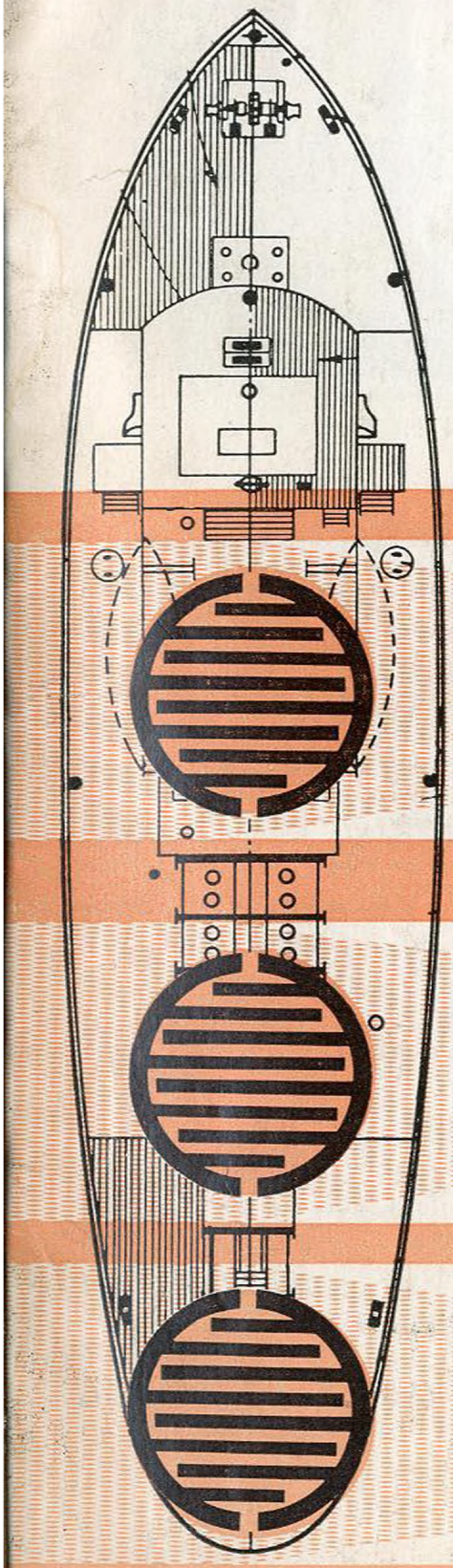
69 Pike

SEPTEMBER . . . 1962

RADIO CONTROL MODELS & ELECTRONICS

PRICE 2s
USA AND CANADA 40 CENTS



TRANSISTOR MULTI Tx.
AERIAL CAMERA
LIGHT CONTROL

RADIO AND ELECTRONIC PRODUCTS

★ *SEND S.A.E. FOR LISTS* ★

TWIN-TRIPLE

★ **RELIABILITY**

Ensured by proven 'tone' circuit design.

★ **STABILITY**

achieved with "high Q" chokes in all transmitters

★ **TEMPERATURE STABILITY**

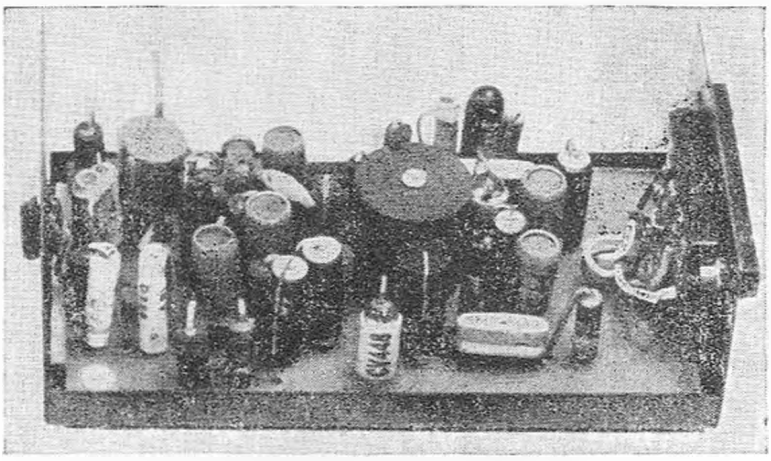
given by selected high-quality components

★ **CRYSTAL CONTROL**

standard on all "multi" transmitters (except TRITONE, where it is an optional extra).

★ **CONTEST WINNING**

Chris Olsen placed first in the Final British R/C Team Trials flying with "REP" DEKATONE equipment and Olsen-Remtrol servos



REVIEWED LAST MONTH

TWIN-TRIPLE

Two-channel tone filter receiver supplied complete with "banked" Elmic escapements and battery box giving three independently selected controls—"compound" rudder action on one channel, sequence elevator (self-neutralising) on second channel. Electronic "quick blip" button for separate motor speed control (via third actuator not included). **Complete set £26.11.3d.**

CLIMAX SERVOMITE SERVOS

(Sole distributors Radio & Electronic Products Ltd.)

The lightest, most compact 'multi' servo available. Less than 2 in. square x $1\frac{1}{16}$ in. Weight only 1.3 ounces. Linear stroke $\frac{5}{8}$ in. 23 ounces thrust on 3 volts; 38 ounces thrust on 4.5 volts. Specially wound MICROPERM motor draws only 300-350 milliamps under typical load conditions.
Standard version 59/8. Transistor-amplified version 158/-.

REP 2/10 RELAYLESS RX.

Fully transistorised relayless receiver with 10-channel reed bank, for connection to one to five transistor amplified 'multi' servos, as required. Single 9v. (PP3) battery supply. **£16.16.5d.**

10-REED BANK

Moulded-in gold plated reeds. Replaces all existing 4-, 6-, 8- and 10-reed units.

Prices only 50/-.

MIN. RELAY

Sub-miniature relay as used on the 1962 'REP' receivers. Non-stick palladium-silver contacts. Weight 1/3 oz. **Price 28/-.**

ANY OF THE ABOVE ITEMS OBTAINABLE THROUGH YOUR LOCAL MODEL SHOP

PROSPECT 9375

RADIO AND ELECTRONIC PRODUCTS 44 SHEEN LANE, MORTLAKE,
(G. HONNEST-REDLICH LTD.) DEPT. RCME 1 LONDON, S.W.14

RADIO CONTROL MODELS & ELECTRONICS

SEPTEMBER 1962

VOLUME 3 NUMBER 9

Editorial and Advertisement Offices :
38 CLARENDON ROAD
WATFORD, HERTS

Telephone :
WATFORD 32351/2
(Monday to Friday)

NEXT MONTH . . .

Highlights of the issue include . . .

WORLD R/C CHAMPIONSHIPS
MINI 4 Rx.
TUNING FORK TONES
LATEST EQUIPMENT ON TEST
GADGETS AND GIMMICKRY
PAGE PLAN
COMMERCIAL DEVELOPMENTS

Plus the usual favourites

CONTENTS

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.

★ 7 Section 64" telescopic chrome aerial 17/6.
★ Mullard FX1011 min. pot core 7/6.
★ Neosid Choke Core $\frac{7}{16}$" x $\frac{1}{8}$" 1/-.
★ OA70 3/-, OA5 6/-, OA81 3/-, OA10 8/-, OA79 3/-, OA-210 11/-, OA85 3/-, OA91 3/6, OA90 3/-.
★ 2p 2w Slide Switch 2/6, 1p 2w Slide Switch 2/-, On/off Slide Switch 2/-.
★ Ultra Sub-min IFS for superhets 5/3 ea., 465 kc/s.
★ Sub-min presets. 500, 1K, 5K, 10K, 25K, 50K, 100K, 250 K, 500K, 1 meg, 2 meg. 2/- each.
★ $\frac{1}{4}$" formers with slug 9d.
★ REP 3-rd unit 35/-.
★ Siemens High Speed Relays, 1700 + 1700 ohms min sealed 15/-.
★ D1001 5:1 transformer 7/-, D240 8½:1 do. 8/-, D129 10:1 do. 8/-.
★ EN2082 transformer 2 secondaries 8/-.
★ All values of min resistors in stock, 3d. ea.
★ Gruner 957 sub-min relay 300 ohm 3 to 9v. 24/-.
★ Paxolin chassis 2¾ x 1¾" 9d., 4 x 2¾ 1/-
★ 1 pole 4-way min. switch, 2/-.
★ Soft Plastic Boxes with lid 4⅜ x 3 x 1½" 2/6, 2½ x 1½ x 1⅛" 2/-, 3 x 2 x ¾" 1/6.
★ ¾" dia. controls. ¼" x 2" spindles. 5K, 10K, 25K, 50K, 100K, 250K, 500K, 1 meg. 3/6 ea., with D.P. sw. 4/6.

POCKET SOLDERING IRON
220/250v. iron, 30 watts, complete with plug & vinyl bag. Handle unscrews to cover element to enable iron to be carr'd. 18/6 p.p. 1/6.

Transistor Circuits for Radio Control
A new publication without doubt the best available. Covers transmitters and receivers, valve and transistor. 7/6 post 9d.

FIRST GRADE TRANSISTORS
New Price Reductions Fully Guaranteed

AF115	10/6	2N1742	25/-	V15/20P	15/-
AF102	27/6	OC71	5/6	OC44	9/3
AC107	14/6	OC72*	7/-	OC45	8/6
AFZ12	35/-	OC75	7/-	OC22	23/-
AF117	9/6	OC76	7/-	OC23	33/6
OC170	9/6	OC78*	7/-	OC24	29/-
OC171	10/6	OC81*	7/-	OC25	12/-
OC139	13/6	OC82	10/-	OC26	25/-
OC140	29/-	OC83*	6/-	OC28	20/-
OC200	10/6	OC84*	8/6	OC29	20/-
OC201	31/6	OC41	9/-	OC35	18/-
OC122	16/-	OC42	9/6	OC16	20/-
SB305	8/6	GET111	10/-	GET114	6/6
SB231	12/6	GET106	14/6	GET115	9/6
2N502	47/-	V15/20IP	19/6	XB112	6/-

*Matched pairs available at no extra charge
NEW COMPLETE LIST ON REQUEST.

POCKET TESTER
MODEL THL.33
Volt, Ohm, Milliammeter
● 0/500μA/ 10m.A./ 250 m.A. ● 0/10/50/250/500 1000v. AC/DC. ● 0/10K/ 100K/1 meg. 2000 ohms/ volt AC/DC. **79/6** pp. 1/6.
Price, inclusive of test prods battery and instructions. Overall size. 5 x 3½ x 1½ in.
● FULLY GUARANTEED ●

Transistor IF strips 465 kc/s and 10.7 mc/s in stock

We can supply most of the miniature and standard components used on circuits in this and other magazines and publications. Let us quote, competitive prices by return of post.

ZENER DIODES

4.3 volt	7/6
6.2 volt	7/6
9.1 volt	7/6
12 volt	7/6
4.7 v. 1 watt	15/-

SILICON DIODES

100v. PIV 750 m.A.	7/6
250v. ,, ,, ,,	8/-
300v. ,, ,, ,,	8/6
400v. ,, ,, ,,	9/-
1000v. PIV 500 m.A.	12/-

VALVES FOR RADIO CONTROL
Sockets 6d. each.

DK96	8/-	6C4	5/-
3S4 (DL92)	7/-		
3A5 (DCC90)	9/-		
1S4 (DL91)	8/-		
3V4 (DL94)	7/6		
3D6 (1299A)	4/6		
XFY34	15/-		
DL66	7/6		
3A4	7/-		

Quartz Crystals for Radio Control
★ 9.065 mc/s third overtone for all valve transmitters on 27 mc/s **12/6.**
Socket to suit 1/-.
★ Sub-miniature 27 mc/s crystal wire ends for valve or transistor transmitters **30/-.**

FULLY GUARANTEED

MERCURY BATTERIES

1.3v.	5000 mA/H 2 x ⅝"	2/6
1.3v.	500 mA/H ⅝ x ¾"	1/3
7.8v.	500 mA/H 3⅞ x ¾"	6/-
16.9v.	500 mA/H 8¼ x ¾"	12/-
3.9v.	500 mA/H 2 x ¾"	3/6

★ Lightweight 2000 ohms headphones 12/6.
★ 7 Section 38" chrome telescopic aerial 12/6.
★ 4th Harmonic 27 mc/s Xtal 5/-, skt 1/-.
★ Miniature wonder plugs 6d., sockets 6d.
★ Sub-min wonder 6d., socket 6d.
★ Min. and sub-min. croc. clips 6d.
★ Mullard pot core LA1 12/6, LA4 10/-.
★ OAZ203 10/6, OAZ208 7/6, OAZ212 7/6, OAZ210 7/6, OAZ213 7/6, Z2A47F 15/-.
★ 1 Henry 60 ohm tone choke 6/-.
★ Push-on release off tone switches 1/6.
★ Sub-min jack and socket with switch 3/6.
★ High 'Q' RF chokes 1/6.
★ Sub-min electrolytics 0.1, 0.25, 0.5, 1, 2, 4, 6, 8, 10, 16, 25, 30, 50, 100 mfd. 2/- each. 6/15 v.w.
★ Miniature types. 1, 2, 4, 6, 8, 10, 25, 30, 50, 100, 200, 250 1/6 each. 6/15 v.w.
★ Phillips trimmer 9d.
★ 1000 ohm test earphone 9/6, with jack plug and socket 12/6.
★ Condensers— 0.02, 0.04, 0.05, 9d., 0.1, 1/-, 0.25, 1/6,
★ Multicore solder, 6d., 2/6, 5/- packs. Special printed circuit solder 1/- per 10 ft.
★ 1 pole 4 way open preset switch, 1/-.
★ 1, 2, 5, 8, 10, 15, 18, 22, 25, 30, 35, 47, 50, 56, 68, 100, 150, 180, 200, 300, 330, 350, 470, 500, 560, 1000, 2000, 3300pf.; 0.005, 0.01mfd. 6d. ea.
★ Sub-min. Neon (82K Res. for 90/110v.), (220K Res. for 220/250v.). Only 2/- each.

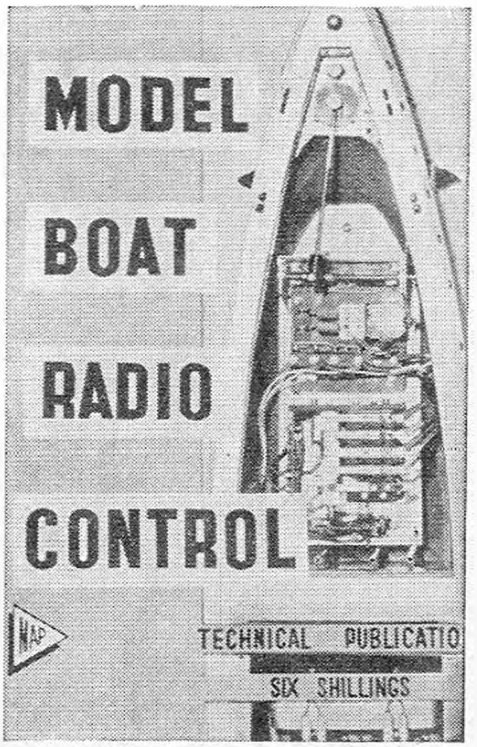
MINIATURE PANEL METERS

0/50 μA	39/6
0/500 μA	32/6
0/1 m.A.	27/6
0/5 m.A.	27/6
0/300 volts	27/6

COMPONENT CATALOGUES
Send 1/- Stamps for new Editions

Henry's Radio Ltd *Miniature Component Specialists* **5 Harrow Rd., London, W.2**
Open Mon to Sat, 9-6, Thurs 1 o'clock. Tel.: PADdington 1008/9
PLEASE ALLOW ADEQUATE POSTAGE WHEN ORDERING

MODEL BOAT RADIO CONTROL



CONTENTS: INTRODUCTION : THE MODEL : PROPULSION : COMPONENTS : RELAYS : COMMERCIAL EQUIPMENT : SOLDERING QUENCH COIL & CHOKE WINDING : SOFT VALVE RECEIVER : HARD VALVE RECEIVER : HAND TRANSMITTER : PORTABLE TRANSMITTER : LOW POWERED CRYSTAL CONTROLLED TRANSMITTER : INSTALLATION OF EQUIPMENT IN THE AUTHOR'S SEA COMMANDER : AIDS TO TUNING & TESTING : TUNING : INTERFERENCE & SUPPRESSION DO'S & DON'TS : FAULT FINDING : APPENDICES : GLOSSARY : USEFUL TABLES : ABBREVIATIONS.

Size 8½ x 5½ ins., 108 pages, 155 diagrams, many full-size or adequately dimensioned, 8 pages of plates illustrating boats and equipment, bound with two colour drawn on card cover . . .

PRICE 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.

...rd 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/-

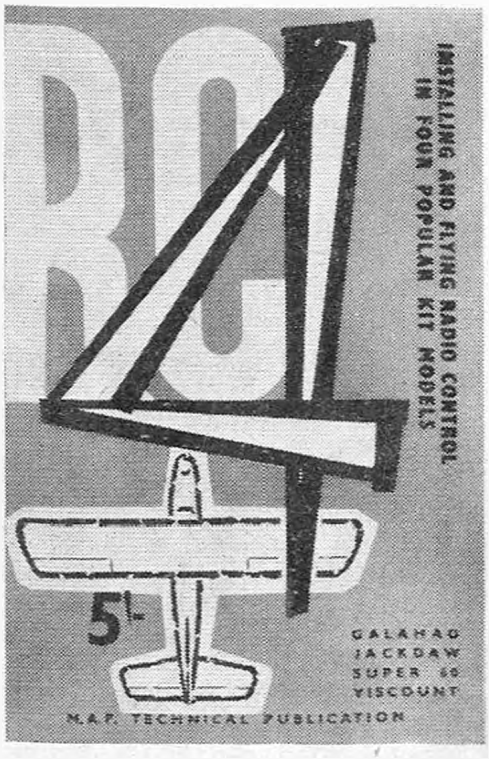
IVY-AEROMODELLER CARRIER WAVE RECEIVER
Ideal and inexpensive project for the beginner. Well-tried Ivy circuit brought up-to-date. Full stage-by-stage instructions in six-page leaflet.
RC/795 2/-

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 card 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/- ☐
MODEL BOAT RADIO CONTROL	6/-	☐	AEROMODELLER ANNUAL 1961/2 Edition	10/6	☐	MODEL AERO ENGINE ENCYCLOPAEDIA	12/6 ☐
CONTROL LINE MANUAL	15/-	☐	AEROMODELLER 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/-	☐	R/C PRIMER	15/-	☐	BOOKLETS (Insert ref. no.)	☐

Name

Address

Sum enclosed £ s d

Technical Books in the World!

38 Clarendon Road, Watford, Herts

Here, There & Everywhere

Stitch In Time

No sooner had we inspected our last month's cover a little more closely we realised that we were due for a good leg pull when we described the Converter as "Knitted". We must of course apologise having pulled the wool over your eyes — it certainly caused the Editorial Director to knit his brows. However, most people saw the funny side of it, and we received a letter from one Tabitha Cablestitch which we publish with a photograph of the Converter in its new form. It should be obvious that it was knitted for a tran-*sister* in some hope that it might transform'er. Whilst the item on the left could be described as a knitted cap, it is obvious that the gubbins on the right has gone to pot.

George Honnest-Redlich is the culprit. We think we can frame this as one of our happiest clangers.

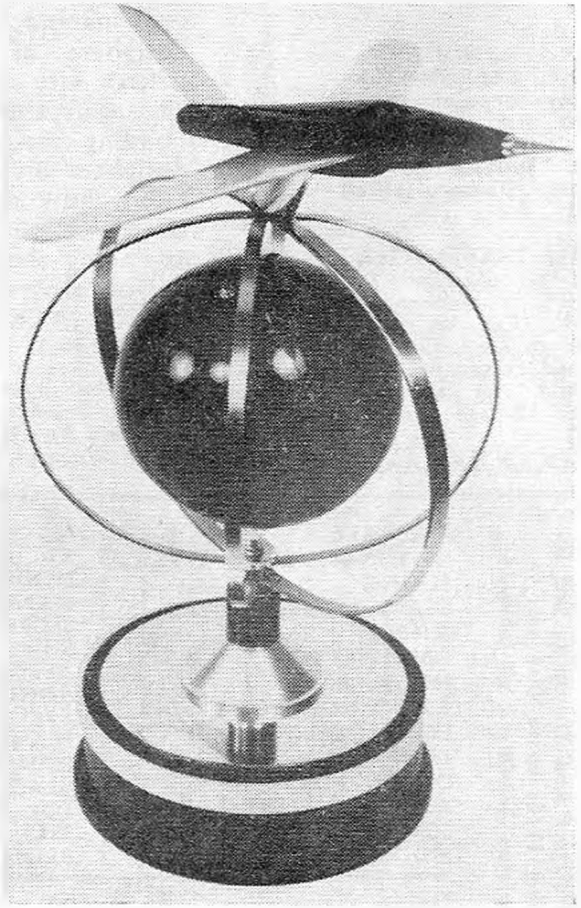
Superhet Circuits

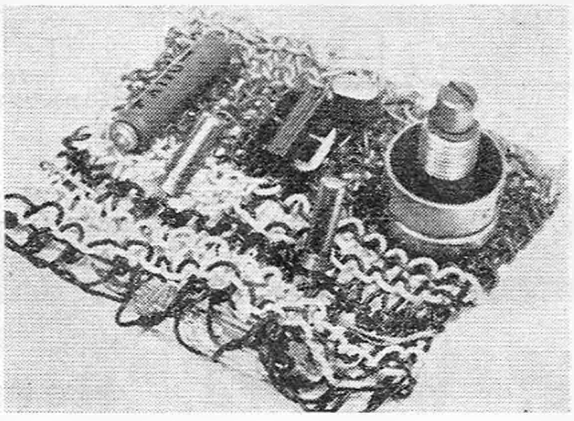
A feature of full size and model displays is becoming rapidly more popular and of course now more practical by the use of superhets is the simultaneous displays provided by a team of modellers, led as in the case of Wellsbourne for the Sutton Coldfield R/C Model Aero Club, by Ed. Johnson. Whilst lacking in the degree of formation flying to which we are accustomed in full sized practice, the superhet men can put on a very eye catching demonstration. Their smoke trailing models carrying pyrotechnic cartridges (at about 15/- a time) prove most effective. Perhaps one day we shall see scale jobs in simulated dog fights to which we would suggest the P.A. system contributes the appropriate firing noises.

But *please* chaps, not so low, it *is* dangerous.

Trophies for the Champs

Sculptor modeller P. E. Norman (see his latest design "Blister") has produced some excellent trophies. The one illustrated here is destined for the world R/C Championships and will be presented at R.A.F. Kenley. This truly magnificent piece of design and craftmanship is built from dural, Perspex and Ebony. Anodising on the metal parts is in silver and gold.





Dear Sirs,

I have tried to make one of your "Knitted Converters", but it does not seem to have any reason.

My husband says that I have lost a stitch, in fact several. Should I have done it in purl instead of plain?

Yours sincerely,

Tabitha Cablestitch.

The more traditional "King of the Belgians" cup will be there, which was first presented for radio control.

The third illustration shows the team prizes (photo supplied by Model Aircraft), we are anxious to do an R.C.M. test report on these two with particular attention to capacity and rate of drain.

Flash

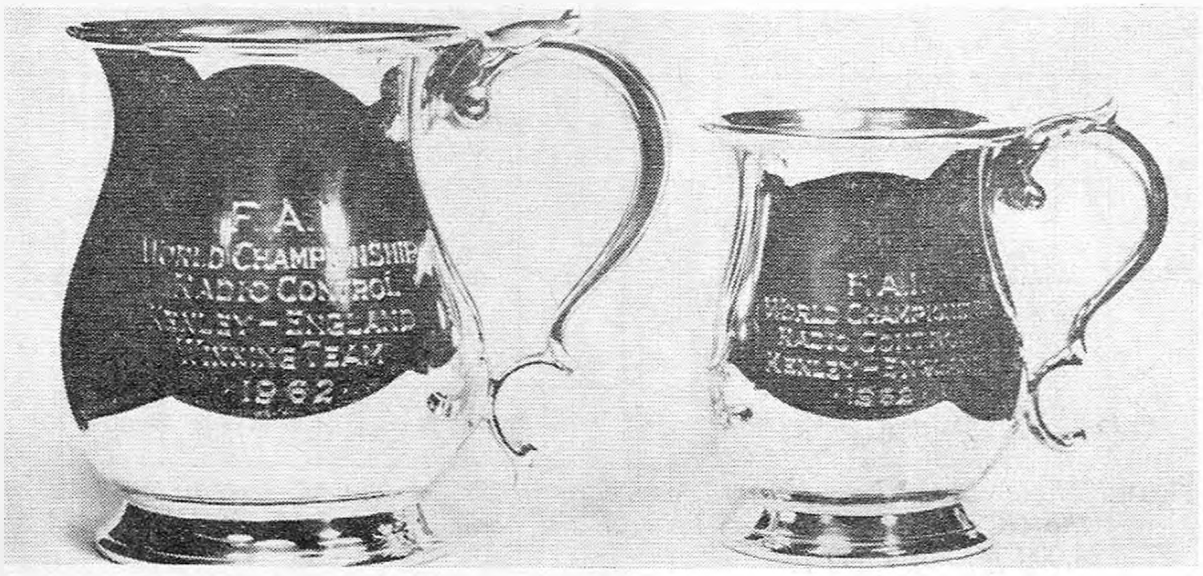
Doug. Spreng has relinquished his place in the U.S.A. R/C team in favour of Willis Robinson, 4th man in the U.S. 1961 Nats., who comes from Las Vegas. Nevada. Doug. preferred to use his vacation time travelling by car to the U.S. 1962 Nats. at Chicago. He was U.S. Nats. Multi Champ in 1960 and 1961.

Rule of Thumb

An effort is being made at the South Midland Area Rally to provide a contest for the truly "single channel" modeller. At the moment single channel flying (or rudder only as it has now become known) places no restriction on the method or complexity of the equipment used to move the rudder and operate the throttle.

The *Macgregor Trophy* is intended to provide a fair competition for modellers who do not have anything more elaborate than single channel equipment and *simple* escapements. Crafty "think boxes" at the transmitter end and pulse systems are definitely out. The rules state that the system must be manually keyed—that is to say one button and a good old thumb. The escapement in the model may have a quick blip facility to operate a throttle escapement, but that's your lot chaps.

Opposite page : The Aeromodeller R/C Trophy ; the clean contemporary lines of P. E. Norman's creation show well in this photograph. The orbital hoops around the globe are gold anodised. Above ; The well known "King of the Belgians" cup. Below : The team prizes (first and second) which were donated by Castrol Ltd.



AT LAST: THE Tx. YOU WANT TO BUILD

(NOT FOR BEGINNERS)

The Windy Kreulen Transistor Multi Tx.

A WELL PROVEN ALL TRANSISTOR BI-SIMULTANEOUS TRANSMITTER

PART 1: 4 CHANNELS

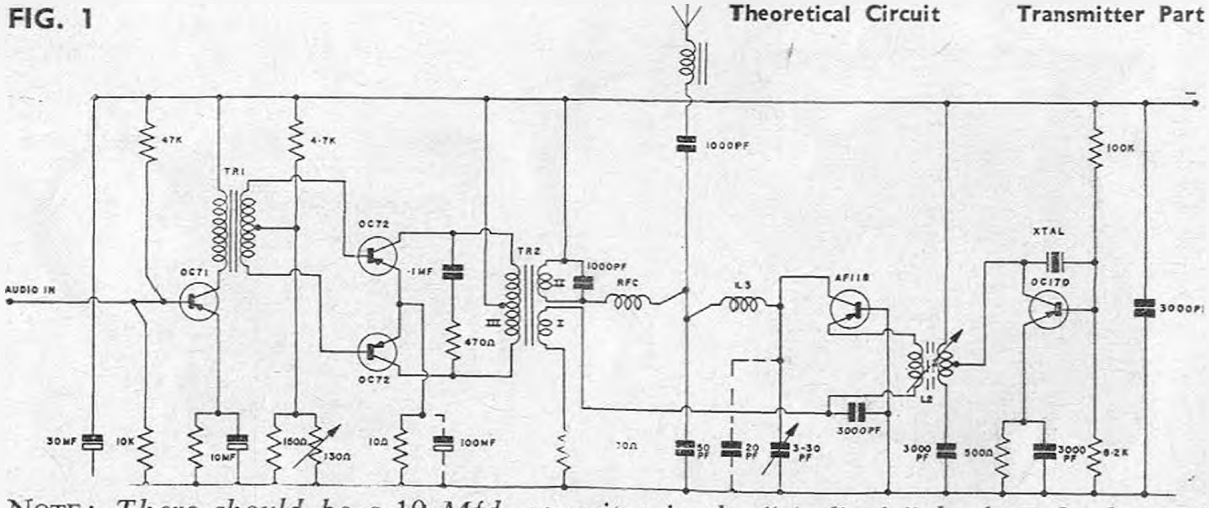
With the increasing popularity of the transistor transmitter, many experimental minded R/C modellers are trying their hand at high output circuits. Earlier experiments in this field were somewhat marred by lack of stability and low output, to say nothing of junk boxes full of damaged transistors; a product of many attempts to obtain suitable modulation.

A number of successful circuits have been developed quite independently of each other, for example, "The Transmistor" which appeared in our March, 1962, issue by Dave McQue and Peter Lovegrove and now Windy Kreulen's latest brainchild, one simultaneous four channel version of which we had the pleasure of using. Our experience convinced us firmly of its range. stability and battery economy. A glance inside shows that whilst there are quite a number of components, well arranged on a printed circuit (Windy sells this board to his own customers in Holland), it is quite straightforward and is reproduced here for the benefit of R.C.M. & E. readers.

The original transmitter experiments were carried out on a widely spaced hook-up and it was in this state that the transmitter was actually used. The whole "bundle of bits" was put in a polythene bag to keep out the rain and later reworked so that it fitted a standard R.E.P. transmitter case. Windy specially built one of the "production" P.C. versions for our examination as previously mentioned. It is this particular model that illustrates our article.

The tone generator is a Dutch design. produced after much experimental work and discussion with fellow enthusiasts in Holland. There are restrictions on the production of the circuit on a *commercial* basis. This need not, however, deter the modeller from building this excellent transmitter for his own use. It is, in fact, quite a simple job and any reader with a knowledge of soldering should be able to get results from his version. Of course, the transmitter is capable of a high output if carefully set up with an oscilloscope by a knowledgeable constructor, but such facilities are not always available and are not essential for successful operation. This may be the case with quite a number of pieces of R/C gear; the little expert touch with the right test gear puts the

FIG. 1 **Theoretical Circuit Transmitter Part**



NOTE: *There should be a* 10 *Mfd. capacitor in the "Audio in" lead to the base of the OC71. The capacitor between the aerial coil and the R.F.C. should be* 4,000 *pf, not* 1,000 *pf.*

finishing touches. (Rather like doing a different sort of tuning on the car.) We now pass you over to "Windy" for his description and building instructions.

Design

We started our experiments when the medium power H.F. transistor became available. Of course, we were *not* successful right away, transistors being quite delicate components and some approaches gave us many headaches. Some circuits used two transistors in the P.A. stage, but we found no advantage in output. So we use a single transistor in a tuned P.A. stage that is an effective harmonic filter as well.

The use of a tuned (centre loaded) aerial is a much better solution to obtain maximum output.

The choice of a stable tone generator has also been a difficulty and earlier experiments showed that the form of modulation was more important and had to be done very carefully to prevent damage of the (expensive) H.F. transistor.

We have at last been able to produce a really stable and efficient tone transmitter that is capable of operating all types of reed receivers at a decent range. The radio frequency will not deviate which makes this Tx. most suitable for use with the latest Superhet receivers.

This is, in fact, all that the average flyer or boat enthusiast needs, and as long as the transmitter continues to do this under varying weather conditions and battery voltage, the transmitter is one to be relied upon. Good H.F. transistors are a little expensive but the advantages of battery consumption repay the builder in quite a short space of time.

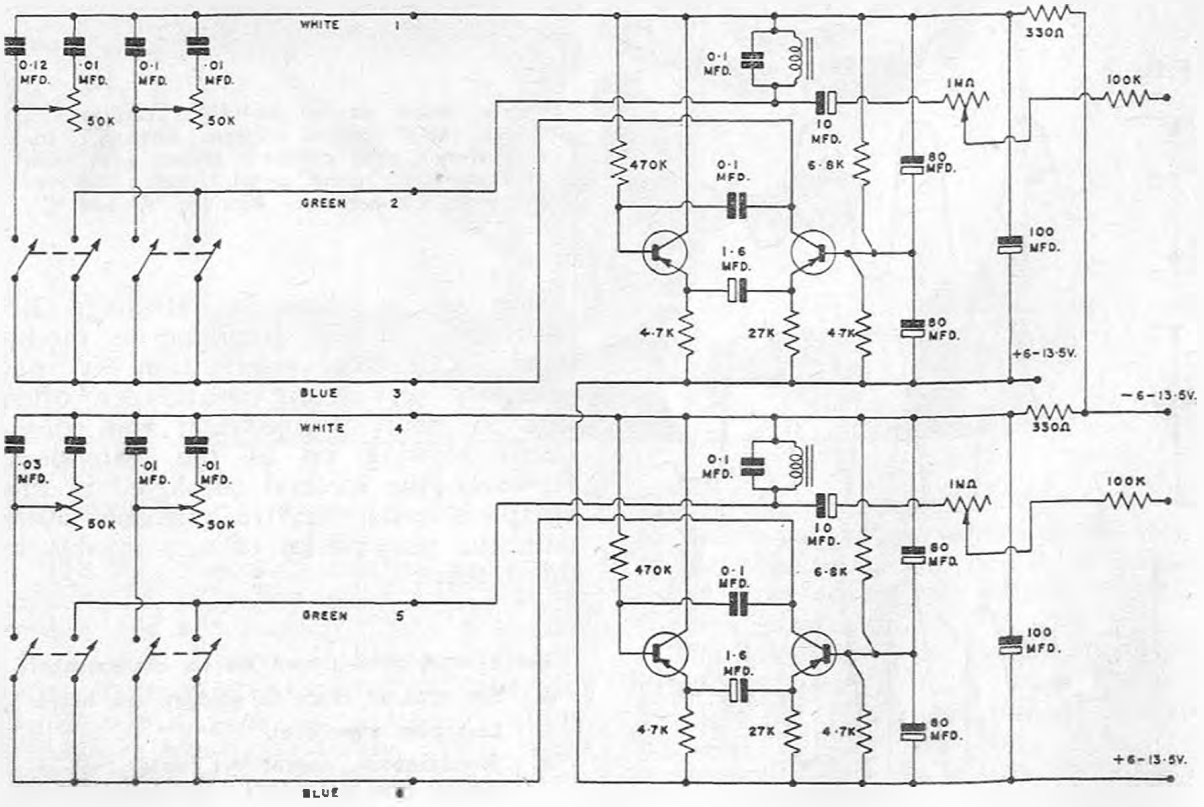
The transmitter does, in fact, answer all these requirements with a ground range of 750 meters using a home built version of the Orbit receiver circuit. Because it is free from harmonics it was tried on a Superhet successfully. Orbit Min-X ten channel and F & M single channel receivers were also used during the successful tests. (Over a mile ground range with an Orbit Superhet.) The ultra-stable tone generator has many advantages which may be summarised as follows:—

(a) Components are inexpensive, at least in Holland. A suitable pot core may be purchased for 10/-.

(b) Any type of transistor may be used providing it is suitable for about 20 volts.

(c) It is rock stable and even if the vol-

FIG. 2 **Theoretical Circuit of Tone Generators.** *Audio outputs via 100K resistors; right.*



tage drops from 13.5 to 4.5 volts the original model will stay on the reed frequency.

(d) Temperature change does not cause instability in spite of the severe tests to which the transmitter has been subjected. for example, the transmitter was left all day in a freezing car boot in the winter and operated a receiver in the house. Later on, the transmitter was warmed in an oven with no more detremental effects.

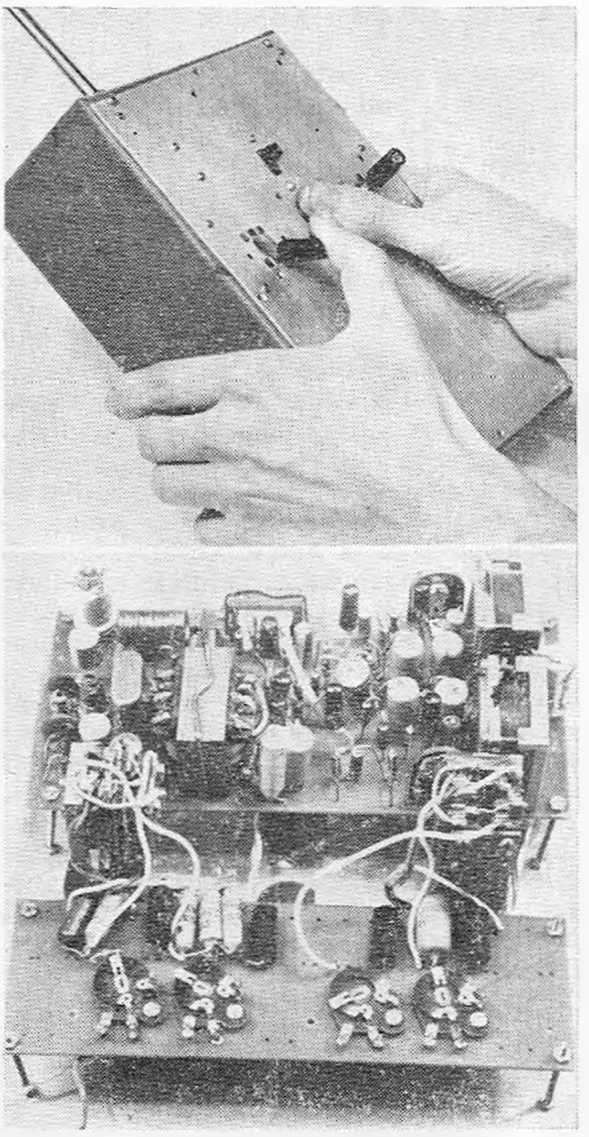
The transmitter could be made much smaller, but for general use this is no advantage. The light weight, however. is . of course. easier on the wrists during a prolonged flight even when a double set of batteries are placed in the case. This gives many months of hard use at a low price.

One word of warning: Readers will know that patience is required for setting up the audio tones for simultaneous operation and the frustration which accompanies the procedure, if the HT is not smooth.

The transistor Tx. is perhaps easier to set up. but it must be understood that careful selection of the capacitors on the pot deck is still necessary for simultaneous work.

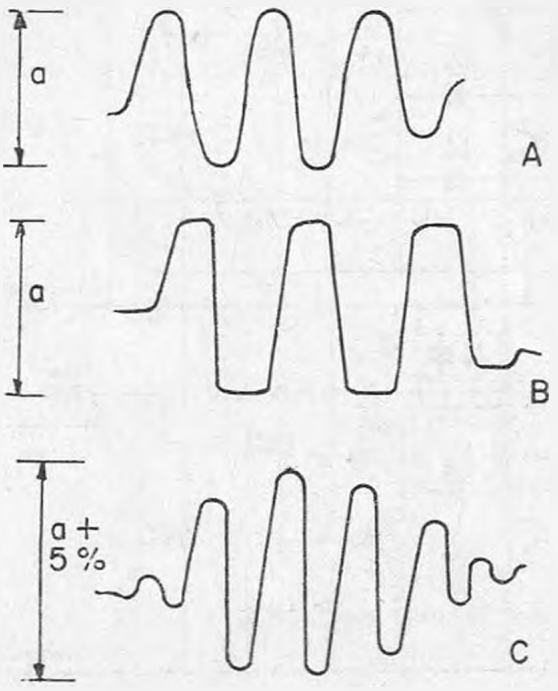
Circuitry

The circuit is quite straightforward, perhaps some readers may find novelty in the way in which the HF stage (RF oscillator and RF amplifier) is modulated. Collector modulation is not generally very effective and can often lead to incorrect operation and consequent blowing up of the transistors. However, the method employed in this circuit is quite effective and does away with the possibilities of any trouble in this respect.



Top : Small size, light-weight case . . . this is the 4 channel version. Bottom : Inside story ; note different layout with tone generators on same panel. Left : Waveforms for comparison. Aim for 'A' and 'C'.

FIG. 2



Left : waveforms shown on an oscilloscope.

A : The type of trace to gladden the heart.

B : Less pure waveform.

C : Simultaneous operation : note the increased amplitude (a).

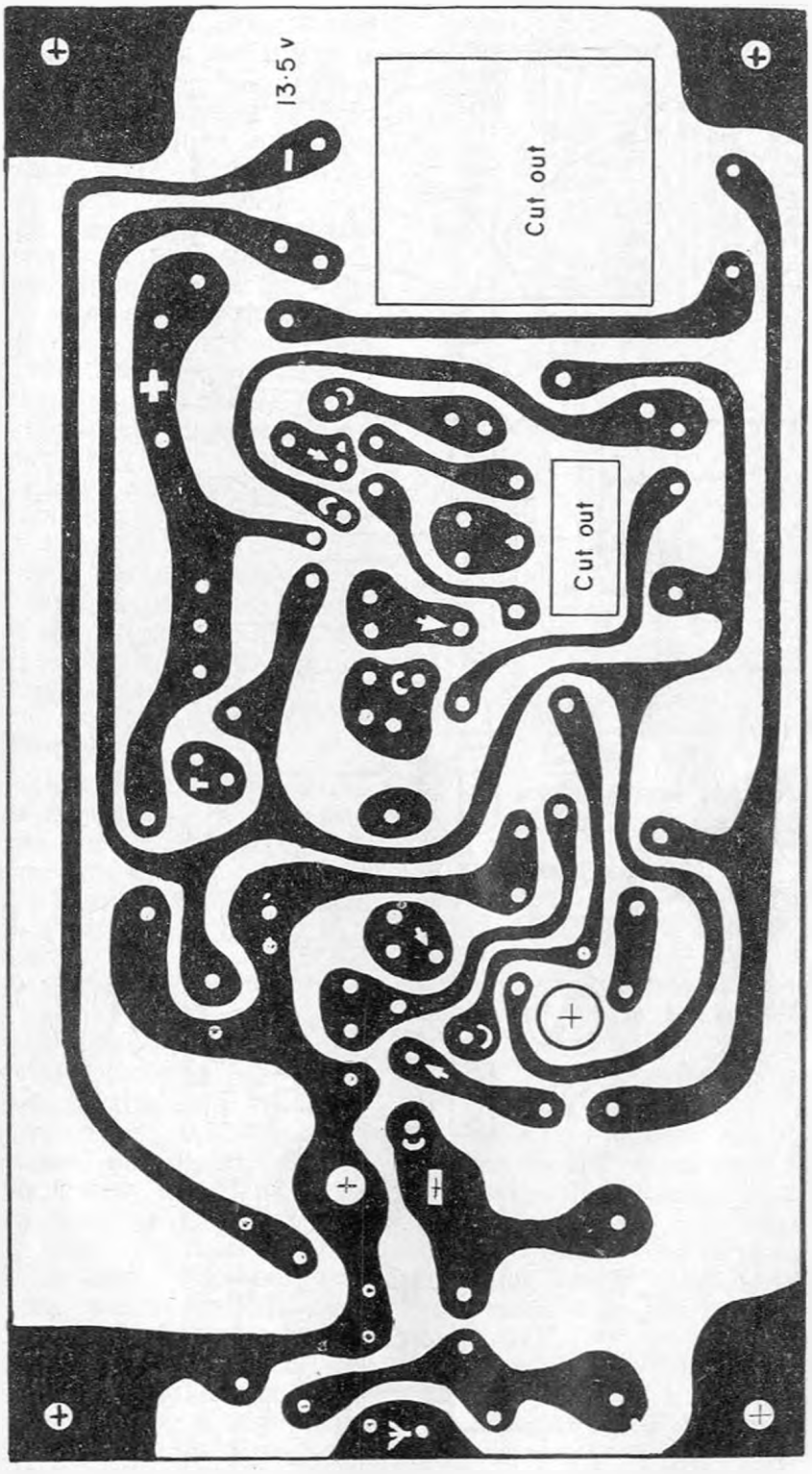


FIG. 3 **Full Size Printed Circuit Panel for the Tx.**

Arrow and "C" symbols identify emitter and collector positions

NOTE : The tone generators are on a separate panel and will be published next month with a second version.

Modulation

The modulator is powerful enough to either over-modulate, or if output is reduced to give exactly 100 per cent modulation. A good feature is that there is an increase of RF power when modulated which goes up again on simultaneous operation (when both tone generators are operated). Some modellers believe over-modulation is necessary to secure optimum range readjustment of the tone generator pot to a *reduced* value is. of course. all that is necessary for this state of affairs.

The modulator is simply push-pull drawing about 2 m.A until audio is fed into it. This measurement is taken between L3 tap and Neg. The tone generators take even less current so with

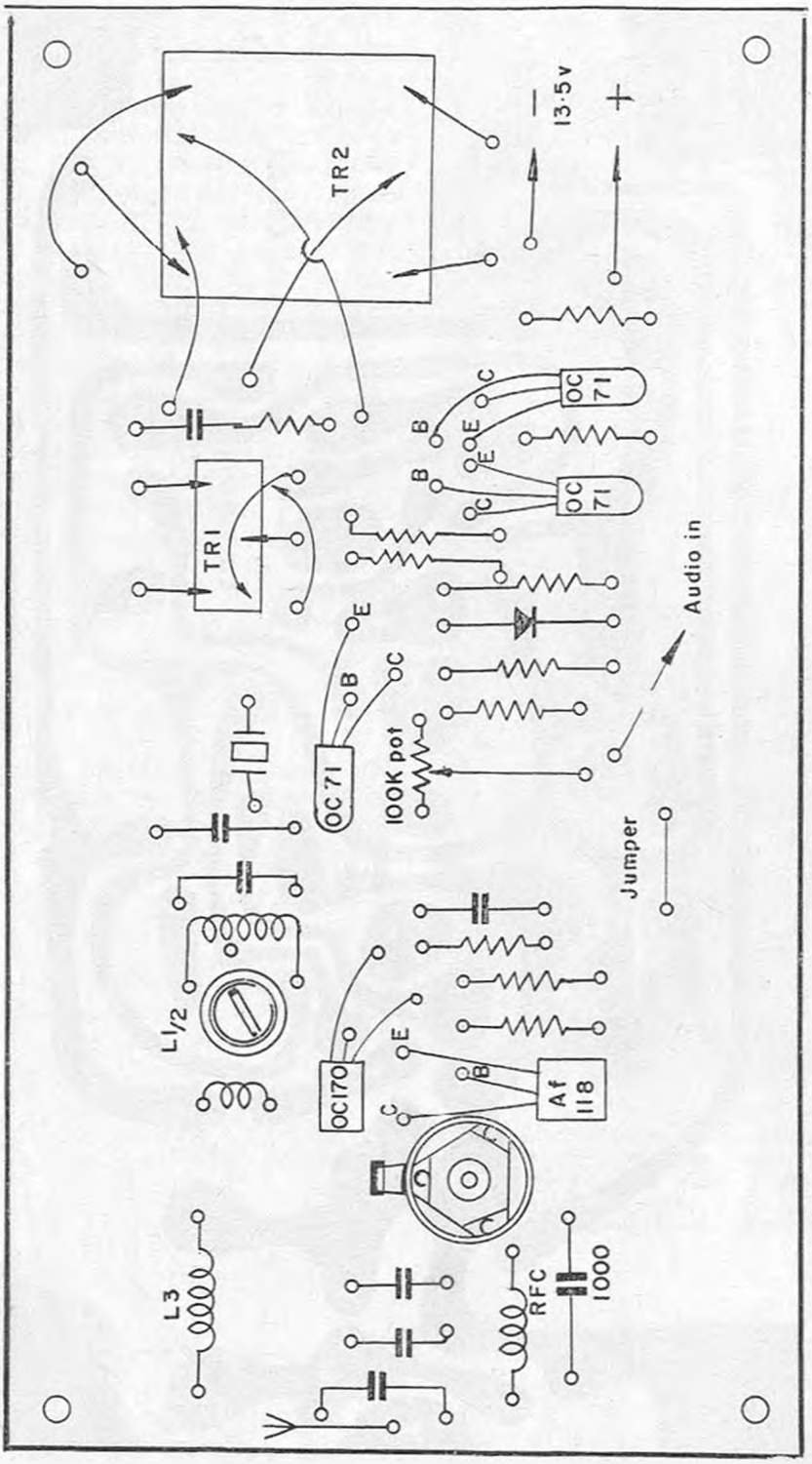


FIG. 4

everything in "full song" the battery consumption is about 50 mA.s on 4.5 volts, idling to 30 mA.s on carrier only.

Construction

It is not recommended that novices attempt this transmitter. One dry joint and there is a possibility that a transistor will blow, for 13.5 volts is quite high for this type of circuit although with all the components operating under the correct conditions, all the values are adequate for their purpose. The HF transistors are expensive and careful checking is necessary to ensure that everything has been done "per plan" before power is applied. There are a few points to consider in this connection, these will be dealt with under "tuning".

It is not possible to provide construc-

tional gen right down to the last nut and bolt as R.C.M. & E. pages are precious these days. However, the transmitter will fit nicely into a standard R.E.P. multi transmitter case which non "tin bashing" builders may obtain from Cosmic Hobbies.

It may be an advantage to make a mock-up of the circuit on a tag board. A point to bear in mind is that the simultaneous version should have the Neg. leads separated when both tone generators are wired up with a view to incorporating them on one panel. (Very strange results occurred from an early experiment when they were common.) Providing a reader can obtain components of suitable size (check these with the component layout in Fig. 4), then the printed circuit panel as shown in Fig. 3 may be used or modified slightly to suit. One of the original transmitters was condensed somewhat by use of small vertically placed components.

Transformer Windings

For those readers who wish to make the transformer themselves, the diagram in Fig. 5 shows the important dimensions of the core laminations. If one is unable to obtain identical laminations to those shown, it is best to err on the side of a large type, at the same time remembering that if there is more iron in the core, LIII must be reduced, but if less more turns will have to be applied.

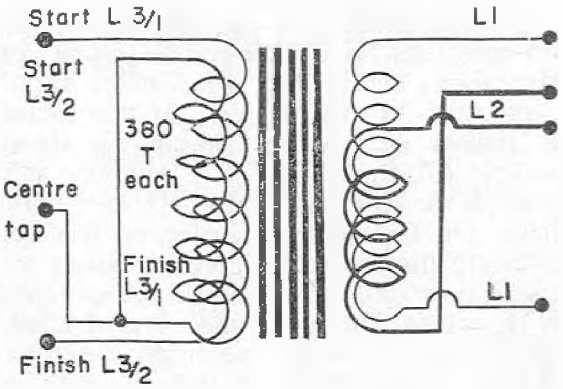
The windings are made as follows:— all windings are in the same gauge— enamelled copper wire; 0.2 mm. was used on the original but slightly thinner British s.w.g. equivalent would do quite well. Start by winding LI (50 turns) then apply LII over the first winding, this consists of 420 turns. Now take two wires together and wind 380 turns over the last winding. This forms a bifilar winding for LIII (2 x 380). Connect the start of one wire of LIII to the finish of the other wire, forming a centre tap.

Readers may obtain transformers on application to the author whose address is. E. Kreulen, Modelbouw, Goudsewagenstraat 4, Rotterdam, Holland.

TR1 can be the same as that used in the Windy Kreulen tone transmitter; a Japanese or British input driver transformer should work quite well.

If the Tx. does not operate reverse winding I of TR2.

Readers will recall on page 62 of our February, 1962 R.C.M. & E., the "Do it Yourself Transformer" article. This



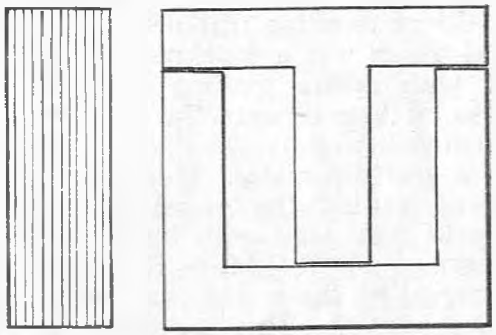


FIG. 5 FULL SIZE

MODULATION TRANSFORMER

LI 50T
LII 420T over LI
LIII 2x 380T over LII
all 0.2 mm. enamelled copper wire.

may be helpful: a home wound transformer may be necessary as there does not seem to be a suitable commercial equivalent.

Installation

The two panels can be fitted on spacers in the upper part of the R.E.P. case with the tone generators below as these never need maintenance once set. If one obtains the lever switches from the same source then the pot panel may be placed over these leaving adequate room for two sets of batteries which should give a whole season's flying.

Tuning

Keep a milliameter in the Neg. lead set to read 0-100 mA. A field strength meter should be at hand tuned to the correct frequency. An oscilloscope is of course most helpful although it may not be possible to get enough power from the Tx. to operate the 'scope direct, to observe the modulation depth. The solution is to build a field strength meter with a plug to fit into the vertical input of the 'scope (see Fig. 6) to be able to observe the "audio" wave form. A monitor is also helpful for an audible check.

Having first made *absolutely sure* that no mistakes have been made in the construction ; switch on. The meter should now read 30 mA. or less. If the current is higher or starts creeping up slowly switch off immediately, a slightly safer way is to try out the Tx. on 9 volts first. On full voltage, however, the field strength meter should give a reading and maximum deflection should be obtained with careful tuning of the core of L1/L2 the current should rise until the maximum current of 25-30 mA. is obtained at this point. Now carefully adjust the 3 to 30 pf. beehive trimmer to tune the aerial which was a Stockman & Westley type with centre loading coil. In the course of experiments the original coil is changed slightly, this can be done with a grid dip meter. This whole business of getting the aerial to resonate properly was dealt with by Hans Heck in April. 1961, R.C.M. & E. and should be studied by those who want maximum RF modulation. This concludes the RF tuning.

Now key the tone generator. the meter should jump to 50 mA.s and come back to 30 as soon as the button is released.

If the Tx. does *not* produce a smooth audio signal ; *reverse* the connections of LI (50 turns) of the modulation transformer. This *is important*. Now key again and keep the switch down for a long time and observe the current. If this starts to creep up switch off and disconnect the tap of the transformer winding (III). Place the meter in this lead to check the fault. It has been found in earlier tests that if the transistors in this push-pull arrangement are not matched, one transistor gets hot and starts to leak, resulting in a high current and a falling off of audio signal For correct operation it should be 2-2.4 mA.s at this point. For this reason a 10 ohm resistor and a 100 μF three volt capacitor has been shown and appears dotted on the theoretical diagram.

If all is well and a 'scope is available the following observations should be made: Reduce the output of the tone generator by adding more resistance (1 meg. Ω Pot) to a point where the 'scope shows a sine-wave. Now observe the field strength meter and note if the RF output increases when modulation is applied. If there is no increase then the transformer windings (bifilar tap III) should be reduced as the pair of OC71's are becoming saturated as the impedence is too great and the transformer matched correctly.

If satisfactory operation is observed both the generators may be keyed simultaneously without flattening the tops and bottoms of the sine-wave form the RF output should be 3-4 per cent higher. Fig 6 shows the sort of trace to be expected.

If no 'scope is available use a receiver with an earphone to monitor the audio. As soon as the note becomes coarse then there is over-modulation. The RF stage will not be easily "over-powered" as its RF output is actually governed by the modulation.

The OC170 in the Xtal oscillator will become just a little hot, so if you are worried increase the 150 ohm emitter resistance to 500 ohm and screw in the core of L1/L2 and bring it back on tune.

In order to obtain identical amplitude of output from the different audio notes. the capacitor in series with the variable pots should be kept as low as possible in value (preferably all the same). It is best to wind the pot core so that with 1 μf across it the shortest reed is not affected, neither should the high note produce the harmonic of one of the other reeds. In the event of incorrect switching the audio so produced would otherwise have disastrous effects during flight!

The values are not critical and as previously mentioned, stability is such that

FIG. 6

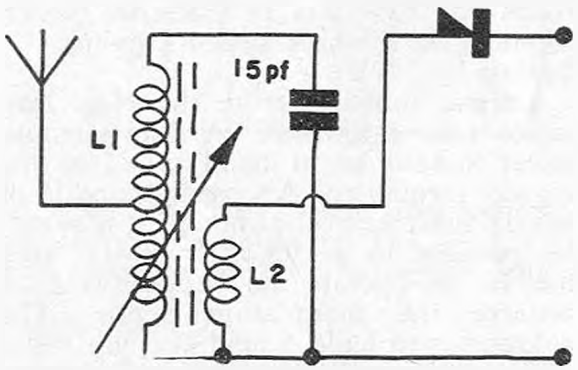


FIG. 6. Aerial 60 cm. Diode OA85. L1 : 24T ? 0.3 on 7 mm. covered former. L2 : 4 to 6T flex over bottom of 61. Connect to vertical input on 'scope.

[Continued on page 447]

Light Control

What the heck is the Angstrom Band ? J. MOAKES explains . . .

The ANGSTROM is a unit used to measure the wavelength of light (one ten-millionth of a millimetre). The red "Band" of the spectrum contains 6,500, *the violet,* 4.000.
Now let us leave technicalities behind and look at the simple circuitry.

THE control of models by means of a light beam is from a model's safety point of view, best restricted to those using land or water. Light control and radio control are similar in that they both suffer from interference and fading. Distance is limited by the power output of the transmitter and the sensitivity of the receiver. The interference may take the form of sunlight through clouds, or if the model is "on the secret list", the street lamps and the tones they radiate may cause trouble. Fading can be caused by things such as rain and smoke. Light transmission has the advantage that is not possible to cause radio interference and of course a licence is not required. The information that can be conveyed by light is identical to that of conventional transmitters if both are amplitude modulated. Frequency modulation of light is more difficult than amplitude, which explains why the latter is used. The range of light transmission will depend on the particular application, for example if all the light is concentrated into a pencil beam, then the range will be much greater than if the same light is made to cover a larger area (Fig. 1). The amount of light falling on a given area placed at either dotted line would be the same.

A TRANSMITTER AND RECEIVER FOR THE ANGSTROM BAND (6,500 TO 4,000)

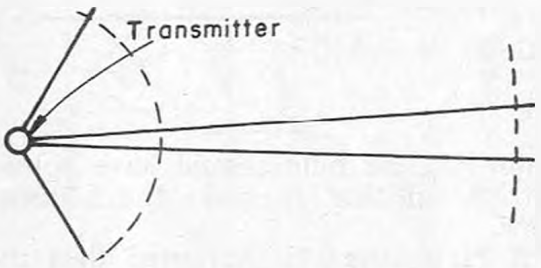
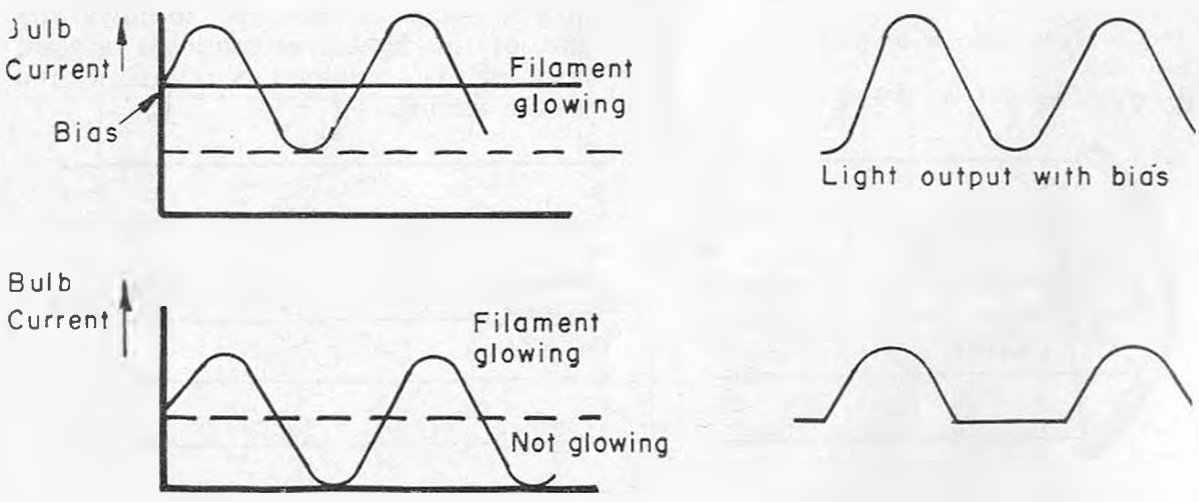


FIG. 1

The Transmitter

The light source may be switched on and off or modulated with tones. For a tone transmitter the best light source is the small torch bulb, in view of its small power requirements and low cost. A bulb with a small filament is essential to obtain a good response at frequencies around six and seven kilocycles, larger bulbs cannot follow the modulation because of the heat stored in their filaments. To obtain minimum

FIG. 2



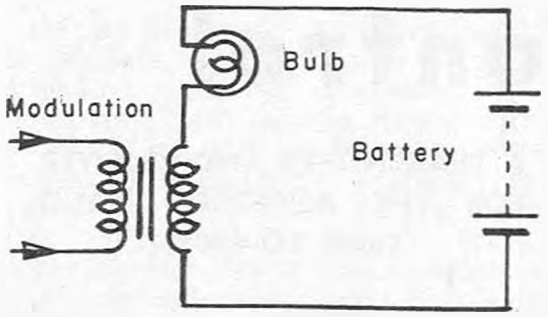


FIG. 3

distortion, the bulb should have a bias current sufficient to make the filament glow.

If bias current is not used then the modulation becomes distorted (Fig. 2).

The light output is proportional to the voltage across the bulb. The voltage may be varied by putting a transformer in series with the bulb and battery (Fig. 3). Now the bulb voltage is that of the battery plus the voltage at the transformer secondary.

FIG. 4

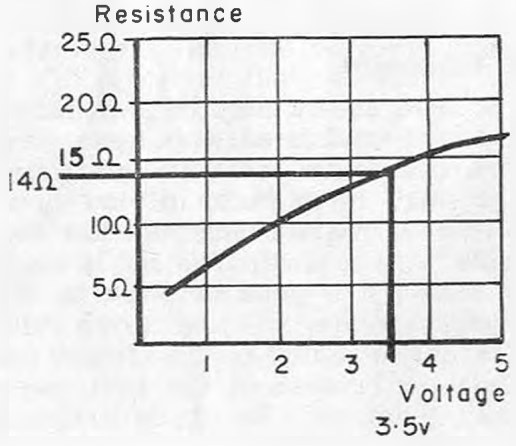
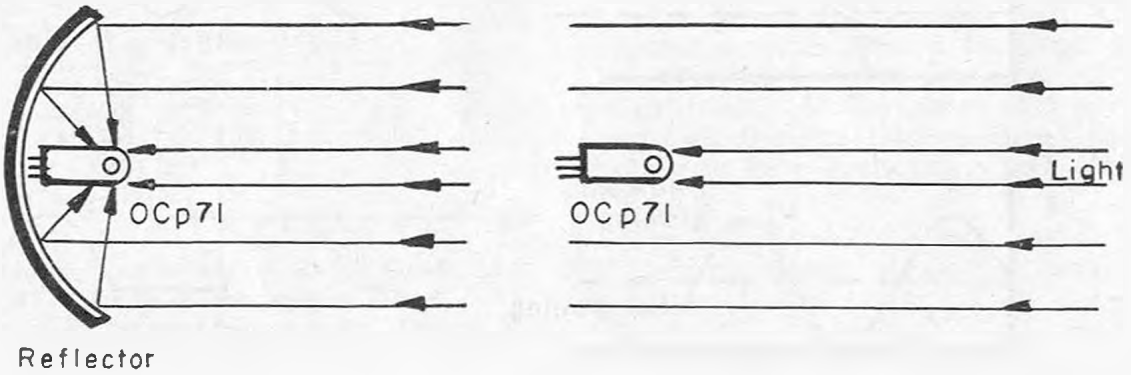


FIG. 5



The resistance of the bulb changes as the filament is heated. Fig. 4 shows the resistance of a 5.5v. 0.3A pre focus bulb plotted against voltage. From this curve the operating point is chosen at 3.5v. corresponding to 14Ω.

The Receiver

There are several devices sensitive to light, the most common of which is the selenium photo-cell, but the transistor comes out on top. When light falls on the transistor junction a base current flows, which can be amplified by transistor action consequently increasing the sensitivity.

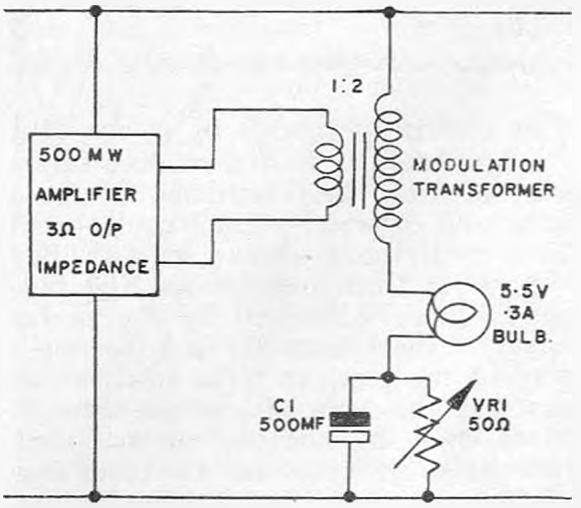


FIG. 6

The OCP71 is manufactured to exploit the light sensitive characteristics of the transistor. If the black paint is removed from an OC71, then this can be used as a pilot transistor with qualities approaching the OCP71. Maximum output occurs in the red to infra red part of the light spectrum, but a good response is obtained throughout the visible section.

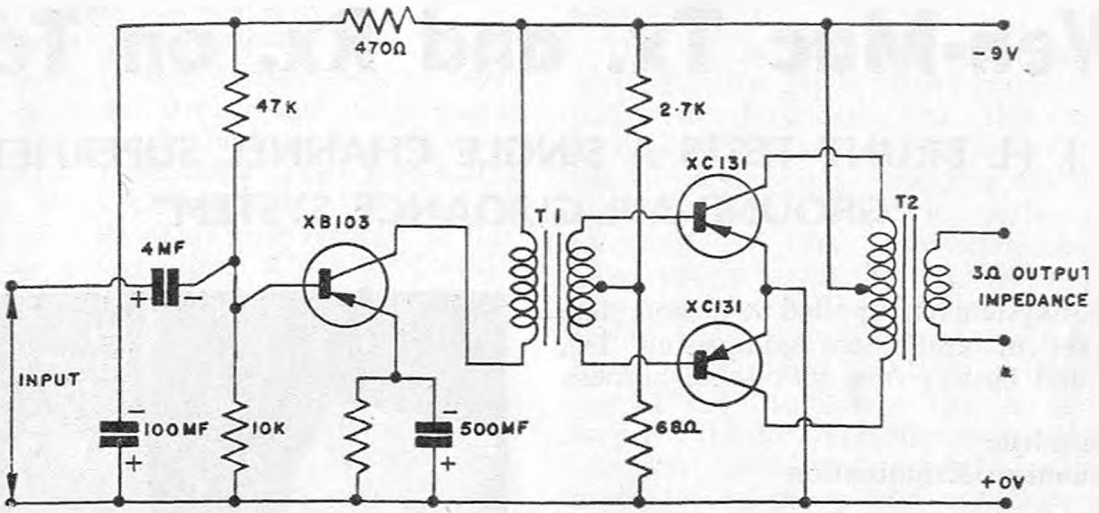


FIG. 7

The sensitivity of the receiver depends largely on the amount of light and falling on the photo transistor.

If the transistor is placed at the focus of a reflector the amount of light will be large compared with the arrangement without a reflector (Fig. 5). The interference effect of stray light may be minimised by placing a red filter in front of the photo-transistor.

Circuitry

Fig. 6 shows the transmitter. For a bias current of 250 mA. the voltage across the bulb is 3-5 v. and the resistance is 14Ω giving a ratio for the modulation transformer of 2 to 2.5 to 1 matching a 3Ω output impedence amplifier.

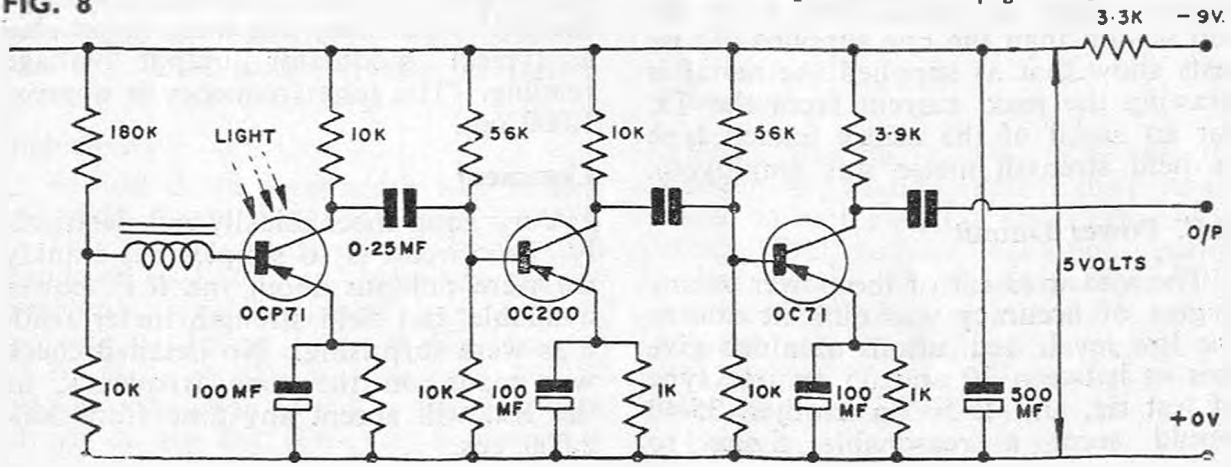
CR1 is adjusted for the correct bias current or can be used as a transmitter output control. It may be found that the receiver is overloaded if used close to the transmitter.

An amplifier suitable for modulating the bulb is shown in Fig. 7, but any of the transistor receiver output stages may be used provided the rating of the modulation transformer is adjusted to suit.

The receiver for a modulated transmission consists of the photo transistor with two stages of amplification (Fig. 8). The inductance L in the base of the OCP71 provides a high impedence to the a.c. component of the light beam. Then the OCP71 will give useful amplification of the modulation while providing a low impedence path to earth for the signal due to the bias current so reducing to a minimum the change in the mean collector current. The signal is then amplified by the OC200. This is a silicon transistor which enables a reasonable signal to noise ratio to be obtained. Further amplification is provided by the OC71. Power requirements are 1 mA. at 5 volts. provided by adjusting the 3.3KΩ series resistor to suit the power supply.

FIG. 8

[Continued on page 440]



Wen-Mac Tx. and Rx. on Test

J. H. BRUNT TESTS A SINGLE CHANNEL SUPERHET "GROUND-AIR GUIDANCE SYSTEM"

THIS system is supplied as a complete set of equipment comprising Tx., Rx. and battery box with cable harness.

Transmitter
Mechanical Examination

Nicely styled, comfortable to hold and is operated with one hand (thumb on button is the best position).

The unit is very neat and well constructed on printed circuit board, the circuit which is fully transistorised is as follows ; xtal Osc. Tr1 (x-1) RF Amp. Tr2 (x-2) both transistors being R-425 (Texas Inst. U.S.A.) and Osc. Mod. Tr3 (x-3) R-456 (Texas Inst. U.S.A.). Access to batteries is possible by removing two slotted screws securing lower rear section of the plastic case. The Tx. is fitted with a meter in the R.F. Amp. collector circuit.

Electrical Tests

The sample tested was set up on 27.045 Mc/s. (channel 2) at the factory, no adjustments of any kind being necessary.

Total currents drawn with 9 volt supply:—

Without aerial plugged in—14.5 mA.

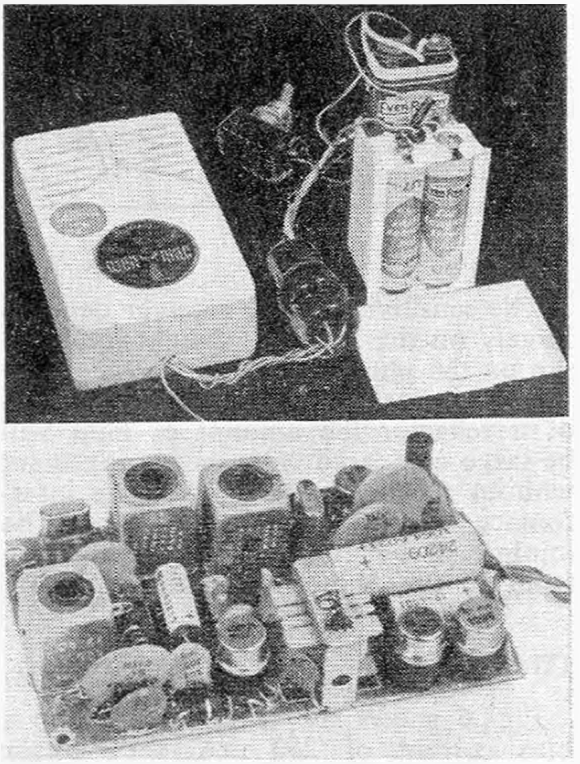
With aerial plugged in—16.0 mA.

Note—when battery falls to 7 volts, it should be replaced (The maker quotes 7.2).

Tests were carried out on the aerial by using first a longer, then a shorter top section than the one supplied. These tests show that as supplied the aerial is drawing the max. current from the Tx. for an aerial of the centre loaded type (a field strength meter was employed).

R.F. Power Output

The measurement of the power to any degree of accuracy was difficult due to the low level. Indications obtained give this as between 30 and 35 on one type of test rig, and 45-50 on another. 35-40 would seem a reasonable figure to expect. The modulation is 95-100 per cent and upwards.



Top : Rx. and battery box.
Bottom : inside story of the Rx.
Case size is 1¼" x 2" x 3½", weight under 4 ounces.

A check was made to find the output volts across the secondary portion of the modulation transformer, connections 2 and 3 of T3, a reading of 4.5 volts was obtained using a multimeter on 12 volt range 1,000 ohm. per volt in series with a -1 mfd. capacitor to block the D.C. This test was done to provide a typical modulator output voltage reading. The tone frequency is approx. 1,000 cps.

Comment

Very good mechanically and electrically. The circuit is so simple that frankly we were dubious about the R.F. power available, but field strength meter readings were surprising. No detailed check was made on the tone frequency, as the Rx. will accept any tone from 300-2,000 cps.

Receiver and Battery Box Mechanical Examination

Rx.—Very neat, though not as compact as some British and Continental Rx's. The circuit line up is as follows; Tr1 Xtal Controlled Self Oscillating Mixer R425 (Texas Inst., U.S.A.), Tr2 Reflexed I.F. (This also serves as 1st. A.F. Amp) Amplifier R-489 or 2N1107 (Texas Inst. U.S.A.) followed by a diode detector IN-295A, Tr3 2nd A.F. Amplifier R-455 (Texas Inst. U.S.A.), Tr4 Power Detector R-363 (Texas Inst. U.S.A.) and Tr.5 Electronic Switch (D.C. Amp.) R-556 or R-455A (Texas Inst. U.S.A.). Construction very good on printed circuit board. Access to Rx. by removing 3 Philips headed screws securing cover. The battery box to which the switch and plug are permanently wired is very neat and compact.

Electrical Tests

As with the Tx. the receiver was factory aligned to 27.045 Mc/s (Channel 2) and no adjustment was necessary, nor readily possible (see comments on Rx).

Total currents drawn 3 v. and 9 v. Supply.

With no signal	3v. - O mA.
	9v. - 3.75 mA.
With signal on	3v. - 200-275 mA.
	9v. - 8.5-12.5 mA

These tests are made with BONNER actuator of 8 ohms D.C. Res. in circuit. During the test no change was noticed in the 9 volt supply, but the 3 v. supply fell to 2.8 v. on full load.

Sensitivity

Better than 10μv input for a current rise of 250 mA. in 8 ohms at the output. For this test, the Sig. Gen. Modulation level was set to 75 per cent for both 1,000 cps and 400 cps. Further, it was noted that even if the modulation level was reduced from 100 per cent to 50 per cent, an increase on only 3dBs in the R.F. level would restore the output current to the same level.

Selectivity

At 6dB down, bandwidth was 30 kcs. At 60dB down, bandwidth was 150 kcs.

This test is carried out at 75 per cent modulation 1,000 cps. Image frequency response (second channel interference).

Note:— Image freq. = Sig. freq.— (1.F. freq. × 2) in this case 26.135 Mc/s. This was found to be only 6dB down on the Sig. Freq. Tr = transistor

Comments

The Rx. is very well made and also very sensitive. (It is rather prone to impulse interference). For this reason modellers are advised to refer to the special instructions regarding the bonding of metal working parts. The selectivity is very good and also we liked the reflexing of the I.F. stage to serve as an A.F. amplifier—no interaction was apparent due to this arrangement. One minor fault, is in the sealing of the trimmers. This is all very well for the I.F. Transformers, but some less permanent fixative could have been used on the mixer and oscillator dust-cores. Dust-cores break in the former very easily when the fixing is too hard. (Silicon Grease is the best dust core fixative).

The only major fault is the second channel, this could give trouble in areas where 26.135 Mc/s. is in use. After all the Tx. is only very low power. A possible cure would be to rehouse the Rx. in a metal case and fit a wave-trap in the aerial lead. A better suggestion, but the maker would have to do this, would be the use of a higher I.F. frequency. For example; between 1.6 and 2 Mc/s. instead of 455 Mc/s. One other improvement would be the use of a plug and socket for the aerial. The slots in the edge of the battery box lid make it rather flimsy.

The hand-book (Owners Manual) is very good indeed, and British manufacturers would do well to copy the idea and provide similar hand-books even if they must charge for them.

Range Check

Using the Tx. and Rx. together, the ground to ground range was $\frac{1}{4}$ mile plus. With more Tx. power the Rx. is capable of working at much greater ranges.

Comments

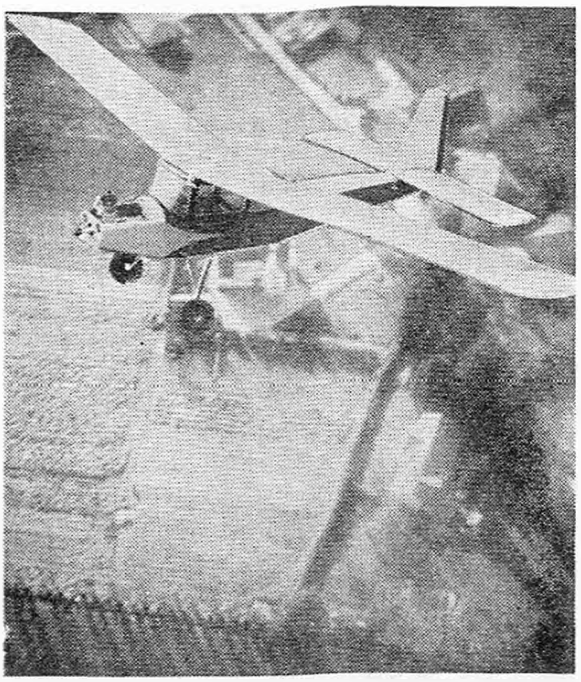
From Section 1, Para. A9 of the manual, it would appear that power could be increased (at some expense of battery life); as our regulations permit higher power at 27 Mc/s. than the American Regulations. Would it not be a good idea if the maker arranged a 100-200 mW. output for export Tx.'s or relevant modification data.

Price in U.S.A. is $69.98.

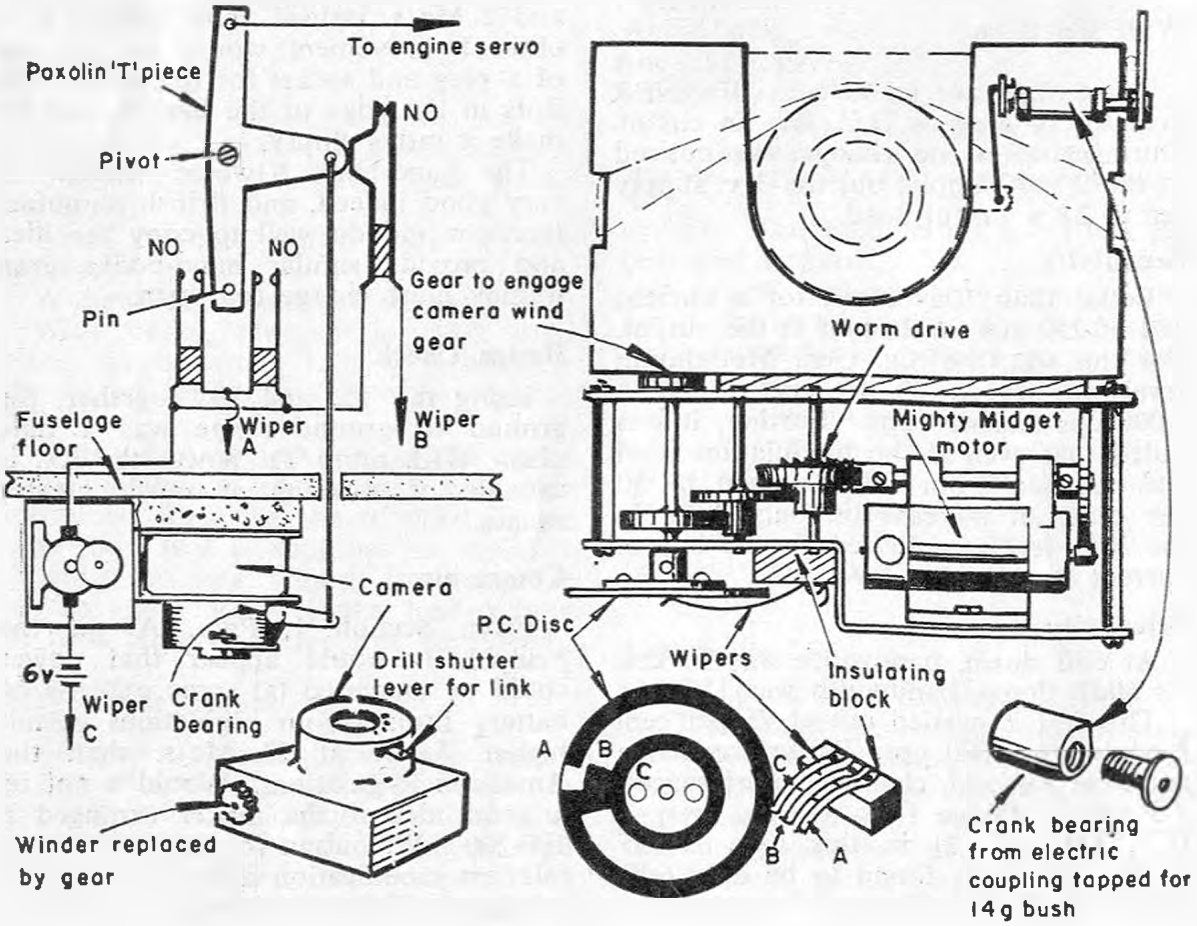
Watch that Birdie

In all probability that "Birdie" is watching YOU, it carries an R/C camera . . . BOB MICHAEL reveals the secret

AFTER one has been flying a radio control model a little while, some new addition to one's repertoire is most welcome ; we were delighted to receive some gen on aerial photography. This is certainly a fascinating trick and one which is reasonably simple to perform. Of course there have been free flight models equipped with cameras, and examples of their work has been exhibited in "Aeromodeller" on occasions. However, Radio Controlled cameras broaden the scope of one's shooting and permit a more selective type of picture to be taken, the only restrictions



The "Double Debutante" at work. Actually this is a piece of art department trickery ; the model is posed over another aerial shot, this time taken from J. R. Denning's "Uproar". Below : All the mechanical details for the "V.P. Twin" camera, readers should modify the construction to suit different cameras.



being that the motor of the model should be stopped at the time, otherwise some rather shaky pictures will result from our old enemy—the vibration gremlin.

Of course it is child's play to send the model up with a camera just timed to fire off as in free flight, or even have the shutter triggered by radio from one channel or a quick blip, but to take a series of photographs by winding the film on and if necessary re-cocking the shutter demands rather more thought and ingenuity. However, a parcel arrived the other day and all was clearly explained when we saw how a Mighty Midget motor was linked up to provide a wind on drive rather like a motorised single channel servo.

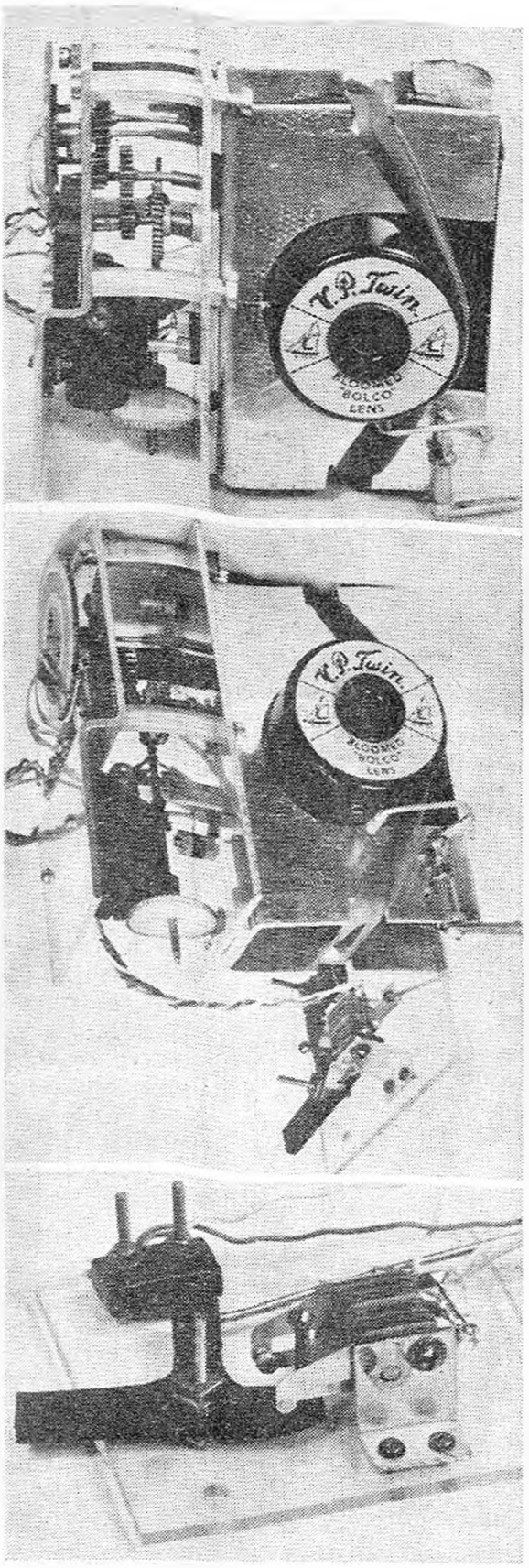
The Camera

Most cheap box cameras should be suitable for the job and of course have simpler shutter operation. Naturally the linkage to the shutter must be arranged according to the particular camera and its operation arranged so that it suits a shutter sequence. For example ; some simple shutters operate by moving the lever up for one shot and down again for the next, this obviously calls for much more complicated linkage than straightforward press and release.

Film Transport

Obviously we have no little robot in the model to peer through that little red window in the back in order to count exposures and see how far to wind on. Some of the better cameras (if you trust your piloting) move the film the required amount for each operation of the winding control, and an override clutch between the transport motor and the camera is then all that is required.

With a simpler camera it is necessary to work out a gear ratio so that the winding knob moves the exact number of turns (or turn and a bit) to move the film on one frame when the transport motor is operated one cycle. This all sounds rather complicated, take a look at the sketches and the situation should be a little clearer ; the printed circuit wiper plate which starts and stops the motor has to make one turn each time the film is wound on to the next frame. The gearing between the motor and the



Top to bottom : The camera in position retained by rubber bands. Next, angled shot shows the "T" piece and linkage. Bottom, the contacts which it operates.

Here we go into a nice turn and . . . CLICK ! The camera on the "Debutante" was facing aft for this flight, hence the tailwheel.

winding part is unimportant. Worm gears were used in conjunction with the standard Mighty Midget gears to obtain sufficient reduction.

The linkage is mechanical more than electronic and in this case a pushrod is taken from the engine servo to trigger the shutter and then start the winding sequence when the engine servo reaches the extreme end of it's movement. The operation of the system is that at either throttle positions the "T" crank closes one pair of points (also makes exposure) causing the p.c. wiper A to become live and moves the p.c. one turn to its dead spot. Whilst on its way to other throttle position, the "T" crank closes the jumper points which moves the p.c. plate on a little by making wiper "B" live. This leaves wiper "A" on the copper circuit ready for the next exposure and rewind at the extreme of the throttle position.

The Model

A nice steady sports model was chosen and the A.P.S. "Debutante" was scaled up to twice the size with parallel chord wings (tongue and box centre joining). Flying wire from fuselage bottom to wings is two strands of C/L wire, after one pair of wings folded up during full power tight banking turns! The bottom of the fuselage is left flat in this case, but the stringered half round effect on the top was retained. Power is a McCoy, Radio Octone, servos Duramites. The McCoy 60 is far too powerful for this model and a 45 would do it, but it is firmly believed that bags of power is best for trouble free flying.

The best method for photographing is to get the model well up. When the engine runs out of fuel (the original would do so at 1,000 + feet) open and shut throttle on the glide and photos are being taken without any worry about engine vibration shaking the camera.

LIGHT CONTROL

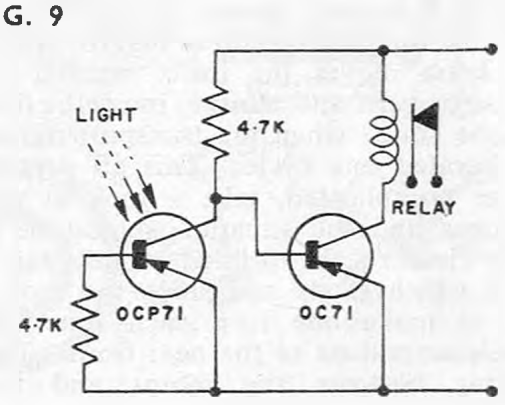
[Continued from page 435]

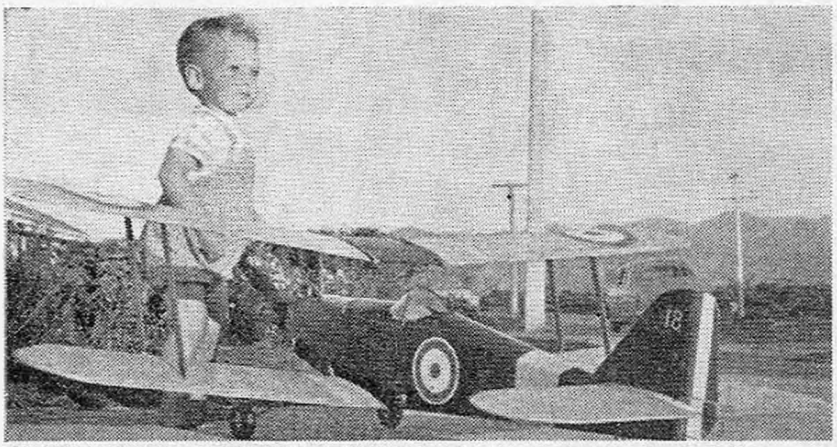
If the transmitter consists of a switched light source. then the change in collector current could be used to operate a relay, as in Fig. 9.

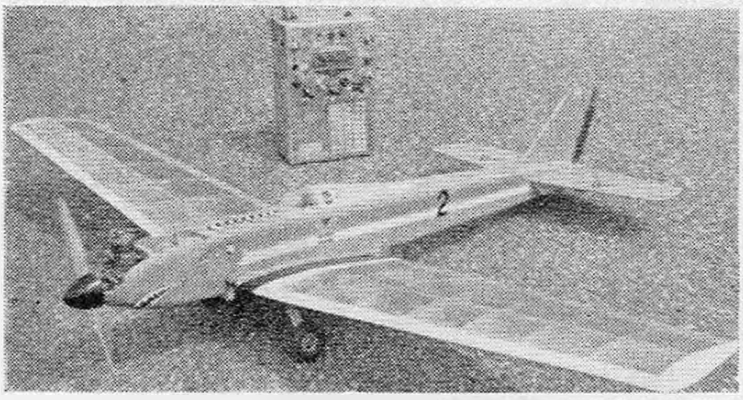
Conclusion

The information in this article may be used as a basis for light beam control. The system will work with any of the control systems in common use. Although the information about light control is rather limited, do not let this discourage attempts at this fairly new branch of modelling.

FIG. 9

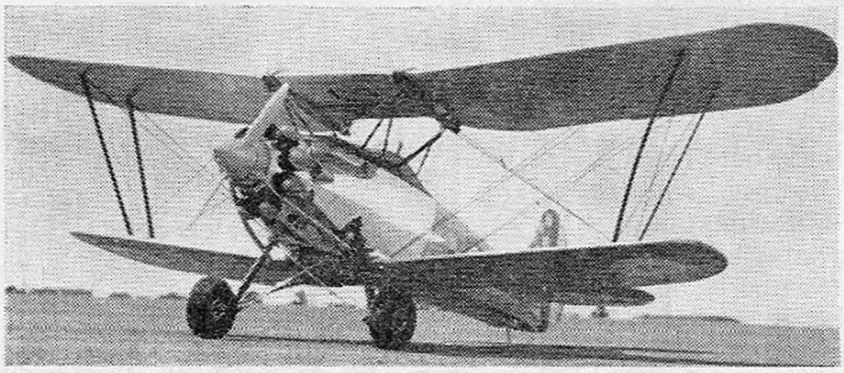




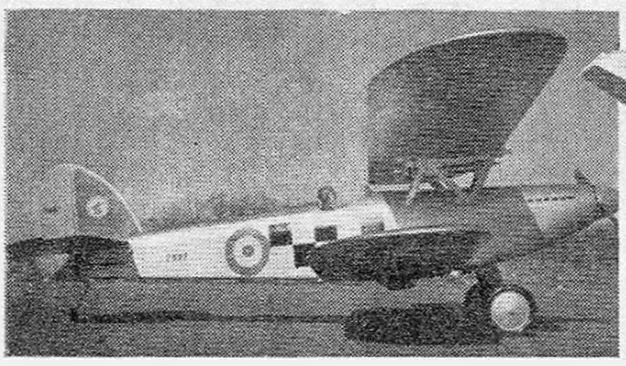


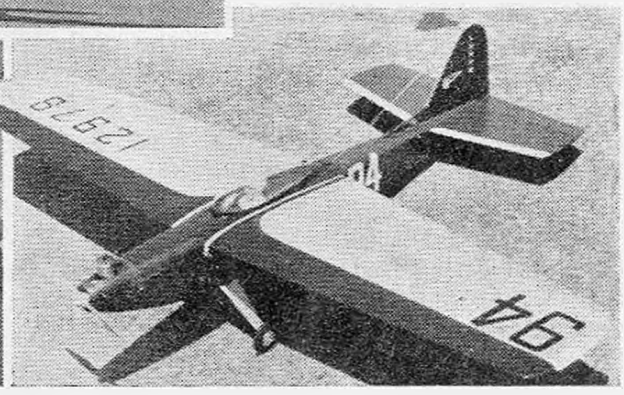
PIC PAGE

Upper right : M. Franklin seems to be breeding Orions. A "tiddler" Cox .049. Upper left : An "oldie" (1958) by S. G. P. McLachlan for an E.D. 346 and Wright R/C gear, upper wing is 56 in. span. Above: D. Handley's 50 in. span s/c model ; and Enya 19 CS 501 with F. Rising escapement. Right: Doug. Shepherd's Avro 504 K based on the A.P.S. Plan (FSP 343). Another CS 501 Rx. and a Cox .049, took nine months to build.



Left : The Bristol Bulldog by Dr. G. Henley of Bristol carries Orbit 8 and a Super Tigre 56. Bottom left: A semi-scale "Hawker Fury" by Maynard Hill of D.C.R.C., Washington, U.S.A. takes advantage of the proportional control afforded by the use of a Solidtronics system. A Merco 49 hides in the cowling. Below : Duck Hawk pylon racer to West Coast rules uses a glass fibre fuselage and Super Tigre .19.



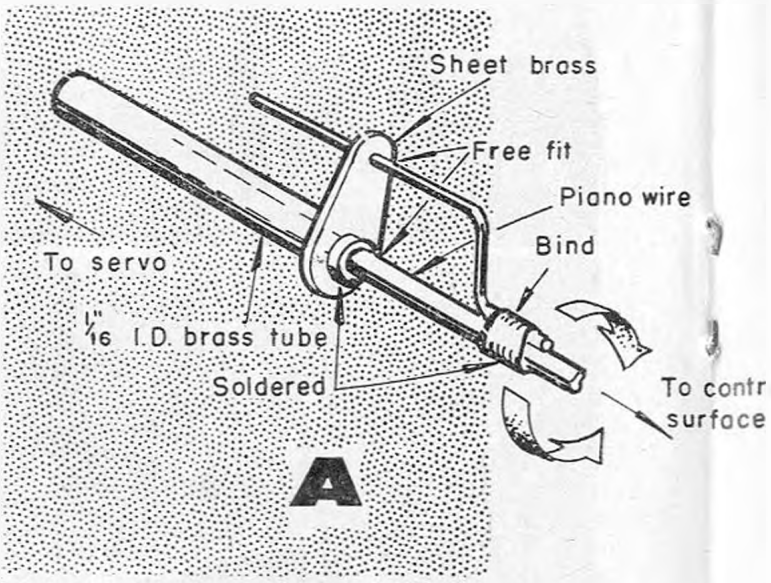


A FEATURE FOR THE EXPERIMENTER, COMPRISING IDEAS AND TIPS FOR ALL

Gadgets and G

Telescopic Linkage

We start this session of Gadgets and Gimmickry with two bright linkage ideas from C. Prendergast; the first one shown in sketch **A** is a sliding linkage for torque rods. This simply made connector is ideal for use with Galloping Ghost systems or bang bang actuators which have a rotary or semi-rotary drive to the control surfaces. A high degree of flexibility is permitted in setting up the gear in the fuselage. as the joint is telescopic. This is an advantage, as the servo may move forward in a crash without dragging the torque rod through the tail end.

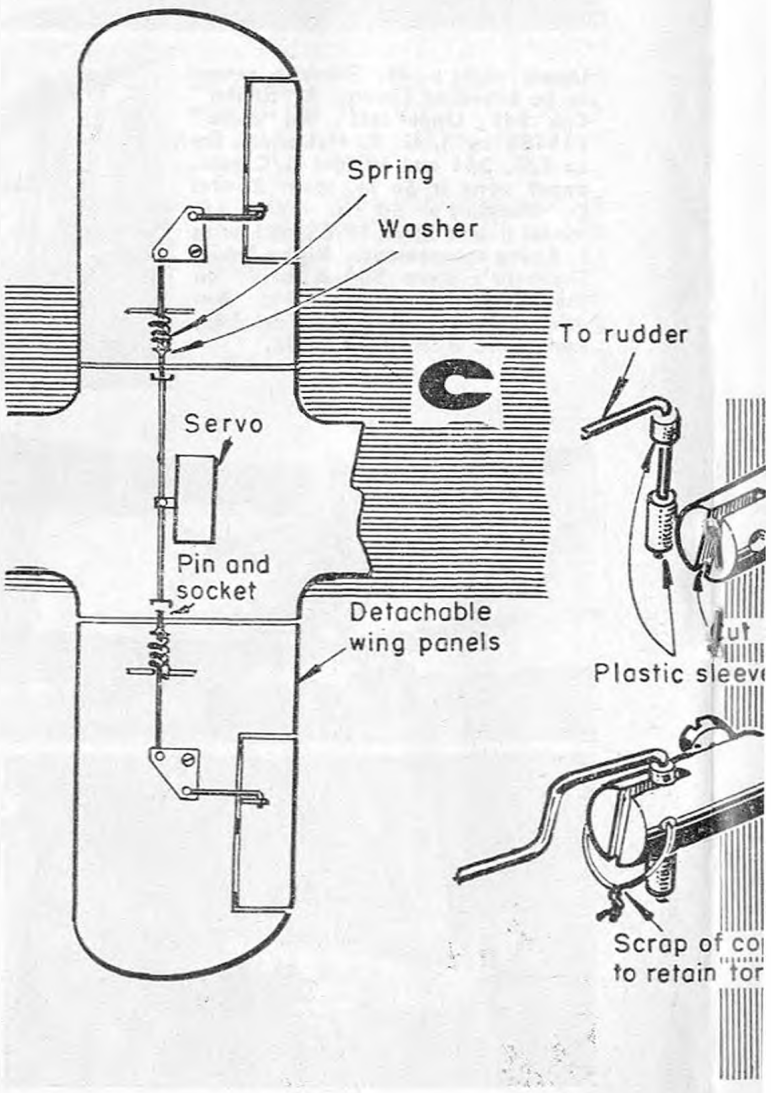


Simple Linkage for Full Span Ailerons

We think this simplified linkage for the rapidly growing number of full span aileron installations will prove popular. The original idea shown in sketch **B,** may have been intended for use in smaller models with normal ailerons, using fairly hefty tube to transmit the torque to the surfaces.

It would be an advantage to keep the servo some distance from the horns in order that the springyness of the push-rods does not cause friction on the horn bearing. The movement of the ailerons being relatively small does minimise the amount of opening and closing of the twin pushrods.

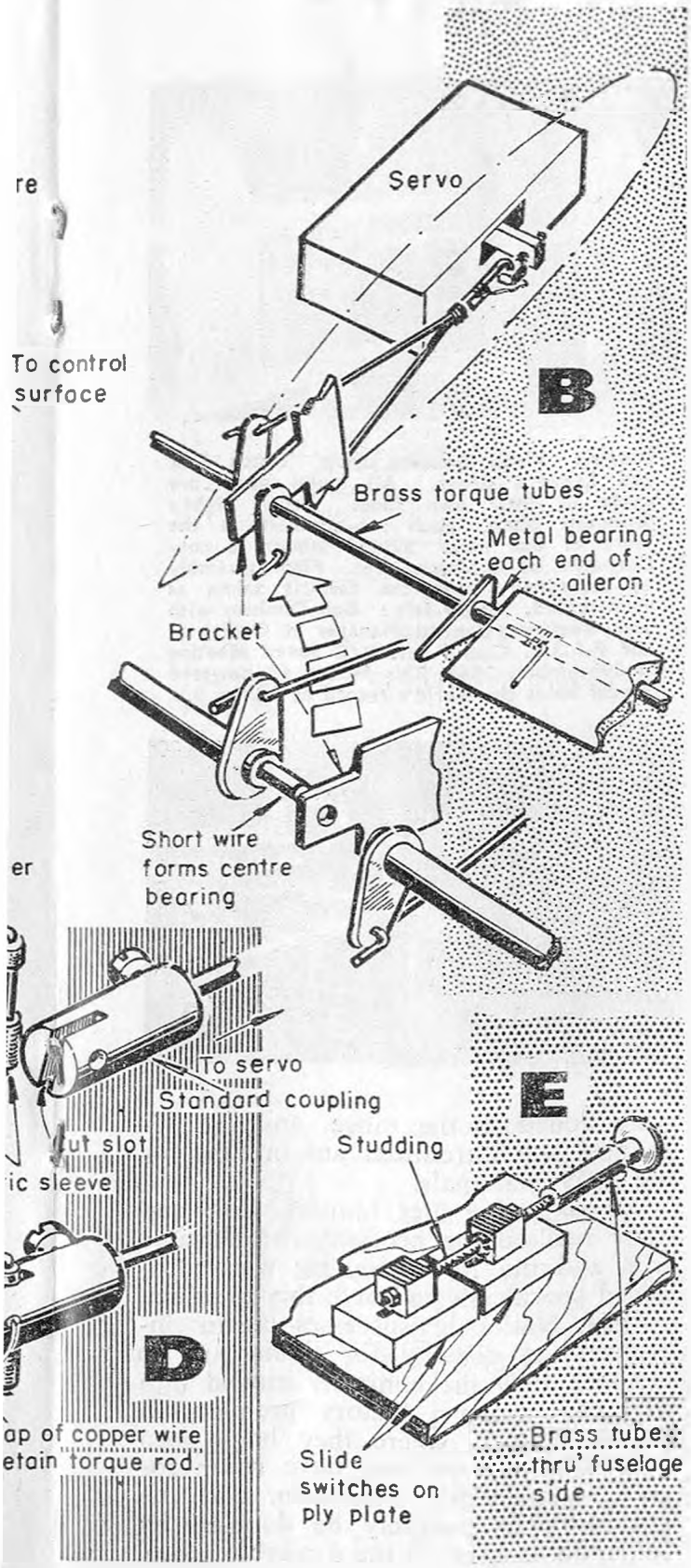
A clever centre connection between the two halves of the torque rod (which rotate in opposite directions) is afforded by the use of a short wire stub which is soldered into one tube, passes through a central bearing plate which is fixed to the structure, and forms a bearing itself for the other torque rod. Keep this wire short to accommodate the dihedral angle.



Detachable Wing Panels

Whilst we do not recommend two or three piece wings for multi scale models the occasion does arise with some kits, an example of this can be seen in the PT 19.

d Gimmickry



The problem of connections to the ailerons can be rather difficult, but an answer was provided in the KC/RC Contacts Newsheet.

The push rod driven by the aileron servo which in this case is mounted in the fuselage, is terminated in a couple of cup like sockets into which pushrods from the outer wing panels are forced by springs. As the springs in each wing panel oppose each other there is no appreciable increase in the effort required to move the surfaces. The springs, however, should be strong enough to pull the ailerons down in flight when the servo makes the appropriate movement. Sketch **C** explains the layout.

Universal Joints

Tommy Ives made good use of standard torque rod coupling to provide a universal joint in torque rods, sketch **D** shows how the coupling is slotted to accommodate the cranked end of the rudder torque rod. Scraps of plastic wire sleeving are forced onto this crank to prevent it slipping out of the slot. A further precaution is to drill right through the coupling at right angles to the slot and use a scrap of copper wire to prevent lengthwise withdrawal of the crank.

We should stress that the slot which may be easily cut with a hack-saw should not be much wider than the wire, otherwise some of the torque movement will be lost in float at this point. However, the end float can be as long as desired and permits quite a soft fixing for the servo or escapement.

Internal Switches

We have always advocated the placement of switches inside fuselages well out of the way of oil and dirt, and this idea by M. Franklin on the Spitfire could equally well be applied to boats.

Sketch **F** shows how the switches are fixed to a ply plate. Slide switches are quite easy to operate via a pushrod, the knobs are simply drilled and a piece of screwed rod (studding) is lock-nutted in place so that both switches move on and off together. A brass tube is either tapped to screw onto the rod or sweated onto a suitable nut, preferably a shake-proof type, this enables the external push rod to be disconnected for removal of the gear.

The ORBIT Story

By HENRY J. NICHOLLS

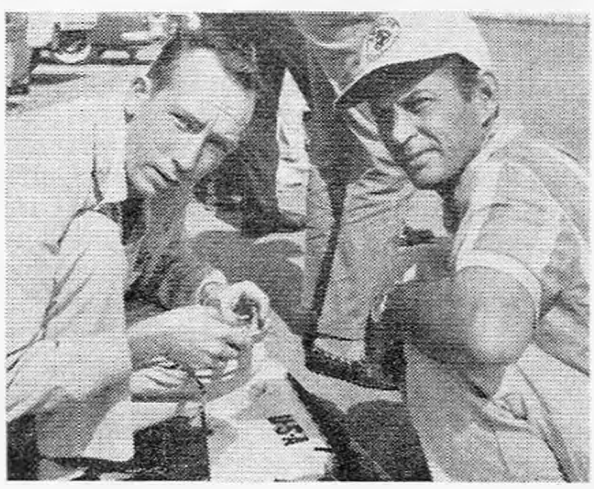
PART 2

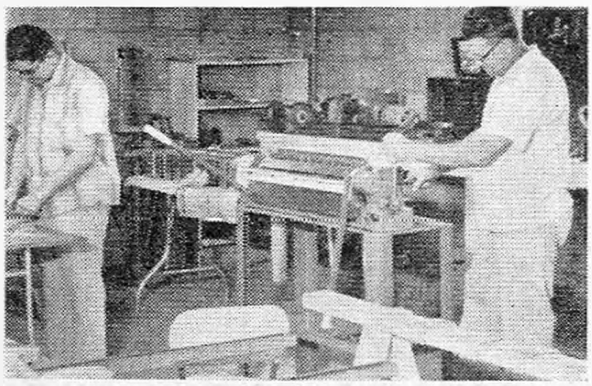
Last month Henry described the start of Orbit's rise to fame, reaching the stage of reliable, temperature stable gear and the success of the first simultaneous control. Now read on . . .

THIS was a turning point in Bob's career and it was soon after the Nationals that Bob had to decide which way he was going as it was obvious that he was not going to be able to cope with the demand for Orbit equipment with the strictly back-room operation he had been running behind his model shop up till then.

He opened a separate workshop where he started full-time Orbit manufacture, while his father ran the Hobby Shop. The first Orbit equipment produced in the new shop were all 8-channel simultaneous, and at the same time they were meeting a steady demand for 5 and 8 channel simultaneous transmitters to match other manufacturers' receivers. There is no doubt that apart from the fact that Bob's equipment was reliable, the simultaneous operation feature was the key to Orbit's success.

As production began to settle down and meet the demand first the 5-channel and then the single channel equipment were added to the range, and the 10-channel was introduced just in time for the 1959 Nationals.



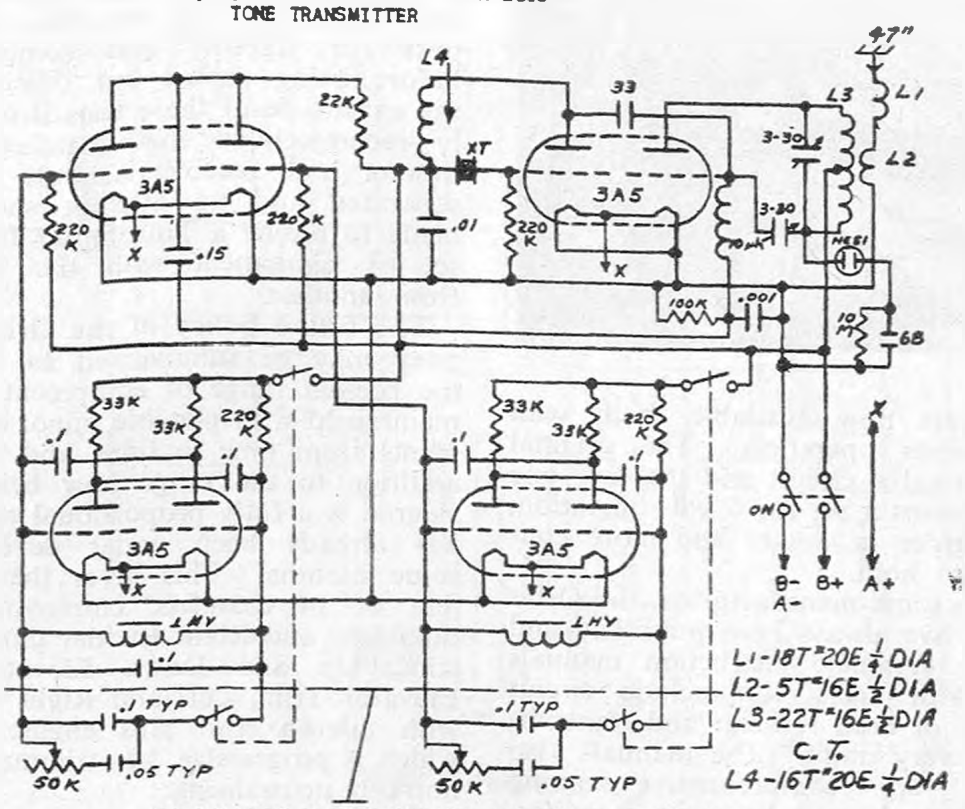


Above : Metal Bending Shop. Butch Falk and Leonard Groes. All metal parts are made in their own shop. Below right : Assembly Shop. Each sub-assembly is the work of one man. Skilled labour is concentrated on sub-assemblies. Final assembly of components into the case is taken as semi-skilled. Below left : Bob Dunham with Jack Bentley (General Manager at Orbit) at the F.A.S.T. Club F.A.I. R/C Speed Meeting in November, 1961. This McCoy 60 powered model holds the world's record at 124 m.p.h.

As an active flier himself, Bob had early realised the necessity for elevator trim and the 10-channel rig was introduced specifically to solve this problem.

1959 Nationals successes again increased the demand for Orbit, and in October 1959 the company moved into fine new modern factory premises in Garden Grove, where they have been ever since. Here they have room for quite considerable expansion, and the output could probably be doubled by full utilisation of all the available space.

ORBIT 6, 8, & 10 CHANNEL SIMULTANEOUS TONE TRANSMITTER



ADD COMMANDS BELOW DASH LINE FOR NUMBER OF CHANNELS

The current production programme consists of :

(a) *Single-channel* super-regenerative receiver with one hard valve and three transistors, and relay. Transmitter has two valves, i.e., push-pull oscillator and modulator.

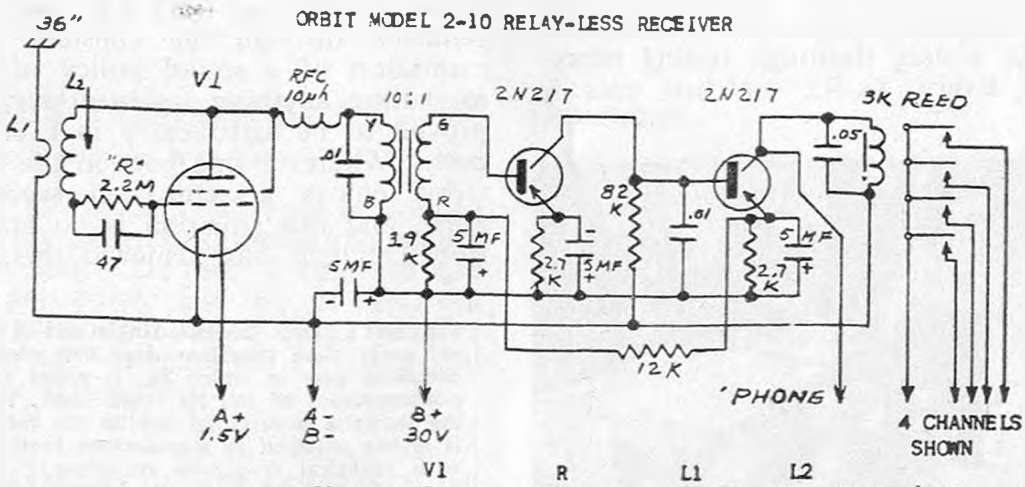
(b) *Four-Channel* Non-simultaneous. Super-regenerative receiver with one valve and two transistors. Has relays. Transmitter has two valves and is similar in layout to the single channel Tx.

(c) *Six-channel* simultaneous. Super-regenerative receiver with relays. One valve and two transistors. Transmitter has four valves.

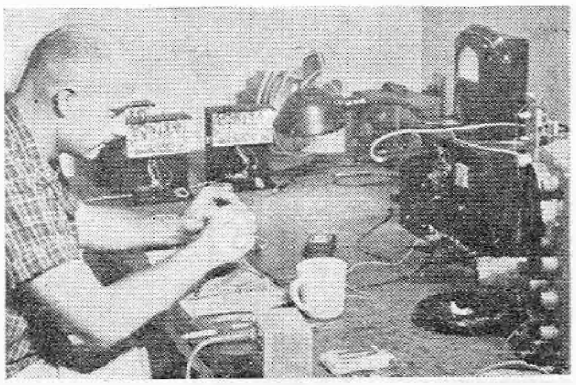
(d) *Eight-channel.* Super-regenerative receiver with relays. One valve two transistors. Simultaneous Tx. has four valves.

(e) *Ten-channel* super-regenerative receiver *with* relays and also super-regenerative receiver *relayless.* The third and recently introduced receiver is the *Superhet* relayless. There are two

ORBIT MODEL 2-10 RELAY-LESS RECEIVER



	V1	R	L1	L2
27 mcs	XFY 34	2.2 meg	2T #26	28T #34 CC 1/4 DIA
50 mcs	1AG4	560 K to GROUND	1T #26	13T #34 CC 1/4 DIA



transmitters now available, both with simultaneous operation. The original is a four-valve circuit and the new one an all-transistor set for 6 volt operation, much lighter in weight and more convenient to hold.

Unlike some manufacturers, the Orbit circuits have always been published and the very complete instruction manuals issued with every set include circuit diagrams of both receiver and transmitter for every outfit. The manuals also contain very comprehensive tuning instructions although in some cases (as, for instance, when tuning cannot be carried out satisfactorily without an oscilloscope), it is strongly recommended that units be returned to the factory for this service to be carried out.

One of the first things that strikes one on a visit to the works is the high proportion of time that is given out of the total man-hours taken to make each equipment, to the successive tuning and checking procedures that have been adopted. The final check-out is done by Bob himself and Dick Riggs who does the last of the works checks before they come into Bob's room puts each complete equipment, Tx and Rx through a very thorough testing procedure. Every Tx-Rx matched pair is put through a simulated range check and has to meet an exacting series of tests for stability and compatability before being passed out. Because of the exactitude of these tests it is strongly recommended that matched transmitters and receivers should not be separated and no attempt should be made to retune a Transmitter from one set of equipment with the Receiver from another.

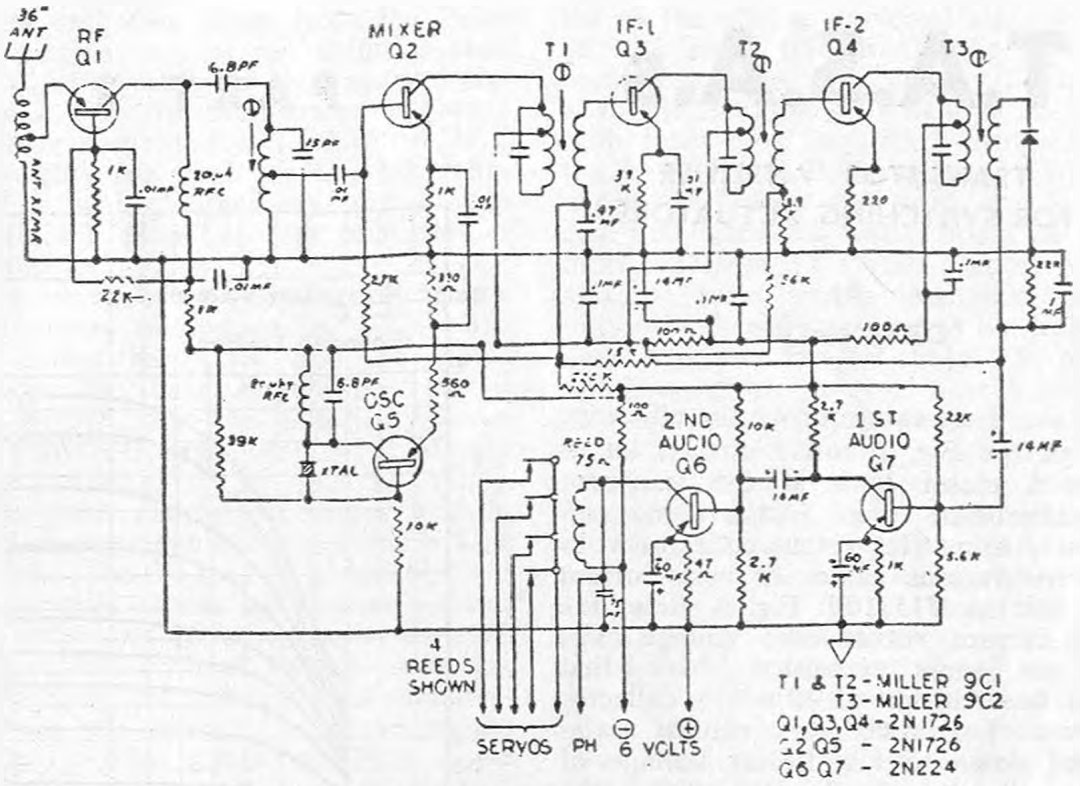
The future policy of the Orbit Company may be summarised as follows: the present range of equipment will be maintained with possible minor improvements from time to time, and the only addition to the range now being considered is a fully proportional rig which has already been under development some months. This gives the equivalent of 14 channels, employing as it does Left and Right Rudder plus rudder trim. Up and Down Elevator with Elevator Trim, Left and Right Ailerons with aileron trim plus engine control which is progressive, i.e., trimmable, and non-self neutralising.

The original of this equipment was built for his own use by Jerry Pullen, and his basic conception is being adapted to the new Orbit set by Bob's development section, as the original model was not entirely suitable for series production.

Jerry Pullen is, incidently, flying a Stormer fitted with his prototype equipment and a Merco 49 engine. The results are certainly first class and his set appears to have a very high degree of stability and reliability.

To summarise, Orbit enjoys an enviable position in the Radio-control field in the States today, and this has only been achieved through the constant implementation of a sound policy of never marketing anything unless it had been proved to be satisfactory in every respect. Wherever one goes in the States, Orbit enjoys a reputation second to none, and this situation is no accident. Bob Dunham has achieved this result

Top left : First Check—Single and 4 channel only. Dan Menziner does first check of complete gear in which Tx. is tuned to the characteristics of the Rx. reed bank. Matching in pairs is essential due to the fact that it is not practical to manufacture reed banks with identical frequency responses. Left : Final Check. Bob finally checks all the equipment himself after 1st check and 2nd check, making three in all.



ORBIT SUPERHET RX.

only by adopting the principle that quality is the only criterion, not price. The continuance of this policy together with his readiness to accept new ideas should certainly ensure Orbit's continued success.

Modellers everywhere will certainly await the new proportional equipment with interest. At this stage of development in the radio field with proportional ready to take a position of ascendency in competition flying at almost any time, and with a number of manufacturers anxious to get into this market, Orbit can be relied upon to produce equipment that will live up to its established reputation. We all await its advent eagerly.

WINDY'S TRANSISTOR TX.

[Continued from page 432]

even a 50 per cent decrease in voltage should not effect it although the output will be less. Do not attempt to use small pot cores, and try to get the desired audio by adding more parallel C. This will decrease the Q factor and spoil the sine-wave.

Do not be afraid to use single pole switches ; it may appear dangerous to short collectors of the transistors but the high emitter values result in a low consumption.

Conclusion

We are sure that this transmitter will be a source of much pleasure to the home builder with a fair amount of radio knowledge, who will be surprised at the amount of power that can be squeezed from the circuit and the range obtained with the use of a good Rx.

★ ★ ★

Windy also sent us some additional circuits and gen on the latest developments. . . . More next month.

T.A.S.A.s

PART 2

TRANSISTOR AMPLIFIER FOR SWITCHING ACTUATORS

By

DAVE McQUE

To see if we can improve the efficiency of the Fig. 2 and 3 circuits let us have a closer look at the transistor characteristics. Fig. 5 shows the collector current (Ic) versus collector voltage for various values of base current (Ib) for the V15/10P. Fig. 6 shows the base current versus base voltage (Vb) for the same transistor. Note that for a base current of 40 mA. a collector current of over 600 mA. can be maintained down to a collector voltage of 200 millivolts or 0.2 v., whilst the corresponding base emitter voltage is about 450 millivolts. This means that the base has to be more negative than the collector, a condition impossible in the circuits of Figs. 2 and 3 because even if VT1 is shorted, VT2 base will only be at the same potential as its collector. By simply connecting VT1 collector to the negative bias rail this limitation is removed, and VT1 can take VT2 base negative with respect to its collector. This circuit is a little severe with VT1, however, because if the VT2 collector becomes disconnected from the batteries it will be lumbered with the motor load and catastrophic failure will occur. For protection a limiting resistor must be added in its collector circuit. Similar reasoning can be applied to VT3 and VT4 and a complete circuit of the improved T.A.S.A. is shown in Fig 7. This has been tested with a variety of actuators. With those using Mighty Midgets and other 5Ω motors, batteries B and C can be up to 3 cells each (4.5 v. nominal on dry batteries, 3.6 v. nominal on D.E.A.C.s). Battery A can be 2 cells, two pen cells are satisfactory here as the drain is low. With lower resistance motors such as Ever Ready and Bonner, the circuit is safe with the same voltages, but B and C are better at 2 cells each to avoid the actuators hunting.

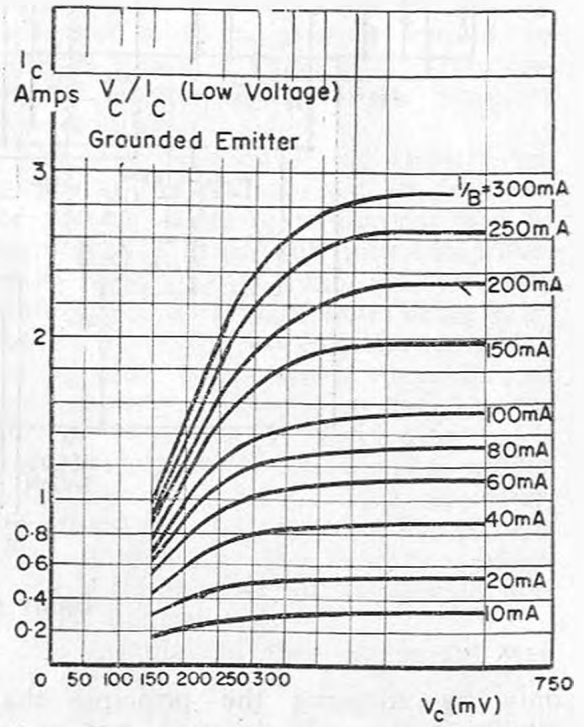


FIG. 5

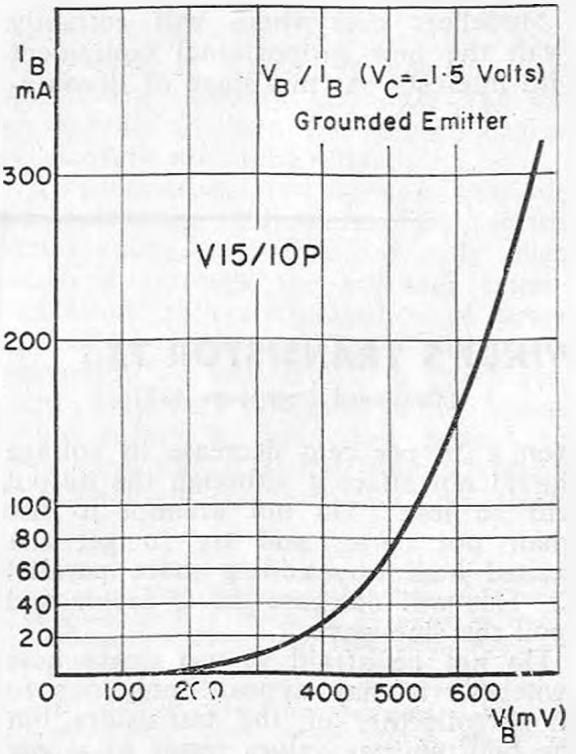


FIG. 6

With actuators made from the Pearsons surplus unit at ten shillings each and V15/10Ps at seven shillings and sixpence, a powerful inexpensive actuator/amplifier combination results. It is a bit weighty for small aircraft but reliability is worth something, and if you have a big plane or fast boat this is just the job.

It is instructive to calculate the maximum power dissipation in VT2 when it is driven hard ON, and the motor stalled. The base current will be at least 40 mA. and the collector current less than 800 mA. for 2.4 v. supply from 2 D.E.A.C.s for the 3Ω motor. In the case of the 5Ω motor with a 3.6 v. supply from 3 D.E.A.C.s it will be 700 mA. (The *on load* of practical sized dry batteries comes out lower). From Fig. 5 the corresponding collector voltages are 300 mV and 250 mV with dissipations of 240 mW and 180 mW respectively and this is with the motor jammed, a fault condition. Now if we can find smaller transistors which will pass these values of collector current at these collector voltages, or less, with reasonable values of base current, it should be possible to operate them within their ratings even under stalled motor conditions. This has been done in the case of the popular Bonner Transmite, (Ref. 1). Selected 2N670 transistors are used in the output stage and are required to have a collector current of 800 mA., and a base current of 15 mA. corresponding to a max. dissipation under stalled motor conditions of 160 mW., this is O.K. up to 45° C. Economically priced switching transistors for currents of the order 800 mA. are not yet available here, however, a useful type is the G.E.C. GET114 rated at 200 mW. up to 45° C (113° F) and 150 mW. at 55° C with a maximum collector emitter voltage of 15 v. Its cheaper companion, the G.E.C. S1 is similarly rated as to power, but has a lower collector to emitter voltage rating of 6 v. which puts it out for use in the VT4 position of Fig. 7 for example.

Examination of the characteristics of this transistor and similar types has led to the development of a new circuit which exploits the S1 ratings to the full without exceeding any of them. The philosophy is similar to that which has led to the almost universal adoption of 12 v. systems on cars in the U.K. in preference to 6 v. systems. To quote a simple example; to light a 36 Watt bulb from 6 v. requires 6 Amps from the battery and 0.1Ω, resistance in the wiring will drop 0.6 volts = 10 per cent and waste 3.6 watts. For a 36 watt bulb fed from 12 v. the current is 3A and the same wiring resistance causes only 0.3v. = 2.5 per cent to be dropped and a power loss of only 0.9 watts. Similarly if we use 4.5-6 volt motors rather than 2-3 volt motors we can halve the currents with improvement in efficiency through reduction in battery, brush and wiring losses with reduction in base current requirements to the point where the output transistors can be safely driven direct from the reed unit. These advantages are not going to be popular, however, if the size and price of the battery has to be increased, so it has been necessary to devise a circuit which uses only a single 4.5 to 6 v. battery **without** taps.

The basic circuit (Fig. 8) has been designed around the Microperm 2,000 motor which has a stall current of 450 mA., at 4.5 v. As it stands it can only be used for spring neutralized or progressive actuators. For example, the Rising and Schulz type which although they use the 5Ω Mighty Midget are also safe with this circuit, due to their slipping clutches. A full blown, power neutralised version with limit and centering switches which was specially developed for the new Rising and Schulz servo, is shown in Fig. 9.

The operation of these circuits is best understood by examining their relay equivalent shown in Fig. 10. As shown

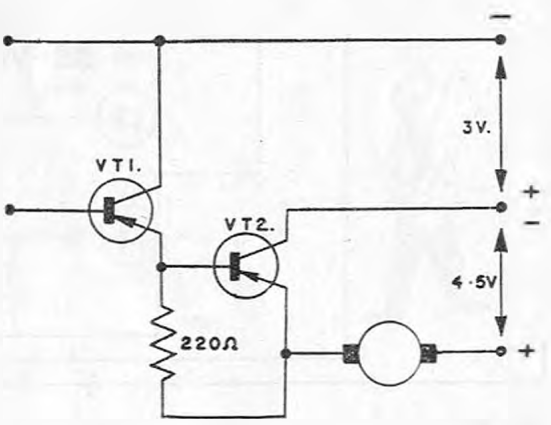


FIG. 7

(Ref. 1—Robert L. Elliot, Relayless Servo for Reed Amplifiers A.M.A.F.C. symposium, 1961)

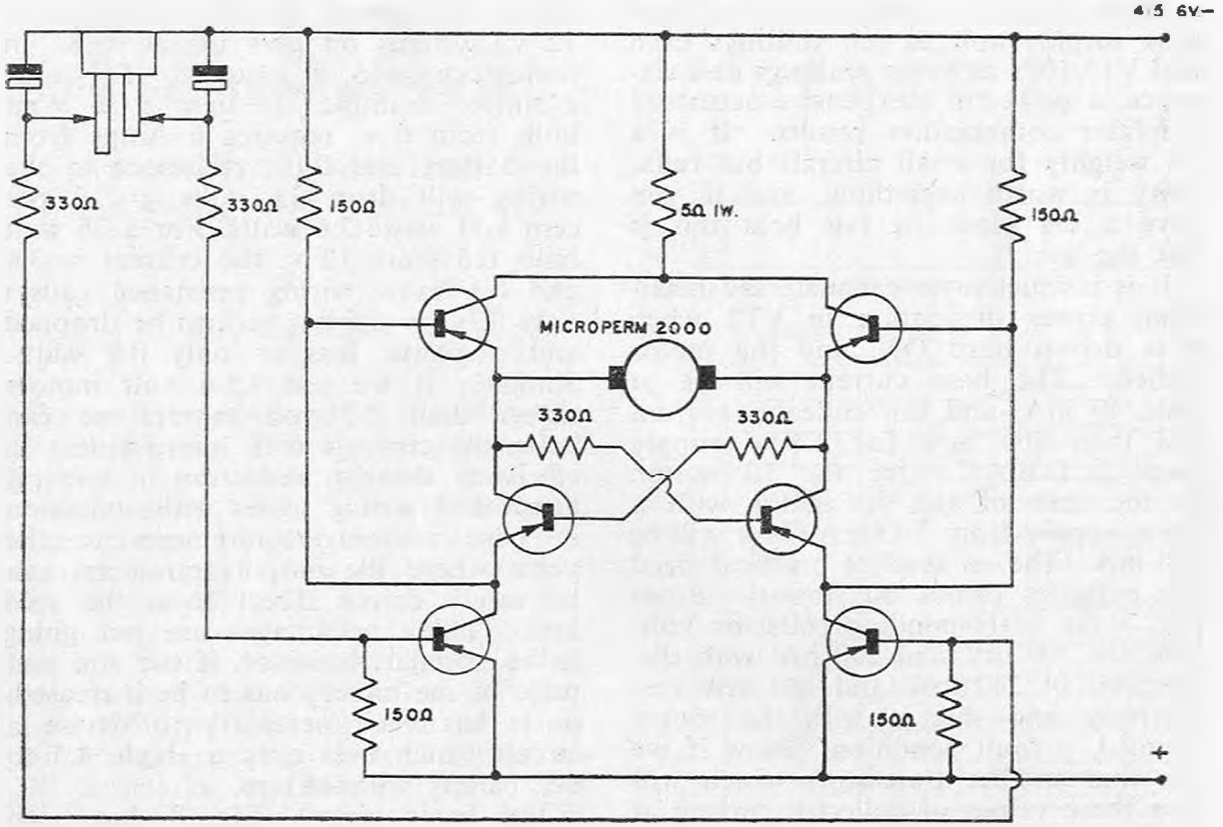


FIG. 8

Capacitors 25 to 50 μF

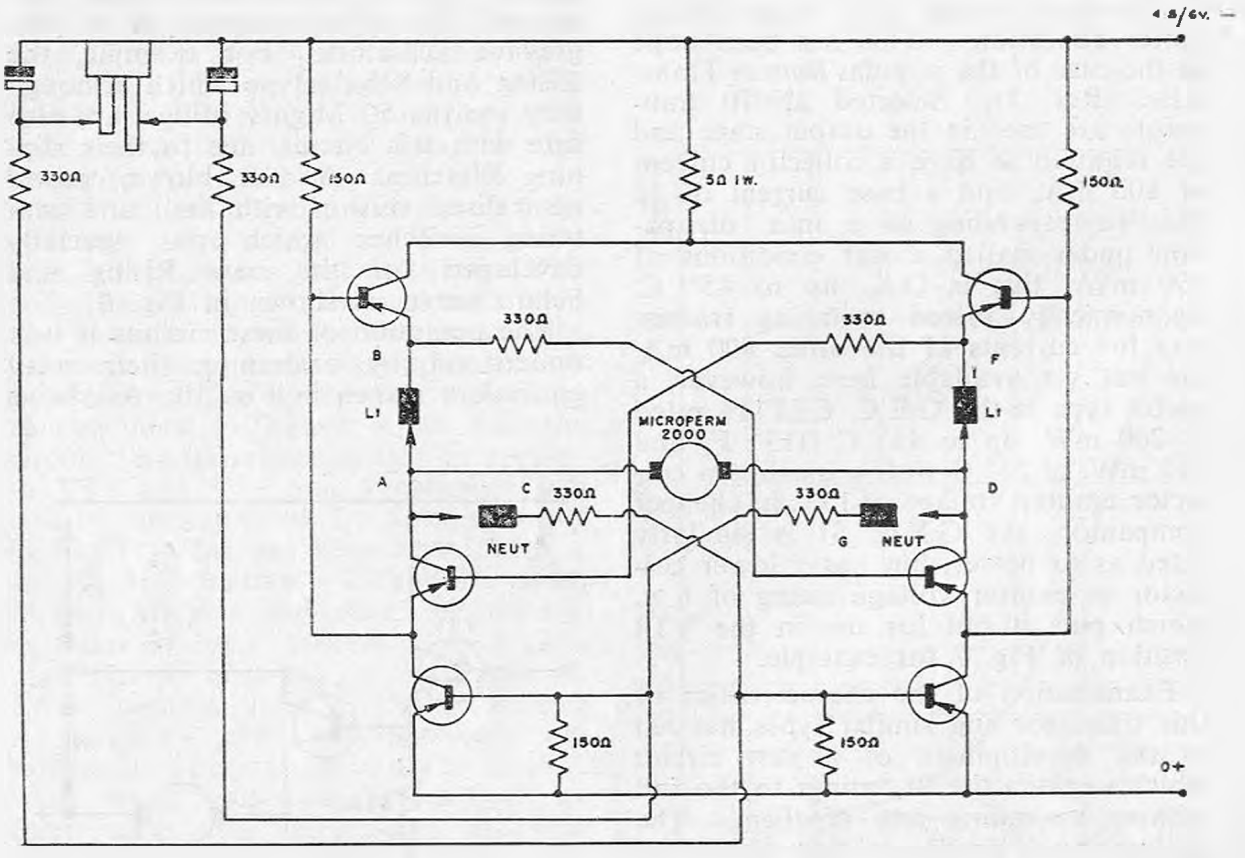


FIG. 9

(A-G = connections betwen actuator and amplifier)

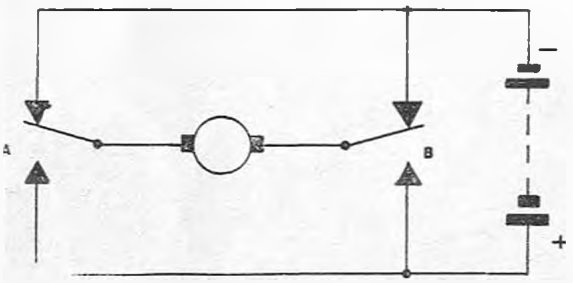


FIG. 10

the motor will be at rest. Operate relay A, and current will flow from negative to positive from right to left, through the motor. Release relay A and operate relay B, then the current will flow the opposite way through the motor. Operate *both together*, and it will remain at rest. To summarise ; the direction of rotation is determined by whichever relay is operated. There is no danger if both operate together.

To revert to our transistor circuit. To form one changeover switch to simulate the relay contacts of Fig. 10 requires at least two transistors, as each represents a single make and break switch. We must ensure that when one is conducting the other is turned off. Fig. 11 shows how this is achieved. When there is no signal VT1 is non-conducting and VT6 can conduct via the motor, this corresponds to the Up position of relay A contacts of Fig. 10. When VT1 is turned on by a current from the reed, a current flows through the Diode D3 and through the motor.

Current also flows via R5 and as there must be a voltage drop across the diode if it is passing any current at all, VT6 base will be positive with respect to its emitter, so it will be cut off. This corresponds to the operation of Relay A in Fig. 10. Although the diode is shown in Fig. 11 to simplify the explanation, it is replaced by a further transistor in Figs. 8 and 9. The reasons for this are firstly ; that the transistor works out cheaper and smaller than any available diode, secondly ; the voltage drop across a saturated transistor is less than that across even a germanium power diode.

The S1 transistors used are tested to ensure that they will pass over 400 mA for a base current of 10 mA (or less) with a collector to emitter voltage of less than 0.3V. This circuit is NOT suitable for low resistance motors

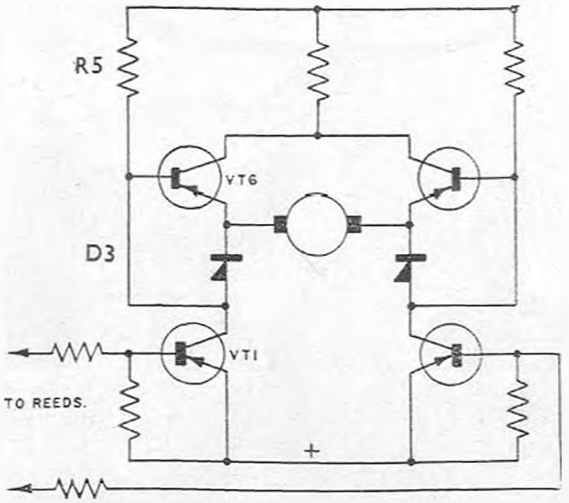


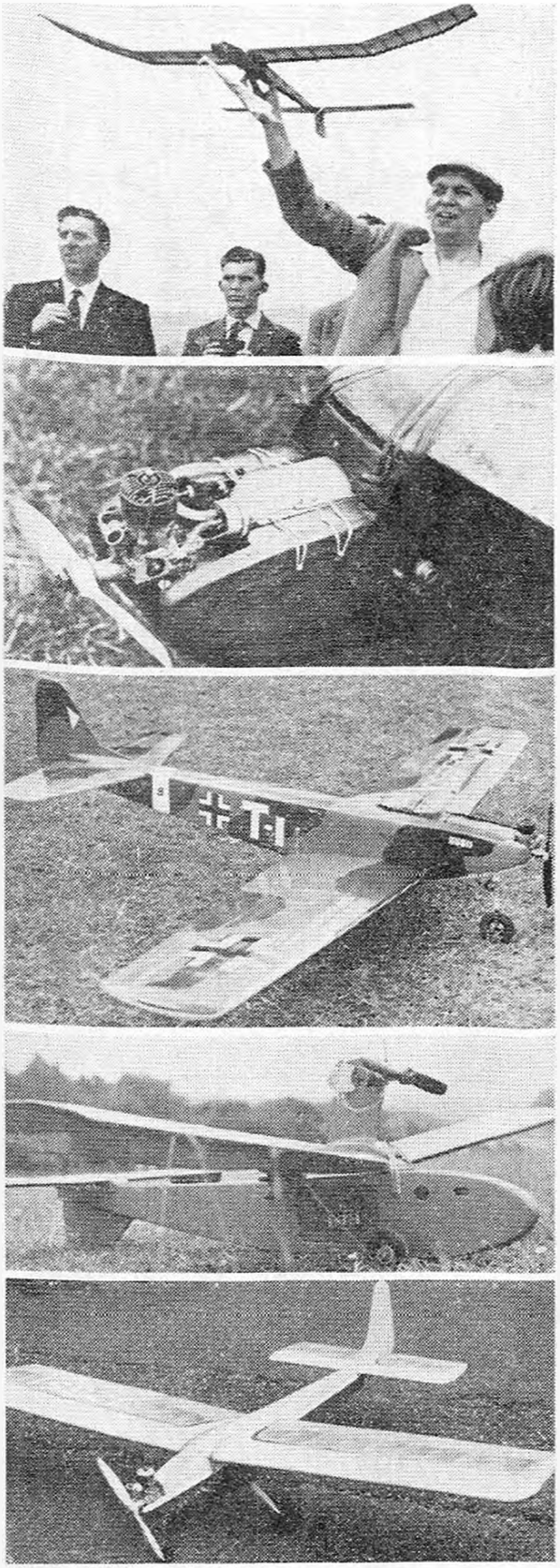
FIG. 11

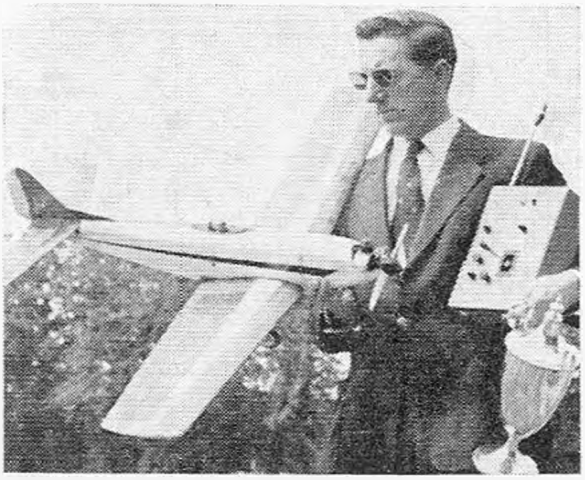
including the low resistance versions of the Microperm used in the Annco and R.E.P. Actuators. American readers could try 2N670's.

Note that only six wires are needed to connect the actuator to its amplifier, as points A and D are also the motor connections.

The circuit is not limited to reed or tone filter applications, but is a useful arrangement for mark/space systems such as Simple Simul. Some of these applications will be described in the next instalment.

Would you mind moving to another field ?





Contests Galore

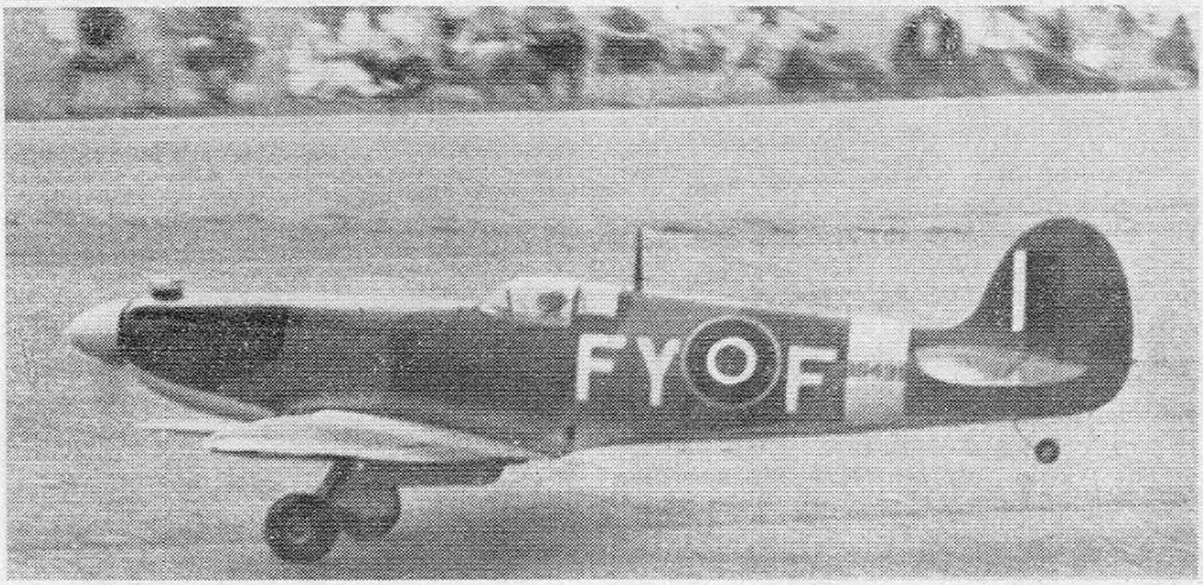
REPORTS FROM NORTHERN HEIGHTS, SUTTON COLDFIELD, POOLE AND MORTLAKE

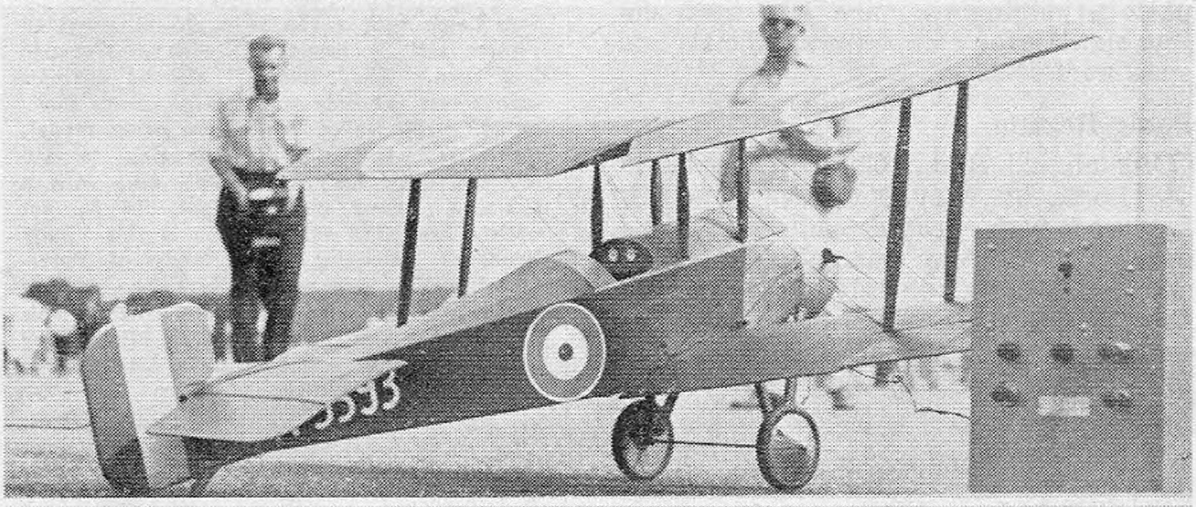
Northern Heights Gala

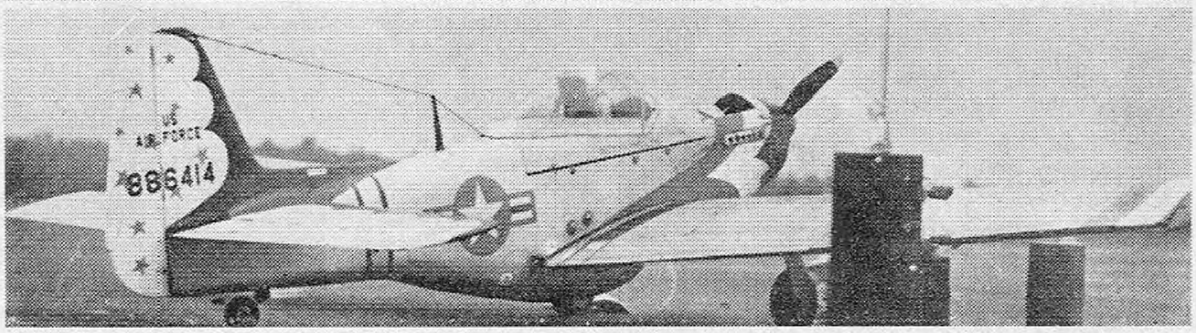
Even for Northern Heights, conditions could be termed perfect. The simple rules of nominated time and spot landing attracted a large entry. The winner —Eric Falkner, was at first disqualified as it was thought that he flew the same model twice, however, all was cleared up after the contest. The tiny hand pulse radio in Dave McQue's "Caprice" proved very effective and could just cope with the breeze, flying all the way backwards with half a second error. Spectators were treated to a simultaneous display by the Franklin brothers just before the contest.

Top right: Winner of Northern Heights Gala R/C Eric Falkner somewhat laden. Left column (top to bottom): Third place Dave McQue with the pulsed "Caprice". Engine cut out detail on the Frog 500 powered second place Junior 60. G. Franklin's model designed by "Von Kasmirski". An oldie (7 years) by J. Blensey of Letchworth now carries a "Terrytone" in its "shop window". Over to Wellsbourne for the last shot ; not a Stormer, own design including equipment by A. Thomas for a Super Tigre 51.

Right hand page (top to bottom): The demonstration team lined up complete with smoke cannisters. The Franklin Spitfire about to unstick. Bristol Scout by B. M. Cook with an O.S.Max. 35 used a "Tritone" converted to eight channel (performed well, even without the aileron plug connected). The Norris "Mustang" which the owner assures does 75-80 m.p.h. when controlled from a speeding sports car !


FYOF




US
AIR FORCE
886414

Wellsbourne Rally

THE second annual Rally was held at R.A.F. Wellsbourne on July 8th. by kind permission of Group Captain E. Earnshaw, O.B.E.

A very good standard of performance was enjoyed by 3.000 spectators who had the privilege of seeing members of the Bristol Club with five models airborne at the same time. during the flight smoke cannisters were used and proved to be most effective and realistic.

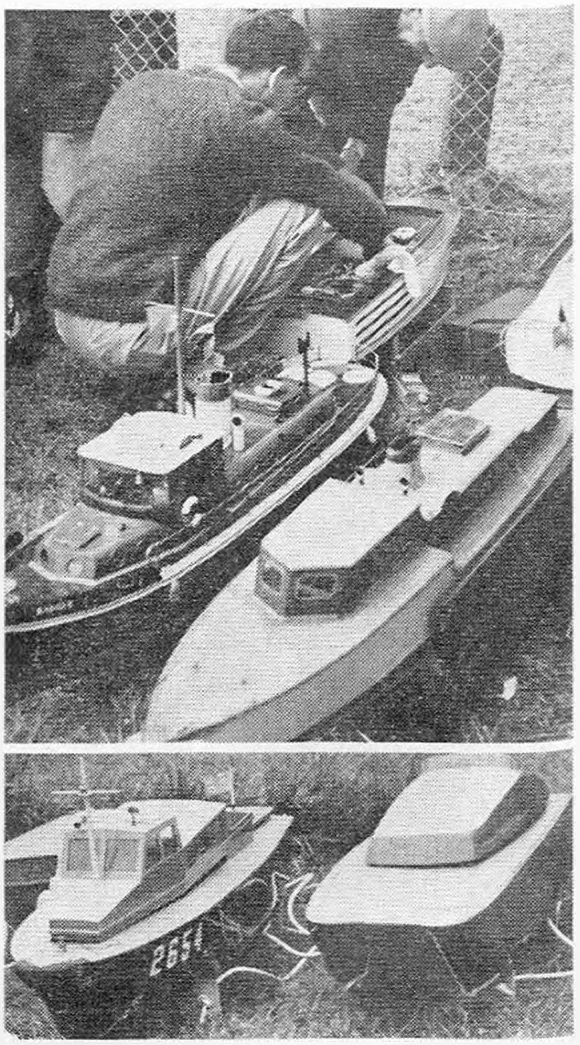
The Rudder Only Single Channel Trophy was won by W. Bellinger of Bath. T. Dumble was second and A. Wittaker third. The Multi Channel Trophy was won by P. Rogers of High Wycombe with Ed. Johnson second and J. Singleton third. The Scale Trophy went to G. Franklin of Leicester. flying a Spitfire. R. Norris (Mustang) was second and the third prize, a Cessna Skylane kit, went to P. J. Anderson who flew a Cessna 172!

The public interest in model flying is obviously very keen as shown by the attendance figures which are more than double those of last year's rally. If this figure can be doubled for the next rally it will be very encouraging to the club.

The whole programme went smoothly. catering arrangements were very good and a vote of thanks is given to the members' wives who played so large a part in helping to make it a most enjoyable day for competitors. officials and spectators alike.

Poole Regatta

THE annual Radio Control Regatta at Poole on May 26th-27th. was not favoured with weather suitable to the occasion. Saturday was cold and windy and Sunday was mainly wet with the wind falling in the afternoon when the simultaneous sailing of yachts was on the programme. In fact the contest



Sam Leigh with a 15a Miles 36 in. powered Pirana, fast! 4 channel E.D. with speed change and horn. The "Badger" electric customs launch was the only round bilge power boat; by H. P. Moore of Wales, the other model, right, is an "Otazel" belonging to Ian Woods which has a "Barbra" hull with a Gannet. Lower photo : right, 34 in. cat with a Frog 349 Min-X radio is this "Buoy Wonder" belonging to F. Body of Portsmouth. The catamaran won the steering event in Bourneville, Brighton. Left : This other model won at Poole, 5c.c. Miles, Frog kit ; the owner spent quite a lot of time improving the stability.

POOLE RESULTS

Speed up to 5 c.c. (11 entries).

1. R. M. Mogg	Whirlwind	2 min. 6.5 sec.
2. M. F. Gulliford	P.T.B.	2 min. 37.5 sec.
3. G. Southwell	Pirana	2 min. 38.0 sec.
4. J. D. Taplin	Pirana	2 min. 56.0 sec.

Bravery Cup. (Knock-out, all yachts) (14 entries).

1. G. Honnest, Redlich. 2. C. R. Jeffries, Electra. 3. J. C. Hogg, Sunlight.

Pairs Race (all power boats capable of operating in pairs) (14 entries).

1. E. R. Millward, Bertha Two. 2. A. J. Spencer, Bertha Too. L. R. Wood, Aard-vark.

Speed over 5 cc. (30 entries).

1. A. Greenfield	S.10	1 min. 13.0 sec.
2. G. Goodfellow	Zeta	1 min. 16.5 sec.
3. L. R. Wood	Aard-vark	1 min. 18.0 sec.
4. E. R. Millwood	Bertha Two	1 min. 19.0 sec.
5. I. J. Wood	Otazel	1 min. 19.0 sec.
6. G. Southwell	G.S.2	1 min. 20.0 sec.

Freeman Cup. (Power steering) (51 entries)

1. F. Body	Frog P.T.B.	120 points
2. Mrs. M. Taplin	Cirrus	105 points
3. J. D. Taplin	Suzanne	85 points
F. J. Till	Mistakat	85 points
I. H. Morgan	Hurion	85 points
6. A. Giecco	Amazon	80 points

was abandoned after only two attempts.

Superhets were the order of the day in the yachts but most power boats seem to use the more conventional Super-regen and as a result single attempts only were possible in the steering and speed events. Some superhets were in evidence in the power boats and we were shown an example developed by Messrs. R. Milward and A. Spencer of the Wulfruma Model Boat Club (Wolverhampton). Circuit and constructional details have been promised and we shall publish a constructional article in due course.

Mr. Burman of the Mortlake Model Boat Club loaned us a beautifully made superhet of unit design and he provided circuit and constructional details with a printed circuit drawing and says that for any reader who is interested a kit (with P/C board) is available. Enquiries should be addressed to Mr. R. Burman, 18 Queens Crescent, Richmond, Surrey.

465 Mc/s was not very much in evidence but no doubt will be seen more frequently as the band is developed. Suitable valves (e.g. Mullard DC 70) and transistors for this frequency and the greater efficiency of the aerials should make this band popular in the future.

Loss of control by competitors was more frequent than one expects these days with better equipment available but on the whole it was a very successful meeting.

Mortlake Regatta

ONCE again the weather was kind for this annual get together and with a reasonable number of entries the day at Barnes pond was a complete success.

It was interesting to note that the self neutralizing actuator was still in evidence and gave a good account of itself against the multi boys.

Trouble with electronics marred some of the attempts but on the whole the events were run off quite smoothly with a high scoring in the steering event.

The method of scoring in this event was changed this year each competitor receiving 200 points with a loss of 10 points for each buoy or gate fouled. In addition a further 10 points was deducted for each minute in excess of four minutes for completion of the run. As completion of the course correctly was compulsory the time factor played an important part in the result. This made the event extremely interesting and the task of the judges proved to be very easy. Other clubs might like to try this idea.

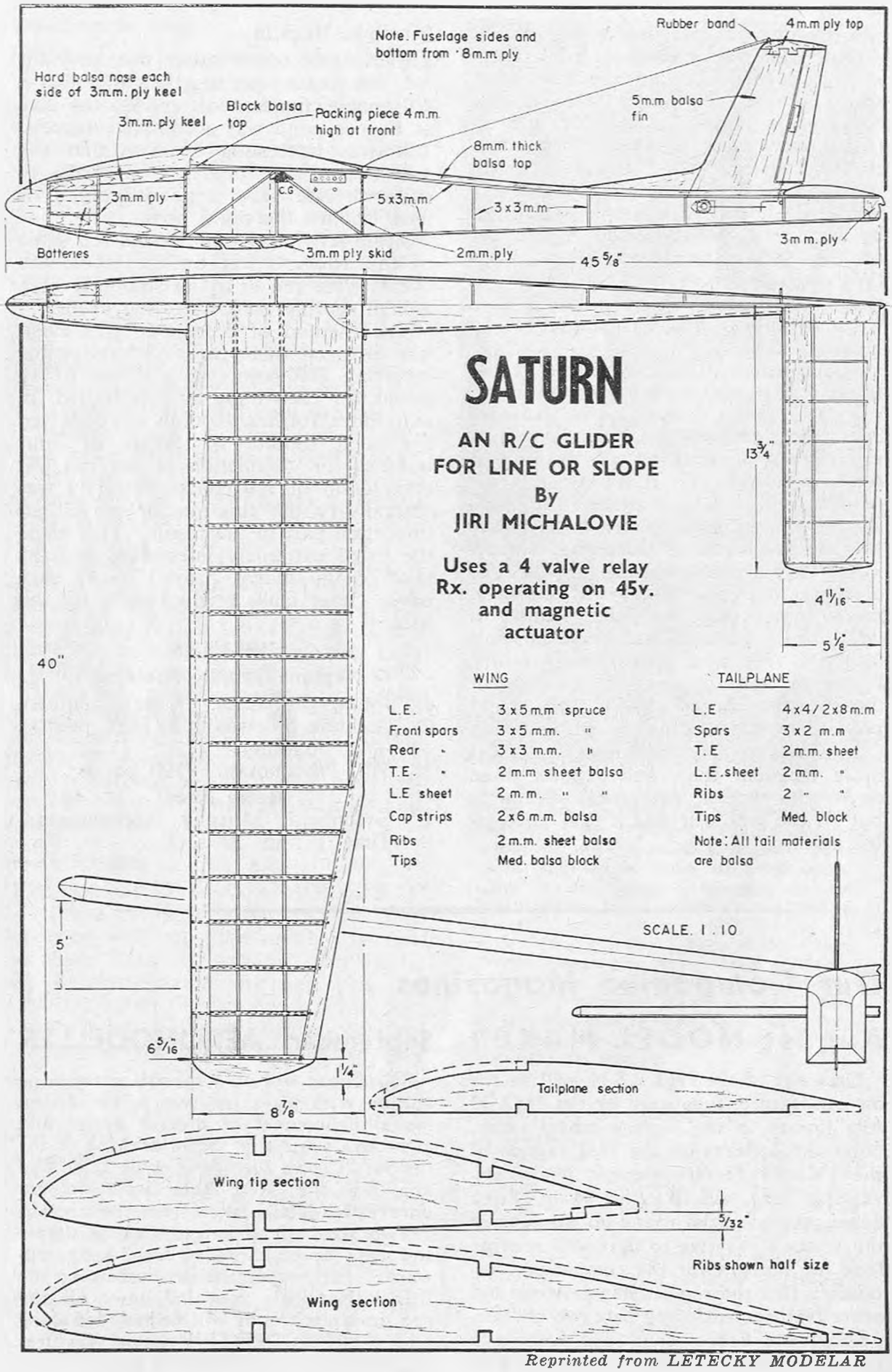
RESULTS

Neptune Trophy (steering)

1. Jones, Mortlake. (Max. points).
2. Careless, Portsmouth (Max points), (2nd. on time).
3. Till, Portsmouth. (190 points).

Relay Race

1. Greenfield, Murphy, Southampton. Time 1 min. 27 secs.



Reprinted from LETECKY MODELAR

Commercial Developments

By TONY DOWDESWELL

CONSUMER STAFF MEMBER SAMPLES NEW PRODUCTS AT HOME AND ABROAD

It has always been my opinion that the lack of following in this country for "Galloping Ghost" and other proportional control systems has been due chiefly to the absence of commercially available equipment to suit this type of system. Not since the famed Fenners-Pike proportional set has the British radio control fan been offered much by way of commercial equipment of this nature. Not. that is. until now, for the picture is rapidly changing. In the July R.C.M. & E. we had a foretaste of something new and now there is more to come.

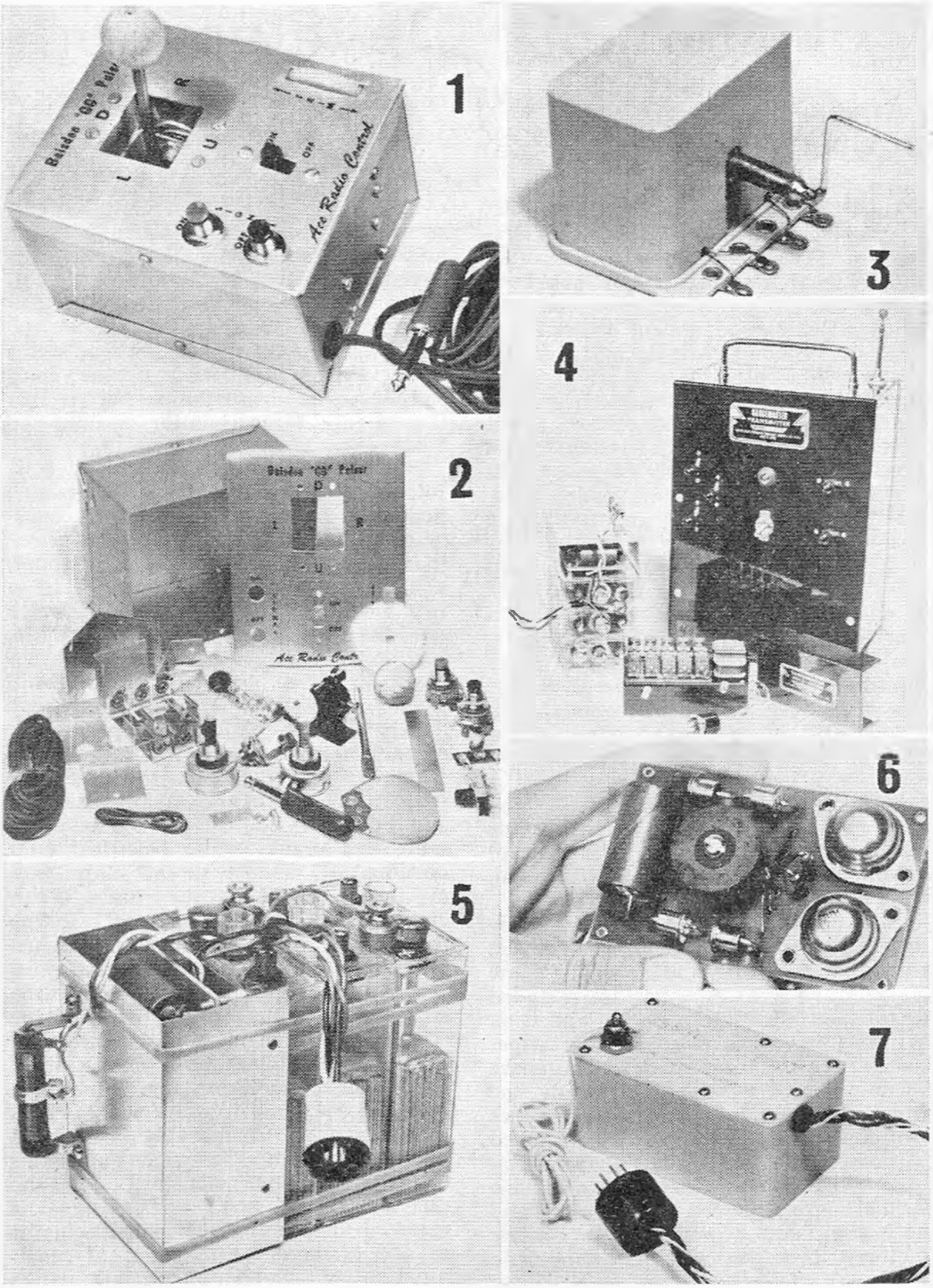
Roland Scott is importing the **Baisden "GG" Pulser.** This is actually a kit and product of Ace Radio Control. It is a mechanical pulser. driven by a Mighty Midget electric motor as opposed to the electronic multivibrator. The alloy case has a mat silver finish and comes completely drilled and worked to accommodate all parts and allow speediest construction. The top face of the case is inscribed with details of control column and auxiliary functions, which include left, right, up. down on the control column, plus full on and off signal, trim elevator and on/off switch.

All mounting brackets are ready drilled and shaped and all is arranged to minimise wiring and soldering. One 50 ohm and a 15 ohm pot are included to provide pulse rate variation and trim. While a copper clad glass fibre wiper plate is used to provide mark/space variation with a wiper driven by the Mighty Midget motor. The plate has two contact sections and could be wired to provide two tones alternately instead of a single on/off tone. Two button switches are included to key full and no signal, and power for the electric motor is three pen cells (we recommend U7 type) which fit in the battery clip, also a feature of the kit. The unit is intended to be hand held, and to that end is provided with a wander lead and jack to plug into a ground based transmitter.

Measuring 5 in. × 4 in. × 3 in. overall, this pulser is indeed compact and comfortable to handle. The instructions. seven pages of them, are straightforward, with detail drawings of layout and hook-up so there should be no problems. Price is £8 5s. which seems rather expensive in view of the unit's simplicity but the irritating part is that the Mighty Midget motor is imported again from U.S.A.!

Rudder only proportional fans will be interested in the **C & S Electronics Septalette Mark III** and **Mark V** magnetic proportional actuators. The former is intended for .010-.020 powered models and the latter up to .049 power. The two actuators are identical except for size, the Mark 111 measuring $\frac{3}{4}$ in. × $\frac{3}{4}$ in. × 1 in., weighing $\frac{5}{8}$ oz, while the larger Mark V is 1 in. × 1 $\frac{5}{16}$ in. overall and weighs 1 oz.

Septalette is basically a permanent magnet free to rotate within a dual field winding. A high impact plastic case protects the mechanism against damage and power to control surface is via a shaft and crank, while electrical connections are made with the solder tags on the top edge of the case. When current flows through one coil winding the magnet rotates turning the attached output shaft towards one extreme position. If then a current is applied to the second coil in the opposite polarity, the shaft is driven in its opposite direction, back to its original position. It must be explained here that this actuator is designed primarily to work with C & S Electronics CS-505 and CS-503 relayless and relay receivers. for which full wiring diagrams are provided. Taking the relayless CS-505 first ; when a signal is received the receiver drives the actuator in one direction to its point of maximum travel (limit stop), on termination of signal the output end of the receiver is so arranged to reverse the direction of drive. The CS-503 works in the same manner except that a relay switches the actuator. If then a transmitter signal is pulsd at a high rate, the magnet tends



1, Baisden pulser ready to pulse. 2, The complete kit of parts. 3, "Septalette" magnetic actuator. 4, The Astro-Craft with the Rangemaster Tx. displayed with the receiver (relay side) and the transmitter power pack. 5, Shows the power pack separately with its own three wet cells. 6, The same power pack available as a separate item, and known as the Power Mite. 7, Astro-Craft model TTR receiver.

to rate alternately in each direction with the result that in fact there is very little movement and actual position of the crank and therefore the rudder is determined by the ratio of signal "on" to signal "off" of the pulse rate cycle. A considerable variation of pulse rate is possible, the well prepared instructions, specifying a rate of 6-20 c.p.s. and a signal "on-off" (mark/space) variation of 30-70-30 per cent so the actuator is indeed quite versatile. Working voltage is 3-3.6 volts. It should be noted, however, that the instructions recommend the U.S.A. high capacity Alkaline Energiser cells in the case of dry batteries to which the nearest British equivalent appears to be the U7 pen cell. 3.6 volts applies of course to DEACs and the 225 capacity type are the minimum recommended in this case. Costs £3 5s.

Also available is the Wen-Mac Air Guidance System reviewed here in July, a test report of which appears elsewhere in this issue. Price is £28, rather less than we had anticipated.

A recent visit to the shop of Henry J. Nicholls revealed some interesting items, including another brand of 10 channel equipment, the **Aristo-Craft Rangemaster.** Imported from . . . yes you guessed it . . . U.S.A., this is in fact a Japanese product and well made too. The transmitter is finished in dark blue and has the normal five, two way keying levers. There is a neon battery state indicator and also a handle on top with which to carry it. One point we appreciated was the addition of a rubber foot at each corner of the case bottom, to protect it against scratching if stood on the ground. The levers switches are perhaps the only point on which one might fault the set, resembling Post Office telephone switch board keys, though admittedly of superior quality. There are four valves and the transmitter is simultaneous. Most desirable feature is the transistor power converter and wet-cell power pack, supplied as part of the set. This is certainly a commendable addition and one which will attract many to it.

The receiver size 4 in. × 2⅛ in. × 2 in. is a 1AG4 valve detector superregenerative type with three transistor stages to the 10 reed unit which has adjustable screw contacts. H.T. is 45 volts, rather unusual and despite the statement of the accompanying literature that the receiver weighs 9¼ ozs, we weighed it in at 10½ ozs. and our scales are accurate. Actual construction of the set is on two panels, the electronic circuitry layed out on a panel bolted below the main chassis and above this the 10 Aristo "Genie" relays and the 10 reed unit.

Considering that it is an import, from U.S.A. and not directly from Japan, we feel the price of £87 2s 6d. quite reasonable, particularly in view of the transistor power converter and battery pack incorporated.

The transistor power converter is also available separately as the **Aristo-Craft "Power Mite"** at a price of £8 1s. 6d. From 6 volts supply this will deliver 140 volts under a 25 milliampere load or 135 volts under 40 milliampere load with input currents of 850 milliampere and 1 amp. respectively.

For single channel enthusiasts there is the **Aristo-Craft Model TTR** receiver. Enclosed in a thick plastic case size 2¾ in. × 1⅝ in. × 1¼ in., it weighs 3 ozs. though the instruction literature claims 2¼ ozs. The circuit again employs a valve superregenerative first stage followed by two audio amplifying transistors ending in a relay again described as the "Genie" but as with the Rangemaster relays, clearly stamped "O.S. Japan". H.T. is 22½ volts with 1½ volts L.T. The receiver responds to any tone transmitter with 75-100 per cent modulation and 400-600 c.p.s audio frequency which seems to indicate that the set is not very fussy! Priced £8 19s. 6d.

Steerable nosewheels again, this time the **Dmeco (De Bolt) R/C Nose Gear.** Intended to mount in the fuselage bottom by a cast mounting plate, this part appears to be rather small for really adequate mounting strength. If it were ¼ in. wider all round an improvement would be effected. This mounting plate is cast with a spindle bearing in which a spindle rotates, actuated by a control horn connected to the rudder servo. The spindle is machined complete with U/C anchor plate into which are clamped the 3⅛ in. long undercarriage legs of 10 s.w.g. piano wire. The two legs, right angled at the bottom to form an axle are sleeved with brass tube to form a continuous axle bearing. The legs are prised apart to accept the nose wheel itself. Less the wheel, which

is not provided anyway, the whole weighs only 2¼ ozs. From the instruction leaflet can be gleaned some very interesting recommendations for the design and arrangement of a nosewheel undercarriage which Hal Debolt has discovered in his long experience. Here it is so hear ye! There should be 2 in. propeller clearance and the nosewheel leg should be ½ in. shorter than the mains. Distance along centre line between hubs of nosewheel and mains should be ⅔ of the main gear track. Hub centres of mainwheel should be ½ in. behind balance point of the model. Now there's something to think about. Price £2 16s 10d.

Lest you be forgetting who imports all this gear, here's more that Henry J. showed us. The **Engel Unitac** pulser from Germany is for rudder only pulse proportional flying, plugging into a transmitter. In a plastic box measuring 4⅛ in. × 3 in. × 1¾ in., it has a control stick connected to a potentiometer for proportional control and two buttons for full and no signal as well as an on/off switch. Inside is an etched circuit base board mounting a quite simple electronic circuit consisting of two OC 305 transistors, the control column connected potentiometer, a low resistance, 6 volt working Gruner 958 relay, which is large and has quite hefty contacts for switching the pulsed signal. plus four resistors and a couple of electrolytic capacitors. It works off 6 volts, for which the instructions, unfortunately written in German specify a pack of 225 DEACs to be tagged up to two wires (red and black) loose inside the case. The literature provided does not reveal the pulse rate of the Unitac, merely providing instruction for its use with the Engel Propomatic proportional servo mentioned in the "New Equipment" section of our January issue. Price is £6 15s. 0d.

Du Bro Compac Battery Boxes save a great deal of soldering time when it comes to battery changes. The 6P type, size 3⅝ in. × 2⅜ in. × ¾ in. takes a variety of battery combinations such as:— 6 pen cells ; 2 pen cells and type B122 (22½ v.) 3 B122 ; 4 pen cells and 1 B122 ; 4 pen cells and 2 BI55 (pen cell size 22½ v.) : 5 pen cells and 1 B155.

The 4P type has accommodation for four pen cells or for any other combination which will fit in the space. Spring contacts of the batteries are provided in a plastic packet and can be fitted as desired and are removeable when necessary. The 6P costs 7/6d. and the 4P 4/6d. In our opinion this type of box is the best available, as the lid holds the batteries in tight so that they cannot jump out of their contacts if jarred, as can well happen with open clips.

The sub-miniature, 3 volts working all transistor receivers have made quite a hit and understandably so, but their limitation is in their single ended output which will operate satisfactorily only an escapement. Ace Radio Control have come to the rescue with an **"Add on Switcher"** which Ed. Johnson imports. This is as simple as it possibly can be, consisting of an etched circuit board just 1 in. × ⅜ in., two sub-miniature resistors and a Philco 2N224 transistor, plus some coloured hook-up wire. Added to these little relayless receivers, it will provide proportional control, using a magnetic actuator like the Septalette mentioned earlier in this passage, or will drive an escapement and provide extra motor control via Quick Blip if the extra motor control escapement is wired in circuit as directed in the instructions, which detail the proportional actuator drive likewise. Construction-wise this is just about the simplest kit we have seen for anything connected with R/C and if anyone were to "goof" building this one, the best thing he could do would be to go back to Chuck Gliders (Shucks, always wanted to build one anyway!) Price from Ed. is 27/-.

For the "build it yourself, come what may" type is something to keep the old think box ticking for quite a time. This is the **Kraft KR 10 SHK ten channel superhet relayless receiver** kit. Straight away one must say that this is quite an undertaking so we will begin with a brief description of the circuit. This is an all transister set, a practice common to modern superhets, since valve types draw a rather high current, making them rather impractical. There are in fact six transistors and three IF tuning stages to deal with. The reed unit is a 75 ohm Medco, which most multi enthusiasts acknowledge as just about the best of its kind available so I need say no more there. It is worth noting


1
Du Bro #4P
COMPAC
BATTERY BOX
Universal
Du Bro #6P
COMPAC
BATTERY BOX
Universal
2
3
4
5
6
7
8
9

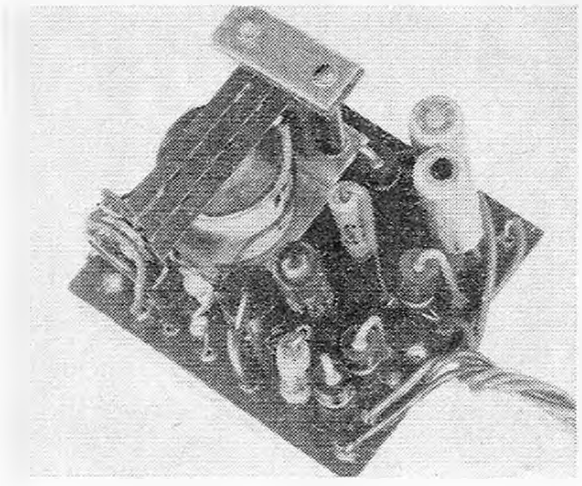
that the reed frequencies fall between 330 c.p.s. and 600 c.p.s. (30 c.p.s. between each). Understandably there are many more components than with the normal superregenerative set, and in this case all are beautifully neat and really sub-miniature examples. So many are there in fact that an extensive set of instructions are necessary and indeed have not been overlooked, the Assembly Manual being 17 pages long size 11 in. × 8½ in. Step by step assembly instructions are given, and there are 64 steps requiring some alert concentration since it would be so easy to solder a component through the wrong hole in the ready drilled circuit board. The metal case is mat silver finished and measures 3⅜ in. × 1⅞ in. × 1 in. and the finished receiver would weigh approx. 4½ ozs. As I said, this is an exercise for those who enjoy home construction and in this case the constructor would need above average (for R/Cers) electronic knowledge particularly when setting up the receiver as the tuning is two stages. First the IF tuning, in which one must balance the three IF tuning cans against each other and then the RF tuning, which is the same as the tuning slug of the normal superregenerative receivers. These stages require specialist equipment in the shape of either an oscilloscope or a VTVM (a Valve Volt Meter to lesser types *like me* and perhaps some of ye). Price is £27, considerably cheaper than a ready built set.

The O.B.M. Company offer the vital parts of Geoff Chapman's Duo-Ten transmitter published in our May edition. Matched chokes, 2.5H inductance cost 50/- per pair, while a ready drilled P.C. board plus valve holders is 17/6d. The 13.5 M/cs Xtal required in the circuit is 33/-, biased off control switches are 9/3 each, toggle on/off switches 8/6d. and a ready made loading coil for the aerial costs 6/6d. Also a ready drilled and grey hammertone finished case with pot, chassis is available price 35/-.

Stockman & Westley have a very small soldering iron for field use in two versions working off 12 v. and 6v. It can however be of equal value for workshop use, by connecting it up to a heater transformer or an electric train control unit which is another good source of power. Despite its small size it has enough heat to allow solder to take to the negative end of a dry cell (pen cell) which one must admit is a considerable achievement for an iron of such small size. At 12/6d. obviously this little unit has been produced down to a minimum price with no frills. The bit is not removable and the handle is made from Paxolin tube. Intending purchasers should add 6d. to the retail price to cover post and packing.

R.C.S. now have a three reed discriminator circuit with one transistor amplified output for throttle escapement switching on their Galloping Ghost system. The two side reeds may be connected via relays to perform additional control functions. Their latest pulser may now be fitted with a width trim at small extra cost. (See their advertisement, page 464).

Well, that's all for you to spend your pocket money on this month chaps, but I'll be back again next month with more goodies.



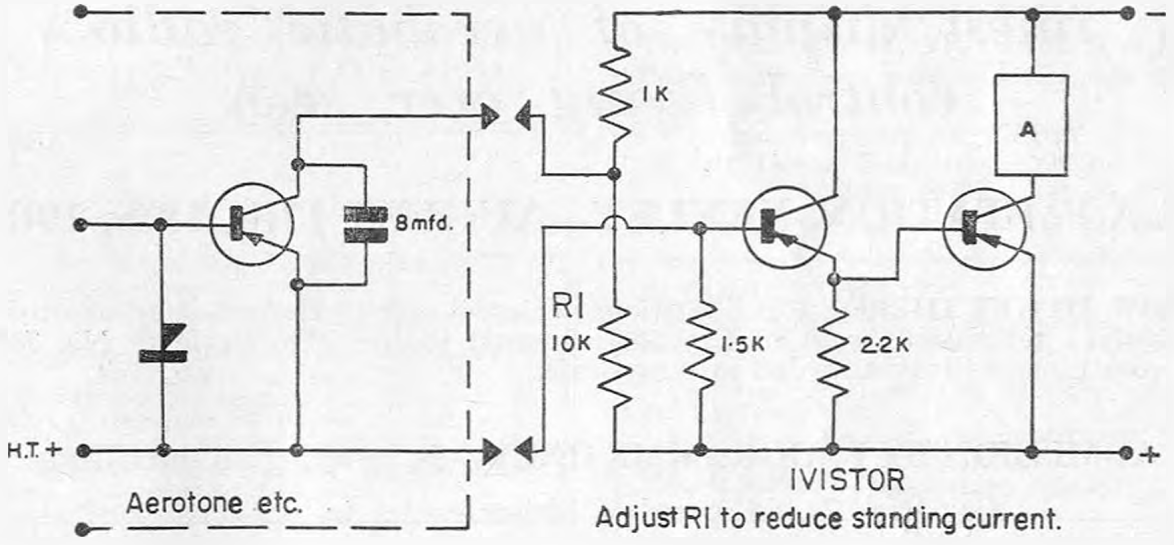
1, Engel Unitac pulser makes quite a neat fistful for mark/space control only. 2, Two sizes of DuBro battery boxes with a packet of contacts and springs for various combinations of assembly. 3, Multitude of parts in Kraft ten superhet kit. 4, Tiny but efficient field iron from Stockman & Westley. 5, Four components and wire for the Kraft add on switcher. 6, O.B.M. bits for the "Duo 10"; crystal centre-loaded aerial coil, P.C. valve base and centre bias switch (threepenny piece not included). 7, Ready wound core for the tone generators. 8, Cleanly finished case and top deck for the Tx. 9, DeBolt nose gear. Left: The discriminator for throttle and two other functions produced by R.C.S.

Query Column

I HAVE been interested in relayless equipment for about one year now and have followed its development with interest in the magazine. I was interested in the "Ivistor" when it appeared, though the actual article did not indicate the method of hook up to current rise receivers (such as "Aerotone", etc.), although I vaguely remember this being rectified in a later McQuery Column. Later also I noticed a query as to whether this simple device might be used as a relay eliminator in multi servo link-ups and although you rightly say that the proper working equivalent of a relay, i.e., including "back contact" must use PNP and NPN equivalents, I see no reason why it is not usable in a non neutralising, i.e., trim servo. In particular I would like to use this set up, for which I have built a prototype servo specifically for R.C. glider elevator using a trim servo (not neutralising) on two channels and a further one or two channels used to select neutral as and when required. For this reason I am interested in how to link up the simple two transistor switch to a reed contact. Also if I remember rightly there was mention in the April issue of R.C.M. & E. of a forthcoming article on multi servo transistor relays, though I see no mention of this in the May issue. what has happened to this ... or am I mistaken?

D.S.P., LONDON, N.W.3.

The circuit for modification to include the "Ivistor" in current rise receivers is shown below. The "Ivistor" can be used with a spring return servo as only two wires are necessary, the servo returning to neutral mechanically. Non-neutralising servos need a current in two directions and the "Ivistor" will not provide this.



SOCIETY OF MODEL AERONAUTICAL ENGINEERS

in conjunction with the

ACADEMY OF MODEL AERONAUTICS OF AMERICA

organisers of

WORLD RADIO CONTROL CHAMPIONSHIP

This will be the finest display of aerobatic radio control flying ever seen

R.A.F. STATION, KENLEY—AUGUST 17th, 18th, 19th

HOW TO GET THERE : R.A.F. Station, Kenley, is at Whyteleafe, Surrey, approximately 7 miles south west of Croydon. Nearest station, Whyteleafe or No. 708 Green Line bus from Croydon to Whyteleafe.

ADMISSION BY PROGRAMME ONLY—5s. covering all three days.

Car Park **2s. 6d.** per day, Motor cycles **1s.** per day

SAVE MONEY Complete the form below (block letters, please) and obtain your programme in advance for only 4 shillings. Send Postal Order to S.M.A.E. Ltd., 19 Park Lane, London, W.1

13 TEAMS

NAME.....

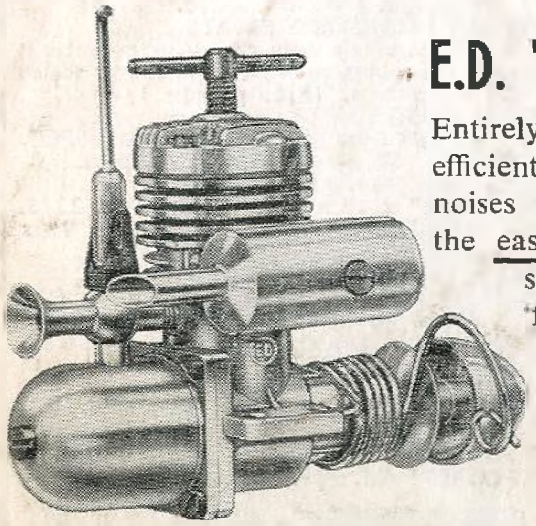
ADDRESS.....

.....

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.

The best models deserve the best engines — E.D!

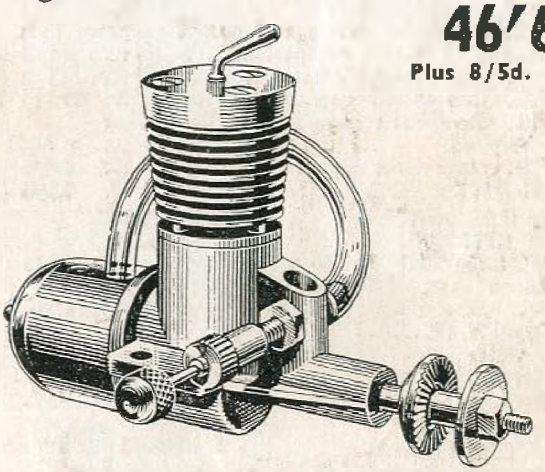
NEW! TWO NEW OUTSTANDING ENGINES SPECIALLY DESIGNED BY GEORGE FLETCHER *Chief Designer* OF E.D.



E.D. 'Cadet' 1 c.c.

Entirely new! Europe's first engine fitted with an efficient Silencer that eliminates the objectionable noises outlawed by many Councils. Designed for the easiest possible starting with 'easy-start' recoil starter. Complete with fuel tank. The ideal 'first' engine.

46/6D.
Plus 8/5d. P.T.



E.D. 'Super Pep' ·8 c.c.

The world's greatest small diesel engine value! Easy starting, top quality, high performance—complete with fuel tank.

36/8D. Plus 6/7d. P.T.

E.D. FIRST TO CROSS THE CHANNEL WITH A RADIO CONTROLLED MODEL BOAT!

E.D. FIRST TO FLY THE CHANNEL WITH A MODEL ENGINE POWERED PLANE!

Over a million modellers use E.D. engines—because they're BEST!

E.D. 'Super Fury' 1.49 c.c.

The competition winner's engine! Outstanding for ½A Team Racing where it is more than a match for specialist engines costing much more. The champion's choice for only

67/6d.
Plus 12/2d. P.T.

E.D. 'Racer' 2.46 c.c.

The outstanding big brother of the 'Super Fury'. The 'Racer' holds many world records and is the world's best selling 2.5 c.c. diesel engine. More team racers have been built for the 'Racer' than any other engine!

70/-
Plus 12/7d. P.T.

NOW IN THE FINAL STAGES OF DEVELOPMENT AND AVAILABLE SHORTLY:

E.D. 'Condor' 10 c.c.

Twin-roller bearing high performance glow-plug engine. Complete with Radio Control throttle and high efficiency Silencer.

E.D.

FREE! POST COUPON for details of the unique E.D. range of Radio Control equipment and E.D. Model Engines, and name and address of nearest stockist.

E.D. Engineering & Electronics Ltd., Island Farm Road, West Molesey, Surrey.
Telephone: Molesey 6037 PBX

NAME.....

ADDRESS.....

.....

.....

RCC. 14.