaller aircraft and so the outcome of several years of experimentation became the new Wright Mark V receiver.

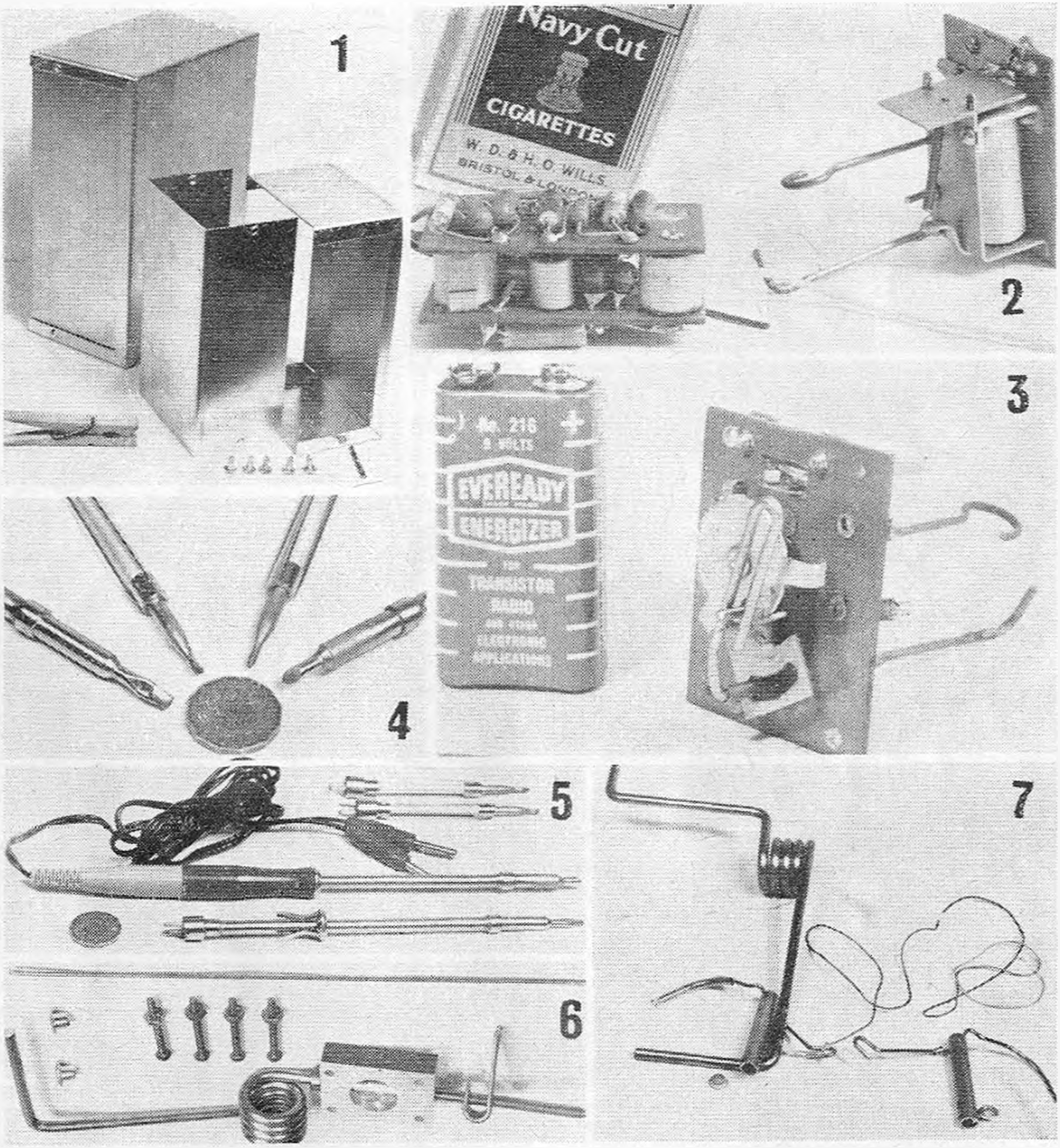
This new receiver employs two transistors in a transformer/choke coupled arrangement. The principle of its operation is the same as the previous Wright equipment, in which the super-regenerative bias is used to limit the current passing through the "Relaytor" coil. On reception of a carrier signal, the hiss disappears with a resultant rise in "Relaytor" current. The 1½ oz. receiver will operate on either of the New Zealand allocated frequencies of 27.12 Mc/s. or 35.7 Mc/s., only one 9 volt hearing aid battery is required for complete operation of the system, this, taped to the receiver to tip the scales at 2½ oz.

The "Relaytor" which is virtually a super sensitive escapement, works direct off the receiver output, eliminating the need for a relay; hence its name. The version illustrated here is a miniaturisation of the earlier Mark 1 and can be mounted in any position. Power is provided by two strands of ⅛ in. flat rubber and the unit weighs 1¼ oz. Coil resistance is 850 ohms and the solenoid pulls in the armature at 5 mA., which drops out at 2 mA.

Probably one of the Mark V's best attributes as far as economy is concerned is that it will operate off any carrier wave transmitter. Unfortunately we have no price to quote yet and there is no British importer at the moment. This in no way detracts from this unit's interest value, however, for all too infrequently do we hear of model or radio control products from the southern hemisphere.

Looking for a neat ready made trim bar? **Skyline Models Trim and Brake Bar** takes some beating for simplicity and neatness. Intended to fit the Bonner servo, the bar is basically a threaded tube with a fixed servo attachment at one end. The opposite end servo attachment, however, is a free fit inside the tube to compensate the variation in distance during operation between the drive arms of the full and trim elevator servos which the trim bar links. Fitting the bar to the servos is by the attachment ends, shaped at 90 degrees to the bar keying into the screw adjustment of the Duramite or Transmite servo and retained by miniature split pins with washers. On the threaded bar are two push rod connectors which are completely adjustable, one for elevator and

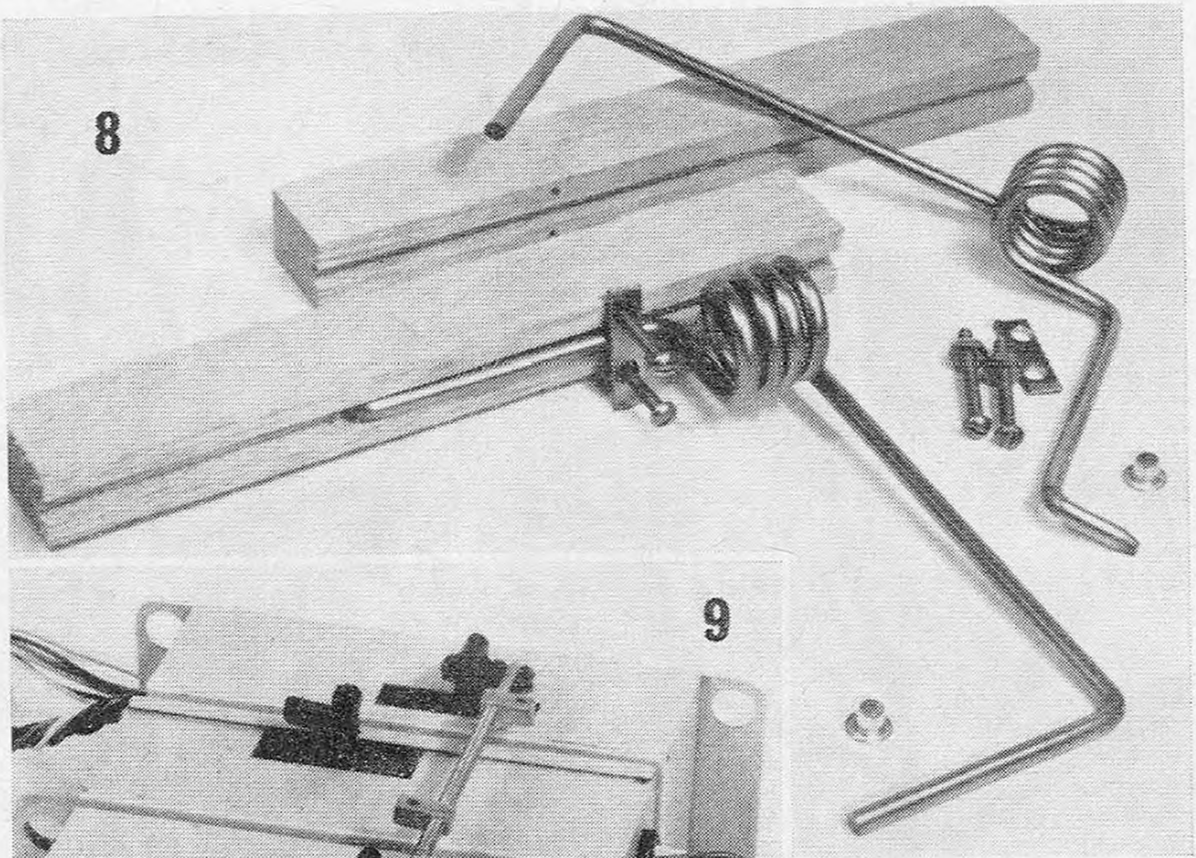
1. Largest and smallest sizes of Bud Mini-Boxes.
2. The new Wright Mk. V receiver and latest matching Relaytor.
3. Other side of the new Relaytor.
4. Minute interchangeable bits of the Microtyp soldering iron also illustrated in (5).
6. Blackwell steerable nosewheel.
7. Blackwell friction brake assemblies, illustrating attachment to U/C leg.

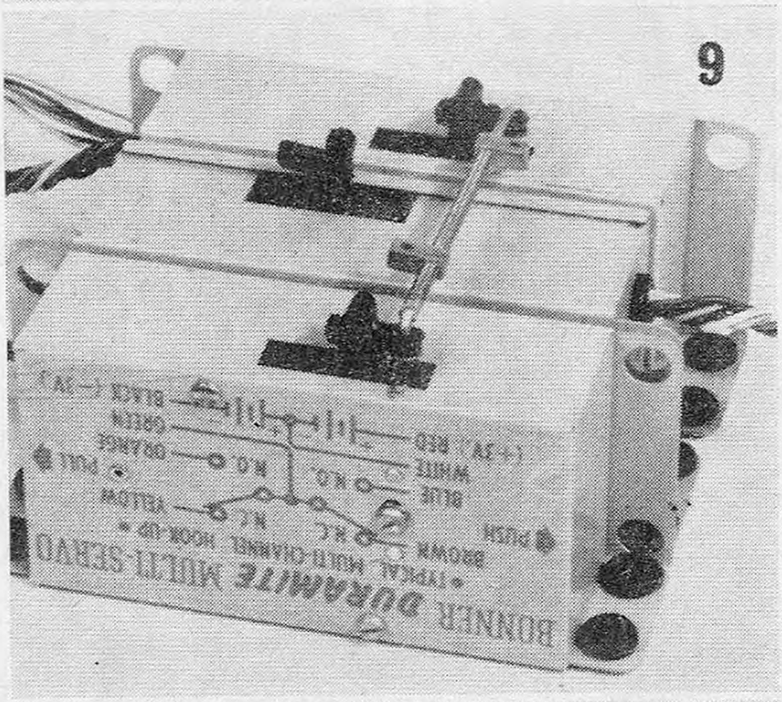


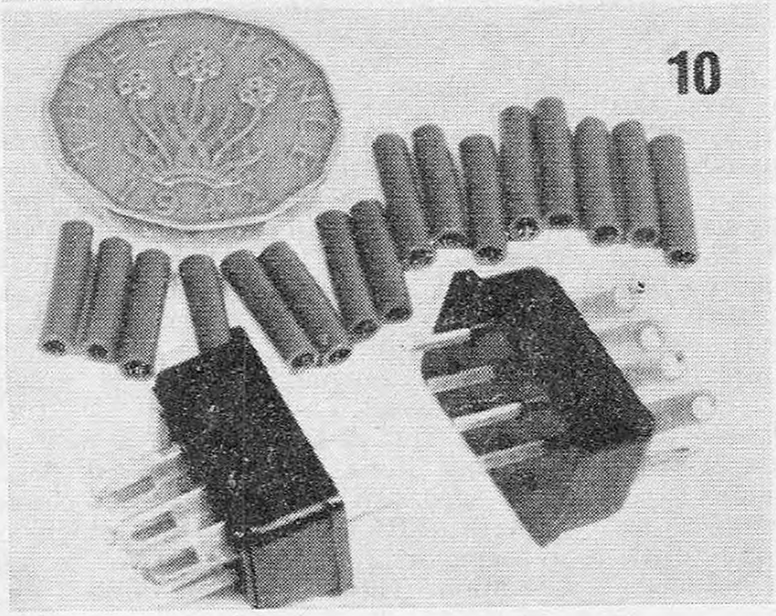
the other for brakes. Having seen this used successfully, we are most enthusiastic about it. Ed. Johnson sells it at 10/-.

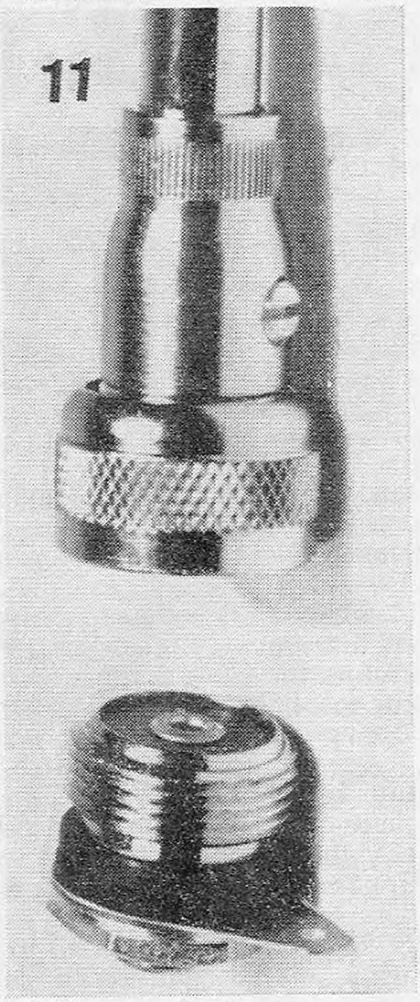
Malcolm Douglass sent along a number of accessories for review. **W. S. Deans Connector** is an 8 pin polarised connector, supplied, we suspect, with the Bonner servo in mind. It weighs approx. $\frac{1}{4}$ oz. and measures $1\frac{1}{8}$ in. from tag to tag, is $\frac{11}{16}$ in. wide and $\frac{7}{16}$ in. deep. A piece of sleeving is provided for each tag, this being a "floating" connector as opposed to the bulkhead mounted type The one we had was easy to plug together, but was a devil to pull apart again, indeed your scribe cut his finger on one of the tags during a determined attempt to part the halves without resorting to prising between the two pieces, *with, we hope, an insulated implement.* The difficulty in undoing the connector is due to its being too small to afford a good grip in one's fingers. All the same it is very compact and ideal for those who prefer not to mount plugs and sockets on bulkheads though rather pricey at 8/8d.

There always seems to be a flow of soldering irons to the editorial desk. Few seen, so far, are more clever than the **ERSA Microtyp 6v.** which as its name implies is intended for 6 volt operation. This iron weighs only $2\frac{1}{2}$ oz..


8


9


10


11

has two banana plug power connections and a flexible lead support in the top of the handle to eliminate any load on the terminals inside. A number of bits are available measuring between 3.5 in. and 9.8 in., with chisel, sloping and needle ends. Replacing the bit is achieved by unscrewing the bottom part of the handle. The bits have two prong attachments to a two pin socket in the top half of the handle. Prices for this iron range from 39/9d. to 42/-, depending on the bit supplied. Prices for spare bits also vary from 22/9d. to 25/3d.

Shunite Model 350 Edgewise Meter is available with either 0-50 or 0-100 D.C. mA. range. This is moulded in a thick plastic case and has a graduated reading scale. It measures $2\frac{3}{8}$ x $1\frac{5}{8}$ x 1 in. and is most useful as an output indicator for a transmitter. Indeed, some of those new all transistor transmitters now available sport edgewire meters for just that purpose. Price is 45/-.

A 54 in. five section collapsible aerial is available price 30/-. This measures 12 in. when telescoped and has a metal bead tip. It is removable by unscrewing from the aerial socket also provided.

Malcolm also has a complete set of **Blackwell** undercarriage systems. **The Shock Absorbing Main Landing Gear** for low wing models has heavy duty $\frac{5}{32}$ in. wire legs with wound coil shock absorbers. Channeled hardwood mounting blocks are provided, ready drilled to receive the wire legs and bolt-on retaining plate. These are tough in themselves, but in a model, only as strong as their mounting, so remember. Price 21/6d.

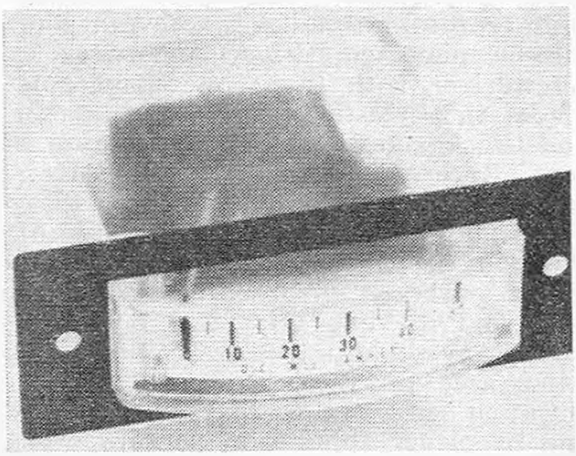
Blackwell Main Gear Brakes are external type friction brakes—"tyre plonkers". These consist of a brass tube which solders vertically upright on to the undercarriage axle. A drag arm pivot on each post is connected via a nylon thread and bellcrank to the elevator or elevator trim servo so that when "full down" is applied to either of these servos the tread is tensioned to bring each drag arm into contact with its respective tyre. Bellcrank and nylon thread are provided together with one pair of brake assemblies for price of 21/6d., but we feel this to be a rather crude arrangement.

Steerable Nose Gear also by Blackwell, consists of a $\frac{5}{16}$ in. piano wire leg with integral wound spring shock absorber. Mounting is by brass bearing aluminium block with simple four-point bolt attachment to engine firewall. This is a simple arrangement to install, which makes it an attractive proposition, particularly since it eliminates the hard work of bending such large diameter wire. Concise instructions are provided all for a price of 36/- less wheel.

8. Blackwell Torsion Bar main undercarriage assembly, block torsion bar wing mounts with coil sprung U/C legs.
9. Skyline trim bar, fitted to bank of Duramite servos. Has two take-off points to elevator and brakes.
10. W. S. Dean's 8 pin connectors, supplied with sleeving.
11. Ferrule and threaded socket of collapsible aerial from Malcolm Douglass.

Multi test meter from Cosmic Hobbies is pocket size and is supplied with small needle prods which makes it ideal for miniature R/C work.

Shunite Model 350 Edgewise Meter below has moulded plastic case enclosing coil.



Looking for a transmitter or pulser box? **Bud Mini-boxes** could fill the bill. These are made from 18 gauge Dural and are available in three sizes. 8 x 6 x $3\frac{1}{2}$ in. at 22/6d., 7 x 5 x 3 in. at 17/6d. and $5\frac{1}{4}$ x 3 x $2\frac{5}{8}$ in. price 11/-. Although the two halves actually clip together when a small blister at top and bottom of each side keys with a hole, self tap screws are provided if this method of retaining the two parts together is preferred. The largest box would be ideal for a single channel transmitter particularly the all transistor type, and the others would be suitable for pulsers or perhaps to enclose the more bulky boat equipment.

That's all from Malcolm Douglass.

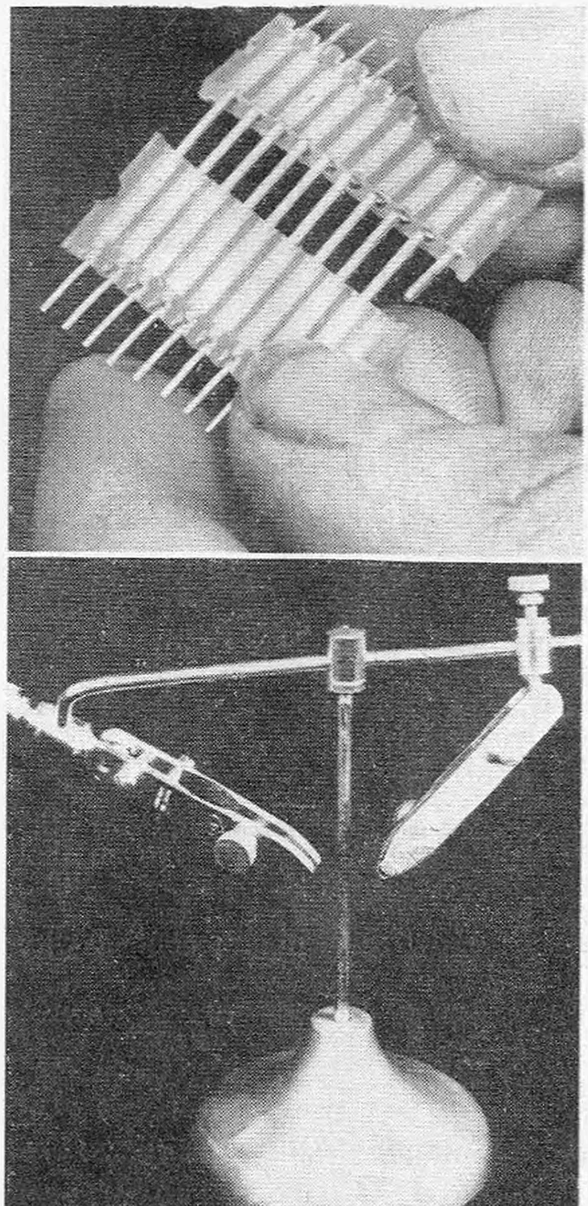
Cosmic Hobbies do a very nice line in miniature **Ten Pin Connectors.** Moulded in translucent nylon it is supplied non-polarised, but can be polarised by reversing end pin and socket. Size of the body when both halves are mated is 1 in. $\times$ $1\frac{3}{8}$ in. $\times$ $\frac{3}{8}$ in., it weighs only 1/5 oz. and passes a current of up to 2 amps. Sells for 7/6d. per set (1 plug, 1 socket).

From Cosmic Hobbies came the **Model TE-10 Multitester** test meter, an import from Japan. This is indeed delightfully small measuring just $4\frac{1}{2}$ in. x $3\frac{1}{4}$ in. x $1\frac{1}{16}$ in. Its ranges cover both D.C. and A.C. voltages of 0-6-30-600-1,200 (10,000 ohms per volt.): D.C. Current 0-120 uA, 0-3-300 mA: Resistance 0-30K, 0-3 Meg. (150 ohms and 15k at centre scale): Capacitance 50 μF to 0.01 μF, 0.00 μF to 0.15 μF Decibels −20 to +63 DB in 5 ranges. The case of the unit is plastic and a pair of needle probes are included, plus operating instructions. Costs £5 19 6d.

Henri Picard and Frere Ltd., supply a wide range of miniature precision tools particularly suited to delicate radio control work. A whole range of anti-magnetic screwdrivers and tweezers, screwdriver with three interchangeable blades in a plastic wallet and a Watch and Clockmakers' tool kit to mention a few. Received for review was a **Soldering Grip** on stand. This consists of a "T" stand with a heavy metal base. At the end of each "T" arm is a screw locked tweezer grip on a universal joint and the two grips will hold and steady any soldering work, leaving both hands free for the operation. This is worth at least one extra pair of hands and by clever application perhaps even two. Costs 15/-. For details of the whole range of items write to 34-35, Furnival St., London, E.C.4.

Here is some information on the **F & M Matador** all transistor transmitter featured pictorially last month in these pages. It has an edgewise meter, and a 6 v. battery which is rechargeable via a socket. A test button in the centre of the case provides simulated load reading on the meter without the Tx. switched on. No centre loading is needed on the aerial. In the normal blue anodised finish of F & M equipment it costs £49.17.6d.

Below, Cosmic Hobbies Ten Pin Connector. Could be cut down if less than 10 of its pins were used.
Bottom, Henri Picard and Frere's Soldering Grip has heavy metal base to prevent it upsetting. Two adjustable grips hold work during soldering operation.



Our Companion Magazines

AEROMODELLER

November issue

Fresh from his travels to Moscow and Kiev, the editor returns with a full account of the *World Championships* for Control-line models. *"Radio goof-ups"* is the title of a radio control article that will appeal to all who have experienced the frustrations—and triumphs of R/C—illustrated by the inimitable Roland and written authoritatively by Ken Willard. *"Migrator"* is an A/2 with simple lines from Vancouver, Canada, which will be attractive to all British gliding enthusiasts. *Aeromodelling in (faraway) Indonesia* is another interesting feature to come, along with others we have ready for your enjoyment—out on October 19th.

Published on the 3rd Friday of each month.

MODEL MAKER

October issue

Features include a home-built electric motor for boat propulsion, notes and a design for hovering craft, radio for beginners, the Lola F.1, T34 tank, a lap recorder, the SSK Mercedes, Airfix cars reviewed, and many other items.

Published on the 4th Friday of each month.

Made and printed in Great Britain by Bletchley Printers Ltd., Central Gardens, Bletchley, Bucks, for the proprietors, Model Aeronautical Press Ltd., 38 Clarendon Road, Watford, Herts. Published by The Argus Press Ltd., 19 Tudor Street, London, E.C.4, to whom all trade enquiries should be addressed. Registered at the G.P.O. for transmission by Canadian Magazine Post.

742 69 5