★★ 25TH Birthday Number ★★

1/3

PRACTICAL MECHANICS

EDITOR : F. J. CAMM

OCTOBER, 1958

A Transparency Viewer and Projector

CONTENTS

The Flamemaster* hand torch

** FLAMEMASTER is the registered trade name of STONE-CHANCE Ltd.*

The Stone-Chance FLAMEMASTER is now distributed only by *Buck and Hickman Ltd.*

This famous little tool remains unchanged in design and invaluable for all glass working, brazing and soldering. It is still made by Stone-Chance, but your enquiries and orders should now be addressed to:—

BUCK & HICKMAN LTD.

2 Whitechapel Road, London, E.1
also at Birmingham, Bristol, Glasgow, Leeds and Manchester
Stone-Chance Ltd., 28 St. James's Square, London, S.W.1

MAKE SOUND JOINTS SIMPLY BY USING Multicore

Wherever precision soldering is essential, manufacturers, engineers and handymen rely on MULTICORE. There's a MULTICORE SOLDER just made for the job you have in hand. Here are some of them.

ERSIN MULTICORE

Contains 5 cores of extra-active, non-corrosive Ersin Flux. Prevents oxidation and cleans surface oxides.

SIZE 1 CARTON
4 specifications for radio enthusiasts.
5/-

HANDYMAN'S CARTON
Suitable for 200 average joints. **6d.**

SAVBIT TYPE 1 ALLOY

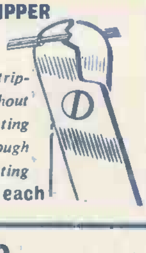
A specially formulated alloy to reduce the wear of soldering iron bits. Contains 5 cores of non-corrosive Ersin Flux and is ideal for all soldering purposes.

SIZE 1 CARTON
5/-
Available in three specifications.

HOME CONSTRUCTOR'S 2/6 PACK

In addition to the well-known Home Constructors Pack (containing 19ft. of 18 s.w.g. 60/40 alloy) a similar pack is now available containing 40ft. of 22 s.w.g. 60/40 alloy especially suitable for printed circuits.

BIB WIRE STRIPPER AND CUTTER



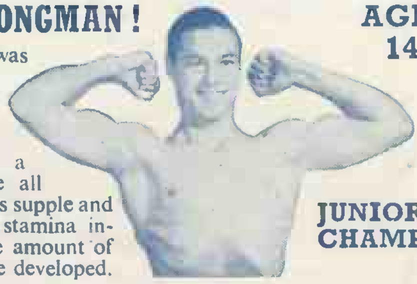
The 3 in 1 tool. For stripping insulation without nicking wire, cutting without leaving rough edges, and splitting extruded flex. 3/6 each

MULTICORE SOLDERS LTD.,
MULTICORE WORKS, HEMEL HEMPSTEAD, HERTS. (BOXMOOR 3636)

SCHOOLBOY STRONGMAN!

AGE 14

Malcolm Baker (right) was encouraged to take up Maxalding by his father to increase strength and improve his physique. He has since developed into a champion athlete, because all muscle built by Maxalding is supple and fast, and both speed and stamina increase in proportion to the amount of muscle developed.



JUNIOR CHAMP.

BIG GAINS AT 37!

Postal Pupil S. J. Noller (left) wanted a heavyweight development when he started Maxalding at 37 years of age. He reported at the conclusion of the course: "Chest now 45½ in. Weight 13 stone 5 lb. I shall continue to tell all my friends of the benefits to be gained from Maxalding."

COMPREHENSIVE INSTRUCTION

Maxalding courses are planned and prepared in accordance with individual requirements and cover a wide range of instruction for muscle development, height-increase, speed, strength and stamina training, fat reduction, etc. etc.

FREE EXPLANATORY LITERATURE

PROFUSELY ILLUSTRATED EXPLANATORY LITERATURE showing nearly 200 photographic reproductions of pupils from 14 to 65 years of age will be sent WITHOUT COST OR OBLIGATION on request. All Maxalding literature is dispatched in sealed covers free from any external advertising matter. (Postage for 4 ounces—6d. in U.K.—is appreciated.)

MAXALDING (PM.8) SHEPHERDSWELL, DOVER, KENT.

PLEASE SEND FREE LITERATURE TO:—

Name.. Age.................

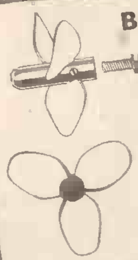
Address ....

.... (PM:8)

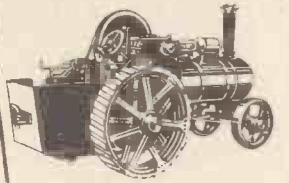
SPECIALS

JUST WHAT YOU NEED FOR YOUR HOBBY— FROM BASSETT-LOWKE'S COMPREHENSIVE CATALOGUES

BRASS PROPELLERS



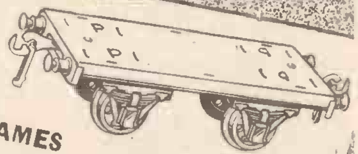

3-blade right or left hand for $\frac{5}{32}$" dia. shaft. 1¼"—6/11. 1½"—8/-. 2"—9/6.
Shafts and Stern Tubes. 8," 9" or 10"—7/8 each. Postage 9d.



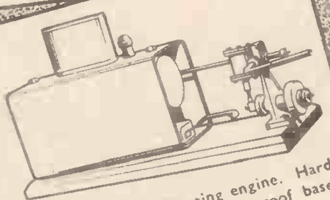
"BURRELL" TRACTION ENGINE

Build this fine ¾" scale working model. Set of 4 sheets of drawings —14/6. Construction Booklet—1/-. Post free.

GAUGE 'O' WAGON UNDERFRAMES

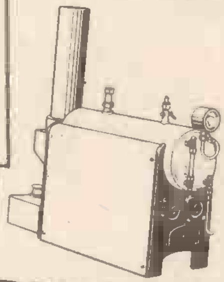


All steel construction with buffers and couplings. Synthetic wheels for 2 or 3 rail. Ideal for special loads. 6/- each. Postage 9d.



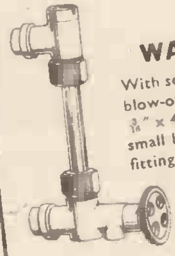
MARINE STEAM PLANT

For models up to 30" long. Double acting engine. Hard soldered boiler 9" x 3½" x 4½" high. Fireproof base. Price £3.17.11. Post free.



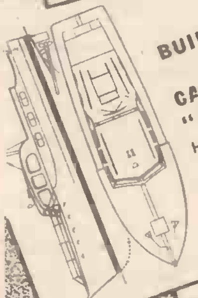
BABCOCK BOILER

All parts ready to assemble Barrel fully brazed. Set includes fittings and piping (exc. pressure gauge). Price £4.12.11. Post free.



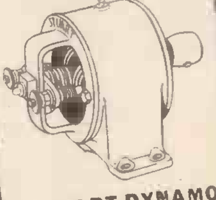
WATER GAUGES

With screw down or lever handle. blow-off. $\frac{3}{16}$" glass screwed $\frac{3}{16}$" x 40 suitable for all types of small boilers. Price 21/-. Similar fitting with plug type drain cock —15/6. Postage 6d.



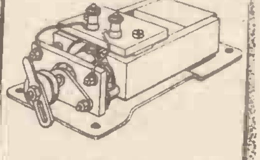
BUILDING PLANS for CABIN CRUISERS "GWEN EAGLE"

Hull lines and General arrangement for 40" models, 10/- the set. Post free.



STUART DYNAMO

Heavily constructed permanent magnet dynamo. Output up to 30 watts at 4 volts. Price £3.15.6 with V pulley. With crown face pulley £3.18.0. Post free.

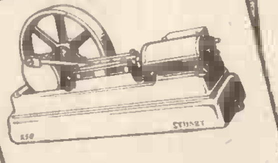


MARINE MOTOR

Powerful permanent magnet type for model boats up to 42" long. 6 volts for use on dry batteries or accumulator. Weight 12 ozs. Length 3½". Price £3.3.0. Post free.

PRESSURE GAUGES

The most reliable fittings yet made. Pressures up to 80, 100, 120 and 150. ⅞" and 1" diameter. Price 30/- each. Syphon fitting for same, 6/-. Postage 6d.



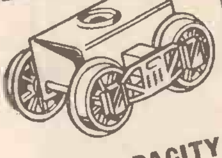
MILL ENGINE

Complete set finished parts, no special tools required. ⅝" bore by 1¼" stroke. Price £4.0.11. Post free.

MODEL SHIPPING AND ENGINEERING CATALOGUE

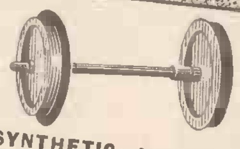
Full of helpful information about your hobby. Lists and illustrated boiler fittings and engine parts, castings and pressings, materials, bolts, rivets, screws, tools, also drawings and plans. 96 pages packed with interest.

Price 2/6.



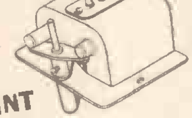
HIGH CAPACITY WAGON BOGIES

Gauge "0" in pressed steel with die-cast wheels. 4/6 each, 8/6 pair. Postage 9d.



SYNTHETIC WHEELS

on axles for Gauge "0" Fine or Standard scale. Hard wearing and true running. Perfect for 2-rail systems. 1/1 per pair. Postage 7d. (12 pairs and up post free.)



POINT MOTOR

12v. D.C. or 20v. A.C. for use with Gauge "0" or Gauge "00". May be mounted in any position. Price 18/4. Postage 9d.

HOW TO ORDER

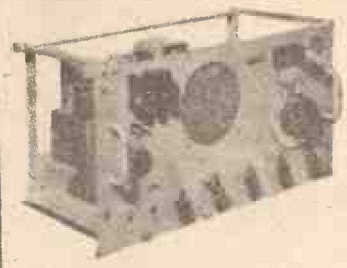
Please send cash with order. Over £1 post free, otherwise please add postage for each item as listed. Send to your nearest branch.

BLOCK LETTERS, PLEASE
NAME ....
ADDRESS ....
....

SEND YOUR ORDER TO YOUR NEAREST BRANCH *Please send me the following*

Quantity	Cost Each	Name and Description of Items	Total
		TOTAL	

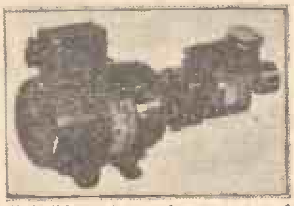
BASSETT-LOWKE LTD.
Kingswell Street, Northampton
LONDON : 112 High Holborn, W.C.1 — MANCHESTER : 28 Corporation St., 4



SHORT WAVE COMMUNICATIONS RECEIVER R208.
ONLY £6.19.6, 19/- deposit.

This is a super short wave receiver covering 5-30 metres (10-60 Mc/s). Uses 6 valves. Has R.F. stage, 2 I.F. stages B.F.O. etc. Muirhead instrument drive, two internal power packs, mains and battery vibrator pack. Complete with own P.M. speaker. Provision for phones and speaker muting. Complete in metal transit case; size approx. 24 x 18 x 12; weight 70lb. Suitable A.C. mains, 100-250 and 6 volt battery. In perfect condition, practically unused. Tested before despatch and guaranteed. Handbook free with each. Price £6/19/6, carriage and insurance 15/-. Or 10/- deposit, plus 15/- carriage, and 15 weekly payments of 10/-.

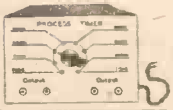
MOTORISED GEAR PUMP



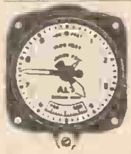
Will build up tremendous pressure for operating hydraulic rams, lifts and similar equipment. Geared to 24 volt D.C. motor, but this can be operated off A.C. mains through step down transformer. £17/10/- each.

PROCESS OR PHOTO TIMER FOR 15/-

Make a time delayed switch to work off mains (A.C. or D.C.), all the parts (less case). Sale price 15/-, post and insurance 2/6.



SENSITIVE ALTIMETER



(Very good but not perfect.) These contain aneroid barometer movement. Price only 5/6, post, etc. 2/-.

Selenium rectifier type 1-500 v. ½ amp. half-wave, easily rebuilt into full wave or multiple type contains 30 35 mm. discs. Price 8/6, plus 1/6 post. Type 2. 36 volt 9 amp. easily rebuilt into six full wave charger rectifiers suitable for 6 or 12 volt batteries at 3 amps. contains 24 84 mm. discs. Real bargain at 19/6, plus 1/6 post.

FISHING ROD FROM DINGHY MAST

Tubular aluminium not separate sections, extends like telescope from 15ins. to 9ft. 5/6 each, post 1/-.

FLEXIBLE DRIVES

6 ft. long, 45/- each; 21in. long, 17/- each; 14in. long, 12/- each.

CONNECTING WIRE

P.V.C. covered in 100ft. coils—2/9 a coil of four coils different colours. 10/- post free.

THIS MONTH'S SNIP
MULTI-PURPOSE MAINS TRANSFORMER

Heavy duty construction, must have cost at least £3 to make. Offered at a snip price of 14/6.

Specification :—

Primary	Standard 230 v.; 50 c.p.s. screen to sep. terminal.
Secondary 1,	660 v.-200 mA. centre tapped.
Secondary 2.	80 v.-100 mA.
Secondary 3.	23 v.-750 mA.
Secondary 4.	7 v.-5 amp. centre tapped.
Secondary 5.	5 v.-3 amp.

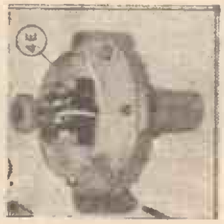
In addition to the above secondaries there is a window space which will allow extra L.T. windings to be put on. The winding ratio is 2½ turns per volt. Weight of transformer is 12lb., size approximately 6in. x 4½in. x 4½in. Connections all brought out to terminals on bakelite panel. We have only 500 of these, so order at once to avoid disappointment. Non-callers add 3/6 postage please.

MOTOR SNIP

Miniature motor 2½in. long x 1½in. diameter, laminated poles and armature, separate winding for reversing. Operates off 20-30 v. D.C. or off A.C. mains through stepdown transformer. Original cost at least £3 each. Snip price for one month only 6/6, plus 1/6 postage and insurance.

ELECTRICAL BRAKE

Electrically operated brake—disc type suitable for stopping lathes and other motorised machines. Operated from the mains through step-down transformer or resistance. 25/-, plus 1/6 postage.



LATEST AVO TESTMETER

Can be yours for only 10/- deposit and 19 payments of 10/- weekly. Like all AVO meters it is a very fine instrument; it has a sensitivity of 10,000 ohms per volt and 19 most useful ranges as follows—D.C. volts 0-1,000 (seven ranges), A.C. volts 0-1,000 (five ranges), D.C. current 0-1 amp. (5 ranges), resistance 0-2 megs. (2 ranges) (complete with test leads). Immediate delivery. **Cash price £9/10/-.**

FREE GIFT.—All purchasers will receive Range Extender scale and data which add: capacity 0-1 m.f. in two ranges. Inductance 0-100 henrys, etc. etc.

ELECTRONIC PRECISION EQUIPMENT, LTD.

Post orders should be addressed to Dept. 1, at Eastbourne Address.

Personal shoppers, however, can call at :—

42-46, Windmill Hill, Ruislip, Middx. Phone: RUISLIP 5780. Half day, Wednesday.	66, Grove Road, Eastbourne. Half day, Saturday.	29, Stroud Green Road, Finsbury Park, N.4. Phone: ARChway 1049. Half day, Thursday.	266, London Road, Croydon. Phone: CROydon 6558. Half day, Wednesday.

STOCKS and DIES

TRIANGLE LEADS AGAIN!

NOW IN A DURABLE PLASTIC TOOL ROLL

★ NO COSTLY WOODEN CASES OR PACKING All the value is in the tools!

★ THE FINEST QUALITY AMERICAN PATTERN TAP WRENCH IS PROVIDED Not the Cheap Bar type.

★ ALL TOOLS 100% BRITISH AND FULLY WARRANTED

★ BRITISH CRAFTSMANSHIP SUPREME

★ AVAILABLE IN: B.S.W., B.S.F., Brass or Metric., N.F., N.C. and Unified threads.

The finest quality available at lowest prices

Obtainable from your usual tool specialists

THE BRITISH TAP & DIE CO. LTD.
TRIANGLE WORKS, EDMONTON, N.9.

The New "ZYTO" 10" Motorised MULTI PURPOSE SAWBENCH

RISE AND FALL BALL BEARING SPINDLE

ILLUSTRATED LEAFLET AND FULL SPECIFICATION POST FREE ON REQUEST

Takes saws up to 10" diam.
Depth of cut 3"
Table canting to 45°
21" x 18"

★ All steel pedestal stand
★ Built-in dust-shoot
★ Unlimited width of cut
★ Complete motorised
★ Push button starter

£49.10.0 *3-phase*
or first payment of **£5.0.0**
8 payments of **£6.2.5**

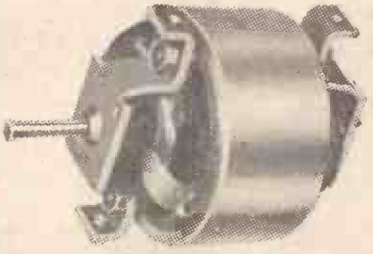
NEW GENERAL CATALOGUE OF WOOD & METAL TOOLS & MACHINERY PRICE 2/6. REFUNDED ON FIRST ORDER OF 40/-

Same machine for Bench. Unmotorised **£24.10.0**
or 50/- first payment
8 equal payments **£3.0.6**

S. TYZACK & SON Ltd.

341-345 OLD STREET, LONDON, E.C.1
(ONLY LONDON ADDRESS)
Telephone: SHOreditch 8301 (10 lines)

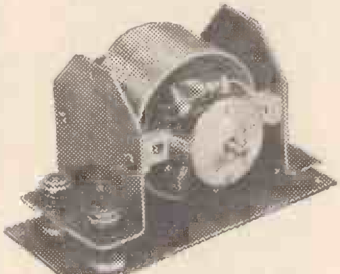
The Bestfrend "ZEPHYR" (M) Motor and Accessories



A silent, shaded pole motor, A.C. only, 200/250 volts, 2,600 R.P.M., 25 watts. 3½" x 2½". Precision built and specially suitable where absolute silence is essential. Continuously rated and designed for use in construction of table and extractor fans, projector cooling units, fan heaters, cupboard airing devices, etc. An extremely high-class product, designed by engineers with a quarter of a century of experience in motor construction.

37/6 Post Free

An anti-vibration stand for above motor. Horizontal or vertical mounting. Supplied in breakdown form for home constructors. 8½" x 2¼" x 2". Three point suspension. Steel, Cadmium plated. **7/6** Post Free



FANS

4 Bladed Metal 4" diam. 5/-

BAKELITE 3 Blades 8" diam. 7/6 Post Free

The Bestfrend Electrical Co. Ltd.
BANSTEAD SURREY
Tel.: BURGH HEATH 1432

"AIRTROL"

Hard Valve Receiver

The smallest receiver in the World!

Size 2¼in. × 1½in. × 1½in. and weighs only 2½ ozs. Has been specially developed to meet the great demand for a transistor hard valve receiver with a specification producing the ultimate in Radio Control. H.T. Supply—22½ volt battery,

Idling Current—0.6 ma.

Current change—0.6 ma.

L.T. consumption—25 ma.

Hard Valve—No Quench Coils.

Simple tuning.

Two transistors for output and economy.

Valve life—4,000 hours.

Write for new illustrated lists giving full technical details of all E.D. Engines, Radio Controls, Mechanisms, Spare Parts, accessories, etc.

Price (inc. P.Tax) **£7.5.0**

and

E.D. P.C.1 TRANSMITTER

A high powered, super compact, lightweight, portable Radio Control Transmitter suitable for the operation of all carrier receivers.

PRICE (less batteries) **£5.19.9**

Order from your Model Shop.

ELECTRONIC DEVELOPMENTS (SURREY) LTD
DEVELOPMENT ENGINEERS
ISLAND FARM RD. WEST MOLESEY. (SURREY) ENGLAND.
PHONE MOLESEY 6037-8036 GRAMS "EEDEE" EAST MOLESEY

Training with I.C.S.
THE WAY TO SUCCESS

The great and growing demand of today is for TRAINED men. Thousands more are needed, but there is no worthwhile place for the untrained.

Through I.C.S. Home Study you gain the specialised knowledge that marks you out for promotion, for SUCCESS! I.C.S. teaches you in your own time—expertly, quickly and easily. It is the world's largest and most successful correspondence school, offering courses for almost every branch of trade, industry and the professions. No books to buy.

ADVERTISING & SALESMANSHIP
Account Executives'
Mail Order
Copy Writers'
Advertisement Managers'
Commercial Travellers'
Sales Management
EXAMS: Joint Inter. A.A. & I.P.A. Finals. Inc. Sales Mngrs. Ass. United Com. Travel. Association.

ARCHITECTURE & BUILDING
Drawing and Designing
Quantity Surveying
Builders' and Surveyors' Clerks'
Bricklaying
Carpentry & Joinery
Construction and Steelwork
Heating and Ventilating
EXAMS: Roy. Inst. of Br. Archts. Inst. of Quant. Surveyors. Roy. Inst. of Chartered Surveyors. Inst. of Builders. Inst. of Mun. Engrs. (Bldg. Inspectors'). Inst. of Clerk of Works.

COMMERCIAL ART
Elementary Art Training
Poster Work
Sketching

COMMERCIAL TRAINING
Bookkeeping and Accountancy
Costing and Auditing
Company and Private Secretarial
EXAMS: Chartd. Inst. Secs. Corp. of Secs. Ass. of Cert. & Corp. Accts. Inst. of Cost & Works Accts. Inst. of Book-keepers.

ELECTRONIC ENGINEERING
Industrial Electronics
Electronic Computers

CIVIL ENGINEERING
Highway Engineering
Surveying and Mapping
Structural and Concrete Engineering
EXAMS: Inst. of Civil Engineers. Inst. of Mun. Engrs. Inst. of Structural Engrs.

DRAUGHTSMANSHIP
(State which Branch)
Architectural
Drawing Office Practice & Machine Design
Structural Drawing
Maths. & Machine Drawing
Woodworking Drawing

ELECTRICAL ENGINEERING
Illumination and Heating
Electricians'
EXAMS: Society of Engineers. C. & G. Cert. in Elec. Eng. Practice. C. & G. Cert. in Elec. Installations. C. & G. Cert. in Illum. Engg.

FARMING & HORTICULTURE
Arable Farming
Pig & Poultry Keeping
Livestock Farming
Farm Machinery (Maintenance)
Flower, Vegetable & Fruit Gardening
Rock & Shrub Gardening
EXAMS: R.H.S. General.

FIRE ENGINEERING
EXAMS: Inst. of Fire Engineers. Fire Service Promotion.

GENERAL CERTIFICATE OF EDUCATION
Principal Subjects at Ordinary or Advanced Level
Engineering Joint Board Preliminary

MANAGEMENT
Foremanship
Industrial Management
Business Management
Methods Engineering
EXAMS: British Inst. of Mngemt. Intermediate, Final and Certificate of Foremanship.

MECHANICAL ENGINEERING
Subjects include: Welding, Fitting, Turning, Erecting, Jig & Tool Design, Production, Draughtsmanship, Mathematics, Inspection, Diesel Engines, Diesel Electric Locomotives, Refrigeration.
EXAMS: Inst. of Mech. Engineers. Inst. of Production Engineers. Society of Engineers.

MOTOR ENGINEERING
Diesel Transport Engines
Motor Body Rebuilding
Owner Drivers'
Running and Maintenance

PHOTOGRAPHY
A basic Course including Colour Work

RADIO AND TELEVISION ENGINEERING
Service Engineers'
Television Servicing and Engineering
Practical Radio with Equipment
Radio Service & Sales
EXAMS: Br. Inst. of Radio Engrs. C. & G. Radio Servicing Cert. (R.T.E.B.). P.M.G.'s Cert. Marine in Wireless Telegraphy C. & G. Telecoms. Engineering. C. & G. Radio Amateurs'.

WRITING FOR PROFIT
Free Lance Journalism
Short Story Writing

LEARN - AS - YOU - BUILD PRACTICAL RADIO COURSE
Build your own 4-valve T.R.F. and 5-valve superhet radio receiver; Signal Generator and High-quality Multi-tester.

INTERNATIONAL CORRESPONDENCE SCHOOLS
Dept. 169D, International Buildings, Kingsway, London, W.C.2.

Please send me free booklet on..*Age*..............

Name.. *Occupation*..............
(USE BLOCK LETTERS)

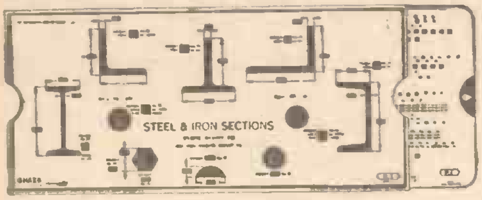
Address ....

.... 10/58

Addresses for Overseas Readers
Australia: 140, Elizabeth Street, Sydney. Eire: 3, North Earl Street, Dublin. India: Lakshmi Bldg., Sir Pherozsha Mehta Rd., Fort Bombay. New Zealand: 182, Wakefield Street, Wellington. N. Ireland: 26, Howard Street, Belfast. South Africa: P.O. Box 19, Cape Town.

INTERNATIONAL CORRESPONDENCE SCHOOLS

OMARO SLIDE RULES

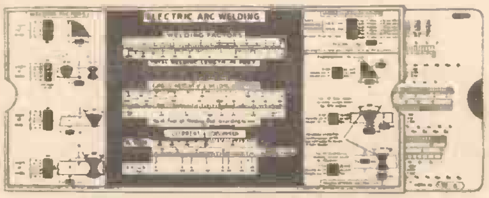


Model P.1

Principal dimensions and weights per foot or square foot of steel and iron sections, sheets etc.

Model L.2

Ratios of Cutting Speeds, Diameters, Number of Revolutions, Feeds, Time for Machining, etc.



Model W.2

Electric Arc Welding

Model M.1

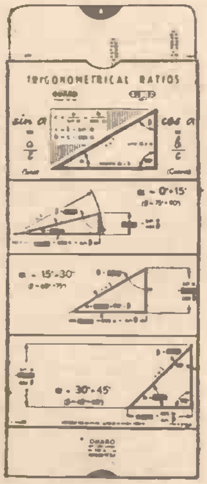
Trigonometrical Functions

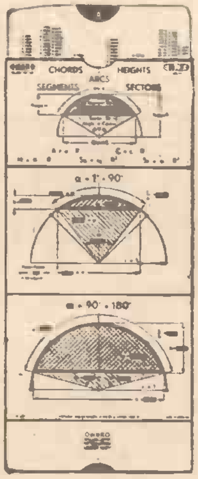
Model M.2

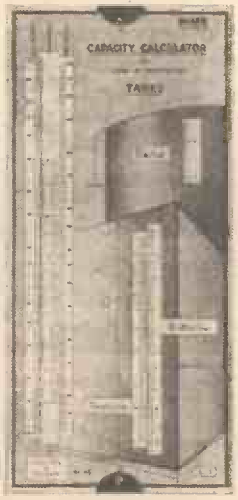
Arcs, Chords, Heights, Segments and Sectors

Model L.11

Capacity Calculator







PRICE 7/- each post free

Write for list of other models.

FREE GIFT With every order for six or more Omaro Technical Charts or Kosine Slide Rules, we supply, free of charge, a complimentary copy of our Cocktail Slide Rule (usual price 10/6d.) with 300 selected recipes. Please apply for your free copy when sending your order for technical charts and slide rules.

NEW ADDRESS

TELEPHONE : NEW CROSS 2589

KOSINE LTD., 1 Blenheim Grove
Peckham, London, S.E.15.

* Permanent Magnets in action *

Picking up tacks

. . . or any small particles is easy for the handyman who uses an "Eclipse" Button Magnet. Simply assembled in any thin non-ferrous cover which allows withdrawal of the magnet from the holding face. *Ask your tool dealer for literature showing many other uses.*

Eclipse

PERMANENT MAGNETS

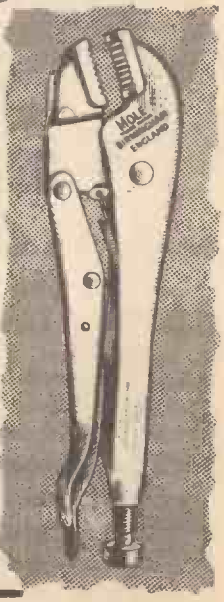
Made by James Neill & Company (Sheffield) Limited *and obtainable from all tool distributors*

PM 45

it's the wise man with a THIRD HAND to-day

Nowadays, it's no laughing matter for a man who hasn't his "third hand" handy in the home, garage or workshop when tackling the inevitable repair and maintenance jobs. With a positive grip, exceeding 2,000 lbs. if required, the Mole Wrench locks on the job-in-hand, leaving both hands free—your "third hand" in fact, used as super-pliers, wrench, hand vice, clamp—whatever the job demands. *Join the thousands of satisfied users—visit your ironmonger, Motor and Motor, Cycle Accessory Dealer for*

THE **MOLE** TRADE MARK *SELF-GRIP* **WRENCH**



In two sizes : 7in., 12/6 and 10in., 15/-

Ask for a genuine MOLE WRENCH—look for the name on it.

If in any difficulty write to :

M. MOLE & SON LTD., BIRMINGHAM, 3.

EMI

"HIS MASTER'S VOICE"

MARCONIPHONE · COLUMBIA

Announce

NEW PRACTICAL WAY

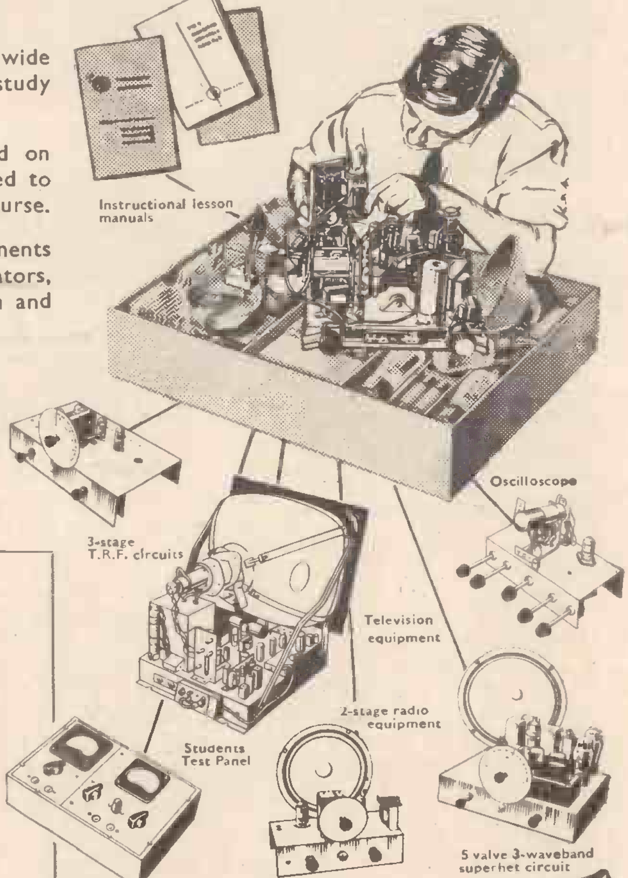
OF LEARNING AT HOME

NEW—completely up-to-date methods of giving instruction in a wide range of technical subjects specially designed and arranged for self-study at home under the skilled guidance of our teaching staff.

NEW—experimental outfits and lesson manuals are despatched on enrolment and remain the student's property. A tutor is allotted to each student for personal and individual tuition throughout the course.

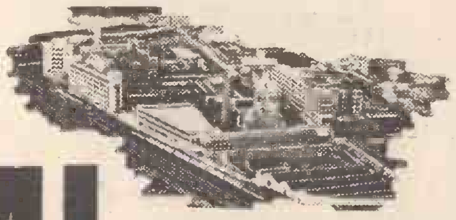
Radio and television courses, with which specially prepared components are supplied, teach the basic electronic circuits (amplifiers, oscillators, detectors, etc.) and lead, by easy stages, to the complete design and servicing of modern Radio and T/V equipments.

If you are studying for an examination, wanting a new hobby or interest, commencing a career in industry or running your own full-time or part-time business, these practical courses are ideal and may be yours for moderate cost. Send off the coupon to-day for a free Brochure giving full details. There is no obligation whatsoever.



Courses with Equipment

RADIO • SHORT WAVE RADIO
TELEVISION • MECHANICS
CHEMISTRY • PHOTOGRAPHY
ELECTRICITY • CARPENTRY
ELECTRICAL WIRING
DRAUGHTSMANSHIP • ART, etc.



E.M.I. Factories at Hayes, England.

EMI INSTITUTES

FREE

Fill in for FREE BROCHURE

E.M.I. INSTITUTES, Dept. 144 x, London, W.4.

NAME .... Age (if under 21) ....

ADDRESS ....

BLOCK CAPS PLEASE

I am interested in the following subject(s) with/without equipments

....

(OCT/58) (We shall not worry you with personal visits) IC.107

The only Home Study College run by a World-wide industrial organisation

A FASCINATING HOBBY made Simple & Successful by means of this BOOK

Lampshade making can give endless fun, beautify your home and delight your friends. There are 83 practical and easy-to-follow illustrations and ideas to show you how to do it.

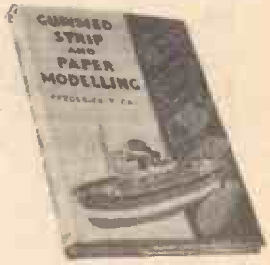
Published by C. Arthur Pearson Ltd., Tower House, Southampton Street, Strand, London, or obtainable from :

SAMUEL JONES & CO., LTD.

8/6

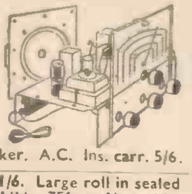
SAMUEL JONES & CO., LTD.

Obtainable from all Booksellers or by requisition



Regd BUTTERFLY BRAND

HOME RADIO, 79/6. 5 valve (octal) superhet. 3 wave band receiver. Can be adapted for your gram. P.U. at a little extra cost. Two A.C./D.C. sizes 9½in. x 18½in. x 11¾in., 9in. x 20½in. x 12in. Wooden cabinets. Ins. carr. 4/6. Please state size required when ordering.



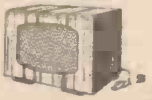
SUPER CHASSIS, 99/6. 5 valve superhet chassis including 8in. P.M. speaker and valves. Four control knobs (tone, volume, tuning, w/change switch). Four w/bands with position for gram. P.U. and extension speaker. A.C. Ins. carr. 5/6.

INSULATED TAPE, 1/6. Large roll in sealed metal container. BARGAIN. 75ft. x ½in. wide. It's a must at this price. Post 9d.
N.B.—Postage on 6 tins is only 2/-. Buy now and save money.

TELEPHONE SETS, 7/9. Ex W.D. Wireless remote control unit. E. Mk. 11. New condition. Morse tapper, switched, jack plugs, etc. Less phone. Ins. carr. 3/6.

COMPASS, 12/9. Ex A.M. 6in. dia. also ex. A.M. 6¾in. dia. Ideal for boats, cars, etc. Please state size required. Ins. carr. 3/6.

T.V. CHASSIS, 25/6. Ideal only for spares. Although this chassis has a wealth of components it is considered uneconomical to attempt rebuilding. This chassis is in 3 separate units. Power Pack : T/Base and S'Vision Strip. I.F.'s 16-19.5 Mc/s. Drawings free. Ins. carr. 10/6.



BEAUTIFUL EXTENSION SPEAKERS, 29/9. Fitted with 8in. P.M. speaker W.B. or Goodmans of the highest quality. Standard matching to any receiver (2-5 ohms). Switch and flex included. Unrepeatable at this price. Money back if not completely satisfied. Ins. carr. 3/6.

STEREOPHONIC SOUND! Those extra speakers will now be required.
8in. P.M. SPEAKERS, 8/9. With O.P. transformer fitted 10/-, postage 2/9.
6½in. P.M. SPEAKER, 12/6. Postage 2/9.

STOP!

Everything's Here for the Enthusiast

17in. T.V. CHASSIS, TUBE & SPEAKER, £19.19.6. 17in. Rectangular Tube on modified chassis. Supplied as single channel chassis covering B.B.C. channels 1-5 or incorporating Turret Tuner which can be added as an extra, at our special price to chassis purchasers, 50/-, giving choice of any 2 channels (B.B.C. and I.T.A.). Extra channels can be supplied at 7/6 each. Chassis size 12in. x 14½in. x 11in. less valves. Similar chassis were used by well-known companies because of their stability and reliability. With Tube and Speaker, £19.19.6. With all valves, £25.19.6. Complete and working with Turret Tuner, £28.9.6. 12 months' guarantee on the tube, 3 months' guarantee on the valves and chassis. Ins. carr (incl. tube), 25/-.

CLOCKWORK MECHANISM, 1/9. A perfectly engineered clockwork unit. Ex W.D. (Type ROF (B) 40SL). Can be modified for use as a darkroom timer, clock or any mechanism requiring activation. FREE DRAWINGS. Post 1/-. 4 for 5/-. Post 2/6.

SOUND & VISION STRIP, 10/6. Not tested s'het., 8 valve bases (6-EF91's, 1-6D2 and 1-6F14, not included). I.F.'s 7.25 Mc/s sound 10.75 Mc/s vision. Vision complete from input up to video output. Sound complete from input to A.F. amplifier. P. & P. 2/6.

POWER PACK & AMPLIFIER, 19/6. Output stage PEN45 O.P. trans. choke. Smoothed H.T. 325 volt at 250 mA. 4 v. at 5 amp. 6.3 v. at 5 amp., 4 v. at 5 amp. centre tapped. Octal or 4-pin. Output is taken from standard plugs. Less valves. Not tested. Ins. carr. 5/6.

SOUND & VISION STRIP, 25/6. Sound I.F. 10.5 Mc/s. Vision I.F. 15 Mc/s. Valve line-up 6-6F1's, 2-6D2's (not included). Any single channel 1-5 supplied, a turret tuner is easily fitted. Supply from Power Pack, 200 v. H.T. 6.3 v. heaters. P. & P. 2/6.

Send for FREE Catalogue to :

TERMS AVAILABLE.

DUKE & CO.

Liverpool St. to Manor Park 10 mins

Dept. (H.10), 621 Romford Road, Manor Park, E.12.
Telephone : ILF. 6001/3.

"REGETTERED IMPROVED VACUUM" T.V. TUBES. 17in. £7.10.0. 12 months' guarantee. 14in. £5.10.0. 6 months' full replacement, 6 months' progressive. Made possible by the high quality of our tubes. Ins. carr. 15/6. 9in., 10in., 14in., 15in. and 16in. round tubes. Our special offer of these sizes £5.

12in. T.V. TUBES, £6. Three months' guarantee on round tubes. Ins. carr. 15/6.

14in. RECTANGULAR T.V. TUBES with burns, 30/-. Ideal as a standby or testing. Carriage 10/-.

IDEAL CHASSIS, 39/9. Radio or Radiogram chassis. 5-valve s/het. A.C. valve line-up. 6K8, 6K7, 6Q7, 6V6, 5Z4. 3 waveband and gram, switched. Less valves. Chassis size 19½in. x 7½in. x 9in. x 8in. P.M. Speaker, 7/9 extra. Set of knobs, 2/- extra. Complete set of valves, 45/9 extra. Ins. carr. 5/6.

RECTIFIERS, 2/9. 250 v. 100 mA. Full or half-wave. Salvage guaranteed. Why hunt for those obsolete rectifier valves when you can cheaply replace with a modern selenium rectifier. P. & P. 1/3.

T.V. AERIALS, 25/6. For all I.T.A. channels. For outdoor or loft 3 elements. Famous manufacture. Sold at half the normal cost. P. & P. 2/6.

CAR AERIALS, 6/9. Whip antenna 50in. long, collapsing to 11in. One hole fixing. P. & P. 1/- (Plated).

PORTABLE RECORD PLAYER CABINET, 25/-. Limited stock. Don't delay. Attractive design in two-tone colour scheme ; clipped lid, carrying handle, etc. Store soiled. Size 16in. x 14in. x 8in. Carr. Ins. 4/6.

SOLO SOLDERING TOOL, 12/6. 110 v. or 6 v. (special adaptor for 200/240 v., 10/- extra). Automatic solder feed, includes a 20ft. reel of ERSIN 60/40 solder and spare parts. It is a tool for electronics soldering or car wiring. Revolutionary in design. Instantly ready for use and cannot burn. In light metal case with full instructions for use. Postage 2/9.

RAWLPLUG

DURIUM
Registered Trade Mark

TIPPED DRILLS

for faster Masonry Drilling

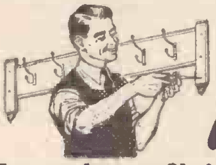
You will get a great thrill when you find how fast you can drill a hole in the hardest brick with a Durium Drill. Used in a hand brace or suitable electric drill you can penetrate inches in seconds without disturbing noise, and what is more, you will get perfectly formed holes to make 100% efficient fixtures with Rawlplugs.
You must try a standard Durium Drill for your next hole boring for Rawlplugs job. If you want to drill right through a wall for conduit or cable you can get a long series Durium Drill. Ask your local dealer for details or write to the Rawlplug Company Ltd., for a free fully illustrated sixteen page-booklet.

Sold in the bright orange and blue metal container clearly marked Rawlplug Durium.

Look for the name DURIUM on the drill shank, no other is a genuine DURIUM Drill.

PRICES:— No. 6, 9/6. No's 8, 10 & 12, 10/-. No's 14, 11/6; 16, 12/-; 18, 12/6; 20, 13/6; 22, 14/- each.

A FREE Re-sharpening voucher with every DURIUM DRILL

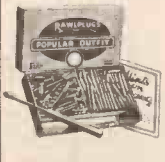


IT'S FAR EASIER WITH RAWLPLUGS!

ESSENTIAL RAWLPLUG PRODUCTS FOR THE HOME & WORKSHOP

To make a fixture that will take the weight

COMPLETE RAWLPLUG OUTFITS

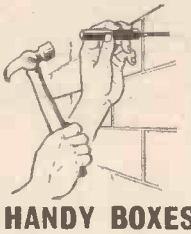

3/-


5/6


11/9

Rawlplugs provide a stronghold for every size of screw from No. 3 (⅛″) to No. 30 (1″). For fixtures taking heavy loads like book racks, coat racks, kitchen cupboards, etc., use long Rawlplugs set deep into brickwork and use screws with the threaded part corresponding to the length of the Rawlplug. Follow the instructions given with every Rawlplug outfit and your fixtures will never let you down.

POPULAR TOOL 1/8



A very cheap sturdy tool for making holes for No. 8 Rawlplugs. Turn the tool as you tap it with a light hammer. It is a very handy tool for the occasional light fixing job.

HANDY BOXES

When you have a set of Rawltools or Durium Drills you can buy the handy shilling boxes of Rawlplugs. Assorted sizes of Nos. 8, 10, 12 and 14 are packed for easy storage and selection

1/-

All Rawlplug Products can be obtained from Hardware Dealers, Ironmongers, Builders Merchants, and Stores everywhere.

PLASTIC WOOD

APPLIED LIKE PUTTY DRIES LIKE WOOD—Can be cut, planed, polished and painted like wood. Will take nails and screws like wood. It does not blister, crack or decay. Rawlplug Plastic Wood is actually the best quality product of its kind on the market.
Natural, Oak, Mahogany or Walnut. Large Tubes 1/-. Tins: ¼ lb 2/3d., ½ lb 3/9d., 1 lb 6/6d.

DUROFIX

The indispensable adhesive for instant use on crockery, glass, wood, metal, celluloid and the thousand and one things handled by the hobbies enthusiast. Instant drying, insulating, waterproof and heatproof. Durofix is grand for repairs to electrical, sports and leather goods.
Handy Tubes 9d., Large Tubes 1/- and 1/6d., Commercial Size 5/-, ¼ lb tins, 2/9d., 1 lb tins 10/6.

DUROGLUE

UNDILUTED ANIMAL GLUE OF INCOMPARABLE STRENGTH. Ready for instant use for the many purposes for which an extra strong glue is needed. Wood, cloth, fabric, felt, leather and any greaseless surface can be stuck with Duroglue.
Large Tubes 1/-. Tins: ½ lb 2/6d., 1 lb 4/9d.

TILE CEMENT

A LIQUID CEMENT possessing very strong adhesive qualities. For replacing tiles to walls, floors, fireplaces, hearths, curbs, etc., in kitchens, lavatories, bathrooms, halls, bedrooms, reception rooms, etc.
Large Tubes 1/3d., ¼ lb Tins 2/9d.

PLASTIC METAL

A SCIENTIFIC PREPARATION IN PASTE FORM which can be applied in a few seconds and dries in a few minutes. You can make quick repairs to many household metal articles but it is not suitable for electrical or wireless connections.
Handy Tubes 10½d.

DUROLASTIC

ELASTIC SEALING COMPOUND
Forms permanently elastic waterproof joints with great adhesive qualities to any dry surface. Resists vibration or shock and will not break away with expansion or contraction. Non-crumbling, non-staining, does not exude oil. Can be painted in a few hours. Ideal for boat builders.
Very large Tubes 1/9d.

THE RAWLPLUG COMPANY LIMITED, CROMWELL ROAD, LONDON, S.W.7

B.595

LATEST SCORES

"P.M." 25 not out
T.C.C. 52 not out

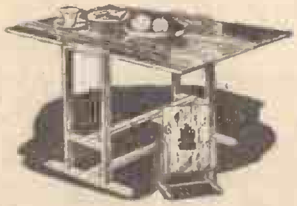
We congratulate "Practical Mechanics" on its Silver Jubilee, and recall that we were advertisers in its very first issue. May we both go on scoring for many years to come.

THE TELEGRAPH CONDENSER CO. LTD.

NORTH ACTON W.3. Tel: ACOrn 0061

CONDENSER SPECIALISTS SINCE 1906

Hobbies



37/6 Kit No. 3050—Table and Firescreen. Serves two purposes. Ideal for the home.

47/11 Kit No. 254 Spcl.—Sturdy, low-priced Doll's House. Grand gift for a child.

19/11 (Post 1/9) Kit No. 255 Spcl.—Superb Swiss Chalet Cigarette Box. Musical movement, 18/3 extra. Ask for list of over 20 tunes.

If you are keen on making furniture for the home, novelties that make delightful gifts, models that are pleasing to the eye—then you should get a copy of Hobbies 1959 Annual, only 2/- from branches, newsagents, etc., or 2/6 post free. It contains a FREE design for making a charming musical Swiss Church, for use as cigarette or trinket box, and ideas for hundreds of projects.

Make a start right away on some of the kits illustrated here by applying at a Hobbies branch or filling in the coupon below. Remember, only a few simple tools are needed for making up these kits—and Hobbies can supply these, too.

To : **HOBBIES LTD., Dept. 071, Dereham, Norfolk**
Please send Hobbies 1959 Annual (2/6 post free) and items detailed.

....

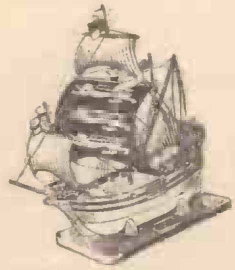
....

Name ....

Address ....

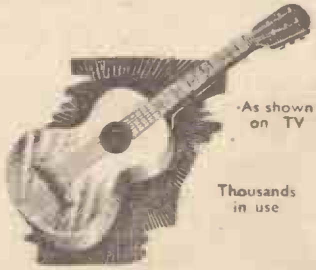
....

(Orders value 30/- and over, post free.)



Kit No. 3108—The "King's Ship" Galleon. A charming model for the home. **7/3** (Post 9d.)

Kit No. 251 Spcl.—Tug "Climax" Super working model with electric motor. **53/6**



Kit No. 3209—Spanish Guitar. A grand, full-size instrument. Kit includes all materials, strings, tutor. **59/11**

INTERESTED IN MONEY-MAKING?

JEWELLERY CRAFT

is just one of the many new, exciting and profitable handicrafts today. Our very comprehensive catalogue 'PROFITABLE HOBBIES FOR ALL' (price 2/-) gives 1,001 different materials for all the profitable hobbies which we supply by post all over the world, including a range of jewellery fittings that will thrill you, together with many other fascinating crafts. **You can even make Real Silver Eternity Rings with real Marcasites for as little as 9/9.**

PROFITABLE HOBBIES FOR ALL (1959 EDITION) PRICE 2/-

★ ★ ★ GLITTERING STAR ATTRACTIONS ★ ★ ★

- ★ **Real Silver mounts for real Marcasites.**
- ★ **Many new designs for claw set necklets.**
- ★ **Glittering stones and marcasites by the 1,000,000.**
- ★ **Chains — Ring mounts — Brooch backs.**
- ★ **Ear fittings — Cups — Screws — Wires, etc.**
- ★ **Beads—Boutons—Chatons—Rhinestones —Silver Irise.**
- ★ **Dozens of the latest Brooch mounts for setting, etc., etc., etc.**
- ★ **Real Silver Ring Mounts.**

OUR POSTAL SERVICE IS WORLD WIDE for
JEWELLERY CRAFTS—SHELL CRAFT—BASKETRY —NYLON FLOWER MAKING—MUSICAL BOX MOVEMENTS—MARQUETRY—SPRAYING WITH FLOCK — ARTISTS' MATERIALS — STAMENS — JAPANESE GARDEN MAKING — MOULDS— DECRA-LEAD—COPPER CRAFT AND ALL DO-IT-YOURSELF MATERIALS.

You really cannot afford NOT to send today for your copy

PROFITABLE HOBBIES FOR ALL

(Price 2/-, post free)

Readers write : " It's a wonderful book."

MARCASITE JEWELLERY

Well over 200 different designs to choose from, with hundreds of fittings, for the home jeweller.

REAL SILVER RINGS

for Marcasites and Cameos —30 different designs.

GLITTERING STONES

Real Marcasites—stones like diamonds — Silver and Coloured Irise— Rhinestones, etc., etc., etc.

MARQUETRY

Many sets illustrated with loose veneers and accessories.

SHELL CRAFT

We supply Tropical and English shells all over the world — a wonderful hobby!

STAMENS

Many different kinds for a fascinating craft.

COPPER CRAFT

Results from this will delight you.

BASKETRY

Contemporary bases and cane.

RAWSON'S CRAFT SHOP

(DEPT. MEC)

1 & 3 WESTCOMBE HILL, LONDON S.E.10

OUR POSTAL SERVICE IS WORLD WIDE

★ **CALLING ALL DOG LOVERS**

MANY RACING GREYHOUNDS BECOME UNWANTED AND ARE DESTROYED. THEY MAKE DELIGHTFUL AND LOVABLE PETS. CAN YOU GIVE A HOME TO ONE ? FOR DETAILS PUT CROSS HERE →

CUT OUT AND POST TODAY

Please supply by return :—

PROFITABLE HOBBIES FOR ALL

I enclose P.O. or STAMPS value 2/-

NAME ....

ADDRESS..

☐ .... (MEC)

We congratulate "Practical Mechanics" on its Silver Jubilee and send our best wishes for its success in the future.

WHITELEY ELECTRICAL RADIO CO. LTD.
MANSFIELD, NOTTS.

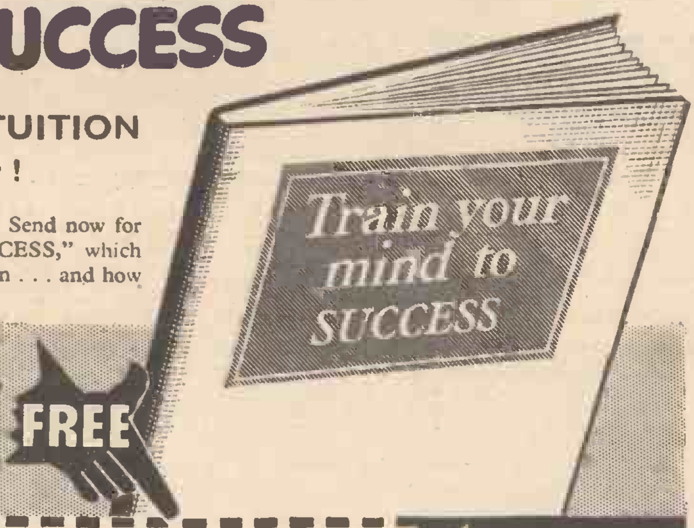
SPEAKERS · CABINETS · ELECTRONIC COMPONENTS & EQUIPMENTS

THE FAMOUS BENNETT COLLEGE can train your mind to SUCCESS

THROUGH PERSONAL POSTAL TUITION

A FREE book vital to your career !

Read how the famous Bennett College can help you to success ! Send now for this recently published FREE book, " Train your mind to SUCCESS," which tells you about The Bennett College proven success in postal tuition . . . and how it can help you to success in your career.



WHAT CAREER DO YOU WANT?

Agriculture
Architecture
Building
Carpentry
Chemistry
Commercial Art
Diesel Engines
Draughtsmanship
Electrical Eng.
Electric Wiring
Fire Engineering
Forestry
Locomotive Eng.
Machine Drawing
Mechanical Eng.
Motor Engineering
Plumbing
Power Station Eng.
Quantity Surveying
Radio Engineering
Road Making
Surveying
Telecommunications
Textiles
Workshop Practice
Book-keeping
Costing
English
Geography
Journalism
Languages
Mathematics
Modern Business Methods
Police Subjects
Salesmanship
Shorthand
Short Story Writing
and many others

OR WHY NOT OBTAIN A QUALIFICATION?

A.M.I.C.E. A.M.I. Struct. E. A.I.Q.S.
A.M.I. Mech. E. A.M.I. Mun. E. M.R.S.H.
A.R.I.B.A. A.M.S.E. A.R.I.C.S.
GEN. CERT. of EDUCATION

TO THE BENNETT COLLEGE (DEPT. 176N), SHEFFIELD

Please send me, without obligation, a free copy of " Train your mind to SUCCESS " and the College prospectus on :

SUBJECT ....

NAME ....

ADDRESS ....

AGE (*if under 21*) .... *Please write in Block Letters*

THIS COUPON COULD BE YOUR PERSONAL PASSPORT TO SUCCESS. *Send it NOW!*

ASTRO—TERRESTRIAL TELESCOPES

Get you the best from BOTH Worlds

SIX POWER. THREE DRAW. 2in. O.G. With interchangeable lenses and eyepieces giving 25, 40, 50 and 80X terrestrial and 60 and 120X astro. Weight 2¼ lb. Length open 30in., closed 10½in. Complete with case and sling. Mint condition, £13.10.0. Used, perfect condition, £12.15.0. Second-hand, guaranteed sound, no case, £11.10.0.

TERRESTRIAL TELESCOPE. 30X. All brass. Length 24in. x 2in. Weight 7 lb. O.G. 1⅜in. As New in wood case, £4.5.0.

VARIABLE POWER TELESCOPES. 7-21X. 2in. O.G. Length 30in. x 3in. Weight 10 lb. As New in wood case, £6.10.0.

ROSS PRISMATIC TELESCOPE. 20X 70. Built in filters. Eyepiece at 60 degree to line of sight. New. £12.10.0. Ditto, 9X 50, £5.

A.A. DUAL TELESCOPES. 35X 60 and 15X 50 on common base. In transit case. New condition. £15 ea. Carr. £1 extra.

PRISMATIC SCOPE. Two turret eyepieces 30 and 15X. 2½in. O.G. All Brass. Weight 10lb. Brand new. £10 ea.

ELBOW TELESCOPE. No. 8. Mk.I 7X 50. New and boxed, £3.15.0. Other types available.

PRISMATIC TELESCOPE. Triple turret eyepieces. 15, 23, 30X. 3in. O.G. With elaborate geared P. and T. with micrometer adj. Complete with tripod. Brand New and complete in two cases. £30 ea. Cost over £150.

AMERICAN N3 VP SCOPE. 10-20X. 2½in. O.G. Elaborate geared base with finder scope. Weight 40 lbs. In two transit cases, £20.

STEREOSCOPIC BINOCULAR TELESCOPES. No. 1. Mk. I, No. 3 Mk. II and German types from £12.10.0 to £25.

FINDER TELESCOPE. Inverted image. O.G. and eye focus. Cross line. 5X 30. £3 ea.

RIFLE SIGHTS. No. 32 Mk. I with E. and W. adj. Used, £3.15.0. Reconditioned, £5.10.0.

RIFLE SIGHTS No. 42. 35/- used. £2.10.0 as new.

ASTRO TELESCOPE KIT. 20in. focus O.G. anchromatic. 45mm. dia., tube to suit and focusing eyepiece. £2 the lot. Ditto, with 27in. O.G., 50/-.

HELIOGRAPHS. 3 mirrors. Geared head adaptable for tele. or camera, brass mounts, etc., plus lovely leather case for sports or pastimes. Mint condition. The best buy of the century, 15/- ea., plus 3/3 carr. Cost £30 ea.

TRIPODS. 36in. lightweight, with P. and T. New, 17/6. Medium, extending to 5 ft., 50/-. Heavy extending. With P. and T., £3.5.0.

DIAL SIGHTS. No. 7 with 4X optical sight. Will lay out any angle and can be adapted for levelling, 45/- ea. Ditto, No. 9, a similar but heavier job, 55/- or brand new in leather case, 85/-. Both units have geared heads cal. 360 with verniers and throw out lever. Cost over £80 ea.

UNISELECTOR SWITCHES. Ex P.O., 25 w., 8 bank, 25/- ea.

TELEPHONE DIALS. New. Chrome plate, with switchgear, 21/- ea.

PHOTO CELLS. Two cells in sealed unit fitted terminals bridge circuit gives about ½ volt neg. or pos., and up to 500 micro amps. New and boxed, 15/-.

AMERICAN MIDGET ACCUMULATORS. Lead acid. One six volt and 3 x 36 volt units in sealed can. Ready charged, only need filling with acid. £1 the lot in can.

SURGEONS SKIN GRAFTING KNIVES. 8in. detachable blade with roll-in guard. In mahogany case. Brand New, 35/-.

CONTROL UNITS. c56/ApX2. 2 off 50K pots. with pointer knobs, 4 screw in fuse holders and fuses. 2 jewelled indicator lights with lamps, wafer switch and toggle switches, etc., in black crackle case, 3in. x 5in. x 7in. Brand New, 7/6, post 1/-.

RECORDING CAMERAS, 24 volt Elect. Driven. 1½in. F4 lens. Runs 2 frames per sec. or single shots. Tested O.K. with magazine in wood case, £3.15.0 ea.

MOTOR BLOWERS. 24 volt A.C./D.C. will run on 12 volt O.K. Brand new and boxed as specified for P.Ms' Hedge Trimmer, 27/6.

CLINICAL TORCHES. Precision, chrome on brass. New, with lamp, 5/- ea. Post 6d.

MICRO AMMETER. 3in. .0 to 100 scaled 0-10. In shockproof mount. New, in sealed carton, 35/- ea.

SCHMIDT TYPE PROJECTION UNITS, as used in Ferranti 24K4 T.V. (the best T.V. ever made). Comprising Spherical Mirror, Plane Mirror (both aluminised) and Corrector Plate or Lens, mounted as one unit and sealed in. Brand New, £5 ea. A few slightly used but as new, with tube and deflector coils, £12.10.0.

TAYLOR HOBSON PROJECTION LENS. 5in. F1.5. Bloomed. Brand New, £14.

NUMEROUS LENSES SUITABLE FOR PROJECTION, from 8 mm. upwards, from 5/- ea., see our lens lists.

INFRA RED BINOCULARS. With focusing eyepieces and objectives, interocular adjustment, image erect. Power unit operates from 6 or 12 volt D.C. Brand New. Tested O.K., £10, complete in crate.

INFRA RED MONOCULARS. A lightweight unit with built-in Zamboni Pile H.T. unit. Self generating. Focusing eyepiece. Image inverted, complete in leather case. Tested O.K., 50/- ea. Spare Z piles, approx. 1,500 volts, 12/6 ea.

HAMBLIN OPTHALMASCOPE. As new. Self illuminated and magnified scale brings 19 lenses to hand plus 6 aux. In case with spare lamps, £12.

MICROSCOPE. Watson SERVICE. Chrome model with 2ocs., 2 objs. and usual refinements, with mech. stage with vernier. Excellent condition, £30.

A.C./D.C. AMMETERS. 6in. dial. Brand new, tropically sealed and crated. 0-15, 65/- ; 0-30, 55/- ; 0-50, 45/-. Cost over £8 ea.

D.C. VOLTMETERS. 0-150 Mc. 4in. dial. Brand New. 45/-.

D.C AMMETERS. 250 amp. 8in. Mirror scale. Sub-standard, in hardwood cases, £6.10.0 ea.

GRINDING WHEELS. Carborundum. Fast cutting. Medium grit, 12in. dia. x ⅞in., 1in. arbour, 2,000 r.p.m. New, 15/- ea., £6.10.0 doz.

WIRE WHEELS. Steel. Morrisflex 8in. dia. x 2in. x ⅞in. bore, 15/- ea. ; 6in. x ½in. x 5/8in. bore, 5/-.

ANASTIGMAT LENS. 1½in. focus F2. No iris. cover up to 1in. sq., 27/6. New. 1in. F3.5, 17/6 ; 1⅜in. F4, 22/6 ; 1.1in. F2. Aldis £2.

PRISMATIC BINOCULARS. GERMAN 6 x 30 from £8.10.0 to £15 ; 10 x 50 from £25 to £35. ROSS 7 x 50 and 10 x 50 from £15 to £20.

NEW LEATHER CASES for Ross 7 x 50 and similar types, 25/- ea. Ex-gov.

BINOCULAR MOUNTINGS for 7 x 50 and similar centre bar types. A pan and tilt arrangement with locking adjustments, suitable for use with stick or tripod, 5/-. Cost over £2.

SPECIAL OFFER. High definition achromatic O.G. slightly marked or scratched and need cleaning, and perfect 5/8 orthoscopic eyepiece to make astro telescope. Perfect results guaranteed. £2 the pair.

TANK PERISCOPES. American. 9in. x 6in. x 1½in. New and boxed, 8/6 each. Post 1/6.

TRANSFORMERS. Suitable for soil heating, etc. 150-250 A.C. input, 50-55 v. output at 10 to 20 amps. In steel case, 12in. x 12in. x 9in. Weight 65 lbs. £3.5.0 each. Carr. 10/-.

CELLULOID SHEETS. 24in. x 18in. x .015, 4/- ; 24in. x 24in. x .03, 8/- ea. Carr. extra.

AMERICAN SEALED-BEAM SIGNALLING LAMPS. 24 v. 120 w. Hand grip, trigger action, with red, green and blue filters. 35/- ea.

S27 A.M./F.M. COMMUNICATION RECEIVERS. 28-143 Mc/s. Practically new, £35 ea. Soiled, untested, £20.

CLINICAL TORCHES. Chrome on brass. Precision built. New. 6½in. x ⅝in., 5/- ea.

AMERICAN GEARED MOTORS. 24 v. D.C. Will run on A.C. 12 to 24 v. Size 7½in. x 3in. x 3in. Two take-offs at 3 and 12 r.p.m. Fitted cam mechanisms and ¼in. shaft cam operated ⅝in., traverse applicable to door bolts, etc. Motor in stainless steel ; gearbox aluminium. Brand new. 32/6 ea. Carr. 2/6.

RECORD STORAGE OR TRANSIT CASES. 9in. x 9in. x ¼in. Made from ⅛" hardboard. New. 5/6 doz., 12/- 3 doz. Carr. paid.

SPIRIT BUBBLES (Precision). In brass tube with twist action, weatherproof cover 5in. x ⅜in. Brand new. 3/6 ea., 30/- doz.

MARKER BEACONS. 5in. cube. Gives Red or Green flashes from self-contained batteries. Gravity switch operated. 15/- ea.

GEARED HEADS. Ex-large directors. Weight approx. ½ cwt., 15in. dia., 12in. ring divided 360 with micrometer to one minute. £7.10.0 ea. Unused. Make good base for large telescope up to 12in. dia. Smaller type, 7in. dia., weight 10 lbs., 55/- ea. Larger and smaller types available.

RELAYS. P.O. type. Various contacts. Low res., 8/6 ea. ; 1,000 ohms, 12/6. Up to 5,000 ohms, 18/6. Many other types available.

LARGE SLIDING RHEOSTATS. 10 ohm 10 a. in box. 30in. x 6in. x 6in. 50/- ea. Carr 10/-.

FIELD STRENGTH METER. TS-509/UR. 100-400 Mc/s. Brand new with handbook. Includes 0-50 microammeter. £6 ea.

DIRECTORS NO. 6. Serves as theodolite for builders, etc. Will level and lay out angles. £6 ea. Tripods to suit, 50/-.

DIRECTORS NO. 12. With 8X elbow type scope. Very similar to normal theodolite in other respects. As new in case, £12 ea. Tripod to suit, 50/-.

SIGHTING TELESCOPE NO. 22. 1X. For precision sighting with erect image. 13in. x 1in. 17/6 ea. Post 1/6.

CHEMICAL BALANCE. Oertling. With rider adj. complete with weights. Glass cabinet, £10. Others from 50/- to £20.

TIME OF FLIGHT INDICATORS. Weight 38 lbs. Large clockwork motor coupled to switch operated by large wheel fitted 120 adjustable pins giving numerous timing sequences £10 ea.

PLANS for 35 mm. to 2¼in. sq. vertical enlarger, 3/6. Lens and condenser kit, 30/-.

BACK PROJECTION TYPE TABLE VIEWER for 2in. x 2in. Plans, 3/6. Condenser and lens kit, 50/-.

SCOUT MK. II SIGNALLING TELESCOPES. 3-draw, 25 x 50. Sound condition. £6.10.0 ea.

16 mm. CINE FILM (KODAK POSITIVE). 2 x 1,000ft. roll in sealed tin, £10.

35 mm. FILM (ILFORD RECORDING). 200ft. tin, 25/-. Kodak Microfile, 100ft., 15/-.

ORTHOSCOPIC TELESCOPE EYEPIECES. Wide angle in mount non-focusing. Brand New, 35/- ea. Ditto, bloomed, 45/-. We have a very wide range of orthoscopic and other eyepieces in stock. See our lists. *For Lenses and Prisms and general optical equipment of all types see our lists. Free on receipt of STAMPED AND ADDRESSED ENVELOPE.*

BOOKLETS.—"HOW TO USE EX-GOVERNMENT LENSES AND PRISMS", Nos. 1 and 2. **2/6** ea. post **6d.**

H. W. ENGLISH

RAYLEIGH ROAD, HUTTON, BRENTWOOD, ESSEX

'Phone : 1685 or 810.

For garage or workshop

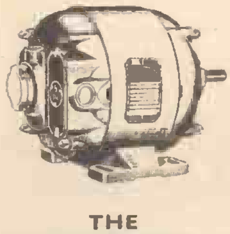
B T-H

FRACTIONAL HORSEPOWER

MOTORS

A.C. or D.C.

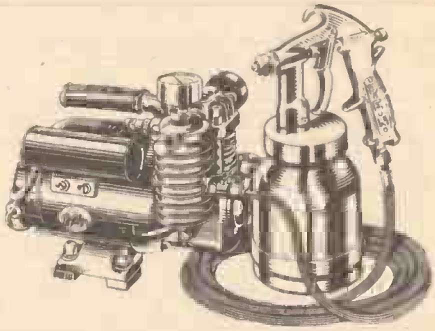
BTH motors and associated control gear are second to none in quality and proved performance.
Types and sizes are available to suit any application.



THE
BRITISH THOMSON-HOUSTON
CO. LTD., NEWCASTLE (STAFFS). ENGLAND
(an A.E.I. Company. A 5186

Do it yourself—

Ideal for
HOME HANDYMAN
MODEL MAKER
CAR OWNER
AMATEUR DECORATOR
Various applications include
SPRAY PAINTING
CREOSOTING
TYRE INFLATION
DISTEMPERING
INSECTICIDE SPRAYING
Easily carried—weight 45lbs.
Write for Leaflet CB. 112 A



with a

BEN **HANDISPRAY OUTFIT**

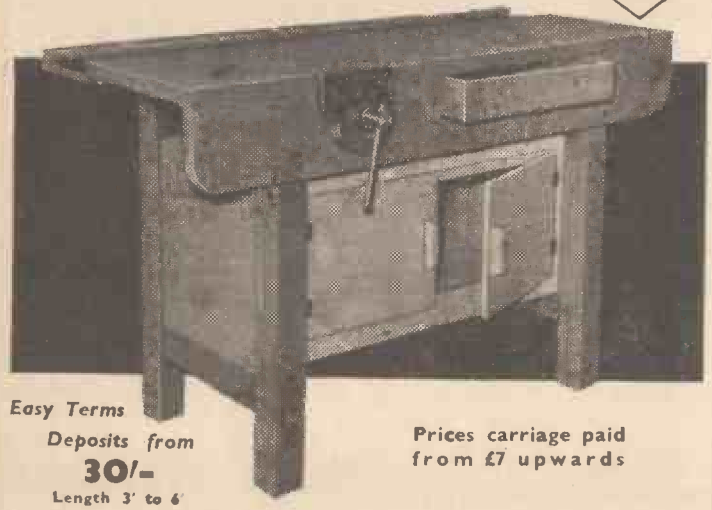
B.E.N. PATENTS LTD (Division of Broom & Wade Ltd.) Dept. X. HIGH WYCOMBE, BUCKS
C.P.289

Here's the new Handyman Workbench

even better than before!

As demonstrated on B.B.C. T.V.—now complete in every detail. Spacious tool cupboard, flush fitting drawer, "Woden" Bench Stop and Holdfast are obtainable as additional extras to the standard model. Made in solid hardwood throughout. Also latest model 7in. "Woden" Quick Release Woodworkers' Vice type A.120, fitted as illustrated.

3 WAY



Easy Terms
Deposits from
30/-
Length 3' to 6'

Prices carriage paid from £7 upwards

To: J. POWELL & SON LTD. (Dept. D),
PENSNETT, BRIERLEY HILL, STAFFS.
Telephone: KINGSWINFORD 3036

Please forward illustrated folder and comprehensive price list.

NAME..
ADDRESS..
....

FREE—CATALOGUE OF
SURPLUS AIRCRAFT MATERIAL

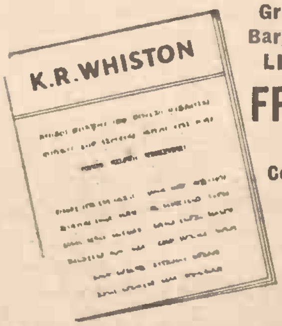
Offered by K. R. Whiston, New Mills, Stockport

It tells about thousands of articles for Model Engineers and about the MANY HUNDREDS OF BARGAINS FOR HOUSEHOLDERS & MOTORISTS

Read about the Gigantic Value Parcels I am offering

EVERYONE can benefit by sending for my Catalogue of Surplus Aircraft Material, etc. It gives particulars of a tremendous assortment of articles, such as Screws, Nuts, Bolts, etc., etc. All so very useful and necessary for Handymen, Motorists, Electricians, Model Makers, and all interested in mechanical, woodworking and other pursuits.

OVER 70 USEFUL MIXTURES



Great Bargain LIST **FREE** Post Coupon

For 'Do-it-Yourself' enthusiasts this is a great opportunity to obtain your requirements at outstanding Bargain prices.

2000 INDIVIDUAL ITEMS

The Catalogue is offered Free and it will surely pay you to write for it today and read about my Special Mixed Bargain Parcels and about the thousands of individual articles all at real money-saving prices. It tells of a marvellous selection of bargains in materials and supplies for Model Engineers. So why not fill and post the Coupon Now for this wonderfully helpful, instructive and most useful Catalogue.

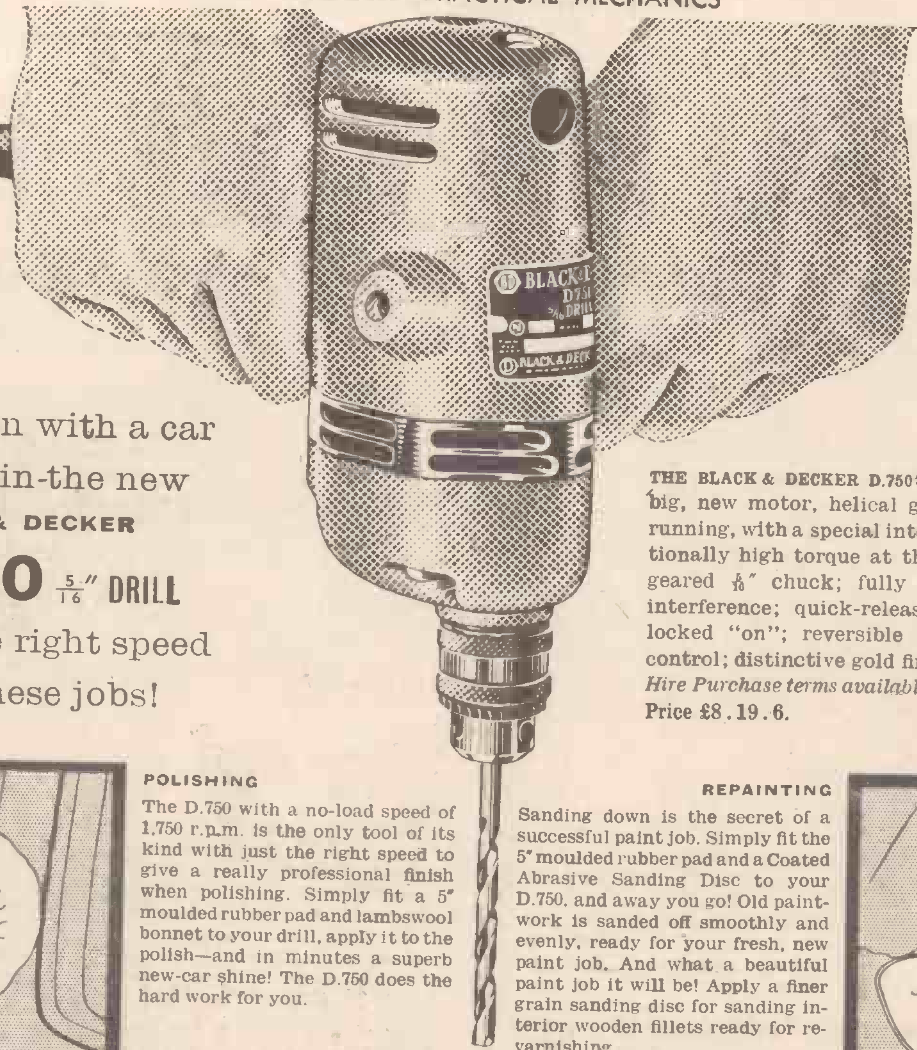
COUPON—POST NOW

K. R. WHISTON (Dept. PM9), New Mills, Stockport.

Please send me a free copy of your Catalogue.

Name ....
Address ....
....

K. R. WHISTON, (Dept. PM9) New Mills, STOCKPORT



For the man with a car to maintain-the new

BLACK & DECKER

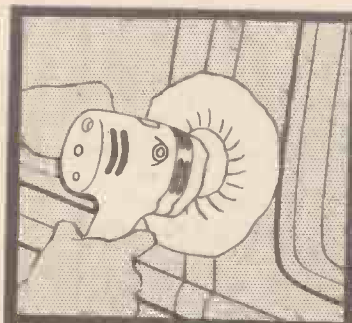
D.750 $\frac{5}{16}$" DRILL

has just the right speed for all these jobs!

THE BLACK & DECKER D.750: Principal features include big, new motor, helical gears for quieter smoother running, with a special inter-gear that delivers exceptionally high torque at the chuck; 3-jaw, precision-geared $\frac{5}{16}$" chuck; fully suppressed against T.V. interference; quick-release trigger switch can be locked "on"; reversible side handle for complete control; distinctive gold finish.

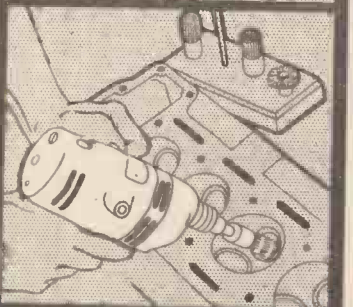
Hire Purchase terms available for D.750 and attachments.

Price £8.19.6.



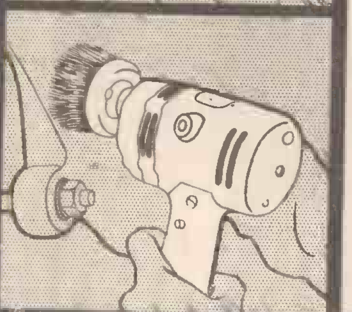
POLISHING

The D.750 with a no-load speed of 1,750 r.p.m. is the only tool of its kind with just the right speed to give a really professional finish when polishing. Simply fit a 5" moulded rubber pad and lambswool bonnet to your drill, apply it to the polish—and in minutes a superb new-car shine! The D.750 does the hard work for you.



DECARBONISING

You do a better job quicker with a D.750 in your hand. Special Black & Decker Carbon Removing Brushes, powered by your D.750 Drill, quickly clean carbon from cylinder heads, tops of pistons, valve ports etc., leaving a finely burnished surface. This way you'll get a really professional job resulting in much better performance and more m.p.g.

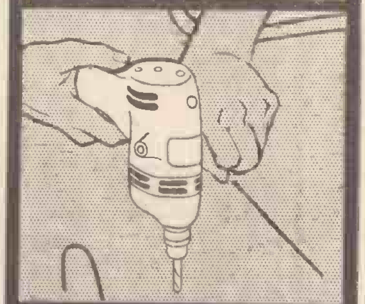


DE-RUSTING AND DIRT REMOVING

No longer a chore when you own a D.750 Drill. It's just the job for removing metal-destroying rust patches and dirt from the chassis or underbody of your car. The attachment used here is the 3" Wire Cup Brush. Spinning at 1,750 r.p.m. it very soon gets rid of every speck of rust and dirt.

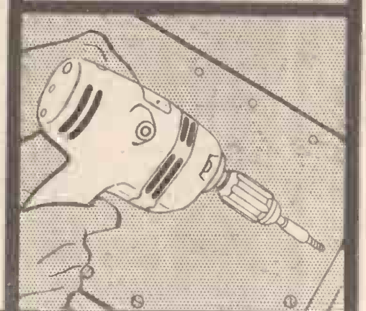
REPAINTING

Sanding down is the secret of a successful paint job. Simply fit the 5" moulded rubber pad and a Coated Abrasive Sanding Disc to your D.750, and away you go! Old paintwork is sanded off smoothly and evenly, ready for your fresh, new paint job. And what a beautiful paint job it will be! Apply a finer grain sanding disc for sanding interior wooden fillets ready for revarnishing.



GENERAL DRILLING

The D.750 is so handy for general work on the car body. Jobs like fixing new mirrors, interior mirrors, windscreen washers, installing ash trays, adding spot and fog lamps etc., can all be attended to with speed and precision. Make up your mind to buy a Black & Decker D.750, and learn to *enjoy* looking after your own car. After all it is a very *special* drill, yet it only costs £8.19.6d.



CONVERSIONS

If you attempt any structural alterations to your car, a D.750 will be a great help. It can be used when converting a saloon to a shooting brake, or fitting interior or exterior panels in a car or side-car—even a major job like building a trailer, or trailer caravan (and why not?) can all be made easier by using a D.750. Dozens of screws to fit? Save your wrists by fitting a Black & Decker screwdriver attachment to your drill.

A *Black & Decker* GOLDEN KEY TOOL

BLACK & DECKER LIMITED · HARMONDSWORTH · MIDDLESEX *Telephone: SKYport 2411/9*

VALUABLE NEW HANDBOOK

FREE TO AMBITIOUS ENGINEERS

Have you had *your* copy of "Engineering Opportunities"?

The new edition of "ENGINEERING OPPORTUNITIES" is now available—without charge—to all who are anxious for a worthwhile post in Engineering. Frank, informative and completely up to date, the new "ENGINEERING OPPORTUNITIES" should be in the hands of every person engaged in any branch of the Engineering industry, irrespective of age, experience or training.

We definitely Guarantee "NO PASS—NO FEE"

This remarkable book gives details of examinations and courses in every branch of Engineering, Building, etc., outlines the openings available and the essential requirements to quick promotion and describes the advantages of our Special Appointments Department.

WHAT THIS BOOK TELLS YOU

- ★ HOW *to get a better paid, more interesting job.*
- ★ HOW *to qualify for rapid promotion.*
- ★ HOW *to put some valuable letters after your name and become a "key-man" . . . quickly and easily.*
- ★ HOW *to benefit from our free Advisory and Appointments Depts.*
- ★ WHERE *today's real opportunities are . . . and* HOW *you can take advantage of the chances you are now missing.*
- ★ HOW, *irrespective of your age, education or experience,* YOU *can succeed in any branch of Engineering that appeals to you.*

144 PAGES OF EXPERT CAREER-GUIDANCE

You are bound to benefit from reading "ENGINEERING OPPORTUNITIES," and if you are earning less than £15 a week you should send for your copy of this enlightening book *now*—FREE and without obligation.

WHICH OF THESE IS YOUR PET SUBJECT?

MECHANICAL ENGINEERING
Gen. Mech. Eng.—Maintenance — Draughtsmanship—Heavy Diesel—Die & Press Tool Work—Welding—Production Eng.—Jig & Tool Design—Sheet Metal Work—Works Management — Mining — Refrigeration—Metallurgy

ELECTRICAL ENGINEERING
Gen. Elec. Eng.—Elementary & Advanced Elec. Technology — Installations Draughtsmanship—Supply —Maintenance — Design —Electrical Traction — Mining Electrical Eng.— Power Station Equipment, etc.

RADIO ENGINEERING
Gen. Radio Eng.—Radio Servicing, Maintenance & Repairs—Sound Film Projection — Telegraphy — Telephony — Television — C. & G. Telecommunications.

AUTOMOBILE ENGINEERING
Gen. Automobile Eng.— Motor Maintenance & Repairs — High Speed Diesel—Garage Mngment.

CIVIL ENGINEERING
Gen. Civil Eng.—Sanitary Eng.—Structural Eng.— Road Eng. — Reinforced Concrete—Geology.

BUILDING
Gen. Building—Heating & Ventilation—Architectural Draughtsmanship — Surveying — Clerk of Works — Carpentry and Joinery —Quantities — Valuations

WE HAVE A WIDE RANGE OF AERONAUTICAL COURSES AND COURSES IN FORESTRY, TIMBER TECHNOLOGY, PLASTICS, G.P.O. ENG., TEXTILE TECHNOLOGY, ETC., ETC.

One of these qualifications would increase your earning power

WHICH ONE?

A.M.I.Mech.E., A.M.I.C.E., A.M.I.P.E., B.Sc., A.M.Brit.I.R.E., A.F.R.Ae.S., A.M.I.M.I., L.I.O.B., A.R.I.B.A., A.M.I.H. & V.E., M.R.San.I., F.R.I.C.S., A.M.I.E.D., CITY & GUILDS, COMMON PRELIM., GEN. CERT. OF EDUCATION, ETC.

THE BRITISH INSTITUTE OF ENGINEERING TECHNOLOGY

BIET
410A, COLLEGE HOUSE, 29-31, WRIGHT'S LANE, KENSINGTON, W.8.
Phone: WEStern 9861

POST NOW!

TO: B.I.E.T. 410A, COLLEGE HOUSE, 29-31, WRIGHT'S LANE, KENSINGTON, W.8.

Only 2d stamp is needed if posted in an unsealed envelope.

Please send me FREE and without obligation, a copy of "ENGINEERING OPPORTUNITIES." I am interested in (state subject, exam., or career)..

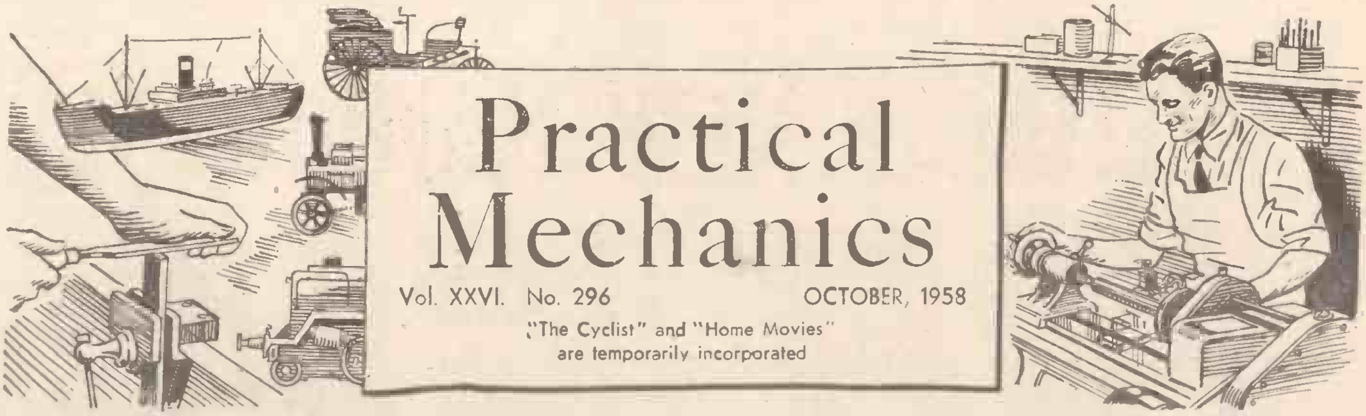
NAME ....

ADDRESS..

....

WRITE IF YOU PREFER NOT TO CUT THIS PAGE

THE B.I.E.T. IS THE LEADING INSTITUTE OF ITS KIND IN THE WORLD



Practical Mechanics

Vol. XXVI. No. 296 OCTOBER, 1958

"The Cyclist" and "Home Movies" are temporarily incorporated

Editorial and Advertisement Offices
"PRACTICAL MECHANICS"
George Newnes, Ltd., Tower House, Southampton Street, Strand, W.C.2

© George Newnes Ltd., 1958

Phone: Temple Bar 4363
Telegrams: Newnes, Rand, London

SUBSCRIPTION RATES
Including postage for one year

Inland	20s. per annum.
Abroad	18s. 6d. per annum.
Canada	18s. 6d. per annum.

Copyright in all drawings, photographs and articles published in "Practical Mechanics" is specially reserved throughout the countries signatory to the Berne Convention and the U.S.A. Reproduction or imitations of any of these are therefore expressly forbidden.

CONTENTS

CONTRIBUTIONS

The Editor will be pleased to consider articles of a practical nature suitable for publication in "Practical Mechanics." Such articles should be written on one side of the paper only, and should include the name and address of the sender. Whilst the Editor does not hold himself responsible for manuscripts, every effort will be made to return them if a stamped and addressed envelope is enclosed. All correspondence intended for the Editor should be addressed: The Editor, "Practical Mechanics," George Newnes, Ltd., Tower House, Southampton Street, Strand, London, W.C.2.

FAIR COMMENT

TWENTY-FIVE TO-DAY!

ELSEWHERE in this issue is a review of the 25 years of progress of this journal. I have received a very large number of letters of congratulation from readers all over the world, and from leaders of various industries, and I gratefully here acknowledge them. All pay tribute to our expansive editorial policy which has promptly dealt with the changing scene in the spheres of science, mechanics, and invention, and, as one reader puts it, "has made P.M. the leader of thought, and the promoter of ideas" in many spheres. It is very pleasant to record that the circulation of this journal has continuously risen since it was first published 25 years ago, and in spite of competition has maintained its leading position throughout. It has a larger circulation than any journal in a similar field.

HOME-BUILT CARS

MANY people today are endeavouring to build their own cars from secondhand chassis obtained from the breaker's yard, in some cases fitting fibreglass bodies and registering them for Road Fund purposes as "specials." Readers should, however, be warned against embarking on any such venture until they have ascertained whether the car will comply with the Road Vehicles (Construction and Use) Orders, which is quite a voluminous tome. There is also the question of whether the car will be accepted for Road Fund registration purposes, for the licensing authorities have power to refuse a licence until the vehicle has been inspected.

If the major parts are more than 10 years old, such cars will have to undergo the forthcoming tests for cars 10 years old or over.

Readers will remember that many years ago I designed, built, tested and described in this journal the £20 car in two versions—the three- and the four-wheeler. The design complied with the law in every respect and many hundreds of them have since been built without difficulty with the licensing authorities. Another important point with a home-built car is that you may find it difficult to get an insurance company to issue an insurance policy for it, and without this you cannot obtain a Road Fund Licence.

If you are thinking of building a home-made car, make quite sure that the design emanates from a reliable source and that it complies with the law, particularly in the matter of brakes and lighting, and that it is fitted with a reverse gear. Some cars have been built with motor-cycle engines not fitted with reverse gear and it is the law that every vehicle which has an unladen weight of over 8 cwt. shall be fitted with reverse gear. There are also regulations regarding safety glass, silencers, reflecting mirrors, parking brakes, length, width, distribution of weight, to mention but a few of the legal requirements.

"NEWNES' ENGINEER'S MANUAL"—5TH EDITION

THE fifth edition of Newnes' Engineer's Manual is now ready, having been out of print for many years. There has been a continuous demand for it, and so the present fifth edition has been prepared. It is an entirely new book, however, and has been greatly enlarged. The new edition costs 35s. or by post 36s. 6d., from the Book Publisher, address as on this page.—F. J. C.

THE CYCLE SHOW—VISIT OUR STAND

ALL readers will be welcome at our Stand No. 13, at The Cycle and Motor-cycle Show, which takes place at Earls Court from November 15th to 22nd.

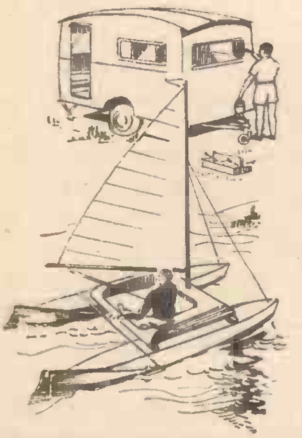
The November issue will be published on October 31st. Order it now!

Our Silver Jubilee

A Review of Our 25 Years of Continuous Publication

By the Editor

THIS issue of PRACTICAL MECHANICS celebrates 25 years of continuous publication—its Silver Jubilee. It was the second of our Practical Group of journals to have attained 25 years of continuous publication, with only one break due to the printing strike. For it was in 1933 that, following the success of *Practical Wireless*, that it was decided to launch PRACTICAL MECHANICS. Its editorial policy was based on the widest possible lines. It was planned to cover the spheres of science, invention, mechanics, model making and all of the wide range of practical subjects. It was evident in 1933 that new sciences and new techniques had brought about a change in pubic interests. They were looking for something more modern and of wider vision than the craft magazines of the period, which were chiefly concerned with model making.



A strong feature of this journal has always been its practical constructional articles. Here are sketches of the P.M. Trailer Caravan and Catamaran

The Launch

Therefore PRACTICAL MECHANICS was launched in October, 1933, at a time when the scientific world was undergoing a rapid metamorphosis. Television was on the way, nuclear energy was dawning, aircraft were beginning to take on a new form, both as to higher speeds and engine design, the plastic industry was beginning to branch out, space flight was being considered as a possibility in the near future, the motor car had taken on a new form, the diesel engine was getting under way, electronic engineering had established itself as a new industry, high speed ocean-going liners were replacing the ships of older type and new industries, founded on new sciences, were springing up almost every month.

News From All Quarters!

It has been a most fascinating quarter of a century and we made it our policy to bring to our readers month by month the latest information of developments in all these directions gathered from the four quarters of the globe. In many cases, readers first learned of these developments from the pages of this journal, often months ahead of the daily press and technical journals. The hobby-minded public were turning from model locomotives and from ornamental turning and other practical crafts to power-driven model aircraft, full-size gliders and light aeroplanes.

Scoops

This journal, therefore, dealt with the construction of the Flying Flea, the Luton Minor light monoplane, full-size gliders, power-driven model aircraft and radio-control of models to satisfy the increasing interest in these newer hobbies. We set a new standard in journalism, not only by the broadness of the editorial field, but also with the exceptional reader service we gave through our Free Advisory Service. We specialised in a wealth of illustrations and it can fairly be said that we set a pattern which many other publishers have endeavoured without success to emulate. *Practical Wireless*, when this journal came out, was two years old and in that period its great success had caused all its competitors except one to fall by the wayside.

Unique

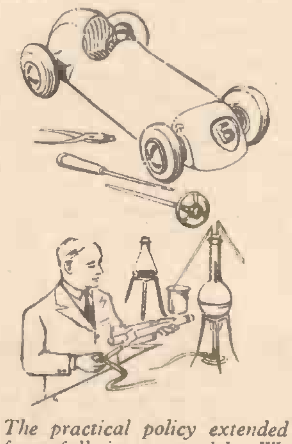
The first issue of PRACTICAL MECHANICS rapidly sold out and, month by month, orders for it increased until they reached its present very high level. PRACTICAL MECHANICS remains the only journal of its type in this country and it is very pleasant to be able to record that many thousands of those who took the first issue are still readers to-day.

Hundreds of readers paid generous tribute to the part this journal has played in earning them promotion. Many ideed, call at these offices to record their appreciation in person. Technical schools and colleges soon found that it was a journal their scholars should read, as it provided an auxiliary education and stimulated interest in the subjects included in the school curriculum. PRACTICAL MECHANICS is on the approved list of the London County Council and most other educational authorities throughout the country.

Inventors in hundreds have appealed to us for advice, and in a large number of cases we have helped them on the road to success and in an even larger number have saved them from the financial disaster which follows when over-enthusiasm for the possibilities of an invention has blinded them to the commercial drawbacks.

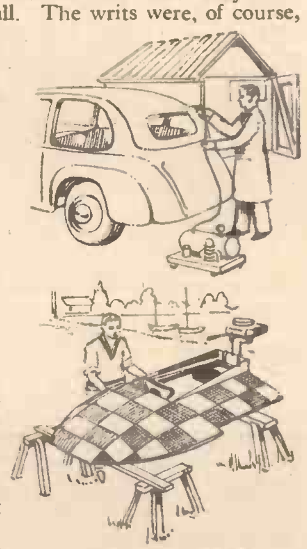
Attack by the Conjurors

It has not always been easy to carry out such a bold editorial policy, for trade associations in some cases resented our exposure of what had hitherto been considered as trade secrets. For example, when we launched our series of articles giving details of conjuring tricks, a magicians' union threatened action against us for what they considered to be "infringement of copyright" in their tricks. A fund was raised through the pages of an entertainment journal in order to prosecute the writ. After the conjurors had taken counsel's opinion, they learned what they should have known, that there is no copyright in a trick as such and their greatest illusion was that they ever had a case at all. The writs were, of course, withdrawn and our reply to the threat was more articles exposing the secrets of conjuring.



The practical policy extended from full-size to model. We were early in the field with a design for a model powered racing car and power-driven aircraft and boats. But equally we gave practical experiments in chemistry and electricity.

The conjurers, I believe, subscribed quite generously to this fighting fund, but I never discovered what happened to the money so raised. The conjurors had for many years been extorting money from other publishers in this way, publishers who preferred to pay rather than fight.



There was a diversity of topics; the above sketch is a reminder that we described how to build garages and how to spray the car. The bottom sketch shows our full-sized hydroplane.

To protect them from future attacks by conjurors we reported the facts to *World's Press News* and other trade papers. One paper humorously commented that whilst we were naturally jubilant with our victories over the rabbit out of a hat merchants, we should be careful that someone did not arrive outside Tower House with a small conjuring table, utter a few words of conjurors' mumbo-jumbo and transport George Newnes, Ltd., and myself, to the Gobi Desert!

Our £20 Car

Soon after this journal was launched I considered that a small runabout car which readers could build for themselves was wanted by a large public which could not afford to buy the cheapest car then on the market. Accordingly, I spent the evenings and weekends over a period of some months designing and building such a car.

It was not designed around pieces of old motor cars obtained from the breaker's yard but from new components available for all from stockists. It could be built for just over £20 and it was called the "£20 Car." Many hundreds of them have been built since then. It complied in every particular with the Road Vehicles Construction and Use Orders which is more perhaps than can be said for some of the designs now being published, which are built round breaker's yard components, and which do not comply with the law. In any case some will have to be submitted to the 10-year-old test.

The Flying Flea

The Frenchman, M. Mignet, at that time under the sponsorship of a daily newspaper, had created national interest in his little miniature aeroplane the Pou de Ciel, or the Flying Louse, but which we in this country rechristened the Flying Flea. This journal, alone of the technical press of this country, made arrangements with him to publish full working drawings of the machine and clubs were started all over the country to build it from those designs. Although a large number were built and successfully flown, there is no record of any of them suffering an accident.

Boats

From cars and aeroplanes to boats was a natural transition and, apart from rowing and sailing boats, we published designs for cabin cruisers, outboard motor boats, and other powered craft. This was the first journal to publish constructional details for a television receiver, which at that time, of course, was a disc machine of the Baird pattern designed for the low-definition (30 line) transmissions of the period. High-definition came much later.

Space Travel

In the 30's too, the Interplanetary Society had been founded by a group of enthusiasts who believed in the possibilities of space flight, and accordingly we commissioned one of the leaders of the movement to write a series of articles on the subject dealing with past experiments, history and present and future developments. Other journals pooh-poohed the idea of space flight. I, however, took the view that space flight was possible, and that it was only a matter of time and money to achieve interplanetary travel. It must be a source of gratification to those early space enthusiasts, as it is indeed a tribute to the pre-vision we showed, to see the fulfilment in part of their dreams, as exemplified by the Russian and American artificial satellites which have successfully demonstrated the theories put forth 25 years ago by the Interplanetary Society.

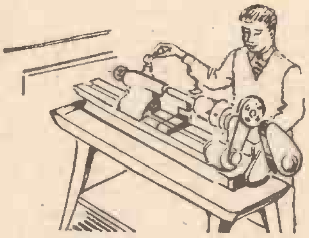
Interspersed with scientific articles typified by the foregoing, we regularly published articles on model making, chemistry, radio, electronics, lathe work, photography, cinematography, and matter which is now known under the general label of D.I.Y.

Our Companion Journals

The great success of these two journals caused us to turn our minds to an expansionist policy of producing practical journals in other spheres, and the next journal on the list was the *Practical Motorist*, which was published pre-war as a weekly, was suspended during the war and reappeared four years ago as a monthly publication. It quickly achieved a larger circulation than any other motoring periodical and it has become the leader in this field. Very naturally other publishers, impressed by the great success of our journals, endeavoured to jump on the bandwagon, but unsuccessfully. Some did not last a couple of years.

Shortly after the *Practical Motorist* came *The Cyclist*. This became one of the early casualties during the war and has become a supplement to this journal.

There followed *Practical Television*, launched just after the Television Advisory Committee had issued its report in favour of the television service. This, however, was ahead of its time, so publication was suspended when the war started, but it has since reappeared and it remains alone as the only practical publication dealing with television in this country. Like PRACTICAL MECHANICS, it is essentially practical and has published several designs for home-built television receivers.



We regularly published articles on the practical crafts such as lathe work and the use of hand tools in wood and metal.

The Practical Householder

But the greatest triumph was yet to come. Just after the war householders began to take a keener interest in house decoration and repair. Special power tools, paints, and materials were being produced and it was obvious from our query service that we could not hope to deal in this journal with all of the D.I.Y. subjects in demand. Accordingly, we launched *The Practical Householder* which immediately achieved an enormous circulation approaching the million mark (it twice exceeded it) and which in spite of journals started in competition with it maintains its lead by hundreds of thousands over all of them.

The great success which has attended the Practical Group of periodicals is a source of satisfaction to all those associated with it and we gratefully acknowledge the loyalty of our vast band of readers who have gathered round our banner and made this possible.

CONGRATULATIONS

A Few of the Hundreds of Birthday Greetings We Have Received

From LORD BRABAZON OF TARA

Many congratulations on 25 years' publication of PRACTICAL MECHANICS. This paper has given tremendous pleasure to thousands of people in every home, and I sincerely hope it will long continue its useful work.

From R. A. FULLER

(Joint Managing Director Bassett-Lowke, Ltd.)

Mr. Whynne (W. J.) Bassett-Lowke would have particularly enjoyed writing this letter for he knew and admired the enthusiasm and industry which launched PRACTICAL MECHANICS.

At that difficult period it was a courageous adventure which rapidly reaped the reward of a steadily increasing readership. The policy of dealing with a wide variety of subjects and keeping readers informed of technical and scientific developments in good, readable English well justified the choice of its name.

Right from those early days we have advertised in your columns and continue to do so for the best of reasons —it's good business.

Congratulations on reaching the 25th Anniversary of PRACTICAL MECHANICS. It is a grand record of past achievement with a great prospect for future development.

From A. H. WHITELEY, M.B.E

(Founder and Managing Director Whiteley Electrical Co. Ltd.)

It is with much pleasure that I send congratulations to PRACTICAL MECHANICS on its fine record. From the early pioneering days the magazine has encouraged a practical interest in mechanical construction and design. Under the inspired direction of its founder-editor, F. J. Camm, intricate and complicated technical details have been presented to its readers in simple, easy to grasp language, so that enthusiastic amateurs in all parts of the world have been able to enjoy the fruits of mechanical development and, often, to play a part in the progress.

I trust that the good work of PRACTICAL MECHANICS may be continued for many years so that readers may keep pace with the long and rapid strides we are witnessing in the field of modern mechanics.

From F. H. BARNES

(Publicity Manager the Telegraph Condenser Co. Ltd.)

Twenty-five years is a memorable milestone in the life of any publication, particularly when its appeal is only to a specialised readership, and I am therefore very pleased to send my congratulations to PRACTICAL MECHANICS.

In so doing, I fully realise that the congratulations and good wishes are primarily to Mr. F. J. Camm. Even his optimism could not have foreseen that the fledgeling he launched in 1933 would, a quarter of a century later, enjoy such a phenomenal circulation.

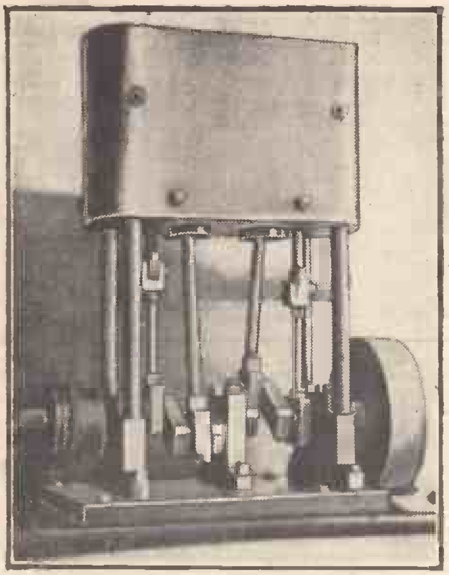
We were in from the beginning, for a T.C.C. advertisement appeared in the first issue. In remembering this, may I sincerely hope that in another 25 years "P.M." will be equally—if not more—popular with another generation of enthusiasts.

From BURNE-JONES & CO. LTD.

From the advanced age of 38 years and as the second electronic and radio company to be established in Great Britain, being preceded only by Marconi, Burne-Jones & Co. Ltd. take great pleasure in offering their heartiest congratulations to PRACTICAL MECHANICS on attaining their 25th birthday.

A quarter of a century ago we advertised in the first issue of this journal offering a dual gang condenser for an early type radio. To-day we specialise in high fidelity sound squipment. In all the years that have seen rapid development in radio, television and sound reproduction, we have found the columns of PRACTICAL MECHANICS helpful and stimulating and its advertising space fruitful.

PRACTICAL MECHANICS are to be complimented on their pioneer work in this field and we look forward to a continued friendly association with this journal and its readers and wish it Many Happy Returns.



A photograph showing the completed twin cylinder vertical steam engine.

A Twin Cylinder Vertical Steam Engine

A High Speed Power Unit for Model Boats, etc.

By A. R. Thomson

THE steam engine to be described was built from available scrap materials and measurements are given to suit these particular materials. Dimensions can be altered to suit materials to hand.

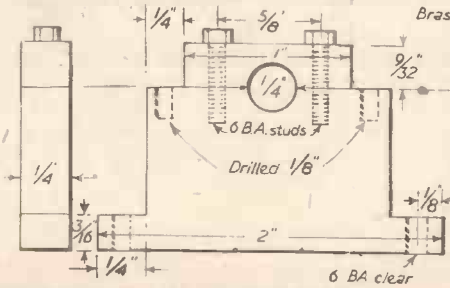


Fig. 2.—End bearings.

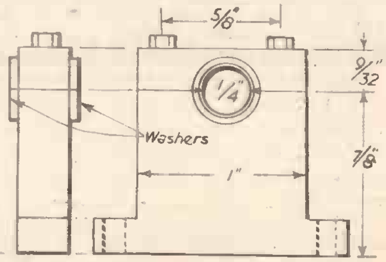


Fig. 3.—Centre bearing.

The engine is capable of a high speed, using a similar type of boiler to that described in the February, 1956, issue.

Main Bearings

The baseplate and main bearings should be tackled first. The baseplate is a piece of 3/16in. mild steel and the bearing fixing holes should be countersunk on the underside. It might be advisable not to drill the holes for the centre bearings, the two end bearings being bolted on first then the centre bearing being lined up accurately, either using the crankshaft as a guide or a straight length of ¼in. rod.

The dimensions of the end bearings are given in Fig. 2. They are made in two pieces and bolted together with 6B.A. studs let into the bottom part and soldered. The ¼in. hole for the main shaft is drilled with the two pieces bolted together. Before parting the bearings again, one face of both top and bottom portions should be marked with a light tap from a centre punch. The centre bearing can have two punch marks, and the other end bearing three. This ensures that the bearings are always assembled correctly and there is no possibility of mixing one with two, and so on. The two end bearings can now be bolted to the baseplate.

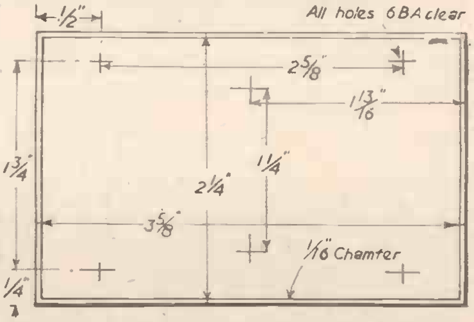


Fig. 4.—Drilling details of the engine bedplate.

The centre bearing can be made in the same way. After the shaft hole has been drilled remove the top section, slip a 1/32in. thick washer over each stud and bolt together again. A 1/16in. thick washer with a bore of 5/16in. is now soldered on to each side of the bearing directly over the ¼in. hole. To prevent the first washer coming unsoldered when the second one is put on, lay the bearing with the first washer underneath on to a flat surface; firm, downward pressure will prevent the first one moving while the second is being soldered in place.

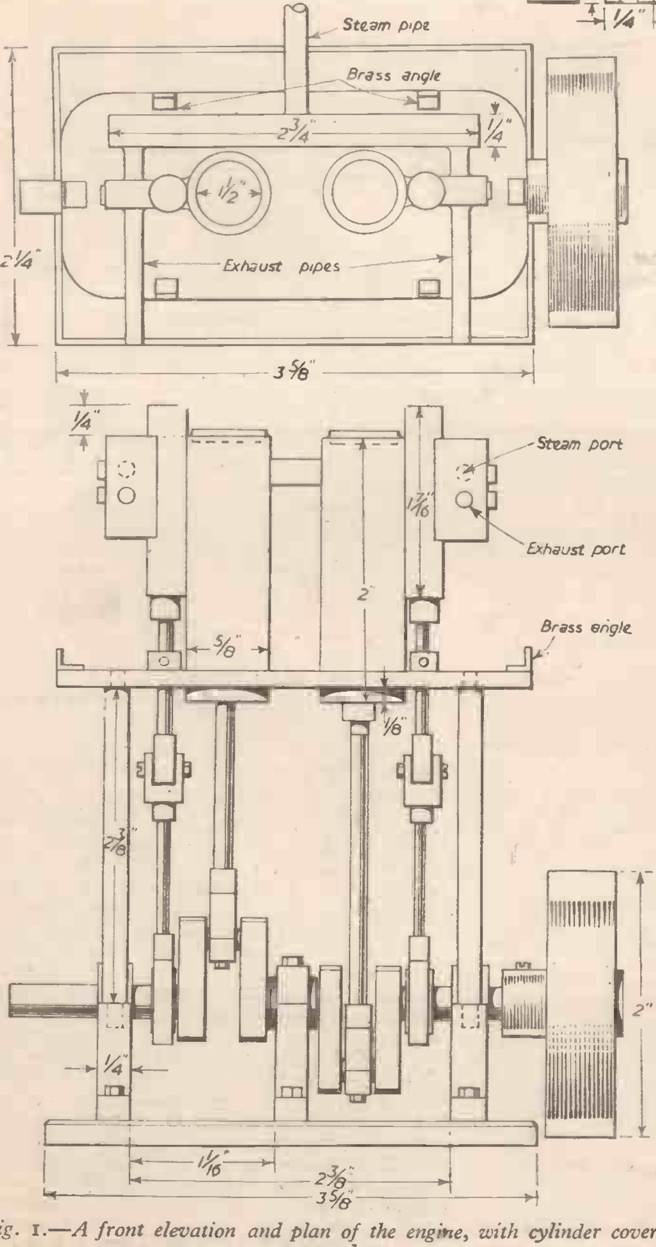


Fig. 1.—A front elevation and plan of the engine, with cylinder cover removed.

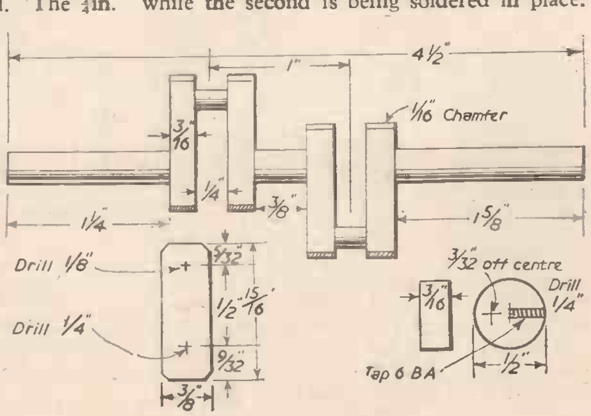


Fig. 5 (Right)—Crankshaft, webs and eccentric.

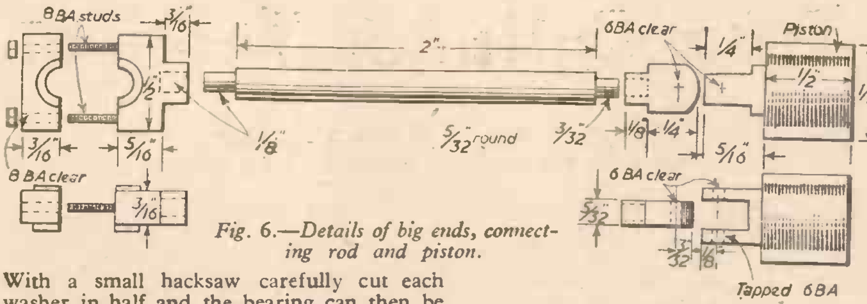


Fig. 6.—Details of big ends, connecting rod and piston.

With a small hacksaw carefully cut each washer in half and the bearing can then be taken apart for cleaning up. These washers are required to keep the crankshaft webs spaced from the bearing and also prevent sideplay in the shaft.

Now place the centre bearing in position and line up with a length of $\frac{1}{4}$in. shafting through the three bearings and finally bolt in position. If all is well the shaft should rotate freely.

Crankshaft

The shaft is $\frac{1}{4}$in. steel rod and the cranks are of brass. Drill each web for the main shaft first of all and then, with a short length of $\frac{1}{4}$in. rod, clamp them together in pairs before drilling the $\frac{1}{8}$in. hole for the big-end pin. This will ensure the two holes being lined up correctly for each crank. Each pair of webs should be marked with a punch mark in a similar manner to the main bearings. Assemble the webs on the main shaft to the spacings shown in Fig. 5 and insert the $\frac{1}{8}$in. crank pins. Now carefully solder the main shaft and crank pins to the webs, making sure that the solder flows right through the joints. The whole crankshaft should be laid out perfectly flat for this operation. Remove the waste $\frac{1}{4}$in. shaft from between the webs and file flush. The crankshaft can now be laid in the main bearings to see if it turns freely.

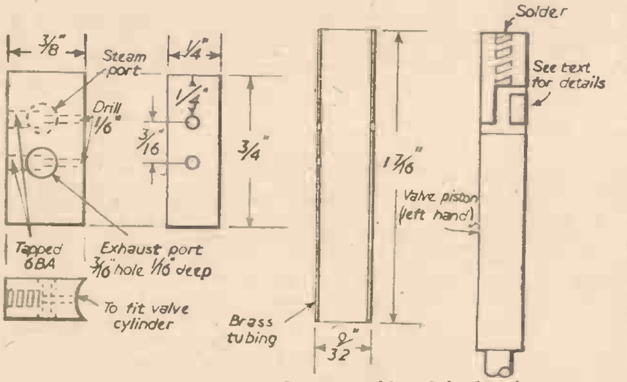


Fig. 8.—Steam valve assembly—left hand.

Big Ends, Connecting Rods and Pistons

The big ends are cut from 3/16in. brass and shaped as shown in Fig. 6. A similar method of construction to the main bearings is used here. The big ends are made in two pieces and bolted together before drilling the $\frac{1}{8}$in. bearing hole. A 1/32in. thick washer is then put on each stud so that space for a saw cut is left between the faces; another 1/32in. washer is then soldered over each bearing hole and carefully cut in half. The two pieces are then separated and the two meeting faces filed smooth.

The connecting rod is a length of 5/32in. steel rod turned down to $\frac{1}{8}$in. at each end, as shown, and soldered into the big end and piston connecting piece, the latter being cut from brass to the size shown.

The piston is of steel turned to the size shown in Fig. 6, carefully finished to be a good sliding fit in the cylinder. One end of the piston is turned down to $\frac{1}{4}$in. and slotted, as shown. Note that this is drilled 6B.A. clearance on one side and tapped 6B.A. on the other.

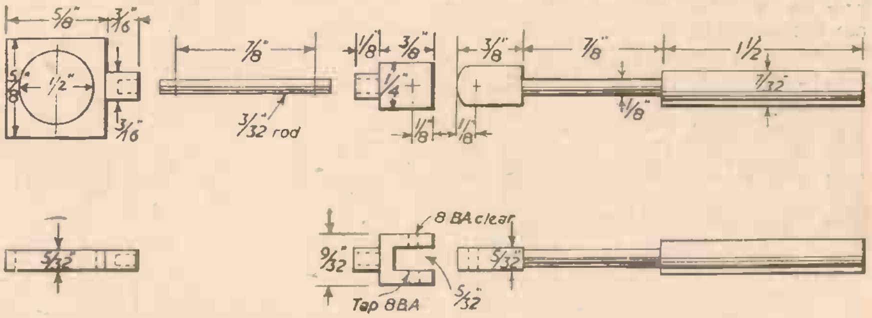


Fig. 7.—Details of valve gear, eccentric rod and valve slide.

Valve Slide and Eccentric

The eccentric is shown in Fig. 5 and is 3/16in. thick, cut from $\frac{1}{2}$in. round bar, steel. Carefully drill a $\frac{1}{4}$in. hole 3/32in. off centre and tap 6B.A. for a grub screw as shown. Fit to the main shaft spaced 1/16in. from the cranks and behind them by 90 deg.

The eccentric head is cut from brass 5/32in. thick. It is advisable to drill the $\frac{1}{2}$in. holes before cutting out and to shape the heads round the holes. A 3/32in. rod is now soldered into the head and also into the brass connecting head, which is coupled to the valve piston.

The valve piston is turned down from $\frac{1}{4}$in. steel rod to be a good sliding fit in the valve cylinder. The $\frac{3}{8}$in. length at one end is filed flat to fit the brass connecting piece without any sideplay. The 8B.A. connecting bolt should be adjusted till the sideplay is at a minimum consistent with free movement.

Cylinders and Valves

The cylinder platform can now be cut from $\frac{1}{8}$in. brass and drilled as shown in Fig. 9. Another piece of $\frac{1}{8}$in. brass is also cut to the same size but left undrilled. This serves as the top of the engine casing and will be referred to later. The cylinders are made from $\frac{1}{2}$in. bore brass tubing and it is a good plan to have them reamed out to ensure they are perfectly round and true before the pistons are fitted. Solder the two cylinders in place on the platform with an $\frac{1}{8}$in. protruding on the underside. The valve cylinders can now be soldered to the sides of the cylinders with $\frac{1}{4}$in. projecting above the top of the main cylinders. A good fillet of solder is required at the join as shown in Fig. 1, plan view.

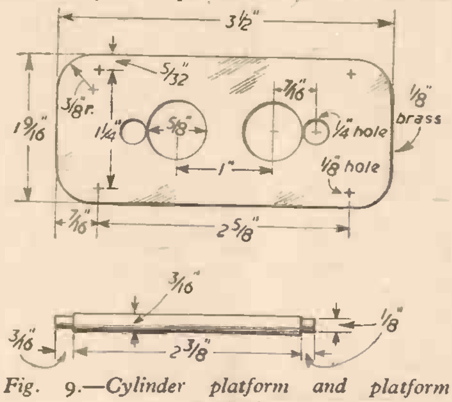


Fig. 9.—Cylinder platform and platform supports.

Solder the four platform supports into the holes previously drilled in the end bearings and also solder the platform to the top of these supports. The supports can be brass, steel or copper. Here they are of copper rod, 3/16in. in diameter, turned or filed down at each end to $\frac{1}{8}$in.

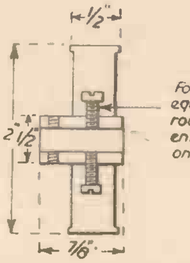


Fig. 10.—Flywheel (section).

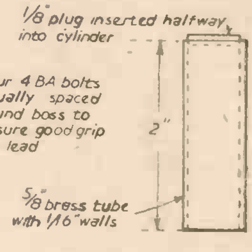


Fig. 11.—Cylinders.

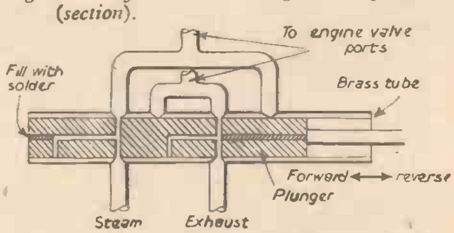


Fig. 12.—Suggested forward/reverse valve.

Place the crankshaft in the bearings with the eccentrics only in position and the valve pistons fitted into the valve cylinders. Taking the left-hand crank first, rotate the shaft till the crank is horizontal, with the crank pin to the front. The valve piston should now be in its highest position. Wedge the crankshaft in this position by placing a piece of thin shim brass between the top of the shaft and the bearing and tighten the nuts. Now drill a 1/16in. hole $\frac{1}{2}$in. from the top of the valve cylinder, through the valve piston and into the main left-hand cylinder. Slacken off the main shaft and rotate through 180 deg. This should bring the right-hand crank horizontal and pointing to the front. Again lock the main-shaft and drill another 1/16in. hole through the right-hand valve cylinder, piston and main cylinder. Remove the crankshaft and valves and drill another 1/16in. hole 3/16in. *below* the first through the outer wall only of each valve cylinder.

Smooth off the burrs inside and similarly with the main cylinders.

Now take each valve piston and drill a 3/32in. hole from the top end till it reaches the .1/16in. hole previously drilled. Drill another 1/16in. hole on the side facing the main cylinders till it reaches the 3/32in. hole. Fill up the end of the vertical hole with solder. Note that the valve pistons have the second 1/16in. hole on opposite sides. This second hole is drilled 3/16in. *above* the first. The action of the valve is self evident from Fig. 8.

The steam pipe and exhaust blocks can now be made as shown in Fig. 8. They are cut from ¼in. brass and filed as shown in the sketch to fit snugly against the side of the valve cylinder. Two 1/16in. holes are drilled right through as shown and then tapped 6B.A. halfway down from the outside. Drill another 1/16in. hole from the front to meet the lower hole and countersink 3/16in. to a depth of about 1/16in. Do the same at the back, but this time to meet the upper hole. These latter holes are for the exhaust and steam pipes.

The pipe connecting blocks can now be soldered to the side of the valve cylinders. Locate them with their holes directly over the two holes in the valve cylinder wall and, to keep them in position with the holes in line, insert two wooden plugs right through the block and cylinder wall. When soldering the block in place care is required so that the solder holding the valve cylinder to the main cylinder does not melt. A good plan is to clamp the two together by binding a layer of thin wire round the bottom part of the valve cylinder and the main cylinder while the blocks are being soldered on. One of the small blow-torches is ideal for this type of work. Finally clean off all excess solder. The main cylinder ends can also be soldered on at this stage.

Steam and Exhaust Pipes

Two short lengths of 3/16in. pipe are now soldered in place into the back upper holes of the blocks (see Fig. 1, plan view). A 2¾in. length ¼in. copper pipe with holes drilled to accommodate the short pipes is now soldered in place and the ends of the ¼in. tube plugged with brass and soldered. The steam pipe from the boiler is then soldered into the centre of the ¼in. tube.

The exhaust pipes are simply lengths of tubing soldered into the holes on the opposite side of the blocks and brought out to the level of the edge of the platform. The exhausts can be fitted in the same way as the steam pipes and brought out to a single pipe. The two holes in each block tapped 6B.A. are now plugged with 6B.A. bolts.

Final Assembly

The pistons, cranks and eccentrics can now be fitted and the crankshaft rotated slowly to check for any binding. The flywheel is of lead cast round a brass boss as shown in Fig. 10. Afterwards it is turned down in the lathe to run true.

The engine can now be tried out. Use compressed air for the first trial and if all goes well change over to steam. After checking that there are no steam leaks at any of the joints, the cylinder cover can now be fitted. This is a piece of tin or brass 2⅜in. wide soldered round the edge of the piece of ⅛in. brass previously cut out and the same shape as the cylinder platform. Two holes are drilled in the front to allow the ends of the exhaust pipes to show through and a slot cut in the back to fit over the steam pipe. The brass angle pieces are soldered to the cylinder platform and tapped 6B.A. Holes are drilled in the cover to coincide.

The engine can be reversed by putting steam into the "exhaust" pipes. The steam pipe then becomes the exhaust. A change-over valve could be fitted to enable the engine to run either way and a suggested method of doing this is shown in Fig. 12.

A Permanent Holder for Multigrade Filters

Details for Making it are Given by S. E. Lacey

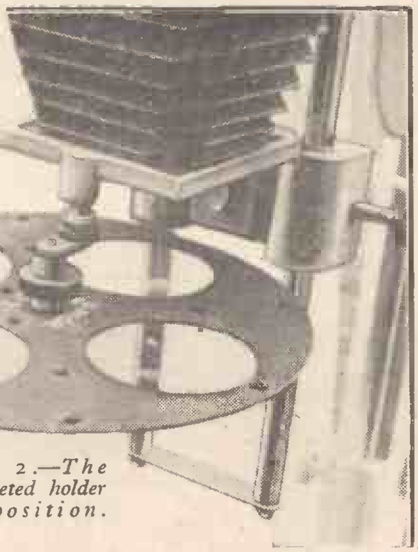


Fig. 2.—The completed holder in position.

HAVING been a user of multigrade papers for some time, and finding that holding the filters up to the enlarger cut down production time, I decided to make a permanent holder.

Two pieces of 22 G. copper sheet, 16 ¼in. No. 8B.A. round head nuts and bolts, and a set of Ilford multigrade filters are all the materials required. Tools required are a wheel brace, drills and a file. Exact measurements cannot be given as these depend on the type of enlarger in use.

In designing the holder as a permanent fixture to the enlarger, it was realised that papers other than multigrade would be used, and therefore provision has been made for this, which, incidentally, is also necessary if one uses the "mixed light" technique.

Construction

Determine the actual size of the filter in the following way. Referring to Fig. 1, radius "A" is the distance from the centre of the red filter spindle to within ¼in. of the focusing bars of the enlarger, or if your enlarger is not of this type then the measurement should be taken to ½in. to ¾in. beyond the lens. Now scribe on one piece of copper sheet a circle to this radius; this forms the outside of the filter holder. Next measure radius "B," which is from the centre of the red filter spindle to the centre of the lens, and scribe a circle to this radius inside the circle already scribed; this circle forms the centres from which the individual filter apertures will be scribed. Next divide the large circle into quarters, and where the straight lines bisect the inner circle these are the centres from which are scribed the four smaller circles. The diameter of these four apertures will be equal to the overall diameter of the lens plus ½in.; this is to ensure that there will be no restriction of light from the lens. Having found this diameter, next scribe the four smaller circles from the points already fixed. Now divide each quarter in half; this is to fix the points for the 8B.A. nuts and bolts between the filters. Having done this, now mark off for all the nuts and bolts as shown marked X on the diagram. This setting out is carried out on one piece of copper sheet only.

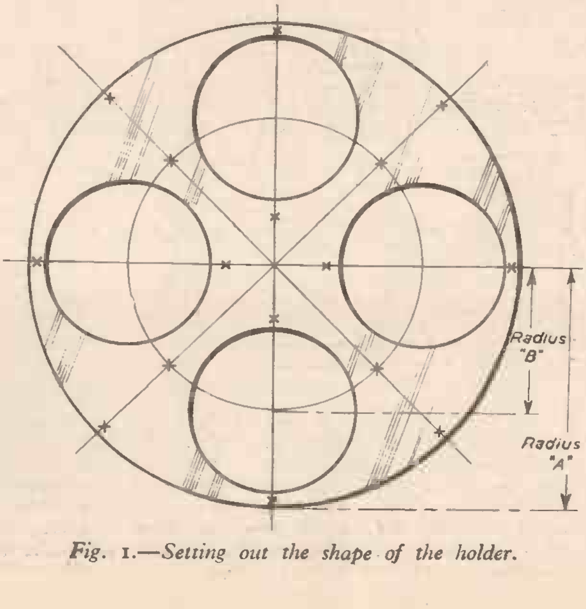


Fig. 1.—Setting out the shape of the holder.

The two sheets of copper are now cramped together, and all holes for the 8 B.A. nuts and bolts are drilled through both sheets, and a centre hole drilled to suit the red filter spindle. Next insert all the nuts and bolts, tighten up, and remove the cramp. The next operation is to cut out the four small circles and finally the outside circle. This can be carried out by one of two methods: (1) by using a tank cutter or (2) by drilling a series of small holes round each circle, breaking out the centres and then cleaning up the holes with a fine file. Paint both sides matt black and leave to dry. Next cut and fit the multigrade filters inside the four nuts and bolts surrounding each aperture, then fix to the enlarger (Fig. 2). You will now have three apertures with filters, and one without.

Gold and Silver Electro-plating

A Profitable Spare-time Business
Described by Peter Wix

THE value of electro-plating equipment to the jeweller and to the craftsman working in copper, brass and similar metals is fairly obvious. But the work of plating, on its own, can provide a very useful income.

Commercial equipment is very costly but fortunately it is a simple matter to make your own. The expense of setting up a small plant depends upon how many of the following items you can muster:

A fairly substantial workbench. It does not matter how rough it is, but it must be kept for plating and nothing else.

A sheet of steel or aluminium of rather heavy gauge, about 2ft. × 1ft.

Two 12in. squares of asbestos mat, at least ½in. thick.

Two 500-watt hotplate-type heating elements or boiling rings. (These need only cost about 5s. each.)

Electric cable, twin and single; a power plug, and an ordinary household switch.

A 6-volt car or motor cycle battery.

Two alligator clips to clip on battery terminals or cell connectors. (In this way you can select 6, 4, or 2 volts.)

A car or motor cycle ammeter.

Any variable resistance that will handle three or four amps.

Two cheap enamel saucepans of 10in. dia. with lids, and one saucepan of 7in. or 8in. dia. which need not have a lid.

Some sofe copper wire of 28 s.w.g. for small jobs, and 22 s.w.g. for general use.

A glass rod for stirring, a good pair of rubber gloves, and a thermometer to measure up to boiling point.

Fig. 1.—The author's plating equipment.

Silver salts, gold salts, silver anode and gold anode will all have to be bought, but their life is extremely long. A serious word of warning is called for. These salts, as powder and in solution, are highly poisonous. They are covered by the Poisons Regulations in the same way as certain photographic chemicals and they are only supplied against a proper printed order signed by the purchaser. The author's equipment is shown in Fig. 1.

Heating Circuit

This is shown in Fig. 2, and a convenient bench layout in Fig. 3. The mains cable is taken via the switch on the right of the control panel, and then under the bench and through it to the heating elements, thus obviating the danger of wet cables.

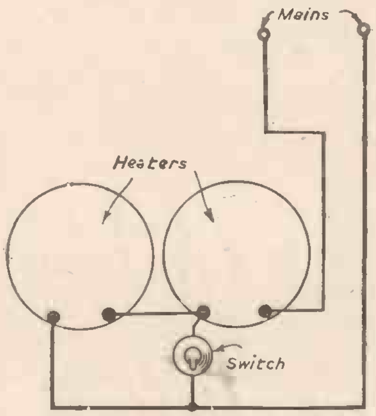


Fig. 2.—The heating circuit.

The metal plate protects the bench from excessive heat and is screwed to two or three wooden strips which keep it raised about 1in. from the bench.

The heaters are fixed on their asbestos sheets, and holes are drilled through the metal plate to take the wires. Be careful where the wires pass through the metal and use the proper porcelain insulators at this point. Always remove the mains plug when shifting plating solutions or doing anything where liquid is liable to be splashed on the live heating elements.

The gold bath and the soda cleaner are used hot. The procedure of heating is as follows:

(a) With the switch in the "on" position, thus giving full heat at the right-hand ring, heat the soda solution in which all work must be cleaned and degreased before plating.

(b) If you are going to silver plate and your cleaning is finished, you will not need the ring again. But to keep the soda hot for further cleaning, switch off so that the heaters are now in series, and thus at reduced heat. If you are gilding you can remove the cleaner and bring the gold bath up to the correct temperature on the ring at full heat before switching them both to "low" and using the other ring to maintain the temperature of the soda for further batches of work.

A 500-watt ring at half heat will keep a plating bath at a fairly steady 140 deg. F.

Plating Circuit

Fig. 4 shows this quite clearly. It is important to have negative and positive terminals as indicated. Reversing the polarity will simply result in plating the anode instead of the work. Always remove the anode from the bath as soon as plating is finished on each article and remove one of the battery clips.

Cleaning Articles for Plating

Plating will not hide marks and defects. Before plating, the surface should be prepared in the same way as recommended for polishing jewellery, the last buffing being done with rouge on a soft mop or chamois leather. A power tool will be found a great advantage as it imparts a mirror-like finish particularly important when plating headlamp reflectors.

Wire the polished article ready for plating by hooking a short length of copper wire to any convenient place where it will make good electrical contact and not obstruct the deposition of metal. Wire marks in plating can be overcome by suspending the article in a fresh position half way through the process, or attaching the wire to a different place.

Wearing a rubber glove as protection from the heat and to avoid finger marks, thoroughly clean in the soda, using a soft cotton swab or bristle brush to remove all traces of polishing material. Next swill thoroughly in hot water, using a clean mop or brush.

Striking

This operation is necessary only when plating silver. It ensures that the very first coating of metal is deposited *electrolytically* and not simply by galvanic action. Failure to strike properly means that the entire plating will rub off, generally at the touch of a finger. If a large quantity of work is anticipated, it is better to use a striking bath which contains a lower proportion of metal than the plating bath. Working on a small scale, articles may be struck in the plating bath.

Whichever is the case the voltage in striking should be about 4 volts with no reduction through the resistance. Attach the pure silver anode by a short length of copper wire to the positive lead from the control panel and hang it in one side of the plating bath. Always immerse the anode and have the current turned on before putting the plating job in the bath. Now drop the work wired to the negative lead into the solution on the opposite side of the bath.

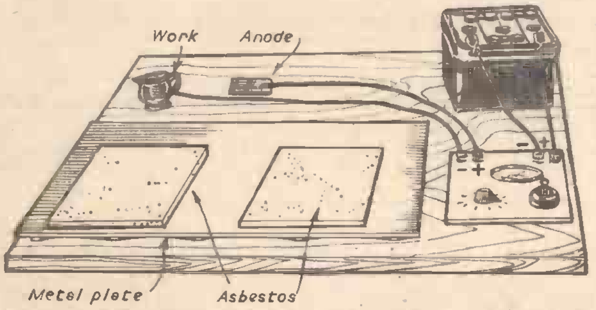


Fig. 3.—A convenient bench layout.

If the rim of the container is properly enamelled there should be no risk of a dead short.

Plating begins immediately. Remove the work and the anode after about fifteen seconds when there should be a thin coating of white silver. The job is now unhooked, swilled in cold water and scratch-brushed on a power-driven wheel or hand brush. The bristles should be of fine, crimped brass wire. Plenty of water must be used when scratch-brushing. Only light pressure is required, but it ensures that the striking coat has adhered. If you have failed in this, you can easily restrike and not much time will have been wasted. If the first film of silver has adhered properly, you can rest assured that the subsequent heavier layer will also be sound.

Plating

The real plating is done in just the same way, but now the resistance may have to be used to control the current. A rough estimate of the total surface area of all the articles to be plated at one time is rather important. For filigree work you may have to double or treble the apparent area. Several articles may, of course, be wired together; but avoid being over-optimistic. The usual current density employed is 3 amperes per square foot of this figure. Thus, if your articles total $\frac{1}{3}$ square foot, current is adjusted by means of battery output and resistance so that the ammeter reads 1 amp. when actual plating is in progress. Moving the anode nearer to or further from the work results in a higher or lower reading, but for most work it is best kept to the far side of the container. A rod laid across the bath will keep the work just clear of any sediment at the bottom.

At the current density mentioned a plating time of two hours will yield a silver coating of about 0.001in. in thickness. On best quality forks, spoons and heavy silver plate the silver is generally about 0.002in. thick, and this is expected to give up to twenty years' service under average conditions. For ordinary domestic tableware, half this thickness is sufficient, and a quarter of this is acceptable for purely decorative work. Thus, a plating time of half an hour will suffice for most jewellery, trinkets, vases, statuettes, etc.

With heavy plating it is advisable to move the work to a fresh position from time to time, and to remove it for swilling and scratch-brushing about once an hour in order to ensure a smooth finish.

Stopping Off

To avoid plating any particular area, the simplest way is to coat that part with a cellulose lacquer just before plating, and afterwards remove it with a solvent.

Doctoring

Many doctoring jobs may be had from antique dealers who have old plated articles from which the silver has worn off at corners and edges. It is seldom economical to replace the whole thing.

Prepare an anode from a piece of silver sheet about 2in. by 1in. and wedge it in a notch cut in the end of a length of dowel rod. Connect the anode in the usual way to the positive lead. Tie several layers of swansdown cloth round the anode. The article is polished and degreased in the usual way, and some part of it wired to the negative lead. The current is switched on, using about 6 volts. The wrapped end of the anode is now soaked in the silver bath and applied to the defective place. Rub gently over it for several minutes until a good plating is obtained. The swansdown must be soaked frequently, for silver is being taken from the solution at a greater speed than it can be replaced by the gradual dissolving of the anode.

Polishing

All plating to have a bright finish is polished with rouge on a very soft swansdown mop, or by hand if you have no motor. It is best to use rouge in powder form, mixed with methylated spirits to a thin paste. A satin finish may be produced by finishing lightly with a wet scratch-brush.

Gilding

The process is basically the same as for silver plating. Strangely enough it is a great deal easier to achieve good results at the first attempt. No preliminary striking is necessary, the polished and degreased articles being immersed in the gold bath immediately after the anode is hung in position and the current switched on. The gold bath is used hot. It must be maintained between 120 and 140 deg. F.

The colour of the deposit may be controlled by variations between the two temperatures. The lower one gives a gilding of pale colour, the higher one of rich colour. Colour is also influenced by the voltage used. A pressure of about 3 volts across the output terminals of the control panel is the average. Higher voltages produce deeper shades, lower voltages lighter shades. So, with control of temperature and voltage, any shade of gilding is possible.

Gilding Anode

One of pure gold is preferable. By slowly dissolving it helps to maintain the gold content of the bath. It can be of very thin sheet, but should not be less than about 2 sq. in. in area. Additions of small quantities of gold salts can be made whenever the bath shows signs of exhaustion by reason of slow or dull plating.

The plating time for gold is very brief. Colour and a reasonable thickness are more important than exact calculations. With a little experience, the ammeter is a useful guide. High temperature and high voltage affect its reading in the same way, and thus give a good indication of plating speed and colour of deposit.

Plating Time

The average for jewellery to give a thin coating is from 5 seconds to 15 seconds. For articles to withstand heavier wear and tear, the plating time should be increased to anything up to three minutes. Articles such as watch cases, to withstand very heavy wear, may need as much as an hour. The plating would then have to be buffed to impart a good finish. Buffing should normally be avoided after gilding. If plating times longer than about 20 seconds are used, the resulting colour will be rather dull and the job should be rinsed, lightly scratch-brushed, and returned to the bath for a further plating of no more than three or four seconds in order to obtain the maximum brilliancy of finish. No further treatment other than washing is then necessary.

The insides of the bowls of high grade silver spoons and the insides of cream jugs are frequently gold washed. This is a very thin flash plating, taking only a few seconds. Stopping out can be avoided by filling the jug or the bowl of the spoon with gold solution at the correct temperature, wiring the article to the negative pole and dipping the anode in the solution. But avoid touching the spoon with the anode as this will produce a dead short.

Safety Precautions

There is no risk attached to using plating solutions if proper precautions are taken. But it must be remembered that they contain cyanide and should therefore be treated with due respect. Several photographic chemicals are just as unpleasant, and strong

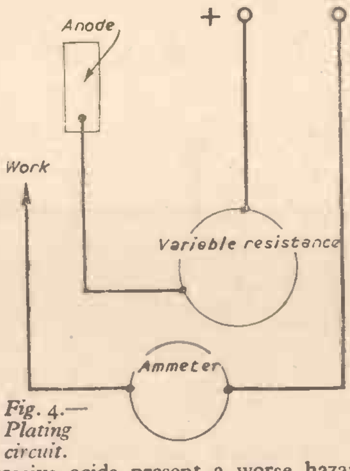


Fig. 4.—Plating circuit.

corrosive acids present a worse hazard. A splash of cyanide will not harm the hands, though it should be rinsed off. Rubber gloves should be worn, and rinsed before taking them off. The silver bath, being cold, gives off no fumes, but it is advisable to do gilding near a window or in a well-ventilated shed. Always keep an outside shed or part of the garage for plating. Throw away your rinsing water and burn any rags used for mopping up spilled solutions. Make sure containers in which salts were packed are quite empty before disposing of them. Never allow any chemical to contaminate plating solutions. Acid, when mixed with solution containing cyanide, produces prussic acid gas, which is dangerous to inhale. The solutions themselves give off no such gas, and will not do so provided they are contaminated only with soda.

Plating baths and salts should be kept under lock and key: you will then rest assured that no one can get hurt. The simplest way is to fit an orange box with two nails at the back to hook under two large staples driven into the bench. This is placed over the entire plating plant, and padlocked in position.

CAMPING EQUIPMENT

Camp Gadgets from Natural Material

In the Fourth Article of the Series Hints are Given on Increasing Camp Comfort By F. Hook

IN spite of all the modern refinements of butane gas cookers, folding tables and chairs, etc., there is still great fun to be had by making various pieces of camping equipment on the actual camp site with but an axe, some pieces of string and the timber of the hedgerow and wood and by cooking on an open wood fire.

Fig. 1.—Section of hand axe blade.

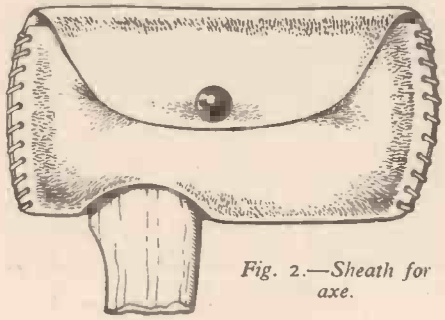


Fig. 2.—Sheath for axe.

Fig. 6.—Kitchen table and utensil rack.

Any attempt to cut sticks out of the hedges or the lighting of open fires on a crowded holiday camp site at the seaside would be received with the utmost displeasure by the owner of the site, but the true camper will avoid such sites. Most farmers will gladly give permission to a camper to light a small camp fire. Never light one without first asking permission, and, above all, never light a fire near ricks of hay or straw or thatched buildings which might easily be set alight by sparks from the fire.

The only tools necessary are a pocket knife and a small hand axe.

The Hand Axe

There are, of course, various kinds of axes, but the one known as a hand axe will suit the present purpose. The handle is about 12in. in length and head and handle together should weigh about $1\frac{1}{2}$lb. When purchased the edge of the axe will be quite blunt. It will need grinding on an old-fashioned grindstone lubricated with water. Do not be tempted to let a friend grind it for you on a high speed carborundum wheel, with no coolant, or the edge will be almost irreparably spoilt by the temper being drawn. If no grindstone is available it will be possible to prepare the edge with a fine

Fig. 4.—The camp wash-stand.

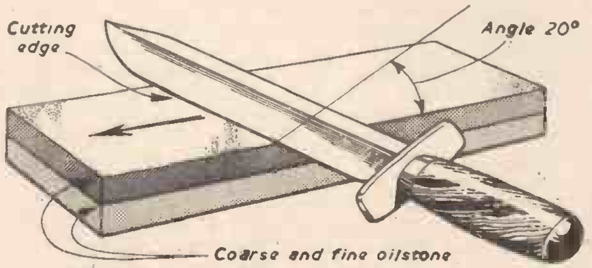


Fig. 3.—Sharpening a knife.

file such as that used for sharpening saws. A section of the axe blade is shown in Fig. 1. Finally, the finishing edge is given to the axe with a small oilstone slip.

When the axe is in use examine the wedge in the handle which secures it to the head. Tap in the wedge should it work loose.

Such a sharp tool cannot be packed with camp gear without some sort of protection. It is usual to make some kind of leather sheath for the head of the axe as shown in Fig. 2. By means of a loop on the back of the sheath the axe may be carried on a belt.

Knives

The sheath knife is a good all round type of knife for cutting food and for use in the forest. A good point in its favour is that when the knife is used for making a hole with its point there is no danger of it closing up and cutting a hand.

A word is necessary concerning the method of sharpening the knife on the oilstone. So many people who should know better so often do it the wrong way. Hold the knife at angle of about 20 deg. to the stone as in Fig. 3 and push the knife down the stone with the cutting edge going first.

At the end of the stroke lift off the blade and bring back to the beginning again and repeat the process about a couple of dozen times at first. Turn the blade over and repeat on the other side. A wire edge, as it is called, will be produced during the sharpening process and this can be removed by drawing the edge lightly across a piece of wood. Like the axe, the knife will require a sheath to protect both the owner and the knife.

For sharpening these an oilstone such as the Washita stone, comprising a coarse and a fine side is recommended. Lubricate the stone with a thin cycle oil and make a light

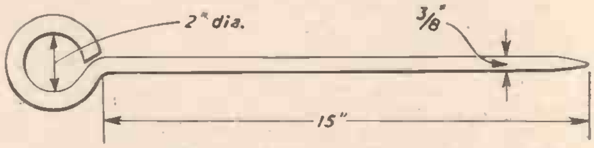


Fig. 5.—A useful tool for making holes in the ground.

wooden case to carry it in.

A Camp Wash Stand

One gadget which never fails to please

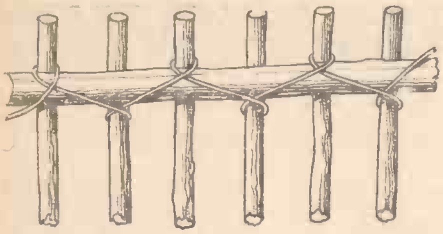


Fig. 7.—Method of lashing sticks for the table-top.

Fig. 8.—Fire made between two bricks.

all members of the family is the camp wash stand shown in Fig. 4.

Most of these camp gadgets need a supply of forked sticks with one, two or more forks. So always be on the look out for these when out for a stroll. Another necessity is a supply of good straight sticks. If you can find a coppice of hazel growth, this will provide all you need in forked and straight sticks.

Three forked sticks are prepared to a length convenient for the average need, say 24in. above ground level with 4in. to 6in. in the ground. Look out for an odd piece of log for a chopping block as on no account should the axe be used to chop wood directly on the ground. If the blade passes through the wood and into the ground the edge will soon be blunted. Put a point on the end of the sticks.

It is sometimes difficult to drive thin sticks into ground which is hard and so it is wise to include in the camping gear a gadget made of mild steel with an eye at one end about 2in. in diameter, and a straight shank of about 15in. length drawn out to a point at the other end (Fig. 5). This tool is useful for making holes in the ground and also for supporting the stick on which the kettle hangs over the fire, as shown in Fig. 8.

The two end supports of the stand are arranged at a convenient distance apart to suit the bowl. A piece of tarpaulin or thick tent cloth can be used to act as a runaway for the waste water. This waste water can either be collected in a bucket placed under the lower end of the cloth or a soak-away pit can be dug. Various spikes on the vertical pieces of wood will suggest themselves for the use of supporting flannels, towels and soap.

The canvas for the water runaway should be about 30in. × 24in. The two longer sides are turned in and stitched to form a hem through which are pushed the thin sticks which will support it and also the round bowl. These side sticks are about 36in. long and are supported at their ends with three forked sticks each about 30in. in length.

Kitchen Table and Utensil Rack

A table on which to prepare foodstuffs and a rack for plates, cups, etc., is always most useful. The size can be to suit individual taste or the materials available. The one shown in Fig. 6 has a table top area of about 36in. × 24in., and is about 24in. above ground level. The spacers for the plate rack are 6in. above the level of the table top, and the sticks for the top are spaced about 1½in. apart and lashed as shown in Figs. 6 and 7 with some thin hemp cord.

Fig. 11.—Oven in use.

Fig. 10.—Biscuit tin oven.

Camp Fire Cooking

To kindle a fire collect a supply of material such as fir cones, twigs from dead branches still on the tree, last year's bracken stalks, dead pieces from under gorse bushes, and in the bottom of hedgerows. Remember that for the thicker wood for burning hardwoods such as oak, ash, beech, hornbeam

Fig. 12.—The altar fire.

and hawthorn make the best fuel. The soft woods burn up quickly.

There are numerous ways of building a fireplace for cooking but a point to remember is that a huge fire is quite unnecessary to cook a meal. It is the glowing embers of the fire that are the most valuable source of heat.

Nearly everyone knows of the trench type of fire where a narrow trench (about 9in.) is taken out and a fire made in the bottom with the pans straddling the trench. As far as possible the trench should be in the direction of the prevailing wind. To save having to dig the trench the fire may be made between two logs or two rows of bricks laid about 9in. apart (Fig. 8).

For such fires an iron grid is very useful to place across the top of the fire. Saw up about a dozen 12in. lengths of ¼in. dia. iron

(*Concluded on page 53.*)

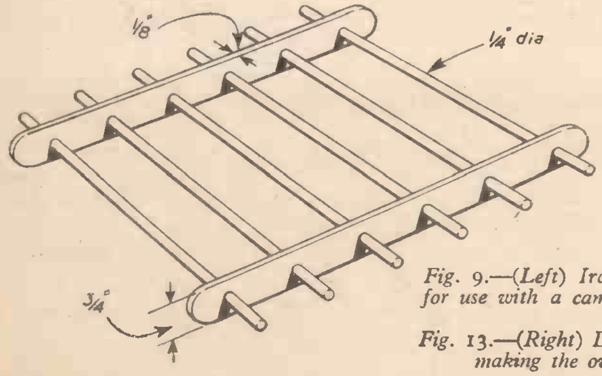
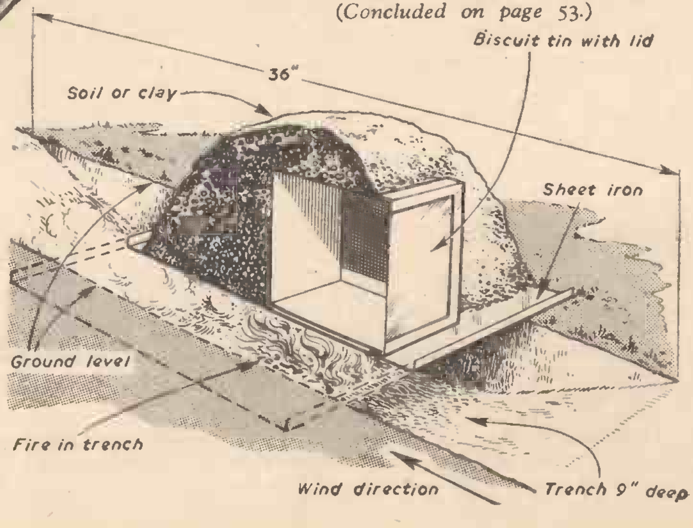


Fig. 9.—(Left) Iron grid for use with a camp fire.

Fig. 13.—(Right) Details for making the oven.

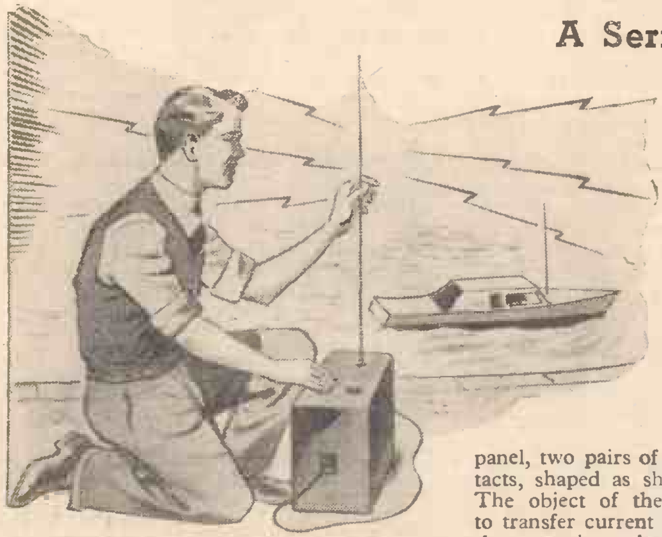


Radio Control for Model Boats

A Series of Three Articles Describing the Necessary Equipment

No. 2.—Adding Engine Speed Control—The Pulsed Pulse System

By D. W. Aldridge



LAST month's article was concerned with the steering of a model boat by radio and in this issue the stages necessary to convert the system for full control (i.e., steering and speed control) will be described.

Figs. 11 and 12 show the construction of a switch suitable for the control of an electric motor used to propel a model boat. The switch unit, as can be seen, is not unlike the simple steering unit described last month and the action is very similar except that the movement of the traveller, running on the screwed rod, is used to operate contacts instead of to impart movement to the rudder. A Mighty Midget motor is again used and if any other type is employed it should be remembered that external gearing will probably be necessary to ensure that the correct time is taken to travel from end to end. A time of about three to four seconds is considered suitable for satisfactory action.

The traveller unit is made up from brass or tinplate and carries, on an insulated panel, two pairs of contacts, shaped as shown. The object of these is to transfer current from the main battery, picked up from the two long inner contact strips, and to pass it to the outer segmented portions. According to the position of the traveller, current is either passed at full strength to the motor; reduced via a resistance to give half speed; passed to a mast lamp to indicate "stop"; or passed to the motor with opposite polarity to give reverse. A safety stop position is also built in to give "fail safe" characteristics and to allow for effects such as anchor lowering, lamp lighting, etc.

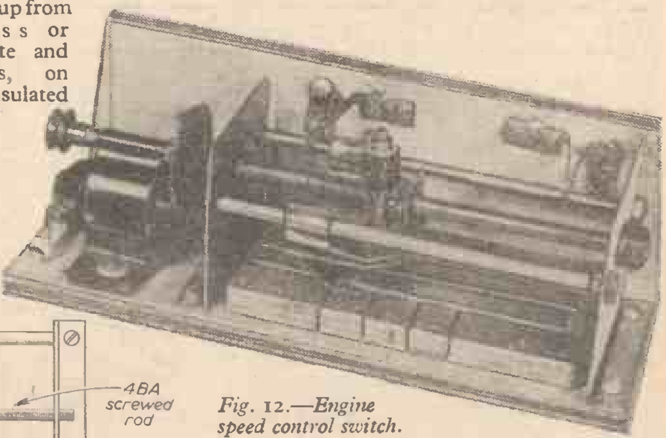


Fig. 12.—Engine speed control switch.

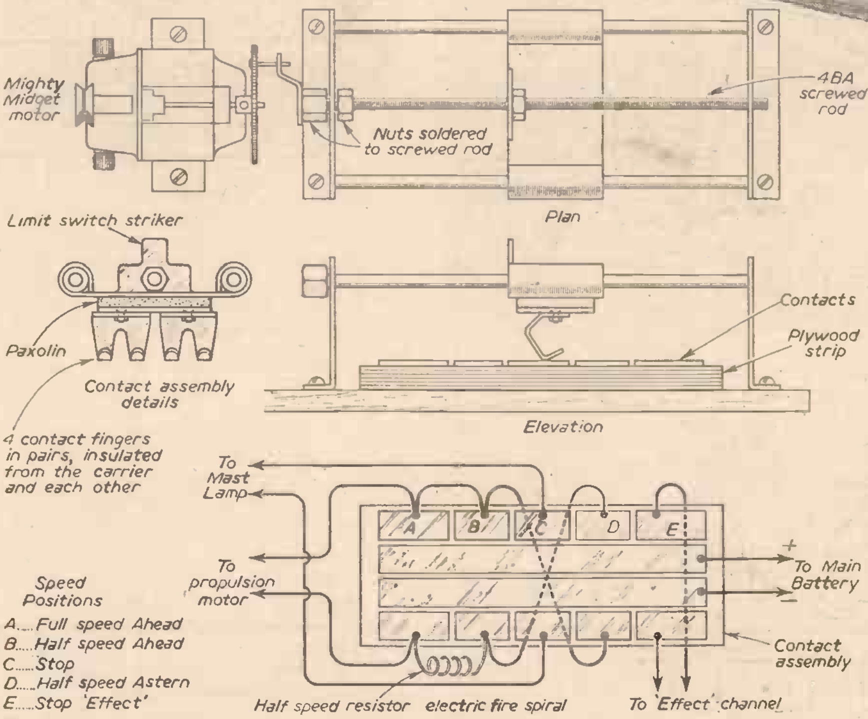


Fig. 11.—Engine speed control switch details.

The Fixed Contact Assembly

This is built up from a small piece of plywood with strips of brass or copper shim tacked into position by means of brass brads. Cutting between the sections can most easily be carried out after tacking the shim into position by sawing across with a fine-toothed saw. The surface should be filed smooth after completion. Wiring can then be carried out as shown and the unit tested. The correct length of electric fire spiral, used for the half speed resistor, must be found by trial and error and will depend upon the propulsion motor used. Only a few inches (uncoiled length) are necessary for powerful motors. Limit switches should be fitted as shown in Fig. 12 and wiring of the motor and limit switches is exactly as the steering units shown last month.

The method of reversing the propulsion motor is applicable to permanent magnet

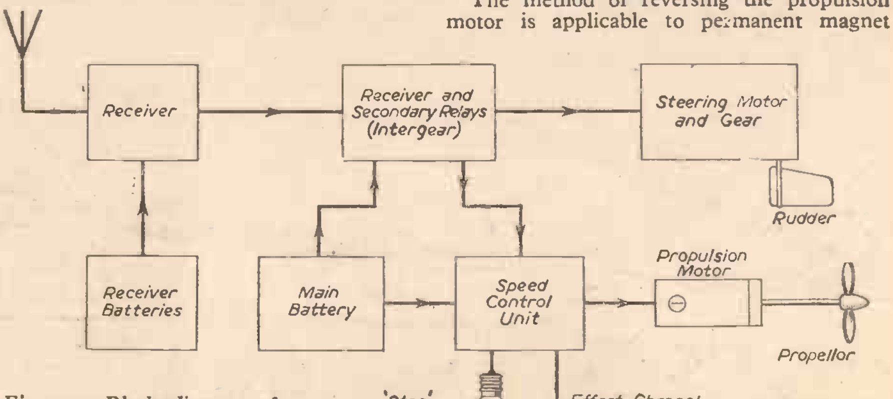


Fig. 13.—Block diagram of complete control system.

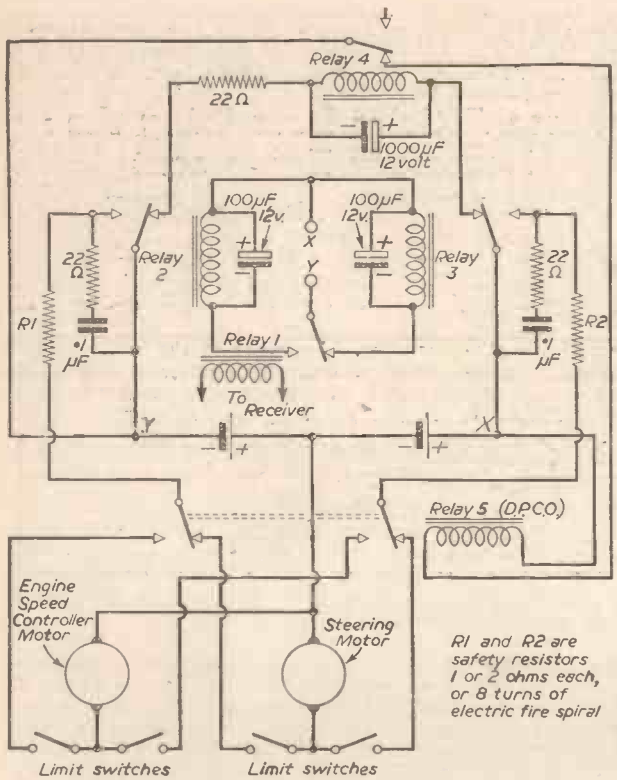


Fig. 14.—Wiring diagram of the "pulsed pulse" system.

motors. If an energised field motor is used, the simplest method of operating is to connect the armature through the speed control unit and to leave the field circuit permanently connected to the battery supply through a switch which can be operated before setting the model in the water.

If a model boat is equipped with a steering unit and speed control unit, as described, full control over its movements can now be achieved.

Fig. 13 shows, in block diagram form, the manner in which the various units are connected up in the model to achieve the desired results. Development of the intergear system to work the steering and engine speed control servos will now be considered.

The Pulsed Pulse System of Control

In last month's article the simple Mark/Space system of control for steering a model boat by radio was described and this was followed up by an improved method in which oscillation of the steering motor was avoided. To understand the development of the system to cover full engine speed and steering control it is necessary to refer back to Fig. 10 of last month's issue. This shows how the two secondary relays are energised alternately by the reed of the receiver relay which is pulsed rapidly. Both secondary relays are held on all the time by the action of the two delaying condensers shunted across their coils. If however, the receiver relay is held to one side for a period in excess of the time delay of the condenser/relay coil combinations, then one of the relays will drop off leaving the other on. The reverse result is obtained by holding the receiver relay on to the opposite contact. Current is, therefore, passed to the steering motor in either direction as required to steer the model.

Fig. 14 shows the next stage in the development of the system, which has been named the Pulsed Pulse system due to the use of two pulse rates, one pulsing the other, as described later. The upper half of the circuit bears a resemblance to Fig 10 and the now familiar outline of two secondary relays and receiver relay will be evident. It will be seen, however, that use is now made of the inside contacts of Relays 2 and 3 which were formerly left disconnected. As these relays are normally held on during pulsing, current from the two batteries will pass into the new circuit shown at the top consisting of Relay 4, a 1,000 μF condenser and a 22 Ω resistor. This relay will consequently be held on and will stay on for an appreciable part of a second (about ⅓ to ½ sec.) even if Relays 2 or 3 drop off due to the delaying action of the 1,000 μF condenser, which is an ordinary bias type of 12 volt working. The resistor of 22 Ω is to prevent Relays 2 and 3 from sticking contacts due to excess currents flowing into the 1,000 μF condenser. The contacts of Relay 4 are connected to the coil of a double pole changeover relay which works as a slave (Relay 5). Relay 4 is another 145 Ω Siemens relay and Relay 5 is an ex-W.D. unit rewound with 34 s.w.g. wire to work on low voltages. It is usually considered safe, if a low voltage relay will work on about two-thirds of the voltage which it is intended to use.

The contacts of the double pole changeover relay are connected as shown, and they now bring in a second servo motor which is the servo used to operate the engine speed control switch.

Operation of the System

The system is based upon a series of delayed relays and works as follows. In the neutral condition (i.e., no servo motors operating) the receiver relay is made to pulse at a high rate (about 30 per second). The effect, as already stated, is to hold Relays 2 and 3 in the "on" condition. Relay 4 is, therefore, held on as well, and in consequence its slave relay (Relay 5) connects the steering motor into the power circuit as shown in Fig. 14.

To steer the model, pulsing is momentarily stopped and, according to whether a Mark or a Space is sent, Relays 2 or 3 will drop off. The steering motor will, there-

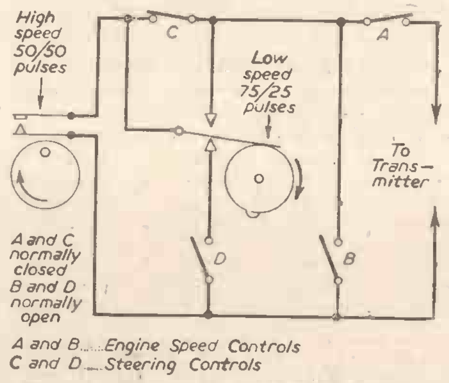
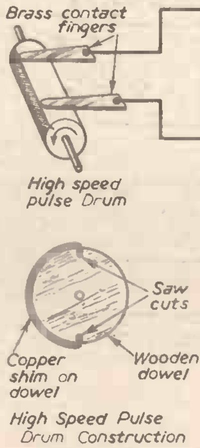


Fig. 16.—Theoretical circuit of control box.



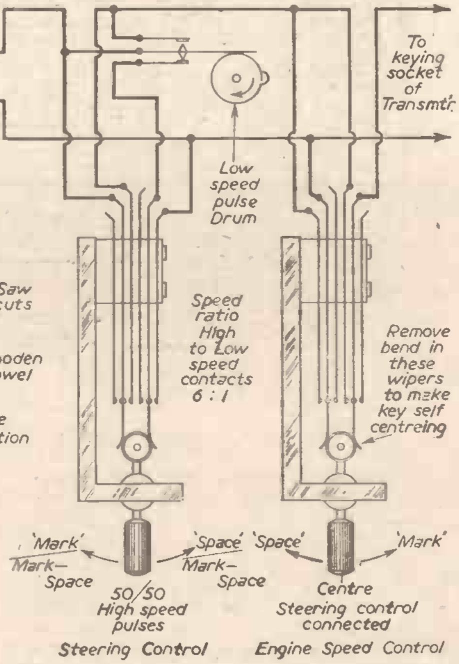


Fig. 17.—Practical wiring circuit of control box.

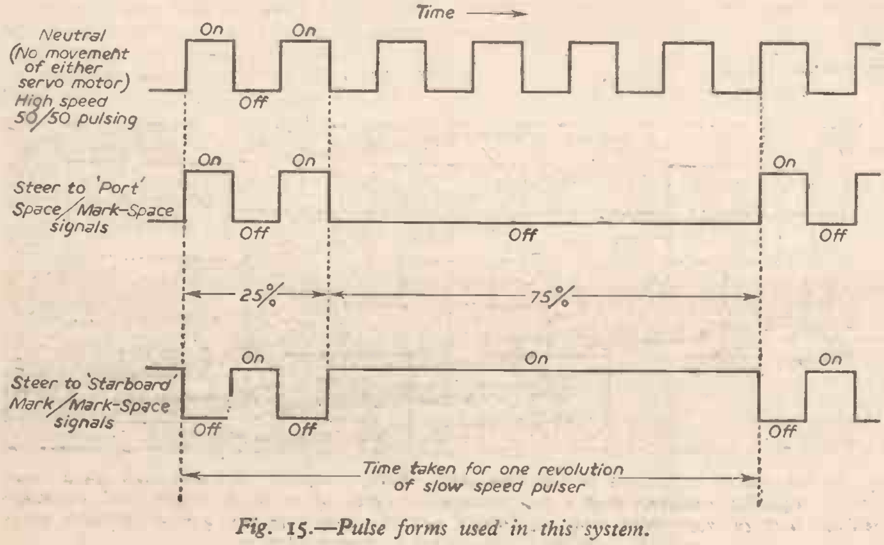


Fig. 15.—Pulse forms used in this system.

fore, become energised and will commence turning in the direction dictated by the polarity of the battery to which it is connected. Whilst this is happening Relay 4 is being held on by the 1,000 μF condenser which is discharging into the relay coil. Before the discharge finishes it is therefore necessary to restart high speed pulsing so as to close both secondary relays and to recharge the 1,000 μF condenser. This takes a fraction of a second, and the steering action can then be resumed, causing the steering motor to make several more revolutions before it becomes necessary to recharge the 1,000 μF condenser. The steering motor, therefore, operates in a series of bursts, always in the same direction and not reversing as in the simple Mark/Space system. In the periods between bursts the steering motor free-wheels until the next surge of power is applied. In practice the motor appears to be running continuously due to the fairly rapid pulse rate.

Operating Engine Speed Control

To cause the engine speed control servo motor to operate it is only necessary to hold on a Mark or Space, the effect of which is first of all to cause a short spurious steering signal to be applied and then Relays 4 and 5 will drop off, bringing in the speed control servo. This will then run in either direction according to whether a Mark or Space is being sent. It is, therefore, possible to steer in either direction and to cause the engine speed control servo to operate in either direction, making the model stop, start or reverse at will. It will be apparent that with this system the model can be made to move ahead and astern as required, and that it is not necessary to follow a definite sequence of speed positions as in some systems. Very precise steering control without creep is a feature of the system, also low current consumption from the servo batteries.

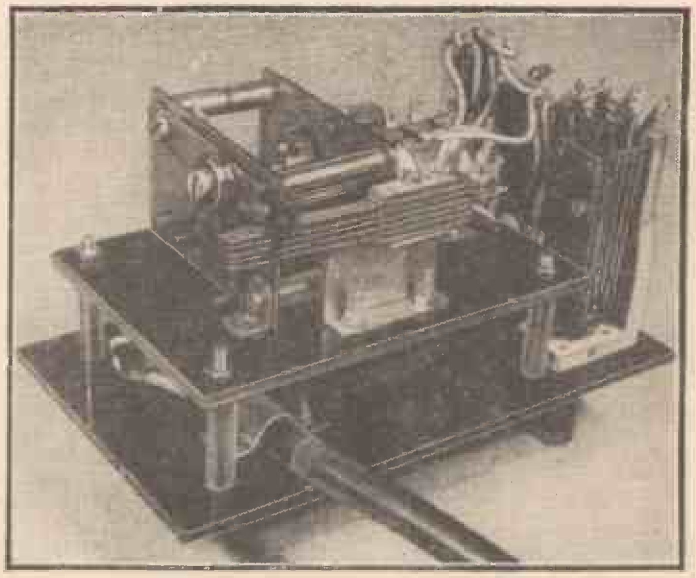


Fig. 19.—A further view of the control box. Note the cam below small ball race on the left-hand side of gear box.

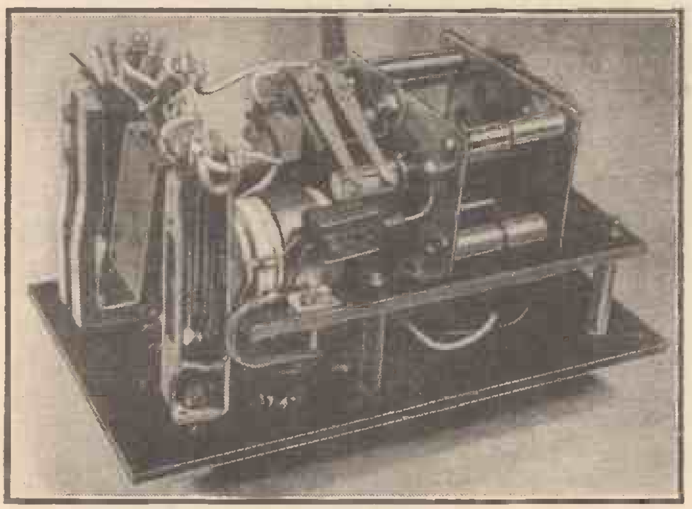


Fig. 18.—The control box.

The spurious steering signal mentioned above is not normally of any consequence and can be counteracted if required by sending a short burst of "opposite" signal before sending the signal desired to bring about the action wanted, i.e., "Mark" is usually arranged to make the speed control servo move to the "full speed ahead" position. If it is required to go from "half speed" to "full speed" a short "Space" should, therefore, be transmitted first and then a "Mark" held on until the model is seen to be travelling at full speed.

Safety Stop Position

As stated above, a "Mark" is used to make the model go at full speed. A "Space" has the opposite effect and causes the speed servo to travel to the other end via half speed, stop, astern and, finally, to the safety stop position. This effect is very useful as it means that if anything happens to break the radio link then the model will automatically stop. It also means that so long as the model is proceeding under full speed the user can be sure it is under control. The safety stop position can also be used if desired to bring in additional effect channels. Circuits can be wired so that in this position power is passed to a servo motor operating an anchor winch for example. It may be undesirable for the anchor to start lowering as soon as this position is reached, and this can be avoided by wiring the circuit so that it is broken until the rudder is put over, say, to full port, where auxiliary contacts are closed. As the boat is stopped when the rudder is being moved over no visible action will take place until the anchor starts to run out. The opposite rudder position can then be used for another effect—say, lowering a boat.

A mast lamp is considered to be an essential as it indicates when the speed controller contacts have reached the stop position. The model will almost certainly still be moving and it is therefore necessary to have some indication of when the stop position has been reached.

The Control Box

In the above description of the operation of the circuit, readers will have noted that rapid pulsing is used with longer bursts of Mark and Space interjected to act as steering signals. Fig. 15 shows graphically the general shape of the pulse forms used and whilst such fine accuracy of pulsing is not essential the general method of high speed pulses, chopped at low speed in a definite ratio must be followed. Generation of the pulses is carried out in the control box and two pulse drums are used. A high speed drum is used to generate 50/50 (approx.) ratio pulses at about 30 per second and a low speed drum, or more accurately—contacts—generate 75/25 pulses at about five per second.

Fig. 16 gives the theoretical circuit of the control box and Fig. 17 shows the practical wiring circuit, using two Post Office key switches for steering and engine speed control switches. The angled wipers which bear upon the roller of the key switch should be bent straight with pliers, as shown in the diagram, so as to make the dolly spring back to centre.

The construction of the control box can be carried out in a variety of ways and Figs. 18 and 19 show the box used by the writer. Two deck construction is used and the steering key switch is mounted flat on the lower deck.

Control Box Operation

Instead of using the key switch dolly for steering, a radio knob is mounted on the panel. This works the key switch mechanism via a steel shaft passing through the holes at present occupied by the steel pivot

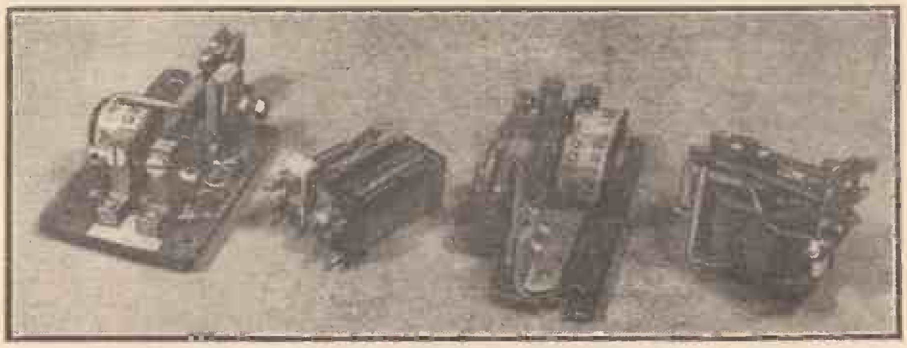


Fig. 20.—Types of relay used in this equipment. Left to right: Siemens high speed relay (1 coil × 145Ω); miniature double pole changeover relay of ex-W.D. origin (coil resistance 170Ω); Siemens high-speed relay (2 coils × 1,700Ω each); double pole changeover relay (ex-W.D.) rewound with 34 s.w.g. enamelled wire.

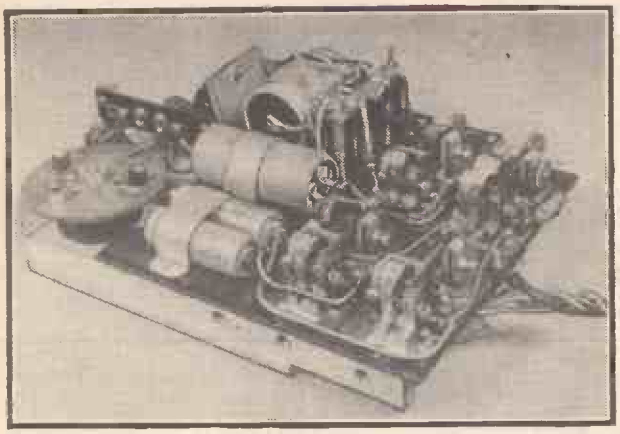


Fig. 21.—Combined intergear and steering gear unit, utilising final form of pulsed pulse circuit to be described in the next article.

pin. The shaft must be a tight fit into the centre moving plate and it is necessary to drill out the two side holes slightly to permit this. The two switches which can be seen are the speed control switch and another switch used by the author for experimental purposes.

The two pulse drums are driven by an Ever Ready motor and this is fed from a 2-volt accumulator in the transmitting case; 4-core cable being used to connect the two units. The motor shaft is connected to the mechanism by means of a small length of rubber tubing cut from a piece of electric lighting flex (i.e., the rubber insulation). The mechanism was made up from gears taken from ex-W.D. equipment and consists of a 2 : 1 gear reduction feeding into the high speed pulse drum (seen in Fig. 18). This drum "makes" contact for 50 per cent. of a revolution and "breaks" it for the remaining 50 per cent. The high speed pulse shaft also drives via a 6 : 1 gear reduction the low speed pulse unit. This is made from a small wheel with a flat filed on one side. A small ball race runs on this wheel and, by means of a pivoted arm, operates a set of changeover contacts (seen in Fig. 19). When the flat comes opposite the ball race the contacts are changed over. (N.B.—More contacts are available than are used in this pulser.)

The flat is cut so that the time duration of the changeover position occupies about 25 per cent. of a revolution. A 30 Ω wire wound resistance is used to vary motor speed and hence pulse rate.

This particular control box was made up from available materials and it is possible to make up much simpler units to carry out the same function. The double pulser can, for example, be made from a Mighty Midget motor with the high speed pulse drum glued to the protruding end of the armature shaft. The low speed pulser is worked from a cam fitted to the low speed shaft (the gear ratio of the Mighty Midget is just right for the job). Changeover contacts taken from an old Post Office relay run on the low speed cam and wiring is then carried out as per Fig. 17.

Setting Up the Complete System

The following sequence should be used when first setting up the completed system.

1. Adjust transmitter and receiver so that the receiver relay works correctly when the transmitter is keyed. The action of the receiver relay must be firm and positive and adequate current change is desirable. With Siemens relays use a change of 3 or 4 mA. to achieve clean action.
2. Start up control box and transmit high speed pulses (i.e., steering and speed control switches in centre positions).
3. Adjust Relays 2 and 3 so that both are held in by the pulsing, then increase tension until they start to chatter then release about half a turn.
4. Test steering control. Relay 4 should hold on during steering pulsing. If not, reduce tension.
5. Test engine speed control (i.e., send Mark and Space). Adjust Relay 4 for minimum interaction between steering and engine speed control without it being effected by steering pulses.

Reducing Relays

It is pointed out that if a suitable relay can be provided for Relay 5—such as a Post Office relay of about 250 Ω or one of the midget relays shown in Fig. 20 (Item 2), then it is possible to substitute this directly for Relay 4 hence reducing the number of relays by one. The circuit shown, however, is the basis for the final circuit to be described in a future article and is recommended when the double pole relay is of a low resistance.

Fig. 22.—Overall view of radio-controlled cabin cruiser using the pulsed pulse system.

SUITABLE RELAYS

Siemens high-speed relays:
2 x 1,700Ω coils @ 17/6
2 x 250Ω coils @ 8/6
from Dependable Radio Supplies, Ltd., 12a, Tottenham Street, London, W.1.
Siemens high-speed relays:
1 x 145Ω coil @ 5/- plus post 1/6
from Midland Instrument Co., Moorpool Circle, Birmingham, 17.
Double-pole changeover relays: Miniature S.T.C. 250Ω coil, silver contacts. Size 1¼in. x 5/8in. x ¾in., 6-volt operation. Price 7/6.
From Chas. Britain (Radio), Ltd., 11, Upper Saint Martin's Lane, London, W.C.2.

Although the circuit has been described with particular reference to electrically propelled boats the engine speed control servo can also be used to open and close a throttle on a diesel engine.

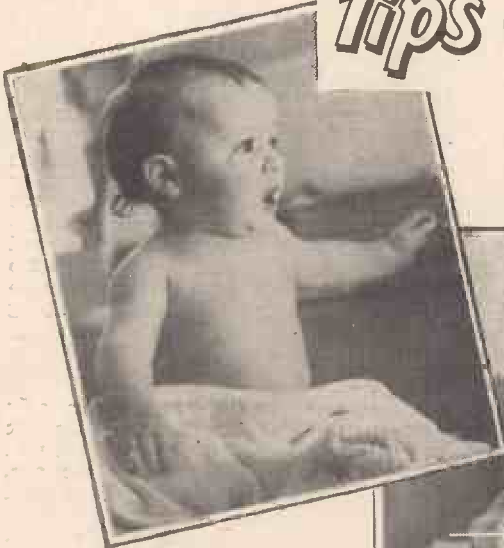
In the final article to be given next month a circuit will be given which extends further the functions of this system and which embodies a different type of speed control switch.

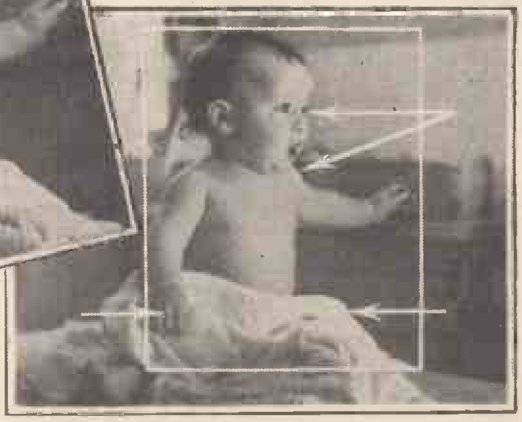
ANDY MANN — THE PRACTICAL MECHANIC

Tips on Baby Photography

How to Obtain Professional Results

By "Snapshotter"





A good bath-time shot is a more difficult proposition than the "pram" technique described here.

MANY amateur "snappers" content themselves with the usual must of baby in the christening gown, the family group and maybe a shot or two of baby in Mother's proud arms later, and then leave baby out of their photographic activities until the toddling stage is reached, with, maybe, a visit or two to a professional for an excellent, posed studio print.

Yet this in-between stage, with baby sitting up and taking notice, but strapped securely in the pram, is probably the best chance to get baby under control photographically. It is certainly far easier than trying to keep an eel-like crawler or toddler in the viewfinder.

Focusing

In the pram, baby can still be an eel, despite the restraining straps; once you have focused, you know he cannot move out of range, however much wriggling goes on.

As it is baby you want reasonably large, even on a contact print, cut out as much unwanted surroundings as possible, fill your viewfinder with your main subject, but do not forget that at distances closer than about 6ft. there is a distortion of perspective when viewing the print. At closer distances than this a hand or limb nearer the camera will seem unnaturally large in proportion to the rest of the figure.

Most modern box-type cameras have two focusing settings, distant, and close-ups, with the range running normally from 6 or 9 ft. to 11 or 15ft.: so that the box user can set his focus lever to close-up and will not be troubled with this apparent distortion effect. The user of the more elaborate folding or fully-variable focusing camera may be tempted to focus down to 3 or 3½ft., the limit of his lens, to get a large image. If he does, then distortion may well spoil his print.

You must always keep the focused distance: mark out, on the grass or gravel, or whatever you are, a circle of 6ft. radius from the pram centre, with a pointed stick. Do not trust to judgment alone to keep your distance, it is so easy to step back or forwards inside the safety limit when dodging around the pram and an out-of-focus, blurred baby will not please you, or its mother! Keeping in position on the line around the pram, you know the baby is always within focus.

There is another gain from this set-focus distance: the box camera at the close-up setting, even if it has not a variable aperture or F. number adjustment, gives sharp focus only over the limited distance range mentioned above: this makes the subject sharper than the background and so makes it stand out clearly. The user of a camera with a fully-variable focusing movement to the lens normally has, also, a wider range of stops or F. numbers than the box-user, so he has the added advantage of being able to open up his lens aperture and so narrow considerably the depth of field over which there is sharp focus. He can make use of a very shallow, sharply focused area to make the subject stand out against a completely blurred background. This is differential focusing.

Lighting

It is not enough just to make sure of your focusing however much baby twists and wriggles, you must plan out the best lighting position in which to place the pram.

Strong, direct sunlight with the sun high in the sky throws deep, harsh shadows on the face, causes screwed-up eyes, loses the texture in features, hair and light-coloured clothes. It gives too much contrast in the negative and few middle tones.

Fig. 1 shows this: strong, direct sunlight has high-lighted fair hair and white clothes, to give a print devoid of detail in both, unless careful shading is resorted to in enlarging from the negative. Shading-in or burning-in difficult contrasts should not be used for contact printing, and even with enlargements it is best avoided whenever possible for ease of printing. The cause can usually be avoided with a little forethought in these cases by placing the pram out of the direct light, using a tree throwing shade to diffuse the light, or a tall wall or building doing the same. A time when light clouds cross the sun, or when the sun is lower in the sky and its brilliance softer, with shadows less hard and pronounced is ideal.

Fig. 2 (Above).—Improvement by introducing diffused light.

Fig. 1 (Left).—Strong sunlight and contrast gives loss of detail.

Fig. 2 shows this, it was taken within minutes of Fig. 1, but with the pram moved near a tree for shade. Now there is detail in the fair hair despite the good light still obtained, and considerably more detail in the white cardigan than before.

Background

Having made use of your near focusing setting for getting baby large on the negative and throwing the background out of focus, and having chosen good but diffused light, now look at the background.

Making a background unassertive by being blurred and out of focus is not enough to make baby stand out clearly. A high - lighted, spotty background will hold interest in the print and detract from baby.

Fig. 1 shows this fault: note the attraction and distraction from baby caused by the blurred highlit trees, and the bad planning shown by the very assertive patch of highlit hedge right behind the head. Leaves in bright light reflect it at all angles, and can ruin the print.

So again the pram must be moved before taking the photograph. A high hedge or brick wall, so distant that its brick-plan is not assertive even when blurred in deep shade, is useful. If the hedge is lowish but out of focus and in shade, then by looking down on the baby the background can be brought up behind him to the top of the print with a little care in planning.

Fig. 2 illustrates this point: background out of focus and subdued in shade with no distracting highlights such as appear in Fig. 1.

A little forethought with Fig. 2 thus avoided both the harsh lighting on baby and the distracting background of Fig. 1.

Fig. 3.—The final picture combining all the hints.

Same time, same baby, a little extra care is all that is needed.

Use a high hedge or plain fence, and look down on baby to raise the background level and cut out distracting areas of light sky. Open backgrounds with trees or buildings, too distant to be distracting with highlights, may also be used successfully and a yellow filter will help to darken the sky area and keep interest in the baby. But it is worth looking for that deeply shaded hedge or fence, far enough away to be quite blurred and without its own highlights, and you will have trouble-free conditions.

Fig. 3 shows all three tips above combined: good but tree-diffused lighting falling on baby; near focus setting at the 6ft. limit, giving large image with no distortion in size of nearer limbs; and a good hedge background out of focus, right in deep shade and so under-exposed in relation to the main subject, printing dark and letting baby stand out.

Shutter Speed

The box camera user may have only Time and Instantaneous shutter speeds, but many in this range have two speeds as well as the time or bulb. If only the one, instantaneous, it will probably be around 1/50 sec., so the shutter must be released at a moment when the baby is almost still. Movement close to the camera blurs much more than distant movement. If there is a range of speeds, use the highest and small movement will not cause unpleasant blurring of the subject.

The more elaborate camera with variable focusing adjustment and apertures will almost certainly have a wider range of shutter speeds. Its user can use the 1/50 sec. or 1/200 sec. and stop all but decisive, swift movement on the part of the subject. There is more scope and latitude than when using the simpler box camera, but with a normal speed film and good lighting and a little more care in selecting a moment of little or no movement, good results can be achieved.

ACUTANCE

ONE of the most difficult photographic qualities to pin down is "sharpness" and it is only recently that the factors which influence image sharpness have been properly investigated. From the photographer's point of view, the sharpness of a photograph can be affected by his camera lens, focusing, camera shake, subject movement, over-exposure and unsuitable development. But what about the manufacturer? What can he do to ensure that his films are capable of giving a sharp image?

For many years resolution had been accepted as the most reliable measure of the capability of a film to reproduce fine detail and this agreed with the observed fact that the finer the grain of a film the higher its resolution was likely to be. However, it was discovered that films with comparatively low resolution were sometimes capable of giving a sharper rendering of fine detail than those with much higher resolution figures, and it was obvious that a new yard-stick was required.

Irradiation

The problem was investigated (L. A. Jones and G. C. Higgins in 1952) by "contact printing" a perfectly true knife-edge on to various samples of film. In each case, instead of a sharp boundary between the exposed and unexposed areas of the film, there was a noticeable shading-off which blurred the sharpness of the image. This was due to light-scatter inside the emulsion layer (irradiation).

Acutance

The width of the shading-off at the edge of the image is, of course, very small—but the changes in density were measured with a microdensitometer and graphed. By comparing the graphs with the sharpness of the image as judged by a number of observers it was possible to work out a mathematical formula for the ability of a film to give a sharp image of fine detail. The term "acutance" was coined to describe this characteristic.

Since then film manufacturers have found methods of increasing acutance. Irradiation can be reduced by using very thin emulsions and by increasing the silver content—so that the individual grains are closer together. The exposure and processing latitude of these films is necessarily limited—but they give excellent results and are becoming increasingly popular with 35mm. workers.

Developers

The standard of definition which can be obtained in a negative is largely determined by the acutance of the film, but it is also influenced to some extent by the developer used. Normal fine-grain developers give a standard of definition which is more than adequate for a high proportion of ordinary work—but the older types of super fine grain developers, particularly those containing silver halide solvents, give a noticeable loss of definition.

When the work in hand calls for the highest possible standard of definition—and the photographer and his camera are capable of using it to advantage—special developers can be used. These are usually highly energetic developers containing limited amounts of developing agent. They give so-called "edge effects"—the result of which is to increase contrast at the boundary between adjacent tones while keeping the overall contrast of the negative to a convenient level. They usually increase the effective speed of the film, but give noticeably coarser grain than developers of the more usual type. Since they are intended for use with film of inherently fine grain structure this may not be of importance—but the photographer must decide for himself in the knowledge that no developer can have *all* the advantages.

Johnson Developers

Of the Johnson range of developers Unitol is the best all-round choice for ordinary work—giving an excellent compromise between film speed, fine grain and high definition.

When maximum definition is more important than fineness of grain, Capitol gives the best results, at a dilution of 1 + 20. As a guide, the following developing times are recommended at 65 deg. F. Films developed in this way should be rated at about twice the normal recommended speed and care should be taken not to over-expose.

Recommended Developing Times
at 65 deg. F.
Capitol 1 + 20

Adox, KB14 and R14; Ilford, Pan F; Kodak, Panatomic X, 35mm., 16 minutes. Adox, R17; Ilford, F.P.3, 35mm. and R.F., Selochrome; Kodak, Panatomic X RF, 18 minutes. Agfa, Isopan F and Isopan FF, 35mm.; Gevaert, Gevapan 27, 20 minutes. Kodak, Plus X, 35mm., and Verichrome Pan RF, 22 minutes.

Build Your Own Aeroplane

A New Version of the Luton Minor is Being Produced

THE Luton Minor single-seater is already a well-proven machine. It was originally produced in 1938 and many examples were built and flown in various parts of the world. The construction was also serialised in PRACTICAL MECHANICS.

Fig. 1.—An artist's impression of the Luton Minor in flight.

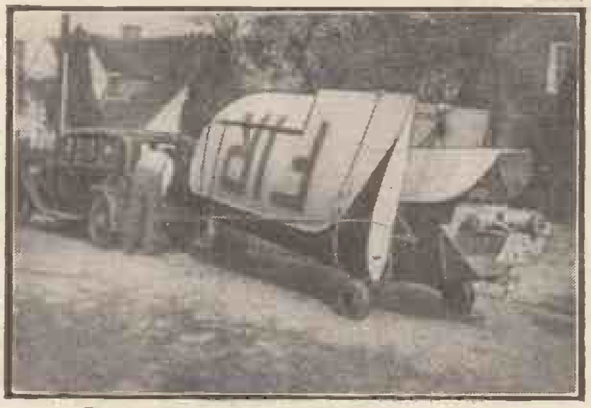


Fig. 2.—It can be towed behind a small car.

Recently, Phoenix Aircraft Limited was formed to re-design and modernise the aircraft to present-day standards and to make it available for the "man-in-the-street" to build.

Heading the company is Mr. C. H. Latimer-Needham, for many years known in the field of light aircraft design, and Mr. A. W. J. G. Ord-Hume, one of Britain's most active amateur aeroplane constructors who built and flew his first aeroplane at the age of eighteen. Phoenix Aircraft Ltd., Cranleigh Common, Cranleigh, Surrey, has produced a new version of the Minor which is simple to build, safe and easy to fly and costs only 2d. per air mile for petrol to fly.

The Minor (Fig. 1) is a real aeroplane in miniature and is a parasol monoplane of all-wood construction. It is only 20ft. long and its wing span is 25ft. Lighter than a large motor cycle, it can cruise at 75 m.p.h. with its 37 h.p. Aeronca J.A.P. twin-cylinder engine, which uses only 2½ gall. of petrol an hour. Any engine up to 65 h.p. can be installed.

The Minor can take off in 80yd. and can land in 40yd. By removing the wings and placing them along the fuselage sides, the entire aircraft can be towed along the road on its own wheels behind a small car (Fig. 2). The Minor is small enough to go in a garage and can be built in a spare room without the use of costly or complicated tools.

Of fabric-covered spruce and plywood construction, the Minor costs £250 to make including the cost of the engine. The complete book of plans and instructions, specially written and prepared for the amateur who has little or no previous aircraft experience, costs £11 10s. which includes one year's subscription to and membership of the Popular Flying Association, whose address is Londonderry House, 19, Park Lane, London, W.1. Phoenix Aircraft will send a representative to give advice and help to any constructor who requires it. During construction the aircraft is carefully inspected by Popular Flying Association inspectors. When it is completed, it is thoroughly examined to ensure that it is properly made and then it is recommended to the Ministry of Transport and Civil Aviation for the issue of a "Permit to Fly."

Many constructors used the series of articles published before the war in this journal to build their Luton Minors, including Mr. A. W. J. G. Ord-Hume.

It is hoped that plans for the construction of the Luton Major will also be available.

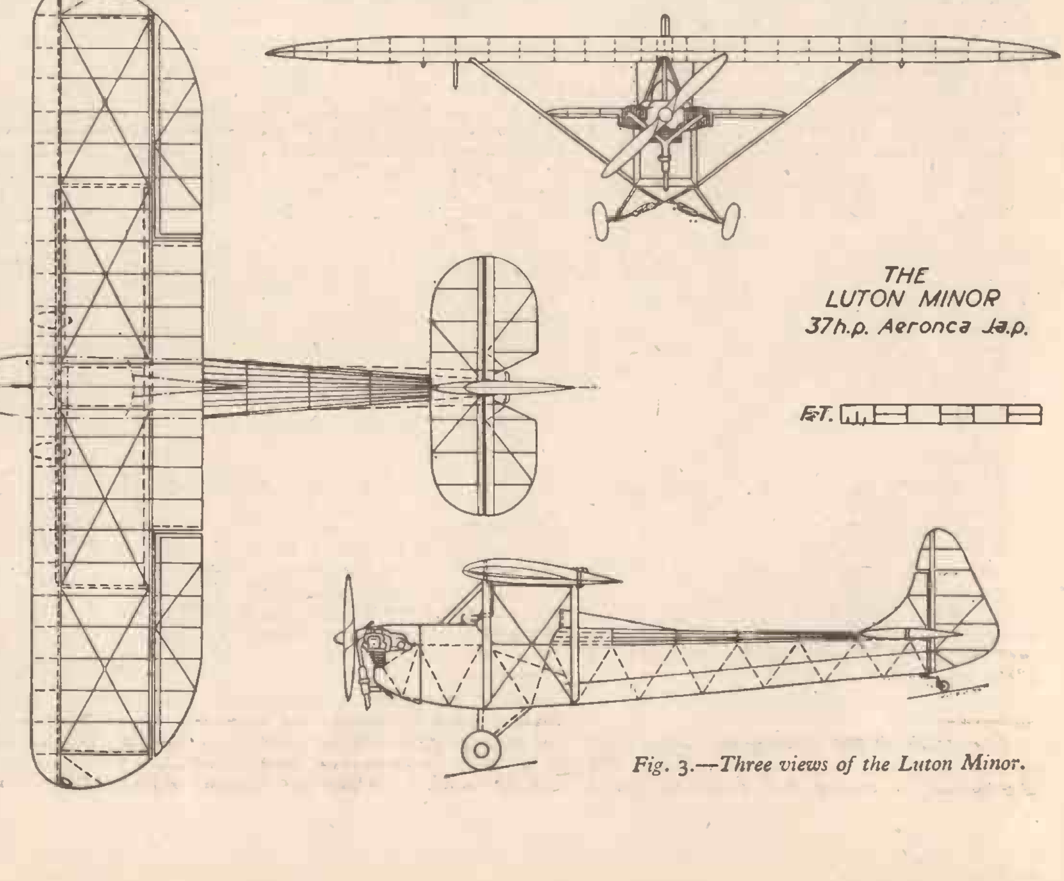
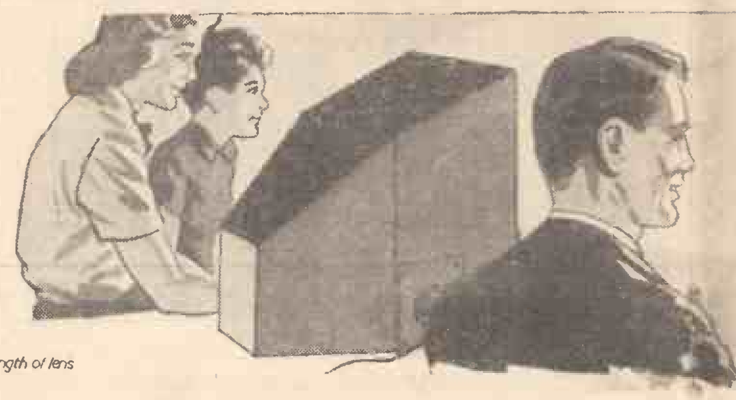


Fig. 3.—Three views of the Luton Minor.

A TRANSPARENCY VIEW



This Unit Shows an Enlarged Screen or Can be Used as a Pr Screen

THE transparency viewer shown in Fig. 4 is designed for 35 mm. colour transparencies and the film is projected from the rear on to a ground-glass screen. For larger transparencies the viewer would need to be redesigned to suit, but the general arrangement could be the same.

The projected picture is 6½in. on its longest side and this is ample for viewing by several people at the same time.

By removing the ground-glass screen the picture can be projected on to a white screen and enlarged as required, the only limits to size being the intensity of the light source, definition of film and quality of lens and mirrors.

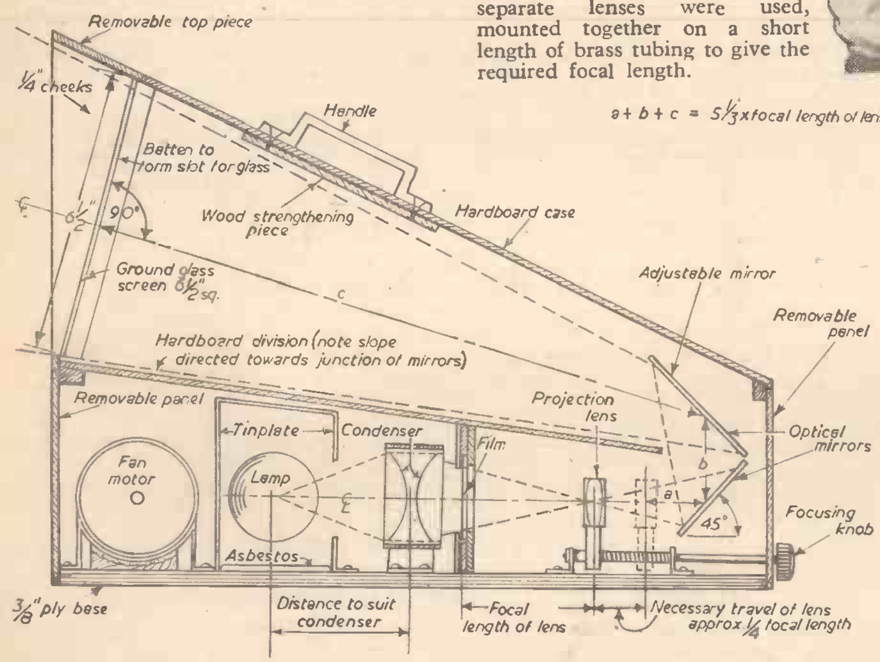


Fig. 1 (Left).—Section through projector, showing general arrangement.

Lens and Dimensions

The dimensions given are related to the focal length of the projecting lens or lenses, in this case between 2½in. to 2¾in. If a lens of different focal length is used then the overall dimensions of the viewer will have to be varied to suit. Fig. 1 shows a section through the viewer giving the general arrangement and indicating those dimensions dependent on the projection lens. These dimensions can be calculated when the focal length of the lens is known and this can be found reasonably accurately by directing the lens at the sun, focusing to the smallest clearest image on a piece of card and measuring the distance from the card to the centre of the lens.

A lens of long focal length is obviously unsuitable for a viewer of this type, as the dimensions of the model would be too large. Although a long focus lens is unsuitable by itself two together can be used quite successfully; in fact, on the model described two separate lenses were used, mounted together on a short length of brass tubing to give the required focal length.

Aperture and Focusing

The lens (or lenses) should be of reasonably good quality and condition. Suitable lenses can be obtained through advertisers in this magazine or from most surplus dealers.

It is important that the aperture of the lens is large enough, especially if it is intended to project on to a large screen. On the other hand, when used as a viewer and less light is required, some stopping down of the lens will improve definition. A refinement to the model described would be to include a variable aperture with outside control. Although not included or described in detail here, it is suggested that this could take the form of a strip of card or thin metal with varying sized holes which is pushed through additional slots and guides and positioned behind or in front of the lens whichever proves most effective.

Focusing is carried out by means of a small knob at the rear which moves the lens along the baseboard the distance of approximately a quarter of the focal length. This distance is important as it allows for focusing either on to the ground-glass screen or on to a wall screen to any degree of magnification.

The reflecting mirrors should be fixed to the baseboard close to the lens (Fig. 2), particularly if the mirrors are small, to ensure that they reflect the complete

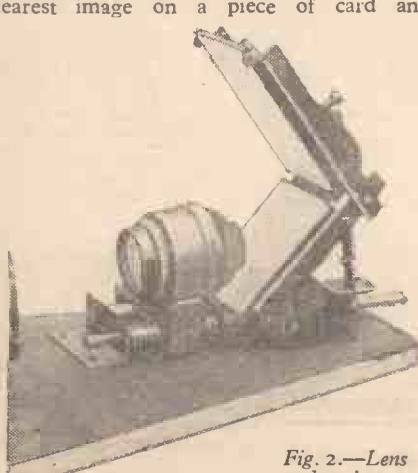


Fig. 2.—Lens and mirrors.

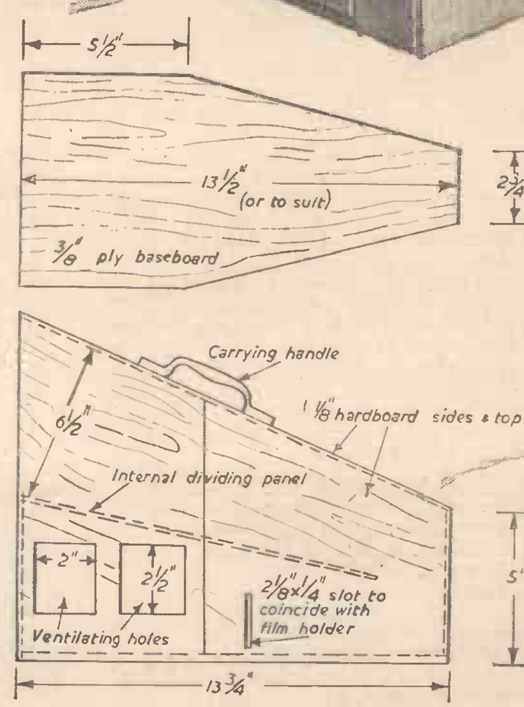


Fig. 3.—Dimensions of cabinet.

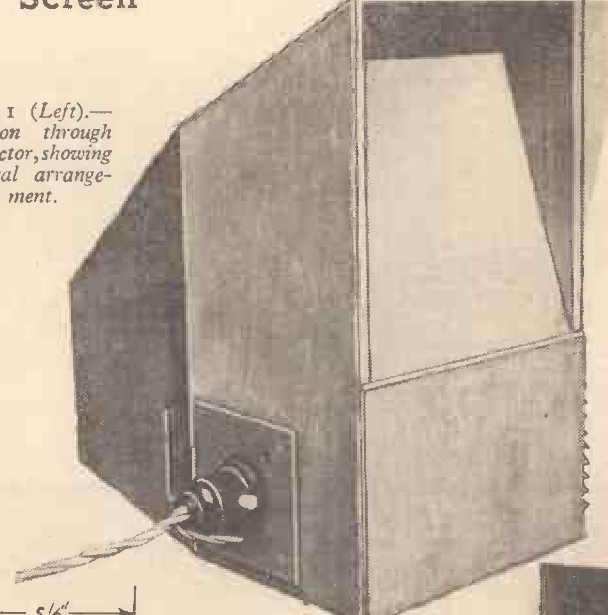


Fig. 4.—Two views of the completed projector.

VER AND PROJECTOR

d Picture on a Built-in ojector With a Separate

By J. E. Turner

picture. Sufficient room must be allowed for the complete travel of the lens.

The fan cooling can be omitted, although its inclusion is to be preferred, particularly if a high powered projection lamp is used. If the fan is omitted, more insulation should be provided to the lamphouse and plenty of ventilation allowed.

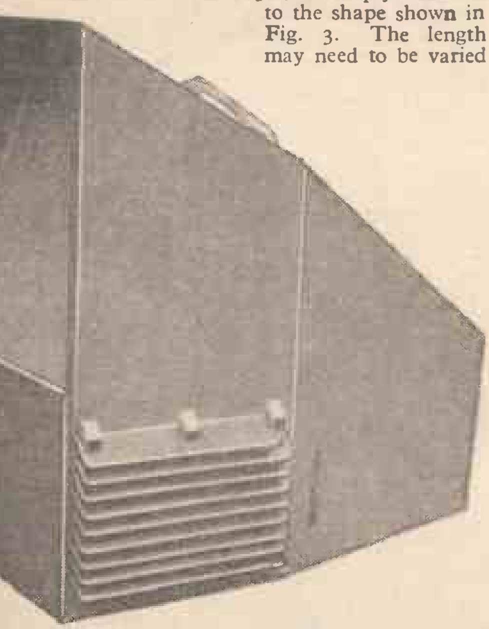
Asbestos mats sold in hardware stores for hot pans are very useful for heat insulation purposes.

Before commencing the construction of the projector-viewer it is well worth while to experiment with the various components to obtain the best results and to check what size baseboard and case will be needed.

The components, including the ground-glass screen, should be rigged up on a temporary baseboard for this purpose.

Construction

The baseboard is ⅜in. thick plywood cut to the shape shown in Fig. 3. The length may need to be varied



—
ws
n-
o-

to suit any particular lens but all other dimensions are satisfactory.

To change direction of the picture transmission a system of mirrors must be used and it was found that only two mirrors are required mounted as shown in Fig. 5. The mirrors on the viewer illustrated are both adjustable, but this is not necessary. The support should be quite rigid as any vibration of the mirrors could not be tolerated, but the top mirror should be capable of slight adjustment by bending the metal support at the junction of the mirrors.

The mirrors must have their silvered reflecting surface on the front face of the mirror; ordinary looking-glass mirrors are quite unsuitable as these are usually silvered on the back.

The minimum sizes of the mirrors can best be decided by sketching out a full-size section through the viewer although the sizes given in Fig. 5 will prove satisfactory in most cases.

Fairly stiff sheet aluminium is used for the mirror support, but any suitable metal will do. The mirrors are fixed with impact adhesive and small metal tags bent over the edges of the mirrors. The lower mirror is fixed at an angle of 45 deg. or just over and the angle between the mirrors should be approximately 100 deg., although the angle of the top mirror will finally be adjusted to accurately position the projected transparency on to the ground-glass screen.

The Projection Lens

This should have a focal length of between 2in. and 3in. It is mounted on a small carriage that can be moved backwards or forwards as required for focusing purposes and, of course, has to be operated from outside the case. Fig. 6 shows two suggested arrangements for this.

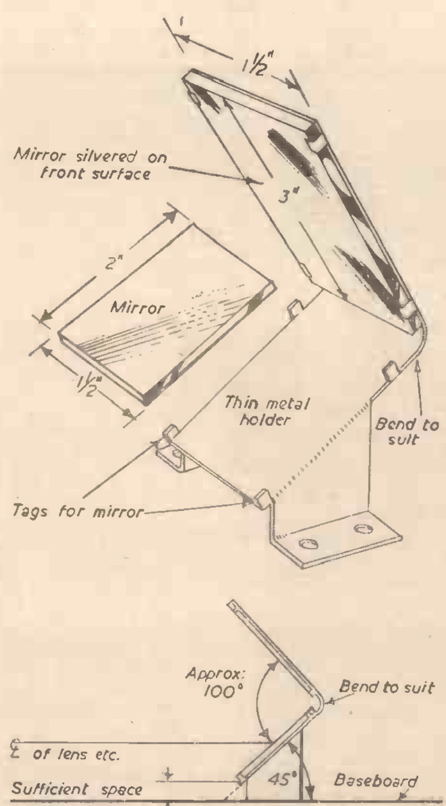


Fig. 5.—Constructional details of the reflecting mirrors.

The Condenser

If a proper condenser lens is not available this item can be very easily and cheaply made up. Two plano-convex lenses are required of short focal length. These are mounted together with the convex sides facing and close together, as shown in Fig. 1. The lenses can be conveniently mounted on thin metal sheet with a circular hole slightly smaller than the lenses and with tags cut around the edge of the hole to grip the lens. The method of mounting is not important but the diameter of the lenses should not be less than 2in. for 35mm. transparencies. The condenser is fixed to the baseboard by a

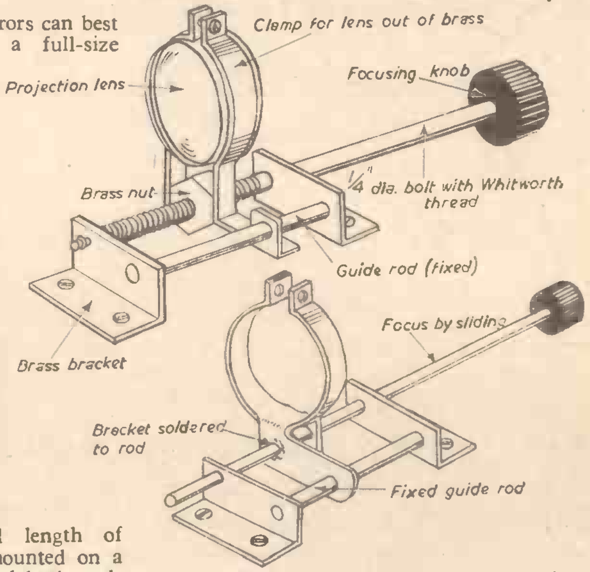


Fig. 6.—Suggested arrangements for focusing.

simple bracket of sheet metal. Small self-tapping screws are very useful for small jobs such as this. Thin sheet metal can be firmly secured to bakelite or other materials without the need for nuts and bolts. The correct distance for the condenser from the projection lens and also from the projection lamp is best found by experiment when the condenser is made up, the principle of the condenser being to get as much light as possible from the lamp through the transparency and on to the projection lens. Figs. 7 and 8 show the completed condenser and method of support.

The Transparency Holder

This is made up from small pieces of hardboard and thin metal strips, as shown in Fig. 8. The small cuts and bends made in the edges of the metal strips firmly hold the transparency in position. The transparencies will have to be mounted between 2in. glass squares and secured at the edges with binding tape. This appears to be the usual size of mounting for 35mm. films. However, if the transparencies are mounted in a different manner or size then the film holder will have to be altered to suit.

The holder should be firmly fixed to the baseboard in its correct position and truly

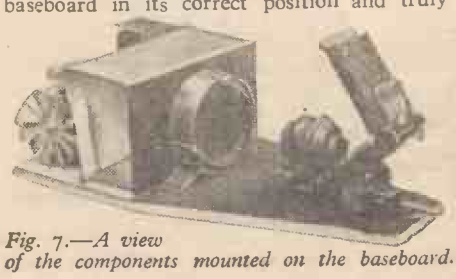
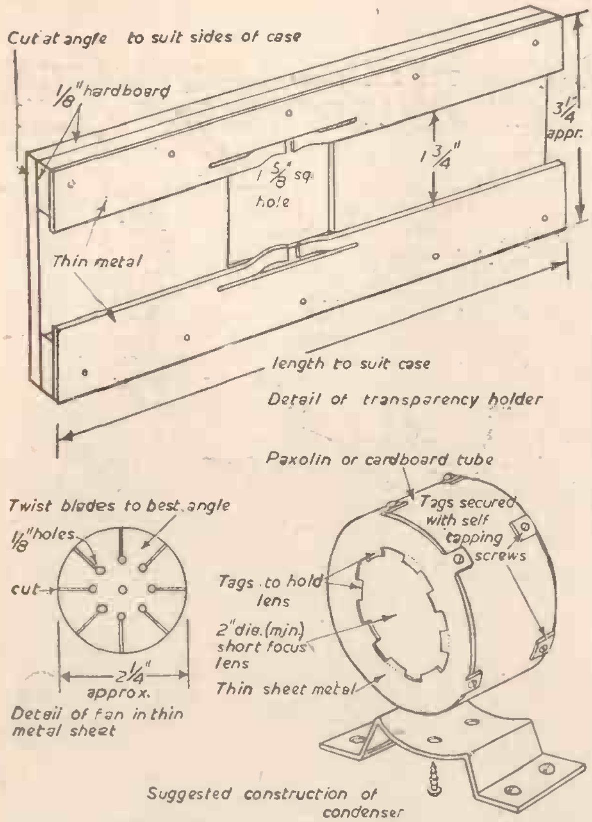


Fig. 7.—A view of the components mounted on the baseboard.



vertical. Small wooden blocks, well glued, will hold it securely.

The film holder is not seen on the photograph (Fig. 9) as in this viewer the holder is fixed to the outer casing and not to the baseboard. However, it is not thought that this method offers any advantages and is certainly more difficult to construct.

The Projection Lamp

The choice of lamp is best left to individual preference. For viewing with the ground-glass screen a 60 watt bulb is ample but for projecting on to a large screen a larger size lamp is needed.

A tinplate housing for the lamp is cut and shaped as shown in Fig. 10 together with a deflector if fan cooling is used. These can then be screwed in position on the base. It might be found necessary to bend the lamp housing to clear the blades of the fan when this is fixed in position.

The Fan

A small rotary converter is used for the motor. There are various types available from surplus dealers or from advertisers, at very reasonable prices. The size is 4in. long, 2in. diameter. The input voltage is not important but the output voltage should be between 200 and 400 volts. The L.T. brushes are removed and the converter is wired as a series wound universal motor. The output voltage of the converter is not critical and a resistor is wired in series as very little power is required. The value of the resistor can be best found by experiment. Sufficient draught for the lamp should be available without noise or vibration. Between 2,000 and 3,000 ohms will probably be suitable and should be of the wire-wound vitreous type. The resistor should be connected across the converter, forming the series connection between the field windings and armature windings and should be supported on its own wire ends and be isolated as it will get rather warm in use.

No interference to television or radio has been noticed, probably because of the reduced current and speed. If any interference is caused a suppressor should be fitted.

Fig. 8 (Left).—Details of the transparency holder, fan construction and condenser construction.

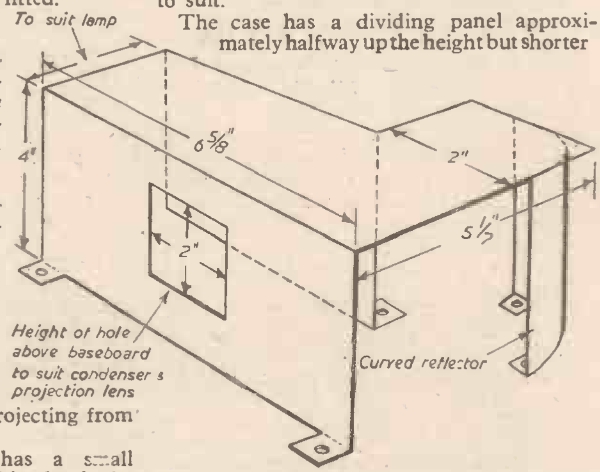


Fig. 10 (Right).—The tinplate lamphouse.

The fan is cut from aluminium as shown in Fig. 8, and the blades bent at an angle to give the best results. The fan is fastened on to the short length of screwed shaft projecting from the end of the converter.

If the converter already has a small plastic or metal fan attached this should be removed.

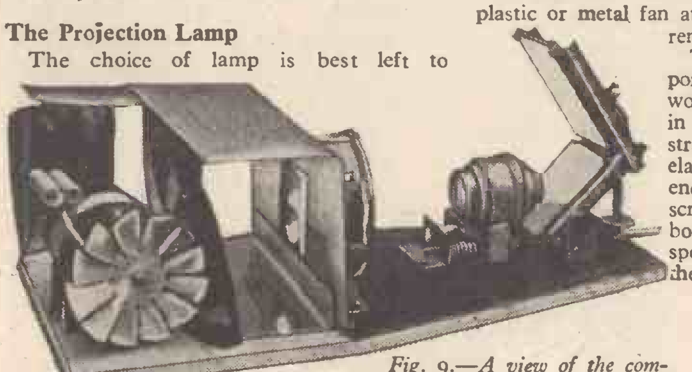


Fig. 9.—A view of the completed unit, with cover removed.

The motor is supported on two small wooden cradles and held in position with a metal strap or one or two elastic bands held at each end by small hooks, screwed into the baseboard. Thin strips of sponge rubber between the motor and the supports should prevent any vibration (see Fig. 11).

The Case and Ground-glass Screen

The outer case is of 1/8in. hardboard, cut to shape and fitted together as shown in Figs. 3 and 11.

The top front panel, lower front panel, rear panel and lampholder require to be removable and should be screwed with small wood screws. The remainder of the case can be permanently fixed together with glue and panel pins, reinforced at angles and junctions with 1/2in. square wood strips, to form a rigid cover. 1/4in. thick triangular softwood cheeks glued to the sides as shown in Figs. 1 and 11 form the grooves for the ground-glass screen. This should slide easily to facilitate its removal when using as a projector.

The ground-glass screen should be 6 1/2in. × 6 1/2in. and can be obtained from glass merchants or from photographic dealers. If from the latter, which is preferable, the nearest size will probably be 8 1/2in. × 6 1/2in. and will have to be cut to suit.

The required angle for the ground-glass screen should be very carefully decided as this will depend upon the layout in individual cases. It is best decided when the outer case has been made and the glass can be pivoted on its lowest edge. The correct angle can easily be found while a transparency is being projected. With the glass held firmly, the sides can be marked with a pencil and the grooves formed to suit.

The case has a dividing panel approximately halfway up the height but shorter than the full length to avoid obstructing the reflected rays from the lower mirror.

Fig. 1 shows the panel, which should be the full width of the case and firmly fixed to the side panels with wood strips, glue and panel pins. The panel slopes at an

(Concluded on page 40)

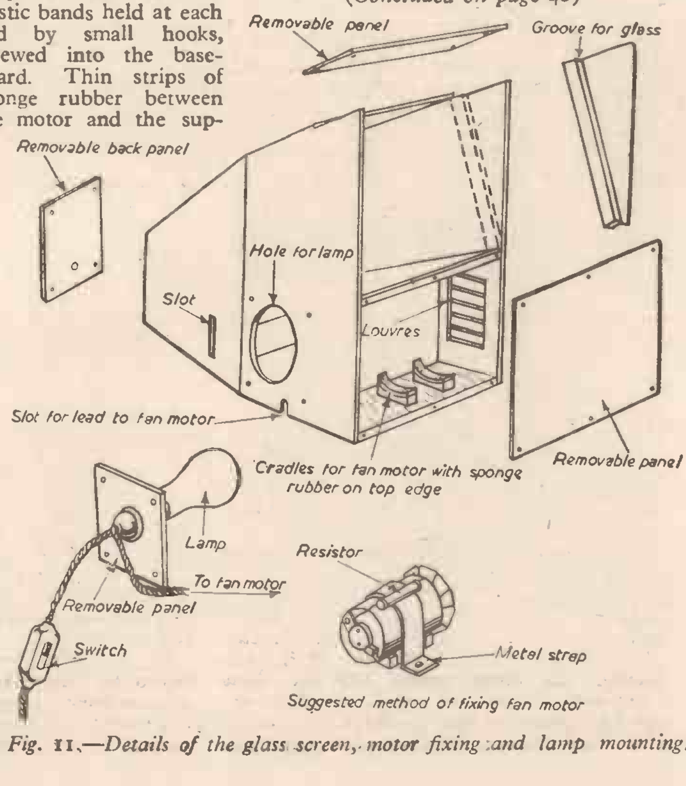
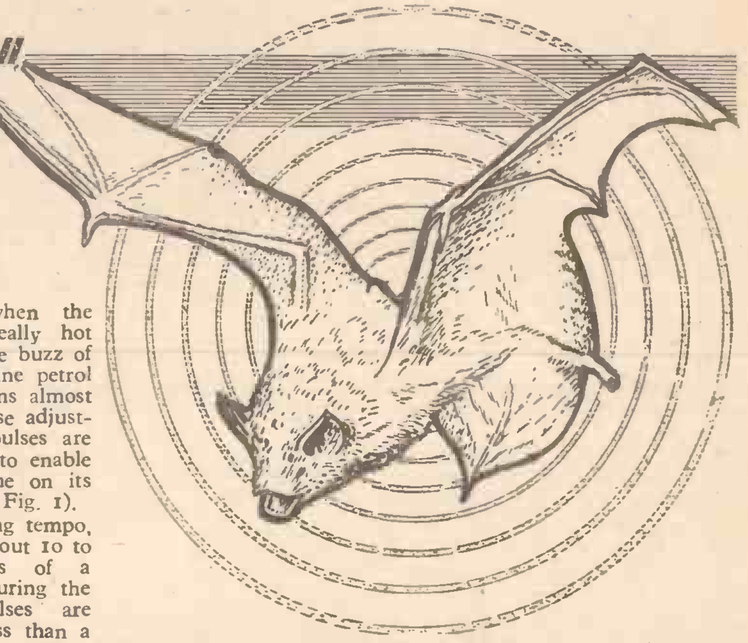


Fig. 11.—Details of the glass screen, motor fixing and lamp mounting.

BAT "RADAR"



How Bats "See" in the Dark

By Donald R. Griffin

IN these days of technological triumphs it is well to remind ourselves from time to time that living mechanisms are often incomparably more efficient than their artificial imitations. There is no better illustration of this rule than the sonar system of bats. Ounce for ounce and watt for watt, it is billions of times more efficient and more sensitive than the radars and sonars contrived by man.

Of course the bats have had some 50 million years of evolution to refine their sonar. Their physiological mechanisms for echo-location, based on all this accumulated experience, should, therefore, repay our thorough study and analysis.

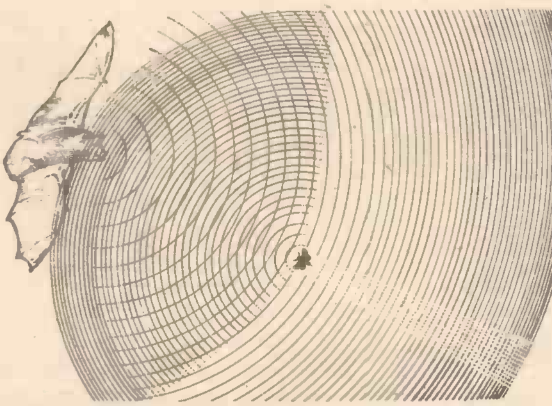


Fig. 1.—Insect is located by means of reflected sound waves. Variation of the spacing of the curves represents changing wavelength and frequency of bat's cry.

Uses of Bat Radar

To appreciate the precision of the bat's echo-location we must first consider the degree of their reliance upon it. Thanks to sonar, an insect-eating bat can get along perfectly well without eyesight. This was brilliantly demonstrated by an experiment performed in the late 18th century by the Italian naturalist Lazaro Spallanzani. He caught some bats in a bell tower, blinded them and released them outdoors. Four of these blind bats were recaptured after they had found their way back to the bell tower, and on examining their stomach contents Spallanzani found that they had been able to capture and gorge themselves with flying insects in the field. We know from experiments that bats easily find insects in the dark of night, even when the insects emit no sound that can be heard by human ears. A bat will catch hundreds of soft-bodied, silent-flying moths or gnats in a single hour. It will even detect and chase pebbles or cotton spitballs tossed into the air.

In our studies of bats engaged in insect hunting in the field we use an apparatus which translates the bats' high-pitched, inaudible sonar signals into audible clicks. When the big brown bat (*Eptesicus fuscus*) cruises past at 40ft. or 50ft. above the ground, the clicks sound like the slow "put-put" of an old marine engine. As the bat swoops toward a moth, the sounds speed up to the tempo of an idling outboard motor, and when the chase grows really hot they are like the buzz of a model aeroplane petrol engine. It seems almost certain that these adjustments of the pulses are made in order to enable the bat to home on its insect prey (see Fig. 1).

At the cruising tempo, each pulse is about 10 to 15 thousandths of a second long; during the buzz the pulses are shortened to less than a thousandth of a second and are emitted at rates as high as 200 per second. Within each individual pulse of sound the frequency drops as much as a whole octave (from about 50,000 to 25,000 cycles per second). As the pitch changes, the wavelength rises from about 6 to 12 mm. This is just the size range of most insects upon which the bat feeds. The bat's sound pulse may sweep the whole octave, because its target varies in size as the insect turns its body and flutters its wings.

Different Types

The largest bats, such as the flying foxes or fruit bats, have no sonar. As their prominent eyes suggest, they depend on vision; if forced to fly in the dark, they are as helpless as an ordinary bird. One genus of bat uses echo-location in dark caves but flies by vision and emits no sounds in the light. Its orientation sounds are sharp clicks audible to the human ear, like those of the cave-dwelling oil bird of South America.

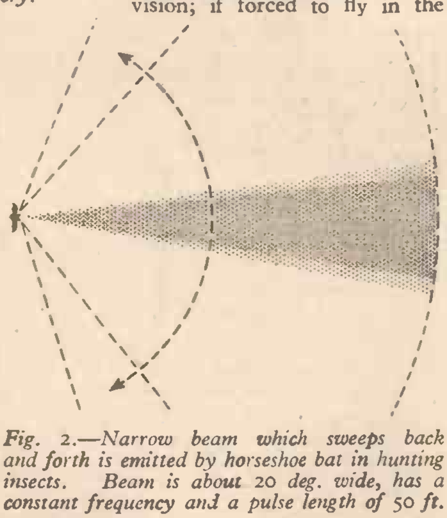


Fig. 2.—Narrow beam which sweeps back and forth is emitted by horseshoe bat in hunting insects. Beam is about 20 deg. wide, has a constant frequency and a pulse length of 50 ft.

On the other hand, all of the small bats (sub-order *Microchiroptera*) rely largely on echo-location, to the best of our present knowledge. Certain families of bats in tropical America use only a single wavelength of a mixture of harmonically related frequencies, instead of varying the frequency systematically in each pulse. Those that live on fruit, and the vampire bats that feed on the blood of animals, employ faint pulses of this type.

Another highly specialised group, the horseshoe bats of the Old World, have elaborate nose leaves which act as horns to focus their orientation sounds in a sharp beam; they sweep the beam back and forth to scan their surroundings (Fig. 2). The most surprising of all the specialised bats are the species that feed on fish. These bats, like the brown bat and many other species, have a well-developed system of frequency-modulated ("F.M.") sonar (Fig. 3), but since sound looses much of its energy in passing from air into water and vice versa, the big puzzle is: How can the bats locate fish under water by means of this system?

Echo-location by bats is still such a new discovery that we have not yet grasped all its refinements. The common impression is that it is merely a crude collision warning device. But the bats' use of their system to hunt insects shows that it must be very sharp and precise, and we have verified this by experiments in the laboratory. Small bats are put through their manœuvres in a room full of standardised arrays of rods or fine wire (Fig. 4). Flying in a room with ¼in. rods spaced about twice their wingspan apart, the bats usually dodge the rods successfully, touching the rods only a small percentage of the time. As the diameter of the rods or wires is reduced, the percentage of success falls off. When the thickness of the wire is considerably less than 1/10 the wave-

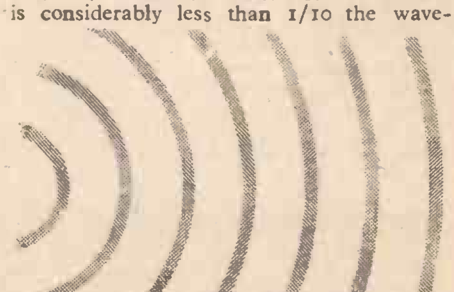


Fig. 3.—Wide beam of short frequency modulated pulses is emitted by most bats while hunting. Each pulse is about 1.5 ft. long. Beam is fixed with respect to bat's head.

length of the bat's sounds, the animal's sonar becomes ineffective. For example, the little brown bat (*Myotis lucifugus*), whose shortest wavelength is about 3 mm., can detect a wire less than 2/10 mm. in diameter, but its sonar system fails on wires less than 1/10 mm. in diameter.

When obstacles (including insect prey) loom up in the bat's path, it speeds up its emission of sound pulses to help in location. We have made use of this fact to measure the little brown bat's range of detection. Motion pictures, accompanied by a sound track showed that the bat detects a 3 mm. wire at a distance of about 7ft., on the

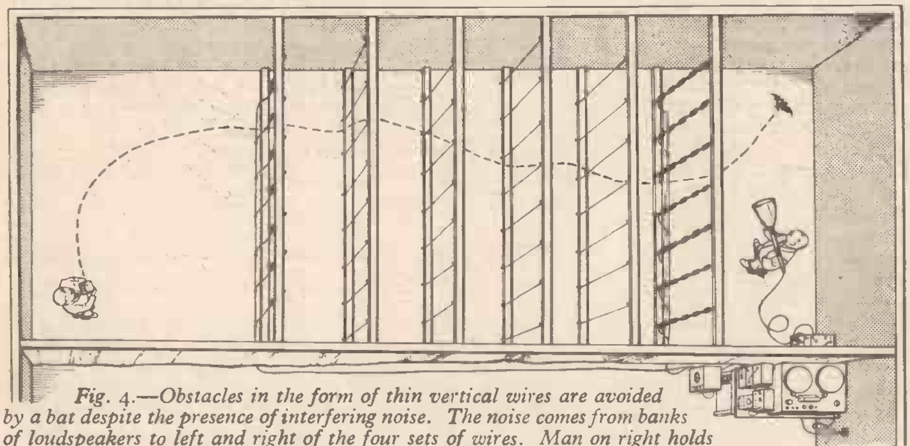


Fig. 4.—Obstacles in the form of thin vertical wires are avoided by a bat despite the presence of interfering noise. The noise comes from banks of loudspeakers to left and right of the four sets of wires. Man on right holds microphone which picks up bat's signals.

average, and its range for the finest wires it can avoid at all is about 3ft. Considering the size of the bat and of the target, these are truly remarkable distances.

Object Identification

Do the echoes tell the bat anything about the detected object? Some years ago Sven Dijkgraaf at the University of Utrecht in the Netherlands trained some bats to distinguish between two targets which had the form of a circle and a cross respectively. The animals learned to select and land on the target where they had been trained to expect food. Bats can tell whether bars in their path are horizontal or vertical, and they will attempt to get through a much tighter spacing of horizontal bars than of vertical bars.

In gliding through a closely spaced horizontal array the bat must decide just how to time its wingbeats so that its wings are level, rather than at the top or bottom of the stroke, at the moment of passage. All in all, we can say that bats obtain a fairly detailed acoustic "picture" of their surroundings by means of echo-location.

"Jamming"

Probably the most impressive aspect of the bats' echo-location performance is their ability to detect their targets in spite of loud "noise" or jamming. They have a truly remarkable "discriminator," as a radio engineer would say. Bats are highly gregarious animals, and hundreds fly in and out of the same cave within range of one another's sounds. Yet in spite of all the confusion of signals in the same frequency band, each bat is able to guide itself by the echoes of its own signals. Bats learned long ago how to distinguish the critically important echoes from other distracting sounds having similar properties.

We have recently tested the bats' discriminatory powers by means of special loudspeakers which can generate intense sound pulses. We found that a continuous broadband noise which all but drowned the bats' cries did not disorient them. They could still evade an insect net with which we tried to catch them; they were able to dodge wires about 1 mm. in diameter; they landed wherever they chose.

In some experiments A. D. Grinnell and I did succeed in jamming certain F.M. bats, but it was not easy, and the effect was only slight. We worked on a species of lump-nosed bat (*Plecotus rafinesquii*) which emits comparatively weak signals. With two banks of loudspeakers we filled the flight room with a noise field of about the same intensity as the bats' echo-location signals. The more skilful individual bats were still able to thread their way through an array of 1 mm. wires spaced 18in. apart. Only when we reduced the wires to well below ½ mm. in diameter (less than 1/10th the wave-length of the bats' sounds) did the bats fail to detect the wires.

To appreciate the bats' feats of auditory discrimination, we must remember that the echoes are very much fainter than the sounds they emit—in fact, fainter by a factor of 2,000. And they must pick out these echoes in a field which is as loud as their emitted sounds.

The situation is dramatically illustrated when we play back the recordings at a reduced speed which brings the sounds into the range of human hearing. The bat's outgoing pulses can just barely be heard amid the random noise; the echoes are quite inaudible. Yet the bat is distinguishing and using these signals, some 2,000 times fainter than the background noise!

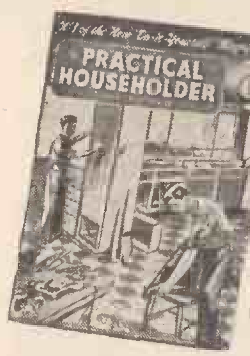
Much of the modern study of communication systems centres on this problem of discriminating information-carrying signals from competing noise. Engineers must find ways to "reach down into the noise" to detect and identify faint signals not discernible by ordinary methods. Perhaps we can learn something from the bats, which have solved the problem with surprising success. They have achieved their signal-to-noise discrimination with an auditory system that weighs only a fraction of a gram, while we rely on computing machines which seem grossly cumbersome by comparison.

When I watch bats darting about in pursuit of insects, dodging wires in the midst of the nastiest noise that I can generate, I am convinced that new and enlightening surprises still wait upon the appropriate experiments.

This article is reprinted from "The Scientific American" by kind permission of the Editor.

The National Do-It-Yourself Magazine

PRACTICAL HOUSEHOLDER



EDITED BY F. J. CAMM

October Issue Now on Sale

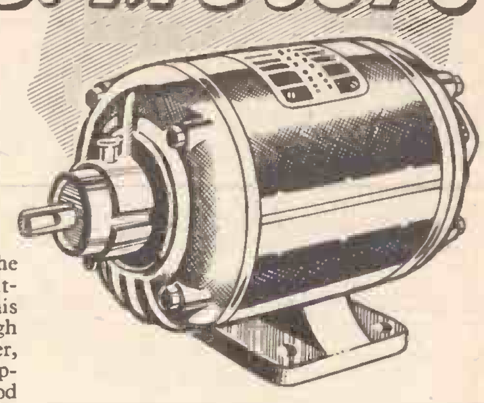
PRINCIPAL CONTENTS:
A Glass Brick Entrance Porch
Briquette Fireplaces
Home Laid Parquet Flooring
How to Make and Fit Tapered Legs
A Conservatory Extension for a Garden Shed
False Ceiling in Glass and Metal
A Guide to Interior Decoration
Condensation its Cause and Cure
Choice of a Heating System for the Home
Making a Spin Drier
An Attractive Kitchenette Table
A Modern Double Bunk Bed
A Slide-away Table
Solid Fuel Heating Troubles
Boxing in the Eaves
Modernising Fireplaces
A Contemporary Television Chair
Weatherboarding
A Built-in Fitted Wardrobe
A Bathroom Mirror Refinement
and many other interesting articles

BOOK RECEIVED

"Handbook of the Aircraft Industry," edited by J. L. Nayler, M.A., F.R.Ae.S., F.I.A.S., and T. F. Saunders. 341 pages. 80 diagrams and 65 half-tone illustrations. Price 35s. Published by George Newnes Ltd., Tower House, Southampton Street, Strand, W.C.2.

THIS is an overdue contribution to aeronautical engineering, as the following list of contents shows. Each of the technical sections has been prepared by a well-known specialist in a particular branch of aeronautical engineering. Contents include: The Aircraft Industry and Careers in Aviation (The Aircraft Industry Today, Aeronautical Engineering as a Career, Aeronautical Education and Training, and People in the Aircraft Industry); Historical Section (Historical Introduction, Development of the British Aircraft Industry, and Records and Achievements); Aeronautical Engineering (Aerodynamics, Principles of Flight, How an Aircraft is Designed and Built, Development of the Aircraft Engine, Variable-pitch Propellers, Aircraft Auxiliary Power Systems, Instrumentation in Modern Aircraft, Radar, and Gliders and Soaring); Research and Development (Nuclear Power for Aircraft); Guided Missiles (Essential Aspects of Design, Propulsion, Guidance and Control, Survey of Guided-Missile Development); Civil Aviation (The Post-war Development of British Air Transport, The Organisation of Modern Airports, Some Problems of Airliner Cabins and their Furnishings, and Aviation Medicine); Modern Aircraft (A Pictorial Guide to Modern Aircraft); and Technical and General Data.

Changing the Speed of Single Phase A.C. Motors



How the Various Obstacles Can be Overcome

By J. L. Watts

IT is not always appreciated that there are considerable obstacles to speed control of many types of single-phase motors. Unsatisfactory results may be obtained, or a motor may become burnt out, if the wrong type of motor, or the wrong system of control, is used.

Series Motors

A common type of single-phase motor is the series or "universal" motor which is used on vacuum cleaners, portable tools, sewing machines, projectors, food mixers, office machinery, etc. As indicated in the inset to Fig. 1, such a motor has a commutator, with brushgear insulated from the frame of the motor, the armature being connected in series with the field windings. In a small two-pole motor the field coils are usually connected on opposite sides of the armature, so that each brush holder is connected only to one field coil, as in Fig. 1.

Curve A in Fig. 1 shows that the motor develops a high starting torque when switched directly on to the A.C. supply, and accelerates to a high speed if coupled to a light load, requiring only a small motor torque. If the load is increased the speed falls considerably, and *vice versa*. Thus, when a given voltage is applied to the motor, its speed depends only on the resistance torque of the load to which the motor is coupled.

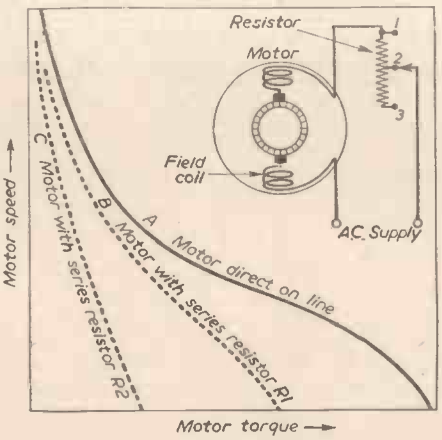


Fig. 1.—Connections and characteristics of a series motor with a series resistor.

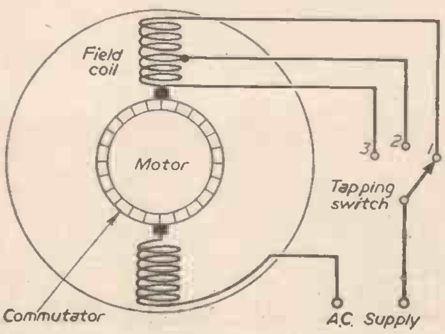


Fig. 2.—Tapped field method of raising the speed of a series motor.

Speed Reduction of a Series Motor

On a given load torque, however, the speed can be reduced by reducing the voltage applied to the motor terminals. This may be done by feeding the motor through a step-down transformer or auto-transformer, which should preferably have several tappings of different voltage. Another method of reducing the speed is by connecting a tapped choke coil, or a variable resistor, in series with the motor. Curve B in Fig. 1 shows the reduction of speed obtained with one value of series resistance, whilst curve C shows the still lower speed obtained with a higher value of series resistance. When a series resistor, or a series choke, is used to reduce the motor speed the speed variation on a varying load is increased. As shown in curves B and C of Fig. 1 the motor is still likely to run at a very high speed on light load because, on light load, the motor current and the volt drop across the series resistor or choke coil are automatically reduced. Less speed variation on varying load is obtained when the motor is fed through a transformer or auto-transformer.

Gauge of wire (s.w.g.)	Dia. of wire (inch)	Resistance (ohms per foot)	Current (amps)
14	0.080	0.104	12.8
15	0.072	0.129	11.3
16	0.064	0.163	9.6
17	0.056	0.213	8.2
18	0.048	0.290	6.8
19	0.040	0.417	5.4
20	0.036	0.515	4.6
21	0.032	0.652	4.0
22	0.028	0.852	3.25
23	0.024	1.16	2.6
24	0.022	1.38	2.15
25	0.020	1.67	1.9
26	0.018	2.06	1.65
27	0.0164	2.49	1.48
28	0.0148	3.05	1.31
29	0.0136	3.61	1.2
30	0.0124	4.34	1.07

Table 1.—Resistance per foot and suggested currents for nickel chrome resistance wire.

Voltage and Resistor Calculations

As a very rough guide it is suggested that if it is required to reduce the speed of a series motor of voltage V from N to N_1 r.p.m. on a given load current I amps. the voltage applied to the motor should be reduced to V_1 volts, where V_1 is equal to $\frac{N_1 \times V}{N}$. If this is to be done by means of a series resistor the value R ohms of this resistor may be approximately equal to $\frac{V\,(N-N_1)}{N \times I}$. If the resistance torque of the load is constant at all speeds, the motor current I amps. will also be constant. However, the resistance torque of many loads falls on reduced speed, with reduction of motor current I. Thus, if an exact speed is required it is advisable to use a rather higher resistance value than is given by this formula, and to have plenty of tappings on the resistor.

Whatever system of voltage reduction is employed, the transformer, choke or resistor must be capable of carrying the required current without overheating. Resistors must be adequately ventilated. Table 1 gives the resistance per foot of various sizes of nickel-chrome resistance wire, as used on electric fire elements, together with suitable current values.

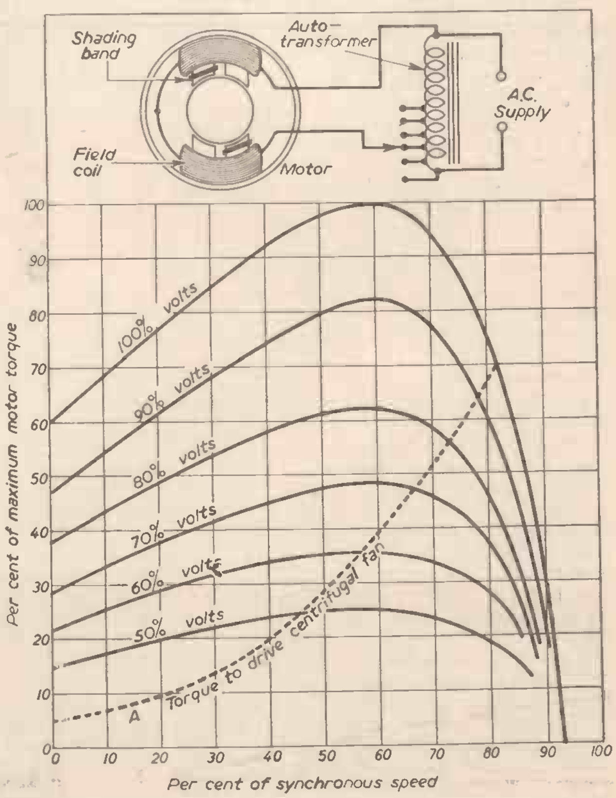


Fig. 3.—Method and characteristics of speed control of a shaded-pole motor.

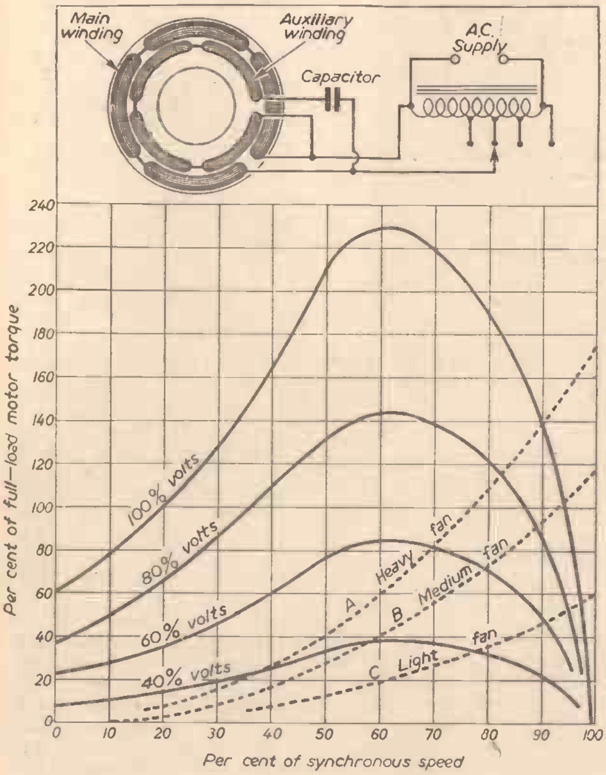


Fig. 4.—Speed control of a capacitor motor.

Increasing the Speed of a Series Motor

The speed of a series motor may be raised by feeding the motor at a higher voltage, as may be obtained from a step-up transformer or auto-transformer. If the load resistance torque is constant at all speeds, the secondary load current of the transformer will also be constant at all speeds, although the primary current will be increased as tappings of higher secondary voltage are used to raise the speed. If the load resistance torque increases on increased speed the secondary current of the transformer will also rise.

Another method of increasing the speed of a series motor is by reducing the number of turns of field winding in series with the armature, as indicated in Fig. 2. With the single-pole tapping switch on contact No. 1, the motor will run at normal speed: a higher speed will be obtained with the switch on contact 2. When the switch is placed on contact No. 3, so that current flows through one field coil only, the speed obtained on a given motor current will be almost doubled. However, with this method of speed control, the motor torque falls as field turns are cut out of circuit. This method of speed control is only practicable if the full-load torque of the motor is greater than that required on the higher speed.

General Precautions when Increasing the Speed of a Motor

When the speed of a motor is increased, care must be taken not to run it at such a high speed that there is risk of the rotating parts being damaged by the increased centrifugal forces, which are proportional to the square of the speed. Care must also be taken to ensure that there is no risk of the motor overheating due to increased current required to drive the load at increased speed, and that the applied voltage is not increased to such a degree that there is risk of the insulation breaking down.

Shaded-pole Motors

Shaded-pole motors are normally not made in sizes exceeding about 1/20 h.p. As indicated in the inset to Fig. 3, these motors have a squirrel-cage rotor, without commutator or brushes, the stator windings being fed direct from the supply. Usually the motors have shaped field poles, as in Fig. 3, in which case they have one field coil of insulated wire on each pole normally, together with a short-circuited copper band which encircles part of each pole face. Other shaded-pole motors have a slotted stator with many coils and a uniform radial air gap between the stator and rotor, in which case the shading winding consists of a few turns of thick wire. The synchronous speed of a shaded-pole motor, or any other type of induction motor, in r.p.m. is equal to $\frac{120 \times f}{P}$, where f is the frequency of the A.C. supply in cycles per second, and P is the number of poles for which the motor is wound. The full-load speed may be about 75 to 90 per cent. of the synchronous speed, depending on the design of the motor.

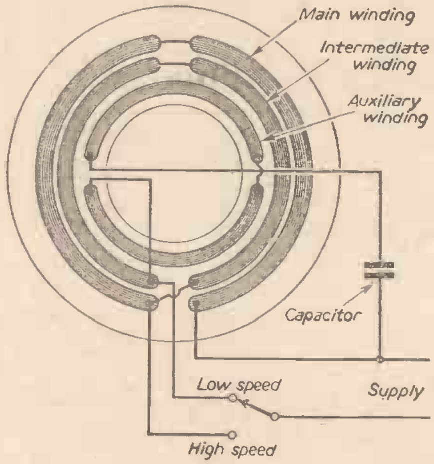


Fig. 5.—One arrangement of a two-speed capacitor motor.

For some purposes it is possible to reduce the speed of a shaded-pole motor by feeding this at reduced voltage through a transformer, auto-transformer (as indicated in the inset to Fig. 3), choke coil or resistor. Fig. 3 shows how the motor speed is reduced on reduced voltage in the case of a particular motor. In the case of this motor, if it were used to drive a load requiring a constant torque at all speeds and this torque was equal to 50 per cent. of the maximum motor torque, the motor would run at 86 per cent. of synchronous speed on full voltage. The speed would only fall to 77 per cent. of synchronous speed on 80 per cent. of rated voltage, and would not develop sufficient torque to drive the load if the voltage was reduced to 70 per cent. of normal value. Thus, on a constant-load torque, the speed could only be reduced about 10 per cent.

However, if the motor were used to drive a load requiring reduced torque at reduced speed, as in the case of the fan whose speed-torque characteristics are given by curve A, a considerable amount of speed reduction could be obtained by reducing the voltage applied to the motor. On full voltage the motor would run at about 81 per cent. of synchronous speed and could also be run at 45 per cent. of synchronous speed on 50 per cent. voltage.

Capacitor Motors

The plain capacitor motor has a main stator winding and an auxiliary stator winding, and has no brushes or centrifugal switch. The characteristics and connections of one such motor are given in Fig. 4. It is possible to obtain some reduction of speed of such a motor by feeding it at reduced voltage through a step-down transformer, auto-transformer (as indicated in the inset to Fig. 4), choke coil or resistor. However, in order to avoid overheating the windings on reduced speed the full-load torque should be reduced roughly in proportion to the voltage. The motor cannot, therefore, be used to develop its rated full-load torque at reduced speed. This limits the amount of speed reduction which can be obtained on a load having a constant resistance torque at all speeds.

For instance, on 50 per cent. of rated full-load torque, the motor speed could only be reduced from about 98 per cent. of synchronous speed to about 85 per cent. by reducing the applied voltage to half. A good deal of speed reduction is, however, possible if the load requires reduced torque at reduced speed.

In the case of the medium fan, whose speed-torque characteristics are given by curve B in Fig. 4, the speed could be reduced from about 94 per cent. of synchronous speed on full voltage to about 57 per cent. on 40 per cent. voltage. This is quite practicable since the fan requires less than 40 per cent. of the full-load motor torque on 40 per cent. volts. Similarly the speed of the light fan (curve C) could be reduced from about 97 per cent. of synchronous speed on full voltage to about 76 per cent. on 40 per cent. volts, or even lower on a lower voltage.

Another method of running a capacitor motor at more than one speed is by altering the number of turns of the main stator

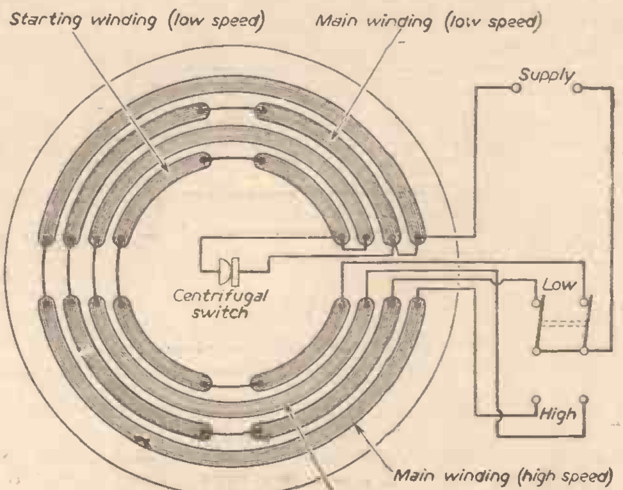


Fig. 6.—Schematic arrangement of a two-speed two-winding split-phase induction motor.

winding to which the supply voltage is applied. One method is indicated in Fig. 5, this motor having a main and an intermediate stator winding. For maximum speed the supply voltage is applied directly to the main winding, and also to the intermediate winding in series with the auxiliary winding and the capacitor. For minimum speed the supply voltage is applied to the main winding in series with the intermediate winding, and also to the auxiliary winding in series with the capacitor. This system also is unsuitable for driving a load which, at low speed, requires as much as the full-load (high speed) torque of the motor.

Induction and Capacitor-start Motors

Ordinary single-phase, split-phase, induction and capacitor-start motors are generally unsuitable for operation at any speed other than that for which they were designed. Reduction of the applied voltage to such motors reduces the full-load torque obtainable without reducing the speed very much.

The speed of such motors can, however, be reduced if they are fitted with a wound rotor which is connected to slip rings, but such motors are very rare. The speed of a slip-ring motor can be reduced by connecting three equal resistors between the slip-ring brushes. The speed of the motor will then vary on varying load, and on light load the motor may run almost at its normal speed unless increased resistance is connected between the slip-ring brushes. This method of control is unsuitable for reducing the speed of a motor by more than about 15 per cent., however, if a centrifugal switch is fitted, as this might then be liable to close and connect the starting winding in circuit, causing this winding to burn out.

Pole-changing Windings

Split-phase, induction and capacitor-start squirrel-cage motors can, however, be specially wound to run at either one of two speeds by the use of two complete sets of stator windings, each set being wound for a different number of poles. The influence of the number of poles on the motor speed was discussed in connection with shaded-pole motors. Fig. 6 shows one arrangement of a two-pole/four-pole motor. When the switch is in the "high" position the motor would have a synchronous speed of 3,000 r.p.m. on a 50-cycle supply; in the low speed position the synchronous speed would be 1,500 r.p.m. On each position of the switch the full-load speed of the motor would be a few per cent. less than the synchronous speed for that switch position.

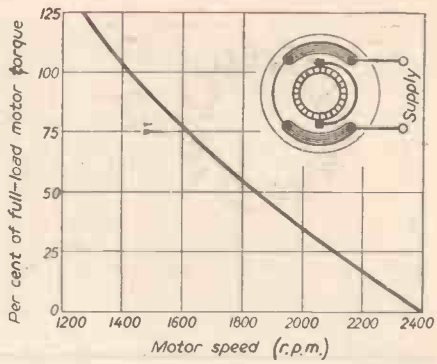


Fig. 8.—Speed-torque curve and connections of a repulsion motor.

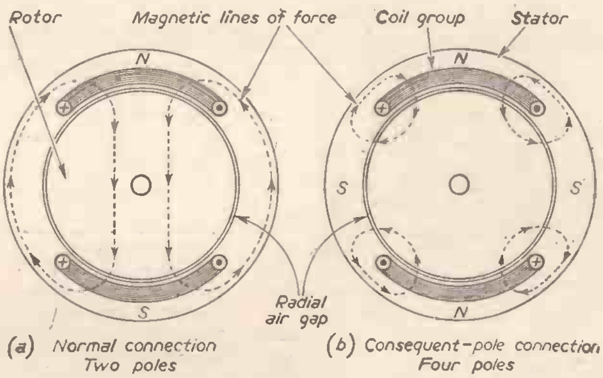


Fig. 7.—Pole-changing connections of stator windings.

Where a single centrifugal switch is used for either set of starting windings, this must be designed to open at about 75 per cent. of the synchronous speed of the low-speed winding. This rather limits the "pull-in" torque obtained when starting with the switch in the high-speed position. The horse-power output obtained from such a two-speed motor is less than can be obtained from a single-speed motor of the same dimensions, due to the space occupied by the inactive set of starting and main windings.

A slightly greater output is obtainable from a given size of motor designed for a two-to-one speed ratio if consequent-pole windings are fitted instead of separate windings for each speed. The principle is indicated in Fig. 7. Fig. 7a shows the normal salient-pole arrangement in which there is one group of coils per pole. By reversing the connections to one group of coils of this two-pole group, each group of coils can be made to produce poles of the same magnetic polarity. Consequent poles of opposite magnetic polarity are then automatically produced between the groups of coils. In this way one winding can be used for two speeds. It is, however, necessary that the coil pitch for the high-speed winding does not exceed 80 per cent. of the full pitch.

Repulsion Motors

The repulsion motor has a laminated stator core, with stator windings fed from the A.C. supply, as in the inset to Fig. 8. The rotor has an insulated winding which is connected to a commutator on which ride brushes which are short circuited together. Usually the brush holders are not insulated from the frame of the motor. As will be seen from Fig. 8 the speed of such a motor with motor load variation.

It is possible to vary the speed of such a motor by simply shifting the whole set of brushes slightly round the commutator, although this also alters the starting torque of the motor. Some of these motors are specially designed to operate at various speeds and on full-load an infinitely variable speed may be obtained. This is ideal, provided that it is not essential for the motor to run at a constant speed on a variable load.

A U.S. "Build-it-yourself" Helicopter

"Spirit of Kitty Hawk" gyrocopter.

AN American firm, Bensen Aircraft Corporation, which produces one-man helicopters for the do-it-yourself builder, has begun production of a new and larger model gyrocopter named "Spirit of Kitty Hawk," shown in the photograph above.

The craft is powered by a four-cylinder; air-cooled, 72 horsepower engine, weighs 250lb. and is capable of lifting an additional 250lb. It is held aloft by a horizontal rotor 20ft. long and is sold in material kit form, less engine, for $395. The new model is available for export in complete, ready-to-fly form for $2,995 including engine.

Labour-saving Apparatus for Stoking the Boiler

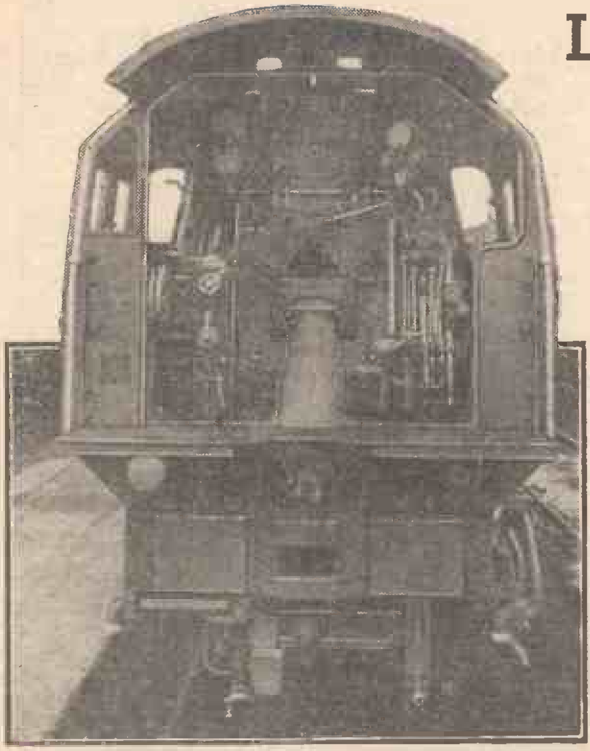


Fig. 1.—Footplate of loco. fitted with the Berkeley stoker, showing riser conduit and screw. On the right are the cocks controlling the steam jets which distribute the coal in the firebox.

OVER the years railways have been confronted with the problem of increasing locomotive capacity and it is generally recognised that the power developed is limited by the physical effort of the fireman.

The fitting of stokers to locomotives is not necessarily dependent upon the size of grate but aims at obtaining maximum output from the boiler at all times regardless of the working of the locomotive and quality of fuel.

The Berkeley stoker, which includes a number of novel features that have proved successful in operation in other countries, is not automatic and has to be intelligently controlled for efficient operation. It does, however, relieve the fireman of heavy physical labour.

Three British Railways Standard 2-10-0 Class 9 Freight Locomotives have been fitted with the stoker, which consists of four main units.

The engine, which is mounted on the tender front dragbox, provides the necessary power under all conditions to supply coal to the firebox, and can be throttled down to furnish the coal as sparingly and continuously as required. It is possible to work the engine in reverse in case of a blockage in the stoker mechanism.

The tender conveyor unit (Fig. 2) consists of a trough, conveyor screw, crusher and gearbox. The trough is located below the coal bunker and is mounted on rollers to take care of the movement between engine and tender. The power from the engine unit is transmitted to the gearbox mounted at the rear of the conveyor unit by means of a slip shaft with universal joints. The gearbox transmits motion to the conveyor screw which carries coal from the bunker through the crusher, where it is broken down to the correct size and is then fed into the intermediate conduit.

The intermediate conduit includes a conveyor screw enclosed in a conduit or casing, which is connected to the riser by a special ball joint.

The riser conduit, which extends upward through the footplate and is secured to the back of the firebox, includes a further conveyor screw which is connected to the intermediate screw by means of a universal joint. The riser screw has a reverse flight at the extreme end and this results in the coal being levelled down and spread out prior to delivery into the firebox, thus ensuring a uniform delivery of coal.

The jet plate fits in the lower portion of the mouth of the riser conduit and means are provided for easy adjustment to the proper firing angularity. The front of the jet plate has hoods above the jet orifices which allow divergence of the steam jet before meeting the coal, thus ensuring efficient distribution over the grate, The jet plate is divided into four compartments, each controlled by a separate valve located in the jet manifold and marked to indicate which section of jets the valve controls (Fig. 1). Pressure gauges are located on a panel in the cab.

It is possible to hand fire the locomotive in case of failure of the stoker or when it is necessary to correct the firebed after removal of clinker, etc., and also when working the locomotive on comparatively short journeys where time would be insufficient to allow correct setting of the coal feed and jet pressures of the stoker.

Fig. 2.—Tender conveyor unit showing trough conveyor screw, crusher and gearbox.

A Transparency Viewer and Projector

(*Concluded from page 34*)

angle, which if extended should meet the junction of the mirrors. The cover, including the removable panels, is finally covered with a suitable material such as bookbinding linen or leathercloth, stuck on with thin glue.

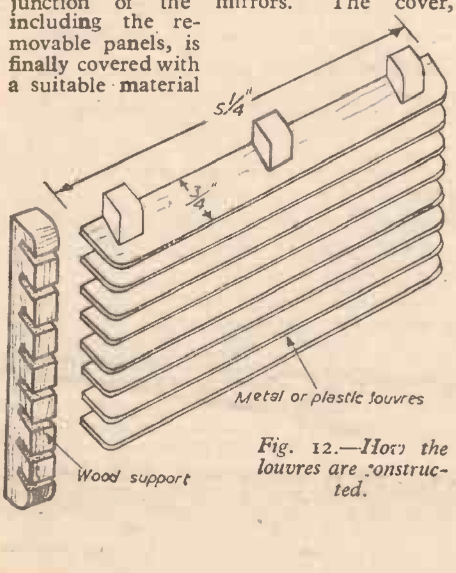


Fig. 12.—How the louvres are constructed.

A carrying handle is required, screwed to the top with a strengthening piece on the underside.

Ventilating Louvres

These consist of strips of plastic with the ends rounded, housed and glued to three hardwood strips as shown in Fig. 12. The completed louvres are cemented to the case to cover the two ventilating holes.

Lamp

The lampholder will have to suit the type of lamp that is proposed to be used and can be fitted to a small panel at the side secured with screws or spring clips for quick removal. The lamp will have to be removed before the case can be lifted off the baseboard. Similarly, of course, the outer casing requires to be screwed to the baseboard before the lamp is inserted.

A switch is needed to operate both the lamp and the fan. On the model described, the switch is combined with the lampholder but this necessitates opening up the lampholder and taking off connections for the fan motor. A better way is to fit a separate switch of the type that is connected in series with the mains lead providing it will safely carry the current.

The wiring is simple, the lamp and fan motor being connected in parallel.

All internal surfaces of the viewer should be painted matt black with the exception of the inside of the lamphouse.

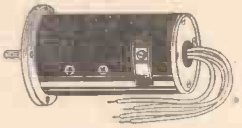
A small knob is required for focusing and is fixed to the spindle, which should protrude through a small hole in the back panel.

When employed as a viewer, using the ground-glass screen, the transparencies are placed in the slot at the side and each one is pushed into viewing position by the next transparency, eventually passing out at the opposite side where they can be collected in order. The transparencies should be placed in the viewer the correct way up but back to front.

For projecting on to a wall screen, the ground-glass screen is first removed by means of the top panel and the films are placed in the correct way up and the right way round, that is, with the front side of the transparency towards the front of the viewer. The rear of the projector will have to be raised slightly when projecting to obtain a square picture.

MAINS BLOWER, 200/250 v. A.C./D.C., ¼ amp., 5,000 r.p.m., consists of the motor with attached enclosed fan, and funnel intake 1¾in. dia., side outlet 1in. x ¾in., plinth base 5in. x 4½in., finish black crackle and die cast aluminium, size overall 9in. long, 4½in. wide, 5in. high, weight 7½ lb., a very superior blower, offered at a fraction of original cost, new, unused, 25/-. Post 3/6.

ZAMBONI PILES, dry voltaic type, consists of 3 piles, each 6in. long by 1in. dia., in high insulation mount to give 1,500-volts, taken from new unused infra-red equipment, 5/-, post 1/6, also variable focus eyepieces and Wratten filter backed objectives, taken from same equipment, 5/- set, post 1/6.



HUGHES MOTORS, shunt wound, 12 v. 1½-amp., speed 5,000 r.p.m., reversing, size 3⅝in. long, 1⅝in. dia., ¼ in. shaft, weight 20 oz., a very superior motor designed for anti-radar equipment, new unused 10/-, post 1/6. £5 per doz., carriage paid, ditto fitted reduction gear, giving a final drive (¼ in. shaft) of either 320 or 160 r.p.m., state which required, 12/6 post 1/9 ; £6 per doz., carriage paid.

K TYPE CYLINDER LOCKS, deadlocking and thiefproof, has 7 concentric tumblers instead of the usual 5 in line, interchangeable fitting with ordinary cylinder locks, latchbolt reversible, for right or left hand doors (no need to specify), complete with 2 keys, all fittings and instruction booklet, new, boxed, 5/-, post 1/6 ; 4 for 20/-, post paid.

RANGEFINDERS by Barr and Stroud, 1-metre base coincidence type, a hand held instrument giving the distance of any object, from 500 to 20,000 yds. (12 miles). The 14x variable focusing right eyepiece provides two images of the object viewed, one from the right objective ; the other from the left. When these two images are brought into coincidence by a thumb wheel control, the distance in yards can immediately be read in the left eyepiece. Fitted two filters and other refinements. A very superior high quality instrument, original cost £180, our price in new or near new condition, supplied in stout fibre cases £5, carriage 100 m. 7/6, 200 m. 10/-, 300 m. 12/6. N.I. 20/-.

SIGHTING TELESCOPES by Ross, Taylor-Hobson, etc., these high quality instruments contain four 40 mm. dia. achromats, 2 of 3 in. focal length, 2 of 3½ in. focal length, also a 18 mm. dia. image erector achromat, 4 screw fine adjustment cross graticule, length 16 in., weight 7 lbs., new and boxed, 35/-, post 3/3.

GUNSIGHT TELESCOPES, has 4 lens high grade optical system with cross graticule, approx. 2x, all brass, 13 in. long, 1 in. dia., makes an ideal rifle sight, or astro telescope star marker, perfect condition, in metal cases, 20/-, post 1/9.

TELEPHONE SETS, consists of two combined microphones and receivers, which when wired up by ordinary twin flex, provides perfect 2-way communication, excellent results at 1 mile range have been reported, self-energised, no battery required, set complete, new unused 7/6, post 1/3 ; suitable twin 14/36 p.v.c. up to 300 ft. lengths at 1d. per ft. supplied, postage each 20 ft. flex 3d. extra.

CHARGING SETS, only 46 lbs. weight, easily carried, 4-stroke air-cooled, runs for 18 hours from 1 gall. petrol, D.C. output 12-18 v. at 80 watts, complete with exhaust and silencer, starter cord, etc., size 14½in. x 14½in. x 7½in., completely works reconditioned and now as new, supplied in stout wood cases, our price £8/10/-, carriage, (inland only) 100 m. 12/6, 200 m. 16/6, 300 m. 20/-.

GRAMOPHONE MOTORS by famous maker, 200/250 v. or 100/130 v. A.C. mains, ¾ in. long, 5/32 in. dia. shaft, speed 1,350 r.p.m., size 2½ in. x 2 in. x 1½ in., weight 18 oz., fitted rubber bushed mounting bracket, recent manufacture and brand new, 15/-, post 1/6.

OIL TEMP. GAUGES, 2½ in. square flush mounting, graduated 0/120 deg. "C", basically a very fine quality moving coil milliammeter, new in sealed cartons, 3/6, post 1/6.

Many other Bargains : send stamped, addressed envelope for lists.

MIDLAND INSTRUMENT CO., Moorpool Circle, Birmingham, 17

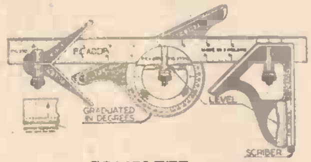
TEL. : HAR 1308

GAMAGES

FOR MONEY-SAVING BARGAINS IN TOOLS

PICADOR QUICK READING CARPENTER'S SQUARE

With Centre Head and Protractor



COMPLETE COMBINATION SET **30/-**

This precision combination set is suitable for Engineers, Motor Mechanics, Model Engineers, Carpenters, Handymen, etc., having many uses. The Square, Protractor, and Centre Head may be slid along the 12in. grooved, hardened and tempered, steel rule and may be locked in any position. The Rule has graduations of 8ths and 16ths one side, 16ths and 32nds other side. The Protractor is graduated in one degrees and gives a very quick clear reading. A spirit level is fitted to the Protractor and Square.

Post & Pkg. 1/6 outside our extensive van area. Square Head and Rule only of above set, 7/6 ea., *post* 1/-.

Centre Square Head, 5/- ea., *Post* 1/-.

SET OF SIX HOLE-SAWS

For increasing the scope of your ¼ in. Electric Drill

⅞in., ¾in., 1in., 1¼in., 1½in. and 2in. clearance through 3/16in. plate. Used with a ¼in. twist drill it will produce clean round holes.

BARGAIN PRICE **21/-** SET

Post & Pkg. 1/5.

Exceptional Value! 'GRIPITAL' CHAIN SPANNERS

Capacity Hexagons A/F 1½ to 3in.

Rounds 2½ to 4in.

The more you pull, the tighter it grips. Turns any shape or pipe. Ratchet action. Works on Plastic, Glass, Wood and other materials as well as metal. 9in. handle, 15in. chain.

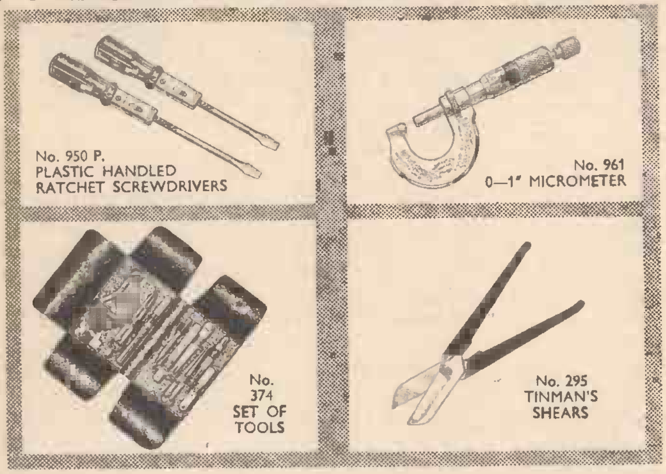
BARGAIN PRICE **4/6**

Post & Pkg. 10d.

Write NOW for Gamages Tool and Car Accessory List and details of their CONVENIENT PAYMENT PLAN.

GAMAGES, HOLBORN, LONDON, E.C.1. HOL 8484.

M&W ENGINEERS' PRECISION & HAND TOOLS



MEASURE UP TO ANY JOB

The next time you buy tools, remember that it pays to buy good tools, tools upon whose accuracy you can rely. M&W tools are made from the finest materials and are guaranteed to conform to British Standard Institution Specifications where they exist. **The next time you buy tools** ask your dealer for M&W Engineers Precision and Hand Tools.

Send 10½d. in stamps for a copy of our catalogue, mentioning this journal.

MOORE & WRIGHT (SHEFFIELD) LTD., 14/28, NORTON LANE, SHEFFIELD, 8

Getting ahead the easy way

Acclaimed by modellers everywhere, the booklet 'Plasticine Modelling for Amateurs' is in great demand. Written, photographed and drawn by A. V. Blanchard – a man with a lifetime's experience of the art – it shows short cuts to success in modelling Heads, Animals and Figures. It also contains a comprehensive chapter on Casting. Price (including leaflet '101 Uses for Plasticine'), 1/9 Post Free.

SPECIAL TRIAL OFFER
We will send 4lb. 'Plasticine' (any colour) with the booklet described above for
Post Free **10/-**

'Plasticine'

Regd Trade Mark

Sole Manufacturers :

Harbutt's Plasticine Ltd, Dept H, Bathampton, Bath, Somerset

FOR PERMANENT MODELS, use 'Plastone,' the self-hardening modelling material, 1 tin and booklet 3/9 post free.

For the "P.M." Electronic Flash Outfit Described in Our July Issue, J. R. Tilsley Describes—

An Extension Unit

The electronic flash unit and two reflectors.

WHEN an electronic flash tube fires, its resistance is of the order of 2 ohms, any resistance in the leads to the tube lowering the output of the lamp. Often a long extension lead is required; it then becomes more practical to use an extension unit having its own condenser and connected to the main unit by any length of well insulated twin core cable. A circuit suitable for use with a

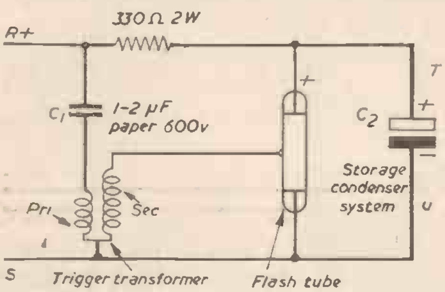


Fig. 1.—Circuit for use with a 270-volt set.

270-volt set is given in Fig. 1, the output being 100 joules.

The storage condenser system is composed of a 1,500 μF condenser and a 500 + 1,000 μF condenser and is wired as shown in Fig. 2, using a three-pole six-way rotary switch.

The points R and S are taken via the twin core cable to a suitable plug. A socket to accept the plug is wired up to the condensers in the main unit (C and D in the circuit in the July issue). R must contact the positive side of the condensers in the main unit and S must contact the chassis.

Should these connections become crossed over the operator is most likely to get a very unpleasant, possibly fatal, shock off the metal parts of the unit.

The switch connections are arranged as in the table further down this column.

When the main lamp is fired, condenser C begins to discharge through the primary of the trigger transformer causing a pulse of high voltage to appear in the secondary which in turn fires the flash tube.

This circuit is very convenient, but there is just one snag—after altering the power it may be necessary to wait 10 seconds for the condensers to charge. This does not usually cause any inconvenience, although it might for some applications.

With slight modification the circuit may be improved to incorporate variable lamp power

Switch Position	Capacity in circuit μF	Output to lamp Joules
1	500	17
2	1,000	33
3	1,500	50
4	2,000	67
5	2,500	83
6	3,000	100

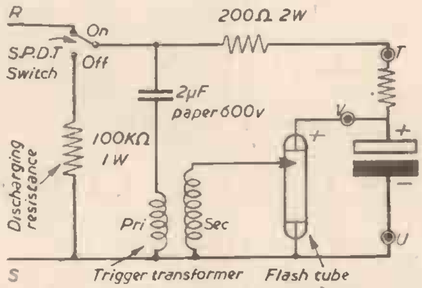


Fig. 3.—Improved circuit.

and better discharging of the condensers. A circuit diagram is given in Fig. 3, and the storage condenser system in Fig. 4.

The circuit is highly reliable and may be incorporated on any commercial unit with modification of the components to suit different voltages. The required values of components will be obvious to anyone with sufficient knowledge to be able to attempt the construction of such a unit.

If voltage indication is required it may easily be provided by a flashing neon lamp system connected across u and v as in Fig. 5. It is best to adjust the potentiometer so that the neon stops flashing at 250 volts. One further point: it should be emphasised that it is dangerous to connect or disconnect the extension unit whilst the condensers in the main or extension units are charged.

As will be seen, this extension unit requires only two connections to the main unit, and the circuits given are merely for guidance and are not intended as finished designs. Chassis and case details are, therefore, not included.

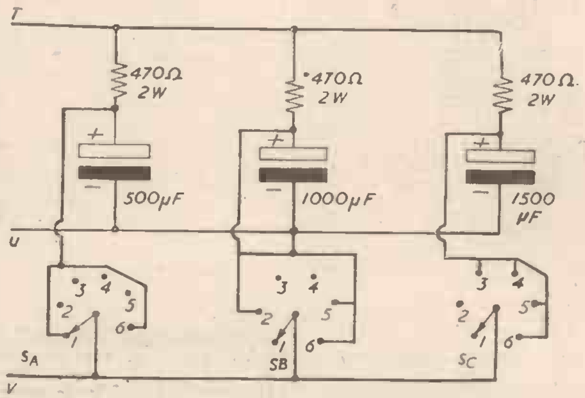


Fig. 4.—Storage condenser system.

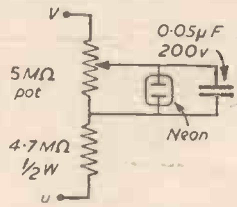


Fig. 5 (Right).—Connections for flashing neon lamp.

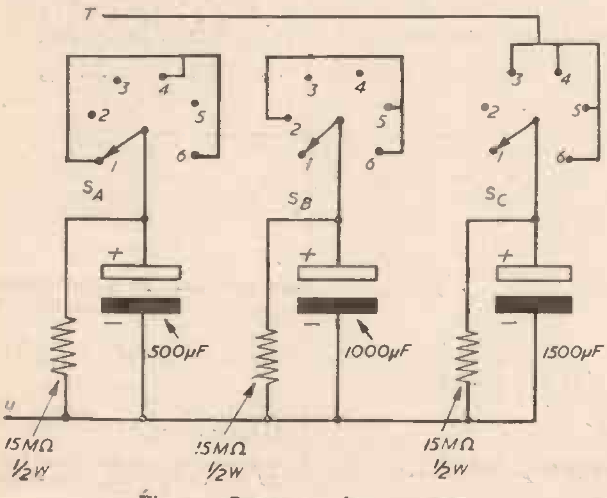


Fig. 2.—Storage condenser system.

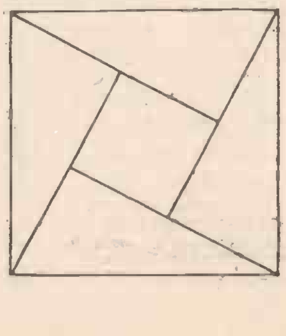
PUZZLE CORNER

Squaring the Rectangle

TAKE a strip of paper, rectangular in shape, 5in. long and 1in. wide. Now cut it into five pieces which can be rearranged to form a square.

Answer

First cut off a square piece from one end of the strip 1in. × 1in.; this will leave a length 4in. long and still 1in. wide. Halve the length so that you have two pieces 2in. long. Divide both pieces into two by cutting along one of the diagonals of each. This gives five pieces, which can be rearranged to form a square thus:



PHOTOGRAPHERS!

Everything's under control *with* Roto-TWO TANK

The perfect tank. Provision for inversion agitation as well as rotary 'cam-action' movement. 'Roto-Feed' easy loading action to spiral which is adjustable to 5 different widths, taking films size 116, 120, 127, 88 (35 mm.) and 16 mm. Special groove stops to permit two size 120, two size 127, two No. 88 or two 20-exposure 35 mm. films to be loaded at the same time without risk of their overlapping during development. One full 36 exposure length of 35 mm. film or one size 116 may be inserted or approximately 6 feet of 16 mm. Price **£1.12.6** Thermometer 5/-.

From Photographic Dealers Everywhere

For confidence in Photography

JOHNSONS OF HENDON LTD

LEECH *Lens*

COMPLETE OPTICAL UNIT FOR 2" x 2" SLIDE PROJECTION

Comprising :

- 4in. Fc. Projection Lens.
- Mounted Optical Condenser.
- Heat Filter.
- Metal Mirror.

Supplied in box with detailed drawing showing how to mount in Projector.

FROM YOUR LOCAL DEALER WITH :

F/3.5 LENS : **£6.13.9** per set.

F/2.2 LENS : **£8.6.9** per set.

ALSO AVAILABLE WITH ASPHERIC CONDENSER. PRICES AND DETAILS ON APPLICATION.

THE HUMMEL OPTICAL CO. LTD.

NEW HOUSE, 67-68 HATTON GARDEN, LONDON, E.C.1

Phone : HOLborn 1752 *Cables : Bycorner London*

SPECIAL OFFER

G.E.C., B.T.H. & WESTINGHOUSE GERMANIUM CRYSTAL DIODES

1/- each. Postage 3d.

Diagrams and three Crystal Set Circuits Free with each Diode.

A large purchase of these fully GUARANTEED diodes from the manufacturers enables us to make this attractive offer

COPPER INSTRUMENT WIRE ENAMELLED, TINNED, LITZ, COTTON AND SILK COVERED

All gauges available

B.A. SCREWS, NUTS, WASHERS, soldering tags, eyelets and rivets.

EBONITE AND BAKELITE PANELS, TUFNOL ROD, PAXOLIN TYPE COIL FORMERS AND TUBES ALL DIAMETERS.

Latest Radio Publications. SEND STAMP FOR LISTS

CRYSTAL SET

INCORPORATING THE SILICON CRYSTAL VALVE

Adjustable Iron Cored Coil

RECEPTION GUARANTEED

Polished wood cabinet, 15/- post 1/3. A REAL CRYSTAL SET NOT A TOY

POST RADIO SUPPLIES

33 Bourne Gardens, London, E.4

AUTOMATIC (TIME) SWITCHES

New and reconditioned 15 day clockwork and electric switches.

from **35/-**

Send S.A.E. for illustrated details to :—

DONOHOE (TIMERS)

1 & 2 UPPER NORFOLK ST., NORTH SHIELDS, NORTHUMBERLAND

TELESCOPES

Study the heavens and watch for EARTH SATELLITES

HOW TO MAKE A TELESCOPE

by

Jean Texereau

Engineer of the Optical Laboratory of the Paris Observatory and President of the Instrument Group of the Astronomical Society of France.

Translated and adapted from the French by A. Strickler

208 pages — 86 illustrations — 7 tables — 25/-

Newton in 1672 personally made the famous first mirror of the "era of bronze." In 1856 Léon Foucault opened the "era of glass mirrors." Now Jean Texereau tells the amateur how to make a first-class astronomical telescope from start to finish—from the grinding and polishing of the important concave mirror to the tube and mounting—ready for use. There is also a chapter devoted to photography with the amateur telescope.

INTERSCIENCE PUBLISHERS LIMITED

88-90 Chancery Lane, London, W.C.2.

SCREEN FABRIC

MAKE YOUR OWN PROJECTION SCREEN

High Grade Fabric as used by Commercial Cine Screen Manufacturers. 48in. wide, any length cut at 18/- per yard.

Or—

CUT PIECES

48in. x 36in....... 18/- 48in. x 48in....... 24/-
60in. x 48in....... 30/- 72in. x 48in....... 36/-

Send 3d. stamp for samples and instructions for making your own "Roll Up" Screen.

SPRING ROLLERS (Self Acting), 1¼in. dia. Swedish Manufacture, complete with Brackets.

36in. 10/3 ; 42in. 10/9 ; 48in. 11/9 ; 54in. 13/3.

SAWYERS LTD.

ST. SEPULCHRE GATE DONCASTER

GENERAL CERT. OF EDUCATION

THE KEY TO SUCCESS & SECURITY

Essential to success in any walk of life ! Whatever your age, you can now prepare at home for the important new General Cert. of Education Exam., on "NO PASS—NO FEE" terms. You choose your own subjects—Educational, Commercial or Technical. Recently announced big extension of subjects gives everyone the chance to get this valuable Certificate.

SEND FOR FREE 136 PAGE BOOK

Full details of how *you* can obtain the General Cert. are given in our 136-page Guide—Free and without obligation. Personal advice on request.

Write today, School of Careers, Dept. 160, 29-31, Wright's Lane, London, W.8.

The School of Careers

ELECTRONIC FLASH

Condensers, Pulse Coils, Resistors, etc., surplus to requirements but guaranteed new and unused. Send S.A.E. for full list and circuit diagram for 50-joule instrument.

Langham Photographic Insts., Ltd., 132, Stanley Park Rd., Carshalton, Surrey.

NEW CABLES & FITTINGS

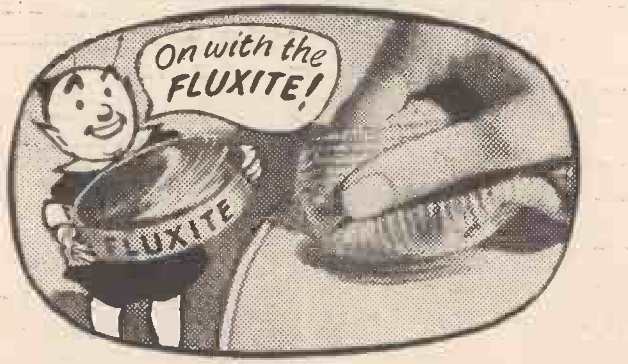
TOUGH RUBBER CABLES

	per yd.	25 yd.	50 yd.	100 yd.
1/044 Twin	6½d.	12/6	22/6	43/6
1/044 3-core	9d.	17/3	31/3	61/-
3/029 Twin	8d.	15/9	28/6	55/6
3/029 T. & E.	9½d.	18/3	33/9	66/-
7/029 Twin	1/1	25/9	48/3	95/-
7/029 T. & E.	1/4	31/3	58/6	115/-
7/044 Twin	1/11	46/-	88/-	174/-

Twin Lead 50 yds., 3/029 56/3, 7/029 83/9. VIR 50 yds., 3/029, 11/6 ; 7/029, 18/3. Earth Wire, 100 ft., 7/029, 11/- ; 7/020, 7/9. Twin PVC Transp. Flex, 50 yds., 10/-. Twin Twisted, 25 yds., 12/6 ; 50 yds., 22/6. TRS, VIR, Lead Cables of all sizes. Holders C.G., 8/-. Batten, doz., 12/-. Roses, Brown, 8/- ; White, doz, 10/-. Junc. Boxes, Sml., 11/- : Lge., doz., 13/-. Switches, 1-way, 18/- ; 2-way, doz., 24/-. White Switches, 1-way, 24/- ; 2-way, doz., 30/-. Flush Switches, 1-way, 18/- ; 2-way, doz., 24/-. Ceiling Cord, do., 1-way 5/- ; 2-way, 6/- ; 2 amp. 2-pin Sw. plugs and Tops, ea., 3/-. 5 amp. 3-pin Sw. plugs and Tops, ea., 5/6. 15 amp. 3-pin Sw. plugs and Tops, ea., 9/-. 13 amp. 3-pin ditto. A.C. only, ea., 7/6. Wood Blocks, 3 x ½, 5/6 ; 3½ x 1, 7/6 ; 3 x 3 x ½, 7/- ; 5½ x 3½ x ½ doz., 9/-. White, 3 x ½, 6/- ; 3½ x ½, 7/- ; 4 x 1, 9/-. Cable Clips, Sml., 2/9 ; Med., grs., 3/3. 10 amp. D.P. Insulated Sw. fuse, 6/-. 21 amp. Ironclad 2-way 15 A. Spltr., 13/6. 30 amp. Ironclad D.P. Switchfuse, 19/6. Metal 5-way Consumer Unit, 42/6. Sw. gear, Fusebds., Spltrs., all types. Lamp Bulbs, 15, 25, 40, 60 watt, 12/: 75 watt, 15/- ; 100 watt, 17/- ; 150 watt, 24/- ; 200 watt, doz., 30/-. Carbon Bulbs, 230 v, 16 C.P., doz., 20/-. Immersion Heaters, 3 Kw., 50/-. Single Car Cable, 10 yds., 3/- ; 100 yds., 25/-. Conduit and Fittings, ⅝in. and ¾in. Industrial Reflectors Tubular Heaters, Fluorescent Fittings, Time Switches and all electrical equipment. Full lists on request. Single items supplied. Satisfaction guaranteed. Terms : Cash with order ; carriage paid if over £5 : orders of £20 or over less 5 per cent. discount. Open daily, inc. Sat., 9 to 6 ; Thurs 9 to 1. Callers welcome

LONDON WHOLESALE WAREHOUSE
165 (P.M.), QUEEN'S ROAD PECKHAM, S.E.15
Tel. : NEW Cross 7143 or 0690.

Follow the **FLUXITE** *way to Easy Soldering*



No. 5. CLEANING SURFACE FOR REPAIR

Solder will not adhere to a dirty surface ; so first of all clean it bright with coarse emery and then smear on FLUXITE with a piece of cloth or stick.

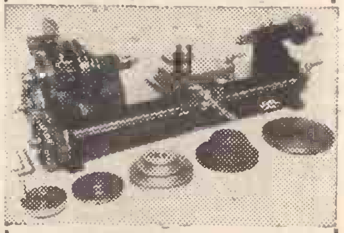
FLUXITE is the household word for a flux that is famous throughout the world for its absolute reliability. In factory, workshop and in the home FLUXITE has become indispensable. It has no equal. It has been the choice of Government works, leading manufacturers, engineers and mechanics for over 40 years.

FLUXITE
SIMPLIFIES *ALL* SOLDERING

Fluxite Limited, Bermondsey Street, London, S.E.1

G.M. 55

UNRIVALLED IN ITS CLASS



The E.W. 2½" × 10" Convertible Lathe

Is so simple. You can buy the basic model and by the addition of inexpensive conversion units possess a machine tool unrivalled in its class. Special features:—* Plain or gap bed * Micrometer feedscrew collars * Ground bed and slides * Instrument finish * Powerful headstock drive * Exceptional accuracy. And the price £17.0.0 for the basic model " A " Lathe.

Send S.A.E. for comprehensive brochure. No fuss, no interest, credit terms. All models in stock. Quickest delivery. Best service.

Full range of accessories from stock.

3/8in. HIGH-SPEED SENSITIVE POWER BENCH DRILLING MACHINE

Price £6.10.0 net, or 10/- Deposit and six monthly payments of £1, carriage and packing extra.

(S.A.E.) for specification and descriptive pamphlet.

WANSTEAD SUPPLY CO.
82, Snakes Lane (East), Woodford Green, ESSEX

LUNAR ROCKET LANDINGS

MOONSCOPES 107/6 !!

COMPLETE SET £8.15.0. Postages 15/-.
OR 25/- DEP. 10/- WEEKLY

See the Moon at close quarters. Examine the huge craters and possible evidence of coming rocket landings. Observe Saturn's rings, Nebulae, outer galaxies, Sputniks, etc.

Specification. 2 in. dia. Astro Refracting Telescope, length 39 in., mag. 53X linear (equivalent to 2809X area), weight 1 lb. 12 ozs. Superior hammer beaten finish. Price 107/6. Regd. post and packing, including strong stowing cylinder, 12/-.

Accessories. Altazimuth Portable Clamp Stand, 37/6, p./p. 2/6. Fixes anywhere. High Power Eyepiece 80X Linear, 30/-, p./p. 2/- (brings Moon within approx. 2,875 miles range).

Inclusive Postages for Complete Set, 15/-. Stamp for full particulars, photographs 1/- set. (returnable). Made to order.

J. K. M. HOLMES & CO. LTD.
(Formerly trading as Holmes, Wilson & Co.),
Scientific Instrument Makers
(Dept. PM39), Martins Bank Chambers, 33, Bedford Street, North Shields, Northumberland.

"ZYTO" "DO IT YOURSELF" TOOL KIT

54 ITEMS BEST QUALITY

PRICE £16-10 or first payment 33/- eight monthly payments 33/-

CONTENTS

1 20" HANDSAW
1 10" BRASS-BACK TENON SAW
1 STANLEY ADJUSTABLE IRON PLANE, 9" x 2"
1 SET OF 3 HANDLED CHISELS, ¼", ½", ¾"
1 CLAW HAMMER
1 6" CABINET HANDLED SCREWDRIVER
1 4" RATCHET ELECTRICIAN'S SCREWDRIVER
1 CROSSPENE PIN HAMMER
2 HANDLED BRADAWLS
1 PAIR PINCERS, 6"
1 7" FOOTPRINT PIPE WRENCH
1 3" PAINT-STRIPPING KNIFE
1 PUTTY KNIFE
1 STANLEY RATCHET BRACE
1 SET FIVE FASTCUTTING CENTREBITS, ¼", ⅜", ½", ¾", 1"
1 POINTING TROWEL
1 PADSAW WITH BLADE
1 PAIR COMBINATION PLIERS
1 SET CRAMPHEADS
1 WIRE BRUSH
1 STANLEY HAND DRILL
1 SET TWIST DRILLS
1 SOLDERING IRON
1 STICK SOLDER
1 TIN FLUX
1 MITRE BLOCK
1 PAIR RADIO PLIERS
1 JUNIOR HACKSAW
6 SPARE HACKSAW BLADES
1 NAIL PUNCH
1 2' BOXWOOD FOLDING RULE
1 INSTRUCTION BOOK

ILLUSTRATED LEAFLET FREE ON REQUEST

S. TYZACK & SON LTD. 341-345 OLD ST., E.C.1
TELEPHONE : SHOREDITCH 8301

You Can Become a

HANDICRAFTS TEACHER

Experience not essential

Men who enjoy making things in wood or metal can turn their hobby into a permanent and interesting career. Short hours, long holidays and security in a job you would really enjoy can be yours if you become a Handicrafts Teacher. Let us send you details of the easiest and quickest way to get the necessary qualification.

We definitely guarantee "NO PASS—NO FEE"

If you would like to know about our unique method of preparing you for one of these appointments write to-day, and we will send you an informative 144-page Handbook—FREE and without obligation. Mark your letter "Handicrafts Teacher."

BIET BRITISH INSTITUTE OF ENGINEERING TECHNOLOGY
591, College House, 29-31 Wright's Lane, London, W.8.

A TWIN SOLENOID ELECTRIC MOTOR

It Will Run at High Speed from a 4-volt Accumulator

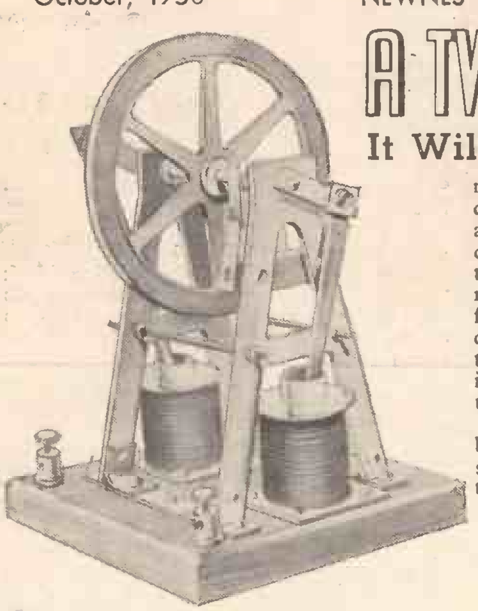


Fig. 1.—The completed twin solenoid electric motor.

As can be seen from Figs. 1 and 2, the motor is of rather unusual design, two solenoid coils being used to provide the driving power. In each coil is a soft iron plunger which is connected to the lower end of a connecting rod. These rods drive the crankshaft, which is supported in bearings at the top of the A-shaped standards. The flywheel is mounted in the middle of the crankshaft and the "make and break" cam-piece is fixed on the shaft between the flywheel and the right-hand bearings, as shown. The cam-piece makes contact with two springs or brushes which are fixed to an ebonite block attached to the right-hand standard. The working stroke of each plunger is the downward one, a circuit being made through the solenoid coils alternately, the flywheel receiving two impulses per revolution.

Construction

The baseboard can be made from a piece of mahogany or oak, planed up and made square, or, better still, a switch block of a suitable size can be used for the purpose.

The A-standards can be sheet brass 1/16in. thick and may be marked out side by side on the metal to the dimensions given in Fig. 5, while the holes need only be marked and centre-punched on one standard. Cut round the outline with the aid of a hammer and cold chisel, afterwards filing down the rough edges all round, nearly to the scribed line. The two standards should now be lightly soldered together in three or four places so that the edges more or less coincide. After drilling the five holes through both plates, file up the edges, leaving them as square as possible, after which the plates may be separated and cleaned up.

Each standard should now have a small brass washer 5/16in. dia. and 1/16in. thick soldered on round the top hole to widen the bearings for the crankshaft, as can be seen in Fig. 2. The holes in the washers should be 3/32in. dia., being drilled to size after they are soldered in place by running a ⅛in. twist drill through.

Four pieces of 5/16in. angle brass can be soldered and riveted on to the bottom parts of the standards, as shown, to form feet, which are afterwards riveted to the brass base plates. These are simply strips of 1/16in. sheet brass, 2 1/16in. long by ½in. wide, having three 3/32in. holes drilled in each to take the fixing screws. For the two stays, two pieces of 1/16in. dia. mild steel rod, 1½in. long, will be required, each piece being threaded for a distance of a ¼in. at both ends to take two nuts.

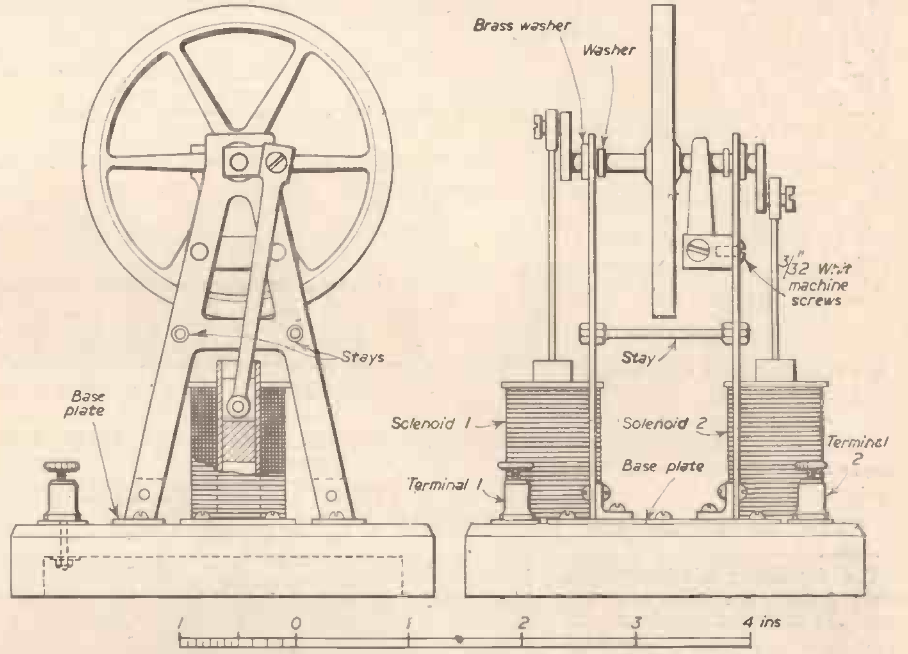


Fig. 2.—A part sectional side view and a front view of the motor.

Crankshaft and Connecting Rods

For the crankshaft a piece of ⅛in. dia. mild steel rod exactly 1 13/16in. long will be required, threaded at both ends for the crank webs to screw on. These can be cut and filed to the sizes given in Fig. 4 from a piece of sheet brass 3/32in. thick, and the two holes drilled and tapped in each, as indicated. The two crankpins can be purchased ready-made, or two ordinary set screws could be used. They should be about 3/32in. dia. under the head. The flywheel, which is 2¾in. dia. and 3/16in. across the face of the rim, can be fixed to the crankshaft by the usual grub-screw method.

Hard sheet brass, 3/32in. thick, can be used for the two connecting rods which can be marked out together to the dimensions given in Fig. 4. Drill the holes for the crankpins and gudgeon pins, and after roughly cutting out the rods with a metal piercing saw, hold each piece in a vice and file down to the scribed line. Each rod is filed down on both sides so that the metal is thinner in the centre than at the ends.

Solenoid Bobbins and Plungers

Details of the solenoid bobbins are given in Fig. 3. The central tubes, in which the plungers work, are intended to be made of thin brass tubing with an internal diameter of 5/16in. The bobbin ends or cheeks may be of sheet brass No. 18 gauge or 3/64in. thick, the top ones being circular in shape and the bottom ones square as indicated. Drill the centre holes in each plate so that they fit tightly on the brass tubing, after which adjust the cheeks so that they are quite square with the tube, and solder the joints.

It will be noticed that the bottom end of each tube is flush with the bottom face of the lower cheek, while the top end of the tube projects 3/16in. above the upper cheek. This is done to provide a guide for the plunger, which overrides the top cheek at the end of its upward stroke. The holes for the fixing screws should, of course, be

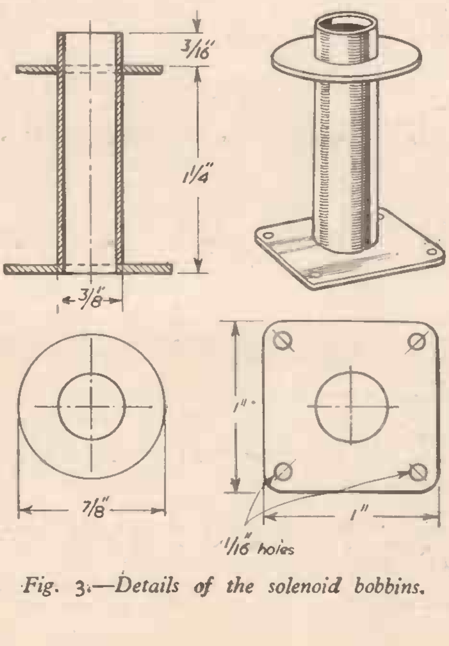


Fig. 3.—Details of the solenoid bobbins.

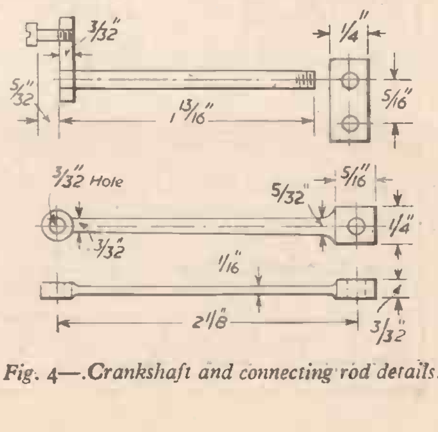


Fig. 4.—Crankshaft and connecting rod details.

drilled at the corners of the square cheeks before they are soldered on to the tubes.

The plungers are pieces of soft iron rod $\frac{3}{4}$in. long and of a diameter that will allow them to slide easily within the bobbin tubes. A slot 3/32in. wide and $\frac{3}{8}$in. deep is cut down the centre of each plunger as indicated in Fig. 6, and a hole drilled through at right angles to the slots at a distance of $\frac{1}{4}$in. from the ends for the gudgeon pins. These can be cut from a piece of 3/32in. dia. mild steel rod.

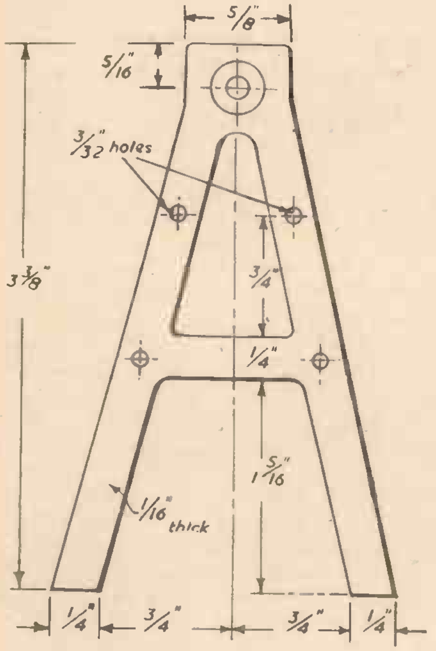


Fig. 5.—Details of one of the A-standards.

Contact Cam, Springs and Insulating Block

The insulating block which carries the brushes can be cut from a small piece of 5/16in. ebonite to the dimensions given in Fig. 7. File the projecting end pieces to an angle, as indicated, to conform to the sloping edges of the standard to which it is to be fixed. Thin, springy German silver, No. 26 gauge, may be used for the two contact springs or brushes, being cut to shape as in Fig. 7 and drilled to take the fixing screws.

Place the block in position against the A-standard and mark the position of the holes where the fixing screws are to go, then drill the holes through 1/16in. dia. and lightly tap out with a 3/32in. Whitworth tap. The 3/32in. Whitworth machine screws used for fixing the block should have the ends filed down so that they do not project more than $\frac{1}{8}$in. into the fibre block, as indicated in Fig. 2, it being important that the ends of these screws do not touch the brushes.

The contact springs can now be screwed on to the block with 3/32in. Whitworth screws, which should not be more than $\frac{1}{4}$in. long under the heads, a thin brass washer being slipped on each screw previous to screwing in. Tighten the screws up so as to hold the springs firmly and then bend them slightly, as shown in Fig. 7, so that the top parts are 7/16in. apart.

To make the contact cam, take a small piece of German silver, 3/32in. thick, and file it to the shape shown in Fig. 7, the hole being drilled $\frac{1}{8}$in. dia. to fit the crank-axle. File away the sharp edges with a fine-cut file, leaving the cam smooth, especially at the narrow end which makes contact with the springs.

Winding the Bobbins

About 18 yards of No. 26 D.C.C. copper wire will be required for each bobbin. Wind each layer on evenly and fill the bobbin right up to the edge of the circular end, leaving about 6in. of the starting and finishing ends free for connecting purposes.

After securing the last coil of wire by tying round a couple of turns of white thread, the bobbin can be given two coats of shellac varnish and then put by to dry.

Assembling the Parts

The other parts of the motor can now be assembled and taking the crankshaft first, with the flywheel in position, slip on the contact cam and also two brass washers, as shown in Fig. 2. Next pass the ends of the crankshaft through the bearings in the A-standards, and then, having screwed the two inner nuts on to the M.S. stay rods, place these in position and screw on the outer nuts. The inner nuts must be adjusted so as to maintain the inside faces of the standards at 1 3/16in. apart, when the outer or clamping nuts may be screwed up tightly. Now rivet the base plates on to the angle pieces at the bottom of the standard, keeping the latter quite parallel. If found more convenient, 3/32in. bolts and nuts may be used instead of the rivets.

The standards may now be screwed down on the baseboard by means of $\frac{3}{8}$in. round-headed wood screws. Screw the crank webs on to the ends of the shaft and, after adjusting them so that they are at an angle of 180 deg. to each other, solder lightly to the shaft. The two washers which fit inside the A-standards can also be soldered in place so as to allow just a slight lateral movement of the crankshaft in the bearings.

Place the solenoids in position and carefully mark the holes in the baseboard to take the fixing screw, first of all making sure that the axis of each plunger tube is in line with the centre of the crankshaft.

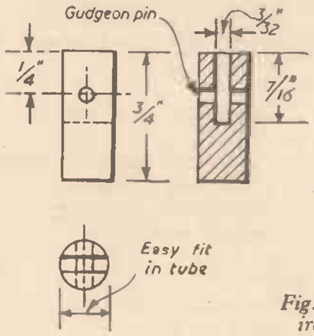


Fig. 6.—The soft iron plunger.

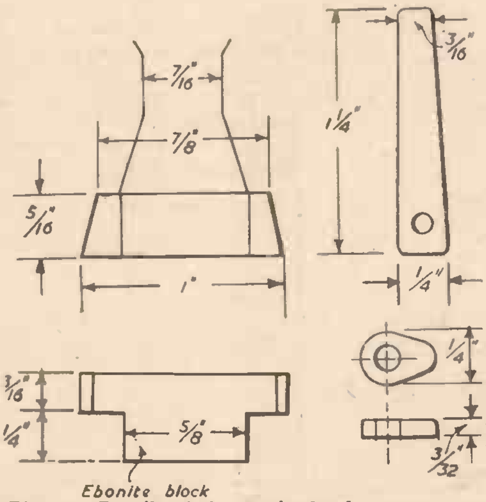


Fig. 7.—Details of the ebonite block, contact cam and springs.

The centre of each tube should also be 5/16in. from the outside face of the A-standard. Having screwed the solenoid down the connecting rods can be coupled up to the plungers by passing the gudgeon pins through, and the "big ends" may then be connected to the cranks by screwing in the crankpins, leaving about 1/32in. for side play, as indicated in Fig. 2.

Making the Connections

After screwing on the insulating block which holds the brushes, fix two terminals near the front corners of the baseboard, as shown in Figs. 1 and 2. A diagram of the connections is given in Fig. 8. It will be seen that one wire from each coil is con-

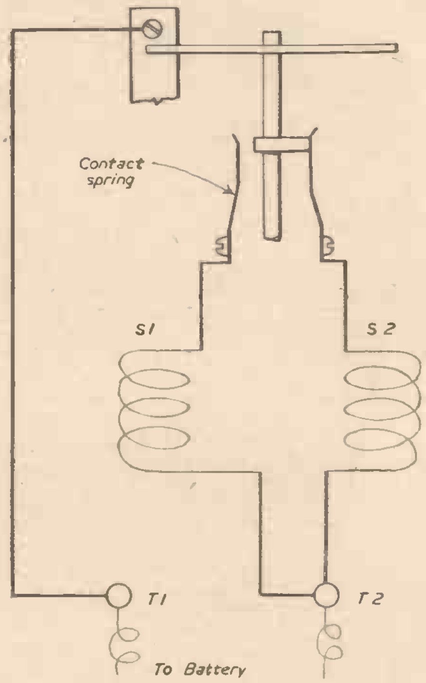


Fig. 8.—Diagram of connections.

nected to terminal T2, and each of the other ends is connected to a contact spring. The terminal T1 can be connected up with one of the screws at the foot of the adjacent standard. The wires from the two solenoids to terminal T2 can be passed through small holes made in the baseboard and connected up on the underside, while the other connecting wires will have to remain "aboveboard." The final adjustment to the cam can now be made so that it makes contact with the brushes at the proper moment.

Try These on Your Friends!

Pairing the Socks

In a room which is pitch dark are 12 blue socks and 12 black ones. Naturally, you cannot see them. What is the smallest number of socks you must pick up in order to make sure that you have a pair? They may be of either colour and there are 24 socks in all.

Answer

Three socks.

How Much Money

THE coins in a till could be described as all half-crowns but four, all florins but four, all shillings but four, all sixpences but four, and all pennies but four. How much money was in the till?

Answer

There was one coin of each value mentioned, i.e.. 2s. 6d., 2s., 1s., 6d. and 1d., adding up to 6s. 1d.

FREE — AN IMPORTANT BOOK

about YOUR CAREER · HOBBY...
...SPARE TIME WORK, etc....

...IN ANY OF THESE SUBJECTS:—

Accountancy
Advertising
Aeronautical Eng.
A.R.B. Licences
Art (Fashion Illustrating, Humorous)
Automobile Eng.
Banking
Book-keeping
Building
Business Management
Carpentry
Chemistry
City & Guilds Exams.
Civil Service
Commercial Subjects
Commercial Art
Computers
Customs Officer
Draughtsmanship
Economics
Electrical Eng.
Electrical Installations
Electronics
Electronic Draughtsmanship
Eng. Drawing
Export
General Certificate of Education
Heating & Ventilating Eng.
'Hi-Fi' Equipment
High Speed Oil Engines
Industrial Admin.
Jig & Tool Design
Journalism
Languages
Management
Maintenance Eng.
Mathematics
M.C.A. Licences
Mechanical Eng.
Metallurgy
Motor Eng.
Painting & Decorating
Photography
P.M.G. Certs.
Police
Production Eng.
Production Planning
Radar
Radio
Radio Amateurs (C. & G. Licence)
Radio & Television Servicing
Refrigeration
Sales Management
Sanitary Eng.
Salesmanship
Secretaryship
Servo Mechanisms
Shorthand & Typing
Short Story Writing
Short Wave Radio
Sound Recording
Telecommunications
Television
Time & Motion Study
Transistors
Tracing
Welding
Workshop Practice
Works Management
and many others

Also courses for GENERAL CERTIFICATE OF EDUCATION, A.M.I.H. & V.E., A.M.S.E., A.M.Brit.I.R.E., A.M.I.Mech.E., A.M.I.E.D., A.M.I.M.I., A.F.R.Ae.S., A.M.I.P.E., A.M.I.I.A., A.C.C.A., A.C.I.S., A.C.C.S., A.C.W.A., City & Guilds Examinations, R.T.E.B. Servicing Certificates, R.S.A. Certificates, etc.

NEW PRACTICAL DO-IT-YOURSELF COURSES

YOU CAN MAKE AND SAVE MONEY IN:—

RADIO & T/V BUILDING & SERVICING
ELECTRICAL APPLIANCE REPAIR
CHEMISTRY · PHOTOGRAPHY
HI-FI EQUIPMENT, ETC.

All the above special courses include practical equipment as part of the training.

- Personal and Individual Tuition given by named tutors
- All equipment yours to keep
- Courses for Beginner or Advanced student

EMI INSTITUTES

E.M.I. Institutes is associated with **"HIS MASTER'S VOICE", COLUMBIA, ETC.**

POST TODAY

To :— E.M.I. INSTITUTES, Dept. 144K, LONDON, W.4.

Please send, without any obligation, your free Book to :—

NAME...AGE........ (if under 21)

ADDRESS...

....

Subject(s) of interest...With* / Without* } equipment

(We do not employ travellers or representatives) *Delete as required

IC.118 OCT/58

The only Home Study College run by a World-wide industrial organisation

John Bull (PM10), 246 High St. Harlesden, N.W.10

NEW BLOWLAMP

A new entirely automatic miniature blowlamp is here. Burns methylated spirit. Compact and small, 5½in. high, weight 7 oz. Solid brass, chrome finished. Slips into pocket. Ideal soft soldering (very hot flame 2,000 deg. F.). Silver sold., model-making, jewellery repairs, paint stripping, glass bending and drawing. Self pressurising, no pumping. Nothing to go wrong. *Also Major Model, 6 times stronger flame,* 30/-. Copper Bit to convert (either Model) to Solder Iron, 5/-.

14/7 Post 9d.

ENGINEER'S MICROMETER .001-1"

Brand new and perfect—invaluable to engineers, apprentices, model makers. Precision Instrument for Schools, Garages, Workshops, Students, Handymen, Engineers. Valuable Micrometer at fraction of price, also 2" model, 14 6

10/- Bargain Post 1/-

REPAIR any WATCH or CLOCK. Complete OUTFIT

DEPOSIT 7/-

for cleaning and repairing. Includes illustrated explanatory booklet, eye-glass, tweezers, screwdrivers, oil, dusting powder, oilers, luminous compounds, jewellers' rouge, dial brush and jewels. Cash 25/- or 7/- down and 3 monthly payments of 7/-.

Guarantee TWO-WAY

HOUSE TELEPHONE

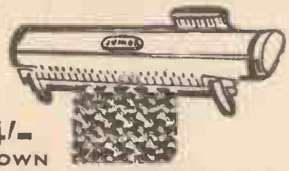
Kit. Self-energised. No Batteries. Ex-W.D. Units. 100ft. Wire & Illus. Instr. Powerful even longer distance. HALLO P. & P. 1/3d. **11/6**

CONVERT your old TV

Do it yourself. It's so easy. Save money & get B.B.C. & ITA Commercial at the flick of a switch. You simply place our Silver-Grey TV Converter on or near your TV set. No alterations to your set—just connect to A.C. mains and co-ax. socket of set. Packed complete with easy instructions.

21/- down and 6 monthly payments of 21/- or £6.6.0 cash.

RECONDITIONED AS NEW



4/- DOWN Tax free Offer. **PORTABLE** KNITTING MACHINE

First of its size in the World Techn. like big models. You'll quickly master knitting on it. All metal, nothing to go wrong. Will last a lifetime. For any thickness of wool. Unlimited patterns. Comp. with illustr. instrs. 4/- down & 7 mthly. of 10/3 or cash 66/9. Sole distributors.

AMERICAN TYPE A.C.
Electric Vibro Tool ENGRAVER

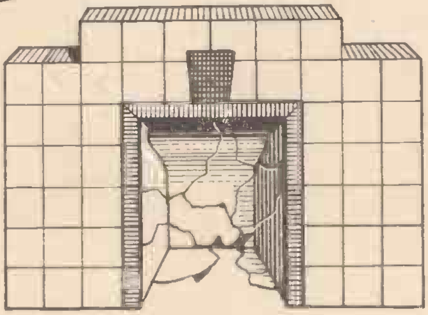
Amazingly versatile, the Vibro Tool—with the aid of the interchangeable accessories—enables the keen handicraftsman to indulge his skill in the crafts of wood carving, lino cutting, leather working, jewellery engraving, glassware decorating and frosting, metal embossing and etching, and engraving on plastics and pottery. 5/- deposit and 6 mthly. of 10/- or 57/6 cash. 90 days' Guarantee. Deposit **5/-** Also the new De Luxe Kit housed in enamelled case with 20 interchangeable accessories £5.5.0. Heavy Duty Industrial Model 75/-. Simple Electric Engraving Pen, 10/-. Reduced for Sale. Originally 15/-. Post 9d.

John Bull (PM10), 246 High St. Harlesden, N.W.10

For REPAIRING FIREPLACES

IN THE BLUE AND WHITE TIN

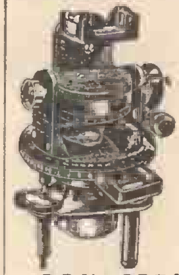
PRICES
1 lb. 1/9
2 lb. 2/9



GOOD HOUSEKEEPING INSTITUTE GUARANTEES

PURIMACHOS LTD.
St. Philips, Bristol, 2

WATSON'S SPECIAL OFFERS



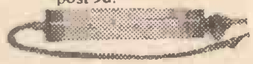
ASTRO COMPASS 22/6 Post 3/-

These are very fine precision instruments useful for many purposes complete in transit case.

COIL SPRING BELTS

¼in. x 12in. long. Extends to 15in. Any number can be joined together. 20 for 4/6 post 9d.

AIR DRIERS



15in. overall, 2½in. diam. 2ft. rubber tubing. Useful where a supply of dry air is required. 8/6, post 2/6.

SURVEYORS LEVELS

Mahogany with brass fittings. 4ft. long. Built in spirit level and plumb bob. Two extra 3ft. folding arms. Designed for gun surveying but useful for many purposes. 15/6, carr. 2/6.

DYNAMOS

14/32 v. 288 w. Shunt wound ball bearing, foot mounted. Price £3.17.6 carr. 5/-.

B.T.H. VERTICAL MAGNETOS TYPE J4

Complete with screened leads. Suitable for FORD 8 & 10 h.p. and similar engines. BRAND NEW, £5.10.0, carr. 3/6. ALSO LUCAS 4-cylinder Standard type with impulse and Vernier Coupling, Anti-clock. NEW, £3.10.0, carr. 3/6.

ENGINEERS BALL PEIN HAMMERS

¾ lb. NEW and BOXED, 5/- each.

Hundreds of other Bargains available. Send 6d. stamp for Illustrated List.

EASTERN MOTORS, ALDEBURGH, SUFFOLK. Phone 51.

DO YOU COUNT IN LIFE?
How To Achieve Your Secret Ambition

PELMANISM — WORLD WIDE AND WORLD FAMOUS

THE secret ambition of thousands of men and women is to live a life that counts for something. They may not give any vocal expression to this ambition but it is there all the time beneath their daily hours.

They are not content to live always in a rut, to be one unit in a multitude, to exist for ever undistinguished and unknown, to be always ignored not merely by strangers but by neighbours, relatives and business colleagues. They want to develop Personality and to do work that is worth while.

This is where Pelmanism helps. Pelmanism develops Personality. It develops Individuality. It strengthens the weak Will. It banishes Diffidence and Shyness and gives Self-confidence. The feeling of inferiority which haunts so many people disappears after a course of Pelmanism. By increasing the efficiency of your mind Pelmanism gives you a well-founded belief in yourself and your powers; it develops Courage, Resolution, Initiative, Self-respect; it inspires you to new effort and thus enables you to get out of the rut into the high road to success. Further, by increasing your efficiency it increases also your Income-earning Power.

Remember—Everything you do is preceded by your attitude of mind

Send for Free Book

The Pelman Course is simple and interesting and takes up very little time. The books are printed in a handy pocket-size enabling you to study them when travelling or in spare moments during the day. You can enrol on the most convenient terms. The Course is fully described in a book entitled *The Science of Success*, which will be sent to you, gratis and post free, on application to:

PELMAN INSTITUTE
130, Norfolk Mansions,
Wigmore Street, London, W.1
WELbeck 1411

Established over 60 years.

PELMAN (OVERSEAS) INSTITUTES. Delhi; Melbourne; Durban; Paris; Amsterdam.

HOW TO LEARN LANGUAGES
The Pelman Languages Institute teaches French, German, Spanish and Italian, without translations. Write for particulars and specimen lesson of the language that interests you, which will be sent gratis and post free.

Pelman Languages Institute, 130, Norfolk Mansions, Wigmore St., London, W.1.

THE PEOPLES ARC-WELDER *ARCMOBILE U*

£15·18·6d (INCLUDING DELIVERY)

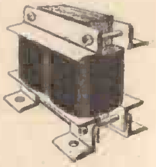
Complete with all accessories shown. Ready for plugging into 10 amp socket 200/250 V. A.C. mains. Infinitely variable control of welding current by handwheel. Welds up to any thickness with single or multiple runs & down to 22g sheet. For the Motorist, Householder & Engineer.

£15 18 6d (INC DELIVERY) CASH WITH ORDER. Uses 14g & 16g Standard Flux Coated Electrodes. Some of each supplied with Welder. Extra Electrodes 6/6 PER BUNDLE · POST FREE

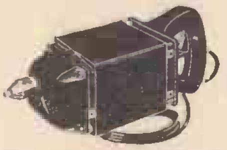
NEST OF DRAWERS

Overall size 7" wide x 5" deep x 11" high. 12 drawers, each measuring 3" wide x 4½" deep x 1½" high. Useful storage for the engineer, motorist and householder for nuts, bolts and small components. Green enamelled. £1. P. & P. 3/-.

TRANSFORMERS



ALL 220/250 V. A.C. INPUT
CONTINUOUS RATING.
EACH £5.12.0.
OUTPUTS:
3-6-9-12 V. 40 Amps.
5 V. 125 Amps.
6-12-18-24-30 V. 12 Amps
12 V. 50 Amps.
110-120 V. 4 Amps.
55 V. 12 Amps.
3.5-8-14-15-16 V. 20 Amps. 6.3/12.6 V. 9/8 Amps.



12 V. HAND DRILLS

With ¼" chuck and length of flex AC/DC, takes 15 amps. works from car battery or transformer, weight 7 lbs.
24 volt Hand Drill available, takes 9 amps. AC/DC, weight 7½ lbs., £5.4.0 each. P. & P. 2/3.

HARMSWORTH, TOWNLEY & CO.
Jordan Street, Knott Mill, Manchester, 15

A CLOCKWORK CRANE

Chiefly Made From the Works of an Old Alarm Clock

Fig. 1.—The completed model crane.

PREPARE a rectangular piece of wood 12in.×9¼in. and chamfer the top edge as shown in Figs. 1 and 2. Find the centre to enable you to fix the turntable to the bed, this being done by using a small bolt or machine screw. Remember that the small bolt must be long enough to pass through the turntable and base.

The turntable is a circular piece of wood made from a piece 6in. × 6in. × ½in. A hole is drilled through the centre to take the fixing bolt.

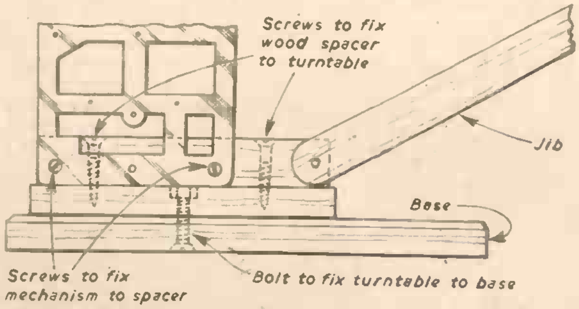


Fig. 2.—Mounting the clock mechanism.

The Mechanism

This is part of an old alarm clock, as you will see from Figs. 1 and 2. This should be mounted centrally on the turntable. To do this, shape a piece of wood that will fit tightly at the base of the works between the side frames of the clock. Fig. 2 will show you that it is first bolted to the sides of the frame, and then screwed firmly to the turntable with csk. screws. Sufficient length must be allowed to extend at the front of the clock mechanism to enable the jib to be fixed at its base by another bolt, Fig. 3A. See that the jib works freely at the base. The jib is 12in. long, and should taper slightly towards the pulley end. A suitable pulley can often be found in some old venetian blinds.

Fixing the Pulley

Take a piece of wire and pass it through the end of the jib sides and the pulley-wheel, allowing about 2in. of wire to extend either side of the pulley-shaft. Bend the wire at the ends as in Fig. 3B, so as to make a small eye, and bend each protruding piece with its eye towards the mechanism at right angles to the spindle. With some twine fix one end to the spindle of the alarm handle and, after winding a little on, the other end can be fixed to the two eyes on the spindle stirrup of the pulley wheel.

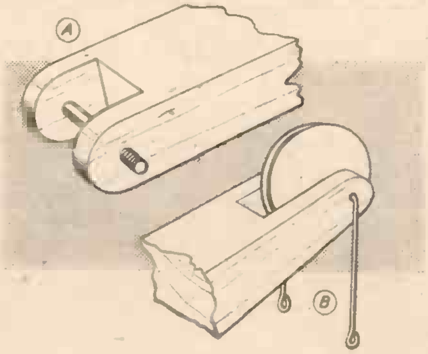


Fig. 3.—Base and pulley ends of the jib.

After making a small hook for lifting the weights over the pulley, allowing a fair amount of twine for depth of rise and fall of weights, pass the twine over the pulley, down the jib, and fix same to the spindle of the handle that winds the time up.

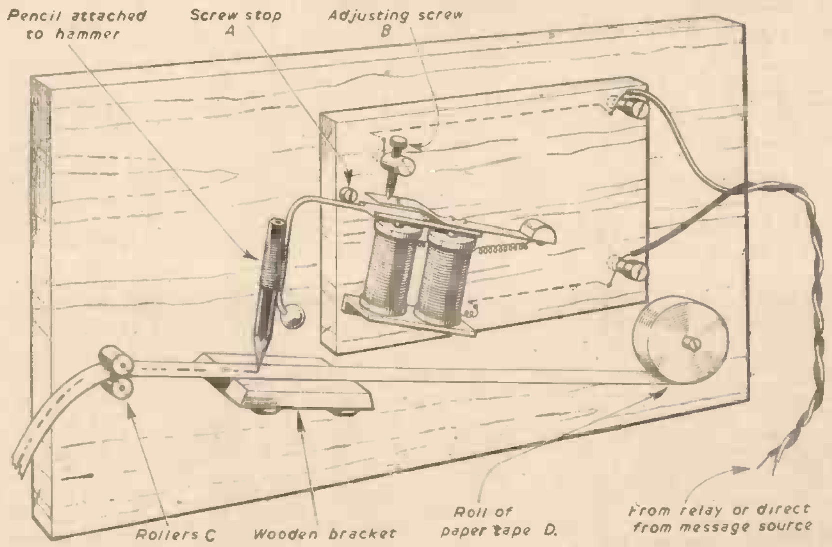
To Work the Crane

When the time handle is wound up the hook will descend, and if you set the clock working the hook will ascend. Care must be taken to see that the twine winds round the spindle when winding up the clock, so that when set in motion it ascends. When the alarm clock handle is wound up, the jib itself descends, and when the clock starts the jib will work the other way.

The crane is now completed and is capable of lifting some ¾lb.

A MORSE CODE RECORDER

ALL that is required is an old bell, some pieces of planed wood and a few screws, all of which can be obtained quite cheaply. Remove the bell and bend the hammer down (see sketch). On to this is tied a pencil, which completes the main piece of apparatus, and it is now ready for working. Adjust B so that the adjusting screw is always in contact with the contact spring. A is a screw to prevent the spring from springing back too far. C and C are two rollers which draw the paper through, and can be controlled by a handle at the back or by an electric motor if so desired. For paper, one can use the popular streamers used at Christmas parties, which can be obtained for a few pence. The roll of paper should rest on a screw D as shown in the sketch.



A view of the completed morse code recorder.

Letters to the Editor

The Editor Does Not Necessarily Agree with the Views of his Correspondents

New Theory of Gravitation

SIR,—I feel I must write concerning two of the letters published in the August issue of your magazine.

Mr. Clayton proposes a new theory of gravitation in which bodies do not attract each other at all, but are "pressed together by outside pressure brought about by constant bombardment of matter from space."

Originality in a scientific theory is not by itself a virtue; the theory should fit experimental facts better, if possible, than existing theories.

Mr. Clayton's theory fits very few experimental facts, least of all the basic experimental fact:

"Any two bodies attract one another with a force proportional to the product of their masses and inversely proportional to the square of the distance between them." No other factors contribute to gravitational force. Note that mass of the body is the vital factor rather than shape or size, which would be the deciding factor on Mr. Clayton's theory. Does Mr. Clayton seriously suggest that space is filled with streams of mysterious particles so directed that all bodies obey the inverse square law to within a remarkable degree of accuracy?

Light v. Heavy Cycle

Mr. Shobrook, who wrote concerning the relative effort required to keep light and heavy bicycles moving, seems to misunderstand your statement in "The Cyclist" leader for June in which I presume you referred to the effort required in steering a cycle rather than pedalling it. A heavier cycle, with wider rims and greater gyroscopic effect in its wheels, will, of course, be easier to steer on a straight course than a lighter one, especially when travelling slowly.

I will not contest the obvious fact that more energy is expended pedalling a heavy cycle up a hill than a light one, but will merely point out an error in Mr. Shobrook's mathematical proof of this fact. His proof makes sense only if "$\sin \theta$" is replaced by "$\cos \theta$", otherwise the vertical reaction is zero on a level road and there would be nothing to prevent the bicycle and its rider from descending through the road into the bowels of the earth under the action of gravity.—J. R. PEVERLEY (York).

Is the Moon Solid? An Odd Viewpoint

SIR,—From my theory of the beginning of the universe, I find that the moon cannot be a solid body, but is the result of the X-ray properties of the sun after they have penetrated the earth and become focused upon the outermost layer (hydrogen) of the earth's atmosphere, opposite the sun.

This, of course, implies that the earth, if it orbits at all, will do so within its own atmosphere and not around the sun.—V. A. MILBURN (Sittingbourne).

Our readers are invited to comment.

FIELD THEORY OF THE UNIVERSE

SIR,—While I found the field theory of the universe (August issue) very interesting, the examples given in the article weaken the theory rather than strengthen it. The author wants to have his space cake and eat it, too, in using Euclidean measurements in a non-Euclidean space.

In the field theory, all matter in normal space may be packed into the inside space. This involves all matter decreasing in size as it nears the centre. A space traveller leaving point X (Fig. 1) and moving to point Y midway to the centre O would decrease to half his original size. All his measuring instruments would then indicate that he still had exactly the same distance to travel as before, that is, point O represents an infinite distance from the earth. Fig. 1 also illustrates the two plumb lines down the mine shaft. C and D are the points of suspension of the two lines and E and F represent the two plumb bobs. In the article, points E and F were found to be farther apart than points C and D, as is shown in Fig. 1, but suppose points C and D are one yard apart and the yardstick is taken to points A and B. As the yardstick has decreased in length, points A and B will be found to be just one yard apart and similarly points E and F will also be exactly one yard apart due to the increase in length of the yardstick.

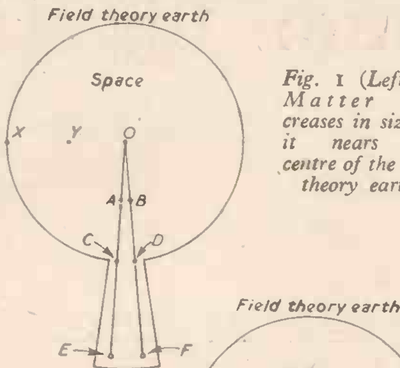


Fig. 1 (Left).—Matter decreases in size as it nears the centre of the field theory earth.

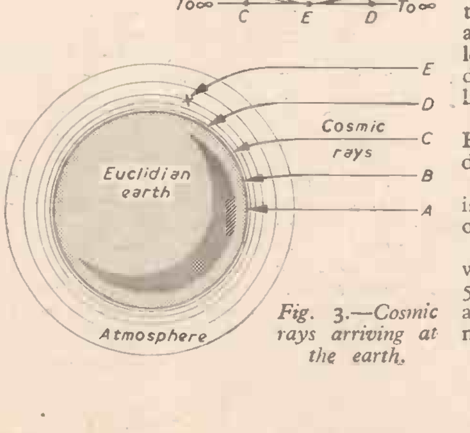


Fig. 2 (Right).—Concerning the mechanically straight line.

Fig. 3.—Cosmic rays arriving at the earth.

Therefore, to help prove the theory, radii of the earth must be shown to be parallel. Incidentally, from this it follows that all circumferences above the earth will also be the same. If sputniks circling the earth at constant speed are found to take the same time to orbit, irrespective of height above the earth then the theory may be right!

The next example concerns the "mechanical" straight line. In Fig. 2, C E D is the straight line in normal space. If this line is produced to infinity and transferred to the inside space, then the circle A O B E is the result. Section A E B will be the mechanical straight line (for example, a taut wire between A and B) produced by devices which are also affected by the inside space. As our machines have "proved" the line A E B to be straight and as there is a separation A X and B Y at the ends of the straight line, but contact with the earth's surface at E, the conclusion would be that we live *on* a ball not *inside*.

One wonders just what type of space the remarkable experiment of 1897 signified!

Finally, the case of the cosmic rays. As these are not rays at all but particles (mainly high-speed electrons) with definite mass, they are affected by gravity and by the atmosphere. Fig. 3 shows five rays arriving at the earth. A will arrive at right angles due to its original direction, B C and D will be drawn towards the centre by gravity and curved further by entering the denser layers of the atmosphere. E, in having to pass through a greater layer of atmosphere (particularly the electrified upper atmosphere) will be absorbed and the actual concentration of rays at C and D will also decrease for the same reason. As will be seen from Fig. 3, the result is that all rays will arrive virtually at right angles to the earth's surface.

In conclusion I cannot help feeling that the author had so little faith in his theory that he had to use "outside" measurements to prove his "inside" theory! Many thanks for a thought-provoking article.—E. W. BERESFORD (R.A.F., Melksham).

★ ★ ★

SIR,—Your article in the August issue on the field theory of a hollow, spherical earth is most interesting, if only that it demonstrates the pitfalls of mathematical "proofs."

The two plumb-lines down deep shafts, which were farther apart at the bottom than the top, are not reliable evidence because an area of heavy mineral ores, such as copper, lead, mercury or uranium, can measurably deflect the plumb-line. Also a very long line is more sensitive to such disturbance.

I have read that, in Northern India, the Himalaya massif has this effect, causing a deflection toward the mountain range.

Surely the article on electro-gravitic force is entire fiction, or such a force would have ousted aircraft long ago.

The author mentions the "Y" ray, which was the darling of science-fiction 50 years ago, arising from the "X" ray, and capable of vast wonders. There has never been such a thing.

(Continued on page 53.)

"Unaccustomed as I am—

"I . . . er, er . . . a . . . don't know just what to say on the subject."

"I wasn't expecting to be called on to speak."

"Mr. Bell can tell you more about the idea than I can."

"Er . . . that is not very clear, but that's the best I can do."

. . . Yet 4 Weeks Later He Swept Them Off Their Feet!

In a daze he slumped to his seat. Failure . . . when a good impression before these men meant so much. Over breakfast next morning his wife noticed his gloomy, preoccupied air.

"What's the trouble, dear ?"

"Oh . . . nothing, I just fumbled my big chance last night, that's all !"

"John ! You don't mean that your big idea didn't catch on !"

"I don't think so. But, Great Scott, I didn't know they were going to let me do the explaining. I outlined it to Bell—he's the public speaker of our Company ! I thought he was going to do the talking !"

"But dear, that was so foolish. It was your idea—why let Bell take all the credit ? They'll never recognise your ability if you sit back all the time. You really ought to learn how to speak in public !"

"Well, I'm too old to go to a class now. And, besides, I haven't got the time !"

"I've got the answer to that. Where's that magazine ? . . . Here—read this. Here's an internationally known institute that offers a home study course in effective speaking. They offer a free book entitled *How To Work Wonders With Words*, which tells how any man can develop his natural speaking ability. Why not send for it ?"

He did. And a few minutes' reading of this amazing book changed the entire course of John's business career. It showed him how a simple and easy method, in twenty minutes a day, would train him to dominate one man or thousands—convince one man or many—how to talk at business meetings, lodges, banquets, and social affairs. It banished all the mystery and magic of effective speaking and revealed the natural Laws of Conversation that distinguish the powerful speaker from the man who never knows what to say.

Four weeks sped by quickly. His associates were mystified by the change in his attitude. He began for the first time to voice his opinions at business conferences. Fortunately, the opportunity to resubmit his plan occurred a few weeks later. But John, this time, was ready. "Go ahead with the plan," said the Managing Director, when John had finished his talk. "I get your idea much more clearly now. And I'm creating a new place for you—there's room at the top in our organisation for men who know how to talk !"

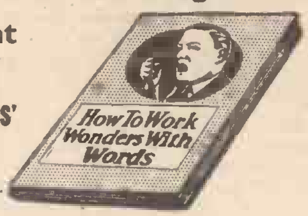
And his newly-developed talent has created other advantages for him. He is a sought-after speaker for civic, banquet and lodge affairs. Social leaders compete for his attendance at dinners because he is such an interesting talker. And he lays all the credit for his success to his wife's suggestion—and to the facts contained in this free book—*How To Work Wonders With Words*. For twenty-five years the Speakers' Service has been proving to men that ability to express oneself is the result of training, rather than a natural gift of a chosen few. Any man can absorb and apply quickly the natural Laws of Conversation. With these laws in mind, the faults of timidity, self-consciousness, stage-fright and lack of poise disappear ; repressed ideas and thoughts come forth in words that sparkle with brilliance, charm and power.

Have you an open mind ? Then send for this free book *How To Work Wonders With Words*. Over 100,000 men and women in all walks of life have found in this book a key that has opened a veritable floodgate of natural speaking ability. See for yourself how you can become a popular and dominating speaker ! Your copy is waiting for you—free—simply for the posting of the coupon.

Send for this Amazing Book

Now Sent FREE

THE SPEAKERS' SERVICE
(Dept. PR/ES2)
Marple, Cheshire.



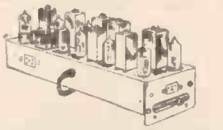
THE SPEAKERS' SERVICE
(Dept. PR/ES2), MARPLE, CHESHIRE.

Please send me my FREE copy of your inspiring book, *How To Work Wonders With Words*, and full details of your methods for speaking effectively. I enclose 3d. stamp for postage.

NAME ....
(Please use Block Letters)
ADDRESS ....
....
....

If you do not wish to use coupon, apply by letter.

I.F. STRIPS — POWER PACKS

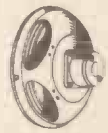


SOUND & VISION STRIP, 10/6. S/Het., takes 6-EF91, 1-6D2, 1-6F14, (Valves extra.) Not tested. Post 2/6.

PLESSEY SOUND & VISION STRIP, 25/6. Superhet, takes 6-6F1, 2-6D2. (Valves extra.) Not tested. I.F.s 10.5 mc/s sound, 15 mc/s vision. Post 2/6.

12 CHANNEL TURRET TUNER, £6.17.6, to fit above. Will plug straight in. Incl. 2 valves, replacing 2-6F1s.
TIME BASE, 4/9. With scanning coil, focus unit, line trans.; less valves. Free drawing. Post 3/6.
POWER PACK & AMPLIFIER, 19/6. A MUST in every workshop. The basis of nearly every experiment or electronic instrument you make. Smoothed H.T. 325 volt, 250 m/a. L.T.s—4 v., 6.3 v. and 4 v. centre tapped. Post 3/9.
MAINS POWER TRANSFORMER, 15/6. 350-0-350 v. 250 m/a. 6 v. heaters at 5 amp., 4 v. at 5 amp., 4 v. at 5 amp. isolated. Extra isolated winding for 2 or 4 v. Drop-through type. Prim. 200-250 v. Size: 4½" x 5" x 5". P. & P. 3/9.
MAINS POWER TRANS., 9/9. 350-0-350 v., 250 m/a, 22 v. at .3 amp., 6.3 v. at 4 amp., 6.3 v. at .08 amp., 4 v. at 2.8 amp., 4 v. centre tapped at 3.6 amp. P. & P. 3/9.
MAINS TRANS., 5/9. 280-0-280 v. 80 m/a 6 v.-2 amp., 4 v.-2 amp., 4 v.-2 amp. Drop through. Post 3/3.
MAINS TRANS., 3/9. 350-0-350 v. 80 m/a. 4 v.-5 amp., 4 v.-2.5 amp. Post 2/9.
O.P. TRANS., 1/3. Salvage, guaranteed. 2-5 ohms, standard size. Post 1/-. 20 for £1. Post 5/6.

SPEAKERS 8" P.M. 8/9



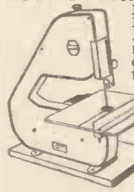
Ideal gift, if fitted in small cabinet. At this price you can afford one in every room. Complete with O.P. Trans., 10/-. P. & P. 2/9.
EXTENSION SPEAKERS, 29/9. In attractive cabinet. Complete with 8" P.M. speaker, flex and switch. Standard matching to any receiver 2-5 ohms. Size 11" x 13½" x 6½". A nice present and real bargain. Post & P. 3/6.
PLESSEY FOCUS MAGNET, 3/9. 35 mm. Permanent magnet type. Salvage. Post 1/9.
ELAC FOCUS MAGNET, 5/9. 35-38 mm. Permanent magnet. Salvage. Post 1/9.
ELAC FOCUS MAGNET, 12/9. Brand New. 35-38mm. Post 1/9.
FRAME OUTPUT TRANSFORMERS, 3/9. To match low impedance coils.
VISCONAL CONDENSERS, 5/9. 12.5 KV. working .001, and 7 KV. working .1uf. Post 6d.
RESISTORS, 6d. doz. 270 ohms ½ watt. Ceramic. Post on 1 doz., 6d.; on 4 doz., 1/-; on 10 doz., 2/6.
INSULATING TAPE, 1/6. 75 ft. by ½ in. wide. Post on 1, 9d.; on 6 only 2/-.
SOLDER REELS, 1/6. 60-40, 3-core Ersin. 20 ft. on plastic spool. Post 6d.
CHASSIS, 1/- each. 6 or 8 valve, latest type midget valve design for A.M. or F.M. New. Cadmium plated on s.w.g. steel. 12¼" x 7¼" x 20⅞". Post 1/9. 4 for 4/-. Post 3/-. 12 for 10/-. Carr. 5/-.
RECTIFIERS. 2/9. 250 v. 100 m/a. Full or half-wave. Salvage, guaranteed. Post 1/3.
EY51 Valves, 8/9. Ex-Equipment. Tested. Post 9d.
OTHER VALVES FROM 1/9 each. Please send for full list (3d. stamp).

P. P. COMPONENTS LTD. (Dept. M.10), 219, ILFORD LANE, ILFORD, ESSEX. Phone: ILF 0295
Send 3d. stamp for FREE Catalogue.

ON TERMS FROM MONDEX

BSR MONARCH
4-Speed Autochanger for building into a HiFi Radiogram. Brand new. As advertised. Guaranteed. Direct from B.S.R.'s factory £9.15.0 *cash or 25/- dep. & 8 m.ps. of 25/-.* (P/P 4/-).
ALSO AVAILABLE—*Amplifiers, R.G. Chassis, F.M. Tuners, Loudspeakers and Cabinets.*

BURGESS Electric BAND SAW



Fully portable. Built-in 1/10 h.p. A.C. motor, will make intricate cuts, or saw through heavy material with ease. On baseboard. £19.7.6 or 40/- *dep. and 8 m.ps. of* 50/-.

HOBBIES TREADLE FRET MACHINES

'GEM' £5.17.6 *or* 10/- *dep. & 8 m. ps. of* 15/6.
'A.I.' £9.9.0 *or* 15/- *dep. & 8 m. ps. of* 25/3.
Complete MOTOR DRIVE ATTACHMENT for motorising Hobbies Treadle machines. £8.17.6 *or* 15/- *dep. & 8 m. ps. of* 23/6.
HOBBIES 'MARVEL' MOTOR DRIVEN Bench Fret Machine, £12.5.0 *or* 20/- *dep. & 8 m. ps. of* 32/6.
'MARVEL' without motor, £4.17.6 *or* 10/- *dep. & 8 m.ps. of* 12/9.
Details of Hobbies lathes, tool outfits, etc., gladly sent on request. Detailed specifications included in Hobbies 1959 Annual 2/- plus 7d. post.
'ULTRA LENS'
Illuminated Magnifier with built-in battery and bulb, always in focus. Complete with spare bulb and battery in case, £6.5.0 *or* 10/- *dep. & 6 m. ps. of* 21/6.

THE NEW 'B & D' D.500 DRILL

Entirely re-designed power drill with helical gears and ¼" geared chuck. Smart two-tone finish. Runs at 2,500 r.p.m. Built to precision standards, yet costs only £8.19.6 or from Mondex, 10/- *dep. & 8 m. ps. of* 18/9.

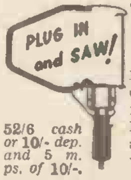
WOLF QUARTERMASTER

A brand new type of power unit of great power and adaptability. Precision engineered. Takes most Wolf Cub accessories. **Unconditionally Guaranteed. £9.9.0** *or* 15/- *dep. & 8 m. ps. of* 25/-.

BRIDGES 'NEONIC' ¼" POWER DRILL

Improved version of the versatile and very powerful DR2T unit, with neon indicator in circuit with motor. 15/- *dep. & 8 m. ps. of* 21/- *or* £7.19.6 *cash.*

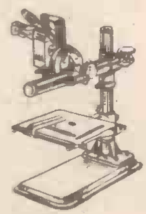
THE NEWEST ELECTRIC COPING SAW



52/6 *cash or* 10/- *dep. and 5 m. ps. of* 10/-.

Improved design. More powerful. Cuts up to 1" in hardwood or soft metal. Takes standard Eclipse Blades. Built-in switch. Adjustable. No TV interference. 200/250 v. A.C. With 4 blades.

TO BUILD A MODERN HOME WORKSHOP

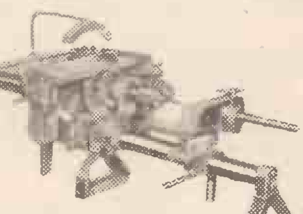


SELECTA HOME-MASTER
Takes any standard ¼" power unit or drill to enable a wider range of jobs to be carried out: 30/- *dep. and 8 m. ps. of* 37/6 (£14.10.0 cash).
SELECTA POWER PAK. Very powerful unit for use with Home-Master. 20/- *dep. and 8 m. ps. of* 27/- (£10.9.6 cash).
SELECTA 30in. LATHE
7/6 *dep. and 8 m. ps. of* 11/9 (£4.9.0 cash).

ACCESSORIES FOR ALL ABOVE MAKES AVAILABLE ON TERMS
NEW MONDEX CATALOGUE FREE

MONDEX PRODUCTS LTD
(*Dept. PM/10*), 87 Aldersgate Street, London, E.C.1

The 'MINORETTE' *Motorised 230/250V.*
UNIVERSAL WOODWORKER



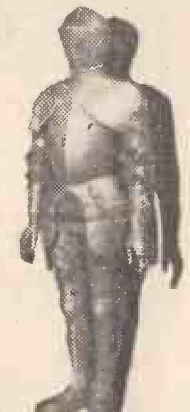
The 'Minorette' has an 18" lathe bed; 7" Tilting Circular Saw table complete with 7" Circular Saw blade; a combination table for use with slot mortiser or as a panel support for repetition cutting; Slot Mortising chuck complete with a ⅜" bit 6½" sanding plate, 6" Grindstone and Arbor Belt and Pulleys. The ⅓ h.p. electric motor is double ended and is TV and Radio suppressed. Attachments can also be supplied for planing, grinding, grooving, comb jointing, flexible drives, etc. Illustrated leaflet free on request to Dept. PM9

Supplied on 1st payment of **£4** Balance of 8 monthly payments of £4.18.8. Cash price £39.17.6.

PARRY AND SON (Tools) LTD.
329-333 OLD STREET, LONDON, E.C.1. *Telephone SHOreditch 9422/3/4*

MAKE MONEY — making casts with VINAMOLD

A grand spare-time occupation



WITHOUT any previous experience you can mass-produce any object from a chessman to a candlestick, statuette or model ship, in plaster, resin, concrete, etc. . . . with "VINAMOLD" the flexible mould that gives the *BEST* results. Easy to work, can be used over and over again. Needs *NO* special equipment, provides a profitable and enjoyable spare-time occupation with minimum outlay.

Write for full details and instructions. *Also available:* Illustrated booklet describing "VINAMOLD," methods of heating and melting, preparation of models and moulds, etc. Price 1/6 post free, from :—

VINATEX LTD. (Dept. P.M.3), CARSHALTON, SURREY

NYLON · P.T.F.E

Rod, Bar, Sheet, Tube, Strip, Wire

No quantity too small · List on application

BRASS • COPPER • LIGHT ALLOYS
ALUMINIUM • BRONZE

H. ROLLET & CO. LTD.

6, CHESHAM PLACE, LONDON, S.W.1
SLOane 3463
Also at LIVERPOOL LEEDS MANCHESTER BIRMINGHAM

NOW a genuine *Tungsten Carbide Tipped Masonry Drill for the householder*

The only safe way to make a fixing in Masonry is to first drill a clean round hole. BLUE FLASH will do this with ease, its Diamond Hard tip will cut cleanly into brick, cement, stone or breeze, giving a perfect sized hole in which to fit a Plastic Maso Plug or ordinary wall plug.

ASK FOR **BLUE FLASH** *by* MASON MASTER

COPPER BRAZED FOR USE IN ALL PORTABLE ELECTRIC OR HAND DRILLS

Send for Leaflet P.M.

From your local Ironmongers and Tool Merchants.

No.6 5/6	No.8 5/6	No.10 6/-	No.12 6/-	No.14 7/-

J. M. PERKINS & SMITH LTD., Braunston, Rugby.

Now, poor old overworked "G" is a star-turn invoked by our good friends "The Flying Sorcerers," who try to invent mechanical heresies to explain phenomena impossible for any material substance.

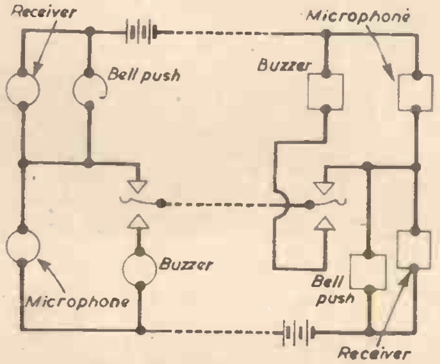
We do at least know that mass, momentum and inertia are concomitants of all matter throughout the cosmos. No matter could behave as saucers are said to behave. If they are not figments of imagination, they are ethereal manifestations not requiring any motive power.

"G" is merely the symbol of acceleration due to gravity near the earth's surface, 32ft. per sec/per sec. It has no special significance, except as a basis of comparison for strain on human tissues arising from rapid velocity changes.

It could no more be a source of power than a pound weight carried in your pocket would run a car without petrol uphill.—F. O. BROWNSON (Bedford).

Room to Room Telephone

SIR,—The circuit below is a suggested modification to the wiring circuit in Fig. 6 of the article on room to room telephones in the August issue of PRACTICAL MECHANICS. This utilises no other components, but it is suggested that the fault



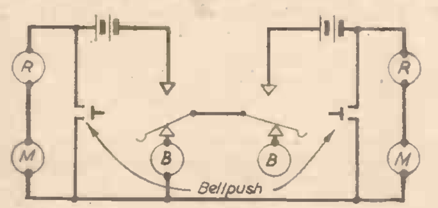
Mr. J. W. Tresadern's circuit.

arising in having earpiece and microphone in series will be eliminated, having full voltage applied across the microphone or earphone in each case.

I have not tried to use this circuit as yet although I have had this scheme in mind for some time.—J. W. TRESADERN (Essex).

* * *

SIR,—With reference to your description of a simple room to room telephone, I should like to point out that although a buzzer may have a low D.C. resistance its A.C. impedance may be quite high and results will be improved if it is not included in the speech circuit. I should also like to point out that the circuit shown in Fig. 7



Mr. J. Chapman's circuit.

will not work with a carbon microphone as this requires a D.C. bias. I suggest the circuit shown above to overcome these difficulties. Over short distances this circuit will work with an "earth return" if a good earth (e.g., a water pipe) is available at both ends.—J. CHAPMAN (Isleworth).

Puzzle Corner—

SIR,—With reference to the "Problem of Pints" in PRACTICAL MECHANICS, dated August, 1958, would it not be simpler to proceed as follows?

Fill the five-pint container and pour into empty churn. Do this again making ten pints in churn. Fill the three-pint container from this churn and pour back into first churn, thus leaving seven pints in second churn.—E. L. BRINSON (Edgware).

SIR,—May I offer a simpler solution to the problem of measuring seven pints

Our Readers wrote in their hundreds on this subject and we print two letters below

from one churn to another using only a five-pint measure and a three-pint measure as posed in "Puzzle Corner" in the August issue of PRACTICAL MECHANICS?

First, fill the five-pint measure and empty it into the empty churn. Next, fill the five-pint measure again and from it fill the three-pint measure. This will leave two pints in the five-pint measure. Add these two pints to the five already in the churn.—E. W. PHILLIPS (London, N.2).

Washing Away Radioactivity

AT an atomic plant in America expensive equipment such as pumps, centrifuges, etc., is being immersed in boiling chemicals and a 28ft. deep bath of water to reduce radioactive contamination to safe levels in order that repairs may be effected. Formerly radioactive equipment could not be touched by repairers and had to be discarded.

The Perceptron

THIS latest electronic device developed for the U.S. Navy, known as the "Perceptron," is the nearest approach yet to a "thinking" machine. It can see, recognise and identify its surroundings without being trained by humans and it is not necessary to record the data of certain surroundings and circumstances and file them, in the way a mechanical brain does. A camera-type lens is used to survey the field and an electrical impulse system, similar to the human brain, does the interpreting.

One hundred squares located at random on right- and left-hand sides of cards were shown to the machine and 97 times out of 100 it correctly indicated whether the square was on the left or right. Eye witnesses said that after about 30 or 40 cards the machine appeared to learn the difference between right and left, as would a small child.

Printed matter, longhand and speech are within its scope and only one step (a difficult one) has to be made before the machine will hear speech in one language and then reproduce it either verbally or in writing in another language.

Ultrasonic Diagnosis

AN ultrasonic probe device has been used to detect lumps or masses within the abdomen. Echo patterns are shown on an oscilloscope and the images created are interpreted. Pregnancy and pelvic and abdominal tumours have been detected.

Electronic Detectors for the Blind

EXPERIMENTS are being carried out as preliminaries to the development of electronic detectors for blind people. They will enable the user to "see" obstacles or sudden changes in ground or pavement level. Another future development is the translation of ordinary printed matter into audible signals so that blind people can read it.

Exploding Star

A STAR in the milky way RS Ophiuchi was seen to explode this year for the third time in 60 years. Normally it is invisible to the naked eye, but during the period of explosion it had a brightness of the sixth magnitude and was clearly visible.

French Diesel/Turbine

IT has been reported that in France a combination diesel and gas turbine engine has been developed. The "free piston gasifier" can use low-grade fuels more efficiently because of the diesel system's high compression ratio. In this engine diesel fuel is burned in a cylinder and opposed reciprocating free pistons are driven by the resulting energy. These generate compressed air which drives a gas turbine.

Camp Gadgets from Natural Materials

(Concluded from page 24)

rods for this purpose. They can be spaced on the top of the fireplace by passing through some holes drilled in a piece of ⅜in. × ⅛in. strip iron (Fig. 9).

Some campers like to have their fire raised up from the ground so that one might almost be cooking on the gas stove at home! It certainly saves a bit of backache for the older ones. This sort of fireplace, shown in Fig. 12, is known as an altar fire. To make it four stout stakes are driven into the ground so that the sheet of iron which supports the fire is about 24in. off the ground. The sheet of iron should be of a stout gauge, say No. 18, and should be about 24in. × 15in. In order to give it greater rigidity it is better to bend up the edges about ⅜in. all round.

A Camp Oven

An oven at camp extends the possibilities of camp cooking, and the biscuit-tin oven shown in Fig. 10 is very simple to make.

Dig out a trench in the direction of the wind about 36in. long and 12in. wide to a depth of 9in. (see Fig. 13). A sheet of iron is placed over the top of the trench and the biscuit tin is placed on its side in the centre of the sheet of iron. The success of the oven depends upon conserving the heat in the tin and to do this the tin is covered with a thick layer of soil. If available locally, clay would be much better than the soil alone. The fire is kindled under the sheet of iron in the usual way. A simple handle fixed to the biscuit-tin lid will make for easier opening of the oven door. A young camper is shown putting the dinner in the oven in Fig. 11.

A Review of New Tools, Equipment, etc.

Combined Dynamo, Headlamp and Horn

THIS latest idea for cyclists is made by Messrs H. Miller & Co. Ltd., and, as can be seen in the photograph, the design of the streamlined headlamp completely hides the horn. Two 6v. 0.5 amp bulbs are fitted and there is accommodation for a one unit cell battery. The extra bulb provides dipping facilities or can be used as a stand-by. The price is 27/-.

Dynamo headlamp and horn button.

The headlamp is also available as part of a complete set, including the dynamo and tail light unit, the hornbutton and the necessary wiring. The price of the set is 50s.

Comprehensive Tool Catalogue

FROM the well-known firm of S. Tyzack & Son, Ltd., 341-345, Old Street, Shoreditch, London, E.C.1, we have received a copy of their new General Tool and Machinery Catalogue. It is beautifully produced and lavishly illustrated, each item being shown either by means of a photograph or sketch. An extremely wide range of tools is included ranging from cording needles to cross-cut saws, from lawn mowers to lathes of many kinds. Reference to any item is facilitated by a comprehensive index and sizes and prices of every tool are listed. A charge of 2s. 6d. is made for the catalogue which is refunded on receipt of the first order of £2. The catalogue will be of great interest to woodworkers and metalworkers, and indeed to everyone who uses tools.

Model Accumulators

G. A. STANLEY PALMER LIMITED, Maxwell House, Arundel Street, London, W.C.2, sole concessionaires in Great Britain for the Deac Perma-Seal hermetically sealed rechargeable accumulators, are able to supply these units in voltages ranging from 1.2 volts upwards and in various amperehour capacities for incorporation in toys and models, as completely portable power sources—rechargeable from an ordinary mains lighting socket. Prices range from 3s. to 7s. according to capacity.

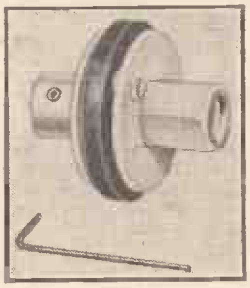
This not only means that a permanent power supply can be built into existing types of toys, rechargeable from the mains as required—but more important, it represents a new basic power source around which new types of toy can be built.

G. A. Stanley Palmer Limited can also supply simple mains charging units which can either be incorporated or sold separately.

Flexible Coupling

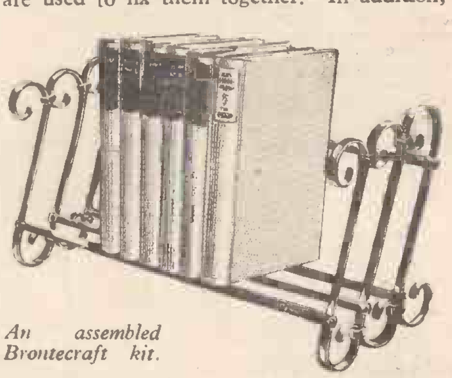
SPECIALLY designed by Selecta Power Tools Ltd., for use with the planing attachment on the "home-master" workshop is a new flexible coupling. The coupling, shown in the photograph, provides compensation for misalignment and axial deflection. It has many other applications other than with the "home-master" and can be supplied, complete with allen key, from stock. The address of the makers is Hampton Road, West Hanworth, Feltham, Middlesex.

The new flexible coupling designed by Selecta Power Tools, Ltd.



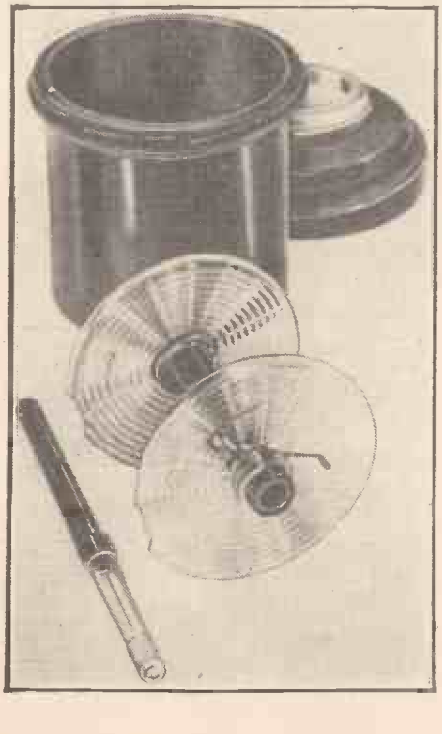
Wrought Ironwork Kits

MARKETED under the name "Brontecraft" and made by Parkerdale, Ltd., these kits are supplied complete with instructions and can be assembled using only a screwdriver. All the parts are drilled ready for assembly and patent scroll clips are used to fix them together. In addition, scrolls, straight lengths and accessories are available separately in either matt black or natural finish. Details and price lists are available from Parkerdale, Ltd., Brontecraft Works, Oxenhope, Keighley, Yorks.



An assembled Brontecraft kit.

New Developing Tank



A NEW developing tank, the "Roto-Two" is being marketed by Johnsons, of Hendon, Ltd. A feature of this tank is the polythene cap on the screw-on lid which enables the user to invert the tank thus ensuring thorough agitation. A transparent-topped, hollow-stirring rod, in which a thermometer can be inserted, is also provided for the conventional rotary agitation.

The tank is particularly easy to fill and empty and the inner portion of the lid is removable for cleaning purposes. The transparent spiral is adjustable to five different widths, taking films size 116, 120, 127, 88 (35mm.) and 16mm. Special groove stops permit two size 120, two size 127, two No. 88 or two 20-exposure 35mm. films to be loaded at once without fear of them overlapping during development. One full 36-exposure length of 35mm. or one size 116 may be inserted or approximately 6ft. of 16mm.

The maximum capacity of the tank is 600 c.c. (21 oz.), and the price is £1 12s. 6d., complete with full instructions.

For developing four 20-exposure 35mm. films or two 36-exposure 33mm. films, a special spiral flange with two spacers is available as an extra. Price 12s. 6d.

(Left) The new "Roto-Two" developing tank.

READERS' SALES AND WANTS

The pre-paid charge for small advertisements is 6d. per word, with box number 1/6 extra (minimum order 6/-). Advertisements, together with remittance, should be sent to the Advertisement Director, PRACTICAL MECHANICS, Tower House, Southampton Street, London, W.C.2, for insertion in the next available issue.

FOR SALE

HOUSE SERVICE METERS, credit and prepayment; available from stock. Universal Electrical, 221, City Road, London, E.C.1.

CHEMICALS AND APPARATUS.—Free booklet of 100 Experiments with orders over 15/-. Send 3d. stamp for catalogue and details of special offers. Scientific & Technical Supplies (Nottm.) Ltd., Dept. M. 9, Wellington Circus, Nottingham.

COMPRESSORS FOR SALE.—Twin Piston with tank, 2½ c.f.p.m., £4. Single Cyl., £2. All types Motors. S.A.E. for list. Wheelhouse, 13, Bell Road, Hounslow (HOU 3501.)

½OZ., 2/3oz and ¼oz. hand-operated, Bench-Type Thermoplastic Injection Moulding Machines for Hobbies and Industry. Dohm Ltd., 167, Victoria Street, London, S.W.1.

HALF PRICE ELECTRIC DRILL KITS. Lambswool Bonnet, Rubber Backing Pad, 12 Sanding Discs, Grinding Wheel, Buffing Wheel, Wire Brush Wheel and Wheel Arbor, 18/- (usually 36/-).
BARKERS, 70, West Street, Leeds. 1.

PORTASS 2IN. LATHE, slide-rest, motor, chucks, etc., £16. Smith, 26, Portland Road, Oxford.

"ASTRO TELESCOPE MAKING." Standard Ramsden Push-in Eyepieces, ½in., ⅓in., ¼in. focus, 35/-; s.a.e. list. Object Glasses from 10/6; Eyepieces from 15/6; Newtonian Mirrors, Focusing Mounts, Tripods, also complete Terrestrial Telescopes and Microscopes. W. Burnet, Grand Sluice, Boston, Lincs.

DOBLE STEAM CARS—the basis for modern design—described in detail. Modern steam power unit for light car—switch on to start, steam launches, stationary power. Magazine, illustrated lists of drawings, castings, etc., 4/-. "Light Steam Power," Kirk Michael, Isle of Man, U.K.

GOVERNMENT SURPLUS AND MANUFACTURERS CLEARANCE

BALL RACES.—3/8" x 1/8" bore, ½" x 3/16" bore, ¾" x ¼" bore, 1/6 ea.; 7/8" x 3/8" bore, 2/- ea.; 2¼" x 1" bore, 3/6 ea.
PNEUMATIC TYRED WHEELS & AXLES.—16" x 4", GIRLING brakes, £7.0.0 per pair.
MIN. MOTORS.—4½ v., reversible, totally enclosed, 5/- ea., 50/- doz.
PRISMS.—Magnifying. 1 3/16" sq. mounted on adjustable frame, 2 filters, 5/- ea.
NIFE CELLS.—3 x 2½ x 1", unused, 5/- ea., 50/- per doz.
NEWALL INDICATOR CLOCK GAUGES.—M/m new, 35/- ea.
GEAR BOXES.—Ratio 10-1, ball race mountings, ½" dia. spindle, 10/- ea.
CROMPTON PARKINSON.—24 v ¼ h.p. D.C. Motors. Suitable factory trucks, invalid carriage, etc. £6 ea.
HYDROMETERS.—ACID. 3/- ea.
VARIABLE SPEED MOTOR.—1/6 h.p. 115 v. 50/60 c.p.s., 2.8 a., with Graham var. spd. gearbox. Output 0-166 r.p.m. £6.10.0 each.
12 v. D.C. MOTORS.—3,800 r.p.m., 1/16 h.p., 22/6 ea.
COMPASS.—P8 A.M. 4" jewelled bearings, ideal for boats, scouting, etc., unused, 25/- ea., used 15/- ea.
MAINS POWER PACKS.—250 v., 80 milliamp. or stabilised, 150 v., 80 milliamp, 30/- ea.
TANNOY MICROPHONES. — With switch and lead, 7/6 ea.
I.T.A. AERIALS.—New and boxed, 3 element, 22/6; 5 element, 27/6. Co-ax. cable, 6d. yd.; air spaced, 9d. per yd.
MORSE KEYS.—Small 2/-, medium 3/-, larger 3/6. Buzzers, 3/- ea.
VALVES.—6J6, 6C4, 6K7, 6J5, 3A4, 4/- ea.; 12AT7, 12AU7, 12AX7, 7/- ea.
TECALEMIT GREASE NIPPLES.—4d. ea., 3/- doz., 20/- per 100.
MOTORS.—28 v. geared 2¼" x 1½" dia., 12/6 ea., less gears 10/- ea.
METERS.—Moving coil, 2½" dia., 50 microamp., £2.10.0; 100 microamp., £2.5.0; 100 milliamp, 12/6; 25 v. 2" dia., basic movement, 5 milliamp., 7/6; 0-50 amp, A.C. 4½" dia., 25/-.
VIBRATORS.—Oak. 12 v. 4 pin, 5/- ea
TORCH BULBS.—Ever Ready, 2.5 v. and 3.5 v., 16/- per 100, 9/- per 50.
HEADPHONES.—Moving iron, low impedance, 6/-; high, 9/-; balanced armature, low, 10/-; high, 15/-; moving coil, low only, 10/- per pair.

HUGGETT'S LIMITED
2/4 PAWSON'S ROAD, WEST CROYDON, SURREY.

FOR SALE (*Continued*)

HOW TO USE EX-GOV. LENSES and Prisms. Nos. 1 and 2, 2/6 ea.; Vertical Enlarger Plans for 35mm. to 2¼in. sq., 3/6 ea.; Optical Condensers and Achromatic Lens to suit, 33/-. Lists s.a.e. H. W. English, Rayleigh Road, Hutton, Essex.

3¼IN. Clear Aperture Astro Refractor Telescope, £45; Zeiss Orthoscopic Eyepiece, £5; 6¼in. Mirror, £12/10/-; 3in. Object Glass, £15. Mackett & Co., Mfg. Opticians and Engineers, 51, Millers Road, Brighton.

A HOST OF USEFUL THINGS for Handymen, "Do-it-Yourself" enthusiasts, Motorists, Electricians, Model Makers, etc. etc., are listed in my catalogue. Write for it to-day and read about my Special Mixed Bargain Parcels and about the thousands of individual articles at money-saving prices. K. R. Whiston (Dept. M.P.S.), New Mills, Stockport.

CADMIUM - PLATED AIRCRAFT BOLTS, 2 B.A. to ⅜in. B.S.F., various lengths, nuts. Fibre, Dural Washers, £1 lots, ¼ cwt., 3/6 part carr. Large stocks Alloy Bolts, Nuts, etc. Northern Surplus Equipment, Arnside, Westmorland.

PRISMATIC PERISCOPE HEADS, unused matched pair, 5/-; splendid wide view Prisms. Hughes, 9, Randall Close, Langley, Bucks.

DOOR CHIMES.—Make your own! Battery operated. Handyman's Parcel Materials and Instructions, 16/- p.p. Roberts, 194, Well Hall Road, London, S.E.9.

MAINS FROM 12v. CAR BATTERY. American Dynamotor Unit, runs 200/250 AC/DC radios, televisions, tape recorders, etc., from 12v. car battery, continuous duty, perfect, cost £25, 80/-; s.a.e. full details. Scientific Products, Cleveleys, Lancs.

CIRCULAR GLASS DISCS for grinding Astronomical Mirrors. Smoothed and edged, per pair with abrasive 80, 180, 280, 320, 400, 600, superfine finisher. Swedish Pitch, Wax, fine Rouge. 6in. x 1in., £2/15/-; 8in. x 1in., £3/15/-; 8in. x 1⅓in., £5/15/-, post paid. H. Gibbs, 75, Portmanmoor Road, Cardiff, S. Wales.

MAIL ORDER NEW TOOLS.—Set H.S. Drills, No. 1-60, 47/-; Heavy Table Vice, 2½in. jaw, 13/6; H.S. End Mill, ⅜in., No. 1 M.T., 7/6; H.S. Small Milling Cutters, 6 different, 10/-; Drill Chucks, ⅜in., No. 1 M.T., 11/6; No. 2 M.T., 11/6; Burnerd Independent Chucks, 4in., 72/-; 4½in., 75/-; 6in., £6/4/6; Micrometers, 1in., 10/-; 1in.-2in., 14/6; Spring Dividers, 5in., 7/6; Spring Inside Calipers, 6in., 6/-; Precision Drill Chucks, ½in. No. 1 M.T., 34/-; No. 2, 35/-; Dies, 13/16in. 40 T.P.I, 5/32in. 3/16in., 7/32in., ¼in., 3/4 each; Taps, 40 T.P.I, 5/32in., 3/16in., 7/32in., ¼in., 2/- each; H.S. ⅜in. Reamer, 10/-; Wood Saw, 6in. hole, ⅝in., 10/-; Dial Gauge, 2in. diam., .005in., £2/16/6. 1/- extra post under 20/- orders. S. Grimshaw, 7, Hall Street, Manchester, 18. (Warehouse: Gorton Lane.)

FIELD GLASSES, several good pairs, cheap. Clearing stock out. Details: Mackett & Co., Mfg. Opticians, 51, Millers Road, Brighton.

PHOTOGRAPHY

PHOTO-ENLARGER Castings and Bellows for 35mm., 2¼in. x 2¼in., 2¼in. x 3¼in., 35/- per set; s.a.e. for details. V. J. Cottle, 84a, Chaplin Road, Easton, Bristol, 5.

BELLOWS, Camera, Enlarger, Process. Industrial Collapsible Machine Guards. Beers, 4, St. Cuthbert's Road, Derby. (Tel.: 41263.)

G. R. CONSTRUCTION KITS.—Build your own double-range highlight Exposure Meter with 50 x 37mm. photo-cell at 57/-, or instant push-button reset 1 to 60 sec. Electronic Enlarger Timer at 62/6; all sizes of Selenium Photoelectric Cells in stock. S.A.E. details. G. R. Products, 22, Runnymead Avenue, Bristol, 4.

GLASGOW. If buying, selling, or exchanging modern Cameras, Enlargers, Equipment, Tape Recorders, etc., for the best deal, call or write to Victor Morris, 406, Argyle St., Glasgow, C.2. (Central 8958.)

ELECTRICAL

EXTRACTION FANS, 6in., silent shaded pole, no interference. A.C. only, price 20/-, post 2/-; also New 1/20th h.p. Universal 230v. Geared Motors, 10-1 reduction, suitable for food mixers, price 22/6, post 2/-; 1/6th h.p. Motors, all types, £2/10/-. Wheelhouse, 13, Bell Road, Hounslow.

THERMOSTATS

Suitable for electric heaters or convectors. 15 amps. at 250 volts A.C. Heavy brass base. Set for 35° C. but can be adjusted to operate from 50° to 5° Centigrade. Sample 5/- or Six for 20/-, post free. Worth 25/- each.

H. MIDDLETON,
639, Abbeydale Road, Sheffield, 7.

THE ELECTRIC GUIDE (12th edn.), 1/3; Electric Hints and Gadgets (4th edn.), 1/3, from B.P.M. Publications, Ringwood, Hants.

"STANFORD" ELECTRIC WELDER, 200/250 a.c., complete with heavy welding transformer, welding torch, earthing cable, goggles, carbons, case, instructions. Absolutely as new and perfect, £4; carriage paid. Will send c.o.d. McGrath, 83, Green Drive, Cleveleys, near Blackpool.

ENTER TRANSISTORS

You can build a simple Transistor Radio Receiver to work a loudspeaker. The only power required is a 4½ volt flash-lamp battery. Parts for Amplifiers for Crystal Set or One valve Set, 27/- and 54/-. Completely built Amplifier, 57/6, post free. Details and notes on transistors, 8d. in stamps to:

MORCO EXPERIMENTAL SUPPLIES
8-10, Granville Street, Sheffield, 2

FLUORESCENT LIGHTING FITTINGS for workshop and home. Complete range from 5ft. to 18in. (also circular) at lowest prices anywhere. S.A.E. for illustrated leaflets and list of Control Gear Kits. Callers welcome. We are Fluorescent Lighting Specialists: E. Brill, Dept. C., 125A, Northcote Rd., London, S.W.11. (Battersea 8960.)

MODEL ELECTRIC MOTORS, amazingly powerful. "Mini Mo," 9/6; "Maxi Mo," 13/6, post free. 4½ to 9v., 1½in. x 1¼in., weight 1½ oz. Dept. (P), "Highland," Alkrington Green, Middleton, Manchester. 3d. stamp full details.

CONVERT your ordinary Washboiler to electric. G.E.C. Circular Washboiler Elements, 200-250 volt, 2Kw., 9½in. diameter one hole fixing, 22/6 each, plus 1/9 p. and p. London Warehouse, 165, Queens Road, Peckham, S.E.15.

MAINS RADIO IN YOUR CAR.—Complete Unit runs 200/250 AC/DC radio, television, tape recorders, etc., from 12v. Battery, perfect, cost £25, 80/-. Stamp full details. Scientific Products, Cleveleys, Lancs.

ANTI-RADAR STRIP DISPENSER UNITS

These comprise 2 1/20th h.p., 24 V shunt wound motors, with train of gears, both 25 and 50 to 1 reduction. The unit is mounted in an aluminium chassis and consists of over 100 gears, pinion shafts, etc., of the Meccano pattern, with variable speed switch and indicator light, bag of spares, and electrical diagram. These are all new and in original waterproof packages. They are something entirely new and have never been offered before. PRICE 30/- each. CARR. PAID.

H. MIDDLETON, 639, Abbeydale Road, Sheffield, 7.

ALL TYPES OF ELECTRICAL GOODS at extremely competitive prices, e.g., 5 amp, Twin Cable, 35/- 100 yards; Lampholders, 7/- doz.; 5ft. Battens, 49/-; quality and immediate despatch guaranteed. Request list. Jaylow Supplies, 93, Fairholt Road, London, N.16. (Telephone: Stamford Hill 4384.)

WOODWORKING

SAWBENCHES, 8in. to 30in., from £9; Motorised, £13; Petrol Portable, £44. Planers, Bandsaws, Lathes, Saw Spindle and Planer Assemblies, Logging and Firewood Machines. Chain Saws, Engines, Motors; deferred terms. Send 1/9 for handbook-catalogue and bargain offers. List free. Beverley Products, Sturton-le-Steeple, 20, Notts.

5IN. Tru-plane, £18/15/-; 9in. Tru-Plane, £37; Mortise Attachments, £12/18/-; h.p. terms. Wragg Bros., Chapel Street, Leabrooks, Derbyshire.

S.G.S. Woodworking Machinery.—Saw Bench Units; "Empire" (for saws to 12in.), £3/6/-; "Royal" (16in.), £5/3/-; "Empress" (20in.), £5/15/-; "Monarch" (30in.), £11/18/6; ½in. Drill Chucks, 14/- extra. Planer Units fitted with high-speed ball bearings; 4½in. £4/15/-, 6in. £6/15/-, 8in. £8/10/-. Wood Turning Combination Lathes: 18½in., 24in. or 30in. centres from £9/19/6. Obtainable from ironmongers, tool shops, etc., or write direct to: S.G.S. Engineers, Dept. 14, Old Costessey, Norwich, Norfolk.

TOOLS

POWER TOOLS.—We stock the lot. Cash or terms. H.D. Co. Ltd., 58, Commerce Rd., Wood Green, London, N.22.

WRAGG 7in. Motorised Bench Shapers, adjustable stroke, automatic feed, £60; h.p. terms. Wragg Bros., Chapel Street, Leabrooks, Derbyshire.

NAMESTAMPS.—Your name in ⅛in. letters, 1/- per letter. Price list for Sets of Letters and Figures, Branding Irons, Stencils; quotations for Nameplates, Dies, Moulds, Metal Labels, Small Forgings, Small Turnings. John C. Swallow (Engravers), (P.M. Dept.), Garden Street, Sheffield, 1.

CLOCKWORK MECHANISM 1/9

A perfectly engineered clockwork unit with a fully enclosed clocktype spring, gear train and escapement. Ex-W.D. (type ROF(B) 40 SL). Can be modified for use as a dark-room timer, clock or any mechanism requiring activation. For the amateur mechanic with ideas, it offers considerable scope. Drawings free. Post 1/-, 4 for 5/-. Post 2/6.

DUKE & CO. (Dept. H.10)
621/3 Romford Road, Manor Park, E.12.
ILF 6001/3

BRAND NEW TOOLS, assorted B.A. Taps, 2 to 12, 9/6 dozen. Send s.a.e. lists Drills, Taps, Dies, at bargain prices. A. King, 152, Halfway Street, Sidcup, Kent.

WATCHMAKERS

LEARN to be a Watch and Clock Repairer in your spare time and earn extra money at home. We can supply everything you need at unbeatable prices, including instructional books. Swiss watchmakers' tools, watches, watch and clock movements, lathes, cleaning machines, all spare parts for watches and clocks, etc. We also have a fine selection of musical box movements and kits. Send 9d. P.O. for bumper bargain catalogue. The Watchmakers Supply Company (Dept. P.M.), Carterton, Oxford.

LADIES' ROLLED GOLD COCKTAIL WATCH CASES, 5/- each. Send for list of Watch bargains. Gleave & Co., Albemarle Way, E.C.1.

WATCH PARTS

For all makes of watches, tools, instructional books, etc. Special Kits for beginners. Send 6d. for "Super Bargain Catalogue." **T. G. LOADER (Dept. B), Watchmakers Mail Order Service, Milestone Road, Carterton, Oxford.**

WATCH REPAIR SERVICE, unrivalled for reliability and speed, coupled with reasonable charges. Part jobs welcomed. Material supplied. Hereford Watch Co., 13, St. Owen Street, Hereford.

(*Continued on next page*)

(Continued from previous page)

HOBBIES

SEREN ASTRONOMICAL SUPPLIES
Warehouse Road, Stebbing, Dunmow, Essex
EQUIPMENT for ASTRONOMERS
Mirrors, eyepieces, focusing mounts, spiders, etc. Do-It-Yourself kits.
S.A.E. for free details.

ILLUSTRATED CATALOGUE No. 13. Containing over 450 Items of Government Surplus and Model Radio Control Equipment, 2/2, refunded on purchase of goods; 2/6 overseas sea-mail. Arthur Sallis Radio Control Ltd., Department P.M., 93, North Road, Brighton.

MAKE YOUR OWN PUPPET THEATRE! Entertain at parties, 10/6 complete. Many already sold. Orders taken. Marshall, 50, Couper Street, Glasgow.

ASTRONOMICAL TELESCOPES.—Grinding, Polishing Kit, suitable up to 8in. mirror. Silicon Carbide: Grade 80, 1lb.; 180, 280, ½lb.; 320, 400, 600, ¼lb.; Optical Rouge, 2oz.; Swedish Pitch, 1lb.; 25/- each, plus 2/6 postage. L. J. Mays & Co., 20, Clover Road, Timperley, Altrincham, Cheshire.

HANDICRAFTS

MUSICAL BOX MOVEMENTS
ONLY 13/- POST FREE.
Kits from 21/- complete with movement. Please send 2d. stamp, or call for new FREE illustrated brochure. Trade supplied.
THE SWISSCROSS Co. (Dept. V) 202, Tulse Hill, London, S.W.2.

MISCELLANEOUS

AQUALUNG and Compressor Equipment. Ballraces and Miscellaneous Items. Lists 2d. Pryce. 157, Malden Road, Cheam.

"FORTUNES in FORMULAS," 900-page American book of formulæ. American technical hobby and other books covering every interest. Stamp for lists. Herga Ltd. (Dept. P2). Hastings

PERSONS WANTED TO MAKE UP HANDY BAGS AT HOME IN SPARE TIME.
SEND S.A.E. FOR DETAILS TO :—DEPT. N/M, BENTOM SUPPLY, 10a, SHELLEY ROAD, WORTHING, SUSSEX

SUPERTONIC SUNLAMPS, listed £7/10/-, 80/-; s.a.e. brochure. Scientific Products, Dept. 1, Cleveleys, Lancs.

BUILD YOUR OWN Refrigerator. Everything to make Built-in or Cabinet Refrigerator. S.A.E. for Sealed Unit List and Schematic Diagram, or 1/- (refundable) for 32-page catalogue, including details of free 4 cu. ft. Cabinet Diagram offer. Hire purchase available. Wheelhouse, 13, Bell Road, Hounslow. (Phone: HOU 3501.)

ARE YOU EARNING ENOUGH? If not, you can add to your income by conducting a spare-time agency for Freemans of London. Generous commission paid on everything you and your friends and relations purchase from the 400-page catalogue obtainable from Freemans (London, S.W.9), Ltd., Dept. 339, 139/141, Clapham Road, London, S.W.9.

CHEMISTRY

PREPARE NOW FOR YOUR FUTURE
We specialise in supplying Laboratory Apparatus for the Student of Chemistry. Send today for free price list to: VIKLAB (PM), 288, Station Road, Harrow, Middlesex.

EDUCATIONAL

FREE! Brochure giving details of Home Study Training in Radio, Television, and all branches of Electronics. Courses for the hobby enthusiast or for those aiming at the A.M.Brit.I.R.E., City and Guilds, R.T.E.B., and other professional examinations. Train with the college operated by Britain's largest Electronics organisation. Moderate fees. Write to E.M.I. Institutes, Dept. PM28, London, W.4.

11 + EXAM | G.C.E.
WRITE NOW for FREE GUIDE, stating date and type of examination, to the Registrar, (Dept. M.34), MERCER'S CORRESPONDENCE COLLEGE, 69 Wimpole Street, London, W.1.

EASY MATHEMATICS COURSE for Radio/T.V.. Write: Tutorials, 200, Buchanan Street, Glasgow, C.1.

$$x = \frac{-b \pm \sqrt{b^2 - 4ac}}{2a}$$

DON'T FUMBLE with Formula, Master Mathematics in 6 weeks the Understandable Way. 1st lesson and details free from Understandable Mathematics, 11, Dryden Chambers, Oxford Street, London, W.1.

HOME BOAT BUILDING

BUILD YOUR OWN two-berth Cabin Cruiser. Kits supplied, also for Runabouts, Dinghies, Canoes, Water Skis. Illustrated brochure on request. Wyvern Boats (Wessex) Ltd., 10F, North Street, Milborne Port, Sherborne, Dorset.

FIBREGLASS

PLASTIC UNITS
Experimental Glass Fibre Unit, 14/9. Plastic Metal for Gear Casting, Plastic Dies, etc., 14/3. Porcelain-hard Cold Setting Finish for food preparation surfaces, baths, washing machines, etc., 16/9 pt. in white, cream, black, sky blue, red, clear and aluminium. S.A.E. for information list, price list, etc. SILVER DEE PLASTICS (Dept. 3), Hartington, Staveley, Chesterfield, Derbyshire.

BOOKS

THE HANDYMAN'S ELECTRIC INSTRUCTOR, 1/9; The House Maintenance Guide, 2/3; The TV & Radio Guide, 2/3. Real book values from B.P.M. Publications, Ringwood, Hants.

PATENTS

PATENTS. Qualified service. Advice. C. L. Browne, 114, Greenhayes Ave., Banstead, Surrey.

! A GOOD IDEA !
CAN MAKE MONEY FOR YOU
LET US ASSIST YOU PROFESSIONALLY TO SELL YOUR INVENTION.
WRITE FOR FULL DETAILS.
PATENT, DEVELOPMENT & MARKETING CONSULTANTS
16 Gore Court Rd., Sittingbourne, Kent.

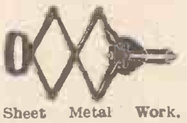
STEEL FRAMED—EXTENDIBLE
LOWEST MONTHLY TERMS of any manufacturer including FREE "Peace-of-Mind" Instalments Insurance.

Write NOW for:—
FREE COLOUR CATALOGUE
BOWSER, MONKS & WHITEHOUSE LTD. (Dept.PM15), Spring Gardens, DONCASTER
MOTOR SHOW STAND 447

FREE CORRESPONDENCE COURSES IN STEAM

TWO COURSES: (1) A simplified Course for the practical man in need of basic information about steam and steam applications: (2) An *Advanced Course* for those with a background of technical training. There is no charge or obligation. Details on request to:
SPIRAX-SARCO LTD.
(TECHNICAL DEPT.) Cheltenham, Glos.

'POP' RIVETERS

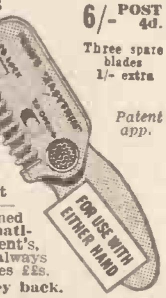


(Lazy Tongs)
Easy to operate. Widely used for Motor Body Repairs. Ideal for Sheet Metal Work, Plastics, Hardboard, etc. Universal Collet takes 'POP' Rivets, 1/8", 5/32", 3/16" and .2" dia., £4.11.0.

'POP' RIVETS
In constant use by Repairers. Three Assortments available:
MTL: 1,000 Rivets—All diameters—33/4.
MTP: 1,000 Rivets—1/8" & 5/32" dia.—29/4.
MOTORISTS' RANGE: 200 Rivets—1/8" & 5/32" dia—12/6.
RIVETING SYSTEMS LTD.
Jordan Street, Knott Mill, Manchester 15

A "FERROUS" ARC WELDING AND BRAZING SET will complete your workshop equipment. For joining and re-inforcing from approx. 26 s.w.g. up to any thickness Mild Steel, Wrought or Malleable Iron. Type F.M.65 Heavy Duty complete with all equipment 190/240 v. single ph. 10/15 amp. (or domestic power supply) delivered free, ex stock, (Cash or C.O.D.) **£25**
H.P. Terms. Illus. leaflet—Manufacturers.
Ferrous Transformers (MEC), Ltd., Church Rd., Croydon, Surrey. CRO 8351/3

CUT YOUR OWN HAIR
CUTS AS IT COMBS
Easier and quicker than clippers. PENN'S IMPROVED "EASYTRIM" The ONLY haircutter that requires NO SKILL—even a child can use it. Trims and taper-cuts evenly on head and removes untidy hair at neck and temples — Fitted specially designed sturdy blade, automatically fixed. Keeps gent's, lady's or child's hair always neatly trimmed. Saves £££s.
6/- POST 4d.
Three spare blades 1/- extra
Patent app.



Satisfaction or money back.
Send P.O. or cheque. NO MORE TO PAY.
Wm. PENN LTD. (Dept. PT), 585, High Road, Finchley, London, N.12

THE JEFFERY TRANSFORMER CO.
(Winders to the late Galpins)
199, EDWARD ST., NEW CROSS, LONDON S.E.14 TIDeway 4458
Leaflets sent gladly, on request

Save on Repairs with **GLASS FIBRE**

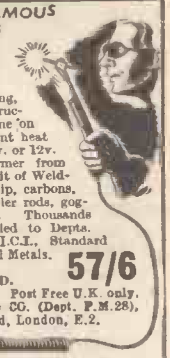
Reduced Prices More Materials		Plus Post
KIT I	12/6	2/-
KIT II	25/-	2/3
KIT III	30/-	2/6

KITS FOR CARS, ETC. £5.10 £9.10 carriage paid

These kits carry a comprehensive range of materials, with full instructions to suit all forms of car body repairs and model making. "Glass Reinforced Plastics" New Illustrated Booklet, 2/6 Post Free
WESTPOLE MOTORS LTD. 89, BRAMLEY RD., LONDON, N.14. PAL 8331

HEAR ALL CONTINENTS
WITH H.A.C. SHORT-WAVE RECEIVERS
Noted for over 18 years for S.W. Receivers and Kits of Quality. Improved designs with Denco coils:
One-Valve Kit, Model "C" Price 25/-
Two-Valve Kit, Model "E" Price 50/-
All kits complete with all components, accessories and full instructions. Before ordering call and inspect a demonstration receiver, or send stamped, addressed envelope for descriptive catalogue.
"H.A.C." SHORT-WAVE PRODUCTS, (Dept. P.M.), 11, Old Bond Street, London, W.1.

THE FAMOUS HARRIS ELECTRIC **WELDER** and Complete Kit



For Welding, Soldering, Brazing and metal construction & repairs in the home on the car or cycle. Instant heat 6,000° F. Works from 6v. or 12v. car battery or transformer from A.C. mains. Complete kit of Welding Tools, 9ft. cable, clip, carbons, cleansing fluid, fluxes, filler rods, goggles, instructions, hints. Thousands in daily use. As supplied to Depts. of H.M. Government, I.C.I., Standard Telephones, etc. Welds all Metals. Up to one-eighth inch.
C.O.D. IF REQUIRED. **57/6**
Obtainable only from: Post Free U.K. only.
HARRIS ENGINEERING CO. (Dept. P.M.28), 269 Kingsland Road, London, E.2.
Terms: 11/- dep. & 5 wkly. pmts. of 10/-

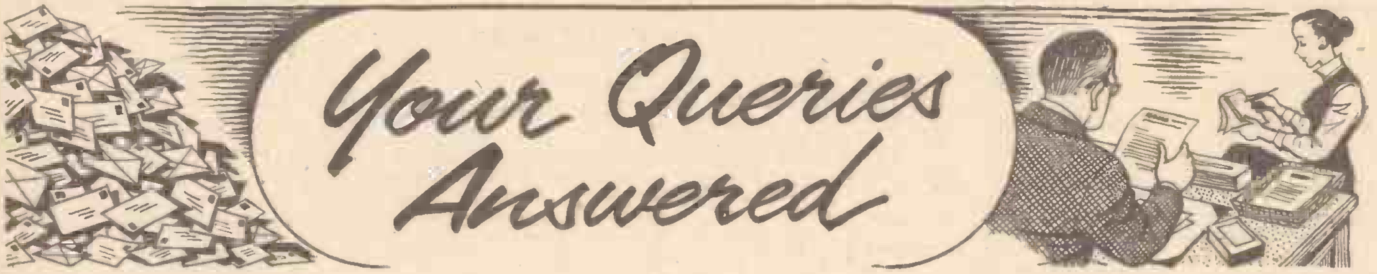
CHEMISTRY APPARATUS
Send 3d. stamp for
COMPLETE PRICE LIST

Booklets:
"Experiments" 1/2
"Formulas" 1/2
"Home Chemistry" new ed., 2/10
(Post Paid.)
BECK (Scientific Dept. A) 60 HIGH STREET
Stoke Newington, London, N.16

ACCURATE HARDHITTING **Webley** AIR PISTOLS

AIR RIFLES · ACCESSORIES
Write for catalogue WEBLEY & SCOTT Ltd.
106, WEAMAN ST., BIRMINGHAM 4, ENGLAND

BUILD YOUR OWN CANOE
Printed illustrated instructions 1/6
TYNE FOLDING BOATS LTD.
206 Amyand Park Road, St. Margaret's, Twickenham, Middx.



Electrical Losses

CAN you tell me if it is possible to drive a generator with an electric motor and the generator to supply the power to drive another motor of exactly the same size ?—W. G. Beechy (Herts).

THERE are internal losses due to friction, windage, windings' resistances, eddy currents and hysteresis in winding cores subject to changing magnetic flux, etc., in any machine in which electrical energy is converted into mechanical energy or vice versa. Consequently, whilst 746 watts is equivalent to one horse power, 746 watts input to a motor would not produce 1 h.p. output at the motor shaft, nor would 1 h.p. applied to the shaft of the dynamo give 746 watts output at the terminals. Thus your suggestion is impracticable and very old!

Material for Evaporative Type Cooler

I WISH to construct a cooler, operating on the principle of heat extraction by evaporation of water, and note that a proprietary model is constructed of a cement or plaster-like compound. Can you suggest: (a) A suitable material for the evaporating surfaces, not brittle and not of cloth or other material likely to attract mildew ? (b) A suitable mix for the "cement" used in the proprietary models ?—R. Riley (Surrey).

THE proprietary cooling boxes normally have a type of fire clay and asbestos slabbing which is highly absorbent and we would suggest that a mix composed of cement, asbestos fibre and vermiculite granules, mixed to a proportion of one part cement, four parts vermiculite granules and one part asbestos powder or fibres would give you a slab which is reasonably stable and fairly absorbent. With regard to the prevention of fungi, you will appreciate that any surface which is continually damp and open to the atmosphere is likely to give rise to a growth of mould or algae. Occasionally sterilising the surface with a sterilising fluid may be the best way, although you could bear in mind that where food is concerned sterilising fluids and disinfectants should be used judiciously.

Obstruction in the Water System

I HAVE cleaned my back boiler with a descalent with good results, but am rather concerned since it's been done with the noise and vibration it makes; also the water comes through rusty. The noise is an occasional dull thud. Can you tell me what is wrong, and how to cure the trouble ?—H. Stapleton (Mitcham).

IT sounds as if when descaling your boiler you have disturbed some rust or scale in another part of the system, which is holding up the flow of water into the boiler. There may, in fact, be some hemp inside the pipe if you have renewed any of the grommets.

Try clearing it, when the fire is out, by attaching a short piece of hose to the mains tap in the kitchen, with the other end over the hot tap; open the hot tap fully, then let the cold run at full bore for a few minutes. You may have to get some help to hold the hose on. If this does not clear the obstruction, it would be wiser to consult a plumber.

QUERY SERVICE RULES

A stamped, addressed envelope, a sixpenny, crossed postal order, and the query coupon from the current issue which appears on the inside of back cover, must be enclosed with every letter containing a query. Every query and drawing which is sent must bear the name and address of the reader. Send your queries to the Editor, PRACTICAL MECHANICS, Geo. Newnes, Ltd., Tower House, Southampton Street, Strand, London, W.C.2.

Remote Controlled Whistle

I AM building a model train set, and would like details concerning a remote system of controlling a "whistle effect" from one of the coaches.

The power supply is 12 volt D.C. but I believe the method is to superimpose A.C. on the D.C. for control.—G. Howard (E.14).

WE consider that you could only obtain a realistic whistle by employing air under pressure. It might be possible for you to fit a small blower on the train, this being driven by the engine. The air outlet of the blower could consist of an opening which can be restricted by means of a coil-operated baffle or similar device when a whistle is required.

This coil could be connected across the engine contacts through a small capacitor, so that only A.C. can pass through the coil. The secondary winding of a small transformer could be connected in series with the D.C. supply to the track, so that it merely acts as a slight electrical resistance when the primary winding of the transformer is not energised. When A.C. is fed to the primary winding, however, an alternating voltage will be induced in the secondary winding and injected into the D.C. voltage fed to the track to operate the whistle coil. In order to operate such a scheme we think that you would need to supply a fairly steady voltage to the train, as will apply if an accumulator is used to feed the train. If you use a rectifier for the train supply we think you will find it necessary to smooth this considerably in order to obtain satisfactory results with the suggested scheme.

Welding Wrought Iron

I AM interested in wrought iron work and to assist construction wish to make an electrical welding plant with which to "tack" the scrolls together prior to clipping together with forged clips, thus saving time.

I have one of the welders that run from a car battery and I find that on using this on scrolls of $\frac{1}{2}$in. × $\frac{1}{8}$in. W.I. the rod will fuse to each piece of iron, but will not join them together. I have been using rod covered with copper. To what is my lack of success due and what solution do you suggest?—M. Willis (Reading).

WE consider that the output of your welder is much too low for your purpose. For welding $\frac{1}{2}$in. by $\frac{1}{8}$in. wrought iron we would advise using a transformer having an open circuit voltage of about 80 volts and a full-load current of 50-80 amps, in conjunction with a choke coil for reducing the voltage between the electrodes to about 25 volts after the arc has been struck.

You could use 1/16 or 3/32in. dia. electrodes, which could be either of the bare or the covered type, in an electrode holder having an insulated handle and an insulating shield to prevent contact with the metal parts.

Paint Stripper

PLEASE give me a formula for a paint-stripper solution suitable for use on iron or woodwork.—A. J. Macklin (Berks).

USE a mixture of: caustic soda, 86 parts; soda ash, 14 parts.

This should be applied to iron with a stiff brush. Allow it to soak for some time and use a scraper vigorously.

THE P.M. BLUE-PRINT SERVICE

12FT. ALL-WOOD CANOE. New Series. No. 1, 4s.*

10-WATT MOTOR. New Series. No. 2, 4s.*

COMPRESSED-AIR MODEL AERO ENGINE. New Series. No. 3, 5s. 6d.*

AIR RESERVOIR FOR COMPRESSED-AIR AERO ENGINE. New Series. No. 3a, 1s. 6d.

"SPORTS" PEDAL CAR. New Series. No. 4, 5s. 6d.*

F. J. CAMM'S FLASH STEAM PLANT. New Series. No. 5, 5s. 6d.*

SYNCHRONOUS ELECTRIC CLOCK. New Series. No. 6, 5s. 6d.*

ELECTRIC DOOR-CHIME. No. 7, 4s.*

ASTRONOMICAL TELESCOPE. New Series. Refractor. Object glass 3in. diam. Magnification x 80. No. 8 (2 sheets), 7s. 6d.*

CANVAS CANOE. New Series. No. 9, 4s.*

DIASCOPE. New Series. No. 10, 4s.*

EPISCOPE. New Series. No. 11, 4s.*

PANTOGRAPH. New Series. No. 12, 2s.*

COMPRESSED-AIR PAINT SPRAYING PLANT. New Series. No. 13, 8s.*

MASTER BATTERY CLOCK.* Blue-prints (2 sheets), 4s. Art board dial for above clock, 1s. 6d.

OUTBOARD SPEEDBOAT. 11s. per set of three sheets.

LIGHTWEIGHT MODEL MONOPLANE. Full-size blue-print, 4s.

P.M. TRAILER CARAVAN Complete set, 11s.

P.M. BATTERY SLAVE CLOCK, 2s. 6d.

"PRACTICAL TELEVISION" RECEIVER. (3 sheets), 11s.

P.M. CABIN HIGHWING MONOPLANE. 1s. 6d.*

P.M. TAPE RECORDER.* (2 sheets), 5s. 6d.

The above blue-prints are obtainable, post free, from Messrs. George Newnes, Ltd., Tower House, Southampton Street, Strand, W.C.2.

*An * denotes constructional details are available free with the blue-prints.*

Sugar soap is the stripper usually used for wood and it should be washed off thoroughly after use. If the paint is very hard use the first mixture and again wash away all traces. Protect the hands with rubber gloves.

Metallising Ceramics and Glass

PLEASE tell me how ceramics, glass and carbon can be metallised so that they can be soldered to metal parts.—Michael Dimech (Malta).

FOR ceramics and glass, a coating of lustre (obtained from Messrs. Wengers Ltd., Stoke-on-Trent) is applied to the part and fired on at about 700 deg. C. Metal can then be soldered on to this part in the usual way, but co-efficients of expansion must be similar.

It is not possible to treat carbon in this way as it would volatilise in the presence of oxygen.

Running a 12-volt Motor off 6 Volts

IS it possible to convert a 12-volt Hoover blower (ex W.D. type) to operate off 6-volt supply and if so what modifications have to be made?—D. Reay (Oldham).

IN order to convert the 12-volt blower to operate on 6-volts you could reconnect the two field coils in parallel with each other, making sure that their magnetic polarity is unchanged and that they still create poles of opposite polarity. The set of field windings should then be connected in series with the armature. The motor will, however, then run at less than the speed obtainable under normal conditions on 12 volts.

If you wish to retain the normal speed you could reconnect the field coils as suggested above and rewind the armature; each armature coil should have half the present number of turns, using wire having twice the cross sectional area of the present wire, i.e., approximately 141 per cent. of the present diameter. The present coil span and connections between the armature coils and the commutator should be carefully copied.

Imitation Coal Fire

I WISH to convert an old oil burning convector heater into an electric imitation coal fire. Please tell me how to make the "coal fire" i.e., the coal, colouring, ashes, etc., which seem to be made up on a linen base.—W. A. Hurford (London, W.14).

YOU might build up the artificial coal portion on a base of Perspex or even glass. This could be covered with a piece of muslin. The ashes, etc., could be made from cotton wool, thoroughly soaked in a hard-setting non-inflammable adhesive and moulded to the required shape. When the saturated cotton wool is dry it sets hard, almost like cement. The black parts could be coated with cylinder black as sold for motor cycle engines, etc.

A flicker effect could be obtained by fitting a lamp under the artificial coal, with a small black propeller which revolves due to the heat waves created by the lamp. A polished aluminium reflector could be used if required.

Copying Device

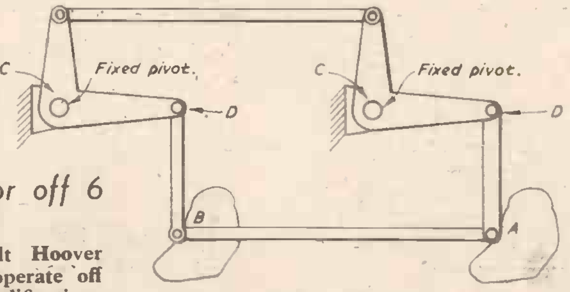
I AM endeavouring to plan a small profile burner with the profile wheel and burning nozzle in the same plane.

Is there a system of linkage which will allow two points to follow each other in parallel—profiling two figures of equal dimensions with a suitable gap between each figure?—H. R. Knaggs (Redcar).

THE linkage shown below causes B to repeat the movements of A and at distance A B.

The dimensions of the bell-crank levers should be such that the arms C D never make a greater angle than about 45 deg. with the direction of A B and the links D A and D B never less than 45 deg. with A B.

These limitations determine the minimum dimensions of C D. D A and D B from the maximum size of the figure to be traced by A.

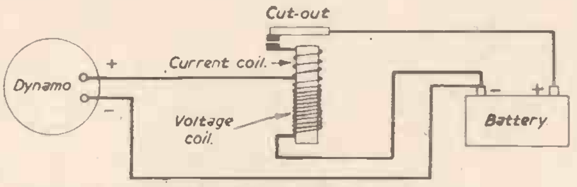


Copying linkage.

Battery Charging

SOME time ago I purchased a hand generator, 6-volt 5-amp., army surplus type. I wish to use this to boost a 6-volt car battery, and I believe it can only be done if a cut-out is used. Please advise me how to connect the generator and the type of cut-out required.—O. Mirfin (Sheffield).

WE presume that you intend to drive the generator at a constant speed so that a steady voltage is obtained. In order to charge a 6-volt battery fully we advise a voltage of about 8.1 volts, so that it may be advisable to drive the generator at more than normal speed. If the machine has a permanent-magnet field system, about 34 per cent. extra speed is suggested. You could use a motor car cut-out connected as shown below.



Using a motor car cut-out.

Circular Saw Speed

I HAVE recently bought a Hoover ¼ h.p. 1400 r.p.m. electric motor, which I use to drive either a small circular or band saw.

Could you give the r.p.m. necessary for these saws, size and type of blades most suitable, etc?—D. McGrath (Kent).

WE advise you to read carefully some notes on the subject because much will depend on the material being cut. If you study the chapter in "Newnes Engineer's Reference Book" entitled Saws and Sawing, you will then be able to decide the most suitable speed for the metal or wood you propose to deal with.

We suggest you adopt the three-cone pulley idea, and use a vee belt in preference to the flat variety as this will give a shorter drive. Messrs. J. H. Fenner Ltd., of Heckmondwike, Yorks are suppliers of this form of belting.

The table giving the saw velocity in the above book will enable you to calculate quite easily the necessary speeds.

Lamp Device

IN a shop window I saw a lamp on top of which was a glass jar containing two liquids which did not mix. The heavier liquid which was coloured red, when warmed, formed a bubble or globule, which rose to the top, cooled, and sank again. Could you tell me what the two liquids are and where I might be able to purchase them?—C. P. Chouler (Southampton).

WE understand that the two liquids are water at the top and carbon tetrachloride at the bottom; the latter being obtained as Thawpit, or Pyrene fluid. The container my be evacuated to boil the carbon tetrachloride and expel the air, the container then being sealed.

Cleaning Unglazed China

I HAVE some genuine "Wedgwood" china, blue and white, and green and white, which has become stained in places. As it is unglazed it is not just a case of washing the stains off. Can you tell me how to remove them without damaging the base of colour, as the china is valuable?—G. D. M. Fisher (Oxford).

IT is problematical whether the stains are of a greasy nature; probably they are. Try first boiling the piece in soda water for as long as may be necessary; if this does not move the stain, boil in "Chloros," which is apparently, a solution of chloride of lime. Immerse the china and bring to the boil. If these, either of them, have no effect try a small spot with hydrochloric acid applying it with cotton wool on a small stick. Do not get any acid on your fingers. Wash with soda water to neutralise the acid.

Information Sought

Readers are invited to supply the required information to answer the following queries.

Electric Rifle

PLEASE can you give details of an electric rifle? How is the beam from the rifle projected on to the target? When the trigger is pulled it projects a beam, in fact a flash, that pinpoints the target wherever the rifle is aimed.—H. C. HUMMELL (London, N.19).

Doubling Number of Exposures

MY camera takes 12 pictures on a 120 film, and I wish to double the number of exposures when using colour. At present the numbering is by means of the film-winding knob which is numbered 1-12; how can I adapt this?—F. D. BRIDGETT (Nottingham).

Glass-beaded Ciné Screen

WHAT is the correct method of making "glass beaded" Ciné projection screen material? The glass beaded substance is called "Ballotini," the type used is .008in. in diameter, a canvas or leathercloth material is given a coating of an adhesive, and then the Ballotini is sieved on to it. What is the exact method of application and embedding the Ballotini at the correct depth? M. GOLD (London, N.18).

A Censer

COULD you supply me with details for making a censer to burn incense?—JASPER G. MILLAR (Fife).

BELL Woodworking Company

Britain's Leading Boat Kit Manufacturers

BUILD YOUR OWN BOAT

during the long winter months

Sailing Dinghies, Runabouts, Cruisers

Details of all these and much information on boat building generally are given in our booklet

HOME BOAT BUILDING

Price 3/- post free.

IF IT'S BELL IT'S THE BEST

Bell Woodworking Co. Ltd.

Narborough Road South, Leicester.

Ensure success with a BELL Kit

GOVERNMENT SURPLUS BARGAINS

TRIPODS. Unused. 38" long, only 5 lb. wt. Immensely strong. Carrying sling. Brass cap easily adapted to camera, etc., etc. Each 12/6, post 2/6.
LOW VOLTAGE MOTORS with REDUCTION GEAR, approx. 4/1 (24-45-90) 6-12 v. D.C., 1 amp., ea. 15/-, post 1/9.
MOTOR ONLY as above (dimensions 3" x 2" x 2") ea. 7/6, post 1/6.
BATTERY CHARGING TRANSFORMERS, 11 v. & 17 v. A.C (for 6 & 12 v. charging at 1 amp.). ea. 17/6, post 1/9.
RECTIFIERS to suit above, ea. 9/-, post 8d.
(These transformers & rectifiers will run the above low voltage motors.)
TEST METERS. Moving Coil. 0/1.5 v., 0/3 v., 0/60 m.Amps. ; 0/5,000 ohms. In beautiful case 4" x 4" x 2½" with selector terminals and switch. Wonderful Bargain. 15/-, post 1/6.
POCKET VOLTMETERS. Moving Coil 0/15 v., 0/250 v. 15/-, post. 1/6.
MOTORS. 200/250 v. A.C./D.C. FHP, approx. 80 watts. High speed. ¼" shaft. (Converted ex R.A.F. motor generator—power about equal to sewing machine motor.) Useful addition to workshop, ea. 30/-, post 2/9.
Send 3d. stamps for list of other Motors, Transformers, Pumps, Lamps, Switches, etc., etc.

MILLIGANS
24, Harford Street, Liverpool, 3
Money Back Guarantee.

SERIES III

NUCLEAVE PRESS

CROPS RIVETS PUNCHES

Ask your Tool Dealer or send for details to :—

Sole Manufacturers.

FITZNER LTD.
197-199, KINGS ROAD, KINGSTON-ON-THAMES

'SUNDIAL' PRECISION ★ WOODWORKING MACHINES

4in. PRECISION PLANING MACHINE

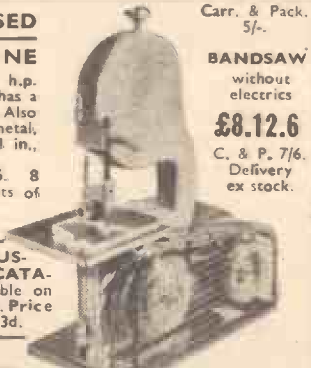
fitted with circular cutter block with 2 steel blades, adjustable and tilting fence fitted. Machine will rebate. Overall length of machine 15½in.

PRICE **£8.17.6** Deposit 17/6. 8 monthly payments of £1.4.4. Carr. & Pack. 5/-.

NEW 7in. THROAT MOTORISED BANDSAW MACHINE

Complete on rigid base and motorised ¼ h.p. 230/250 volts electric motor. This machine has a tilting table, will cut wood up to approx. 2in. Also fitted with 3 speeds. Ideal for cutting wood, metal, plastics and alloys, etc. Height of machine 21 in., weight 56lb.

PRICE **£16.17.6** Deposit £1.13.6. 8 monthly payments of £2.1.9.
Delivery ex stock.
Carr. and Packing 12/6.



BANDSAW without electrics **£8.12.6** C. & P. 7/6. Delivery ex stock.

★ **1958 FULLY ILLUSTRATED TOOL CATALOGUE** now available on request to Dept. PM10. Price 6d. Postage 3d.

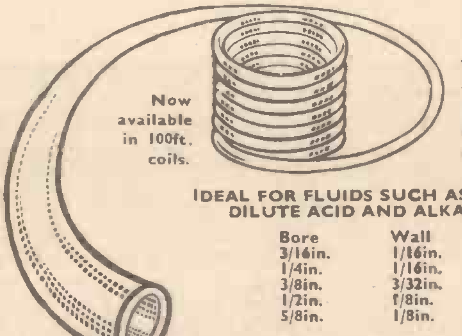
NEW 7in. "SUNDIAL" PRECISION SAW BENCH

Table size 14in. x 13in. fitted with rise and fall spindle, table will tilt 45 degrees. Machine complete with rip fence and mitre fence. PRICE **£12.5.6** Delivery ex stock. Carr. & Packing 9/-.
Deposit £1.5.6. 8 monthly payments of £1.10.3.

SHOreditch 9422-9423-9424

PARRY & SON (Tools) LTD.
329-333, OLD STREET, LONDON, E.C.1.

CRYSTAL CLEAR FLEXIBLE P.V.C. TUBING



Now available in 100ft. coils.

This non-perishing thermoplastic tubing, which possesses glass-like clarity, has a multitude of industrial uses.

IDEAL FOR FLUIDS SUCH AS CUTTING OILS, FUELS, DILUTE ACID AND ALKALI SOLUTIONS, ETC.

Bore	Wall	Per 100ft. coil	
3/16in.	1/16in.	£1.11.0	P. & P. 2/–
1/4in.	1/16in.	£1.19.0	P. & P. 2/3
3/8in.	3/32in.	£4.16.0	P. & P. 3/3
1/2in.	1/8in.	£7.14.0	P. & P. 3/6
5/8in.	1/8in.	£9.17.0	P. & P. 4/–

Trade enquiries invited for large quantities at special prices.

TENSILE PRODUCTS LTD.
70, Willoughby Road, HARPENDEN, Herts. Tel. : Harpenden 3515

SOLID LEATHER BLACK ARMY DESPATCH RIDERS BOOTS ONLY 25/- POST ETC. 3/-

NEW. Send 25/- only, plus 3/- post & handle on free 7 days' approval. Cash plus return postage instantly refunded if not worth £6.6.0. Take them to your boot dealer for independent valuation. Full chrome leather of finest quality, calf length. Soles & heels are of finest HEAVY LEATHER, sewn, pegged and riveted. By best makers in country, every pair bearing maker's name, which cannot be published. Unissued. Ideal M/Cyclists, Outdoor workers, Farmers, Riding, Fishing, etc. Ideal Jackboot. Sizes 5 to 13.

ROYAL CANADIAN ADMIRALTY ★ NEW HEAVYWEIGHT OILSKIN **SIMPLEX COATS** *Storm & Blizzard Proof*

FURTHER SENSATIONAL REDUCTION TO **10/11** POST ETC. 2/7

Meets most stringent Government specifications. Outdoor work, country wear, sports use, etc. Extra full length coat, fully lined shoulders, sleeves. Generous wrap-over, two deep pockets with flaps. High outdoor collar. Olive-green. Chest 36 to 44. 10/11, post 2/7. List, Clothing, Footwear, Tents, Marquees, Camping Equipment, Sleeping Bags, Binoculars.

HEADQUARTER and GENERAL SUPPLIES LTD.
(DEPT. PMC 35), 196-200, COLDHARBOUR LANE, LOUGHBOROUGH JUNCTION, LONDON, S.E.5. Open all Saturday. 1 p.m. Wednesday.

HIGHSTONE UTILITIES

SOLDERING IRONS. Our new streamlined iron is fitted with a Pencil Bit. 200/250 v. 50 watts, 11/6, post 1/-. **Standard Iron** with adjustable bit, 200/250 v. 60 watts, 13/6, post 1/-. **Heavy Duty Iron,** 150 watts, 18/6, post 1/6. All parts replaceable and fully guaranteed. **Small Soldering Irons,** for use on gas, 1/4, post 8d. Resin-cored solder for easy soldering, 6d. packets or large reels 5/-, post 9d.

Ex-R.A.F. 2-valve (2 volt fil.) MICROPHONE AMPLIFIERS as used in plane intercom., in self-contained metal case ; can be used to make up a deaf-aid outfit, intercommunication system, or with crystal set ; complete with valves and fitting instructions, 20/-, post 3/-. Useful wooden box with partitions to hold amplifier, 2/- extra.
AMPLIFIERS, less valves, but containing resistances, condensers, transformers, switches, etc., 10/-, post 3/-.

SPARKING PLUG NEON TESTERS, with vestpocket clip, 3/3, and with gauge, 3/6, post 4d. **S.B.C. Neon Indicator Lamps,** for use on mains showing "live" side of switches, etc., 2/6, post 4d. **Neon Indicator,** complete with condenser (pencil type), with vestpocket clip, indispensable for electricians, etc., 7/6, post 5d.

BELL TRANSFORMERS. These guaranteed transformers work from any A.C. Mains, giving 3, 5, or 8 volts output at 1 amp., operate bulb, buzzer or bell. Will supply light in bedroom or larder, etc. **PRICE 9/-,** post 1/-. **Similar Transformer** but with output of 4, 8 or 12 volts, 13/6, post 1/6. **BELLS** for use with either the above or batteries, 6/6, post 6d. **"Big Ben" Chimes.** Housed in Cream Plastic Case. Easily connected to give Two-Note Chime from Front Door, and Single Note from Rear. Operated from 6-9 volt Batteries or Transformer (shown above), 23/9, post 1/6.

CRYSTAL SETS. Our latest Model is a real radio receiver, which is fitted with a permanent crystal detector. Why not have a set in your own room ? 12/6, post 1/-. Spare Permanent Detectors, 2/- each. When ordered separately, 2/6. With clips and screws, 2/10, post 3d. Special Crystal Diodes, 2/6, post 3d. Headphones, brand new, S. G. Brown, G.E.C., etc., 23/- and super-sensitive, 30/- a pair, post 1/6.

HEADPHONES IN GOOD ORDER, 6/-. Better quality, 7/6 and 10/-. Balanced armature type (very sensitive), 13/6. All post 1/6. **New Single Earpieces,** 3/6. Balanced armature type, 4/6 (two of these will make an intercom. set or Baby Alarm). Ex-R.A.F. earpiece, 2/6, all post 6d. **Headphones,** with moving coil mike 15/-. Similar phones with throat mikes, 12/6, post 1/6. **Headphone Cores,** 1/3 a pair, post 3d. **Replacement Bands,** 1/3, post 6d. **Wire Bands,** 6d. **(All Headphones listed are suitable for use with our Crystal Sets.)**

HAND MICROPHONES with switch in handle and lead, 5/6. **Tannoy** 7/-. Similar instrument, moving coil, 8/6. All post 1/6. **Mask** type with switch, 3/6, post 6d. **Mike Buttons** (carbon), 2/-. **Moving Coil,** 3/6 ; **Transformers,** 5/-. All post 4d. each. **Throat Mikes,** 5/-, post 7d.

MORSE KEYS. — Standard size keys wired to work **Buzzer or Lamp,** 3/-, post 8d. Slightly smaller keys, 2/6, post 6d. **BUZZERS,** 4/3, post 5d.

Terminals, brass 2BA, mounted on strip, 6d. pair. .0005 **Airspaced Variable Condensers,** 2/6, post 6d. .00003 twin gang with trimmers, 2/6, post 6d. 24 volt, 15 mm., **M.E.S. Bulbs** for model railways, etc., 1/- each, 10/- doz., post 4d. **Wander Plugs,** Brass, 1/6 doz., post 4d. **Fuses.**—1 amp ; 1¼in. packet of 10, 2/6, post 4d. Also 150 mA. and 250 mA., same price. Ex-G.P.O. Telephone **Twin Bells,** with box, 5/-, post 1/6. **Single Telephone Bell,** 3/6, post 9d. **Magnets,** extra strong, 2in., 1/3, post 4d.

TELEPHONE HAND GENERATOR. G.P.O. type, giving 70 volts for ringing bells, etc., 8/6, post 2/-. Telephone hand comb sets, 12/6, post 1/6.

Bargain Parcels of really useful equipment, containing Switches, Meters, Condensers, Resistances, Phones, etc., 10/-, or double assortment, 17/6 ; treble, 25/-. All carriage 3/-. This country only.

METERS. 20 amp. 2in. m/c, 8/6 ; 20 v. 2 in. m/c, 8/- ; 150 v. 2in. m/c. 10/- ; 3.5 amp. 2in. T.C., 6/- ; 4 amp. 2½in. T.C., in case with switch, 9/6 ; 100 mA. 2in. m/c, 7/6 ; all post extra. Meter units containing 2-500 microamp. movements. 9/-, post 1/6.
Money refunded if not completely satisfied.
STOP PRESS. We can supply the parts for the one-valve set, as shown by the B.B.C. in Studio E.

HIGHSTONE UTILITIES
58 New Wanstead, London, E.11
Letters only.
New Illustrated List sent on request with 2d. stamp and S.A.E.

BATTERY CHARGERS

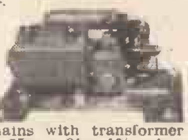
Input 200/250 volts A.C., 50 cycles Output 10 amps., 22 volts D.C. Controlled by two 4-position switches for fine and coarse control which enables 6 to 24 volts batteries to be charged. Made by G.E.C. Brand new with 0/12 ammeter. Fused A.C. and D.C. £17 10s., carriage, 15/-.

NIFE BATTERIES. Practically indestructible. 1.2 volts. 75 amps. Alkaline filled. Any voltage can be built up. Brand New. 25/- each, carriage 5/-.
NIFE BATTERIES. 1.2 volts, 3 amps. 2¼in. x 3¼in. x 1in. overall, 5/- each, 48/- doz. Post 2/-.
"VENT AXIA" EXTRACTION FANS. 230 volts A.C. 6in. blades. Ideal for ventilating kitchens, etc. Easy to fix. Silent running. 130/-, post 3/-.
LARGER TYPES FOR CAFES, HOTELS. "XPELAIR." 7¼in. blades with baffle outlet, 190/-, cge. 7/6.
MEGGER Circuit Testing Ohmeter. 2 scales 0/1000 Ω and 100 200K Ω inf. with test prods. Brand New, £4.17.6. Post 3/-.
"WEE MEGGER" 500 volts in leather case. Brand New, £12.10.0. Post 3/-.
HEATING ELEMENTS. Flat enclosed type 230 volts 500 watts. "Bray Chromalox." 10in. x 1¼in., 7/6. Post 1/6.

VACUUM PUMP
Brand New 7 cu. ft. per min. 10 lbs. per sq. in. at 1,200 r.p.m. Rotary Vane type 35/- each, post 3/-.

SOLENOIDS. 12 volts D.C. with a 3¼in. lever, very powerful. Ideal for Model Railways, etc., 5/- each, post 1/6.
ROOM THERMOSTAT. Adjustable 45 to 75 deg. Fahr. 250 volts 10 amp. A.C. Ideal for greenhouses, etc., 35/-, Post 2/-.
INSPECTION LAMP. Fits on forehead, leaving hands free, battery case clips on belt. 7/6, post 1/6. Takes E.R. Battery No. 1215, 2/9. Post 9d.
ELECTRIC MOTORS. 200-250 v. self-starting, 1 r.p.m., 35/-. Post 1/6.
PORTABLE BLOWER. 200/250 v. A.C./D.C. 300 watts with switch and leads. 1½in. outlet, £5. Post 3/6.

BULKHEAD FITTING. 9in. diam., flat tripod type, suitable for lamps up to 100 watts, complete with pushbar switch lampholder. Ideal for farm buildings, garages, greenhouses, etc., brand new, 17/6. Post 2/6.
TELEPHONES SOUND POWERED. No batteries required. Just connect with twin flex for clear speech, can be used as a room-to-room telephone, extension speaker, baby alarm, etc. Crystal clear reception. Transmitter Receiver Units. 4/6 each. Twin Flex, 4½d. yard. Post 1/-.



GEARED MOTOR for the model maker, small and very powerful. 4 r.p.m. at 12 v. D.C. or 8 r.p.m. at 24 v. D.C. 35/-, post 2/6. Works from 230 v. A.C. mains with transformer and rectifier. 12 v., 25/-, or 24 v. 40/- extra.
TELEPHONE SETS. MODERN DESK TYPE, £8.17.6 per pair, complete.

METERS GUARANTEED

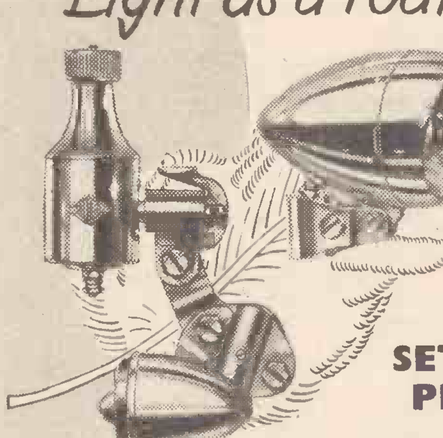
F.S.D.	Size	Type	Price
50 Microamps	2½in.	MC/FR	70/-
100 „	2½in.	MC/FR	50/-
250 „	3½in.	MC/FR	55/-
500 „	3½in.	MC/FR	27/6
500 „	2½in.	MC/FR	37/6
·1 Milliamps	2in.	MC/FS	27/6
1 „	2½in.	MC/FR	35/-
5 „	2in.	MC/FR	17/6
30 „	2½in.	MC/FR	12/6
100 „	2½in.	MC/FR	12/6
200 „	2½in.	MC/FR	12/6
300 „	2½in.	MC/FR	12/6
5 Amperes	2in.	MC/FS	27/6
15 „	2in.	MC/FR	10/6
25 „	2½in.	MI/FR D.C.	7/6
30-0-30 „	2in.	MC/FR	15/6
50-0-50 „	2in.	MC/FS	12/6
20 Volts	2in.	MC/FS	10/6
40 „	2in.	MC/FS	10/6
300 „ A.C.	2½in.	MI/FR	25/-
300 „ „	6in.	MI/FR	110/-

TERMINAL BLOCKS. 2-way fully protected No. 5C/430, 4/- doz., 50 for 15/-; 3-way 6/- doz.; 50 for 22/6. Post 1/6.

CROSSPOINTER METER with 2 separate 100 microamp movements. Brand New, 22/6. Post 2/-.
HEADPHONES. High resistance 4,000 ohms. Type CHR, 12/6 pr. Post 1/6.
HEADPHONES. High resistance, very sensitive. Balanced Armature. Type DHR, 17/6 pr. Post 1/6.

L. WILKINSON (CROYDON) LTD.
19, Lansdowne Road, Croydon.

Light as a feather!



SET No. 535T
PRICE 35/-

Here is an entirely new conception of cycle lighting. The ultra lightweight headlamp of this model weighs only 5½ ozs.—perhaps not quite as light as a feather—but it's the perfect answer for the keen clubman who wants light without weight. This compact set will give years of reliable lighting at any speed. Finished in chromium plate throughout.

MILLER

CYCLE DYNAMO LIGHTING SETS

H. MILLER & CO. LTD
ASTON BROOK STREET · BIRMINGHAM 6

METALS
AND ACCESSORIES

ALUMINIUM, BRASS, COPPER, STEEL, ETC.

Angle, Sheet, Tube, Foil, Strip, Channel, Rod, Bar, Wire, Moulding, Etc. Tin Plates, Silver Steel, Expanded Metal, Blanks, Rivets, Springs, Etc. Tools. Drills, Taps, Dies, Screws, Etc.

Formica, Perspex, Pegboard, Paxolin, Ebonite, Curtain Rail and Rod, Adhesives. Etc., and many other items for use in Home, Workshop, Etc.

LARGE or **SMALL** Quantities — **COMPARE** our **PRICES**
MAIL ORDER SERVICE (2d. stamp for list) — **IMMEDIATE DESPATCH**

CLAY BROS. & CO. P.M. 11
6a SPRINGBRIDGE ROAD, EALING, W.5
Phone: EALing 2215
2 MINS. EALING BROADWAY STATION, OPPOSITE BENTALLS

Picture this — MYFORD

ML7
3½" LATHE
IN YOUR WORKSHOP

Better still send to DEPT. 4/43 for fully illustrated details and prices of the most popular 3½in. Centre Lathe ever manufactured. Large range of Attachments available for Milling, Taper Turning, Dividing, etc.

MYFORD ENGINEERING Co. Ltd. BEESTON · NOTTINGHAM

Extra Special Carb. Grinding Wheels Offer. 6"-7" dia., 1/4", 1/2", 3/4" thick. 1/2" or 3/4" hole, 10/- the three, postage 2/-. Value over 30/-, 6 for £1, post paid. Ass. grits for tool and cutter grinding, also 5" dia. dish wheels, 1/2" hole, 4/9 each.
H.S. Reamers clearance, No. 1 M.T. shank, sizes, 7/32", 3/8", 7/6 pair.
Fine Ground Thread Taps for instrument work, 1/4"-7/8" dia., 8 ass., 6/-. Actual value around £4.
H.S. Taper Pin Reamers, sizes 4, 5 and 7, 12/- for 3.
1,000 **H.S. Inserted Blade Expanding Reamers,** 17/32", 19/32", 15/- each; 21/32"-23/32", 16/- each; 23/32"-25/32", 17/6 each; 25/32"-27/32", 18/6 each; 27/32"-31/32", 18/6 each; 15/16"-1 1/16", 20/- each; 1 1/16"-1 3/16", 27/6 each.
200 **Cast Steel Circular Saws** for wood, 4" dia., 7/6 each; 6" dia., 12/- each; 8", 16/6 each; 10", 22/6 each; 12", 28/6 each. Please state size of hole required and if rip or cross cut teeth.
300 **Lengths Precision Ground Silver Steel,** 36" long, 5/16" dia. 4/- 9/16" dia., 10/-; 5/8" dia., 12/6 per 3' length.
3,000 **High Speed Routing Cutters,** straight shank, two lip, as used for cutting slots in wood, sizes 3/8", clear 4/- each.
10,000 **H.S. Super Quality Tool Bits,** 1/4" square, 2 1/2" long, 15/- doz. 5/16" square, 3" long, 20/- doz. 3/8" square, 3" long, 25/- doz. 7/16" square, 3 1/2" long, 30/- doz. Ground finish.
5,000 **High Speed Slitting Saws and Slotting Cutters,** 2 1/4" dia., 5/8" bore, 0.045", 0.051", 0.057", 0.064" thick, 3/9 each. 2 3/4" dia., 1" bore, 0.036", 0.048" 0.051", 0.056", 0.064", 0.072", 0.080" thick, 3/9 each. 3" dia., 1" bore, 3/64", 5/64" thick, 6/- each. 3 1/2" dia., 1" bore, 3/64", 9/64", 5/32", 11/64" thick, 7/6 each. 4" dia., 1" bore, 5/64", 7/64", 7/32" thick, 8/6 each. 5" dia., 1" bore, 5/64" thick, 12/6 each. 3/16" thick, 12/6.
500 **Whitworth Screwing Tackle Sets** with bright polished steel diestock, dies 2 1/4" dia., cutting 9/16", 5/8", 3/4", 7/8", 1" Whit., 50/- per set. Also B.S.F. ditto, 50/- per set. Only a third of real value.
1,000 **High Speed Side and Face Cutters,** 2 1/2" dia., 1" hole, 1/4", 3/8", 1/2" thick, 15/- each. 3" dia., 1" hole, 1/2", 5/8" thick, 20/- each. 3 1/2" dia., 1" hole, 3/8", 3/4" thick, 25/- each. 4" dia., 1" hole, 7/8", 1" thick, £2 each 5" dia., 1 1/4" hole, 1/2", 3/4" thick, 50/- each.
All items brand new. £1 orders post paid, except overseas
1,000 **H.S. Long Straight Shank Twist Drills** approx. 1/16" and 3/32" dia. both 4 3/4" long, 2/6 pair. Approx. 3/16" and 3/8" dia., 6" and 7" long, 5/- the two. 9/64" dia., 11" long, 3/6 each. Approx. 13/64" dia., 10" long, 4/6 each.
200 **H.S. Spot Facing Cutters,** 1 1/4" dia., 1/4" dia. detachable pilot. No. 2 M.T. shank. An essential tool for facing bolt holes on castings Worth 45/-. Gift 12/6 each.
500 **Sets Hex. Die Nuts.** Sizes 1/4", 5/16", 3/8", 7/16" and 1/2" Whit. B.S.F. American Car thread or 26 brass thread. These sets are in a neat case. Present day value over 30/- per set, to clear 15/- per set any thread. Two sets 28/6, four sets, 55/-. Also 5/8" and 3/4" in Whit. and B.S.F. only, 5/8", 5/- each; 3/4", 6/- each, 10/- per pair.
1,000 **H.S. Morse Taper Shank End Mills.** No. 1 shank 1/4" 5/-, 3/8", 6/-, 1/2", 6/6, also No. 2 shank, 9/16" 10/-, 5/8", 11/-, 3/4", 12/-, 7/8", 12/-, 1", 15/-. Also straight shank H.S. 5/16", 3/6, 3/8" 4/-, 1/2", 5/-, 7/8", 10/-.
2,000 **Small H.S. Twist Drills,** approx. 1/32", 3/32", 4/- doz. Approx. 1/16"-1/4", 7/6 per doz. Approx. 9/32"-15/32", six for 10/-.
3,000 Circular Split Dies, 1" dia. cutting 1/4", 5/16", 3/8", 7/16", 1/8" Whit. B.S.F., also brass thread, 26 thread all sizes and American N.F. 12/- per set of 5 sizes, 2 sets 22/6, 4 sets 42/6. Taps to suit, 12/6 per set either taper or second or plug. 1" dia. stocks 6/- each.
1,000 **Hand Reamers,** 5/16" 3/6 each. 5/8", 4/9 each.
7,000 **Pratt & Whitney** circular split dies, superior quality precision ground cutting edges, 13/16" dia. suitable for machine or hand use. Sizes: 2, 4, 5, 6, B.A., 8/6 per set 13/16" die stock 3/6 each.
5,000 **Ball Races,** 1/8" bore, 3/8" o.d., 1/8" thick, 4/- pair; 1/4" bore, 3/4" o.d., 7/32" thick, 4/- pair; 6 mm bore 19 mm. o.d. 6 mm. thick, 4/- pair; 9 mm. bore, 26 mm. o.d., 8 mm. thick, 4/- pair; 3/8" bore, 7/8" o.d., 7/32" thick 5/- pair; 3/16" bore, 1/2" o.d., 5/32" thick, 4/- pair.
2,000 **Files** 4"-6" good assortment, 10/- doz., also toolmakers' needle files ass., 12/6 doz. 3" sq. saw files, 10/6 doz.
Metal Marking Punches sizes 3/32", 1/8" and 1/4" figures, 8/6 per set, letters 25/- per set, any size. 1/2" figures, 15/- set.
2,000 **Straight Shank End Mills,** size 1/8", 5/32", 3/16", 7/32", 1/4", 5/16", list price 30/- set, 15/- set, also 3/8", 7/16", 1/2" ditto, 12/6 set.
500 **H.S. 90° Countersinks,** body 1/2" dia. Gift 5/- each.

J. BURKE
192, Baslow Road, Totley, Sheffield.

Inspection Rear 36, Fitzwilliam St., Sheffield.

THE Cyclist
Editor : F. J. CAMM
VOL. XXVII OCTOBER, 1958 No. 435

All letters should be addressed to the Editor, "THE CYCLIST," George Newnes, Ltd., Tower House, Southampton Street, Strand, London, W.C.2

Phone: Temple Bar 4363
Telegrams: Newnes, Rand, London

WHAT I THINK By F. J. C.

Don't Mix Religion With Sport!

IN the August issue I made some comments, which I here reaffirm, emphasise and underline, that religion and politics should not be mixed with cycle sport, and equally cycling sport should not be used as a canvassing medium for a particular brand of politics or religion. People join a cycling club for the sport of cycling and it should be possible for cyclists of all political and religious denominations to join in without having to segregate themselves into groups according to their political or religious beliefs. There is one such club in this country, for example, which is allied to a political party. It has failed to establish itself as a national organisation for that very reason and its views are never sought by Government departments. When a club insists upon allegiance to a particular religion or brand of politics, there are ulterior motives, and the sport of cycling is being used to enhance them. My comments in the August issue were, of course, prompted by an appeal by the St. Christopher's Catholic C.C., which claims to have a "national" membership of about 800. Membership of this club is confined to Roman Catholics. If religion means anything at all, it should mean that all members of the church, whatever the brand name of their religion, should be able to enjoy the sport together.

Mr. C. Whittaker, who calls himself the "National Public Relations Officer," has written to me on this subject, from which it would appear that this club is attempting to become a national club like the C.T.C. There is no room, nor is there any need, for another national club, especially one which collects its members according to its religious faith. Otherwise, we could have a Protestant Cycling Club, a Jewish Cycling Club, a Methodist Cycling Club, a Tory Cycling Club, and so on, each claiming to be national. People are quite free to follow whichever faith they have chosen without interference and their faith is respected by those who are not of the same denomination. In his letter to me, Mr. Whittaker says that St. Christopher's Club enables members to follow their sport and at the same time to practise their religion by providing opportunities not normally available in other cycling clubs. This is utter nonsense. Whatever your religious faith, cycle sport need not interfere with it. He says that there is no coercion or indoctrination to produce religious conversions. Of course not! How can there be when you have to be a Roman Catholic before you join? I made no imputation to the contrary. The common interest of a cycling club should be sport not religion.

I do not withdraw anything which I have written on this matter. Another reader, Mr. George Gould, of Stockport, writing on this subject, and adopting the Russian method of suppressing too shrewd a criticism, says that he has removed the cutting from the issue so that his members may not read my words. This attitude rather lends point to my comments.

Many years ago the subject of Sunday cycling sport was hotly debated and religious hotheads of all denominations went virulently to the attack in the support of the "Go-to-Church-on-Sundays" movement. The tenets of Christianity which they professed to follow were singularly lacking in their statements, which were full of venom, malice and hatred, not in the best traditions of the Lord's Day Observance Society, which has done its best for years to make Sunday a day of misery. Fortunately, prominent members of the church are turning against this curious body which wishes to force its method of spending Sunday on the rest of the community. The passing of the recent decades, however, has shown that these religious fanatics have lost the battle, and a good thing too, for there can be nothing irreligious about holding cycle sports meetings on Sunday. They take place throughout the year in Ireland which is a Roman Catholic country and so does football. It is high time that the Government repealed the various archaic laws upon which this society depends for its killjoy policy.

The old "Spread Eagle" at Midhurst, Sussex.

The Cycle Show

AN analysis of the pre-show releases from manufacturers of their exhibits at the Cycle Show, makes it apparent there will be no surprises except, perhaps, in the field of scooters and lightweight motor cycles. The bicycle for 1959, therefore, will be very much what it is to-day with minor improvements.

On the other hand, accessory manufacturers year by year introduce new designs which greatly add to the convenience of cycling and the manufacturers of special clothing are continually improving their products and increasing their ranges. I feel that the proper place for cycle gears is in the bottom bracket, and I think that this coupled with a shaft drive is due for reintroduction.

If you wish to attract newcomers to the pastime, it should be with the intention not only of selling them a bicycle but of making them life-long cyclists, and this can only be done by introducing some radical changes in design, particularly in the direction of comfort.

Our Stand at The Cycle Show

All readers will be welcome at our Stand No. 13 at The Cycle Show at Earls Court, which opens on November 15th and closes on November 22nd.

Chain Alignment

How to Obtain it Correctly

Fig. 2.—*Sighting along the chain.*

ONE of the chief causes of chain wear, chain breakage and a chain which is perpetually jumping from the sprockets is incorrect lining up of the chain-wheel and sprocket. This means that the chain does not run in a straight line, as can be seen at A in Fig. 1. There are a number of reasons why a chain may be out of line, and these include a bottom bracket spindle of the wrong length, uneven or incorrect spacing washers on the spindle of the rear wheel and the wrong amount of packing behind the sprocket. The correct method of adjustment is by means of these packing washers behind the sprocket, so the first step is to ensure that a bottom bracket spindle of the correct length is fitted (i.e., not a gear-case clearance type). Next pack the spindle of the rear wheel with spacing nuts (exactly the same amount of packing being put on both sides) until the wheel fits exactly in the rear forks without having to bend them at all. Finally pack the rear sprocket until it is directly in line with the chainwheel. Lining up can be done in two ways—either by sighting along the chain when everything is in place (see Fig. 2) or by means of a long metal straight edge.

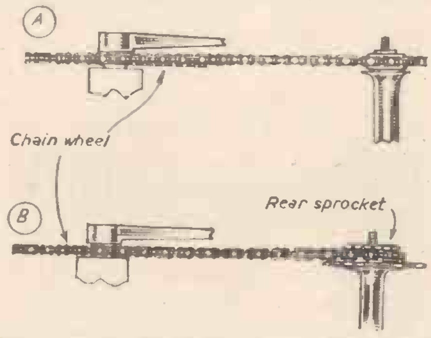


Fig. 1—(*A*). *Unaligned chain ;* (*B*) *lining up with a derailleur gear.*

Derailleur Gears

When a derailleur gear is fitted, the chain-wheel should be in line with the centre sprocket as shown in Fig. 1 at B. Where four gears are employed the chain should be lined up between the chainring and the point between third and fourth gear, with five gears the third gear is the one concerned. In fact, the chainring must always be lined up with the centre of the multi-speed block.

A free-wheel or multi-gear block is difficult to remove once it has been tightened into position on the hub, so when fitting ensure that the chain line is correct before finally tightening the block into position. If the thread is well greased and is clean, it should be possible to screw the sprocket near enough to its final position without it becoming irrevocably fixed in order to check on the chain line and then to remove it again to adjust the packing. The sprocket can be assisted over any tight spots in the thread when being removed by means of one of the usual free-wheel removal devices.

Resoldering a Brake Cable Nipple

The Correct Procedure Described Step by Step

IT is very seldom that the cable on a cycle brake ever fails, but when it does it usually frays near, or pulls through, the nipple. A cable which has failed in this way can be repaired quite easily, but care must be taken or the cable may pull out again at some critical moment.

First, cut off the frayed ends of the cable so that an end with all the wires laying close together is obtained and then clean the shallow declivity in the top of the nipple and the hole through it. Tin the inside of this hole by heating the nipple and then running melted solder through; while the heat is still being applied, pass an old piece of wire through to make sure that only the sides of the hole are tinned.

Push the trimmed end of the brake cable through until it protrudes as shown at A in Fig. 3, then heat the nipple again so that the tinning inside the hole melts and fixes the cable in place. Part the wires of the cable where they protrude through the nipple, as shown at B, and then run melted solder into the shallow declivity in the top of the nipple and round the splayed ends of the cable, finally achieving a rounded end to the solder blob as shown at C.

This is the strongest possible way of soldering the nipple and the cable should now be good for a long time.

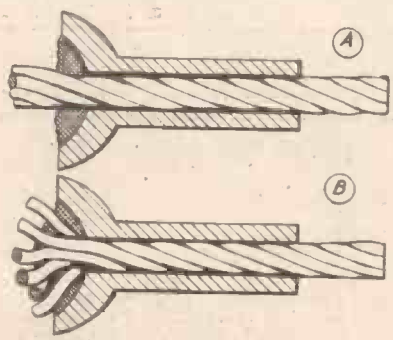


Fig. 3.—(*A*) *cable is soldered into the nipple ;* (*B*) *the end is splayed ;* (*C*) *the whole is fixed and sealed with a blob of solder.*

A Method of Removing Cotter Pins

How it Can Be Done Without Damaging the Thread

COTTER pins which have been fitted for a long while often become jammed in place and are very difficult to remove. If the cycle is merely being overhauled and the cotters have to be replaced, the problem of extracting them undamaged becomes very real. The following is one solution to the problem. Being able to remove a cotter pin without damage to the thread is important not so much because of the cost of replacement as for avoiding the laborious process of filing new cotters to fit.

Unscrew the nut until it is half-way off the thread and then screw another old cotter down into the half of the thread of the nut which is unoccupied. When these are tightly in position, support the crank round the cotter with a mallet head or some other firm support. Now use the old cotter pin as a punch to hammer out the cotter which is to be used again, without damage. This set-up is shown in Fig. 4.

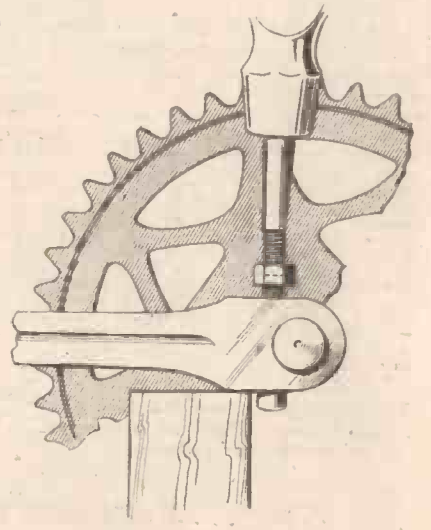


Fig. 4.—Set-up for cotter pin removal.

Build your own HI-FI

— with an entirely *NEW* range of Hi-Fi units and cabinets!

Imagine the pleasure of having this magnificent Hi-Fi equipment in its beautiful contemporary style furniture for your home . . . and experiencing an entirely new realism in sound reproduction. Yet the Emistructor Hi-Fi will save you money and give you all the *extra* fun and satisfaction of building it yourself—and being able to service and maintain it afterwards. Special instruction manuals guide you at each stage and teach you all about the equipment in simple terms as you build. No skill or experience is needed—only a few simple tools.

Emistructor equipment is made to the highest quality standards and is a product of E.M.I. Institutes Ltd.—part of a Company world famous for sound recording and reproducing equipment.

There is a wide variety of equipment and cabinets at different price levels to suit individual tastes and requirements. The range varies from a complete HI-FI installation with separate speaker enclosures to a simple all-in-one compact system for those with more modest requirements. All equipment is suitable for stereo or non-stereo reproduction of records. Full details and complete specifications will be sent with our free Brochure.

EMISTRUCTOR

Dept. H.F.144, 43, Grove Park Road, London, W.4

Associated with one of the World's largest recording organisations comprising—
"HIS MASTER'S VOICE" · CAPITOL · COLUMBIA · MGM etc.

OCT/1958 IC 137

WE SUPPLY EVERYTHING FOR THE
HOME HANDYMAN

Timber—Mouldings—Dowels—Hardboard—Plywood — Fittings Legs—Kidney Shapes

READY TO ASSEMBLE SETS

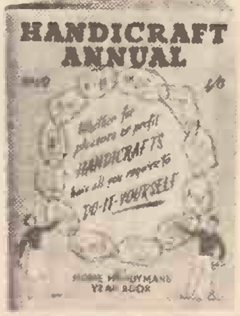
Baby's Cot—Baby's Play Pen—Feeding Chair—Stools —Workbox—Bedside Cabinet—Dinner Wagon—Record Cabinet—Picnic Set—Coffee Tables—Television Table—Standard and Table Lamps.

WE SUPPLY AND SEND OUR GOODS ANYWHERE BY MAIL OR RAIL

"DO IT YOURSELF"
WITH HANDICRAFTS MATERIALS

Send now for HANDICRAFT ANNUAL, contains many things to make and many things to do, all materials available by post.

SEND 1/6 plus 5d. postage to :
HANDICRAFTS LTD., P.M. Dept., PETERBOROUGH

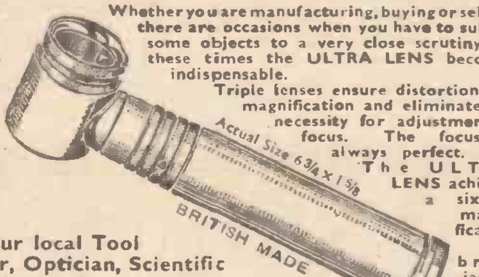


THE ULTRA LENS AIDS PRODUCTION

This unequalled electric magnifier is of the most modern design and has proved its extreme and sustained usefulness to countless industrial firms engaged on minute examination of surfaces of every conceivable object.

Whether you are manufacturing, buying or selling, there are occasions when you have to submit some objects to a very close scrutiny. At these times the ULTRA LENS becomes indispensable.

Triple lenses ensure distortion-free magnification and eliminate the necessity for adjustment of focus. The focus is always perfect. The ULTRA LENS achieves a six-fold magnification in a brilliantly-lit field which is shadowless.

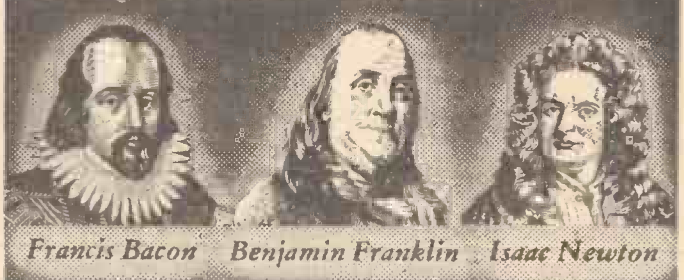


Please ask your local Tool Shop, Jeweller, Optician, Scientific Instruments, Stamp-Dealer, or

Write for full particulars to

THE ULTRA LENS COMPANY
17c, Oxendon Street, London, S.W.1 *Tel.: TRAfalgar 2055*

These great minds were Rosicrucians . . .



WHAT SECRET POWER DID THEY POSSESS?

Why were these men great?

How does anyone—man or woman—achieve greatness? Is it not by mastery of the powers within ourselves?

Know the mysterious world within you! Attune yourself to the wisdom of the ages! Grasp the inner power of your mind! Learn the secrets of a full and peaceful life!

Benjamin Franklin, statesman and inventor . . . Isaac Newton, discoverer of the Law of Gravitation . . . Francis Bacon, philosopher and scientist . . . like many other learned and great men and women . . . were Rosicrucians. The Rosicrucians (NOT a religious organization) have been in existence for centuries. Today, headquarters of the Rosicrucians send over seven million pieces of mail annually to all parts of the world. Address: Scribe A.T.C.

The ROSICRUCIANS

25 Garrick St. (AMORC) London, W.C.2, England

Scribe A.T.C.
The ROSICRUCIANS (AMORC)
25 Garrick St., London, W.C.2, England

Please send me the *free* book, *The Mastery of Life*, which explains how I may learn to use my faculties and powers of mind.

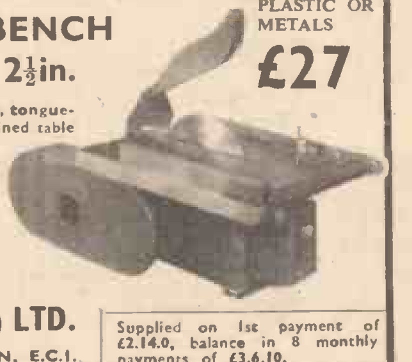
Name ____________________
Address ____________________
City ____________________ State ________

SUNDIAL new 8-inch motorised SAW BENCH DEPTH OF CUT 2½in.

IDEAL FOR WOOD, PLASTIC OR METALS

£27

For ripping, cross-cutting, mitring, tongueing & grooving & tenoning. Machined table top measures 14in. x 14in. with 8in. saw blade. Designed for clean and accurate sawing. Strong construction throughout in cast iron. Weight 93 lbs. Rise and fall spindle. Fence to full length of table. Vee Belt Motorised ½ h.p. T.V. and Radio suppressed motor. Press button starter switch fitted.



PARRY & SON (Tools) LTD.
329-333 OLD STREET, LONDON, E.C.1.
SHOreditch 9422, 9423, 9424.

Supplied on 1st payment of £2.14.0, balance in 8 monthly payments of £3.6.10. Cash Price £27. Carriage and Packing 22/6.

STILL THE BEST BY ANY TEST!

The "BRITINOL" Spirit Blowlamp

Gives a hot clean flame 3-4 inches long, burns methylated spirit, and has neat folding soldering iron supports. Completely automatic action. Ideal for all soft soldering jobs, jewellery and lampshade making, cane singeing on basket work and many other uses.
Price 7/6 from Halfords branches and Model and Tool Shops.
Send for FREE illustrated leaflet showing other Easy Soldering Products from the sole manufacturers :

BI-METALS (BRITINOL) LTD.
St. Mary's Works, Bridge Road, London, N.9. *Tel.* : *TOTtenham* 9413.

THE WORLD'S GREATEST BOOKSHOP

FOYLES

FOR BOOKS

FAMED CENTRE for TECHNICAL BOOKS

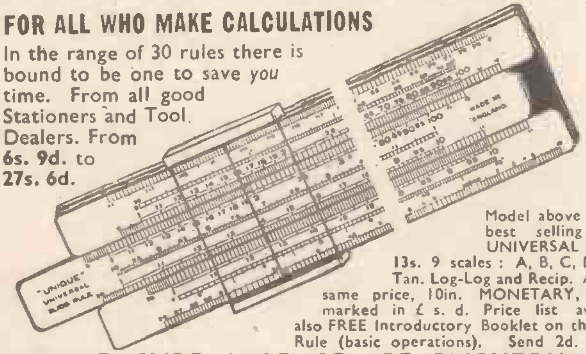
"That's what I call quick service—I telephoned Foyles at 10 a.m. and the book (although it was out-of-print) reached me by the next morning's post." —A Customer's Letter

119-125 CHARING CROSS RD LONDON WC2
Gerrard 5660 (20 lines) ★ *Open 9-6 (incl. Sats.)*
Two minutes from Tottenham Court Road Station

UNIQUE SLIDE RULES

FOR ALL WHO MAKE CALCULATIONS

In the range of 30 rules there is bound to be one to save *you* time. From all good Stationers and Tool Dealers. From **6s. 9d.** to **27s. 6d.**



Model above is the best selling 10in. UNIVERSAL U1 at 13s. 9 scales : A, B, C, D, Sin. Tan. Log-Log and Recip. Also at same price, 10in. MONETARY, scales marked in £ s. d. Price list available also FREE Introductory Booklet on the Slide Rule (basic operations). Send 2d. stamp.

UNIQUE SLIDE RULE CO. OF BRIGHTON LTD.
400, SOUTH COAST ROAD, TELSCOMBE CLIFFS, NEWHAVEN, SUSSEX.

IMMERSION HEATERS. 2 kW. or 3 kW., 11in. and 16in., £3.8.4. Thermostat for either of above heaters, **£1.10.0.**
THERMOSTATS. BW/1, 5 amps, 15/6. Post 6d. SN/40 ½ amp., 5/6. Post 4d. C. S. Convector Thermostat 15 amps, 25/-. Post 10d. Model MB for Immersion Heaters, 15 amp., £2. Post 2/-. PF Room Thermostat 15 amps, £2. Post 10d. M.L. Greenhouse Thermostat 10 amps, 35/-. Post 10d. P.J. Miniature Thermostat for Hotplates, 5 amps. 9/3. Post 6d.
FLEXIBLE ASBESTOS ELEMENT WIRE. 15 or 25 ohms/yd. 1/-. per yard.
REPLACEMENT ELEMENTS. Send 4d. stamp for lists.
TELEVISION SUPPRESSOR KIT, for appliances up to 1 amp., 3/6. Post Free.
BI-METAL. Hi-Flex 45 3/16in. x .010, 6d. per ft. Standard 6in. x ¼in. x .036, 6d.
NEON ILLUMINATED INDICATOR SWITCH. 2 amps, 240 v. A.C., 10/6.
MAGNETS. Sintered Bar Magnets of great power and stability ⅜in. x 3/16in. x 1/16in., 9d. each. 8/- doz. Post 5d.
We also supply Silver Contact Screws and Rivets. Porcelain Interlocking Insulating Beads. Send 4d. stamp for list.

THE TECHNICAL SERVICES CO., Banstead, Surrey

10/6

ASSEMBLE IT YOURSELF AND BRIGHTEN UP YOUR HOME

PROJECTION 6½"

Wrought Iron Electric Wall Bracket Kit Comprising :

A. Bracket of ½" x ⅛" steel, handwrought, forged, twisted, hammered and brazed to scroll, forming one unit with screw-on nipple for lampholder. All ends and edges beautifully rounded. Not painted.
B. Backplate hollowed, drilled for wire and for one of the bracket-holding screws which forms double purpose of earth terminal.
C. Undulated sconce plate ready for fitting over nipple.
D. Lampholder, black wire and candledrip.
Money returned if not satisfied. Further particulars or any other wrought iron job, please send stamped, addressed envelope.

P.O., M.O., or CH. to :
C. HAMFELDT (Dept. P.M.I), 69, Drew St., Brixham, Devon

★ *WAR SURPLUS* ★

N.S.F. VERNIER CALIPER GAUGES

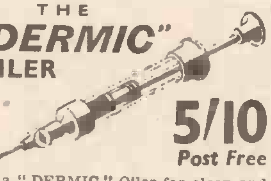
A wonderful opportunity to obtain one of these precision 6 in. gauges, brand new at fraction of cost. Reads by vernier to 1/1,000th inch. Limited stock. Complete in fine fitted case, **£4·10·0**

A few Swiss 'Proch' 9 in. also available in brand new condition with case at **£6·15·0**

MONEY-BACK GUARANTEE

CHARLES FRANK
67-75, SALTMARKET, GLASGOW, C.I.
Phone : BELL 2106/7. *Established* 1907.

THE **"DERMIC"** OILER



5/10 *Post Free*

Use a "DERMIC" Oiler for clean and accurate lubrication of models, clocks, watches, sewing machines, typewriters, movie cameras and projectors and any delicate instruments or mechanism. Get one from your local Model or Tool Dealer or send direct to the actual manufacturers.

S. & B. PRODUCTIONS
Orton Buildings, Portland Road, South Norwood, London, S.E.25.
Phone : LIV 4943

JUST OUT!!

A NEW COMPLETE CATALOGUE

Containing a full range of TOOLS AND MACHINERY for WOODWORK and METALWORK

Hundreds of illustrations

2s. 6d.
Refunded on first order of 40s.

S. TYZACK & SON LTD.
341-345 OLD STREET, LONDON, E.C.I
Tel.: SHOreditch 8301

PREFABRICATED CRUISER KITS ... OR FINISH YOURSELF HULLS!

from **£68** complete

Write for details of our comprehensive range or 'phone Hoddesdon 4778

BROXBOURNE BOATS LIMITED
The Old Mill, Mill Lane, Broxbourne, Herts.
We do the work - you have the fun!

CONDOR

SLICED

FOR QUALITY

FOR FLAVOUR

FOR AROMA

FOR CUT

FOR FRESHNESS

REAL VALUE

I T ' S   A   G A L L A H E R   T O B A C C O

STEEL SHELVING

72 in. HIGH
34 in. WIDE
12 in. DEEP

- *Brand new—Manufactured in our own works.*
- *Shelves adjustable every inch.*
- *Heavy gauge shelves will carry 400 lbs, each.*
- *Stove enamelled dark green.*
- *6 shelves per bay—Extra shelves 8/- each.*
- *Also available in white at £5 per bay.*
- *Quantity discounts.*

Delivered free £3 15s.
Ready for erection.

ALL OTHER SIZES available at equally keen prices.

Deliveries Free to England, Scotland and Wales.

N. C. BROWN LTD.

Green Lane Wing
HEYWOOD · LANCS
—the manufacturers!

Telephone: Heywood 69018 (3 lines)

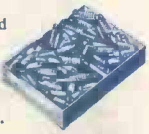
. . . compression, 18 S.W.G. x $\frac{5}{16}$ x 2", 17 coils?

Sorry, you'll never find it in that drawer of odds and ends. Why not use TERRY'S BOXES OF ASSORTED SPRINGS and put your hand on it right away?

Just the job for you experimental people—a simply unlimited variety of springs of every kind—compression, expansion, long, short, heavy, light, any gauge you want. We show *some* of our boxes here, but why not let us send you our fully illustrated list—post free?

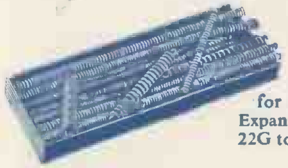
No. 757.
Extra Light Compression, 1 gross Assorted, $\frac{1}{8}$" to $\frac{3}{8}$", $\frac{1}{2}$" to 2" long, 27 to 20 S.W.G.
15/- each.

No. 388.
$\frac{1}{2}$ gross Assorted Small Expansion Springs. $\frac{3}{4}$" to $1\frac{1}{2}$", 18G to 21G.
9/6 each.



No. 758.
Fine Expansion Springs. 1 gross Assorted $\frac{1}{8}$" to $\frac{3}{8}$", $\frac{1}{2}$" to 2" long, 27 to 20 S.W.G.
15/- each.

No. 753.
3 doz. Assorted Light Expansion $\frac{1}{4}$" to $\frac{1}{2}$" diam., 2" to 6" long, 22 to 18 S.W.G. **10/6** each.



No. 1024.
20 Compression Springs 12" long, $\frac{1}{8}$" to $\frac{1}{2}$" diam., 24G to 18G, suitable for cutting into shorter lengths; and 30 Expansions $1\frac{1}{2}$" to 12" long, 5/32" to $\frac{3}{8}$" diam. 22G to 16G. **24/-** each.

*** Interested in Spring Design ? Send for 'Spring Design and Calculations'—Post Free 12/6**

TERRY'S
ASSORTED SPRINGS

HERBERT TERRY & SONS LIMITED · REDDITCH · WORCS.

(Makers of quality Springs, Wireforms and Presswork for over 100 years)

HT 24 A

Published about the 30th of each month by GEORGE NEWNES LIMITED, Tower House, Southampton Street, Strand, London, W.C.2, and Printed in England by W. Speaight & Sons, Exmoor Street, London, W.10. Sole Agents for Australia and New Zealand—Gordon & Gotch (A/sia), Ltd. Sole Agents for South Africa and Rhodesia—Central News Agency Ltd. Subscription Rate (including postage): For one year, Inland 20s., Overseas 18s. 6d., Canada 18s. 6d.

" Practical Mechanics " Advice Bureau. COUPON
This coupon is available until October 31st, 1958, and must be attached to all letters containing queries, together with 6d. Postal Order. *A stamped addressed envelope must also be enclosed.*
Practical Mechanics. October, 1958.

Free Guide — SUCCESS IN ENGINEERING

132-PAGE BOOK FREE!
SEND FOR YOUR COPY

One of the following Courses taken quietly at home in your spare time can be the means of securing substantial well-paid promotion in your present calling, or entry into a more congenial career with better prospects.

ENGINEERING, RADIO, AERO, ETC.

Aero. Draughtsmanship	Elec. Draughtsmanship
Jig & Tool Design	Machine ,,
Press Tool & Die Design	Automobile ,,
Sheet Metalwork	Structural ,,
Automobile Repairs	R/F Concrete ,,
Garage Management	Structural Engineering
Works M'gmnt. & Admin.	Mathematics (all stages)
Practical Foremanship	Radio Technology
Ratefixing & Estimating	Telecommunications
Time & Motion Study	Wiring & Installation
Engineering Inspection	Television
Metallurgy	Radio Servicing
Refrigeration	Gen. Elec. Engineering
Welding (all branches)	Generators & Motors
Maintenance Engineering	Generation & Supply
Steam Engine Technology	Aircraft Mainten. Licences
I.C. Engine Technology	Aerodynamics
Diesel Engine Technology	Electrical Design

Ordnance Survey Dr'ship.

BUILDING AND STRUCTURAL

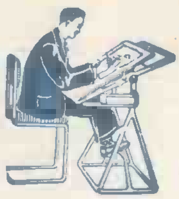
L.I.O.B. A.I.A.S.	A.R.S.H. M.R.S.H.
A.M.I.P.H.E. A.A.L.P.A.	A.F.S. A.R.I.C.S.
Building Construction	Builders' Quantities
Costs & Accounts	Carpentry & Joinery
Surveying & Levelling	Building Inspector
Clerk of Works	Building Draughtsmanship
Quantity Surveying	Heating and Ventilating

GENERAL, LOCAL GOVERNMENT, ETC.

Gen. Cert. of Education	Common. Prelim. Exam.
Book-keeping (all stages)	A.C.I.S., A.C.C.S.
College of Preceptors	A.C.W.A. (Costing)
Woodwork Teacher	School Attendance Officer
Metalwork Teacher	Health Inspector
Housing Manager (A.I.Hsg.)	Civil Service Exams.

BECOME A DRAUGHTSMAN—LEARN AT HOME
AND EARN BIG MONEY

Men and Youths urgently wanted for well paid positions as Draughtsmen, Inspectors, etc., in **Aero, Jig and Tool, Press Tool, Electrical, Mechanical** and other Branches of **Engineering**. Practical experience is unnecessary for those who are willing to learn—**our Guaranteed "Home Study" courses will get you in.** Those already engaged in the General Drawing Office should study some specialised Branch such as Jig and Tool or Press Tool Work and so considerably increase their scope and earning capacity.



★ OVER SEVENTY YEARS OF CONTINUOUS SUCCESS ★

NATIONAL INSTITUTE OF ENGINEERING

(In association with CHAMBERS COLLEGE—Founded 1885)

(Dept. 29)

148, HOLBORN, LONDON, E.C.1

SOUTH AFRICA: E.C.S.A., P.O. BOX NO. 8417, JOHANNESBURG
AUSTRALIA: P.O. BOX NO. 4570, MELBOURNE

FOUNDED 1885 - FOREMOST TODAY

This remarkable FREE GUIDE explains:

- ★ Openings, prospects, salaries, etc., in Draughtsmanship and in all other branches of Engineering and Building.
- ★ How to obtain money-making technical qualifications through special RAPID FULLY-GUARANTEED COURSES.

MANY INTERESTING COURSES TO SELECT FROM!

A.M.I.Mech.E., A.M.I.M.I., A.M.Brit.I.R.E., A.M.I.P.E., A.M.I.C.E., A.M.I.Struct.E., A.M.I.Mun.E., M.R.S.H., A.M.I.E.D., A.F.R.Ae.S., London B.Sc., Degrees.

Fully guaranteed postal courses for all the above and many other examinations and careers. Fully described in the New Free Guide.

THE ACID TEST OF TUTORIAL EFFICIENCY
SUCCESS—OR NO FEE

We definitely guarantee that if you fail to pass the examination for which you are preparing under our guidance, or if you are not satisfied in every way with our tutorial service—**then your Tuition Fee will be returned** in full and without question. This is surely the acid test of tutorial efficiency.

If you have ambition you must investigate the Tutorial and Employment services we offer. Founded in 1885, our success record is unapproachable.

ALL TEXTBOOKS ARE SUPPLIED FREE
PROMPT TUTORIAL SERVICE GUARANTEED
NO AGENTS OR TRAVELLERS EMPLOYED

Free Coupon

SEND OFF THIS COUPON NOW AND BE ALL SET FOR SUCCESS

To: NATIONAL INSTITUTE OF ENGINEERING (Dept. 29), 148-150, Holborn, London, E.C.1.

Please Forward your Free Guide to

NAME ....

ADDRESS ....

....

My general interest is in: (1) ENGINEERING (2) AERO (3) RADIO (4) BUILDING (5) MUNICIPAL WORK

(Place a cross against the branches in which you are interested.)

The subject of examination in which I am especially interested is

....

To be filled in where you already have a special preference. (2d. stamp only required if unsealed envelope used.)