Radio Control Models & ELECTRONICS

MAY - - - - - - - - 1961

TRANSISTOR SWITCHING CIRCUITS

★ ★ ★

TONE STABILISATION

★ ★ ★

SERVO TESTS

★ ★ ★

ODIHAM MEETING

PRICE - - - TWO SHILLINGS

8 Channel Hand Held Tx

FREE Transistor Data Slide

R.S. FOR RADIO SERVICE

★ METZ R/C ★

FOR COMPLETE RELIABILITY

"Mecatron" Universal Tx. for single or 3-channel with adaptor.	£16.18.6
Hand held adaptor.	£2.15.0
"Mecatron" Rx. single.	£13.13.6
Adaptor plugs in to convert to 3-channel.	£12.3.0
"Baby" Rx. single.	£10
"Mecatronic" multi purpose servo for 3 different control systems.	£3.18.0

● **ALL ITEMS OF METZ R/C USE 6 VOLT BATTERIES** ●

★ DEAC CELLS ★

225 DK 1.2v. Button	4/6
225 DK 3.6v. Pack	15/6
225 DK 4.8v. Pack	21/–
225 DK 6v. Pack	26/–
225 DK 7.2v. Pack	31/–
450 DK 1.2v. Button	6/10
450 DK 7.2 Pack	50/–
225 DK Charger	20/–
450 DK Charger	25/–

★ ACTUATORS ★

"Quadtrol" Selective for Rudder Elevator & Engine.	118/6
"Code-a-matic" Control Box Manual Operation, pos.	99/–
"Sage" Actuator, especially suitable for Gliders.	99/–
"Transmite" Relayless.	225/–
"Transmite" Trim.	220/–
Cobb "Ouncer", multi.	95/–
"Duramite", multi.	104/–
Metz "Blip".	33/10
F.R. Lightweight.	25/3
F.R. Compound.	49/11
F.R. 4 Pawl Clock.	44/3
R.M.A. Mactuator.	23/7
Kinematic (Boats).	52/–
E.D. Multi Servo	70/10
Hillcrest Motor Servo	59/6
Aristo Selective.	65/–
Aristo Motor Control.	38/–
"Powertrol" Transistor.	170/–

GRAUPNER "ULTRATON" RX. Latest type of this popular receiver now in stock. £11.19.0

'CHANNEL MASTER' TX. Hand held crystal controlled for tone receivers. £13.5.0.

All orders over 20/- post free. Overseas orders acknowledged by airmail and forwarded by the quickest route. C.O.D. service available.

★ R/C ENGINES ★

Merco 35 Multi 6c.c.	152/–
Veco 19 Multi 3.2c.c.	135/–
Tornado Twin 5c.c.	232/–
Taplin Twin 7c.c.	170/–
A.M. 15 Multi 1.5c.c.	70/8
A.M. 10 Multi 1c.c.	69/8
K & B Torp 45 7.5c.c.	230/–
Enya 19 multi.	114/9

ALL STANDARD ENGINES AVAILABLE FROM STOCK

★ RELAYS ★

Siemens 100 ohm.	26/–
Siemens 300 ohm.	26/–
Siemens 5000 ohm.	26/–
Gruner 957 300 ohm.	25/–
E.D. Polarised.	30/–
E.D. P 100 ,,	31/–
E.D. Bleep.	24/–
R.E.P. ½ oz.	24/–
E.D. Oct. Reed Bank.	60/–

★ BRITISH R/C ★

Reptone (Boats).	£15.8.0
Reptone (Aircraft).	£16.16.0
Unitone.	£16.10.6
Quadratone.	£29
Sextone.	£31.17.3
Octone.	£50.0.0
Dekatone.	£90.0.0
Black Prince/Arrow 1.	373/–
Black Prince/Arrow 4.	575/6
Black Prince/Arrow 6.	649/4
E.D. PC1. Tx.	118/–
E.D. Airtrol Rx.	144/–
Black Knight Tx.	138/9
Aeromodeller Rx. Kit.	64/–
P.C. Tx. Kit.	20/6

★ R/C BOAT KITS ★

Maycraft Meteor 48".	378/–
Maycraft Mercury 38".	132/6
Webra Hawaii 40".	176/–
Sterling Corvette 48".	337/–
RAF Crash Tender 34".	70/–
Torpedo Boat 40".	116/8
Caribbean Coaster 32".	95/9
Sea Queen 42".	116/8
Sea Commander 34".	70/–
American Scout 50".	249/–
USS Missouri 55".	235/–
St. Laurie 42".	161/3
Graf Zeppelin 42".	131/10

★ ACCUMULATORS ★

Exide 2 v. 5 amps.	19/9
Exide 6 v. 5 amps.	58/9
Varley 2 v. 7 amps.	25/6
Venner L2 1½ v. 2 amps.	22/6
Venner L10 1½ v. 10 amps.	49/–
Magnatex 2 v. .25 amps.	3/–

A PERSONAL MESSAGE . . .

You can see from our recent advertisements that we are "BANG UP TO DATE" with all the latest in R/C. Having just returned from the Nuremburg Fair with many samples of new equipment we are very enthusiastic, but as always, we will be thoroughly flight testing this equipment before offering it to you. My advice is —drop me a line and get on our mailing list today.

Sincerely,

ROLAND SCOTT.

★ R/C PLANE KITS ★

Orion Multi 5-10cc.	230/–
White Cloud 3-5cc.	125/–
Schuco Auster 1-2.5c.c.	67/6
Snapdragon 44 1-1.5c.c.	75/–
T. 100 2.5-5cc.	109/6
S-10-W Ranger 3-5c.c.	109/6
Viscount 2.5-5c.c.	112/6
Junior 60 2.5-5cc.	58/–
Super 60 2.5-5cc.	97/6
Galahad 1.5-2.5cc.	36/–
Matador 1.5-2.5cc.	25/3
Buster Pylon Racer.	99/–
Comanche Scale.	109/–
Jetco PT 19 72".	250/–
Pursuit 66" Multi.	160/–
Astro Hog 3.5-6c.c.	170/–
Rearwin Speedster 38".	59/–
Sterling PT 19 48".	73/9
Wizard Bipe.	124/3
Explorer 56" 3-5cc.	150/–
Mambo 48" 2.5cc.	73/9

HIRE PURCHASE TERMS

We can accommodate you on any order over £8. One-fifth deposit, balance in six to twelve months. Write for quotation today.

★ R/C ACCESSORIES ★

Tornado 12" x 5" props.	11/3
Tail Wheel Brackets.	4/3
Nylon in Orange, Blue and Yellow, 1½ sq. yds.	7/6
Jap Silk. per sq. yd.	6/–
Oryx Irons 6-12 v.	25/–
Oryx Irons mains.	32/6
Telescopic Aerials 36".	12/6
Telescopic Aerials 60".	25/–
7-core R/C cable per yd.	2/6
XFY 34 valves.	15/–
XFG 1 valves.	17/6
DCC 90 valves.	20/–

PHONE, WRITE OR CALL . . . THE SERVICE IS THE SAME FOR ALL

ROLAND SCOTT LTD.

RADIO CONTROL SPECIALISTS

147 DERBY ST., BOLTON
('Phone : 27097)

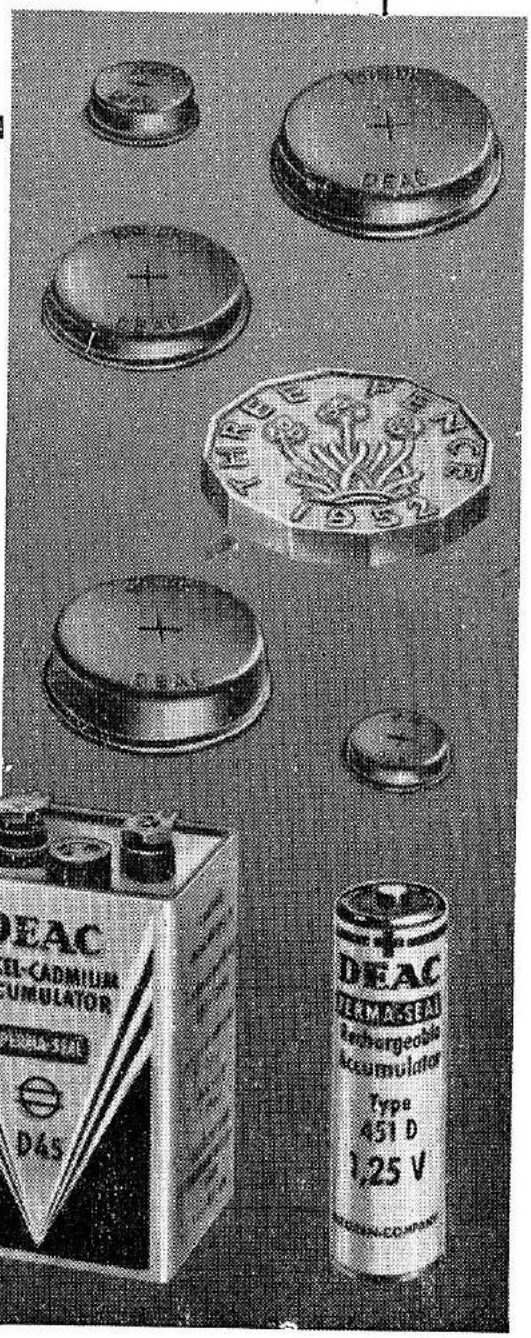
97 RAILWAY RD., LEIGH
('Phone : 72673)

SEALED RECHARGEABLE

Nickel Cadmium Cells and Batteries by

DEAC

PERMA-SEAL



NOW MADE IN GREAT BRITAIN!

DEAC rechargeable cells are used with confidence in every branch of the Electrical and Electronics Industries throughout the world.

The latest DEAC range includes Disc, Rectangular and Cylindrical types of cells which can be "wired-in" to work with complete efficiency under any conditions, without maintenance.

For Radios, Hearing-aids, Tape Recorders, Shavers, Torches, Electric Toys, Portable Measuring Instruments, Photo Flash Equipment, Television Sets.

★ No Corrosion. ★ No gassing. ★ No maintenance. ★ Unlimited shelf Life. ★ Robust and compact. ★ From 20 mAh to 23 Ah.

All enquiries to the Sole Distributors :

G. A. STANLEY PALMER LTD.,
Maxwell House, Arundel Street,
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Mfrd. by **DEAC (GT. BRITAIN) LTD.,** Altona Way, Buckingham Avenue, Trading Estate, Slough, Bucks.
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G. HONNEST-REDLICH LTD., 44 SHEEN LANE, MORTLAKE, S.W.14

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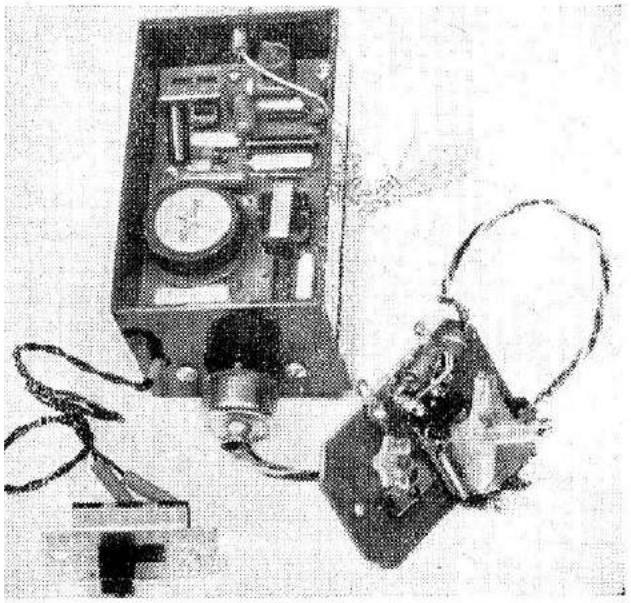
THE COMPLETE RANGE OF RADIO CONTROL EQUIPMENT

★ **From components to complete kits of parts there is R.E.P. equipment to satisfy novice or champion, for aircraft or boats designed and produced by practical experts.**

MINI-REPTONE

RELAYLESS TONE RELIABILITY



Fully transistorised, relayless, special compound escapement with provision for an extra control. Receiver/Battery box unit. $2\frac{7}{8}$ x $1\frac{3}{4}$ x $1\frac{1}{2}$. All up flying weight of Receiver, Batteries and Escapement only $5\frac{1}{4}$ oz. Three U12 pencells provide total battery requirements. No soldering, plug-in batteries and escapement cable. Low consumption hand held transmitter with fully telescopic aerial.

Complete transmitter, Receiver/battery box and compound escapement. **£16/16/0**
Receiver/battery box separate. **£9/6/0**

COMPLETE EQUIPMENT

combining **range, reliability, durability,** achieved by up-to-date "Tone Systems".

Full 12 months' guarantee

"REPTONE"

SINGLE CHANNEL

Unit construction with Plug-in batteries and Motorised Compound actuator, complete. **£15/8/0.**

"UNITONE single channel tone. Hand held transmitter **£9/3/0.** $2\frac{1}{2}$ oz. Receiver **£7/7/6.**

"TRITONE" 3 channel reeds. Hand held transmitter **£9/6/6.** 5 oz. Receiver **£11/6/6.**

"QUADRATONE" 4 channel crystal controlled Transmitter, 7 oz. Receiver **£29/0/0.**

"SEXTONE" 6-channel reeds. Crystal controlled transmitter with "Joystick". 8-oz. Receiver **£31/17/3.**

"OCTANE" 8-channel reeds. Simultaneous operation. Crystal controlled Transmitter and matched 10-oz. Receiver **£50.**

A FULL RANGE OF ACCESSORIES

R.E.P. ½ oz. Relay ...	**24/–**
3-Reed unit	**35/–**
6-Reed unit	**50/–**
8-Reed unit	**60/–**
10-Reed unit	**80/–**

ACTUATORS

"MINI UNIAC" motorised **52/-.** "OMNIAC" motorised for single or multi **60/-.** OLSEN / REMTROL multi-actuator **70/-.**

TRANSMITTER POWER CONVERTER, 135v. at 25 m.A. From 6v. accumulator. **£8/10/0**

KITS

"AEROTONE" Receiver. Single or multi-channel "tone" **83/-.** "AEROMODELLER" Receiver. Single channel "carrier" **64/-.** "PRINTED CIRCUIT" Carrier transmitter pre-tuned **20/6.** "MODULATOR" tone generator **38/8.** "P.C." and "Modulator" combined are suitable for the "Aerotone". All kits are pre-assembled.

DEKATONE

10 CHANNEL RELAYLESS.

Tone and frequency stable crystal controlled transmitter in duotone chrome and red case, with angled telescopic aerial and carrying handle.

Receiver with integral power convertor. Size, $2\frac{7}{8}$ x $2\frac{1}{8}$ x $1\frac{1}{2}$, 6 oz. Receiver output cables plug direct into the five **powertrol** transistor amplified servos. $2\frac{7}{8}$ x $1\frac{3}{8}$ x 1, $2\frac{1}{2}$ oz.

Only power supply required from actuator battery pack, 6v. All up weight (receiver, 5 servos, battery pack and cables), 23 oz. Ready to plug in, ready to operate. **£90** (P.T. inc.)

"POWERTROL"

Transistor servos to operate from split reed units. (All R.E.P. 6, 8 and 10). **£8/10**

NOTE. — Unitone and Tritone Transmitters are available crystal controlled at extra cost of £2/7/0 & £2/14/0.

★ R.E.P. STAR POINTS ★

★ "Tone stability" achieved by use of tuned high Q chokes in all transmitters.

★ "Receivers" totally enclosed. Protected from dust and exhaust fumes.

★ "Temperature" stability ensured by choice of high stability components.

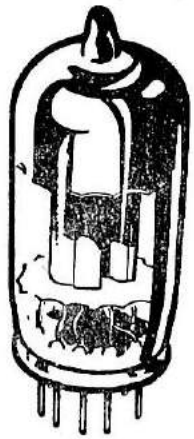
★ "Sextone and Octone" fitted with original "neon flasher" battery voltage indicator.

★ Gold Plated Reeds. Require no maintenance.

★ "Pretuned", no adjustments or tuning required.

★ **EXTENDED PAYMENTS** available on equipment from £15 ★ You can order R.E.P. equipment from your local model shop ★ S.A.E. for Price Lists and Information. Trade enquiries invited.

★ VALVES for Radio Control



DK96 **8/–** 6C4 **5/–**
3S4 (DL92) **7/–**
3A5 (DCC90) **9/–**
1S4 (DL91) **8/–**
3V4 (DL94) **7/6**
3D6 (1299A) **4/6**
Valve Holders for above types 9d. each.
Others available.

SEND FOR NEW FREE LIST OF OVER 800 TYPES FOR DOMESTIC AND COMMERCIAL USES.

★ 27 Mc/s Quartz Crystals for RADIO CONTROL

9.065 mc/s third overtone for all 27 mc/s radio control valve transmitters.

12/6d.

Sockets 1/3d.
Fully Guaranteed

Sub-miniature versions for valve or transistor transmitters. **30/–**

RELAYS

All for Model Control

- Miniature Differential Relay, two coils. 350 ohms each. Min. 140 microamps, max. 10 m.A. 1 pole, 2-way or centre stable. Contacts 100 m.A. up to 50 volts. Size 1¼ x ⅝ x ¾ in. **19/6** each.
- **Gruner 957 Relay for Transistor Receivers.** Min. op. 4½ volts, 8 m.A. 300 ohm. 1 pole 2-way contacts up to ½ amp. Size 28 18x9mm. **24/-** each.
- **Siemens High Speed Sealed Miniature Relays.** 1 pole 2-way contacts. 1700x1700 ohms. **15/-** each.

Adjustable contacts and pressure.

DIODES (1st Grade)

OA81, GEX34 **4/–**
OA91 (Sub-min) **4/–**
GD3 **2/–**. OA70 **3/–**
Surplus Type **1/6**

TELESCOPIC CHROME AERIALS

*36 in. extended, 7 in. closed, 7 sections. **12/6** (p.p. 1/-)
*64 in. extended, 10 in. closed, 7 sections. **17/6** (p.p. 1/-)

IDEAL FOR ALL MODEL CONTROL

Transistors FROM 3/6d. EACH

All 1st Grade
Fully Guaranteed

★ High Frequency for 27 Mc/s Front End

SB305, **10/-** SB231, **15/-** OC169, **18/-**, OC170, **25/-** OC171, **50/-** XA131, **35/-**

★ Low Frequency Types

OC71, **10/-**. OC76, **12/6**. OC72, **12/6**. XB102, **7/6**. XB103, **10/-**. XC121, **15/-**. Red Spot, **3/6**. Green/Yellow, **7/6**. OC75, **15/-**. OC42, **17/6**.

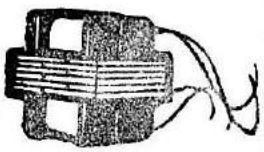
★ Power Output Transistors

V15/10P, **15/-**. XC141, **25/-**. OC16, **25/-**. OC29, **35/-**. OC28, **35/-**. V15/20IP, **20/-**. Others in stock.

FREE LIST of 60 types with data on request. Also equivalents for U.S.A. and Continental types available.

★ TRANSISTORS and MINIATURE COMPONENTS

We stock the largest range of components in the country for the home constructor.



WE HAVE YOUR ITEM IN STOCK. Just ask and we will quote competitive prices.

★ PERSONAL EARPHONES

Magnetic 600 ohms Impedance Earphones complete with leads, jack plug & socket (sub-min.).
Only **10/6** post free.
Ideal for tone receiver checking and transmitter monitoring.

★ ZENER DIODES

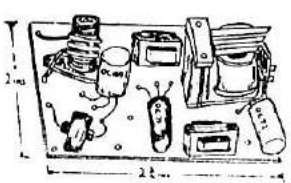
4.7 volt nominal voltage reference diodes. 1 watt.
19/6.

★ A selection of our really sub-miniature electrolytic condensers.

2 mfd. 1½ vw. 4 mfd. **6 vw.**
1 mfd. 25 vw. 2 mfd. 9 vw. 6 mfd. 6 vw. 8 mfd. 12 vw. 10 mfd. 6 vw. or 25 vw. 8 mfd. 12 vw. 16 mfd. 12 vw. 25 mfd. 12 vw. 30 mfd. 6 or 12 vw. 50 mfd. 6 vw.
All **2/-** each.

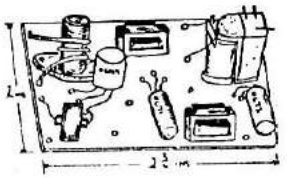
TO BUILD YOURSELF ★ RADIO CONTROL RECEIVERS SUPER-SENSITIVE NEW DESIGNS

- **SUPERTONE 3C** 3 reed unit receiver uses OC169/OC71/OC72 in super-regen transformer coupled circuit.
- Uses 3-miniature 1½ volt batteries and miniature 15 volt.
- Overall size 2¾ x 2 x 1⅛ in. 1st grade components.
- Suitable 3-reed unit **35/-**



Total cost of all necessary components 69/6d. p.p. 1/6d., with batteries.

- **SUPERTONE 1C** Single channel 3-transistor transformer coupled receiver. Uses OC169/OC71/OC72 transistors. 15 m.A. current rise.
- All components supplied are new and 1st grade. Overall size 2¾ x 2 x 1⅛ in. Uses 3-miniature 1½ volt batteries.
- Suitable miniature relay **24/-**



Total cost of all necessary items 69/6d., p.p. 1/6d. with batteries.

'305' Relayless Rx. 89/6 (p.p. 1/6).

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

DEAC—

The Modern Battery

7.2 volts, 6 cells, size 225 Dk, welded together, rechargeable, centre tapped at 3.6 volts for multi servo use, no maintenance, weight 3 ozs., size 1 in. dia. x 2 in. long, crashproof (225/22A charger separately available), immediate delivery :—

7.2 volt centre tapped battery. **31/–**
DEAC charger for this battery. **20/–**

RELAYS (made in Germany), brand new. MAKER'S BOXES—**NOT** SURPLUS :—

Siemens type 151.—Coil resistance 5,800Ω size 1 1/16 in. x 15/16 in. x ¾ in., weight ¾ oz., completely enclosed in dustproof plastic box, pull in 2.5 m.A., drop out 1 m.A., single pole change-over contacts rated at 1 amp., not adjustable. Price **26/–**

Siemens type 154.—Coil resistance and size as for type 151. **Double** pole change-over contacts, separately insulated, rated at 1 amp., pull in at 4 m.A., drop out at 1.2 m.A. Price **26/–**

Gruner type 957. 300 Ω coil, 6 volt operation, single pole change over contacts rated at ½ amp., relay weight 1/3 oz., size 28 x 18 x 9 mm. Price **24/–**

MULTI RECEIVER KIT

American multi receiver in kit form. **Complete** 8 channel relay receiver. All components included : Valve, transistors, reed unit, subminiature relays, components, P.C. Board, smart black case **and** comprehensive, stage by stage, constructional, explanatory, illustrated, instructions to build a top quality, reliable, multi receiver for half the cost of **comparable** ready-made receivers. Price **£27.15.0**

TORNADO NYLON PROPS

12 x 4 12 x 5 12 x 6 **10/9d.** each
11 x 4 11 x 6 **7/2d.** each
(In Stock **Now**)

B.U.P.

Relayless Servo

(Neutralising or trim). **£10.19.6**

The world's most popular multi servo, the **Bonner DURAMITE,** is now available with the sensational, new, type 1213 **MANNING SERVISTOR** fitted by me.

If you already have **BONNER DURAMITES,** type 1213 is available separately for £6.10.0, or we will fit them to your SERVOS if you send them, together with a self addressed adhesive label, and £6.12.6 to cover the cost of return post and packing.

SERVISTOR type 1213 completely eliminates the need for relays, and operates direct from **any** reed unit.

- ★ 12 months' guarantee against CRASH DAMAGE. (No! Not the servo—the Servistor).
- ★ 12 months' guarantee against component failure.
- ★ Immediate replacement service for my customers.
- ★ **CANNOT** be damaged by operating both switching reeds together.
- ★ Amplifier unit fits **inside** servo case.
- ★ B.U.P. servo, weight 3 ozs.
- ★ Recommended voltage 2.4 volts (Deacs) or 3 volts (dry cells) each way.
- ★ Reed contact current ¾ m.A.
- ★ All new and modified units tested before dispatch.

N.B.—Damage caused by misuse, or excessive, or incorrect voltage will be charged for—so follow the instructions carefully.

Send Duramites, for conversion, to :

MR. J. SINGLETON,
34 Park Street, Salisbury, Wilts.

Send orders for new servos or Servistors to me.

Bonner DURAMITES for relay operation. **£5.0.0.**

All Duramite spares in stock. S.a.e. for list.

TRANSMITE NEUTRALISING, £11.15.0.

TRANSMITE TRIM, £11.0.0.

AMERICAN MODEL SUPPLIES

By ARRANGEMENT with America's leading Mail Order and Radio Control Stockists, **ANY,** repeat **ANY,** item of American equipment can be sent direct to you, after prepayment to me. Please include a magazine cutting or quotation to help identify what you require if possible. Estimates gladly sent. To assist your conversion of U.S. retail prices to sterling—$1=approximately 7/2d. Postage and packing are extra. Surface post add 10%. Air mail delivery is possible if goods are required urgently. **IMPORTANT :** Customs charges, at the time of importation, are payable **by you,** but if the amount charged is considered excessive you are at liberty to refuse to accept the parcel and instruct that it be returned to the senders. When the parcel has been safely received in America I will refund the money originally paid, less the parcel postage from America to you.

I will be pleased to arrange the importation of any American equipment for British customers and will gladly quote a price inclusive of all postage, Import Duty and Purchase Tax if chargeable.

American Radio Control Equipment Guide, 8/6d. (Equipment, kits, engines, sundries). (7/2d. refund on first order over £2.)

Subscriptions to all British magazines, and American Modeller and Model Airplane News. Most American manufacturers advertise in both American magazines. New equipment also reviewed editorially in all magazines.

Ed. JOHNSON (Radio Control)

LARKHILL : WILTSHIRE : ENGLAND

HOLIDAY : MAY 27th–June 10th. **Phone before you call : Durrington Walls 366**

SERVISTORS

We apologise ! Owing to the terrific demand we are well behind with our deliveries. Please be patient with us WE *ARE* DOING OUR BEST.

A big 'thank you' To all who have sent us helpful suggestions, and in particular to

Ed. JOHNSON

whose comments have enabled us to produce the

new TYPE 1213

- ★ **Price £6.10.0.**
- ★ **Size $1\frac{1}{8}$" x $1\frac{7}{16}$" x $\frac{53}{64}$".**
- ★ **Fits inside the 'Bonner' Servo.**
- ★ **Will work with all servos we have tried, incl. REP : ED : CLEVELAND** (plus home constructed types).
- ★ **Seven Mullard Transistors.**
- ★ **Weight less than $\frac{1}{2}$ oz.**
- ★ **12 months GUARANTEE.**
- ★ **Prang Repair Service.** (although it's virtually crash-proof).

★ **The ONLY Transistor Amplifier with the SAFETY CIRCUIT**

(If both reeds operate together
NO DAMAGE WILL RESULT)

PATENT APPLIED FOR

Sole manufacturers:

Mannings Sales & Service Ltd.

17a SILVER STREET · WELLINGBOROUGH

Telephone: Wellingborough 3496/7

Sales enquiries: NORTHAMPTONSHIRE WAREHOUSE CO. LTD., HIGH STREET, WELLINGBOROUGH, NORTHANTS.

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Here, There & Everywhere

"I thought my battery was bright until . . ."

THE American dry battery industry is suffering from an influx of cheap Japanese batteries and has invoked action from the U.S. Senate to curb this competition which is leading to unemployment. We have received a quantity of literature on the subject which puts the American manufacturers' point of view most forcibly. What we would really like to see, however, is some equally powerful comment from the consumers' side! The whole of the comment we have read harps on the cheapness of these wicked imports (probably made in American-built factories launched with dollar aid!) but we can find no suggestion anywhere as to the quality of the goods.

Our experience has been that, in our particular field of interest at any rate, price is in itself only a secondary consideration to the question: "Is it a good battery?" Alas, it seems to be the policy nowadays to produce short life batteries that are hardly worth installing into a model—and—with very few exceptions imported batteries are more highly regarded than our native product.

We rather imagine the same state of affairs exists in U.S.A., that, leaving price out of it, the imported goods are proving *more efficient* than their own and so attracting buyers. European production what with Common Market and Sixes and Sevens can produce a similar state of affairs here (at present we have seen no signs of Japanese battery penetration) unless our own manufacturers consider their "special users" a little more closely. There are obviously very many more people using torch batteries or other "ordinary" uses than we can ever muster, but the future for a really top class range of quality batteries is very rosy and will in time reach the mass production quantities so dear to the hearts of every manufacturer.

Some British manufacturers have already toyed with this better battery market. We hope more will do so and would welcome word from their P.R.O.S. and samples of their products to prove us in error.

R/C on TV

Those two keen propagandists for R/C — George Honnest-Redlich and Stewart Uwins—appeared together in a short BBC TV spot in Arthur Garratt's Radio at Work programme for schools (Sixth Form please!) early in March. Items demonstrated included a Tritone

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delivery truck and an *Orion* in which George's latest Dekatone 10-channel equipment had been fitted. Both did credit to their operators. Model R/C was used to introduce the principle of remote control, and it was explained how this might be extended until orbiting satellites was achieved, and thence into the meat of the feature.

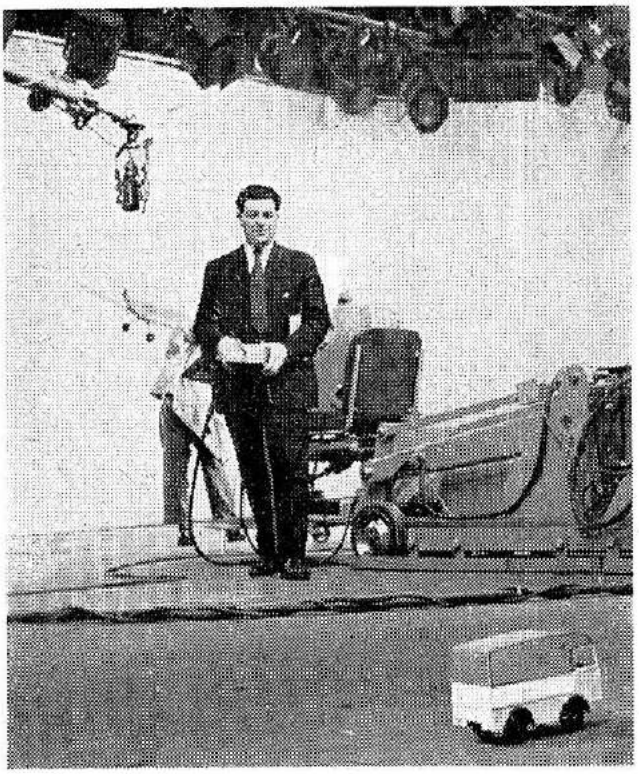
We still deplore the exclusive use of model items at Children's Hour and Schools Programme levels—father is really much more interested!—but must congratulate the producer on a near-adult presentation in this case. One of these days some bold, ruthless, mad-keen, influential genius will persuade the powers-that-be to try a real model series presented to a real grown-up audience and the broadcasting people will have found another winner!

What Other People Are Doing

Our Czech correspondent sends us news of a busy winter session revising their R/C notions. Havlin and Michalovic (ex-Dubendorf team) are now working on 10-channel simultaneous and Hajic has a three-channel job for elevator, rudder and ailerons, plus two further channels for engine control. An *Orion-type* aircraft is being evolved, and power is being stepped up by use of the new MVVS 35 RC. Pneumatic control has been discarded entirely in favour of electro-servos. A new batch of competitors may be expected for the non-championship international meeting in Sweden this summer.

Until now equipment has all been individually built, but now the central model aircraft body will be producing relays, servos, Tx. and Rx. up to multi-channel level. A new engine will also be appearing from Brno of 5.6 c.c. capacity, originally a C/1 special, but now adapted in a R/C version.

In the U.S.S.R. the Soviet Aeromodelling Laboratory, under Vasilchenko, announces production of all transistor multi-channel apparatus with resonant filters. The present six channel RUM—ED type—has not proved too successful and is said to be unreliable and have too many contacts. In Hungary MOKI is now producing an all transistor single channel Rx.; in Poland a similar one channel job is to go on the market.

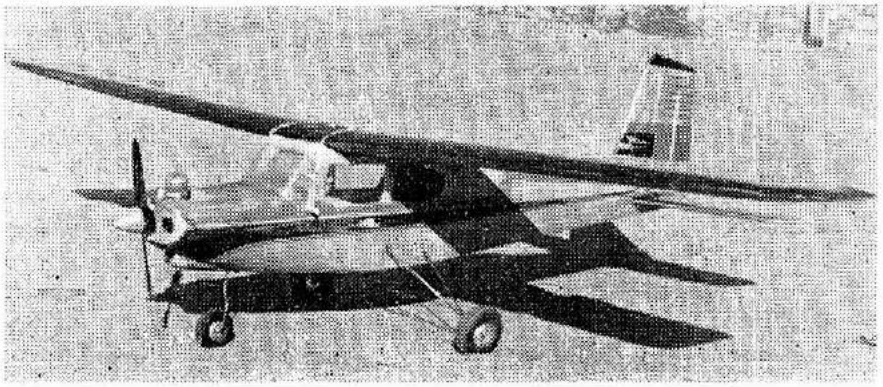


Stewart Uwins operates his Morrison Electracar powered by Mighty Midget, controlled by R.E.P. 3-reed Tritone, in the studio. Stewart made the truck, G. H. R. supplied the equipment and the "Orion" (shown suspended in mid-air behind Stewart).

Generally it looks as though R/C is catching on in a big way amongst the Soviet group and their directors are prepared to spend time and money in the effort to develop their own national equipment.

R/C Meetings to Note

Coventry Group of the I.R.C.M.S. will again be running the society's annual Model Aircraft Contest at



This Cessna-ish semi-scale model comes from Italy. Built by Angelo Gallena of Forte dei Marmi, it sports 10-channel Graupner equipment, Super Tigre G.21/35 R.C. engine. Span is about 6 ft. 9 ins., and all-up weight about 7½ lbs.

R.A.F. Wellesbourne on Sunday, August 27th. It is their intention to stage a flying scale event in the programme and for that reason will be studying Sutton Coldfield's event on May 7th with particular interest. Details from P. Haselock, 25 Wainbody Ave., Coventry.

Wulfruna M.B.C. offer two Open Regattas to be held in the West Park, Wolverhampton, on Sunday, April 23rd, and Sunday, August 13th, both starting at 11 a.m. Two radio control events will be held on these dates, steering round a marked course, and a three-lap relay race for teams of three boats. The secretary adds: "The fastest time last year was six minutes by a team from Manchester I.R.C.M.S.—it's not so easy as it looks!" Details from: A. Spencer, 18 Mander Street, Wolverhampton.

One Candle !

This is our first birthday number, which means that a dozen numbers are behind us, that a large number of initial subscriptions are due for renewal, and that, like all proud parents, we must begin to wonder what to do with baby when he grows up. To help us in our future policy we shall be offering readers next month another questionnaire form which we hope they will complete. In it we shall invite their views on likes and dislikes and give this prior notice so that they can think over the matter before putting pen to paper. This enquiry will differ from he original one that started *R.C.M. & E.* in that whilst that asked for support of something still to be created, we shall now be asking for suggestions in the light of a twelve-months' experience.

Multi Control at British Nationals

The S.M.A.E. will be staging the British Nationals over the Whitsun weekend as usual this year, that is to say on Sunday, May 21st, and Monday, May 22nd. Venue has been switched from the tentative site of Waterbeach to Barkston Hath, which lies a few miles from Grantham, Lincs. Alas, as already reported, there will be no single control event, but Multi Control will be spread over the two days. We understand that all entrants will take part in the first day's flying, and then the best of the bunch invited to continue on the second day with further flights to establish the winner. Quite apart from this major R/C aircraft event there will be hosts of other aeromodelling contests taking place, so that there is always a great deal to do and see, and this is undoubtedly the year's big 'get-together' of aeromodelling well worth a trip.

Glass Fibre for Amateurs

We are happy to announce publication of our latest M.A.P. Technical Book *Glass Fibre for Amateurs* by Geof. Lewis and R. H. Warring. As the only popular priced book on the subject indeed, the only complete new work on the subject published in this country since 1947 or thereabouts we recommend it with confidence. Chapters are not only devoted to model aspects, but cover the whole gamut of its uses, from full-size boat and car construction to carrying cases for fiddles, garden furniture, in fact the lot. It comes in two varieties, a limp edition at 7/6d. and a special library edition bound in hard covers at 10/6d. Take your choice !

Reed Pioneer Dies

It is fitting that we should pay tribute to E.L. "Ed." Rockwood, whose death is reported in the United States. Every user of reed equipment owes much of his pleasure to Ed.'s pioneer work on the subject. So often the passing of time dims our recollection of just who did what and when, so that we are pleased to be able to point to the exact time and place where his work was first released, namely August, 1949, *Model Airplane News* under the title of "Audio Tone R.C." Truly prophetic was the concluding sentence of that article where he ends: ". . . will give an impetus to more widespread activity in the radio control field, which holds a great deal of enjoyment in store for all model plane fliers, whether interested in keeping a cherished model from getting away out of sight or in doing aerobatics and pylon-racing".

Our own George Honnest-Redlich, who led the way with reeds in this country, recalls the long and interesting correspondence he enjoyed with Ed. in the immediate post-war years and is loud in his appreciation of the sterling work that he did to establish this branch of our hobby.

The ever widening circle of R/C enthusiasts throughout the world must be his uninscribed memorial.

Multi Channel Tone Stability

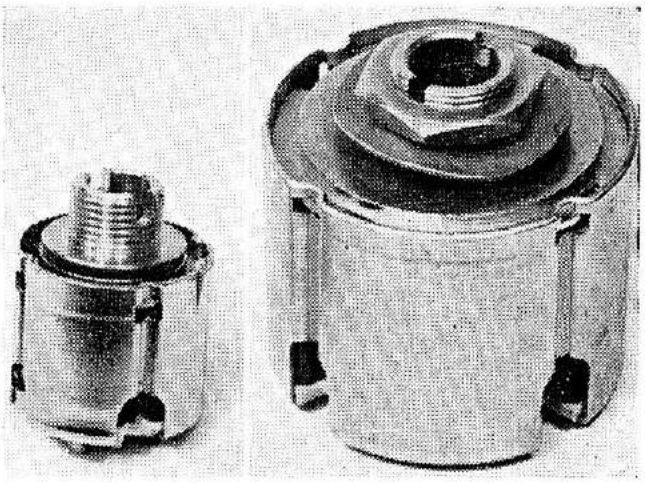
By T. H. IVES and DAVE McQUE

IN the good old days tone stability was one of the main problems and one often heard the complaint that temperature changes affected the reed frequency but it is now generally accepted that the trouble was in the transmitter.

Present day commercial equipment can be regarded as trouble free in this respect and this in the main appears to be due to the use of toroid or pot core chokes in the tone oscillator circuit. Orbit use the multi vibrator oscillator which is sensitive to voltage changes, etc., but by including a toroid choke between the two valve grids very good stability is achieved. R.E.P. and E.D. use a dynatron oscillator stabilised with pot core chokes and in general it can be said that the stability problem has been solved.

There is scope for the home constructor in this direction and the following systems are given in order to stimulate interest in this direction.

The normal method of tuning the choke to the different frequencies is by means of a capacitor in series with a potentiometer across the choke but the introduction of the Mullard VINKOR tunable pot core offers an alternative. With this type of core, however, it would seem that a separate choke would be needed for each channel.



Two of the Vinkor core units from Mullard. Photograph slightly less than full size. Smaller type is ¾ in. dia. and the larger 1½ in dia.

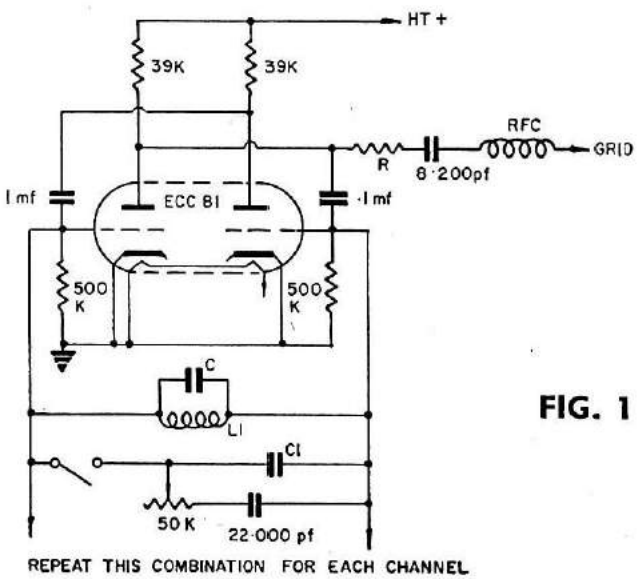


FIG. 1

We must first make reference to items which have already appeared in our magazine and which provide a solution to the problem. Page 31, May, 1960, includes an article by Ted Sills on phase shift oscillators and on page 74, June, 1960, will be found a transistor phase shift oscillator by Dave McQue who claims adequate stability with his circuit.

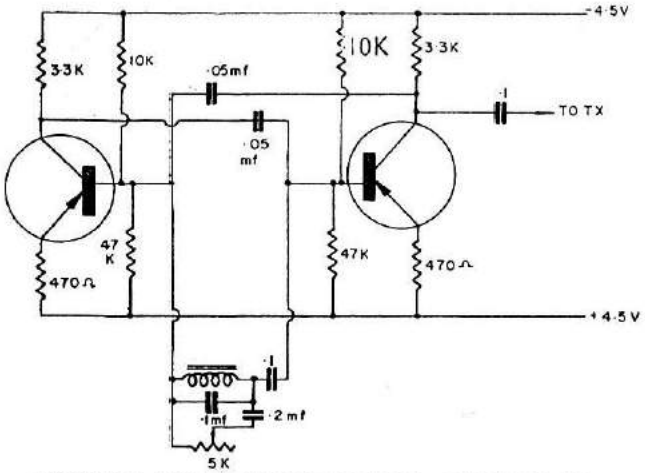
Once the pot core became available a somewhat simpler approach could be made and this was done commercially as mentioned above.

From Belgium comes a circuit which the author W. Vandermeulen says was inspired by Orbit (Fig. 1) but was nevertheless his own development. To us it looks the same. A cheap double triode ECC 81 (American 12AT7) is used together with an inductance of 1 Henry. Best is a toroid of this value,

but a surplus toroid choke of about 1 Henry has been used with good effect. The values of the capacity C must be adapted to the value of the inductance of the toroid, the first changing somewhat with the surplus samples. C1 is then chosen to cover the reed frequencies. R is taken as high as possible and still get 100% modulation. It would be best to check this on an oscilloscope.

The stability of this generator is of a very high degree. Falling voltage has no influence whatever. This does not mean that you should try to drive the plate with the filament supply.

The writer has tried out a transistor multi vibrator with a stabilising pot core between the two transistor bases (Fig. 2) and found very good stability



FERROXCUBE CORE No. 25 USED FOR TEST — LAI WOULD BE SUITABLE WOUND FULL 40 S.W.G. ENAMELLED WIRE.
A BUFFER AMPLIFIER IS RECOMMENDED FOR FEEDING THE TX.

FIG. 2

once the correct operating values (resistances and capacitors) had been found. Checked on an oscilloscope against the 50 cycle mains supply, the input from the multi-vib. being applied to the Z input, the change of frequency when the voltage was varied from nine to three was of the order of one or two cycles per second. Temperature variation made no difference at all and when listened to on phones no frequency change could be detected by ear. The modulated R.F. output from a transistor oscillator was also checked on the "scope" and the same negligible change was observed and in a receiver no change could be detected by ear.

It is offered as something to play with.

From Dave McQue come two circuits which have not been proved but offer

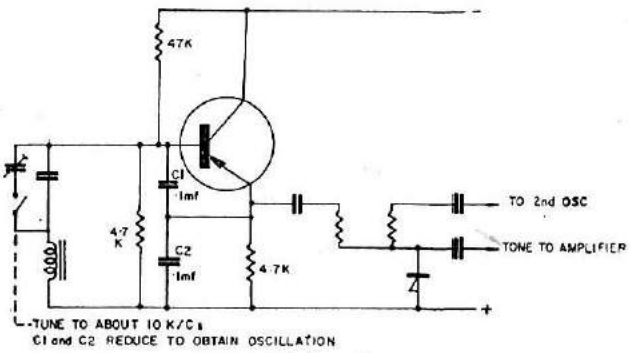
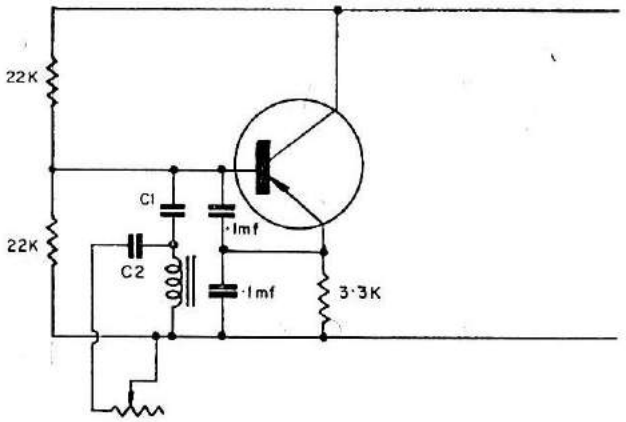


FIG. 4

scope for experiment. The first (Fig. 3, shows good stability and the second Fig. 4) is a combination of two circuits of Fig. 3 coupled as a beat frequency oscillator (B.F.O.). The theory in the case of the B.F.O. is that any variation producing a change of frequency affects both oscillators in the same direction and the net effect is no change of the beat note.

For Fig. 3 the pot core (say L.A.1) would need to be wound with 44 or 46G wire to obtain the low frequency for reeds but 38 or 40G will do for Fig. 4.



C1. ADJUST TO SUIT FREQUENCY RANGE
C2 " " " " REQD. FOR EACH CHANNEL
POT. TO SUIT FREQUENCY REQD.

FIG. 3

Multi Purpose Ohm Meter

By P. WELLS

AN OHM meter is a useful piece of equipment for any R/C enthusiast and the one described here, though perhaps more costly than the usual adaptions to a volt/amp test meter. Provides several useful additional features apart from the resistance measurement.

The biggest drawback to home made OHM meters is the calibration of the scale, and to include 0 to 1 megohm on a two or even three inch meter, makes the scale very crowded, especially at the top end as such a scale is non-linear.

To overcome this scale crowding with a small meter, the "Do-it-yourself Man" can turn to the Wheatstone bridge method of resistance measurement. For those not familiar with the Wheatstone Bridge principle, here it is simply.

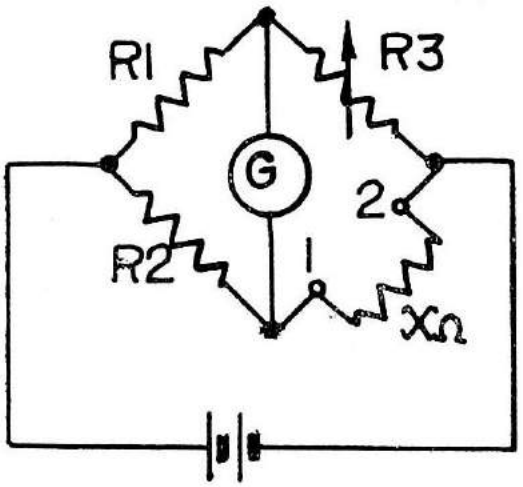
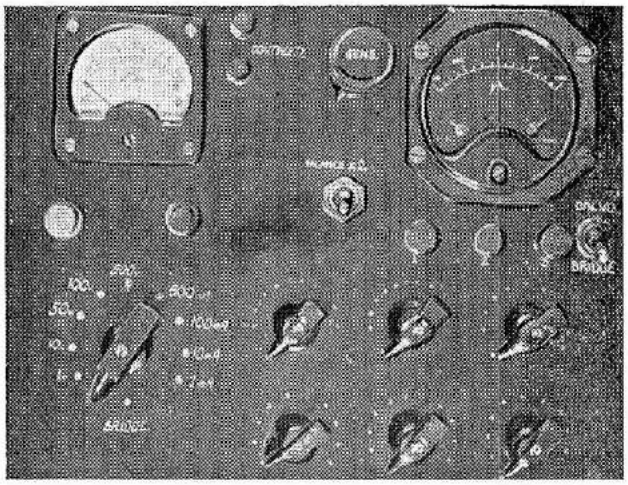


FIG. 1

If an unknown value resistor 'X' is inserted at the terminals 1 and 2 and the variable resistor R3 is altered until there is no deflexion of the centre zero meter G then $\frac{R1}{R2} = \frac{R3}{x}$ or $x = R2 \frac{R3}{R1}$ R3 OHMS. Now if R1 and R2 are made identical values, then when the meter is balanced, x = R3. If we now have R3 marked off in ohms then the value of x can be read off directly.

The complete circuit of the bridge described here is shown in Fig. 2 and was mounted on a piece of $\frac{1}{8}$ in. perspex, painted black on the underside. The size is unimportant and can best be found by grouping the components on the sheet and cutting to size.



Panel layout of a multi meter incorporating the Wheatstone bridge.

The circuit shown in Fig. 2 corresponds exactly to the standard wheatstone bridge shown in Fig. 1 with the addition of two switches and a 10K pot. The latter, shunting the meter to protect the movement when a large degree of unbalance occurs.

The variable balancing resistance R3 comprises 6 pots. all in series starting at 10Ω, each being 10 times the value of the previous one up to 1 megohm.

To complete the bridge circuit, switch 2 must be closed. An unknown resistance is inserted at terminals 1 and 2 and the 10K sensitivity pot. across the meter turned to zero. Switch 1 is then closed, completing the battery supply and the meter will deflect. The meter is brought to the zero position by the balance pots.; if 10 is not enough, try 100 and so on.

When balance has been found approximately, turn the 10K sensitivity pot. to maximum resistance and any

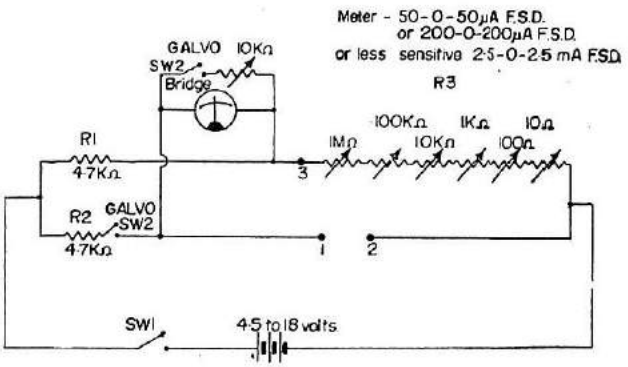


FIG. 2

slight out of balance still left will give much more meter movement, which can now be corrected. Fairly heavy gauge wire should be used throughout to keep unwanted circuit resistance to a minimum. Even so, allowing for pot. wiper contact resistance on the zero settings, it may be found that the bridge will not balance at zero ohms when terminals 1 and 2 are shorted, but maybe $\frac{1}{2}$ or 1 ohm out.

Switch 2 has been incorporated so that both the bridge and the 10 K pot. across the meter may be switched out of circuit. The meter may then be used as a centre zero micro-ammeter on terminals 1 and 3. Connection to terminals 2 and 3 will give any value resistance one may require between zero and 1,111,110 ohms. With switch 1 and switch 2 open, then a voltage applied to terminals 1 and 2, with 5,000 ohms wound in for every volt applied (on a 200-0-200μA movement) or 20,000 ohms wound in on a 50-0-50μA movement, gives a handy voltmeter from millivolts up to 50 or 200 volts, depending on the movement.

Calibrating the Potentiometers

At this stage it is necessary to know of someone who has a decade box or a commercial multi-meter (capable of resistance measurement) in order to calibrate the pots., should not be too difficult, wavemeters get calibrated so someone must have a signal generator, so why not a commercial multi-meter? The local night school or technical college may be pleased to help you if you ask them. Assuming one of these instruments is available then calibration may be carried out as follows:—

With a Decade Box

With switch 1 and switch 2 closed connect the decade box to terminals 1 and 2, the knobs on all balance pots. must be at zero. Mark all zero positions on the perspex. Switch the decade box to 1 ohm and increase the 10 ohm pot. to balance the meter, at maximum sensitivity. Mark the perspex opposite and close to the pointer. Switch the decade box to 2 ohms, balance the meter and mark the knob setting; and so on up to 10 ohms. Return the 10 ohm pot. to zero and similarly calibrate the 100 ohm pot. in 10 ohm steps. The

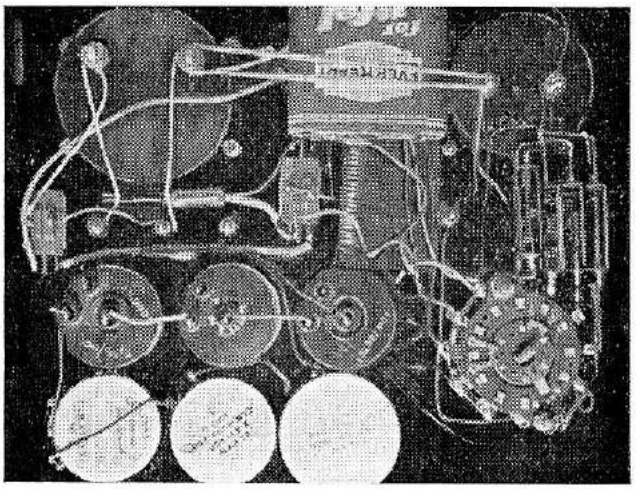


Photo illustrates layout of Wheatstone Bridge as part of a multi-meter test box. Battery supply to the bridge is incorporated in the selector switch (right).

1 K pot. in 100 ohm steps and in a similar manner up to 1 megohm.

Now at the tip of every pointer where it lines up with the scratched calibration marks, drill the perspex with a $\frac{1}{32}$ in. drill to a depth of $\frac{1}{32}$ in. When all the holes are drilled, a spot of white paint in each will provide a good indication. Any unknown resistance may now be measured and the value read off the scale.

With a multi-meter ('Avo' type)

Calibration with a decade box will give most accurate results, but a commercial multi-meter will do if the former is not available. In this case the meter, switched to the ohms scale, must have the leads clipped to the pot. being calibrated, and the pot. increased until the appropriate reading is obtained on the meter, i.e. 1, 2, 3 ohms, etc. 10, 20, 30 ohms, etc. up to 100 K, 200 K, 300 K ohms and so on to 1 megohm.

Lower meter sensitivity on the 1 megohm pot. may give slightly inaccurate calibration, i.e. comparatively large pot. movement for a small meter movement, but this is not very important as an unreliable balance reading on the 1 megohm scale of an unknown resistor can usually be associated with a preferred value very near the actual reading.

A point to point wiring diagram seems unnecessary as the instrument can easily be wired following Fig. 2.

Eight Channel Hand Held Transmitter

By G. C. CHAPMAN

General

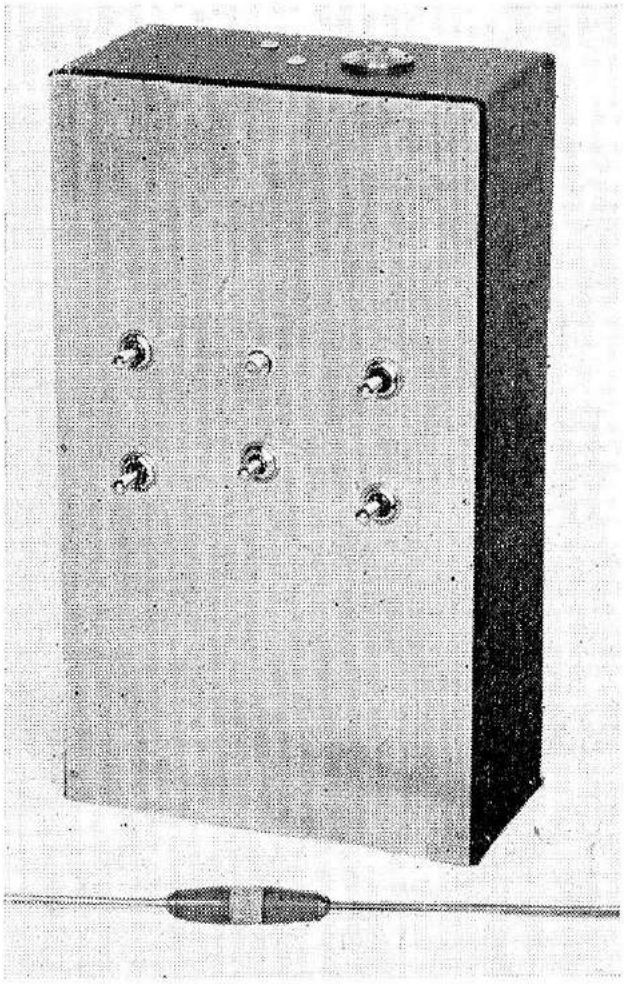
THIS transmitter is offered for those who, like the writer, are members of the do-it-yourself brigade and wish to graduate from single to multi-channel.

As a point of interest, this transmitter can be built for about £10—half the price of the ready-made article.

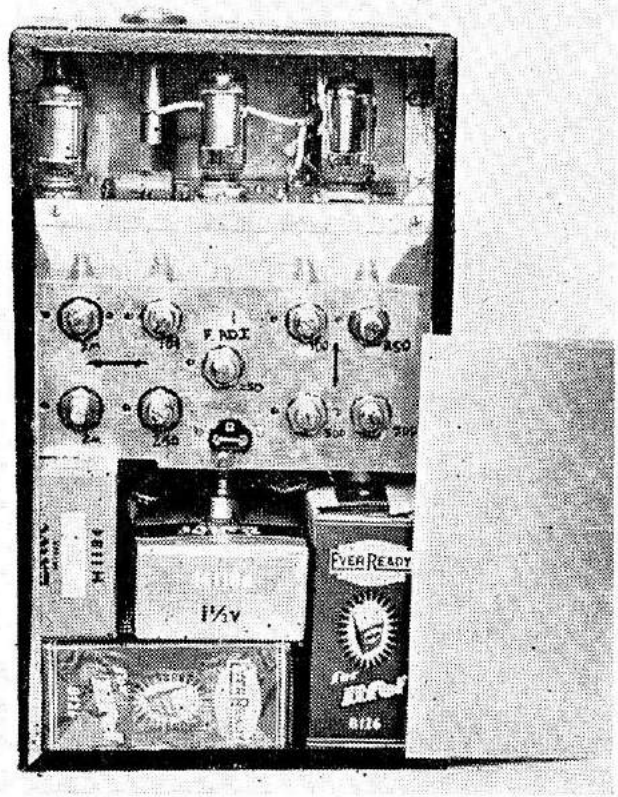
The object of the exercise was to produce a hand held transmitter which would enable the pilot to give himself more elbow room and breathing space when flying in crowded places.

The Hill Transmitter, published in R.C.M. & E. August, 1960, looked an attractive proposition from two points of view.

Firstly, Eric Hill had proved his ability to design for the home constructor with his Hill Receiver Circuit which, even today, takes a lot of beating. Secondly, his circuit for a tone modulated transmitter, according to the one or two electronic brains consulted (human ones), had the right type of tone oscillator and generally appeared a very sound scheme. The one major snag was that the transmitter, as published, was not hand held.



ABOVE : Neat external appearance of the case is enhanced by use of the leather cloth trim. The RipMax loading coil may be seen lying in front.



LEFT : Compact assembly is shown in this shot with the back removed.

This article describes how the writer made the transmitter hand held, but, of course, it does apply equally well should one wish to convert an existing ground based transmitter, the majority of the components will fit in. Whilst eight channels are quoted, obviously this is a matter of choice, although the ready-made case is prepared to accept eight channels.

Re-boxing a transmitter to make it hand held brings in its wake a series of problems such as component layout, aerial loading, battery sizing consistent with economic life, etc. Each of these points has been carefully considered and the results found to be acceptable.

The writer is grateful to fellow members of the North Kent Nomads, especially Eric Hook, and members of the trade for their help.

Construction

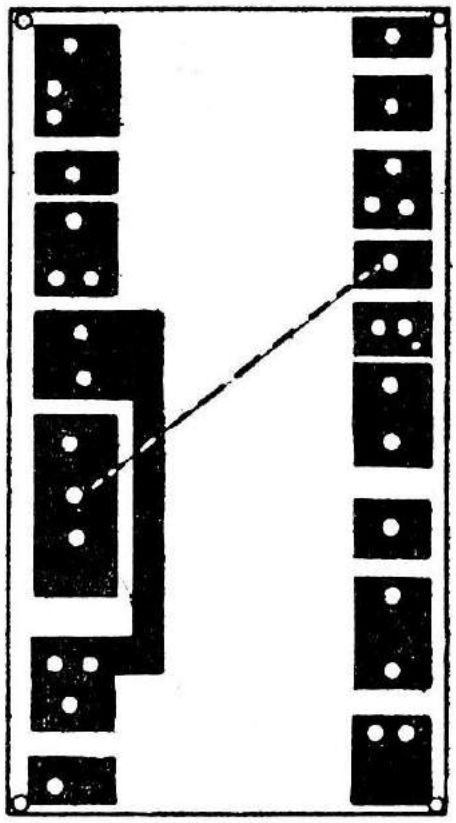
Preferably to be read in conjunction with pages 172-176 R.C.M. & E., August, 1960.

Chassis

It will be seen from the component layout that, roughly speaking, the original Hill has been changed from a straight line layout to a concertinaed 'W', and printed circuit applied to the phase shift oscillator components. The R/F section has been left very nearly as originally so as to minimise the risk of trouble from this quarter.

The chassis was cut from 18 s.w.g. aluminium and formed up as shown, those holes local to bend lines being cut in after forming. A ready prepared chassis with the larger holes ready punched is now available.

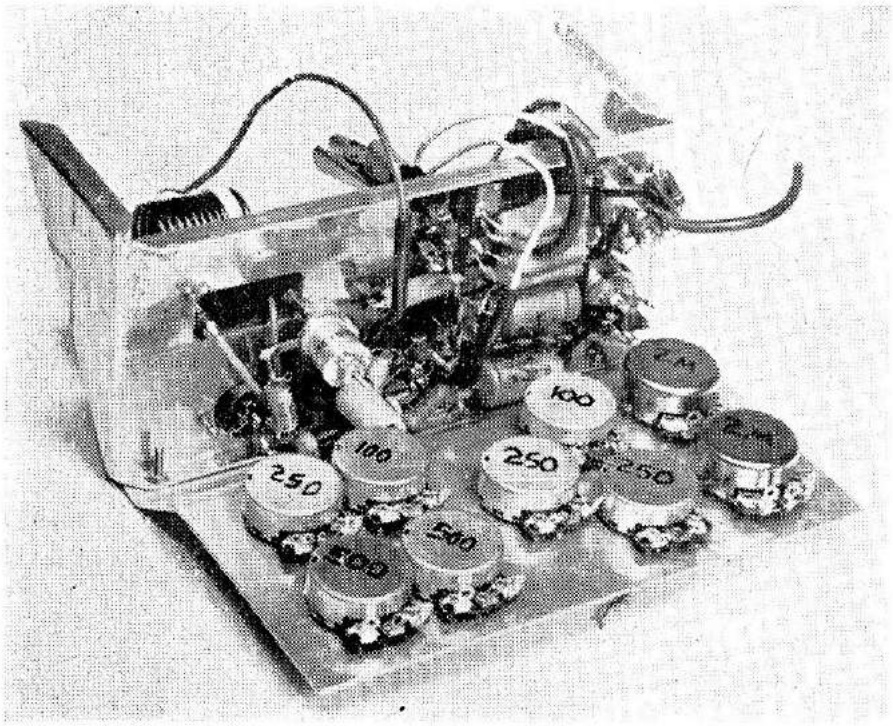
The valve bases, previously wound coils, crystal holder, etc., were mounted to the chassis using, wherever possible, 10BA screws. The printed circuit was



prepared as described below. A really midget crystal is now available, although the larger pattern will just about fit in.

Preparation of Printed Circuit

The drawing of the printed circuit was traced and then transferred by carbon paper to thin card. The components were arranged in their appropriate places, and since it is unlikely that anyone will obtain an exact dupli-



★

ABOVE : Full size printed circuit board in easy to cut land forms, the diagonal dotted line indicates the position of an insulated wire connector.

LEFT : This view of the complete chassis shows the pots. clearly.

FACING PAGE (TOP) : P/C board in position in the upper part of the chassis. Theoretical circuit shown at the foot of the page.

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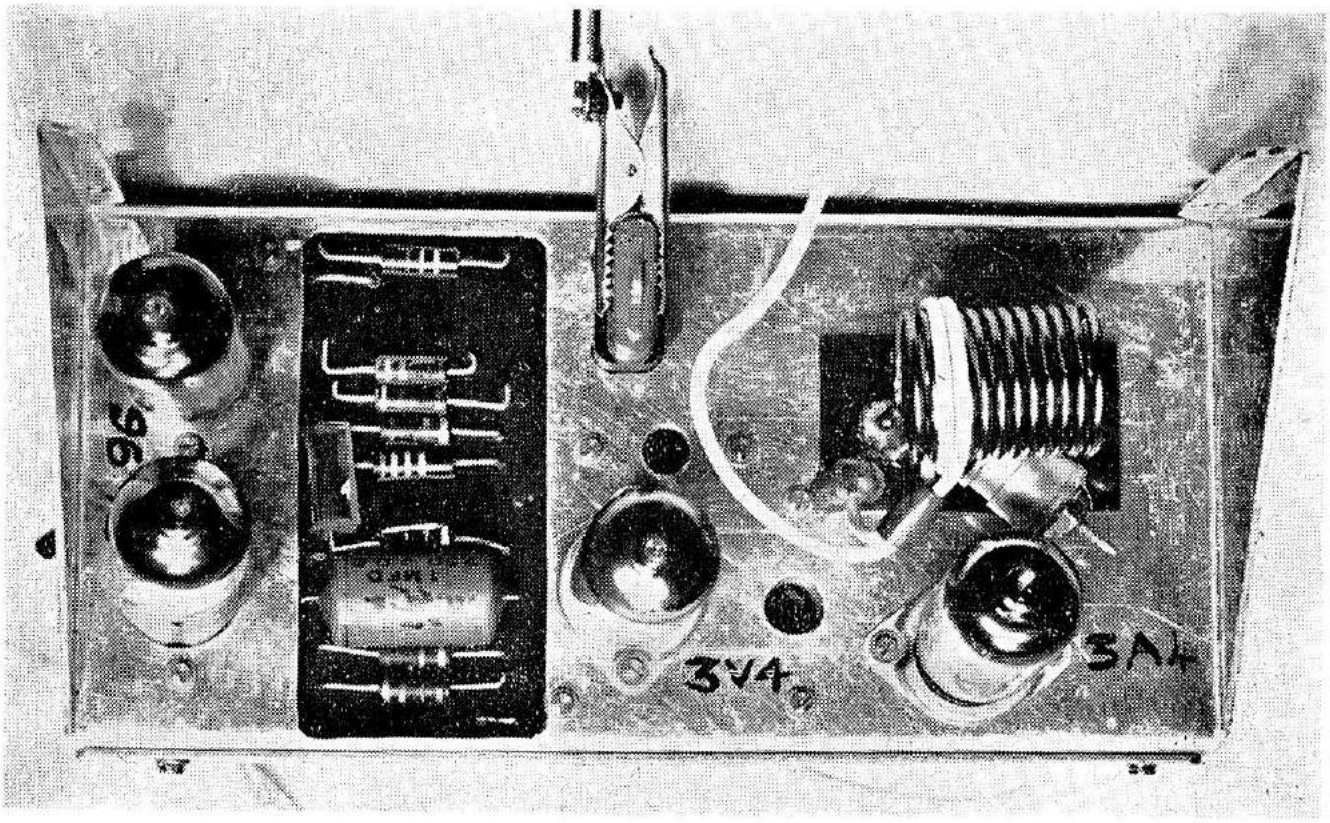
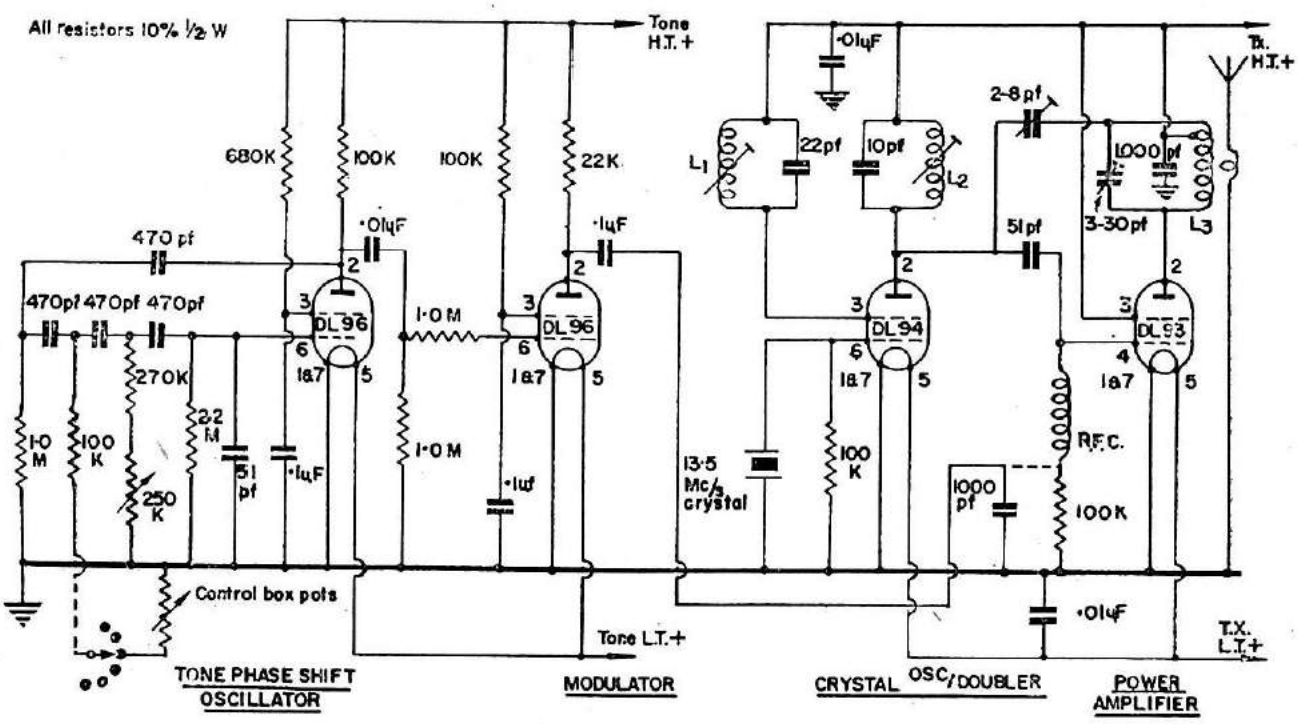


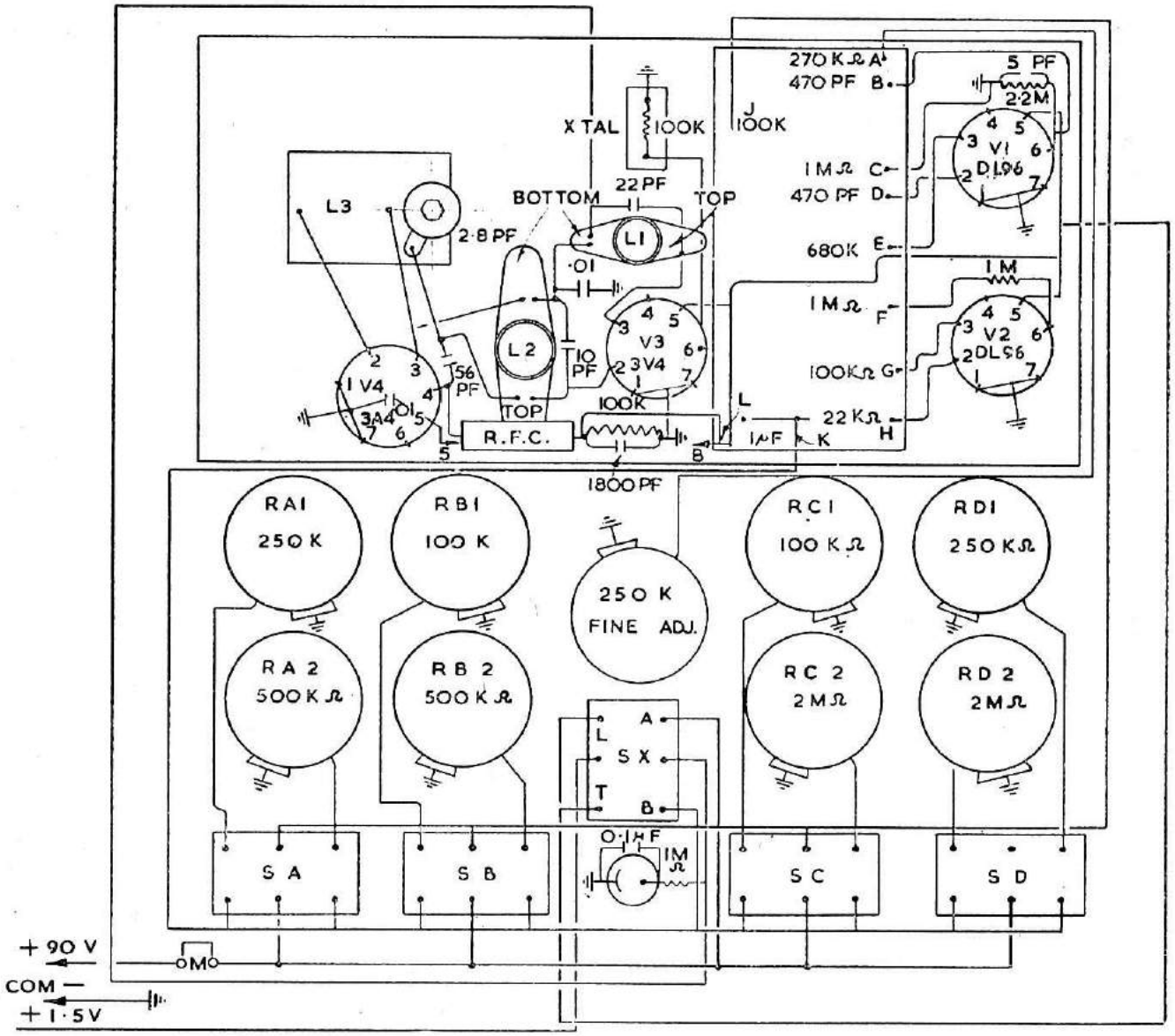
cate set of components as that used in the original, the conductor layout can be rearranged to suit.

The printed circuit board was cleaned by rubbing with 'Vim' and a little water, and covered with Sellotape edge to edge over the entire copper area; care being taken to ensure there were no air bells. The amended drawing or the original are now stuck to the Sellotape with 'Durofix' and the conductor shapes carefully cut around. The area to be etched by the ferric chloride solution was now uncovered by pulling off the card and Sellotape from the board.

After etching, the 'islands' protected by the Sellotape and card were uncovered and the board was ready for drilling. The components were mounted on the printed circuit board and soldered in position.

A careful study of the photographs and the component layout should make building self-explanatory. (The croco-dile clip appearing on the crystal of





COMPONENT LAYOUT.

two photographs just happened to be placed there.)

The printed circuit was mounted to the chassis by 10BA nuts and bolts using 8BA nuts as stand-offs to give clearance to those components which might otherwise touch the chassis.

Wiring Up

Wiring up of the components took place in much the same way as described in the August issue of R.C.M. & E.

Attention is drawn to the 3-30 pf. Beehive across the P.A. coil. This was angled so that it can be more easily adjusted now that it is located immediately behind V4.

It was found useful to have the chassis carrying the nine variable resistors made up before the components on the underside of the chassis were mounted. The two chassis were then offered up from time to time to ensure that such items as the choke on the one chassis do not foul the components on the other.

Incidentally, the nine variable resistors used were, in the main, 'Radio Spares' TV Linear Pots which are about the right size and moderately priced, but, unfortunately, they cover all the required sizes except 2 meg. ohm, and these were of a different make and similar size. The anode current check socket was also fitted, care being taken that the chassis is well clear of anything carrying H.T.

On completion of the wiring up, the Tx. was mounted on to a board and connected up with batteries and aerial with a 0-50 m.A. meter in the checking socket, and given a thorough bench and field checking, in comparison with a Tx. and Rx. which were known to be

satisfactory. In this way, one's confidence in the equipment and knowledge of its idiosyncrasies are built up. This the writer finds to be very important with home built equipment.

Construction and Assembly in the Case

The size of the case is determined to a large extent by the size of the batteries to be carried. Cases of suitable dimensions (copied from the original) are available ready made.

A check with a well-known battery manufacturer shows that two B.126's in parallel (90 volts) will together give 30-40 hours total intermittent use at a drain of 20 m.A. before showing a drop of 12 volts (the max. felt desirable).

This compares with a life totalling 10 hours if one B.126 were used for one hour per week with six days' rest.

From the same source it was learned that two AD.35's in parallel will give approximately the same life on the L.T. as the H.T. batteries.

The original Tx. carries a neon indicator which flashes whilst the carrier is on. A falling frequency in the flash denotes a declining H.T. voltage. This does provide an instant field check on approximate H.T. voltage.

It is worth mentioning that by using two batteries in parallel with H.T., care must be exercised when plugging in since when one battery is plugged in, the other plug is live, and should it touch the chassis, a short will occur and about two hours battery life goes in one very pretty blue flash!

The transmitter case is constructed from 18 s.w.g. alumium. It is bent in the form of a shallow channel $3\frac{3}{16}$ in. wide with $\frac{1}{4}$ in. flanges; bird mouths being cut for the two upper corners. This piece is now formed to give an approximate $\frac{1}{8}$ in. radius at each of the two top corners of the case. The bottom is made from a separate piece flanged on all four sides—the two shorter ones being cropped at each end so as to fit inside the channel section previously formed.

The aerial mounting is made from a small brass bolt drilled to take the aerial. The aerial socket is insulated from the chassis by a bush cut from tubing with insulating washers either side as shown in the drawing. The aerial consists of 2 × 27 in. lengths of piano wire 14 s.w.g. with a loading coil interposed.

The loading coil is that sold by Messrs. Ripmax.

The two joined chassis are held in the case by three fixings—two countersunk 8BA screws through the flangings of the case and chassis. The variable resistor chassis is nutted either side on to a length of 4BA studding which, in turn, is located in 4BA nut, Araldited to the front panel.

The front and rear panels are retained by 8BA screws into nuts previously Araldited to the inside of the flanges. If preferred, self-tapping screws can, of course, be used.

Two small holes in the top of the case for tuning L1 and L2 after assembly were found useful on the original.

The four control switches and the main on/off carrier/tone selection switch and neon indicator are mounted to the front plate after careful checking that no fouling with either chassis' component occurs.

The whole transmitter was assembled into the case, including the batteries, to check clearances and to see how best the wiring could be run between the switches, variable resistors, batteries and chassis, etc.

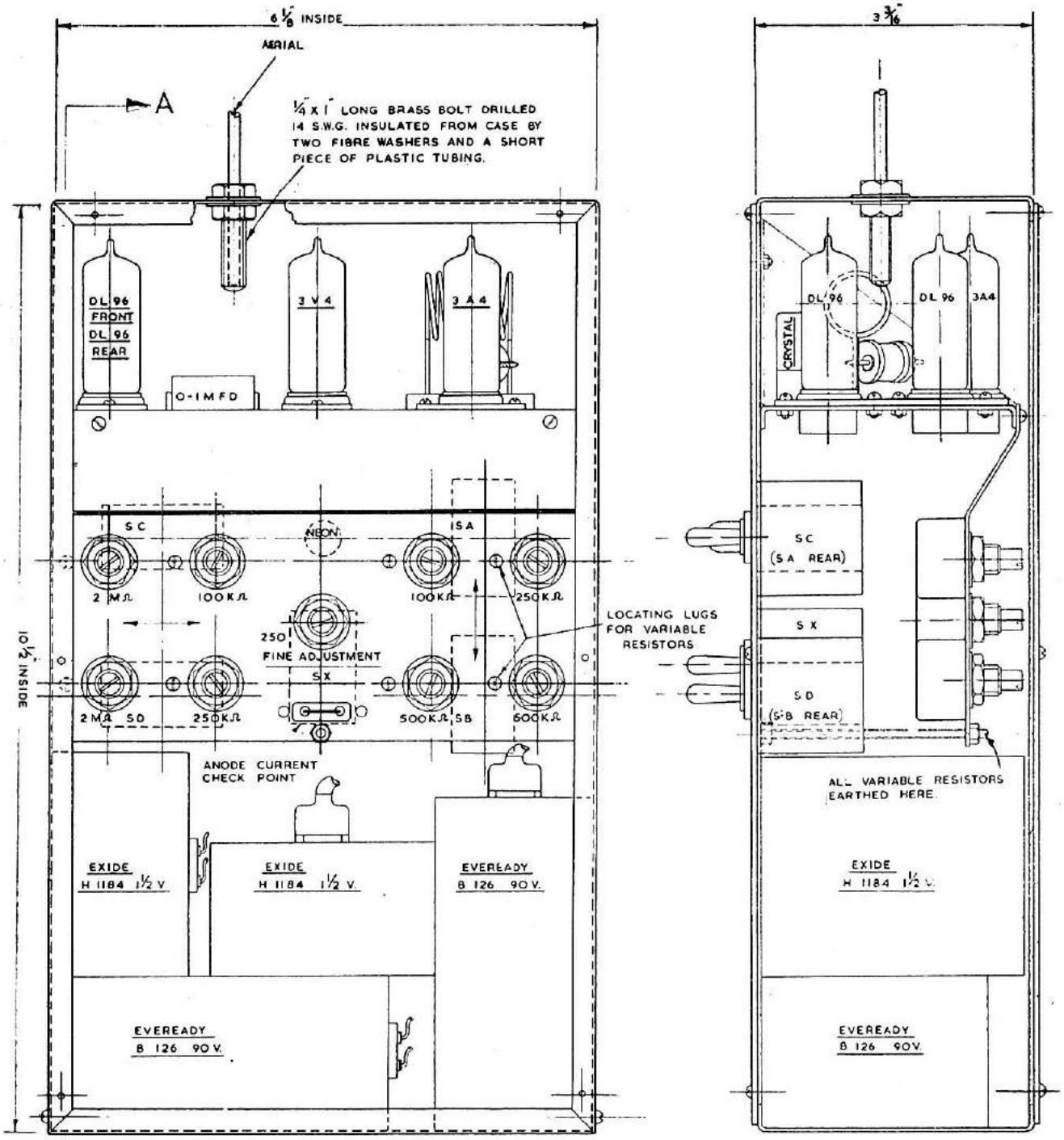
On completion of the engineering and wiring, the case was covered with thin leather cloth, used for the covering of books and obtainable from stationers.

The front and rear panels were cleaned with wet and dry paper and given two coats of fuel proofer—from past experience this has proved a very simple and serviceable finish.

Testing

The transmitter is set up in exactly the same way as described in R.C.M. & E., August, 1960, and should give virtually identical results, remembering that the Tx. is now operating on 90 volts H.T. as against 120 volts originally, i.e. total anode current now is 20-22 m.A. carrier only, when finally set up with aerial.

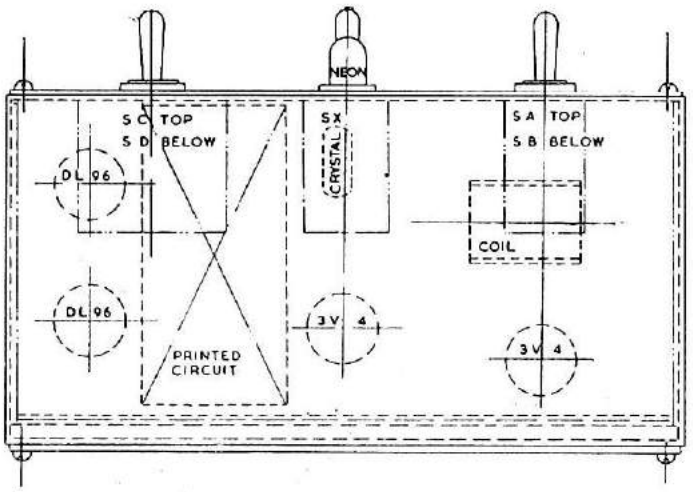
The original was tested thoroughly over a period, and apart from the introduction of the centre loading coil, no modifications were made. From the initial setting up, range and tone stability were satisfactory from 90 volts



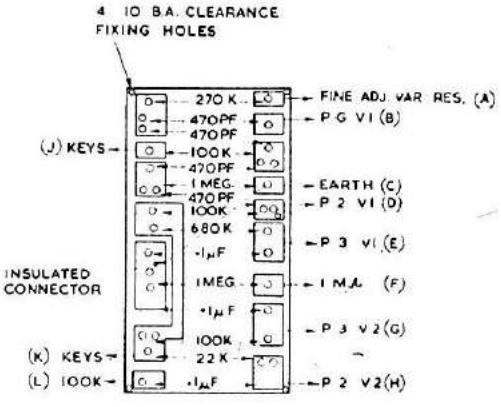
VIEW WITH BACK PLATE REMOVED

A

VIEW ON A-A



PLAN VIEW



PRINTED CIRCUIT TONE P.S.O. LAYOUT

COMPONENTS LOCATED ABOVE & BELOW BOARD.

to 75 volts H.T., and 1.5 volts to 1.1 volts L.T. L.T. voltage being found to be the more critical.

Availability of the less readily obtained components

The O.B.M. Co., 4 Lowden Road, Southall, Middlesex,
will be pleased to supply C.W.O. the following components as used on the original:—

Hand held case—front and rear panels. Holes for five switches and Neon Indicator, ready punched.

Ready formed chassis to accept components and variable resistors with large holes ready punched.
(Post paid) £1/9/6d.

Switches

Centre biased off — two position (four switches for eight channels).
Each (post paid) 9/3d.

Centre off for L.T. and Tone/Carrier selection switch.
Each (post paid) 8/6d.

(The above switches have a long toggle and short thread to make them compact and of professional appearance.)

Midget Crystal and Holder, 13.5 m/cs. nominal frequency.
Each (post paid) £1/14/0

Neon Indicator. Each (post paid) 4/9d.

Back issues are still available from these offices, price 2/4d. post free.

Readers may like to study the Modified Hill Tx. Circuit on page 213, with a view to making the same alterations to this version.

Basic Radio

Part VII

The Superhetrodyne Receiver

By G. E. DIXEY

Introduction

FOR broadcasting and communications the superhet. is without equal, combining, as it does, good sensitivity with selectivity. For radio control work it appears to be not so popular, since few people have adopted it.

The reasons for this may be as follows:—

(1) A superhet. employing valves is much heavier than a single or two valve super-regen. receiver.

(2) Generally, high selectivity is not a requirement, since most transmitters used are not crystal-controlled, and are, therefore, prone to frequency drift.

(3) The super-regen. receiver has extremely high sensitivity, and, although it is not usually highly selective, this point is often not a disadvantage, since the wider frequency response accommodates transmitter frequency drift.

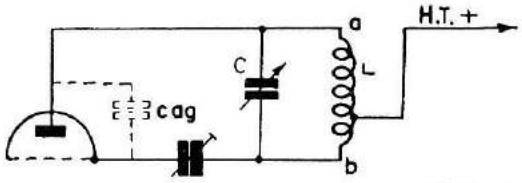


FIG. 1

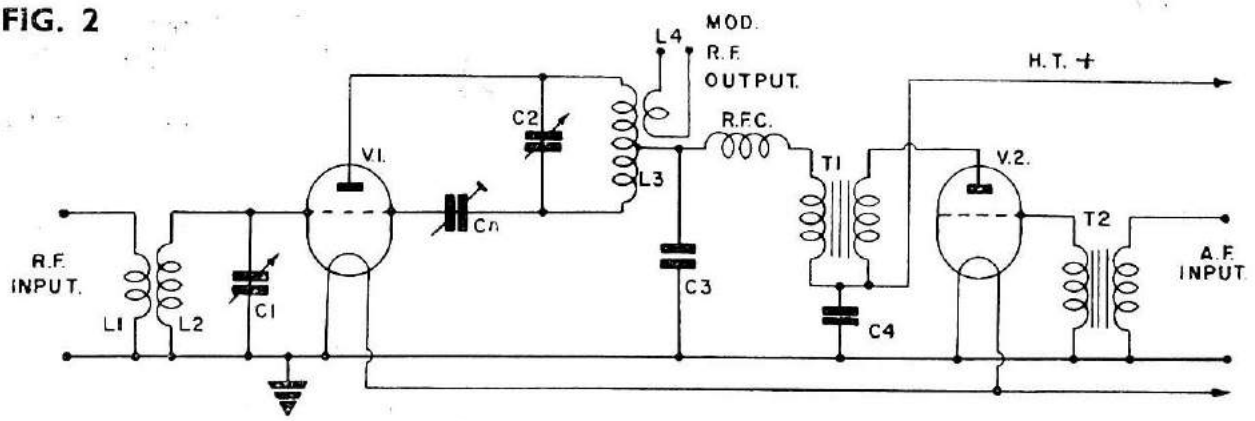
However, if both transmitter and receiver were crystal controlled, and the receiver designed for high selectivity it would be possible for a number of operators to control their models simultaneously without mutual interference. In addition, one could be sure that the transmitted frequency lay within the specified band for radio control.

With the advent of V.H.F. transistors at reasonable prices, it is now possible to build a very light superhet. receiver utilising smaller batteries and having increased reliability. For boats where weight does not matter valves may be used.

Principle of the Superhet

The frequency of the waves propagated by the transmitter is changed, at the receiver, to a much lower frequency known as the 'intermediate frequency' (i.f.). It is this lower frequency which is amplified in the receiver and demodulated (or detected) to

FIG. 2



produce the alternating currents, which correspond to the speech or tone which was transmitted.

There are two fundamental reasons why this frequency conversion is carried out:—

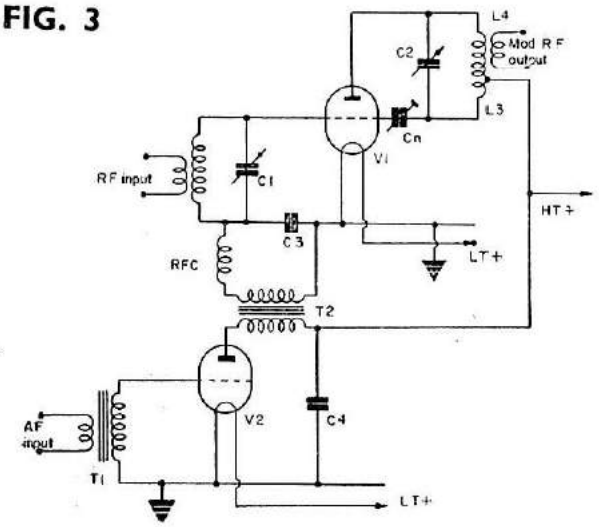
(1) Amplification is achieved more easily at the lower frequency; and
(2) Because the i.f. always has the same frequency.

Anode Modulation

Anode modulation is achieved in the circuit of Fig. 2, V_1 is the output valve of the transmitter, whose grid circuit is tuned by L_1 C_1 and anode circuit by L_3 C_2. The r.f. carrier is fed into the grid circuit by the link coil L_2. V_2 is the modulator valve, which is a power amplifier, which gets its input (the a.f. tone) via transformer T_2.

The anode of V_2 gets its supply from the H.T. + line by way of the primary winding of the modulation transformer T_1. The anode of V_1 gets its supply from the H.T. + line by way of the secondary of this transformer. Since the a.f. tone, amplified by V_2, appears across this secondary, it follows that the anode supply to V_1 instead of being straightforward d.c. as in a normal r.f. amplifier consists of d.c. upon which is superimposed the a.f. voltage. V_1 has to amplify the r.f. input, but effectively the amplification of the valve is varying with the alternating anode supply, so that the amplified r.f. bears the a.f. modulation. Capacitor C_3 and R.F.C. form a decoupling network for r.f. C_4 decouples the a.f. and the modulated r.f. output to the aerial is taken via a link coil L_4. A neutralising capacitor C_n is shown, the function of which will be explained later.

FIG. 3



Grid Modulation

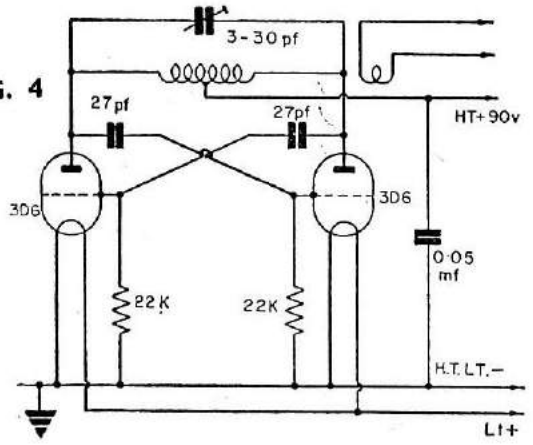
This method, shown in Fig. 3, is less popular since distortion is easily introduced, but has the advantage that less power is required to perform the modulation process.

Valve V_1 is the transmitter output valve, whose grid circuit is tuned by L_1 C_1 with the r.f. coupled in via L_2. The anode circuit is tuned by L_3 C_2 the modulated r.f. being fed to the aerial via L_4. V_2 is the modulator valve, whose a.f. input is fed in via transformer T_1. The modulation transformer T_2 has its primary in the anode of V_2 and its secondary is in series with the grid circuit of V_1. Thus V_1's grid is influenced by both the a.f. and r.f. voltages, and modulation is achieved. The R.F.C. and C_3 provide r.f. decoupling, C_4 provides a.f. decoupling and C_n is the neutralising capacitor.

Transmitters

A large number of transmitters used for radio control, carrier only, operation are very simple being nothing more than an oscillator, whose tuned circuit is coupled to the aerial via a link coil. Any r.f. oscillator can be used, but a

FIG. 4



very popular circuit is the cross-fed Hartley circuit of Fig. 4.

This type of circuit can be built very quickly, and cheaply, and oscillates with no bother at all. The 3-30 p.f. Phillips trimmer tunes the oscillator to 27 mc/s, and this must be done in conjunction with a wavemeter or short-wave receiver. The tuning coil is nine turns of 18 s.w.g. wire well spaced on a 1 in. dia. former. The link coil is two turns of plastic covered flex wound round the tuning coil, and set in place with polystyrene cement. There are many transmitter circuits of this type or similar, and this one is included for the benefit of those requiring a cheap transmitter as a stand-by or to build for interest's sake. The oscillatory condition can be checked with an ordinary flash-lamp bulb soldered to a single turn of insulated wire which is brought up close to the end of the tuning coil.

Adjacent Channel Interference

This type of interference is encountered when another transmitter is working on a frequency not far removed from that on which one is operating. For example suppose one person is operating on a frequency of 27 mc/s, and another person is using 27.1 mc/s, then the receivers must be sufficiently selective to accept only one of these signals. This is achieved by tuning the input to the frequency-changer with a high selectivity circuit.

Second Channel Interference

Suppose that the operating frequency f_s is 27 mc/s and the i.f. is chosen as 1 mc/s, then a local oscillator working at f_o=28 mc/s will give the right i.f.

i.e. $f_o - f_s$ = i.f., 28—27=1 mc/s.

Suppose that a station (in the amateur band) is putting out a strong signal at 29 mc/s. This can also mix with the local oscillator frequency of 28 mc/s to produce a difference frequency of 1 mc/s, which will pass through the i.f. circuits and cause interference. If the tuned circuit in the input of the receiver is very selective, it will attenuate this 29 mc/s signal, but it may still be appreciable. If the i.f. is raised to 3 mc/s, the local oscillator must now work at 30 mc/s, and the second-channel interfering signal must be 33 mc/s. This is much further removed from the operating frequency of 27 mc/s than was the 29 mc/s signal, and the receiver will reject this satisfactorily. Thus, when designing the receiver the i.f. should be made moderately high.

The next article will deal with the circuits employed in the superhet. receiver, and a description of the operation of the super-regenerative type of receiver.

Pre-Flight Check

Paste this list of pre-flight checks on your Tx. case and follow them religiously whenever in doubt about model or equipment.

1. Battery voltage receiver. H.T. L.T. Servo.
2. Transmitter battery voltage. H.T. L.T. (and pulser if used).
3. Mountings of Rx. Servos, batteries.
4. Check wiring harness ends and sockets.
5. Control linkage for slop or binding.
6. Motor for secure mounting.
7. Tank ditto plus feed line.
8. All controls in operation (correct deflection and centering).
9. Check all surfaces for warps and correct decalage.
10. All surfaces and UC securely attached.
11. Check UC for correct tracking and brakes if fitted.
12. Flight simulation test (engine running, model suspended on rubber bands) check all controls.
13. Range check.
14. Taxi test.
15. Flight test: (a) natural turns; (b) Rate of climb; (c) Precision pattern; (d) Low speed glide angle.

Mainly from East Bay R.C.C.

Servo Tests

T. H. IVES REPORTS ON THREE NEW SERVOS

Graupner Duo-matic

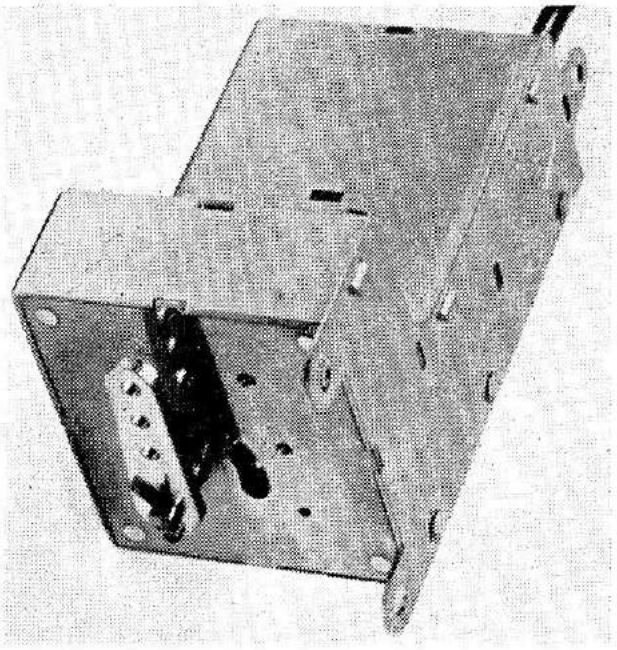
THE Graupner Duo-matic servo distributed in U.K. by A. A. Hales Ltd., is a serious challenge to the Bonner Duramite which for some time has been regarded as ideal for multi channel use where high loads are imposed.

It is a good looking unit and the works are completely enclosed making it immune from troubles due to damage, dirt, etc. From the photographs it will be seen that it comprises two separate parts held together by the outer case.

The motor proper is one unit and is positioned by means of two thin paxolin strips held securely in place by the case. The motor is linked to the gear train by a very clever and simple centrifugal clutch, see below.

The final gear in the train is spring loaded for return to neutral and as the clutch disengages when the motor stops the spring has to move the gear train to neutral. The result is a very positive return to the neutral position.

The use of the clutch which is slipping when the control is in the on position allows the motor to continue to rotate at a reduced speed and this means that there is a continuous current drain whilst the control is operating.



The current flow, however, is much lower than that which would occur if the motor were stalled. Also the use of limit switches, etc., a prolific course of trouble is avoided. (Current drain at 6 volts is approximately 300 m.A.).

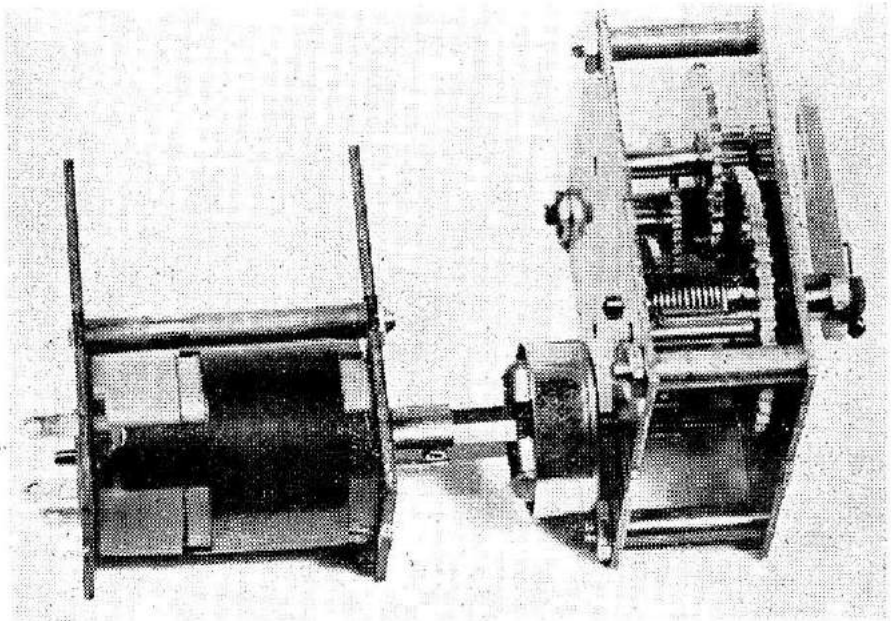
The figures for current in the chart were taken with the clutch slipping and maximum torque being transmitted. The maximum load figures were those at which the clutch continued to drive the load. Above these figures the clutch slip was too great to move the load. At no time was the motor stalled and the figures for current, etc., can be regarded as the maximum likely to be reached in use.

Transit time to control position was approximately the same irrespective of load but the return to neutral varied with the load applied.

★

Heading picture shows the Duo-matic from the output lever end, square shaft enables one to re-position the lever at 90° if required. RIGHT : Simple clutch has nylon-tipped bob-weights on thin spring arms. Accurately cut wide face gears may be seen in the transmission box at extreme right.

★



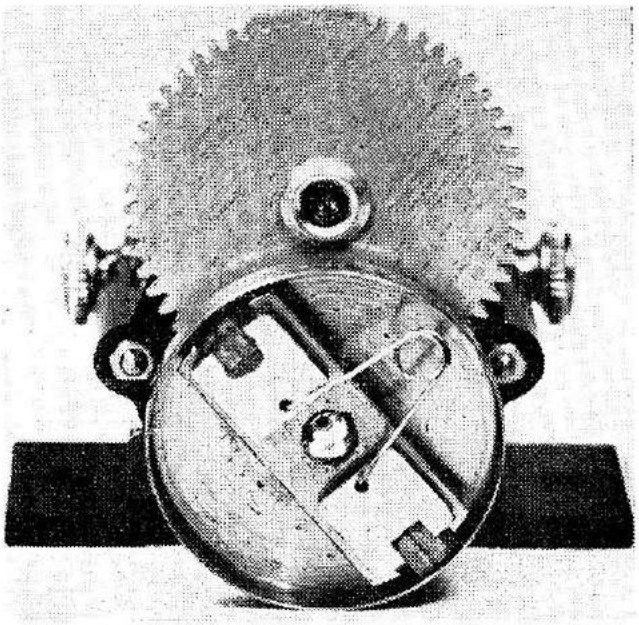
A minor criticism is that there appears to be no provision for lubrication internally. To obtain access it would be necessary to bend the holding lugs in order to remove the case. It is possible, however, that little or no lubrication is necessary.

On the whole the unit is one that we have no hesitation in recommending to the serious R/C modeller. The price is not low but compares favourably with the Duramite both as to price and performance. Recommended voltage 2.4 to 4.5. The makers recommend 6 volts but in view of the power output at lower voltages this would not appear to be necessary.

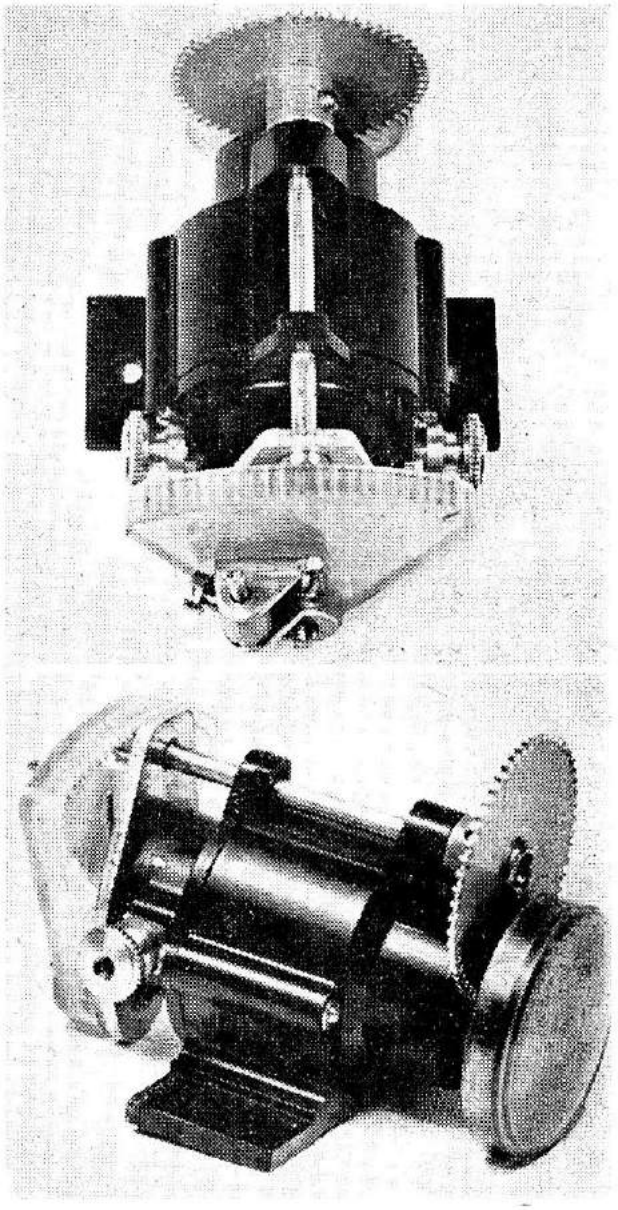
Current	2.4 volt	4.8 volt
(Clutch slipping)	120 m.A.	260 m.A.
Control arm travel	Position (1)	$\frac{1}{4}$ in.
	(2)	$\frac{3}{8}$ in.
	(3)	$\frac{5}{8}$ in.
Max. load.		
Position (1)	12 ozs.	3 lb. 14 ozs.
(2)	8 ozs.	2 lb. 4 ozs.

Transit Time

To control position.	1 sec.	.42 secs.
Return to neutral (depending on load)	.125 secs. to	.83 secs.
Gear Ratio	approx.	400-1
Return to neutral		100%



ABOVE : Rising Servo from the clutch end showing the weights in their guide channel, cork blocks provide transmission. Transparent plastic cover is fitted to the clutch assembly and may be seen in the upper right photographs. Nylon drive quadrant now has a modified tooth face.



Rising Servo

THIS servo made by Fred Rising and marketed by H. J. Nicholls Ltd., has the well-known Mighty Midget miniature electric motor as a basis and uses a centrifugal clutch to transmit the torque to the gear train.

The clutch which is fixed to the motor shaft is completely enclosed. Two spring loaded brass weights slide in channels and under centrifugal force engage with the outer ring of the clutch housing. Engagement is positive and when the gears are stopped at the end of travel of the control arm the clutch slips and allows the motor to continue to rotate at a slower speed. A saving of current is therefore achieved and limit switches are eliminated.

The final gear is in the form of a triangular shaped housing with one edge curved and teeth moulded on the inner side of the curve.

On test the unit showed the familiar Mighty Midget characteristics, i.e. low operating voltage and reasonable current consumption.

Torque was not high as the gear ratio is fairly low (approximately 100-1) but response was rapid and the torque obtained would be ample for most needs.

A well made useful product and at £3.7.6 is not expensive.

	2.4 volt	3.6 volt	4.8 volt
Current (Clutch slipping)	240 m.A.	360 m.A.	.52 amp.
Max. load	2 ozs.	16 ozs.	20 ozs.
Transit time :			
To control position	.17 secs.	.1 secs.	.08 secs.
Return to neutral :			
Depending on load	.17 secs. (lowest)		
Length of travel of control arm	$1\frac{1}{4}$ in. for test		
Return to neutral	100%		

Cobb "Ouncer" Multi Servo

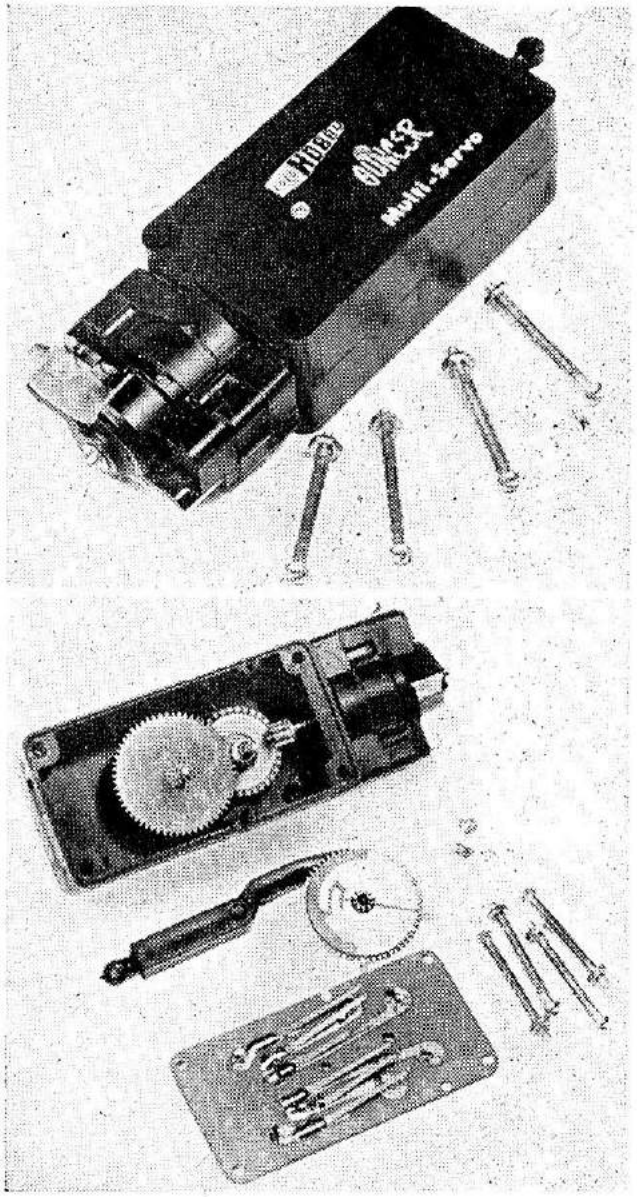
This latest addition to the Cobb servos distributed in U.K. by Ed. Johnson, incorporates a different design of gear train. By the use of a crown wheel and pinion in the first gear the direction of movement is changed to a push rod action in line with the driving motor shaft. This makes possible a quite slim outline without the disadvantage of a lead screw and its attendant troubles. The gear ratio is not high (approximately 120-1) and the current drain of the driving motor is appreciable.

A switch plate is fixed to the final gear and six phosphor bronze fingers wipe across its surface. These fingers give the switching arrangements usual for this type of servo (i.e. limit switching at the end of travel each way and a neutralising switch). With this arrangement current only passes whilst the control is moving to position.

The whole unit is housed in a neat high impact black plastic case and is dirt proof.

The voltage used for the tests was 2.4 and 3.6 with DEAC cells. The makers recommend 3 volts.

Quite a useful addition to the motorised servos and with a weight of 1.4 ozs. quite an attractive proposition. We would like to see a lower current drain however.



Two views of the Cobb "Ouncer" (so named because of its weight). Simple printed circuit switch disc is shown removed. The pushrod is fitted with an adjustable drive lug.

	2.4 volt	3.6 volt
Current—no load	320 m.A.	400 m.A.
Max. load	480 m.A.	.6 amp
Max. load	18 ozs.	28 ozs.
Travel	$\frac{3}{8}$ in.	
Transit time :		
No load	.83 secs.	.67 secs.
Max. load	1 sec.	.83 secs.

The manufacturers recommend the practice of cutting away part of the printed circuit on the return part of the switching disc in order to obtain a wide neutral position for trim. The output end of the pushrod describes a slightly "S" shaped path due to the geometry of the linkage.

Transistor Switching Circuits

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

(Hon. Secretary, I.R.C.M.S., in whose Bulletin this feature first appeared.)

TRANSISTORS have found wide application in pulse circuitry by reason of their excellent switching properties, low power consumption, small physical size and high reliability. In this section of the series of Transistor Articles I am writing for the Bulletin, some typical switching circuits are described and design formulae given.

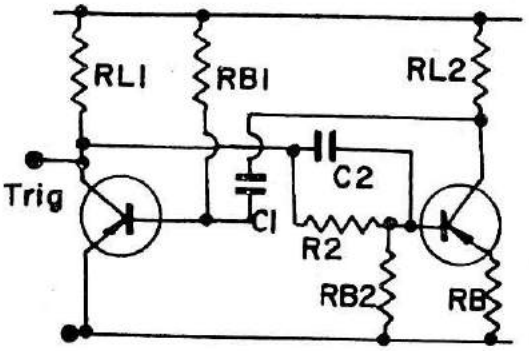


FIG. 2

There are three types of switching circuit in this particular 'family'. They are commonly known as: (1) astable; (2) monostable; and (3) bistable switches.

1. THE ASTABLE SWITCH. This is also known as a free running multivibrator. A number of articles have been written about this switch for the production of mark-space pulse trains.

2. THE MONOSTABLE SWITCH. This is a device which is not free running, i.e. it does not produce a continuous pulse train by itself. When a monostable switch is in the steady state condition, it requires a small pulse to trigger the switch into its other state. However, by nature of its circuitry, it automatically triggers itself back into its normal steady state condition after a predetermined time governed by the time constants of the components. This means that the switch is only stable in one state.

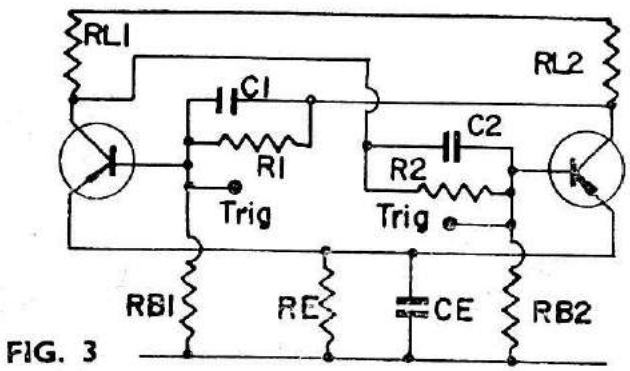


FIG. 3

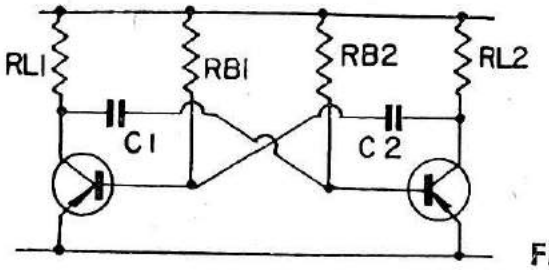


FIG. 1

3. THE BISTABLE SWITCH. This is also a non-free running device. The difference between it and the monostable switch is that the bistable one has two steady states. That is, it requires one pulse to switch to one state and another pulse to switch to the other state.

The accompanying diagrams give typical theoretical circuits for the three devices.

Notes about the Circuits

1. MULTIVIBRATOR. The timing of the multivibrator is given by the formula:

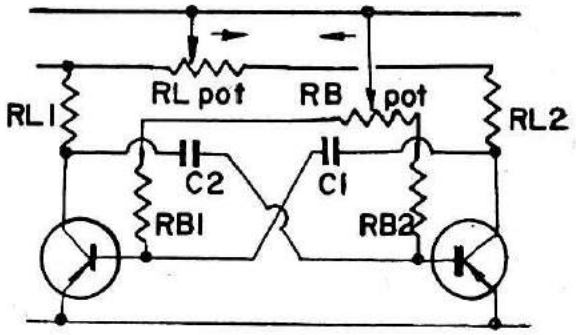


FIG. 4

$T = 1.3\ CR$, where $C = C_1 = C_2$; $R = R_{B_1} = R_{B_2}$; & $T = \frac{1}{\text{freq.}}$

See diagrams 5, 6 and 7, giving pictures of waveforms as observed by oscilloscope. It will be noticed that the collector waveform may take one of three general patterns. The first (Fig. 5) is that of correct operation. The second and third (Figs. 6 and 7) are the patterns of incorrect operation. To obtain the correct waveform, the following points should be observed:

(a) R_B CB R_L, where CB is the large signal collector to base current gain.

A typical value is 30 to 50 for OC 71, VLO/30, GET 3, 4, 104.

(b) If R_B is too low then the timing capacitance is very large.

(c) If R_B is too large then the transistor will not "bottom" and the waveform appears as in Fig. 6.

(d) If R_L is too large then the charging current for the capacitor is too small and as a result the charging time becomes noticeably long and the waveform is no longer square, appearing as in Fig. 7.

N.B.—It is often best to select transistors possessing similar characteristics.

Design

SUPPLY VOLTS 6. TRANSISTORS OC 71 (C_B = 35).

FREQUENCY OF OPERATION = 200 c/s.

$$\text{Hence } T = \frac{1}{200} \text{ sec.} = 5\text{mS.}$$

LET COLLECTOR CURRENT = 1.8 m.A.

When COLLECTOR LOAD = 3.3 k:—

R_B = 3.3 k x 35 = 100 k.

Now T = 1.3 R.C.

Therefore $C = \frac{5 \times 10^{-3}}{1.3 \times 10^{5}}$ .04μF.

An actual circuit gave T = 5.2mS or 192.5 c/s.

The reason for this is that the value of C is approximate and that there is a certain tolerance (about 10%) on the circuit components. It will be found that R_L = 3.3 k and R_B = 100 k will work for most circuits, the frequency being changed by altering the value of C only. The frequency will increase slightly with heating of the transistors by a few degrees, i.e. warm.

The circuit described will provide only a 50/50 mark-space pulse. Often it is required to vary the ratio and speed, so now we will take a look at the means of solving these problems.

It is possible to vary the mark-space ratio by inserting a potentiometer in the base resistors, and taking the slider of it to the negative line. The trouble with this method, however, is that as the ratio of mark-space is altered so the ratio of the base resistor R_{B_2} to the collector resistor R_{L_1} is altered and the equality RB $C_B R_L$ does not hold.

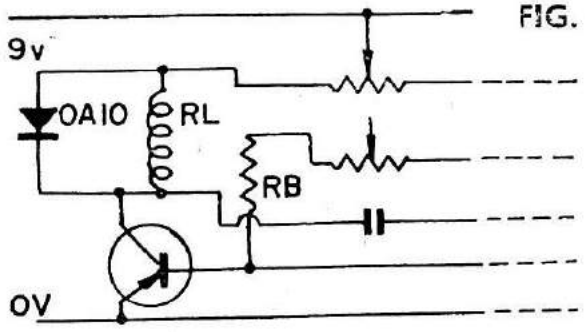


FIG. 6

This can be overcome by putting another potentiometer in the collectors. It should be noted, however, that potentiometers are connected so that the collector resistance of one transistor is reduced as the base resistance of the other is increased, and vice versa. (See Fig. 4). Also note that the potentiometers are not directly connected to the transistor electrodes. This is because there must be current limiting resistors in the collectors and to produce correct tracking there must also be resistors in the bases.

Another trouble encountered is that the frequency varies by possibly 5 to 10%. Also that because it is essential to have collector resistors, and consequently also base resistors, the maximum limits of the mark-space ratio are

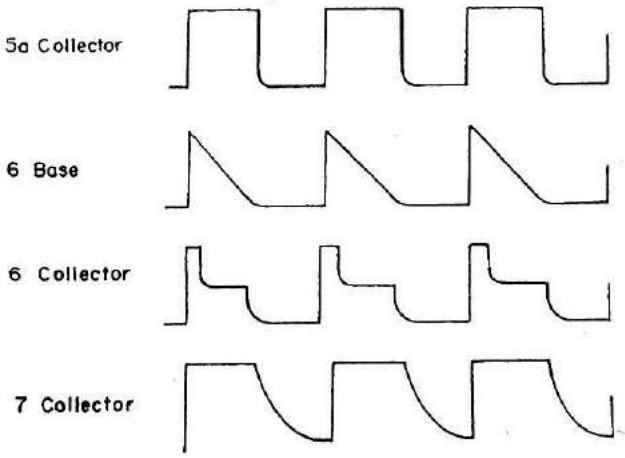


FIG. 5

no more than 20/80 and 80/20.

Example : A circuit giving 110 pulses per second has R_L 1.2 k; R_B 22 k; R_L pot. 5 k; R_B pot. 100 k; and C 0.1uF.

If C_L were 1.0 uF, the frequency would be about 11 c/s.

Instead of R_L it is possible to put in each collector lead one coil of a Carpenter (polarised) relay—the polarising being adjusted so that the relay armature stays put on either contact. It is essential to connect the coils round the correct way. Because of the inductance of the coils it is best to connect a diode across each coil in the reverse direction, as shown in Fig. 8. This will prevent a reverse surge voltage from damaging the transistor.

Good Pulsing!

[*To be continued in future issues*]

Gadgets and Gimmickry

[SKETCHES OVERLEAF]

THE Do-It-Yourself brigade will welcome Howard McEntee's use for a discarded valve, as shown at "A".

Carefully break the envelope away leaving the more solid base part complete with pins, remove "innards", file, grind or burn the sharp edges to a less lethal shape and solder the flexible leads to the inside ends of the pins. Now bind the leads together with a narrow strip of tape, fair into the base with plastic wood or encapsulating material, and you have a B7G plug.

D. O. Harison has an alternative solution to the problem of core locking, sketch "B". Remove the core and make a sawcut in the former well clear of the windings, taking care to ensure that it is at the same angle and coincides with the thread as shown in section. Form a spring clip from phosphor bronze wire and insert the flat side in the sawcut where it will hold the core sufficiently tightly to prevent accidental displacement; a touch of petroleum jelly will ensure smooth adjustment when tuning.

"C" shows another McEntee idea, this time for preventing removable whip aerials becoming detached from models at the wrong time. Drill the wander plug cap at right angles to the pin and insert a piano wire retaining bar. Kink or Araldite to prevent the wire sliding from the position shown. Two rubber bands over the wire ends and the wing dowels or other convenient points of attachment will ensure that the plug stays in its socket.

Now for boat modellers. If you cannot obtain a sufficiently tight turn with the standard rudder on your craft, try arrangement "D" as used by M. G. M. Drewe on a Veron police launch. Simply solder or locknut the additional rudders on to a brass outrigger soldered to the existing central rudder. This saves all the trouble of fitting extra tubes and tiller linkage in the finished hull, the whole unit does not have to turn through so great an angle to have the desired effect so less power is wasted.

George Sexton and Mike Kleinpeter use the following method of motor control in the idea we selected from "Printed Circuit".

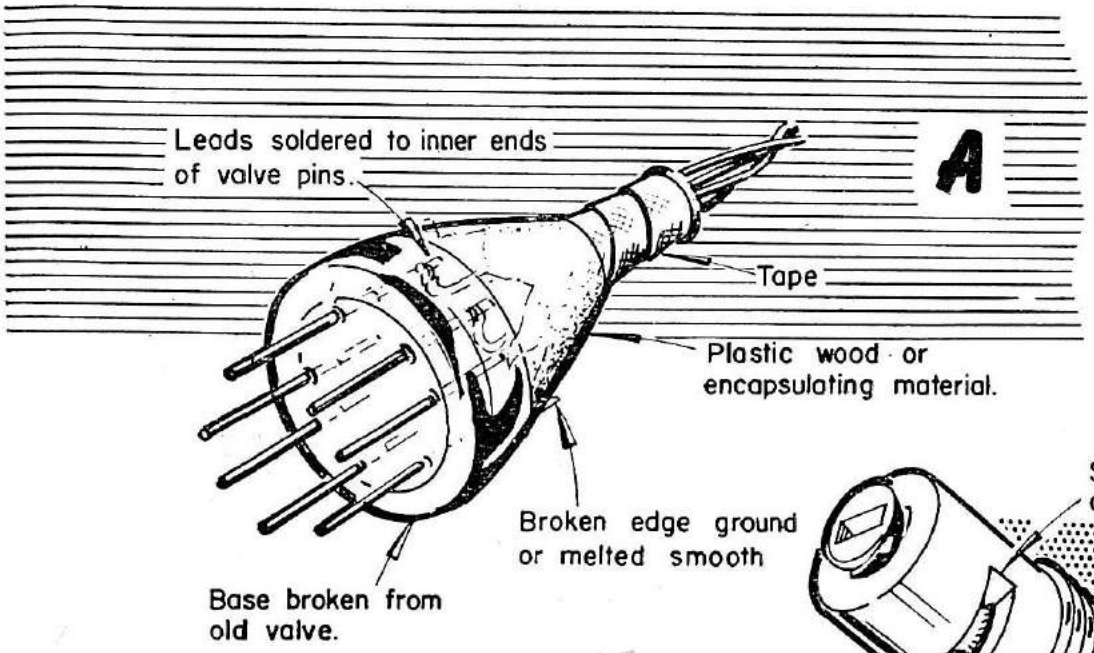
It is intended for rudder only proportional systems and a glance at sketch "E" will show what makes it tick. A thin brass strip $\frac{1}{8}$ in. to $\frac{5}{32}$ in. wide is soldered to the gear shaft of a standard nylon geared Mighty Midget motor. The edges of the strip are bevelled as shown and a spot of suitable adhesive applied to secure it to the gear. A pair of wiper arms are fitted to the base or motor case and make a circuit via the strip and gear shaft when the motor is centred. The switch so formed is put in series with a 2,500 Ω resistor, a 22.5v. battery and a 5K. relay which operated the motor servo. A capacitor is added across the relay coil to ensure that the relay does not operate at normal rate (between 20 and 50 mfd. should form the basis of experiment). It will be appreciated that at high rate whilst the wiper dwells on the contact strip the rudder is centred, but his time would only have to be slightly more than the complete traverse time of the crank.

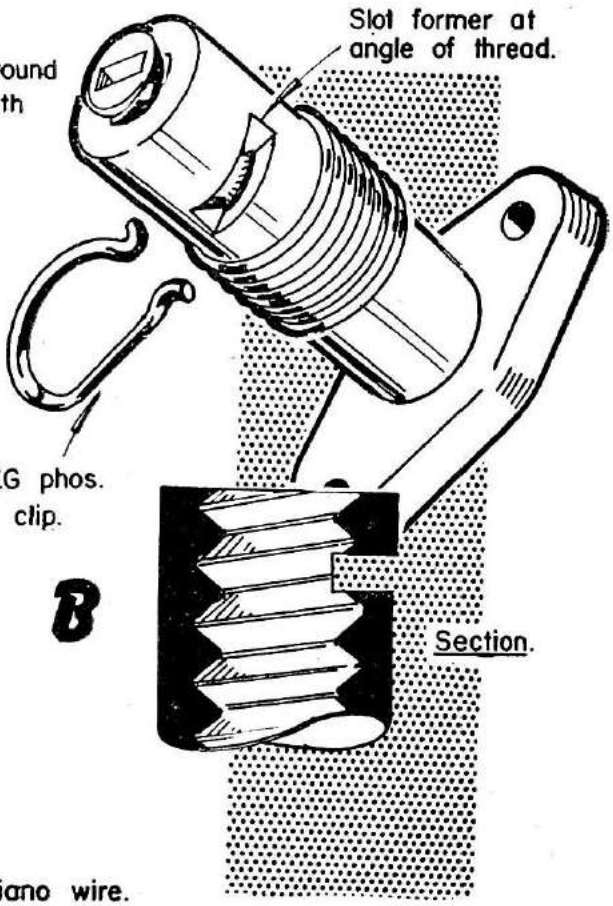
A. R. McLean sent us this ultra quick way of converting a Graupner Servo Relay (which is really a two position, two neutral escapement), to a compound type.

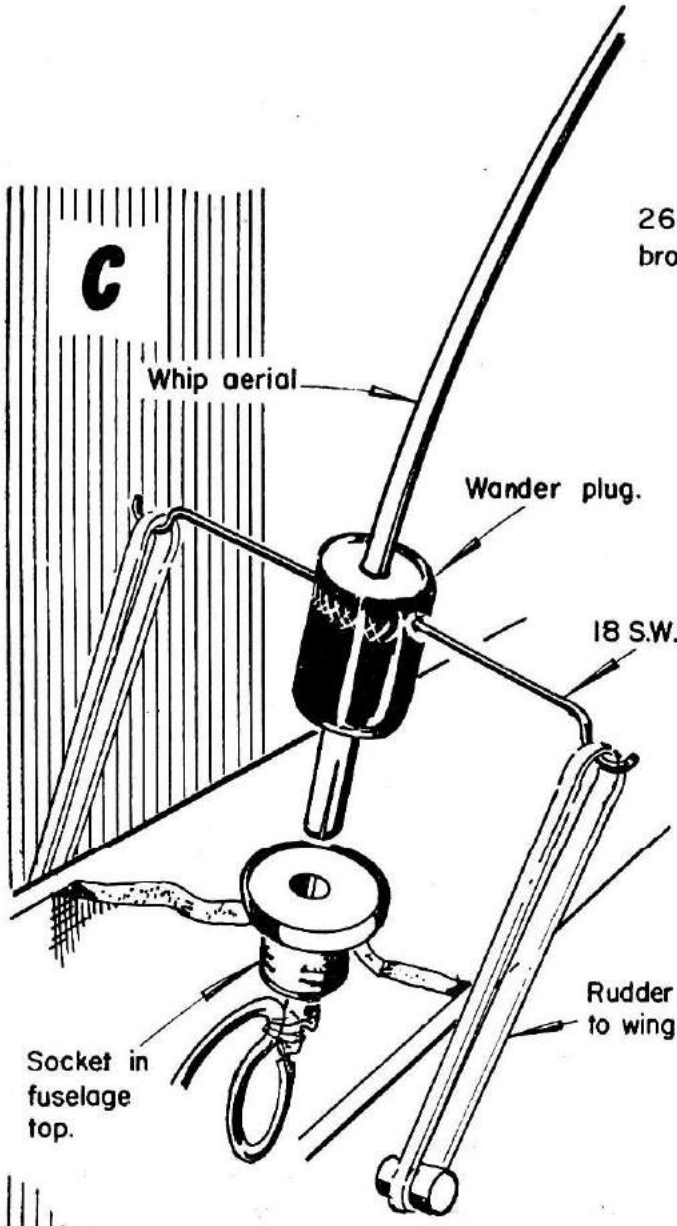
Simply remove the mechanism from its case, take off the circlip retaining the actuating arm which is then removed. Unscrew the rubber hook from the ratchet wheel the reverse side of which appears as in "F". Remove the pip indicated with a sharp knife and re-assemble, it will now be found that there is only one neutral.

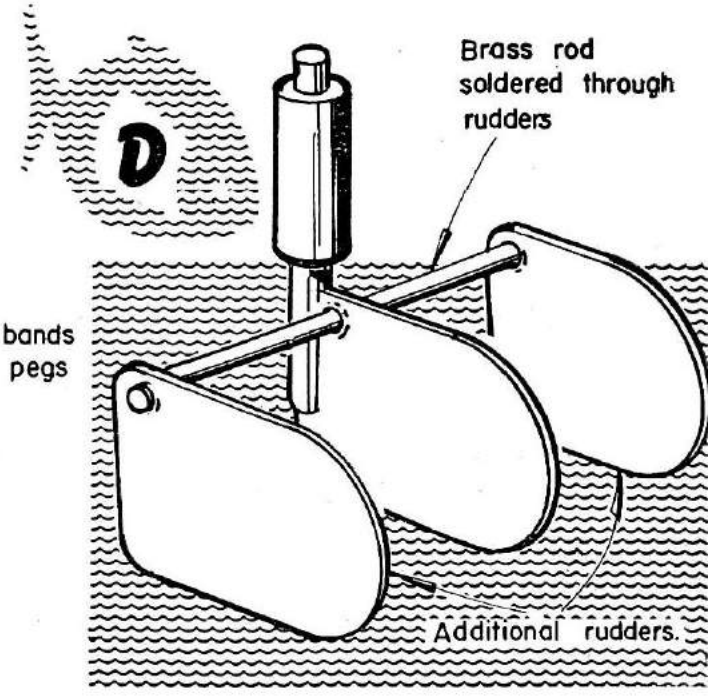
Keying will be one for RIGHT, two for LEFT. With a little ingenuity wipers could be fitted to give motor control or cascade.

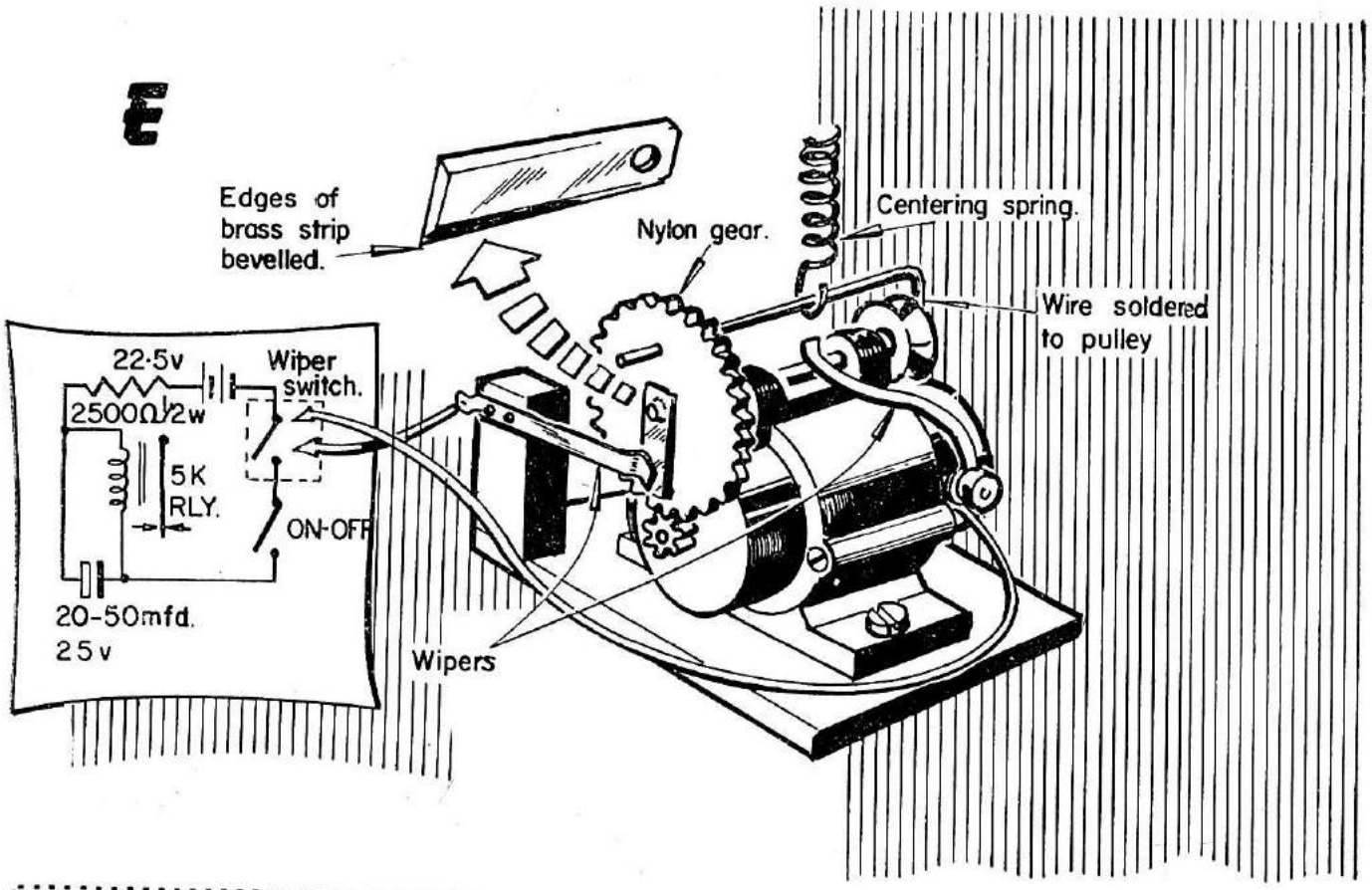
Finally, from "Carrier" comes a Dick Mayers method of reducing transmission of engine vibration. A sponge rubber tyre fitted between the motor mount and the fuselage bulkhead as in "G" will form an effective damper and permit thrust line adjustments to be made by tightening up the appropriate pair of retaining nuts.

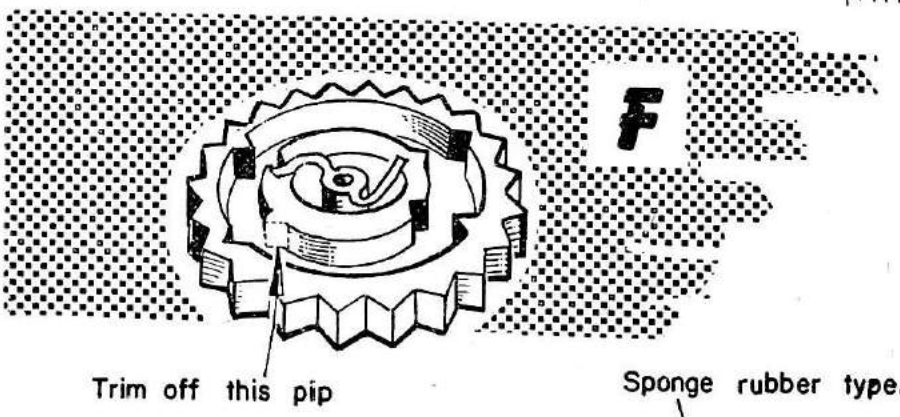

A
Leads soldered to inner ends of valve pins.
Tape
Plastic wood or encapsulating material.
Broken edge ground or melted smooth
Base broken from old valve.

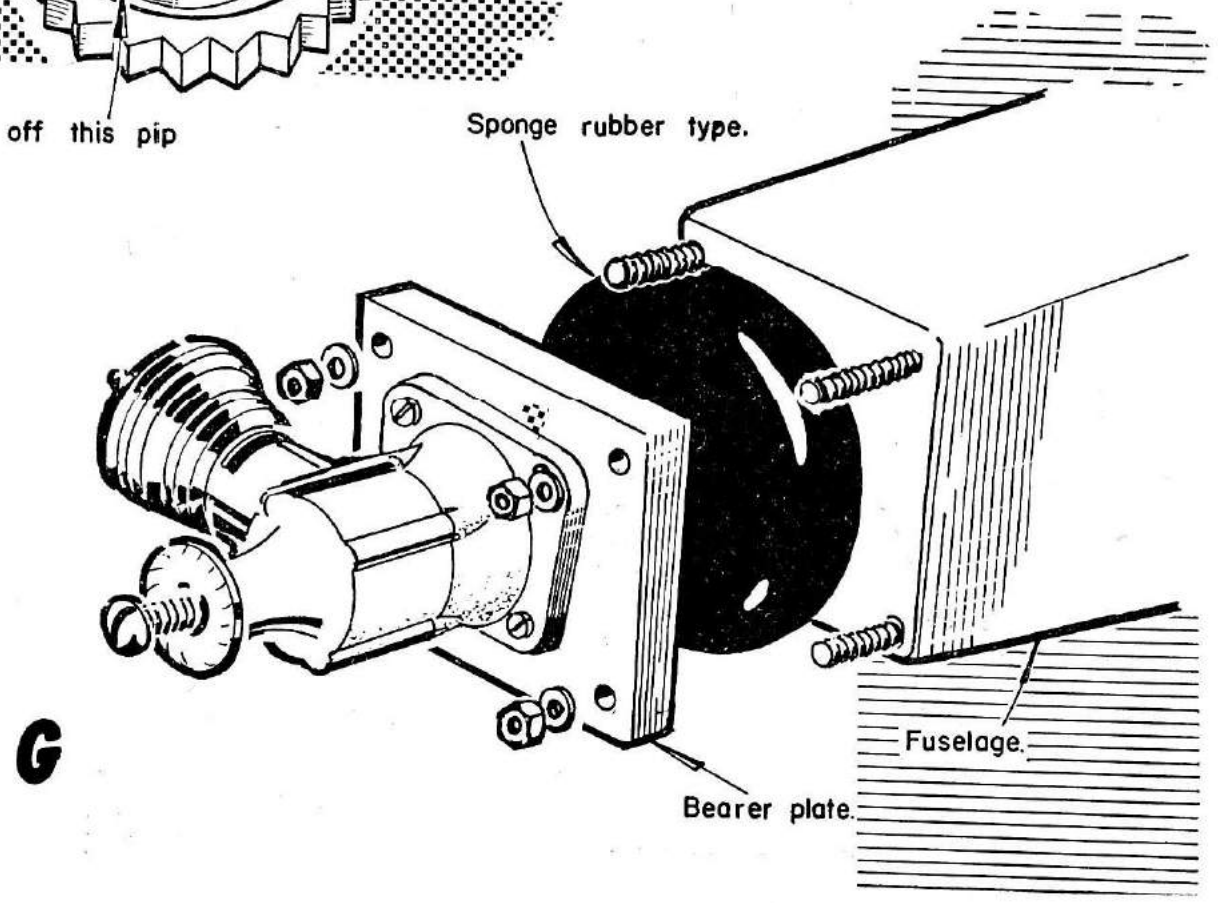

Slot former at angle of thread.
26 S.W.G phos. bronze clip.
B
Section.


C
Whip aerial
Wander plug.
18 S.W.G piano wire.
Rudder bands to wing pegs
Socket in fuselage top.


D
Brass rod soldered through rudders
Additional rudders.


E
Edges of brass strip bevelled.
Nylon gear.
Centering spring.
Wire soldered to pulley
22·5v
Wiper switch.
2500Ω/2w
5K RLY.
ON-OFF
20-50mfd. 25v
Wipers


F
Trim off this pip


Sponge rubber type.
G
Fuselage.
Bearer plate.

New Equipment

From Arthur Sallus we received a sample of an ex-Government unit which is being offered at a special price of 7/6d. (p.p. 3/6d.) to readers only. An instruction book can be supplied at 2/- (p.p. 1/3d.).

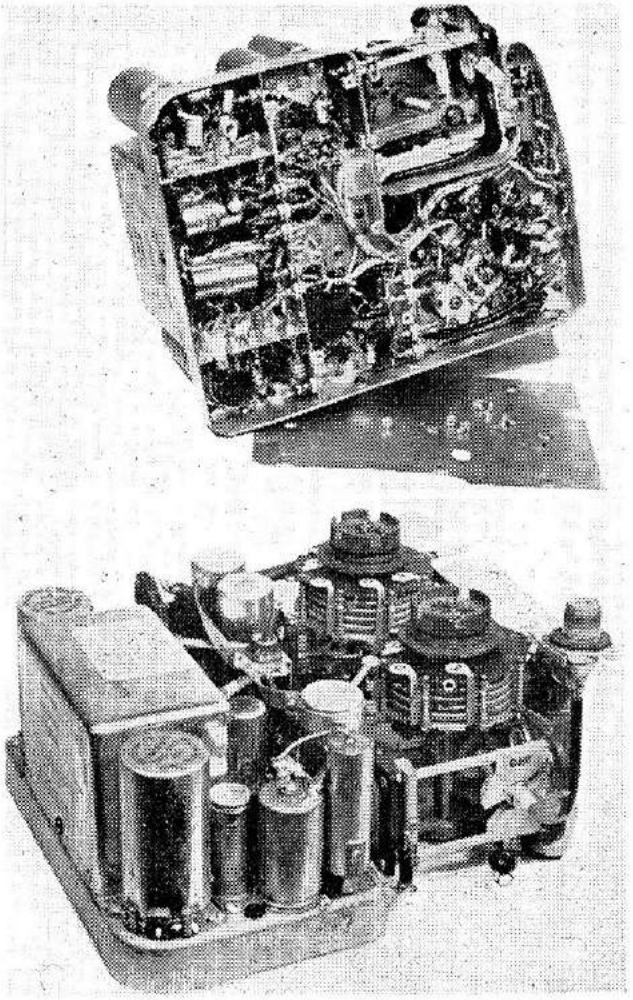
Known as a Beacon unit, this is a transmitter and receiver normally operated at frequencies from 214-234 meg.c/s.

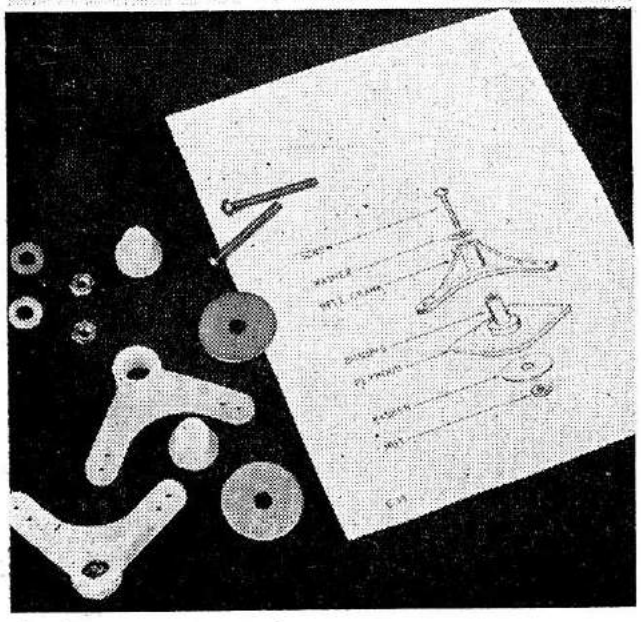
In its present state it is of little use to the R/C modeller but the radio components alone make it well worth the price asked.

There is a vibrator pack and two 2 volt synchronous vibrators. The pack delivers over 400 volts for the Tx. and approximately 150 volts for the Rx. The receiver section could be used to supply H.T. for an R/C Tx.

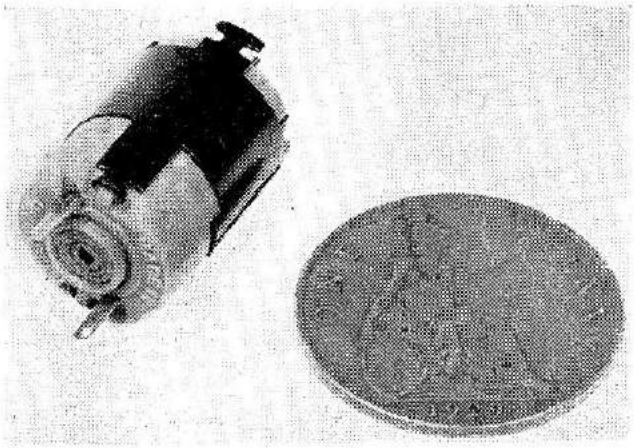
Among the components are nine good quality B7G valve holders, a toggle switch, and a number of resistors and capacitors, etc. The tuning mechanism incorporates several useful sets of gears and bearings.

Commercially available printed circuit boards are now coming on to the market, Stan Spencer sent these two examples which are nicely executed and finished with a protective varnish. The





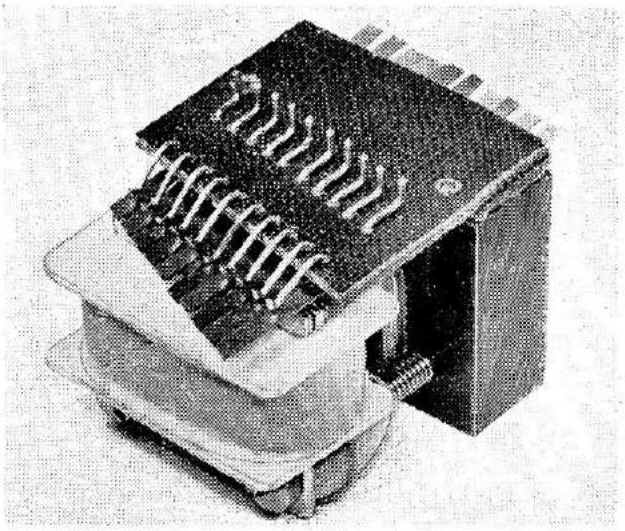
ABOVE : Two views of the Beacon Unit showing the power pack at the left hand end. UPPER LEFT : No prizes are offered to anyone who makes a receiver on the top printed circuit. The one to the left is for a Grogan Micro X transistor receiver and that on the right for a Ketchledge Pulser. BELOW : Top Flite bellcrank assemblies with exploded diagram.



ABOVE : Microperm motor as used in last month's R/C Car and R.E.P. Powertrol Servos. Method of fixing is by the "T" shaped lugs which are twisted after passing through suitable slots on the panel. RIGHT : R.E.P. ten reed unit which sells at £4.

cartoon which accompanies them in this photograph was in the form of a printed circuit itself! All one has to do is to send a full size drawing or tracing of your circuit lands, and the board comes back by return ready drilled. Charge is 3d. per square inch plus 1/- process fee. Ready-cut panels of P/C board material is available at 1d. per square inch.

R.E.P. announce the availability in the near future of some of the MICROPERM range of miniature electric motors. One of these is incorporated in the R.E.P. transistorised servos and a similar to those in the Graupner Duomatic. Two versions of this particular motor are to be available for up to 6 volts at a low drain and a higher drain type rated at up to 2 volts. Larger motors similar in appearance and suitable for boat drive are fitted with a reversing switch. More information relating to price, and performance will be published as soon as available.

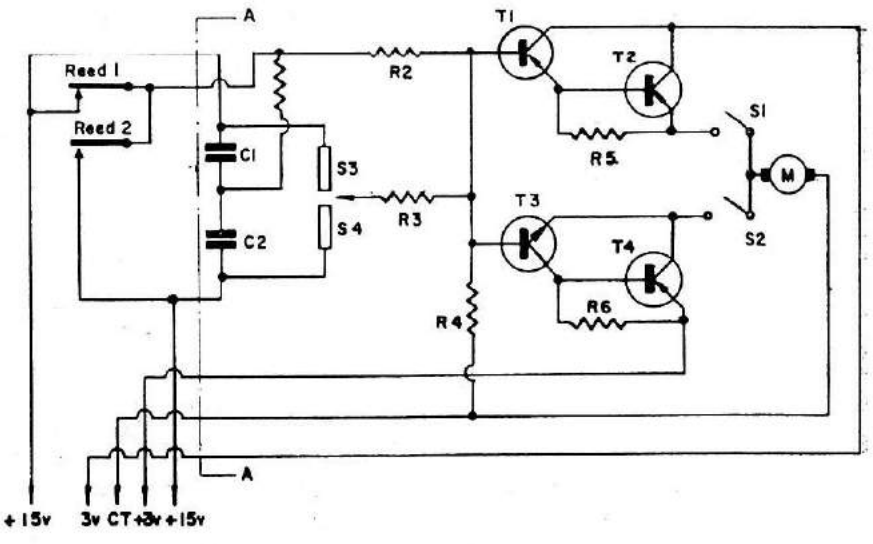


A robust pair of aileron bellcranks in nylon bearing bushes are supplied by Ed. Johnson and manufactured by Top Flite. A bolt passes through the bearing which is of sufficient length to prevent it binding on the actual crank. Washers and locking nuts secure the assembly to a suitable ply plate in the model. Assembly details are printed on the packet and the retail price is 6/6d. per pair.

The last photograph shows the R.E.P. ten reed unit which is used in the "Dakatone" receiver, but available separately at £4, including gold plated reeds.

CORRECTION

We must apologise for the fact that the collector and emitter were shown transposed on the N.P.N. transistor (T3) in the circuit of Bob Dunham's Servo Amplifier published in March R.C.M. & E., page 144. The corrected circuit is shown herewith.



Book Reviews

Recent Publications Reviewed

by T. H. IVES

R/C Primer

By Howard G. McEntee published by Kalmbach Publishing Co., Milwaukee 3, Winsc., U.S.A. Size, 11¼" x 8"—printed on good quality art paper. Semi-stiff glossy cover. 64 pages, 73 illustrations and 72 line drawings.

THE ever increasing ranks of R/C modellers has created a need for a book which deals with the subject in a practical manner. There are countless little problems which arise before successful operation can be achieved and there are many ways of solving them.

To the newcomer this must be very confusing and in his latest book Howard McEntee attempts to explain in simple language, the problems which arise and the most satisfactory way of solving them. It is not a book for the constructor of equipment and deals only with existing equipment available in the shops.

The first chapter deals with the American licensing matters and is of academic interest only.

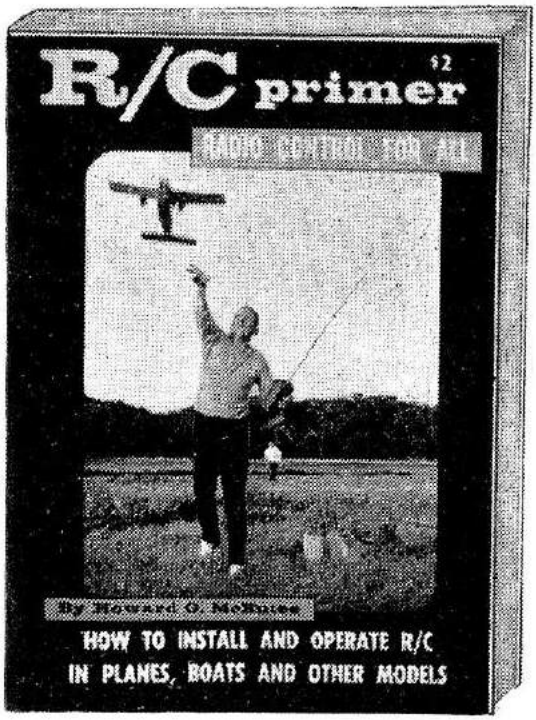
Chapter II explains the nature of the controls needed, describes the various systems available and the extent to which they achieve the required result.

Chapter III describes the various components needed to complete a system and covers a very wide field. Such matters as methods of linking the controls to the actuating mechanism, ways of securing batteries and connections, types of switches and plugs available, are dealt with in a comprehensive manner.

A separate chapter covers transmitters and associated equipment and gives examples of gear obtainable in U.S.A. (much of it is now available in U.K.).

Installations, maintenance and trouble shooting are all very adequately dealt with, including such matters as winder hooks, etc. which the average modeller is inclined to dismiss as trivial but which can make all the difference between success and failure.

Whilst model boats are less numerous in the R/C world they are becoming more popular and although the book relates mainly to model aircraft a separate chapter is devoted to matters peculiar to boats.



On page 63 is a very useful index which enables the reader to find the matter of immediate interest promptly.

Altogether a truly remarkable book which fills the gap between theory and practice admirably. We have no hesitation in recommending it both to the raw beginner and the practical flyer who thinks he knows all the answers.

It is anticipated that it will be available in U.K. in the near future.

Bernards Radio Books No. 102. 40 Circuits Using Germanium Diodes.

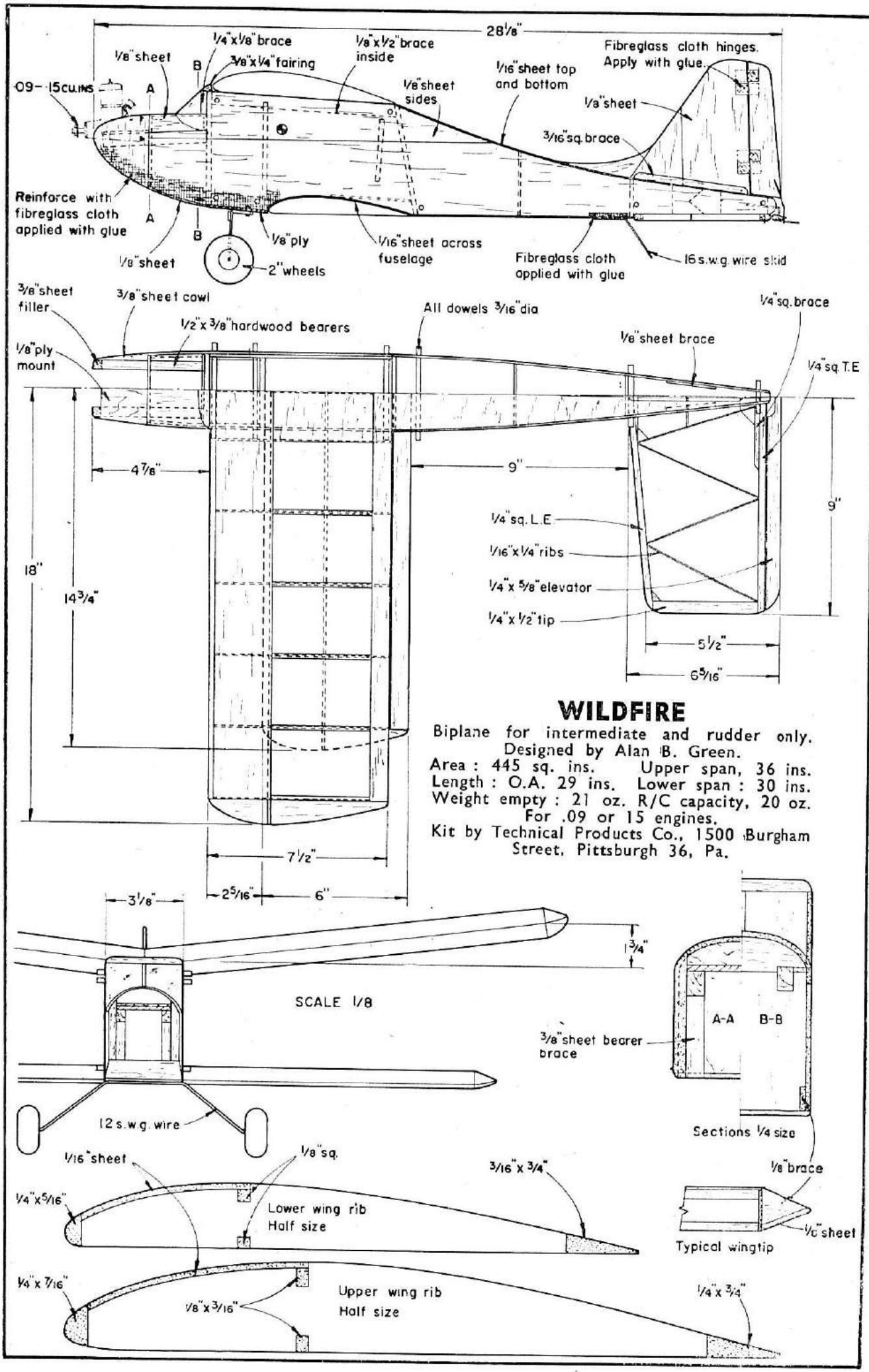
By Sylvania Electric Products Inc. Size, 7" x 5"—semi-stiff glossy cover. 48 pages. 46 line drawings (including 40 circuits). Price 3s. net.

THIS is one of the numerous Bernard publications and deals with most of the uses to which the crystal diode can be put.

There are three chapters, the first dealing with receivers and receiver applications. Chapter 2 covers transmitters and amplifier applications and chapter 3 is devoted to instruments and gadgets.

The book is in the form of a number of circuits (40 in all) with a description of how each section operates. Con-

[Continued on page 254]



WILDFIRE

Biplane for intermediate and rudder only.
Designed by Alan B. Green.
Area : 445 sq. ins. Upper span, 36 ins.
Length : O.A. 29 ins. Lower span : 30 ins.
Weight empty : 21 oz. R/C capacity, 20 oz.
For .09 or 15 engines.
Kit by Technical Products Co., 1500 Burgham Street, Pittsburgh 36, Pa.

More on Modulation

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

H. Cuckson enlarges on his previous series of articles on Modulation Technique for the benefit of readers who have expressed the wish to delve further into the matter.

It was evident from letters received that considerable interest had been created by the series on Modulation Technique.[1]

Several questions have been asked which are of general interest and this article may be regarded as a formal reply. A reader in Australia raises the following points, which are typical:—

"In his country the maximum input to the final (P.A.) stage is fixed at two watts, disregarding the power handling capabilities of the final stage, what is the best output available with each of the following systems: (a) C.W.; (b) Anode modulation 100% sine wave; (c) grid bias modulation 100%; (d) chopped carrier grid modulation; (e) 100% modulation of a push pull self excited oscillator.

The highest power output is, of course, obtained when the final stage is operated as a Class C C.W. amplifier. With high power valves it is quite possible to achieve efficiencies of 85% under practical conditions, i.e. when the stage is delivering power into the aerial.

However with the small valves in general use, for example 3A4 or 3V4 it is doubtful if 60% efficiency is ever exceeded. Even so, it should be possible to operate a 3A4 at 135v. anode supply and 15 m.A. mean current, a D.C. input of 2 watts and obtain 1-2 watts of R.F. output, provided that the grid excitation voltage is adjusted. For a more detailed description of Class C operation please read Terman[2].

The anode modulated amplifier is adjusted in exactly the same manner as the Class C amplifier, the R.F. output then has a linear relation with the D.C. supply voltage variations in which are provided by the modulator.

Example

If the same valve 3A4 is to be modulated, the D.C. voltage would be reduced by a half to 67½ volts and the modulator would then swing the applied voltage between 135v. at the peak to nearly zero at the trough. It is evident then that at the peak of the modulation cycle the peak power output would be exactly the same as for the Class C C.W. amplifier. The carrier power without modulation will be one quarter of the peak.

[See Nov., Dec., Jan. issues R.C.M. & E.]

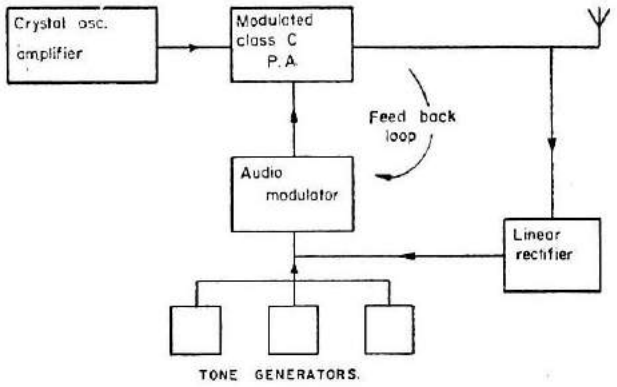


FIG. 1

With grid bias modulation, then the R.F. excitation, modulation and bias voltage are adjusted so that at the peak of the modulation cycle the stage is operating more or less as a normal Class C amplifier.

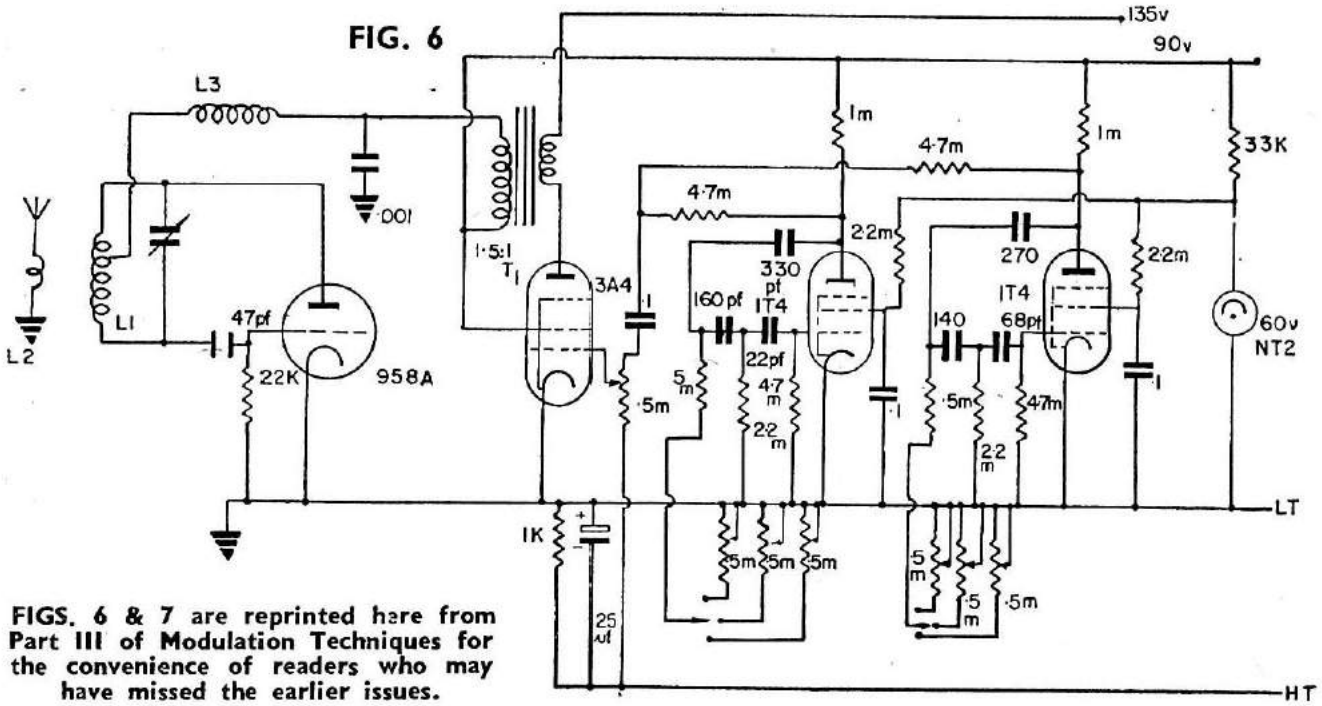
However since the modulation characteristic departs from a linear law when the valve is driven into grid current, it is usual not to drive it as hard as in the case of Class C C.W. or Anode modulation, as a result the available power output is somewhat less and the efficiency when modulation is absent is considerably worse.

In general the factors tend to prefer anode modulation, it is more linear, less critical to adjust and gives more output for a given size of valve, but as stated earlier in the series it requires a large modulator power.

The "chopped" carrier grid modulation system when unmodulated is a straightforward Class C C.W. amplifier and has a high power efficiency, but enough was said about this method in Pt. 2.

An anode modulated push pull self excited oscillator would be expected to give approximately the same output as a modulated Class C.P.A. for the same input conditions.

FIG. 6



FIGS. 6 & 7 are reprinted here from Part III of Modulation Techniques for the convenience of readers who may have missed the earlier issues.

The same reader also enquires about the amount of frequency modulation produced when an oscillator is anode modulation:—

The anode-grid capacitance of the valve, forms part of the tuned circuit and because of "Miller" effect the apparent capacitance is the actual physical capacitance multiplied by the gain of the stage modified by the phase angle of the load, i.e. C in = C a-g (1 + A Cos. θ).

The gain of the valve is dependent on Gm and Ra which vary with anode current which in turn is dependent on the supply voltage. So this apparent capacitance must vary as the applied voltage and the resulting frequency modulation is inevitable, and can be minimised only by using a high C tank circuit so that the fixed capacitance is large compared to the change in capacitance of the valve. It is fortunate that a high C tank circuit is necessary when the oscillator is required to deliver power.

It will have been realised that with all correct methods of modulation the increase in output during the crest of the modulation envelope is exactly balanced by the decrease during the trough, so that on a meter reading the average anode current of the P.A. stage

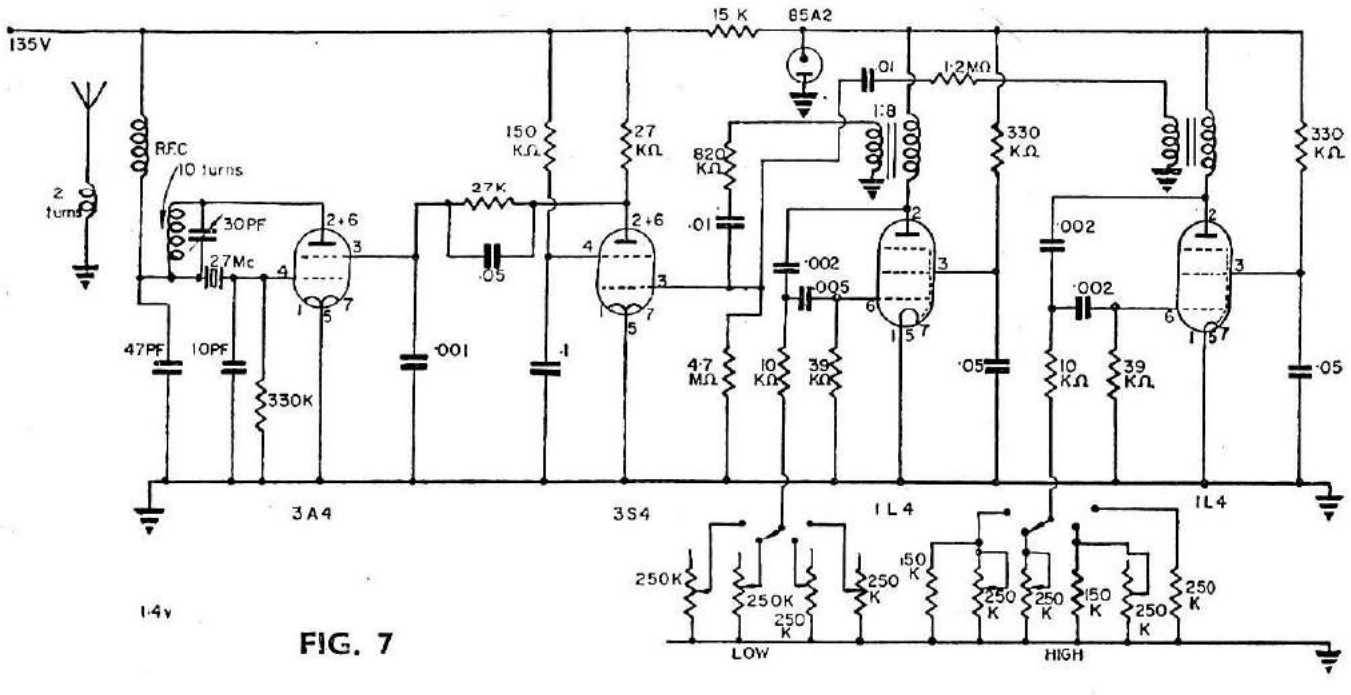


FIG. 7

would show no change during modulation. In fact, if a change should occur it indicates that distortion is taking place.

It will also have been noticed that the average D.C. input power to the P.A. is considerably less (about $\frac{1}{4}$) when used for modulation. Now if the output valve were capable of being driven to higher powers it would be possible to adjust the stage to have a D.C. input of 2 watts without modulation giving a carrier power of 1 to 1.5 watts which when fully modulated would have a peak output of 4 to 6 watts, yet there would be no measurable change in D.C. input, so it would seem that the Australian regulation of 2 watts input to the P.A. stage is open to abuse.

(A signal strength meter would, of course, register the increase in power and the British reader is reminded that we are limited to 1.5 watts effective radiated power.)

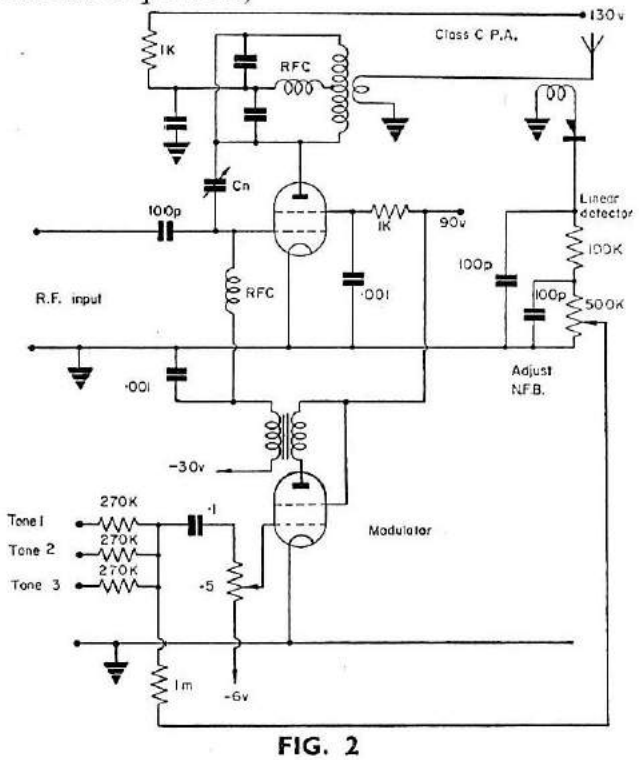


FIG. 2

Application of negative feed back to grid modulated Class C P.A.

Some interest has been shown in Fig. 7, part 3, which was used as an illustration of one of the better commercial approaches to correct modulation. In actual fact screen modulation is not as linear as grid bias modulation, but the distortion produced is far less than that produced by chopped carrier modulation. An obvious improvement could be effected by correctly biasing the grid of the 3S4 modulator using either fixed battery bias or automatic bias as in the transmitter shown in Fig. 6, part 3. The optimum value could be found by experiment but it would be from 3-6 volts.

The Use of Negative Feedback in Tone Transmitters

It is possible to use negative feed back in tone transmitters which improves the modulation envelope of the R.F. output as N.F.B. in audio amplifiers improves the audio output.

A simplified block diagram demonstrating the layout is given in Fig. 1. It will be seen that a small portion of the R.F. output is rectified to produce a small audio voltage which is applied to the input of the audio modulator. As in audio amplifiers it is essential to observe correct phase relationships otherwise the possibility of oscillation is introduced. A practical circuit is given in Fig. 2, the experimenter is advised to commence with small amounts of N.F.B.

The use of N.F.B. is particularly useful where high efficiencies are required from systems which normally would become non-linear at these levels, i.e. grid or screen modulation. On the other hand N.F.B. must not be regarded as a general cure for all transmitter troubles and should not be relied on to compensate for bad design, i.e. N.F.B. will not prevent distortion due to over-modulation, which is the kindest way of referring to chopped carrier systems.

Last month's graph for checking wing loading was designed by Ernie Reuther and was reprinted from "Printed Circuit" (newsletter of the North Jersey Radio Control Club). This credit line was omitted from the bottom of page 183, *where the graph appeared.*

"Feedback"

Comments from our readers

M. S. Seaman gives his views on two further subjects: Overhead wire interference and contact oil.

IN the December, 1960, issue you comment on the loss of control of radio controlled aircraft when flying near overhead wires, but do not give a satisfactory explanation.

The reason is that any conducting medium will have voltages induced in it by any radiated signal. If the material has a low resistivity and its dimensions are not small compared with a wavelength of the signal concerned, these voltages will cause currents to flow in the medium, and in turn these currents will radiate a signal, which will interfere with the original signal.

In some cases, these re-radiated signals can be put to good effect; in fact this is precisely how the reflector and director rods on T.V. aerials work (the sizes and positions have to be calculated to suit the frequency concerned a 10% error may be enough to cause them to give exactly the opposite effect to that desired). In the majority of cases, the result is usually inferior reception the effects being apparent in different ways. T.V. viewers are probably familiar with "ghost pictures" and a form of jitter known as "aircraft flutter" when an aircraft flies low near the receiver; both these are caused by multipath transmission when the re-radiated signal picked up by the receiver is comparable in strength to that picked up by direct reception of the transmitter.

If a radio control transmitter is operated near any overhead wires, then re-radiated signals from the wires are almost certain, and there will consequently be difficulty in maintaining control of the model. In general, no hard-and-fast prediction of how this re-radiated signal will interfere with control of the model is possible, since much depends on the type of modulation signal, the polarisation of the radio waves and the size and relative spacing of the wires causing the trouble.

If a carrier operated system is used, serious interference is unlikely unless the wires lie between the transmitter and the model. With a tone-operated receiver beats produced between the direct and re-radiated signals can easily cause spurious operation of the sub-carrier circuits.

These effects are independent of the voltages on the overhead wires causing the trouble for, in general, there will not be any discharge from the wires which would cause interference with model-control receivers. However, the larger diameter, spacing between wires and height above ground of e.h.t. lines (66kV. and above) make them potentially greater sources of trouble than low-voltage and telephone lines.

★ ★ ★

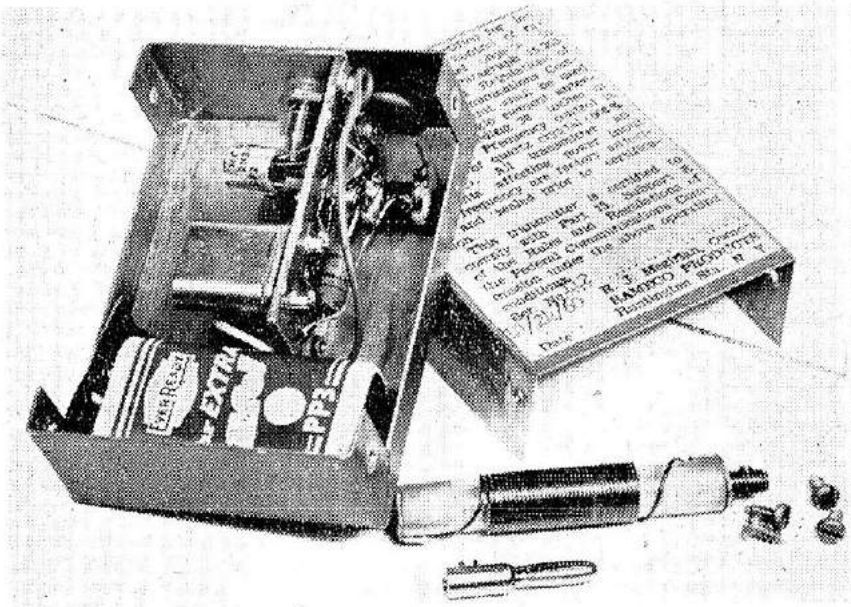
A second comment from the same pen relates to the use of contact oil on relay points.

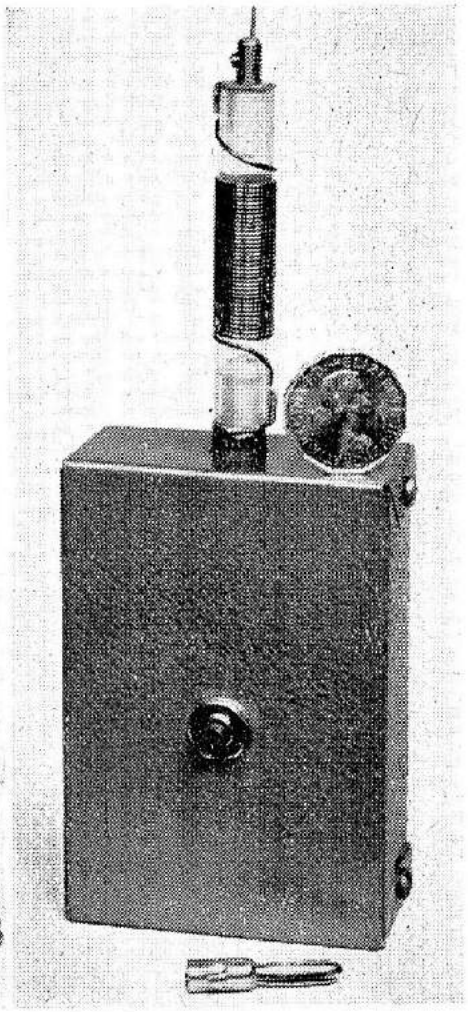
On page 23 of the January, 1961, issue you printed an article concerned with the oiling of contacts. Although I have not used the Electrolube oil myself, I would like to point out that similar switch cleaning oils are unsuitable for use on relay contacts—at least, if they are used, they must be cleaned off afterwards, since the comparatively small force available is usually unable to force the oil from between the contacts when the relay operates.

On rotary wafer switches where there is a rubbing action between the live parts after contact initially occurs, the use of such oils, which are usually non-conductors, in removing dirt and oxides from the contact area, and protecting the contacts from further oxidation, is quite useful. However, with relay contacts (and microswitches) there is no relative motion and it is necessary to rely on contact pressure to force the oil away from the contact area before continuity can be established.

There is another disadvantage in using these oils, in that they will collect dirt, just like any other oil, if allowed to accumulate on exposed surfaces.

Rameco Miniature Tx.





MALCOLM DOUGLAS sent this little . . . but *little* carrier transmitter along for our comments.

It is about the tiniest Tx. we have seen, and appeared to be the ideal model for a spot of party trickery when concealed in the pocket. Without the aerial, but with the loading coil supplied provides about 10 feet range with a very short aerial on the receiver.

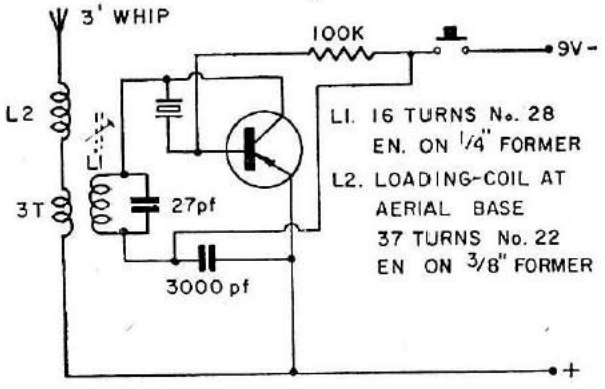
Naturally, we checked extreme range and using a Babcock Magic Carpet Rx., found that the field fell off sharply at 400 feet. Perhaps this could be increased by fitting a tunable load coil and a counterweight "tail" to augment the small area of the metal case, although one presumes the designer has already experimented to find the best load/aerial combination. The instructions state that an aerial length of three feet, but not exceding five feet should be used, which does give one the opportunity to try various aerial lengths to obtain the best matching.

The circuit, illustrated here, is extremely simple and is crystal controlled. A nine volt deaf-aid battery provides the power (40 m.A.). Inspection of the inside revealed some unused space even at this diminutive size, in fact there seems to be no reason to suppose that a *half size* version could not be built.

The aluminium case is sprayed metallic blue and carries a centrally placed keying button, price inclusive of loading coil and a separate aerial adaptor is 117/-.

Why not have one in the model, keyed automatically by a switching mechanism which upon receipt of a particular tone would monitor flight information and transmit it back to the operator for a predetermined number of seconds. It would be necessary to cut the main transmitter completely during this monitoring period, but control could be resumed immediately in an emergency.

In fact this Tx. has prompted us to dig up an experiment started a number of years ago, but shelved until a light enough transmitter was devised.



Odiham Report...

Two pages of pictures overleaf

COMPETITORS who had trimmed in the glorious weather on Saturday were greeted by an overcast sky and a cold bleak wind, the intensity of which proved unsettling for a number of fliers who had obvious difficulty in executing their loops and bunts in the same piece of sky, in fact several of the consecutives changed axis, finishing at right angles to the wind.

Chris Olsen with his new tricycle U.C. "Uproar", showed that suitable allowance could be made for the wind, in a delightfully smooth flight pattern which was executed at rather lower altitudes than that flown by his fellow competitors. His usual skill and familiarity with the machines amassed 3,117 points to put him in top place.

Frank Van de Bergh was flying his well proven "Sky Duster" with characteristic polish to make second place with 2,410 points. The combination of well tried model and pilot's lengthy experience with the controls in all conditions contributed to the first three places. Ed. Johnson collected 1,893 points for third position with "Skylark". We noted Ed. had trimmed his elevators . . . with a razor blade.

One of the nicest shapes we have seen in the sky was P. Brown's "Thunderhawk", decidedly "Spitfire-ish" in wing planform, with high aspect ratio ailerons, modified to their present form and hinged on plain wire and tube bearings to avoid flutter which had affected test flights.

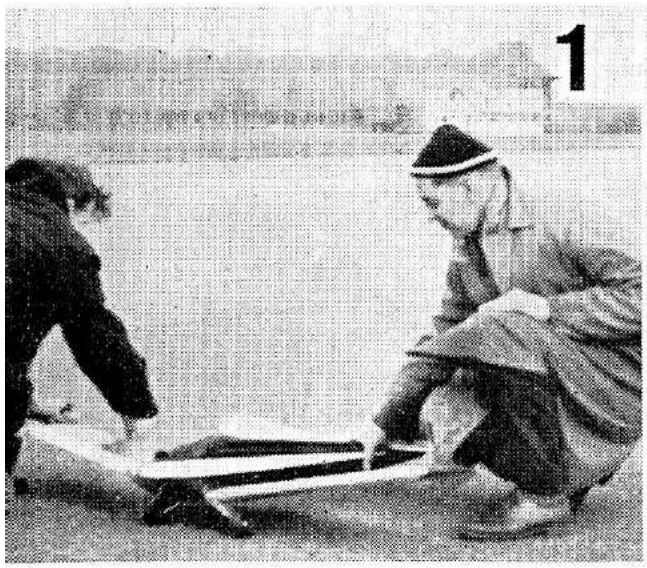
Charles Ryall gave a spirited display but was handicapped by the fact that he could only use rudder and elevator to maintain inverted; in fact the model rolled out during the second round flight.

Walker's "Voltswagon" had to be hand launched after it was discovered that the steerable nosewheel was not steering in the appropriate direction. This model was powered by a Super Tigre .56 and used a Merco barrel throttle with a home built exhaust restrictor.

The only unlucky flight of the day was that made by Paul Rodgers who lost all response just after take off, which spread the "Orion" over a considerable area of grass.

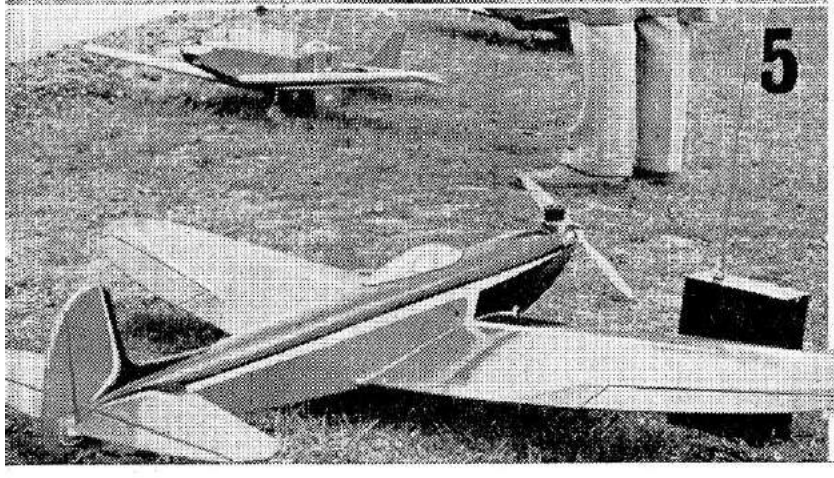
It had been intended to hold a single control event, but the wind proved too strong and only two entrants (G. White and R. Yates) appeared for their flights. Two noticeable points were the use of a "prompt" man at the elbow of most of the competitors (possibly in view of the fact that the new F.A.I. schedule was being used) and the high percentage of Orbit 10 outfits.

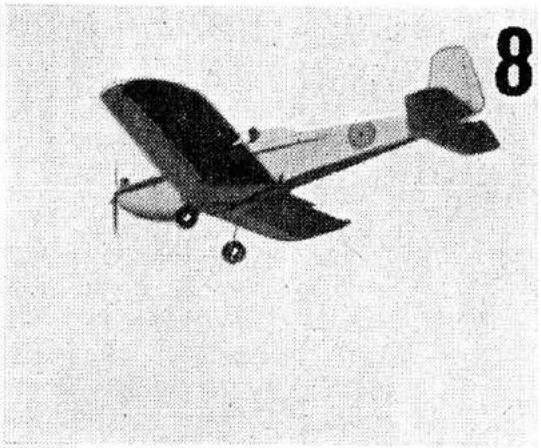
A fly for fun session was held after, in which Charles Ryall sanded his wingtip on the runway, as this was intentional, we may yet see "Ratteler" with a modified U/C placed to accommodate this manoeuvre.



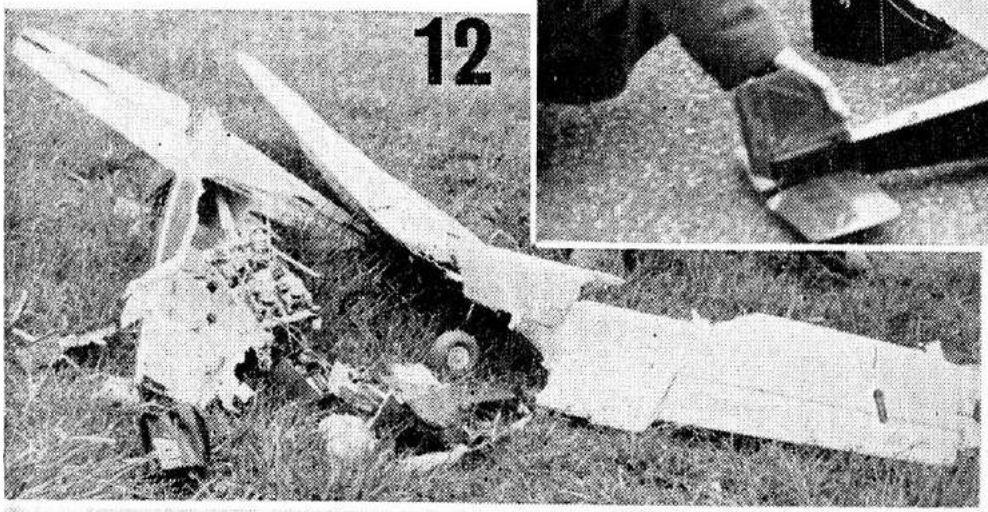
ODIHAM MEETING

1. Frank Van De Bergh lends a hand. 2. Winner Chris Olsen need not have looked so worried. 3. The Voltswagon nosewheel that caused trouble. 4. Charles Ryall prompts for B. Leach. 5. Clean lines expressed in Thunderhawk. 6. Walker tanks the Voltswagon.



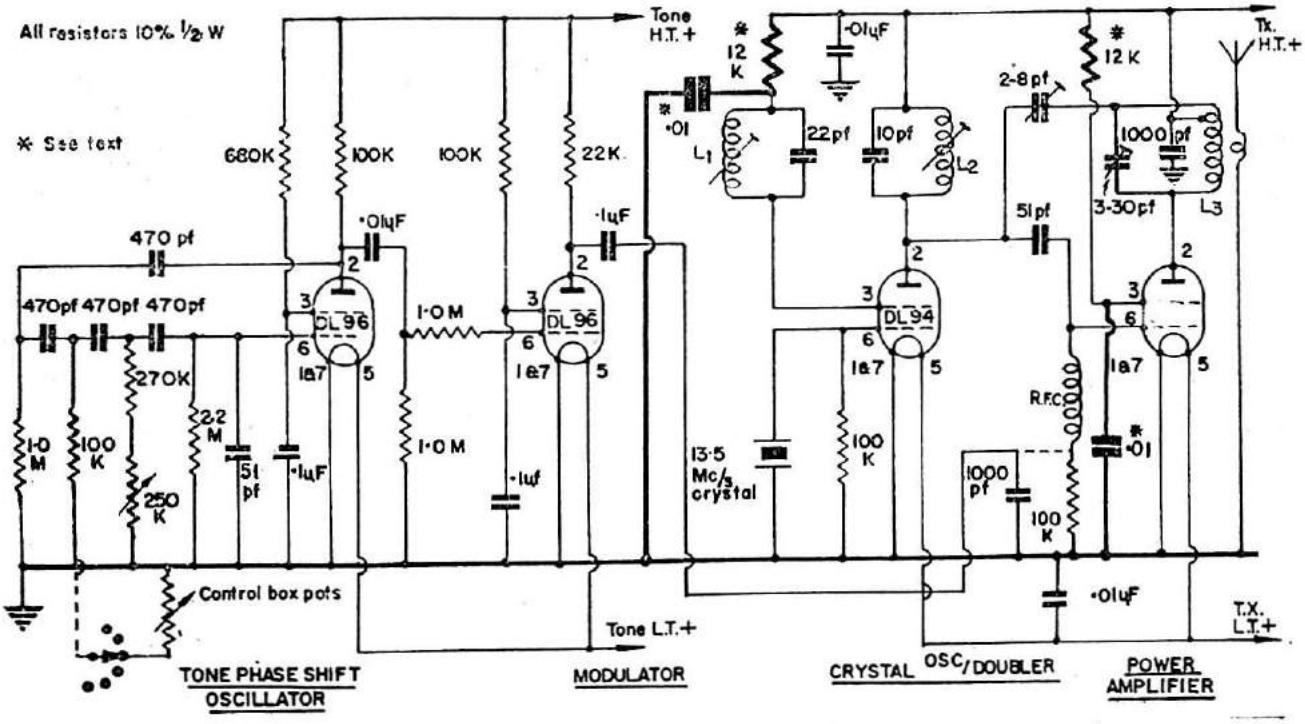


7. Yes it WAS cold, Morton's fuel can was most appropriate beside his Astro Hog, seen landing "dead stick" in 8. 9. Charles Ryall with what might still be called a hand held transmitter. 10. Two wind-swept judges George Honnest Redlich and "Rushy". 11 & 12. Beginning and end of Paul Rodger's flight with "Orion".



Modifying the "Hill" Tx.

The "Hill" Tx. design was first published in the August, 1960, issue of R.C.M. & E. There have been many requests for details of mods. required to use a 3V4 (DL94) valve for the P.A. instead of the specified 3A4 (DL93). Designer Eric Hill has produced these for us and in addition gives a couple of minor mods. which he has found improve the performance of the Tx.



1. The lowering of the screen voltage on V3, the oscillator/doubler stage, by means of a 47K. resistor, decoupled to chassis with a .01 mfd. capacitor results in a drop of some three to four milliamps in the total H.T. current and also flattens the tuning of the osc. coil L1 to some extent. This is achieved without any loss of drive. All that is required is to:—

(*a*) Unsolder the two H.T. leads from tag 4 of L1 and replace with a new lead direct to the H.T. end of L2 (i.e. by-pass L1).

(*b*) Connect a 47K. ½ watt resistor between the H.T. end of L2 and tag 4 of L1.

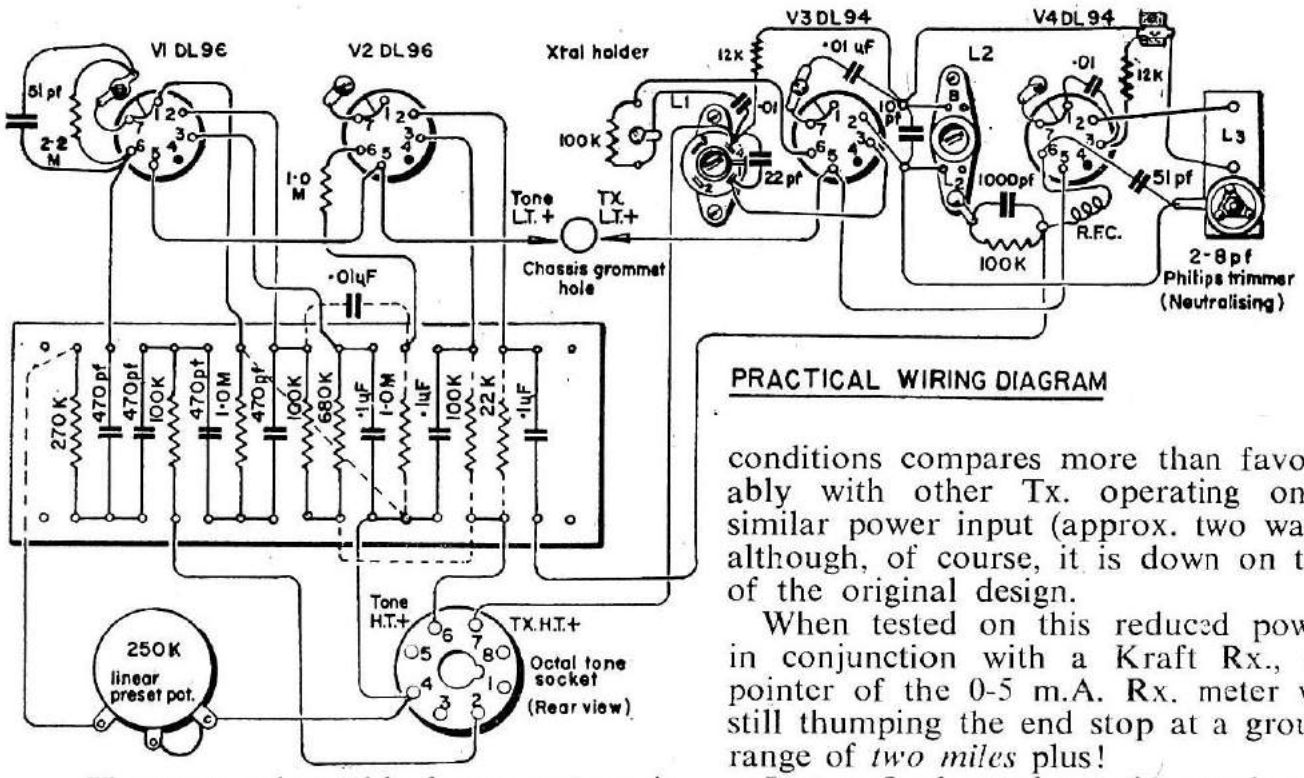
(*c*) Connect a .01 mfd. capacitor between tag 4 of L1 and chassis, (The crystal earth point is handy for this connection.)

The dust core of L1 is adjusted for maximum dip and is then backed off on the gentle slope side by unscrewing the core (if viewed from the underside) until the current rises by *one* milliamp (instead of the three milliamps originally).

2. This second mod. only calls for the reduction of the aerial coupling from two turns to one and a half turns. This reduces the loading on the P.A. slightly and improves the efficiency.

The R.F. power output of the Tx. may be more than is really necessary to ensure control of the model. This depends entirely on the distance over which control is required and the type of Rx. used. Some of the four-stage transistorised Rx. are extremely sensitive for instance and a reduction in R.F. output with its accompanying saving in H.T. current drain is well worth consideration.

Having done the two mods. just described, the total H.T. current with a ¼ wave aerial and 3A4 P.A. stage will be approx. 27 m.A. This can be reduced to approx. 20 m.A. if a 12K. ½ watt resistor is used to lower the screen voltage of the P.A. (V4), and is decoupled to the chassis with a .01 mfd. capacitor.



PRACTICAL WIRING DIAGRAM

However, when this lower output is adequate, it is more economical to use a 3V4 for the P.A. stage. A 12K. resistor and .01 mfd. capacitor are used (as for the 3A4) but the R.F. choke and 51 pF. must now go to pin 6 instead of pin 4.

The *total* H.T. current is now only 16 or 17 m.A. and the L.T. current is reduced by 100 m.A. by way of a bonus. The R.F. output under these conditions compares more than favourably with other Tx. operating on a similar power input (approx. two watts) although, of course, it is down on that of the original design.

When tested on this reduced power, in conjunction with a Kraft Rx., the pointer of the 0-5 m.A. Rx. meter was still thumping the end stop at a ground range of *two miles* plus!

Just a final word on the much misused 3V4 valve. It is rated for a maximum H.T. of 90 volts and maximum cathode current of 12 m.A. so although it offers no strong objections to an H.T. of 120 volts (and is commonly used on 135 volts) do limit the cathode current to 12 m.A. by accepting the lower output and including the 12K. in the screen, otherwise use the 3A4 which is designed for the job.

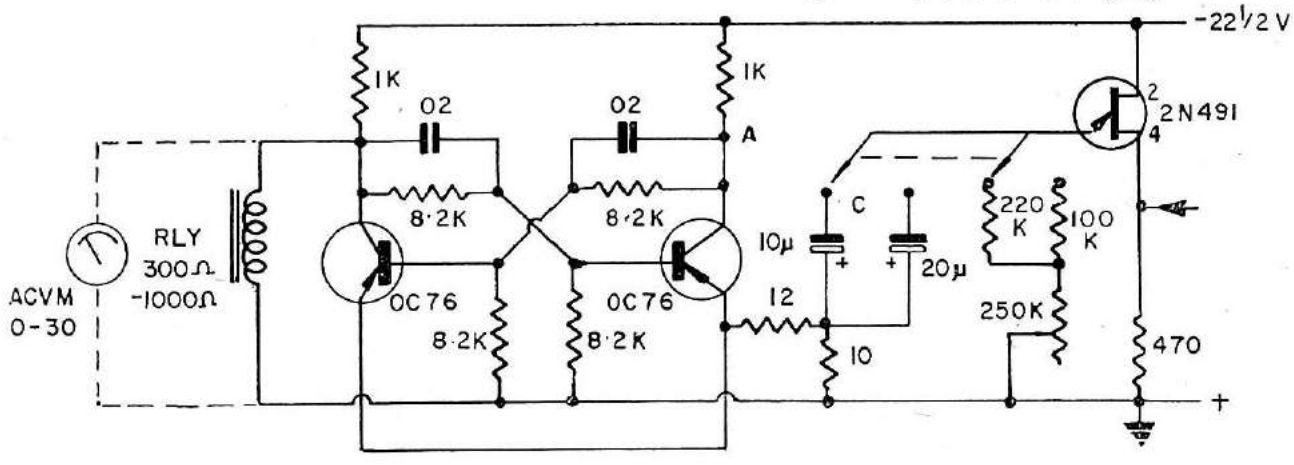
Pat's Pulser

A TRANSISTORISED PULSE UNIT

By PAT WHEELER

This Unijunction-triggered flip-flop—shown here—gives absolute square wave variable from 1 pulse per 20 secs. to 2½ pulses per second; by variation of pot. and capacitors "C" can go as high as 100 KC. With signal fed to sync. point can be used as electronic counter, 0-30 V. A.C. Meter.

Circuit information has been adapted from G. E. data sheets. The 2N491 is expensive but efficient, requiring no high capacities for "normal" operation, it is very economical in layout space; circuit shown goes into 2½ in. x 3⅛ in. x 1 in. (built as Motor Trials Pacemaker, it adds up mileage at whatever speed is set to be averaged).



BOOK REVIEW

(Continued from page 242)

structional details are included with suggested values for components and advice on how to use the unit when completed.

Taken at random one finds the simple crystal receiver, a tubeless tone oscillator, a sensitive AF/RF signal tracer and a receiver for model control.

On the whole a useful book for the shelf. It can provide the answer to problems which arise and might well suggest a line of experiment.

Radio Controlled Models for Amateurs, No. 133.

By J. M. Kerney. Bernards Publications Ltd. Size, 9¾" x 7¼"—semi-stiff glossy cover. 58 line drawings and 73 pages. Price 5s.

BERNARDS have published a number of books dealing with electronic theory and practice and the present book is a minor departure into the field of model control.

It is intended in the main for the person who knows little or nothing about electronics and deals with the subject in a non-technical manner, referring only to simple theory where necessary in describing a particular system. There is a complete absence of mathematics and the average reader will not find it difficult to follow.

Chapter 1 describes the various systems available to the amateur constructor. Chapters 2 and 3 deal with individual receivers and transmitters. Chapters 4 to 6 give details of the various methods of converting the received signal into a movement of a control. From the simple self-neutralising actuator to multi-channel reed or choke systems the book includes sufficient information to enable the would-be constructor to proceed with the assurance that a satisfactory result can be achieved.

Detailed drawings of individual units are given so that the "do it yourself" merchant can make most of the parts of a complete system.

The number of pages obviously limits the amount of detail which can be provided but there is ample for the purpose for which the book is published.

It is intended for the less knowledgeable and it would have been an advantage to have an explanation of the symbols used in the theoretical circuits or perhaps some practical diagrams which the uninitiated find easier to follow.

Query Column

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

AFTER I have read the article about "305" all transistor super-regen. receiver in July issue, I am very interested in that circuit especially as you stated that it can work for low resistance reed work. Unfortunately, I have waited for months but I cannot find any further article concerning "305". Would you please give me a modified circuit for using reed and also state what resistance of the reed coil is suitable.

I am unable to get SB305, V10/50A, V10/15 and V15/20IP in local radio shop but I can get OC series such as OC170, OC71, etc. Please show me OC series transistor instead and explain any change if required by using substitution of other type transistors.

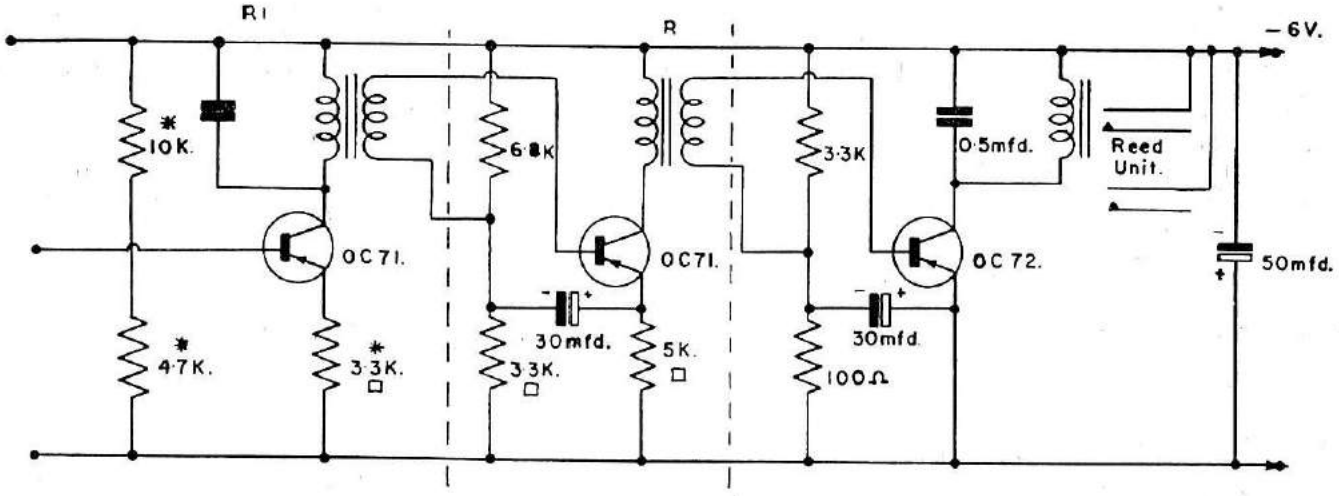
I am planning to build a multi control system. Would you please give me your suggestion to which receiver and transmitter with simultaneous control are the best for home-made. I like all transistor receiver and transistorised transmitter.

If it is possible, I wish you would publish a series of articles of building multi Rx. and Tx. with simultaneous control by step in your coming issue.

T. C. K., HONG KONG.

A suggested circuit modification to adapt the "305" receiver to reed operation is given here. You will appreciate that time limitations make it impossible to give more than circuit forming the basis of experiment and component values may need a certain amount of trial and error to arrive at the optimum.

Transistors to take the place of (not direct substitutes) the SB "305" are OC



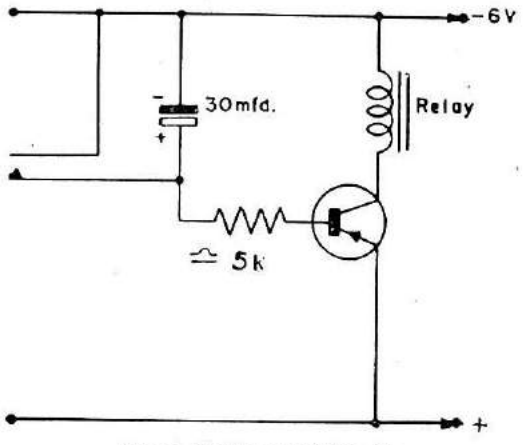
305 Circuit Modification.

170. V10/50A—OC71 and V10/1s—OC76 (this in original circuit).

You may find that you need a six volt supply to get the OC170 to work. Due to the low voltage it will be necessary to follow each of the reeds themselves as this low voltage is not enough to operate a relay direct.

It is suggested that you rewind an E.D. or R.E.P. reed unit with 38 or 40 s.w.g. wire to give a resistance of between 150 and 200 ohms.

The relays could be about 100 ohms. Other than the substitution of the OC170 the circuit is unchanged up to and including the collector circuit of TR 2.



Reed Follower Circuit.

I WISH to fit a milliammeter to my E.D. Black Prince/6 Tx. I have an 0-5 m.A. meter, 1½ in. diameter purchased from Service Trading Co., Kingston-on-Thames, who advise me that they cannot undertake modifications.

Can you please tell me what resistance is necessary to enable the m.A. meter to register 0-20 m.A. and also how to wire it? The meter is a M.C. type stamped 10 AR/2562, and has been advertised in "Model Maker".

G. R. T., TYNEMOUTH.

The value of the parallel resistance for your 0-5 m.A. meter will depend on the resistance of the meter.

If you have access to a meter of the correct for calibration it should be placed in series with the meter under test. A short piece of resistance wire (say 260) should be connected across your meter terminals and its length varied until the reading coincides with the standard meter. Note that a resistance suitable to the battery used should be in series with both meters. A variable resistance will enable you to obtain the required current in the circuit.

If no meter is available connect as above without the standard meter but leave out the parallel resistance. Adjust the variable resistance until you have a reading of say 4 m.A. Connect the resistance in parallel with the meter terminals and vary its length until the reading is 1 m.A. Any reading on the meter will be multiplied by 4 (i.e. full scale reading of 20 m.A. instead of 5 m.A.).

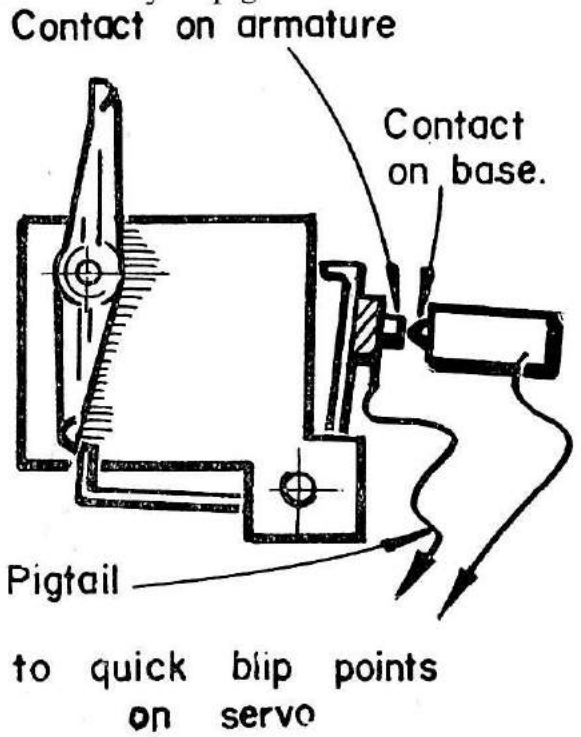
The voltage applied should be low in order that the series resistance used to adjust the reading is of low value.

IS it possible to modify the "305" receiver so that it can be used for the "quick-blip" method of motor speed control?

I would like to use my F.R. Compound Actuators to provide motor speed control but have no "back-contact" as on a relay to provide the return lead connection from the motor actuator.

T. J. S., EXETER.

You can use the armature of the compound actuator to get your "back-contact". Simply solder a small piece of silver wire or plate, or contact from an old relay to the side of the armature that engages the nylon arm when the actuator pulls in. Now fix the other contact to make with this when it drops out, the circuit through these contacts can only be complete when no current flows through the actuator. If necessary to insulate the contact on the armature from the body of the actuator, fit the contact on to a piece of fibre and then stick this to the armature with Araldite adhesive, connection can now be made by a pigtail of flexible wire.



I AM building a Parker Bell 14-6 *and am fitting S/C radio in it. My problem is connected with the aerial; if the aerial as suggested comes through the cabin top and on to the Burger mast and back to a post on the centre of the stern, the removal of the cabin top will interfere with the aerial and will make tuning, etc. rather difficult. I thought that if the aerial was brought out of the cabin side and formed a rail round the bows it would eliminate the above difficulty,* BUT *the aerial might be splashed in that position (I am afraid I do not know whether this is harmful) and also it would not be so high up as before. Please can you tell whether my idea is alright, if not, please can you suggest a way which would be suitable for my model. It is built from M/M plans and is powered by an A.M.* 15.

M. R., IPSWICH.

One solution to your problem is to arrange for the aerial to lead out through the rear of the cabin but in this position it may impede starting of your motor. Another is to use an electric motor for drive but you may have interference troubles and housing the drive battery may be a problem.

The best solution would be to use a whip aerial projecting from the front of the cabin in a vertical direction.

The height of the aerial is not all that important providing you have sufficient power in your transmitter to cope with reduced sensitivity, but to place it round the rail is not so good as in a wet state the pick up would be greatly reduced due to partial earthing.

I AM building a scale R/C aircraft, and for reasons of appearance I do not wish to use the normal shorting plug in the meter socket.

I have read that this can be achieved by permanently connecting a resistor across the socket.

Could you please tell me the value of this resistor? (I am using an Aeromodeller Transistor Rx. with an E.D. bleep relay).

R. A. J., MORETON.

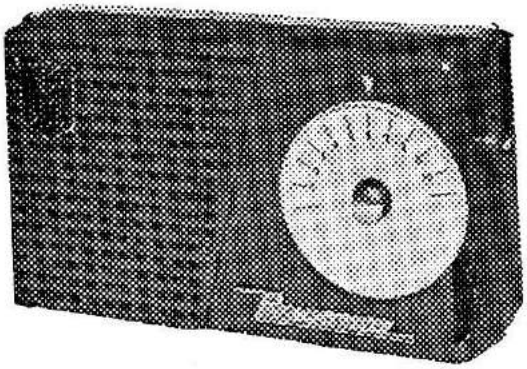
It is quite correct that it is possible to permanently connect a resistor across the meter socket to avoid using a shorting plug. The resistor will, however, act as shunt on the meter so that the meter will need recalibrating with the resistor to be used.

With the "Aeromodeller" Transistor Rx. a resistance of 100 ohms would be suitable and if the meter has a resistance of less than 10 ohms (marked on the face) the error involved will be small enough to be ignored.

Another way to avoid the use of shorting plugs is to use a closed circuit phone jack and plug, then when you remove the plug the jack automatically shorts itself. You can get Bulgin miniature and sub-miniature jacks and plugs (types P519/J30 and P523/J33) from: Home Radio Ltd., 187 London Road, Mitcham, Surrey. I am not certain if the sub-miniature component is available as closed circuit type but the miniature certainly is, and would only need *one* very small hole for mounting. (And meter calibration is unaffected).

TRANSISTOR POCKET RADIOS

MOST EFFICIENT R.F. CIRCUIT



Circuit comprises 2 h.f. transistors reflexed to equal 4 stages. Permanent germanium diode and high gain a.f. output stage, fitted with miniature speaker, proper tuning condenser, volume control and in case (less monogram), completely portable. No aerial or earth required. Pocket 3 uses 2 transistors and 1 diode, **27/6.** Pocket 4 uses 3 transistors, and 1 diode, **42/6.** Pocket 5 uses 4 transistors, diode and feedback, **52/6,** post and ins. **2/6.**

★ **Results proved in all areas. Components guaranteed for 12 months.**

★ **Plans free with parts, or separately 1/6.**

More details S.A.E.

Transistors for R.F., F.M., T.V. and U.H.F.	
Frequencies quoted are approx cut-off	
SB 078 15-20 Mc/s	**8/6**
SB 305 20-30 Mc/s	**9/-**
SB 231R 40-50 Mc/s	**15/-**
AMERICAN 2N1727 100-150 Mc/s	**15/-**
AMERICAN 2N1728 100-150 Mc/s	**12/6**
AMERICAN T1832 1000-1300 Mc/s	**25/-**
AMERICAN T1833 1000-1300 Mc/s	**25/-**

Read these testimonials
THE ORIGINALS MAY BE SEEN AT THIS OFFICE

Mr. S. Rigby-Jones, South Molton, N. Devon. — "I was delighted to receive my Pocket 4 Transistor set. After I assembled and tested it I was amazed such a small receiver had such good reception".

Mr. E. Balcombe, Manchester.— "I have constructed your Pocket 4 Loudspeaker radio and am delighted with its performance and appearance. For the cost I consider it excellent".

Mr. R. Belt, Newcastle-on-Tyne. —"I have built your Pocket 5 Transistor set. I am very pleased with it".

Mr. A. J. Simmonds, Welling, Kent.—"I purchased from you a week ago the Pocket 4 Transistor Kit. I put it together last night in 1½ hrs. On switching on the set, I was right on Radio Luxembourg. I must say thank you, because not only has the set a very attractive appearance, it also behaves fantastically".

ELECTRONIC PRECISION EQUIPMENT LTD.

★ Orders received by post are despatched from our warehouse, **Dept. T, 66 Grove Road, Eastbourne,** and to save time, please post your order to this address. Please include enough for postage. Callers, however, should use one of the following addresses :

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Electronics (Finsbury Park) Ltd., 29 Stroud Green Road, Finsbury Park, N.4.
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E.D.

equipment is recommended for the KeilKraft 'Super 60" Kit for Radio Control

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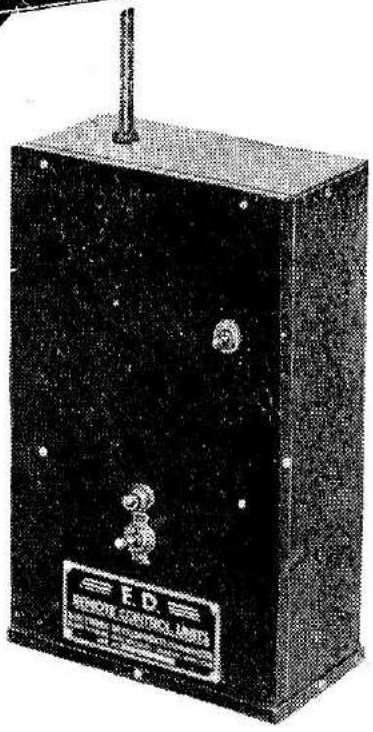
Single Channel Tone Transmitter (Standard or Crystal controlled) is the ideal beginners unit and may be used with any receiver operating on a tone of 300 to 600 cycles per second. Normally supplied as a companion to the **BLACK ARROW/1 RECEIVER.** Transmitter Size : 9¾" long x 6½" wide x 3⅛" deep. Weight including batteries: 5 lbs. Receiver Size : 2½" x 1½" x 1⅝". Weight only 3 oz.



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ELECTRONIC DEVELOPMENTS (SURREY) LTD.

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SPECIAL OFFER to R.C.M. & E. readers. P.P.N.2. Vibrator Trans/Receiver on chassis, 200 mc/s approximately. Consisting of two Self-Rectifier Vibrator units, 2 volt input with four outputs; 29v.—77v.—162v. at 50 m.A., 480v. at 30 m.A. approximately. The whole unit mounted on chassis 9 in. x 7 in. and containing 9 B79 valve holders, tuning condensers, two sets of worm and spur gears, switch, full wave rectifier, transformers, sockets, lead-through insulators, dozens of resistances and condensers, etc. New condition, all for 7s. 6d. plus 3/6d. postage. Instruction manual for above, fully illustrated, 2/6d. post free.—ARTHUR SALLIS (Radio Control) Ltd., 93 North Road, Brighton, Sussex.

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TAPLIN TWIN

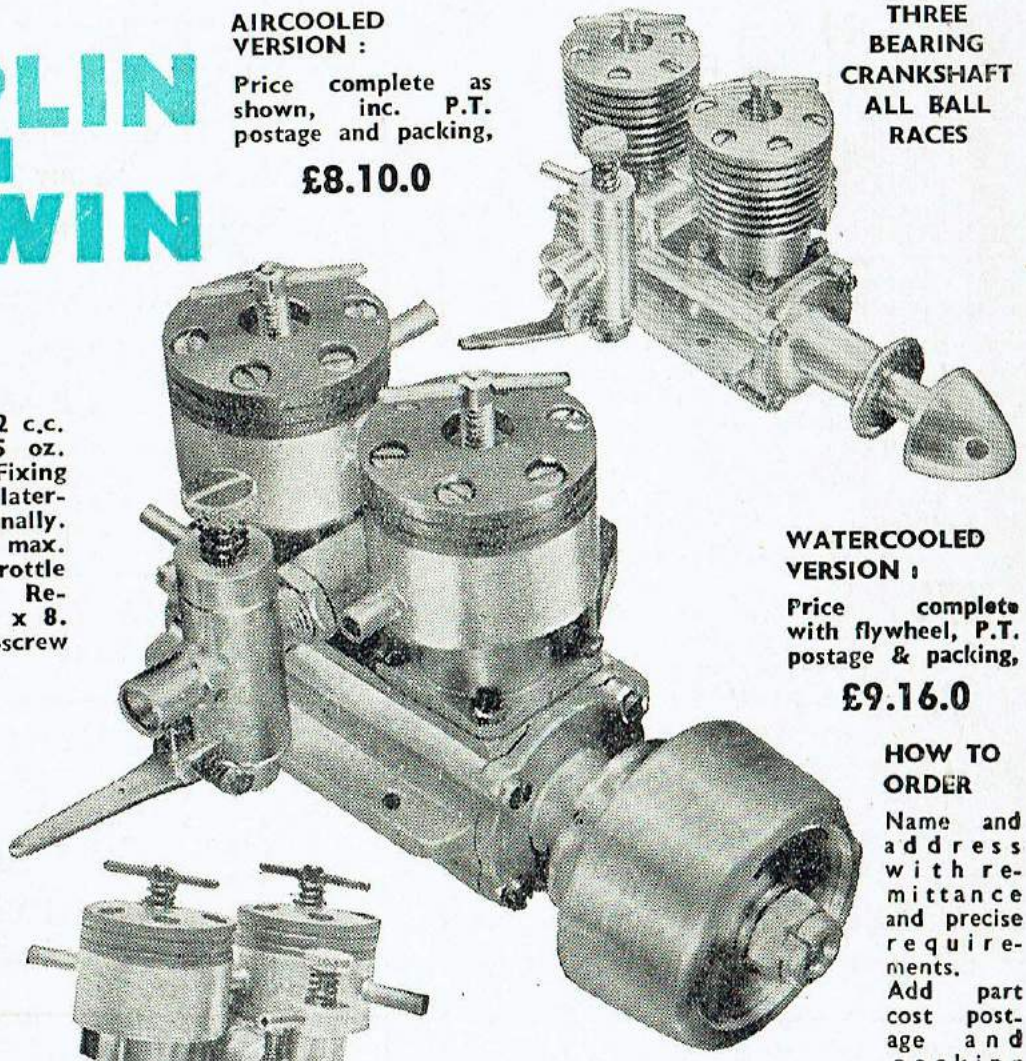
British Patent No. 747742

AIRCOOLED VERSION :

Price complete as shown, inc. P.T. postage and packing,

£8.10.0

THREE BEARING CRANKSHAFT ALL BALL RACES



VITAL STATISTICS :

Capacity: 7 c.c. (6.92 c.c. actual). Weight: 15 oz. Engine bearers: Fixing holes 1½ in. centres laterally and longitudinally. Max. height 3½ in., max. width (excluding throttle toggle arm) 2⅛ in. Recommended prop. 13 x 8. Recommended water-screw 2½ x 2½ (2-blader).

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WATERCOOLED WITH FORWARD FLYWHEEL

for more convenient starting is also available, price, inc. flywheel, P.T., postage and packaging.

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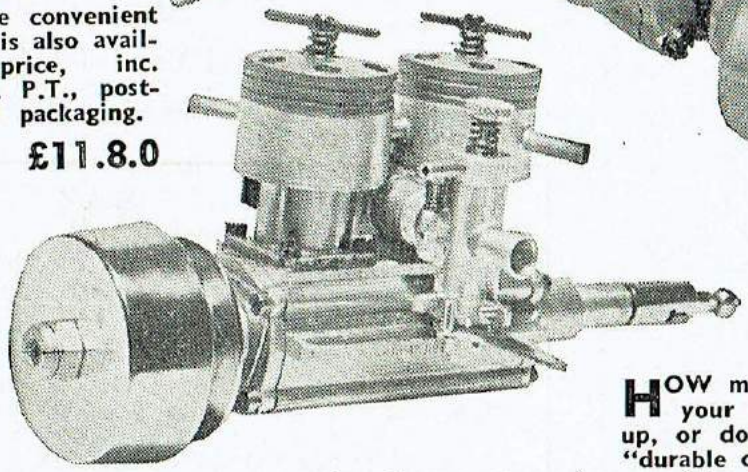

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