

*An Indoor-Outdoor Miniature Golf Course*

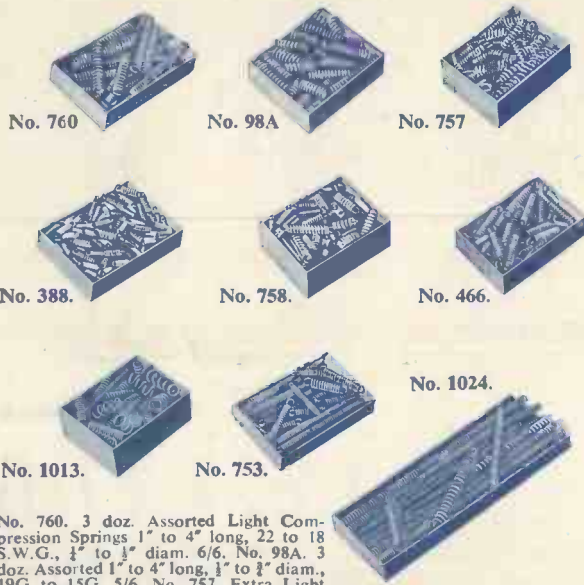
NEWNES

13

# PRACTICAL MECHANICS

EDITOR : F.J. CAMM  
OCTOBER : 1956





No. 760. 3 doz. Assorted Light Compression Springs 1" to 4" long, 22 to 18 S.W.G.,  $\frac{1}{8}$ " to  $\frac{1}{4}$ " diam. 6/6. No. 98A. 3 doz. Assorted 1" to 4" long,  $\frac{1}{8}$ " to  $\frac{1}{4}$ " diam., 19G to 15G. 5/6. No. 757. Extra Light Compression, 1 gross Assorted,  $\frac{1}{2}$ " to  $\frac{3}{4}$ " to 2" long, 27 to 20 S.W.G. 15/-. No. 388.  $\frac{1}{2}$  gross Assorted Small Expansion Springs,  $\frac{1}{4}$ " to  $1\frac{1}{2}$ ", 18G to 21G. 9/6. No. 758. Fine Expansion Springs. 1 gross Assorted  $\frac{1}{2}$ " to  $1\frac{1}{2}$ ",  $\frac{1}{8}$ " to 2" long, 27 to 20 S.W.G. 15/-. No. 466.  $\frac{1}{2}$  gross Assorted Small Expansion Springs  $\frac{1}{2}$ " to  $1\frac{1}{2}$ " long, 3/32" to 3/16" diam., 21G to 24G. 6/6. No. 1013. 1 gross Small Coil Compression Springs,  $\frac{1}{2}$ " to  $1\frac{1}{2}$ " long, 3/32" to 7/16" diam., 24G to 19G 6/-. No. 753. 3 doz. Assorted Light Expansion  $\frac{1}{2}$ " to  $1\frac{1}{2}$ " diam., 2" to 6" long, 22 to 18 S.W.G. 10/6. No. 1024. 20 Compression Springs 12" long,  $\frac{1}{8}$ " to  $\frac{1}{4}$ " diam., 24G to 18G, suitable for cutting into shorter lengths; and 30 Expansions  $1\frac{1}{2}$ " to 12" long, 5/32" to  $\frac{1}{2}$ " diam., 22G to 16G. 24/-.  
 No. 1013. No. 753. No. 1024.

# How are you off for Springs?

TERRY'S BOXES OF ASSORTED SPRINGS are just the job for your experimental department — a wonderful assortment of Compression and Expansion Springs... all sorts of lengths, gauges, diameters. The nine boxes we show are just a few from our range. Why not let us send you a full list — free?

## TERRY'S ASSORTED SPRINGS

The prices quoted are subject to the usual trade discount.

HERBERT TERRY & SONS LTD.  
REDDITCH, WORCS.

SPRING MAKERS FOR 100 YEARS

These Boxes of Springs can also be obtained at:  
LONDON  
27 Holborn Viaduct  
MANCHESTER  
279 Deansgate  
BIRMINGHAM  
210 Corporation Street

HT170 (R)



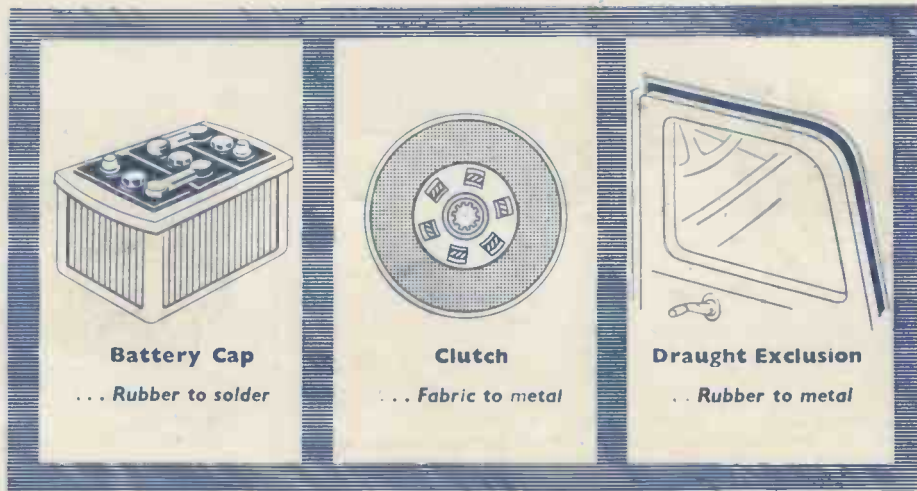
# How to stick anything to anything . . .

Use quick-setting, easy-to-apply Pliobond, the new thermoplastic adhesive that sticks anything to anything permanently.

Whatever material you're using — wood, metal, plastic, fabric, rubber, leather, glass, paper, plaster or ceramics — Pliobond will join them to one another and to themselves.

And the resulting permanent yet flexible bonds are highly resistant to water, oils, greases and chemicals. Bond strength improves with age.

Supplied ready to use in tubes, bottles (with a handy brush in the lid) and tins, Pliobond is obtainable from ironmongers and garages. Use Pliobond for every sticking job.



USE

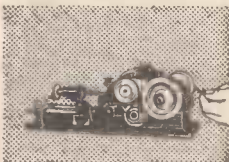
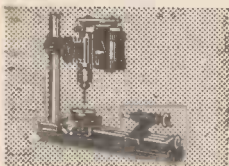
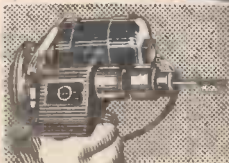
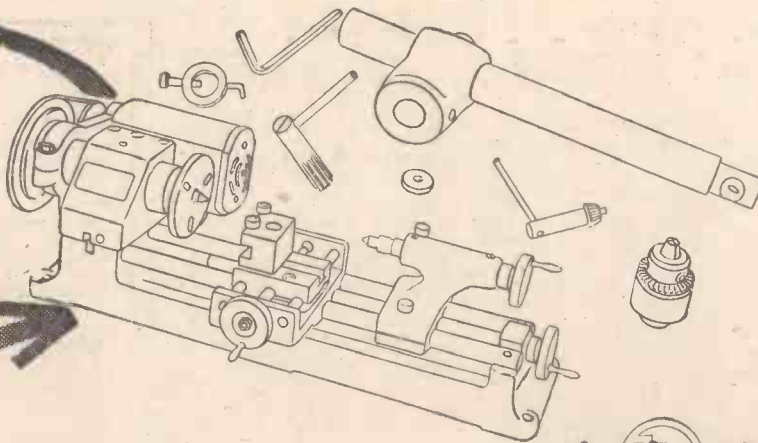
# Pliobond

Reg'd. Trade Mark

A GOODYEAR PRODUCT OBTAINABLE FROM GARAGES AND IRONMONGERS

# THE EMCO-UNIMAT

*a complete power workshop - 16" long!*



Don't let the size deceive you! The amazing Emco-Unimat is not a toy—it's a precision, portable power-tool, capable of a number of standard workshop practices on a miniature scale. The basic-tool will buff, turn, polish, drill, grind and mill with remarkable accuracy, whilst additional equipment extends these applications. Working to very fine limits, and variably speeded from 300 to 9,000 r.p.m., the Emco-Unimat is the perfect equipment for model makers and amateur craftsmen.

HAND DRILL • MILLING MACHINE • TABLE DRILL PRESS • TOOL GRINDING MACHINE

### Specification

Centre Height, 1½". Takes between centres, 6½". Hollow spindle admits ¼". Drill Chuck Cap, ¼". Chuck to Drill Table (max.), 4½".

### Additional Equipment

Jig Saw. SC Lathe Chuck. Circular Saw. Drilling Vice. Milling Table and Clamps. Flexible Shaft.

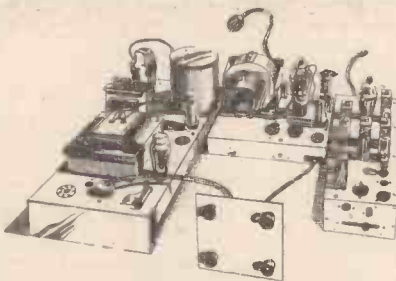
CASH PRICE  
**£27-17-6**  
EXTENDED CREDIT AVAILABLE

See the versatile EMCO-UNIMAT at your local tool dealer, or write for fully descriptive literature to:

**J. & H. SMITH LTD.**  
16, HARRISON STREET  
LEEDS, I. TEL. 21561

jhs 910

**T.V. TUBES. £5.** 6 months' guarantee. 12in. Mullard. As supplied for the last 4 years. 15½ in. carr. Cash with order. 14in. RECTANGULAR, £5/10/-. 17in. RECTANGULAR, £7/10/0.



### T.V. 12in. CHASSIS. 97/6.

Complete chassis by famous manufacturer. R.F. E.H.T. Unit included. Drawing FREE. Easily fitted to Table or Console model, owing to this chassis being in three separate units (Power, Sound and Vision, Timebase) inter-connected. THIS CHASSIS IS LESS VALVES AND TUBE, but see our catalogue for cheap valves. Our £5 Tube fits this Chassis. List of valves by request. Carr. 5/- London, 10/- Provinces. Channels 1-5.

**SPEAKER SALE.** 8/9 each to clear. 8in. P.M. std. 3-5 ohms.

or with matching O.P. trans. 10/9. Post 1/9.

**V.H.F. 1124 RECEIVER.** 7/6 less valves, ex-V.D., good condition; 6-channel switching. Receives T.V. sound, police, fire and amateurs; 30/5 mc/s to 40 mc/s. I.F. 7 mc/s. Post 2/6. Drawings and conversion data free with each set.

**V.H.F. 1125 SET.** 7/9. This little set is a V.H.F. receiver, requires some modification to put it into service. Complete with valves. Post 2/3.

**R.F. 24 UNIT.** 10/6. New and packed. Tuning 20-30 mc/s. Including 3 valves. Post 2/-.

**RADIOGRAM CHASSIS.** 29/9. Including 8in. speaker. 5 VALVE S/HET. 3 w/band. A.C. mains, complete but less valves. All used, tested, and guaranteed. Carr. 4/6. Drawings 2/6 or free with order.

**T.V. CHASSIS TO CLEAR.** (Famous manufacturer.)

**POWER PACK AND AMP.** 29/9. 5 K.V. E.H.T. 325 v., 250 m.a. Smoothed H.T. heaters. 6 v. 5 amp., 4 v. 5 amp., 4 v. 5 amp. Carr. 4/6.

**TIME BASES.** 10/6. Containing scanning coil, focus unit, line trans., 10 controls, etc. Drawing free with unit. Carr. 2/6.

**MAINS TRANSFORMER.** 5/9. 350-0-350 v. Heaters, 6 v. and 5 v. Post 2/-.

**MAINS TRANSFORMER.** 3/9. 350-0-350 v. 12 v. 4 v. heaters. Primary 100-250 v. Make ideal auto trans. Post 2/-.

**MAINS TRANSFORMERS.** 5/9. 350-0-350 v. 4 v., 4 v., heaters. Primary 200-250 v. Post 2/-.

**O.P. TRANS.** 1/3. Standard 3-5 ohms. Guaranteed. Post 9d.

Stamp only for catalogue.

MONEY BACK GUARANTEE.

CWO or COD.

REMEMBER  
**SATURDAY**  
OPEN ALL DAY

**DUKE & CO.,**  
621 ROMFORD ROAD, LONDON, E.12.  
Tele: GRA 6677.

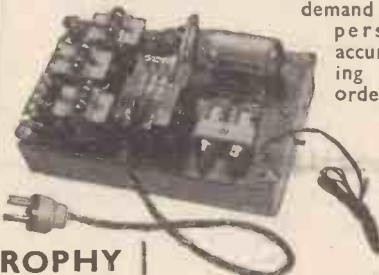
## ED RADIO CONTROLS

The system of Tuned Reed, pioneered by E.D. has, after long and exhaustive tests, proved the reliability and ease of control of this system. Success after success in competitions has proved that there is nothing to compare with them.

These 3 models will adequately meet the demands of all Radio Control enthusiasts.

### E.D. MK. IV RADIO CONTROL UNIT TUNED REED 3 CHANNELS

Comprising Transmitter, Control Box and Receiver. The last word for the control of models which demand progressive, personal and accurate following of multiple orders.



Order from your Model Shop.

2 models available. Senior or Junior.

### TAPLIN TROPHY

for Radio Controlled "A" Class Yachts  
POOLE RADIO REGATTA  
23rd and 24th June, 1956

G. Honnest-Redlich  
1ST. (FOR THE THIRD SUCCESSIVE YEAR)

USING  
E. D. EQUIPMENT

### THE E.D. BOOMERANG

A Radio Control Unit completely wired and ready for use in your model plane or boat. Simplicity itself to install and most economical in use.

### E.D. MK. II MINIATURE 3-VALVE RADIO CONTROL UNIT

Comprises Transmitter and Receiver. Standard battery pack will give over 3 hours' continuous operation with a receiver and batteries weight of only 10½ ozs.

Write for illustrated list giving full details of E.D. Radio Control, Engines, Accessories, and Spare Parts, etc.

**ED ELECTRONIC DEVELOPMENTS (SURREY) LTD**  
DEVELOPMENT ENGINEERS  
ISLAND FARM RD. WEST MOLESEY, (SURREY) ENGLAND.

# Make model buildings —



## as simply as this!

A new method—described in a new book on Pyruma Modelling. This shows how to turn empty match boxes into model buildings, by Pyruma 'Plasticraft.' It is one of the many methods of modelling in plastic Pyruma, shown in black and white and full colour pages, which enable you to build and finish in natural colours:—

**MODEL FARMS, RAILWAY STATIONS, SIGNAL CABINS, AIRPORT BUILDINGS, DOCKS, SHIPS, FIGURES, ANIMALS, ASHTRAYS, BOOKENDS, DOLL'S FURNITURE, PLAQUES, RELIEF MAPS, ETC.**



is a ready-to-use material, cheap to buy locally, and easy to work by following the Instruction Book offered below. Pyruma dries or can be baked to stone-hard permanence, then painted in natural colours. Sold by local Ironmongers and Hardwaremen, Hobbies shops and Art material Dealers, in airtight tins from 1/6 upwards.

Send Coupon and 6d. P.O. (not stamps) for this NEW Book of instructions to:—

**J.H. SANKEY & SON, L<sup>TD</sup>**

Est. 1857.

DEPT. P.M., ILFORD, ESSEX.

Enclosed 6d. P.O. (not stamps) for PYRUMA MODELLING INSTRUCTION BOOK addressed to:—

NAME (Block Letters).....

ADDRESS .....



## S. G. Brown AUDIO AIDS

Headphones with individual volume control. Ideal for use with church and cinema deaf aid installations or for individuals with impaired hearing. They provide the essential clarity of reception when listening to Radio and TV.

Send for Brochure "P" of all types available. If desired, advice is given on selection of type most suited to individual needs.

S. G. Brown provide Headphones and associated equipment for all known purposes.

### S. G. Brown, Ltd.

SHAKESPEARE STREET, WATFORD, HERTS.

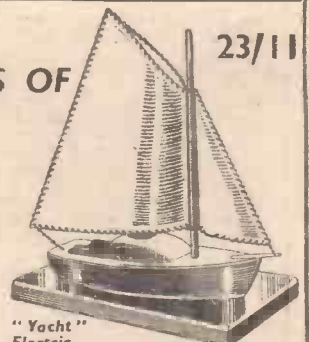
Telephone: Watford 7241.

(4)



PRESENT HUNDREDS OF WAYS TO

# BRIGHTEN YOUR HOME!



"Yacht" Electric Light. Delightfully practical: 23/11.



Swiss Chalet Musical Cigarette Box. Kit for Chalet, 6/11. Musical movements, 18/10.

POST COUPON NOW!

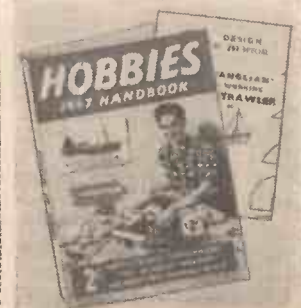
**TO HOBBIES LTD.,**  
Dept. 071, Dereham, Norfolk.

Please send free 20-page booklet and items marked X.

Swiss Chalet Kit No. 3152: 6/11  "Yacht" Light Kit No. 3110: 23/11   
List of Musical Movements at 18/10  Hobbies 1957 Handbook 2/3 (all post free)

NAME .....

ADDRESS .....



# The BURGESS vibro-tool



**the ideal engraving tool for the handyman!**

YOU will be really amazed by the Vibro-Tool—the power hand-tool that is as easy to handle as a pencil. With it you can write on steel, engrave jewellery, glass and plastics, tool leather, carve wood and cut stencils—and a host of other handicraft and workshop jobs . . . with speed and facility you never dreamed possible.

The V.250 Vibro-Tool complete with standard engraving point.

The Vibro-Tool, which operates on the vibratory principle, is designed for working off 50-cycle A.C. supplies only. Just connect to any electric light socket or plug point. When ordering, please specify voltage.

**52/6**

**97/6**

Vibro-Tool De Luxe Kit



Write for Brochure V.T.1 to: BURGESS PRODUCTS Co. Ltd. (Vibro-Tool Dept.), HINCKLEY, LEICESTERSHIRE.

## "CHIMELITE"



It is a hall light as well as a double chime and you can make it in a couple of evenings for the total cost of only 19/6 including instructions, post, etc., 2/-—data available separately price 2/-.

### MAINS-MINI



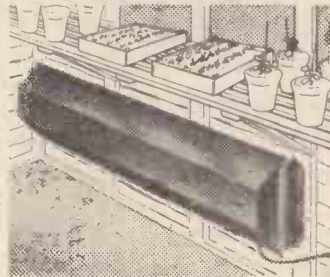
Uses high-efficiency coils—covers long and medium wavebands and fits into the neat white or brown bakelite cabinet—limited quantity only. All the parts, including cabinet, valves, in fact, everything, £4.10.0, plus 3/6 post. Constructional data free with the parts, or available separately 1/6.

### CONNECTING WIRE



P.V.C. covered in 100ft. coils—2/0 a coil or four coils different colours, 10/-, post free.

### INSTANTUS HEATER



Practical Convector heater, of 1kW. rating, 4ft. long, made from heavy gauge sheet steel (galvanised). Can be used for any size house, up to three heaters can be controlled by one thermostat. Price, £2.10.0 or with thermostat £4.5.0, carriage 5/-. Write for Horticultural list.

### MINIATURE MOTOR



Size only 2 1/2 in. long by 1 1/2 in. diameter—American made—laminated poles and armature—intended for 24-volt D.C. but O.K. on lower D.C. voltages and A.C. mains, through step-down transformer—price 10/6, post, etc., 2/-.

### CLOCK CASE

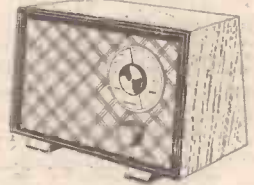
Also suitable for barometer or other instrument. Nicely polished. Price 4/6, post and packing 1/6. Clock numerals to suit these cases etched on metal, 2/6.

### ELECTRIC BLANKET WIRE

Waterproof P.V.C. covered, so blanket washable. 161 ohms per foot—1/8 per yard. 14 yards, ideal for average blanket, £1 post free.

## THE SKYSEARCHER

An all mains set for 19/6.



This is a 2-valve plus-metal rectifier set useful as an educational set for beginners, also makes a fine second set for the bedroom, workshop, etc. All parts, less cabinet, chassis and speaker, 19/6. Post and Ins. 2/6. Data free with parts or available separately 1/6.

### THE REALITE



This is a complete fluorescent fitting, stove enamelled white, with starter and ballast all ready to install. Price 28/-, plus 4/6 carriage and packing. 40-watt tube, 10/-, no extra for packing if ordered with fitting.

### BABY ALARM



Unlike most baby alarms, this not only enables you to hear baby but also to talk to him. Price complete with one microphone and 100ft. twin flex, £8.19.6, carriage 3/6, additional microphone, 19/6.

### DON'T BE CAUGHT LIKE THIS



### CAR STARTER CHARGER KIT

All parts to build 6- and 12-volt charger which can be connected to a "flat" battery and will enable the car to be started instantly. Kit comprising the following—  
 Mains transformer..... 19/6  
 5-amp. rectifier..... 17/8  
 Regulator Stud Switch..... 3/6  
 Resistance Wire..... 2/-  
 Resistance Former..... 2/6  
 Mains on/off Switch..... 1/-  
 0-5 amp. Moving Coil Meter..... 9/6  
 Constructional Data..... 1/6  
 or if brought all together price is 52/6, plus 2/- post and packing.

### MULTI-METER KIT

Parts suitable for making a multi-meter to measure volts, milliamperes and ohms. Kit containing all the essential items including moving-coil meter, resistors, range selector, calibrated scale, etc., etc., is only 15/-, plus 1/- post and packing.

### 12in. TV. CABINET—15/-

We are offering these at less than the cost of the plywood they contain. If not wanted for TV, many useful items can be made—record storage cabinet, H.F. loud-speaker case, book case, etc., etc.  
 Price 15/-, carriage 3/6.

# WARN OUT REFRIGERATORS



## GIVE YOURS A NEW LEASE OF LIFE

These silent running "Sealed Systems" will completely modernise that Pre-war Refrigerator. They are ready to install, no technical knowledge required. Fit it yourself, SILENT. EFFICIENT. CHEAP. 5 YEARS' FREE REPLACEMENT WRITTEN GUARANTEE WITH EACH UNIT.

NO MORE SERVICING EXPENSES.

8 MODELS AVAILABLE, RANGING IN SIZE FROM 3 cu. ft. to 15 cu. ft.

Prices from £26/15/0 to £36/15/0.

Free Delivery in British Isles.

Send stamped, addressed envelope for

"SEALED SYSTEMS." Free Reduced Price Leaflet.

Latest complete general catalogue with many 'Hints & Tips', price 1/- post free (Refunded on first order).

## BRAID BROS.

for Home Refrigerator Construction.

50, Birchwood Ave., Hackbridge, Surrey. Tel.: Wallington 9309.

We do not wish to be associated with Scrapped Second-hand Ice-cream Components.

## ELECTRONIC PRECISION EQUIPMENT LTD.

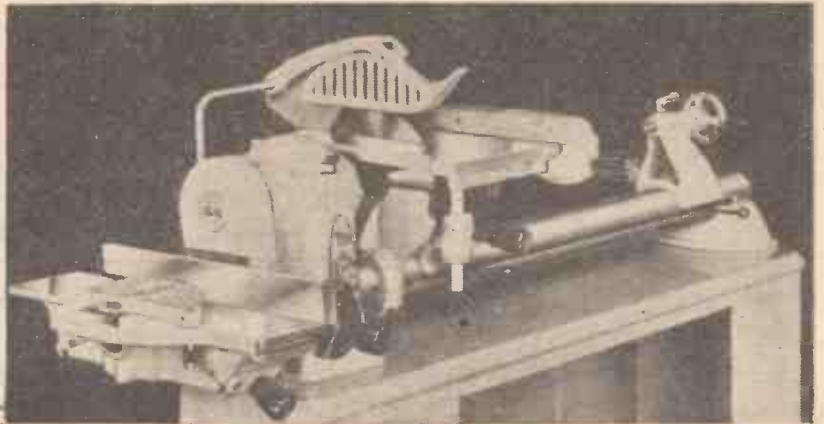
Post orders should be addressed to Dept. 1, Sutton Road, Eastbourns.

Personal shoppers, however, please call at:

42-48, Windmill Hill, 152-3, Fleet Street, 29, Strand Green Rd., 249, High Rd., Kilburn.  
 Ruislip, Middx., E.C.4, Finsbury Park, N.4. Phone: MAIDA VALE  
 Phone: RUBSLIP 6780 Phone: FLEET 2833 Phone: ARCHWAY 1049 4921  
 Half day, Wednesday. Half day, Saturday. Half day, Thursday. Half day, Thursday.

# Let the ML8 COMPLETE WOODWORKER do it for you

The ML8 Multi-purpose Woodworker is a complete workshop on its own. It does by power all those time-taking jobs which are usually done by hand. It takes the hard work out of woodwork and enables SAWING (bandsaw or circular saw), PLANING (4½ in. wide), REBATING, SANDING, POLISHING, BUFFING, LARGE DIAMETER TURNING, LONG BORING (lamp standards etc.), PANEL SAWING, GROOVING, METAL SPINNING, METAL and PLASTIC TURNING, GRINDING.



The ML8 with Circular Saw and Planing Attachment mounted for operation

Woodworking is a fascinating occupation for young or old. It pays you over and over again in pleasure and profit — and Myford Power tools for the woodworker are the finest in the world, and give maximum value per £ of cost.

There is no need to buy the complete range of equipment at once. You can start off modestly with the ML8 Woodturning Lathe or Shortbed Drive Unit which is the basic power unit, and add to your workshop with the easily-fitted, multi-purpose attachments just as required.

The ML8 is sold through leading Tool Merchants. Your nearest shop? Write to Myford—and ask for the free ML8 folder, "Power Tools for the Woodworker" (Publication 808)



## OMARO SLIDE RULES

**MODEL L.2.**  
Ratios of Cutting Speeds, Diameters, Number of Revolutions, Feeds, Time for Machining, etc.  
7/- post free.

### MODEL P.2. Bending Allowances and Weight of Non-ferrous Metals.

Price 7/- post free.

### MODEL W.1. Welding Data (Side 2)

Rightward and Leftward Welding, Vertical Welding (from 1 side, 1 welder and simultaneously from both sides, 2 welders). Blowpipe sizes (in cubic feet Acetylene per hour). Types of joints recommended, Distances between edges, Welding Rod sizes, Welding Rod consumption in feet and corresponding weights, for weld-lengths, of 10 to 100 feet, Welding Time per foot and welding Speed per hour. All values relating to various thicknesses of mild steel. Side 1 is giving Cutting Data.  
6/3 post free.

List of other Models on application.  
Kosine Ltd., 104, High Holborn, London, W.C.1  
Telephone: HOLborn 1301

### SPECIAL OFFER

#### OF NEW AND EX. GOVERNMENT BINOCULARS & TELESCOPES

**LIGHTWEIGHT PRISMATIC BINOCULARS.** Brand new instruments of highest quality. Recommended for general holiday use and long-range viewing. Tested and approved by Institut D'Optique de Paris. Lenses are coated for extra brightness.

8 x 25	£8.17. 6	} All complete with case and straps, and post free U.K.
8 x 30	£12.10. 0	
10 x 35	£15.10. 0	

**8 x 50 COOKE TROUGHTON & SIMMS ELBOW TELESCOPE.** A beautifully made instrument with wonderful definition. Length 11 in. Weight 6½ lbs. Excellent condition. 57/6. Post 2/6.

**IDENTIFICATION TELESCOPES.** Tremendous clarity and powers of 12X and 30X with Object Glass dia. of 60mm.—makes it ideal for long-range viewing, lunar observations, etc. Traversing and elevating gear enables fast-moving objects to be sighted quickly. Net weight 40lbs. Complete in fitted transit case and in excellent condition. Original cost £185. £15. Carriage free.

Satisfaction or full refund. Catalogue on request.

## CHARLES FRANK

67-73, SALTMARKE, GLASGOW, C.I. Phone: BELL 2106

### TUNGSTEN CARBIDE TIPPED TOOLS

**PLUGGING DRILLS**  
For clean round holes in brick, concrete, tiles; marble, etc., for all fixing jobs with Maso Plugs.

**GLAZEMASTER**  
For drilling windows, mirrors, glasses, bottles, plate glass, shelves, etc.

Write for Booklet P.M. Obtainable from your Tool Stockist, and Ironmonger.

# MASON MASTER

*The Tradesman's Choice*

Manufactured by  
JOHN M. PERKINS & SMITH, LTD., BRAUNSTON, NR. RUGBY  
Tel: BRAUNSTON 351-2

# A COMPLETELY NEW CONCEPTION OF HACKSAW DESIGN

## ELIMINATING THE FAILINGS OF EXISTING ORTHODOX DESIGNS ALTERATION OF BLADE ANGLE IS QUICK AND SIMPLE

To adjust the angle of the blade slack off the thumbwheel and the spring-loaded plungers will free themselves, rotate the blade to the approximate position required, retighten the thumbwheel and the plungers automatically seat themselves in accurate alignment.

### BLADE CHANGED IN SECONDS

To change a blade simply slack off the thumbwheel

until the blade becomes free. If required, continue to rotate the thumbwheel to adjust the frame for a different length of blade, drop the new blade into position on the retaining pins and tighten up the thumbwheel.

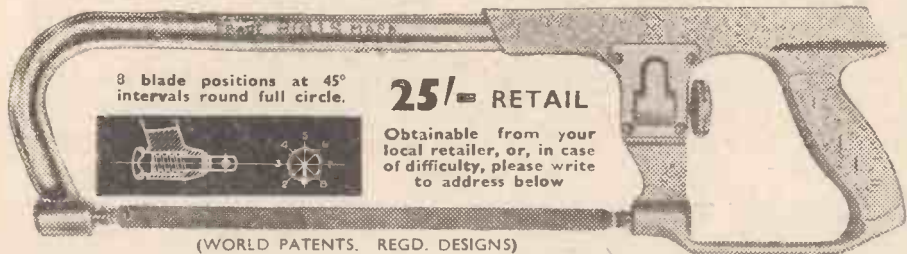
### ALL ADJUSTMENTS CONTROLLED BY A SINGLE THUMBWHEEL

The outstanding feature of the Rolls Hacksaw is the single thumbwheel which controls all adjustments for tension, blade changing, angle of blade or alteration of length of blade. Conveniently placed in the handguard, this thumbwheel has an integral worm driving a pinion which engages

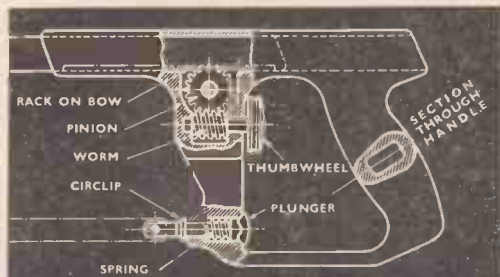
with a rack on the bow. This arrangement locks positively under tension and cannot be knocked loose in use, yet the thumbwheel runs freely on release of tension and provides infinitely variable adjustment for tension on all sizes of blade from 9in. to 12in.

### FRAME NEVER FALLS TO PIECES

The bow is captive in the handle so that the frame never falls to pieces, and the spring-loaded plungers which carry the retaining pins are secured by circlips so that they are always in position ready to accept the new blade.



(WORLD PATENTS. REGD. DESIGNS)



### FINEST MATERIALS

All parts of the finest quality materials, selected for suitability rather than price, to put the Rolls Hacksaw in a class of its own.

**THE THUMBWHEEL** worm and pinion are accurately machined. The totally-enclosed mechanism is dust and dirt proof for trouble-free operation, and requires no attention whatsoever.

**THE BOW** is of special light alloy, forged and heat treated for toughness. The stress-calculated section eliminates whip and overstrain. The rack is machine cut for accurate control and the wide throat permits full-depth cutting.

**THE HANDLE** is pressure die-cast in aluminium to a special pear-shaped pistol-grip design, giving a comfortable sawing position for accuracy and minimum fatigue. Its distinctive hammered finish is non-greasy and easy to keep clean.

**THE PLUNGERS** are precision formed for accurate alignment.

### DESIGNED BY CRAFTSMEN FOR CRAFTSMEN.

Hitherto the design of Hacksaw Frames has been limited to the orthodox. The ROLLS HACKSAW FRAME is not introduced as "another frame" in an overcrowded field where Hacksaws are much of a muchness... merely blade holders in fact! It brings to the bench of every craftsman the advantages of painstaking scientific development which has produced this major advance in Hacksaw design, and the previously accepted waste of effort, time and temper is completely eliminated.

No longer need the craftsman be irritated or hampered when turning or changing a blade or lengthening the saw. By taking full advantage of the versatility of the Rolls Hacksaw, TIME AND TEMPER ARE SAVED increasingly as the ease of manipulation and comfort in use give real aid to production.

The superb balance, styling, design, quality, performance and finish of the Rolls Hacksaw make it the finest value in the World.

## ROLLS HACKSAW

Made in England by ROLLS TOOLS LTD.  
Dept. 3, 154/6 Blackfriars Road, London, S.E.1  
Telephone: Waterloo 3131 (5 lines)

## 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



## \* Permanent Magnets in action \*



Ever dropped a nut in a gearbox?

In case you do, have an 'Eclipse' Pot Magnet available to help you recover the nut. This is one of many ways in which magnets can help you.

Ask your tool dealer for descriptive literature.



## PERMANENT MAGNETS

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

## 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.

The ULTRA LENS is used extensively in collieries, foundries, electricity works, tool shops, forges, motor works, and practically every branch of the engineering trade. Librarians use it for reading Micro-Films.

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.



Write today for full particulars and price list to

THE ULTRA LENS COMPANY

Tel.: TRAFalgar 2055  
17c, Oxendon Street, London, S.W.1.

# NEW!



Available in two qualities —  
High Speed & Regular Tungsten.  
Write for full particulars.

**J. STEAD & CO. LTD. SHEFFIELD 2. ENGLAND**

S 24



Keep lathes, drills, vices and hand tools thoroughly lubricated, clean and smooth working with **ESSO HANDY OIL**. Blended with a special additive which positively prevents rust. Always ready for use. Long spout makes it easy to oil into awkward corners.

*Oil often for smooth running—*

**BICYCLES  
PERAMBULATORS  
LAWN MOWERS  
SEWING MACHINES  
CAR FITTINGS  
LOCKS, HINGES  
GUNS**

*Every handy man needs*

## Esso Handy Oil

**OILER TIN WITH SPOUT 1/3d**  
**REFILL BOTTLE . . . 1/-**

*From Hardware Stores everywhere*



### FOR THE BEGINNER

### JOHNSON PHOTOGRAPHY OUTFITS

If you want to start developing and printing your own photographs and are not quite sure what you need, Johnson Home Photography Outfits provide the answer. Each outfit is a complete self-contained unit including the most up-to-date Johnson equipment and chemicals. A 100-page book of instructions is included with the Developing and Printing sets.

**No. 1 Outfit** contains everything necessary for making prints from  $2\frac{1}{4} \times 2\frac{1}{4}$  in. and  $2\frac{1}{4} \times 3\frac{1}{4}$  in. negatives. Includes Plastic Printing Frame, Portable Darkroom Lamp, Dishes, Measure, Thermometer, Chemicals, etc. Price £1.17.6.

**No. 3 Outfit** (as illustrated) for developing 120 and 620 films. Price £2.10.0.

**No. 21 Outfit** incorporates a Johnson Battery Printer for making first-class  $2\frac{1}{4} \times 2\frac{1}{4}$  in. and  $2\frac{1}{4} \times 3\frac{1}{4}$  in. prints. Price £2.11.6. Battery extra 2/9.

**No. 22 Outfit** has the Johnson Mains Printer and everything else required to produce contact prints. Price £3.4.6.

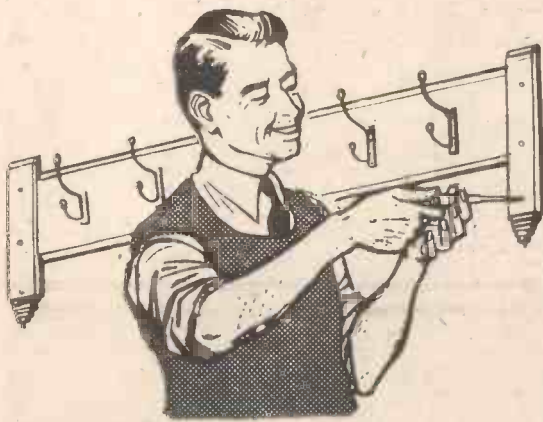
**No. 5 Outfit** for Drying and Glazing Prints, £4.15.0.

**No. 6 Outfit** for making Postcard size Enlargements, £4.12.6.

**No. 44 Outfit.** Complete Darkroom Equipment, £5.12.6.

JOHNSONS OF HENDON LTD. LONDON, N.W.4





# IT'S FAR EASIER WITH RAWLPLUGS!

THE EASIEST WAY of fixing screws in masonry is *still* the world-famous Rawlplug way. Rawlplugs are used by the million in industry! You drill

a hole, insert a Rawlplug and screw up your fixture. Far easier, far quicker, far safer than any other method. A Rawlplug Outfit (from as little as 3/-!) contains all you need—Rawlplugs, Rawltool, screws, 16-page 'Hints on Fixing'. Get one today!

## HIGH-SPEED MASONRY DRILLING—IN A HAND BRACE!

When drilling brick, tile, stone, enjoy the *durium*, clean-cutting ease of a Rawlplug DURIMUM-tipped Masonry Drill. Drill right through a wall if you wish—easily and silently. There's nothing 'just as good'—look for the name DURIMUM on the shank.



8518 A

**Rawlplug DURIMUM-tipped DRILLS**  
FROM YOUR IRONMONGER OR HARDWARE DEALER

THE RAWLPLUG COMPANY LTD · LONDON · S.W.7

1,000 H.S. Inserted Blades Expanding Reamers, 21/32"-23/32" 18/-; 11/16"-1 17/8; 1"-21/32", 17/8; 27/32"-15/16", 18/6; 1"-31/32", 18/6; 15/16"-1 1/16", 20/-; 31/32"-1 1/4", 22/6; 1 1/16"-1 3/16", 27/6; 1 3/16"-1 11/32", 32/6 each.

200 Slotting Cutters 2 1/2" dia. 1" thick, 1" hole, 5/- each.  
500 Sets Hex. Die Nuts. Sizes 1", 5/16", 3/8", 7/16" and 1" Whit., B.S.F., American Car thread or 20 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 25/6, four sets 55/- Also 1" and 1 1/2" in Whit. and B.S.F. only. 1" 5/- each; 1 1/2" 6/- each, 10/- per pair.  
1,000 H.S. Morse Taper Shank End Mills. No. 1 shank 1 1/2", 5/16" 5/8, 1 1/4", 1 1/8", 1 1/2", 1 3/4", 2" shank 9/16" 10/-, 1 1/4", 1 1/2", 1 3/4", 1 1/2", 1 15/- Also straight shank H.S. 1 1/2", 5/16" 3/6, 1 1/4", 1 1/2", 1 3/4", 1 1/2", 1 15/6 each.

700 Circular Split Dies, 2 1/2" dia. cutting 9/16", 1", 1 1/16", 1 1/8", 1 1/4" B.S.F. thread complete with die stock, 42/- per set, actual value over £5. Also 1", 1 1/8", 1 1/4" Whit. and 1" and 1 1/2" gas thread, complete with die stock, 42/- per set. Any size dies, 7/6 each, die stock, 10/- each.

1,000 H.S. Jobber Twist Drills, 5/32" 10d., 3/16" 1/2; 7/32" 1/10; 15/64" 2/-; 9/32" 2/8; also 25/64", 27/64", 29/64", 31/64", 13/- for four, 3/6 each.

Special Clearance, H.S. taper pin reamers, sizes 4, 5, 6, 7, 8, 9, £1 the lot, worth £5.

1,000 H.S. long straight shank twist drills 3/64" to 7/64" dia., 1/4"-5" long, 3 ass. 5/-; approx. 7/32" and 1" dia., 6" and 7" long, 5/- the two; 9/64" dia. 1 1/2" long, 3" flute length, 3/8 each; 2" dia. 10" long, 8" f.l. 4/6 each; 19/64" dia. 9" long, 7" f.l. 4/6 each.

500 High Speed Side and Face Cutters, 2 1/2" dia., 1" hole, 1", 1 1/8", 1 1/4" thick, 10/- each; 3" dia., 1", 1 1/8" thick, 15/- each; 3 1/2" dia., 5/16", 1", 1 1/8" thick, 17/6 each; 4" dia., 1", 1 1/8" thick, 25/- each. All 1" hole.

This is a H.S. Milling Cutter Bargain. All 1" bore, 3"-3 1/4" dia., 1"-1 1/4" thick, including side and face cutters, plan and angle cutters. A most useful lot for any tool room, 6 ass. for 50/- The present maker's price of the cheapest cutter in this selection is 40/-. You must get this lot, remember you get same on approval against cash.

All items brand new. £1 orders post paid, except overseas.  
2,000 Small H.S. Twist Drills, approx. 1/32"-3/32", 4/- doz. approx. ; 1/16"-1" 7/6 per doz. approx. ; 9/32"-15/32", six for 10/-.

3,000 Circular Split Dies 1" dia. cutting 1", 5/16", 3/8", 7/16", 1" Whit., B.S.F. also brass thread, 25 thread all sizes and American N.F. 12/- per set of 5 sizes, 2 sets 22/6, 4 sets 42/6. Taps to suit 11/- per set, either taper or second or plug. 1" die-stocks 6/- each.

1,000 H.S. Slitting Saws, 2 1/2" dia., 1" hole, .019", .027", .029" thick. Actual value 10/- each, clear 3/9 each.

1,000 Hand Reamers, 5/16", 3/6 each.  
1,000 High Speed Parting Off Tool Blades, Eclipse brand : 11/16" x 3/32" x 5" long, 5/- each; 13/16" x 1/16" x 6" long, 5/- each; 15/16" x 3/32" x 6" long, 6/- 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" bore, 1" o.d., 1" thick, 4/- pair; 1" bore, 1" 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; 1" bore, 1" o.d., 7/32" thick, 5/- pair.

2,000 Files, 4" to 6" flats, half-round, rounds, squares, warding, assorted cuts, good general lot, 10/6 doz. ; three doz. 25/6.

2,000 Straight Shank End Mills, size 1", 5/32", 3/16", 7/32", 1", 5/16"; list price 30/- set, handy bargains, 15/- set, also 1", 7/16", 1" ditto 12/6 set, all in makers' wrappings.

500 H.S. 90° Countersinks, body 1" dia., teeth cut to point. An essential tool for any workshop using c/s screws. Gift 5/- each.

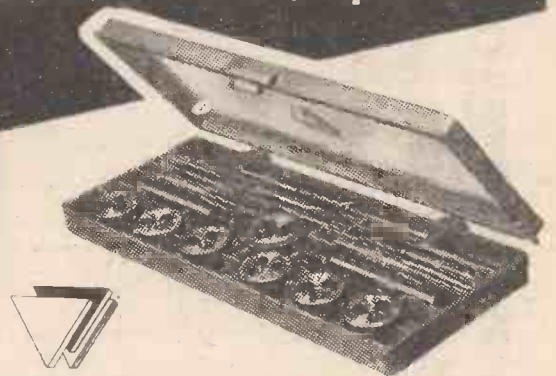
J. BURKE

192 Baslow Road, Totley, Sheffield

Inspection Only at Rear 86 Fitzwilliam St., Sheffield.

## TRIANGLE LEADS AGAIN

### with the finest set of STOCKS & DIES produced



**NOW** — IN COMPACT POCKET SIZE PLASTIC CASE REINFORCED WITH WINDOW FRONT

The Dies are Circular Split 13/16in. O.D. and all Tools are of the highest quality, fully warranted. Supplied in B.S.W., B.S.F., B.A., M.E., N.F., N.C.

Obtainable from all reputable dealers, or in cases of difficulty write to :

THE BRITISH TAP & DIE CO. LTD  
Triangle Works, Town Road, Edmonton, London, N.9. Telephone EDMoncton 1546-7

**Maximum production depends on high technical skill such as that acquired by I.C.S. Students**

**TENS OF THOUSANDS MORE TRAINED MEN ARE URGENTLY NEEDED NOW—BUT THERE IS NO WORTH-WHILE PLACE FOR THE UNTRAINED**

**Ambitious men everywhere have succeeded through I.C.S. Home-Study Courses. So also can you.**

# I.C.S.

## TRAINED MEN ARE IN GREATER DEMAND THAN EVER

The man with an I.C.S. Training in any one of the subjects listed in the coupon knows it thoroughly, completely, practically. And he knows how to apply it in his everyday work.

Students intending to sit for examinations in Mechanical Engineering, Architecture, Quantities, Civil Engineering, and others, should enrol NOW for preparatory Courses.

Using a specially prepared Study Programme, the student studies in his spare time at his own pace and, with time for revision, sits with full confidence of success.

Courses are also available for General Certificates of Education and most other Technical, Professional, Commercial and Civil Service Examinations.

(I.C.S. Examination Students are coached until successful.)

Moderate fees Include ALL Books required.  
REDUCED TERMS TO H.M. FORCES.

If you need technical training, our advice concerning your work and your career is yours for the asking—without obligation. Let us send our special free booklet on the subject in which you are specially interested.

**The successful man DOES to-day what the failure INTENDS doing to-morrow. Write to us TO-DAY.**

**Dept. 169B,  
I.C.S., 71 KINGSWAY, W.C.2**

Accountancy	Electric Power, Lighting, Transmission Traction	Motor Vehicle Elec.
Air Conditioning	Electronics	Municipal Engineering
Architecture	Eng. Shop Practice	Police Entrance
Architectural Drawing	Fire Engineering	Plumbing
Boiler Engineering	Gardening	Production
Book-Keeping	Heating and Ventilation	Engineering
Building Construction	Hydraulic Engineering	Quantity Surveying
Building Specifications	Illumination Eng.	Radio Engineering
Business Training	Industrial Management	Radio Service Eng.
Business Management	Journalism	Refrigeration
Carpentry & Joinery	Machine Design	Salesmanship
Chemical Engineering	Machine-Tool Work	Sanitary and Domestic
Civil Engineering	Maintenance Eng.	Engineering
Clerk of Works	Mechanical Drawing	Sheet-Metal Work
Coal Mining	Mechanical Engineering	Short-Story Writing
Concrete Engineering	Mining Engineering	Structural Steelwork
Diesel Engines	Motor Engineering	Surveying
Draughtsmanship	Motor Mechanics	Television Technology
Drawing Office Practice		Welding, Gas and Elec.
Electrical Engineering		Woodwork Drawing
		And many other subjects

## INTERNATIONAL CORRESPONDENCE SCHOOLS

Dept. 169B, International Buildings, Kingsway, London, W.C.2.

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

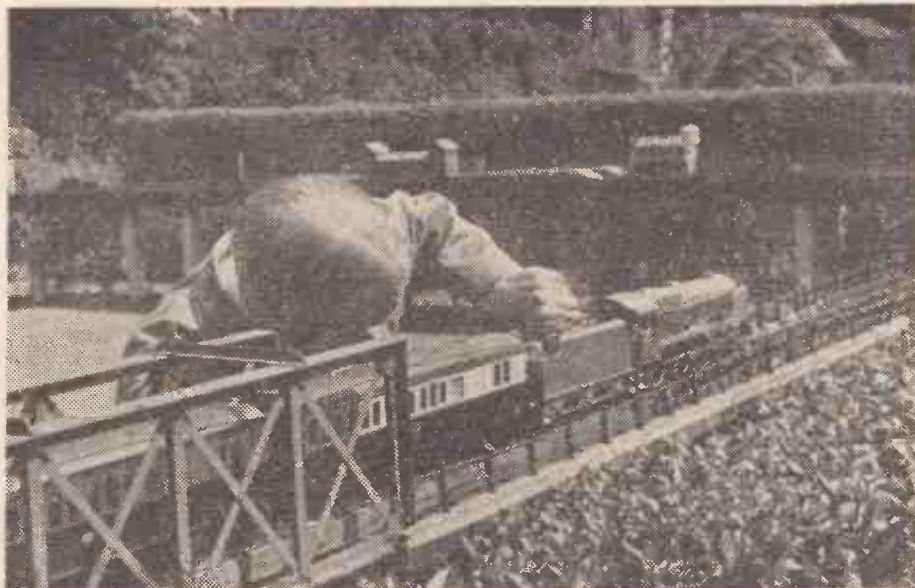
Name..... Occupation.....  
(USE BLOCK LETTERS)

Address .....

10.56

### Addresses for Overseas Readers

AUSTRALIA : 140, Elizabeth Street, Sydney. EGYPT : 40, Sharia Abdel Kkalek Sarwat Pasha, Cairo. 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 : Dept. L., 45, Shortmarket Street, Cape Town.



**THESE ARE  
THE BOOKS**

The Bassett-Lowke Model Railway catalogue and the Bassett-Lowke Shipping and Engineering catalogue are packed full of information and interest. From the smallest single job to the largest garden railway—whatever your interest you cannot afford to be without these famous books.

Write today to your nearest Bassett-Lowke branch for "Model Railways" (2/-) and/or "Model Shipping and Engineering" (2/6).

Our staff at London and Manchester branches will be very pleased to answer any questions and give you practical advice concerning your outdoor railway, or write to us at Northampton for full details.

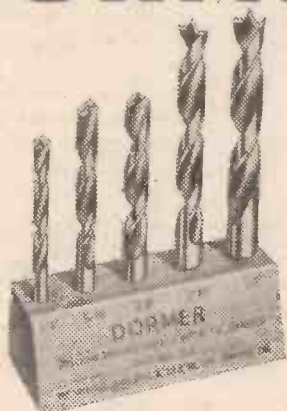
**BASSETT-LOWKE LTD.**

21, Kingswell St., Northampton

London : 112, High Holborn, W.C.1

Manchester : 28, Corporation Street

**DORMER Drill Sets**



**No. 33**

**WOODWORKING DRILLS**

With 1/4 in. dia. Shanks  
Sizes : 1/4 in. to 1/2 in. by 16ths.



**No. 52 - No. 53**

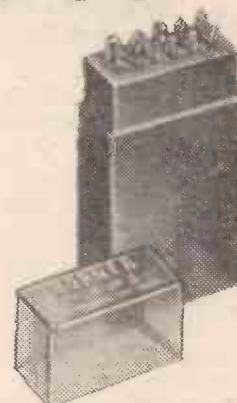
**HIGH SPEED STEEL CARBON STEEL**

**STRAIGHT SHANK DRILLS**

Sizes : 1/16 in. to 9/32 in. by 32nds.



**OTHER POPULAR SETS  
ARE ALSO AVAILABLE**



**No. 9 - No. 10**

**CARBON STEEL HIGH SPEED STEEL**

**STRAIGHT SHANK DRILLS**

Sizes : 1/16 in. to 3/16 in. by 64ths  
and 7/32 in. to 1/2 in.

**THE SHEFFIELD TWIST DRILL AND STEEL COMPANY LIMITED**  
SHEFFIELD ENGLAND  
DORMER DRILL SETS ARE OBTAINABLE FROM YOUR USUAL ENGINEERS' MERCHANTS

**THE "FLUXITE QUINS" AT WORK**



"I'm never left in mid-air  
With FLUXITE I haven't a care.  
For sound secure joints  
It scores on all points  
New work—or tricky repair."

No need to emphasise to you how good Fluxite is! Everyone who has ever done soldering work—and done it well—knows that Fluxite is a "must" for a first-class job carried out in double-quick time. Keep on using Fluxite and you'll keep on giving satisfaction.

**FLUXITE**  
simplifies  
soldering

★ **FLUXITE SOLDERING FLUID**  
Tried it yet? It's modern, specially formulated and a big advance on old-fashioned liquid fluxes.

FLUXITE LTD BERMONDSEY ST LONDON S.E.1

TELEPHONE: HOP 2632.  
G.M. 29.

EXPORT ENQUIRIES INVITED.

THE **HANDYMAN** WILL TREASURE THIS  
**'THIRD HAND'**



The Improved  
**MOLE**  
Self Grip  
**WRENCH**  
7"-12/6 10"-15/-

This multi-purpose tool locks on to work with tremendous grip and stays there with hands off until the release lever is touched—how often have you wished for just that? Use it as super pliers, a vice, wrench, clamp and so on. The Mole Wrench is your "third hand"—sturdy, easy to handle—really something to treasure.

If any difficulty write to:—  
M. MOLE & SON,  
BIRMINGHAM, 3.

From Ironmongers, Motor and Motor Cycle Accessory Dealers.

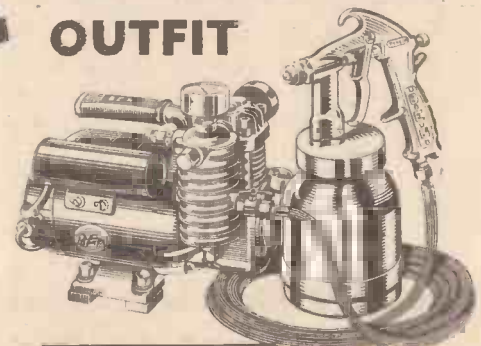


Do it yourself with a  
**B.E.N. HANDISPRAY OUTFIT**

Ideal for  
HOME HANDYMAN  
CAR OWNER  
AMATEUR DECORATOR  
FARMER  
SMALLHOLDER  
NURSERYMAN

Various applications include  
SPRAY PAINTING  
CREOSOTING  
TYRE INFLATION  
DISTEMPERING  
INSECTICIDE SPRAYING

Easily carried—weighs 45lb.



PRICE: £40-5-0 including gun & hose  
Hire Purchase Terms: £20.8.0 deposit and insurance, and 12 monthly payments of £1.18.6

Write for Leaflet CB. 112

B.E.N. PATENTS LTD. (Division of Broom & Wade Ltd.)  
P.O. Box No. 10, Dept. X, HIGH WYCOMBE, BUCKS. Tel.: High Wycombe 1630

# Bridges — for better class power tools



**Bridges**  
OF LONDON

**'Tool Power'  
Drill**

No other home workshop tool has a pedigree to match that of the "ToolPower" drill. Built primarily to meet the rugged demands of Industry, it is the most powerful tool of its kind in the World. This extra power is essential when a drill is used as a power unit for home workshop equipment. The renowned Bridges "ToolPower" drill works well within its maximum output and therefore gives you longer service life.

You can buy Bridges "Home Workshop" complete or, by starting with any one of the following Kits, you can build up a range of power tools to suit your own requirements. There is no duplication of parts and all Kits are available on a small down payment.

**Bridges "Complete Home Workshop" includes the following separate Kits:—**

- Lathe    Bench Saw**
- Bench Sander    Bench Grinder**
- Drill Polisher    Drilling Machine**

See this equipment at your local tool shop, or write for free illustrated brochure

**ToolPower—the better-class power tools**

**S. N. BRIDGES & CO. LTD., Parsons Green Lane, London, S.W.6**



Tel. RENown 3344  
AP3/11/121

# 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.

## 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**



410A, COLLEGE HOUSE,  
29-31, WRIGHT'S LANE,  
KENSINGTON, W.8.

Phone : WESTern 9861

### 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.

### POST NOW!

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

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

NAME .....

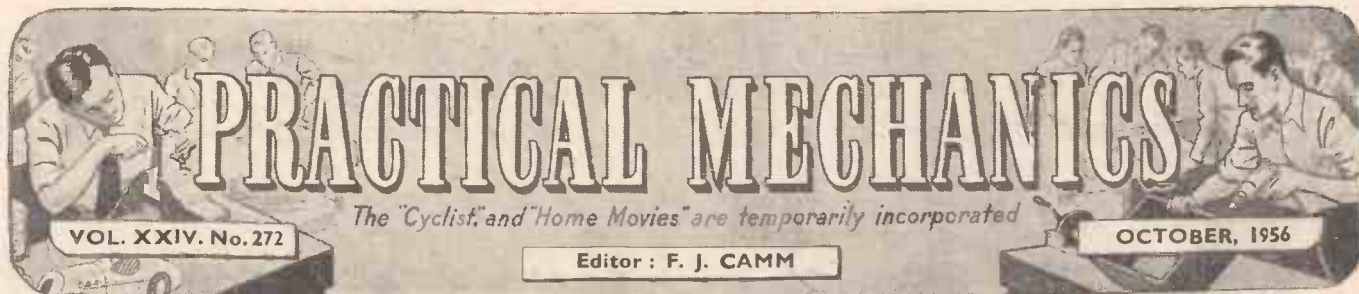
ADDRESS.....

WRITE IF YOU PREFER NOT TO CUT THIS PAGE



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

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



### Founders of Industry

IT is one of the pleasant duties of the editor of technical journals to visit annual exhibitions. By this means he is able to see trends in development, changes in design, new ideas, materials and methods of particular industries under one roof, and thus to bring the very latest information to his readers.

He is also able to discuss various subjects with executives of firms and once a year meet those with whom perhaps he only has contact during the year through the medium of the post.

In strolling round this year's Radio Show, Model Exhibition, The Aeronautical Show, and several other national exhibitions, I reflected upon the large numbers of people now holding important positions either as founders of firms or as designers and works managers, who owe their careers almost entirely to their interest in models and amateur mechanics. The radio industry undoubtedly was founded by amateurs. Every important firm started its existence in a small way as a result of the enthusiasm of a keen amateur. Today those businesses have expanded, and in their turn are absorbing into their personnel the amateurs of the present generation. The aeronautical industry was entirely founded by model makers and experimenters. Sopwith, Fairey, A. V. Roe, Handley-Page and many others were all keen model makers, who have founded large businesses of international standing and importance.

Model making and amateur mechanics, therefore, are important national movements which should be encouraged by the State. The Science Museum at Kensington contains some of the models of young men who later became famous. Model making is indeed a fascinating way of learning the rudiments of engineering. It imbues a desire to use tools and to understand materials. Parents should encourage it. Any inclination shown by their children towards making things is bound to stand them in good stead later on.

### Education of the Young Worker

BEARING on this subject, it is reassuring to note that some of our universities are interesting themselves in the education of the young worker. The

## FAIR COMMENT

By  
The Editor

sixth Oxford Conference on this topic was held earlier this year and the particular subject under consideration was the needs of those young workers for whom at present there are no satisfactory schemes of training or further training, or who fail to take advantage of such opportunities as are open to them. There was general agreement that every encouragement should be given to the provision of training for those outside the apprentice group, remembering that they are an offspring of an age which has known two world wars and has seen striking advances in science and technology. For all these young workers the change-over from school, where they were of some importance, to work, where they become a mere check number, is a period of considerable difficulties. They enter the work with a certain enthusiasm which tends to disappear in the atmosphere and attitude towards work which they find in employment. Their elders often fail to foster in them a proper regard for work as a source of human dignity and a necessary social activity.

The conference recommended that for the non-apprentice groups, schemes of training should be instituted under an officer parallel to the apprentice-supervisor, to enable the adoption of planned training. The responsibility for initiating such schemes, including those run jointly for small and medium-sized firms, should be with the trade associations in collaboration with the

appropriate trade unions. Small employers should band themselves together for schemes of further education on general lines, in much the same way that joint apprenticeship councils now do for vocational training and the initiative for framing these schemes should come from trade associations. The possibilities should be investigated by the Ministry of Labour and the T.U.C. of the extension of the apprenticeship system to occupations other than the traditional crafts and to the inclusion of girls in all such schemes.

### The Young Inventor

I HAVE often remarked that this country gives precious little encouragement to inventors. It is only concerned with production and marketing and the exploitation of inventions after someone has ploughed the lonely furrow. The Institute of Patentees, which was founded 37 years ago, has done a great deal towards encouraging and advising inventors and canalising their efforts. For the young inventor it has a special class of membership known as "Companion." These are young people of schoolboy and student age who the Institute wishes specially to encourage so that any inventive talent they may have may be developed.

The president of this Institute is Professor A. M. Low, and the vice-presidents and executive are all men of wide experience and international reputation. I am giving a lecture on the subject of invention and inventors before the Institute on October 9th, and readers who wish to attend should write to the Institute at 207-208, Abbey House, Victoria Street, S.W.1.

### Volume 23—Indexes

LAST month I mentioned that the September issue completed Volume 23, but the dates of the commencing and finishing issues became transposed. Volume 23 commences with the issue dated October, 1955, and concludes with the issue dated September, 1956. Indexes for Volume 23 are now available at 1s. 3d. by post. This is a reminder that Volume 23 contains only 10 issues as, owing to the printing dispute, we did not publish issues dated March and April.

This present issue, of course, is the first of Volume 24.—F. J. C.

#### SUBSCRIPTION RATES

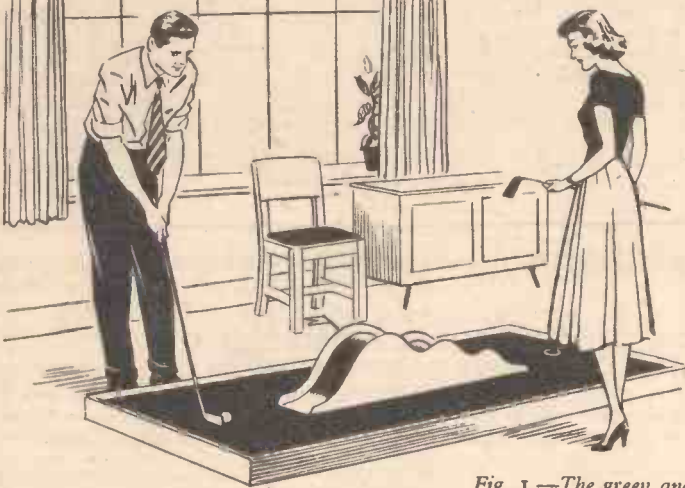
including postage for one year

Inland	- - -	18s. 6d.	per annum.
Overseas	- - -	17s.	per annum.
Canada	- - -	17s.	per annum.

Editorial and Advertisement Office: "Practical Mechanics," George Newnes, Ltd., Tower House, Southampton Street, Strand, W.C.2  
Phone: Temple Bar 4363  
Telegrams: Newnes, Rand, London.

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. Reproductions or imitations of any of these are therefore expressly forbidden.

# AN Indoor-Outdoor Miniature Golf Course



## Constructional Details for Making a Green and Nine Interchangeable Hazards

2in. wide. The two sides are 3ft. 6½in. long and the end 2ft. 3in. long. The end piece in one green has to be shaped as shown in Fig. 2. This cut out is at the opposite end to the hole and is

**T**HE green is the same in every instance, being a smooth flat wooden surface covered with baize, so that it will look realistic and effective. There are nine hazards all different and each of robust construction. The heading picture shows the completed green and one of the hazards. A full-size golf ball and putter are used and, if the hazard is removed, practice at putting on the flat green may be obtained.

Fig. 1.—The green and one of the hazards being played.

to allow for the swing of the putter.

Four cross strips must be provided for each half of the green, 2ft. 3in. long, ½in. thick and 1in. wide. These are fitted inside the 2in. wide outside framework and ensure that the plywood top is at the right height. One is put immediately inside the end, the next 9½in. farther in and the third one 9in. beyond that. In one of the halves the

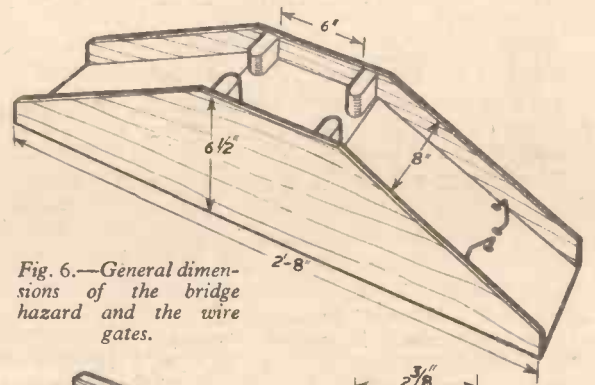


Fig. 6.—General dimensions of the bridge hazard and the wire gates.

### The Nine Hazards

1. The Bridge.
2. The Switchback.
3. The Castle.
4. The See-saw.
5. The Slope.
6. The Gates.
7. The Chasm.
8. The Tunnel.
9. The Bell.

### Construction of the Green

Plywood 3/16in. thick is used for the floor and two pieces 3ft. 6in. long by 2ft. 3in. wide are required, the green being made in two sections. Each half of the green has two sides and one end made from wood ½in. thick and

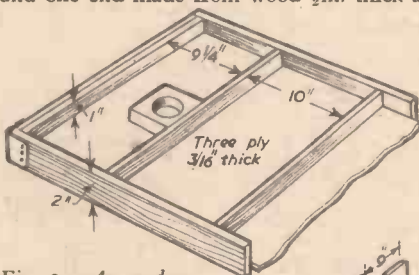


Fig. 2.—An underside view of the end of the green.

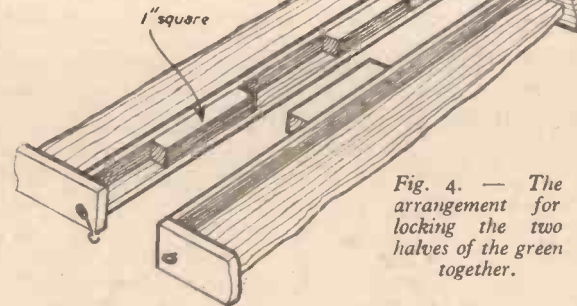


Fig. 4.—The arrangement for locking the two halves of the green together.

fourth strip is set ½in. in from the further end, and in the other level with it (see Fig. 4). These pieces are all glued and screwed to the side, flush with the bottom edges, so that when the whole framework is turned over and the piece of plywood dropped into the frame, it is ½in. below the edge of the sides.

### Making the Hole

First make the block of wood which is to strengthen and provide depth to the hole and which is shown in Fig. 2. The block should be 5in. square with a 3½in. hole cut in the

1in. by ½in. stripwood can be used. Then turn the plywood over and stretch the baize evenly across to the other side, where it is turned over the edge and held in a similar manner. The cloth should be glued to the whole surface of the plywood as it is stretched over. A hot iron is put over the cloth to smooth it out and press on to the wood before the glue sets. The overlap of the baize at the ends is turned over in a similar way. When the glue has set cut across the cloth over the hole in the shape

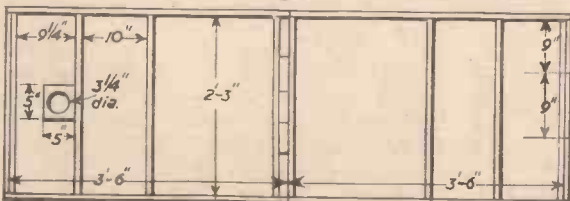


Fig. 3.—An underside plan view of the green.

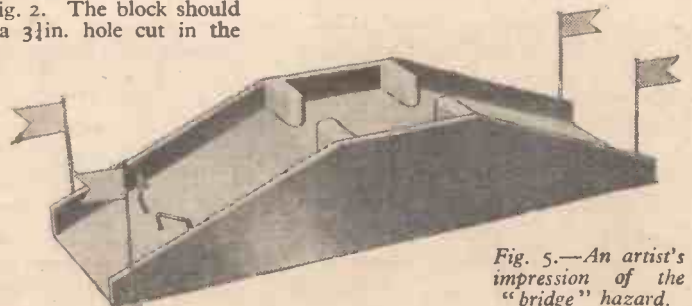


Fig. 5.—An artist's impression of the "bridge" hazard.



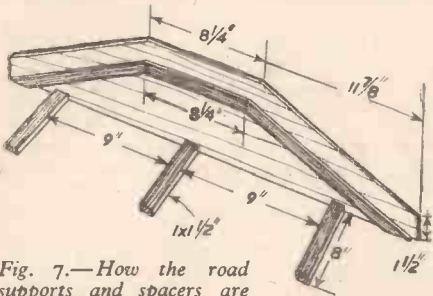


Fig. 7.—How the road supports and spacers are positioned.

of a star, turn the points under the board and fix there as before.

The complete sheet of plywood is now forced into the framework and if it has been accurately made it will fit firmly in place. If stripwood has been used to hold the baize underneath, accommodating recesses

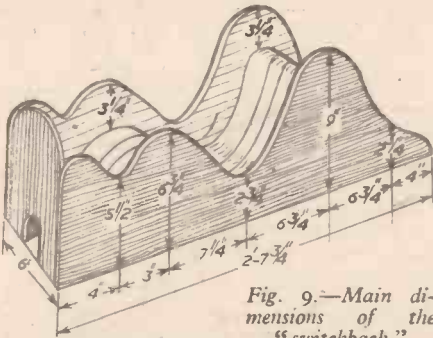


Fig. 9.—Main dimensions of the "switchback."

must be made in the cross struts of the frame. The thick block forming the depth of the hole is glued beneath the corresponding hole in the top (see Fig. 2). The upright edges of the green can be covered with baize if so desired, but look quite well if merely given two coats of green paint.

The outside corners of the green should be protected with brass strips measuring 3in. by 2in., bent round the corners and tacked in position as shown in Fig. 2.

**The Locking Device**

In Fig. 4 is shown the method of joining the two halves of the green together. An 18in. strip of 1in. square wood is cut into three pieces, each 6in. long. These are glued to the two end battens as shown in Fig. 4, one piece fitting between the other two. A hook and eye on each side complete the arrangement.

**The Bridge Hazard**

Fig. 5 is an artist's impression of this hazard, which is known as the "bridge," and the main overall dimensions are given in

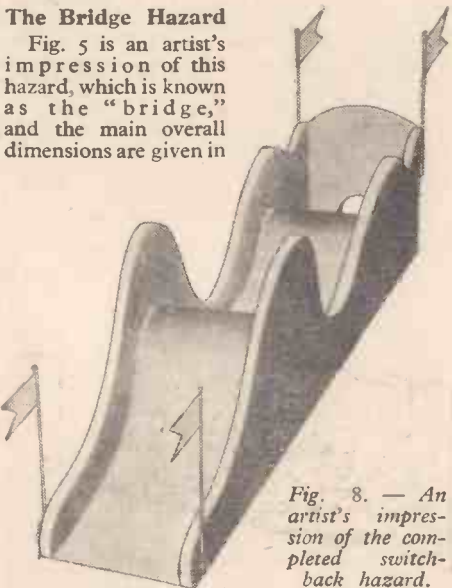


Fig. 8.—An artist's impression of the completed switchback hazard.

Fig. 6. In order to hole out, the ball must be driven up the ramp between the projecting walls and down the other side.

The two sides are made first and these are cut from pieces of 3/16in. plywood, each 2ft. 8in. by 6 1/2in. The shape will be apparent from Fig. 7. An interior framework has to be provided to hold the two sides together and support the roadway which runs between them and the pieces of stripwood required are shown in position in Fig. 7. The three strips to support the road on each side are made from wood 1/2in. thick and 3/4in. wide, glued parallel to the top edge and 1 1/2in. away from it. Strips 1in. wide by 1/2in. thick by 8in. long are used to form the struts across the bottom.

The roadway is formed from three pieces of 3/16in. ply which are laid on the supports glued to the sides. The ends of the pieces which form the ramps are chamfered with a file so that they join smoothly with the top piece and so that no ledge is formed where they meet the green.

The projecting walls on the top are cut

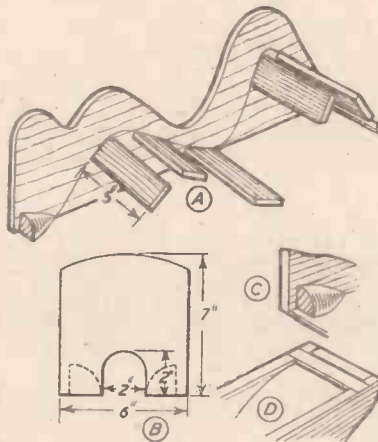


Fig. 10.—The interior supports of the "switchback."

from pieces of wood 1in. thick, 1 1/2in. wide and 2 1/2in. long. The corners on the fairway side must be rounded as shown in Fig. 6 and the walls must be glued in position about 6in. apart. On one of the slopes two guides can be provided to guide the ball towards the hole after it has passed between the walls on top. These can be bent up from steel rod, threaded and fixed as shown in Fig. 6.

Finally, the whole of the outer surface is given a coat of glue and whilst it is still tacky

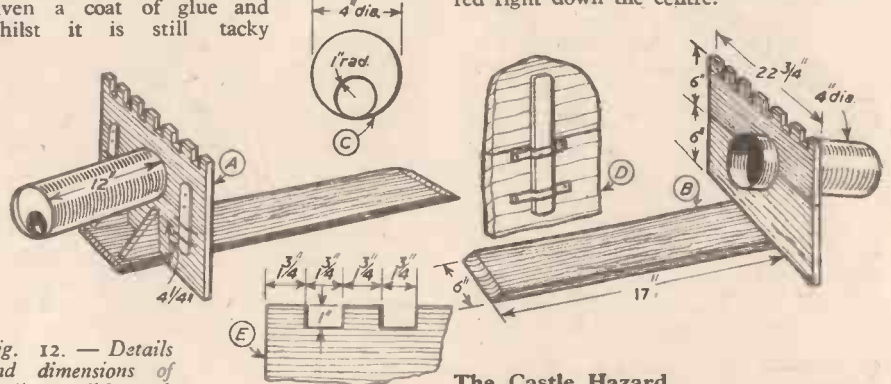


Fig. 12.—Details and dimensions of the "castle" hazard.

sawdust is sprinkled on. When it is all dry, the hazard is painted green and the fairway a lighter colour such as buff or sand.

**The Switchback Hazard**

The completed switchback is shown in Fig. 8; it measures 2ft. 7 1/2in. long and 6in. wide. As can be seen it has two "waves"

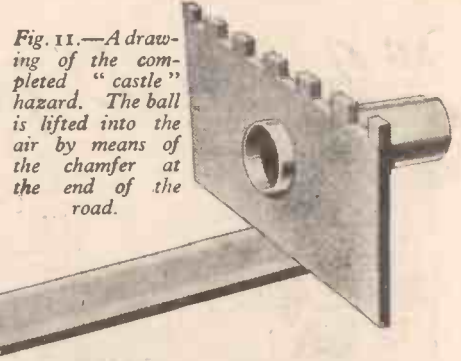


Fig. 11.—A drawing of the completed "castle" hazard. The ball is lifted into the air by means of the chamfer at the end of the road.

and finishes up with a hole at one end through which the ball is guided. There is a definite knack in playing the hole for the ball has to run at an exact speed in order to get over the two waves of the hazard.

For the sides two pieces of deal or plywood are required 2ft. 7 1/2in. by 9in. wide and on each is marked off the dimensions and heights given in Fig. 9. Connect up the marks in a continuous curving line as shown and cut along the line with a fretsaw. On the inside of the two pieces draw a line parallel with the curved top edge and 3 1/2in. below it as shown in Fig. 9.

The six struts which support the roadway are cut from 1/2in. deal, 5in. long and 2in. wide and these are fixed in the position shown at A in Fig. 10. They are glued in place and can also be nailed and screwed from the other side, but before fixing them in position cut out the end piece, shown at B in Fig. 10. This is cut from a piece of 1/2in. wood of the dimensions shown, the top curve and bottom arch being cut with a fretsaw. When this and the struts are fixed in place the whole structure should be rigid.

The roadway is fitted next and this is made from a strip of linoleum of appropriate length and 5in. wide which should fit snugly between the two sides. The tacks for fixing the linoleum are fixed as near the sides as possible, leaving the fairway smooth and clear. A strip of tinplate is fixed underneath the open end of the switchback, so that the end of the linoleum may be nailed to it as shown at D in Fig. 10; the other end may be fitted under the end arch piece. At C is shown two small wedge-shaped pieces which are fitted to guide the ball out through the hole.

The sides and end of the hazard are finished off as was the first hazard with sawdust, glue and green paint. The fairway may be painted a buff colour, with perhaps a strip of black or red right down the centre.

**The Castle Hazard**

An artist's impression of the "castle" is given in Fig. 11 and the principal dimensions are shown at A and B in Fig. 12. As can be seen, it consists of a fairway on which is raised the battlemented wall. Through this wall is a pipe positioned at a slight angle, so that once the ball is shot into it it will roll down gently and out the other end. The roadway and castle wall are made from 1/2in. deal and the pipe

which is 4in. in diameter may consist of any available piece of tubing. The roadway is a board 20in. long, one end of which is chamfered to make the ball rise.

The wall is built in two pieces, each 22½in. long and 6in. wide. One edge is cut to form the battlements (see E in Fig. 12) and the two parts are held together by a stirrup being fitted to the upper one and receiving brackets to the lower one (D in Fig. 12). Semi-

circles of 2in. radius are cut out of the centre of both top and bottom sections so that the pipe fits loosely and tilts downwards from the roadway.

The completed wall is fixed to the roadway 3in. from the end opposite to the chamfer, and little angle blocks (see Fig. 12) help to hold it in place.

Screw and glue all these parts together and then cut out the 4in. diameter circle of wood

which fits in the end of the pipe. A 2in. diameter hole is cut in this, with its edge just touching the perimeter of the circle (C in Fig. 12). A larger pipe may, of course, be used.

The wall may be treated with sawdust and glue method and the roadway painted as for the last hazard. The pipe may be painted black.

(To be continued.)



# MIRROR BALL

ball and also allowed to dry. It is advisable to glue pieces of strip paper over the edge of the neck to "seal" in the layers of paper.

Light glass (10in. x 8in. photographic plates) can be silvered for 1s. 6d. per sheet, and is then cut into pieces

**F**IRST, the beach ball is blown up to the required size, then pieces of gummed strip as used in parcel wrapping is placed round it with the sticky side outwards. This is continued until the surface is covered, with as little crossing over as possible to ensure a regular shape. An area of about 3in. diameter, through which the ball may be removed later, is left uncovered.

The beach ball is now blown up a little more until the paper covering becomes taut.

Another layer of gummed strip is stuck on with as much change of direction as is possible. This time the gummed strip is stuck with the gummed side down, finishing with a ring of stout brown paper round the "neck," which is glued in position.

Layers of newspaper and brown paper are now put on alternately until the required thickness is obtained, but allowing the glue to harden between layers. About eight layers should be sufficient, always finishing with the ring round the neck. When the glue has thoroughly hardened, the ball may be let down and removed.

A light coat of Bostik is now put over the

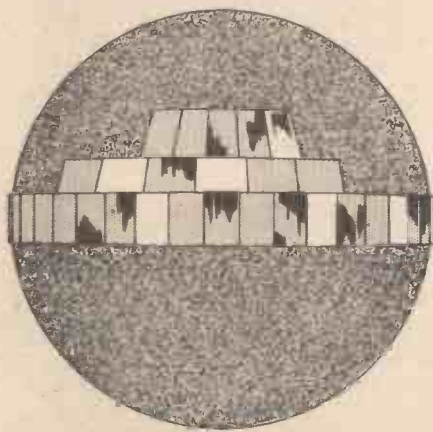


Fig. 1.—How the mirror segments are positioned.

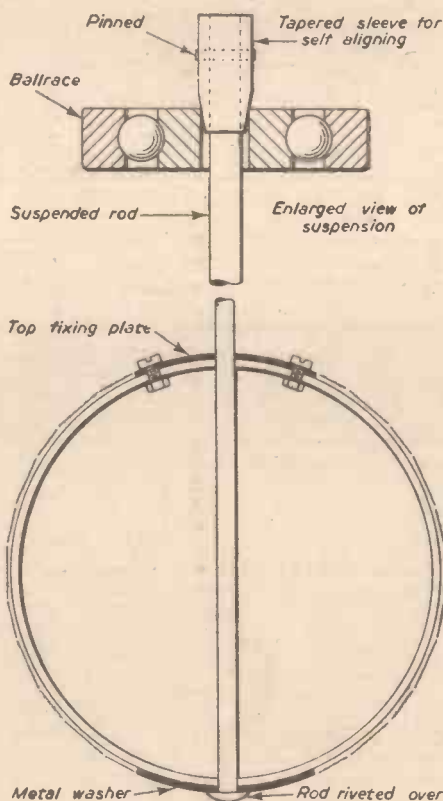


Fig. 2.—Method of suspending ball from the ceiling.

1in. x 1½in.; the number required for a 16in. ball will be around 600.

The method of fixing is for a complete ring of pieces to be put round the middle of the ball first, either vertical or horizontal, as long as each succeeding ring is put the opposite way; this counteracts for the loss of diameter in each ring of pieces (see Fig. 1).

The last few rings will be found awkward, but by careful placing of the pieces only small areas of the ball will be left uncovered. Care should be taken to ensure that the Bostik with which the glass is stuck on goes on to the

Details Received from W. J. Watts in Reply to a Query Published in "Information Sought"

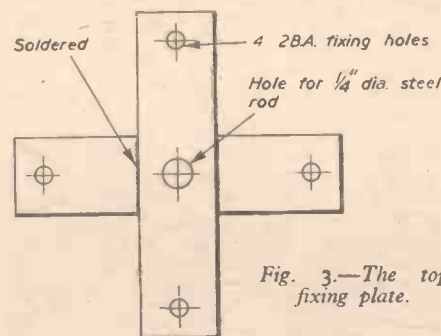


Fig. 3.—The top fixing plate.

edges of the glass, otherwise the silvering may give way, allowing pieces of glass to fall.

Sufficient space should be left at the bottom for a metal disc about 3in. diameter so that a rod passing through the ball may be safely fixed without fear of pulling through the ball (see Fig. 2). The top hole has two strips of metal about 1in. wide, which are soldered in a cross, the ends of the cross being fixed through with bolts, nuts and washers to give stability to the suspending rod, as shown in Fig. 3. The method of drive in my case was a small motor geared down to 5/6 r.p.m. (sold for around 12/6). It required 110 volts, and a small transformer was used.

Suspension is important and the method used was a taper plug fixed on to the end of the suspending rod and resting in a ball-race, the taper allowing the ball to be self-aligning.

### Materials Required

- A beach ball.
- A supply of brown paper and newspaper.
- Glue and one tin of Bostik.
- Gummed strip.
- Old photographic plates (any lightweight glass).
- ½in. diameter steel rod.
- Metal disc.
- Metal strip.
- The newspaper and brown paper are cut into squares of about 2in.-2½in.

### WORKSHOP CALCULATIONS TABLES AND FORMULÆ

11th Edition

by F. J. CAMM

A handbook dealing with methods of calculation, solution to workshop problems, and the rules and formulæ necessary in various workshop processes. It contains all the information a mechanic normally requires.

From all booksellers, 7/6d. net, by post 7/10d. from the publisher,

GEORGE NEWNES LTD. (Book Dept.), Tower House, Southampton Street, W.C.2

# A Carpenter's Bench

THIS bench is of fairly straightforward construction. Its rigidity is gained by extra framing which allows any type of top to be fitted and also provides for renewal and/or replacement of this when required without disturbing the frame. In addition a very strong member supports the vice and provides for the best possible way of attaching this all-important tool. Further, a tail vice has been devised which is easy to make and is a very great help in many ways—especially in dealing with awkward chiselling or planing jobs which cannot be safely held by normal methods.

The general construction follows standard mortise and tenon practice with important proviso that all joints must be very good fits. An idea of general frame layout may be obtained from Fig. 1.

The material must, of course, be a personal choice; there are many

Sturdy; Rigid; Comfortable  
and Cheaply Made

By G. E. SAVAGE

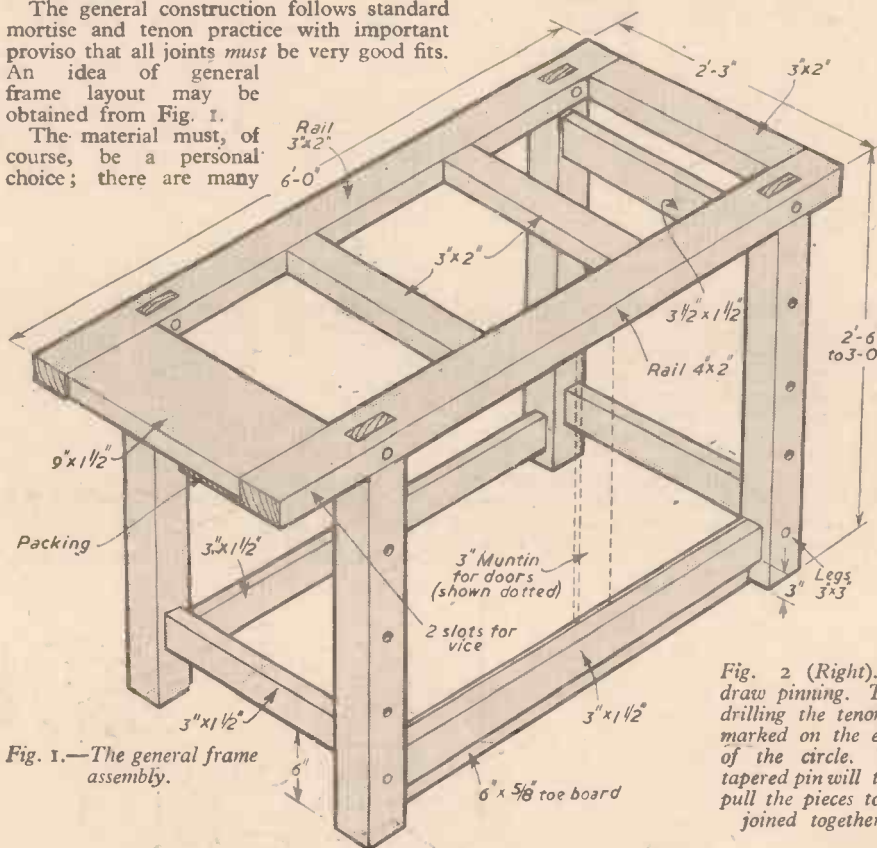
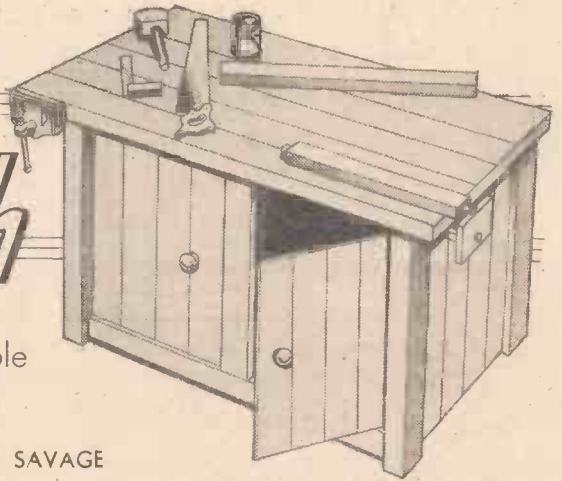


Fig. 1.—The general frame assembly.

suitable woods available. In new wood there are imported woods which are very good and not too expensive—Santa Maria, Podo Iroko, and many others. Alternatively, good second-hand timber is useful. A valuable source of sound stuff is the second-hand market, where many obsolete spring mattress frames can be bought. The larger ones provide a good proportion of the wood required. In any case, it is worth seeking out the best material that can be afforded because this bench will give a lifetime's service. It is important that the sizes of the various members are not reduced in any way, because these sizes have been found to give satisfaction over a long period.

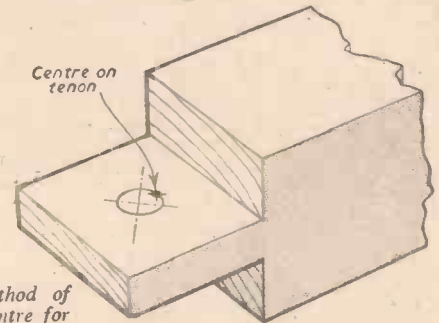


Fig. 2 (Right).—Method of draw pinning. The centre for drilling the tenon is marked on the edge of the circle. The tapered pin will then pull the pieces to be joined together.

### The Top Frame

The construction is best done in sections, dealing with the top frame first, since this is the most important item. It must be both square and flat, so the greatest care should be taken with all the joints. The

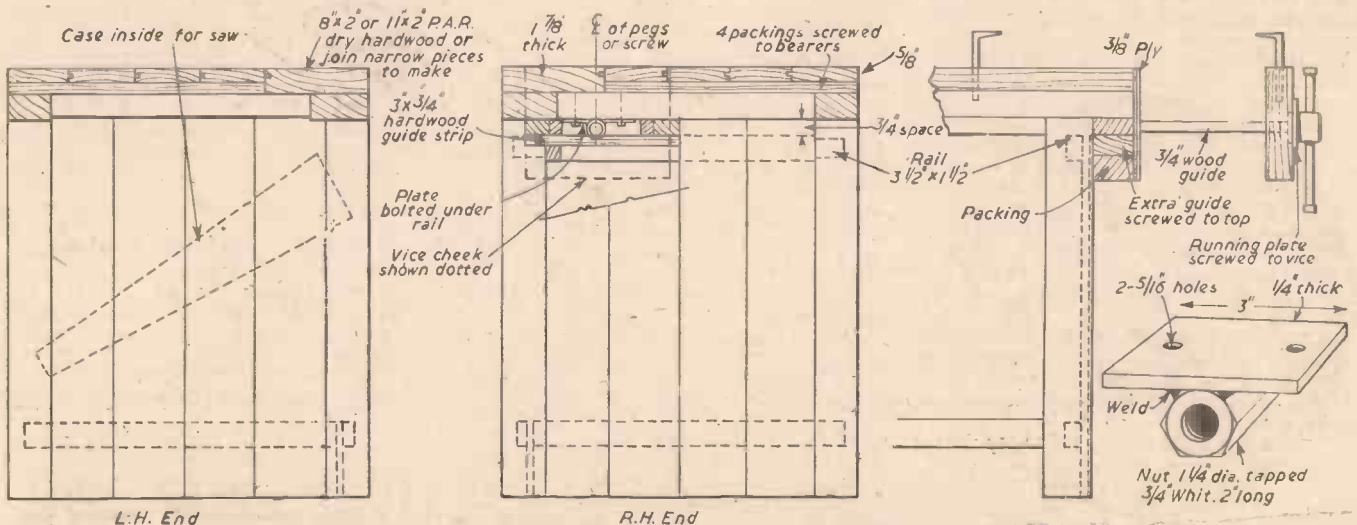


Fig. 3.—Views of the two ends of the bench and details for fitting the tail-vice.

end mortises are haunched mortises and the middle ones stump mortises. Those in the front rail should be 2½ in. long and the back ones 2 in. long. As it is very likely that many will not have the heavy cramps required to put this frame together, it is suggested that the very old and sound method of draw pinning be used.

After the frame is assembled dry and tested for truth, it is taken down and each mortise has drilled in it a central ¼ in. hole right through from side to side. Next the frame is reassembled, using a heavy hammer and

packings as shown in Fig. 3 to form a square box to take the guide strips and pack out, finishing level with the end face of the top frame. A piece of ¾ in. or ½ in. plywood screwed to the end rail of the top and to the packings will make a smooth surface and allow the tail vice to be used as an extra vice. Fig. 4 shows one method of making a screw, but these can be bought complete from Hamptons, of Sheffield, if no facilities are available for making one. Fig. 5 shows details of construction. Sycamore is usually used.

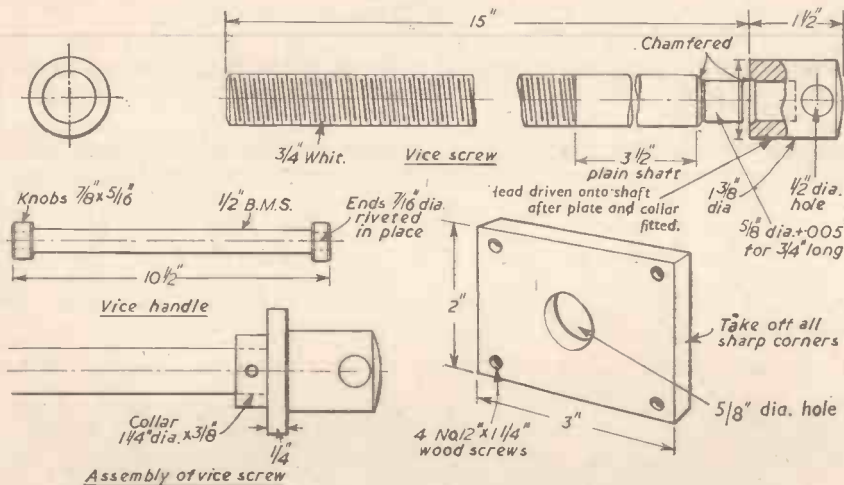


Fig. 4.—Details for making the vice screw and handle.

a block of wood to drive home the joints. The bit used for the boring is pushed into each hole in turn, given a full turn and removed. Each tenon should now have a clear circle marked on it. Take apart and mark the centre for boring on the edge of the circle nearest to the shoulder on each tenon (see Fig. 2). Bore all the tenons. Now make a dozen straight pieces of wood 12 in. long by ½ in. to ⅝ in. square. Roughly round these like a skewer. The taper gives a drawing effect and the holes being a half out of centre adds to the terrific compression possible by this method. All the old framed houses were assembled by this method and many old carpenters' tool bags had in them a draw pin forged by the local blacksmith to help start the pegs. Now, with all ready and some Cascemite glue to hand, glue up and assemble. Do not overdrive the pins, because the mechanical advantage of these is enormous. Once all is up and true, set aside to dry.

**The Leg Frames**

These again must be sound jobs. Decide which type of cupboard you wish to use underneath and set out the rails accordingly. As drawn, the top rails are intended to finish at ½ in. below the top of the leg tenon shoulder (to allow at right-hand end for the vice guides), see Fig. 3. Alternatively, several rails can be fitted at one or both ends to take drawers or additional shelves. Note in Fig. 3 provision for box to take a handsaw. Assemble these end frames true and square otherwise the finished bench will not be stable or stand level. The same method as for the top frame is used to pull the joints home and tight, i.e., draw pins.

Remember in setting out the rails to allow for sufficient space at the outside for the panels, i.e., the rail face must finish ½ in. in from face of leg for ½ in. matchboarding and ⅜ in. for hardboard panels.

Assemble the leg frames to the top frames, using draw pins as before.

**The Tail Vice**

Plane the guide pieces to a good sliding fit between the rail and the top frame; make

**The Main Vice**

The main vice is fitted to the wide rail at the left-hand end of the top. Standard vices will require two slots for the ribs behind the main cheek and packings will be needed to bring the vice cheek to 1 in. from the top of the finished bench top. This is more than usual, but it provides a more efficient finish. A strip of hardwood at least as wide as the cheek is thick and more than 1 in. thick is glued and screwed with brass screws to the edge of the top plank. Mushroom head bolts are used to bolt the vice in place (use hexagon-head nuts underneath); ½ in. block board makes efficient soft jaws.

**The Top and Fittings**

The top is fitted with No. 14 by 3 in. screws in deep recesses which are filled in with pallets of hardwood and planed smooth. The tops of the vice cheeks are planed level with the top face.

The bench stops are easy to make from ½ in. or ¾ in. dowel rod, and at least three should be fitted square across the top; one at 1½ in. from the front edge, the next at 1½ in. between centres away and, finally, one at 1½ in. from back edge of main top plank. Given care in fitting, these last a long time, but, in any case, are easily replaced.

In line with the centre line of the tail vice screw, bore ½ in. holes 6 in. apart, starting at 4½ in. from the left-hand end. These holes take ½ in. steel dogs (see Fig. 3). With these dogs wood can be clamped between the tail vice and any appropriate hole and work done on it without any risk of movement; carving and dovetailing is easy this way. In addition a strong pad can be contrived with holes to fit those in the tail vice so that this with a peg in the bench acts as a cramp.

**The Cupboards**

It is strongly recommended that the lower part of the bench be fitted out as store space. It is suggested that the space be divided into two by a wide muntin set in behind the lower rail and stumped into the top rail (shown dotted in Fig. 1). Behind this a hardwood panel is fitted to a similar muntin at the back. Two matchboard or panelled doors are fitted, the left one being fitted out with racks, etc., for all small tools in normal use. This door folds back on hinges on the muntin and if the pockets for tools are carefully made they will fit snugly under the top and be handy at all times. A floor of hardboard on battens will, of course, be needed. The top can be kept free of all tools and, since there is no well, it is only a minute's work to sweep all junk off on to the floor. The right-hand cupboard is useful for paints, varnishes and all sundries. To add to efficiency make a sawing board with a hole in it to match the holes in the bench top. Then, when sawing a difficult part, a peg pushed through the bench sawing board into a bench hole will stop all movement. Keep this at the right-hand end on a peg and do all your sawing here so that the waste goes on to the floor.

The holes in front of the legs (shown in Fig. 1) are for pegs to hold long boards or frames while planing or sawing in the main vice.

**Finishing**

Paint all framing with creosote and then apply hard brown spirit polish over this. Two coats each of this treatment will prolong life considerably and prevent staining.

For outside workshops it is recommended

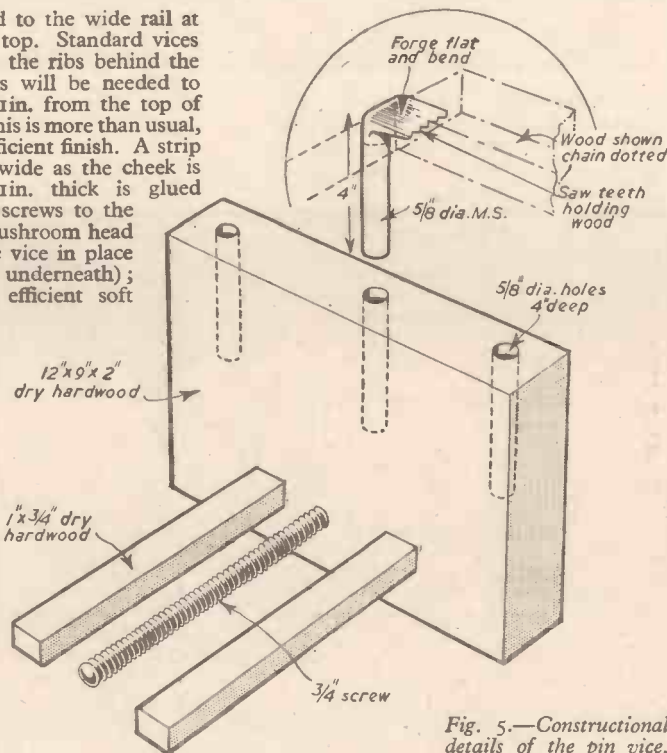


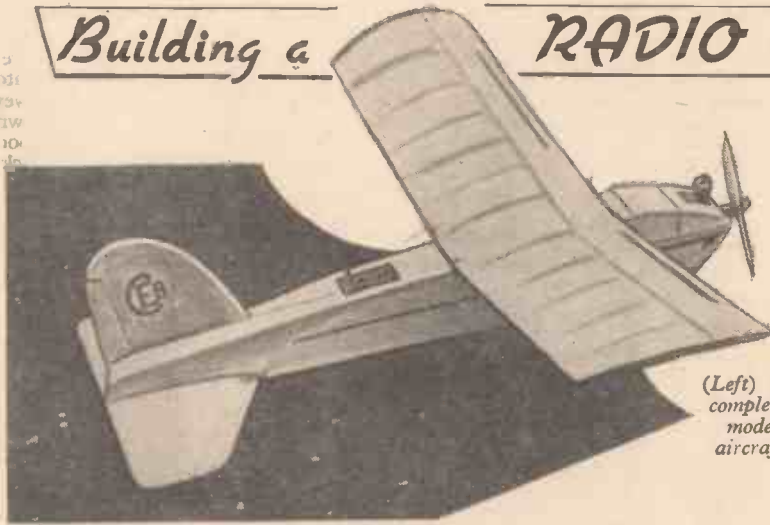
Fig. 5.—Constructional details of the pin vice.

that the bottom 3 in. of each leg be well tarred and then stood on thick bitumen felt.

8th (Fully Revised) Edition of the  
**PRACTICAL MOTORIST'S ENCYCLOPEDIA**  
 By F. J. CAMM  
 400 PAGES, 493 ILLUSTRATIONS, 17/6 or 18/- by post from:  
 GEORGE NEWNES LTD., TOWER HOUSE, SOUTHAMPTON STREET, STRAND, W.C.2

# Building a RADIO CONTROLLED MODEL AIRCRAFT

By Col. C. E. BOWDEN



(Left) The completed model aircraft.

## A Description and Diagrams of the "Radio Rook"

(Concluded from page 519, September Issue)

NOW that the fin has been fitted to the fuselage, the whole can be covered with cheap "butter muslin" of light weight, obtainable at a fabrics shop. This material can be tautened over the fuselage, etc., after smearing the structure with photopaste. It is then doped with two thick-flowing coats of Cellon full-strength tautening dope. Real aeroplane dope is preferable to model dope, for it makes a lasting durable job, whereas model dope requires at least six coats, and is really too thin for radio models. One or two coloured coats of dope can then be put on, but remember too much "finish" weighs a lot, and always gets shabby through fuel, etc.

### The Wings and Tail

These must be drawn out full-size from Figs. 11 and 12 on to kitchen paper, and the wings and tail built over the plan, with a sheet of greaseproof paper inserted between to prevent cement sticking to the plan.

Wing construction is very simple. First, lay down the trailing edge 1/16in. sheet balsa, and cement on the trailing edge spar of 1/8in. by 1/4in. balsa and the 1/8in. balsa tip. Now lay down the central lower main spar and cement the ribs into their correct positions over the plan, cementing the ends of the ribs to the trailing edge and its sheet. Pin until dry. The spars can be of hard balsa, but if you can obtain it, spruce or obechi wood are best for these two main spars. They are the only hard-

trailing edge wire well plastic wooded into the rear sheet balsa. When set hard the whole wing is sanded down, and the leading edge is covered with light 1/16in. sheet balsa, top and bottom, up to the central spars only, and at wing-tips, using plenty of cement to adhere to ribs, etc., and temporary pins. Cement in wing hooks, well reinforced by plastic wood, and reinforce the wire dihedral pieces with plastic wood on the inside of the sheet covering. Finally sand down.

Now cover with butter muslin or nylon. The first is cheaper, and is applied dry, using photopaste to stick down to the framework. If nylon is used it must be put on damp and allowed to shrink dry before doping. Apply two coats of full-strength full-scale aeroplane tautening Cellon dope, and two of colour. The tailplane is made in the same way as the wing, only there is no dihedral to bother about.

Be sure to weight down surfaces to flat boards or table

whilst they are tautening after the dope loses tackiness, but before it dries hard. Should any warps develop in spite of this, they can be twisted out in front of an electric stove, being very careful not to set the wings on fire.

### Flying the Model

Make sure you have the angles of wing and tail correct, as shown on the side elevation of the fuselage drawing. Be sure there are no warps anywhere, and that wings and tail, etc., are set on square. If slightly out through poor building, pack up square with balsa.

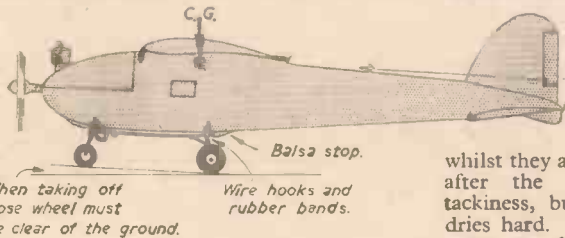


Fig. 10.—Aircraft in take-off position, with centre of gravity marked.

wood spars in the model. Now cement in the leading edge spars of balsa, 3/16in. by 3/16in. The wing is best made in one piece on this size of model, but if transport forbids this it can be "split" at the centre. A one-piece wing is far stronger and more true, giving more consistent flights. Five foot is not a long structure to carry. Assuming you make the wing in one piece, the dihedral must now be put in as shown in sketch Fig. 13. One end is jacked up on a table or building board, and 12 s.w.g. wire centrepieces are bound and cemented to the various spars, with the

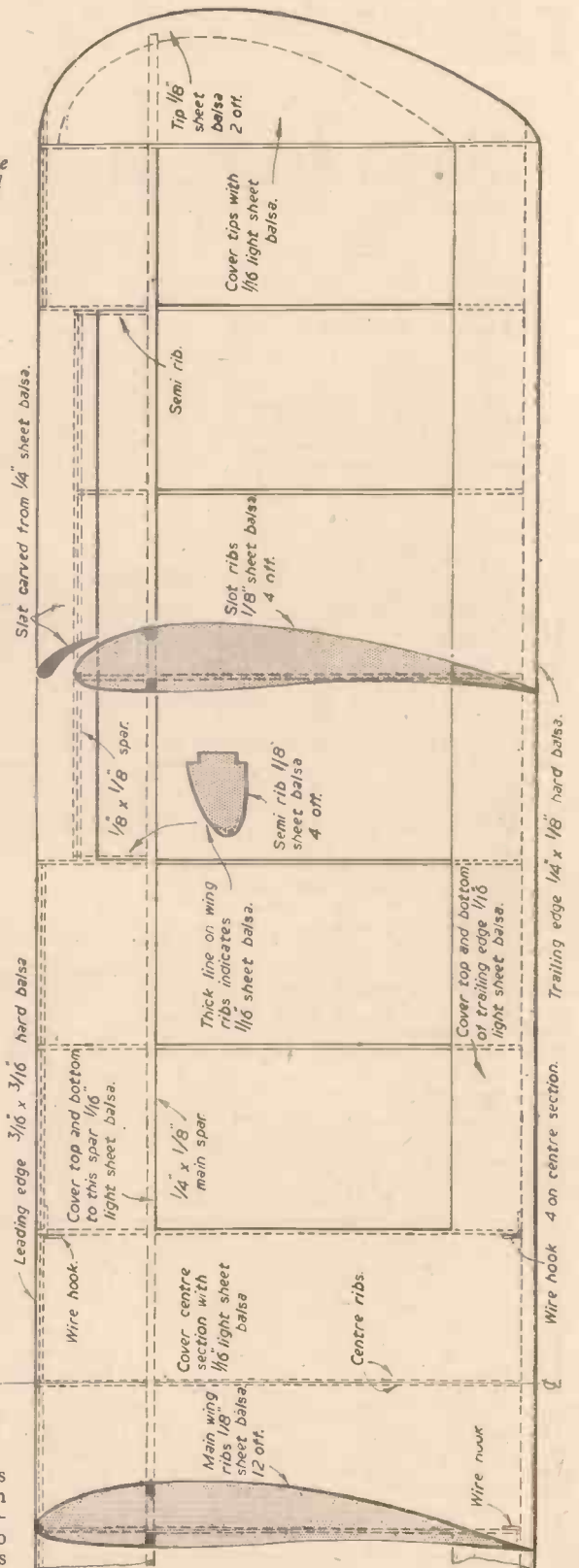


Fig. 11.—A scale drawing of the wing, showing details of construction.

Be certain that the model balances on the fingers at "C.G. Point of Balance," shown in Fig. 10. If not, due to poor building or balsa weight differences, move the balsa box slightly to get proper balance, and then fix position.

Now glide the model with radio in, over long grass, dead into a slight wind, throwing the model forward, and very slightly downward

the model up wind and climbing, steadily until you can handle it competently. Never hold on a turn too long, until you have gained good height, and then only do spiral diving long turn handling when you understand what you are doing. Turn more to the left than to the right when you start, for this is safer. To do a long turn give a short rudder left,

With the E.D. clockwork actuator, there is provision to alter the amount of rudder travel. If the model always turns too much one particular way, adjust the rudder lines so that there is a trifle of offset to the rudder in the opposite direction, but first make sure that the model flies straight under power when the rudder is centralised, by engine offset adjustment, as already explained.

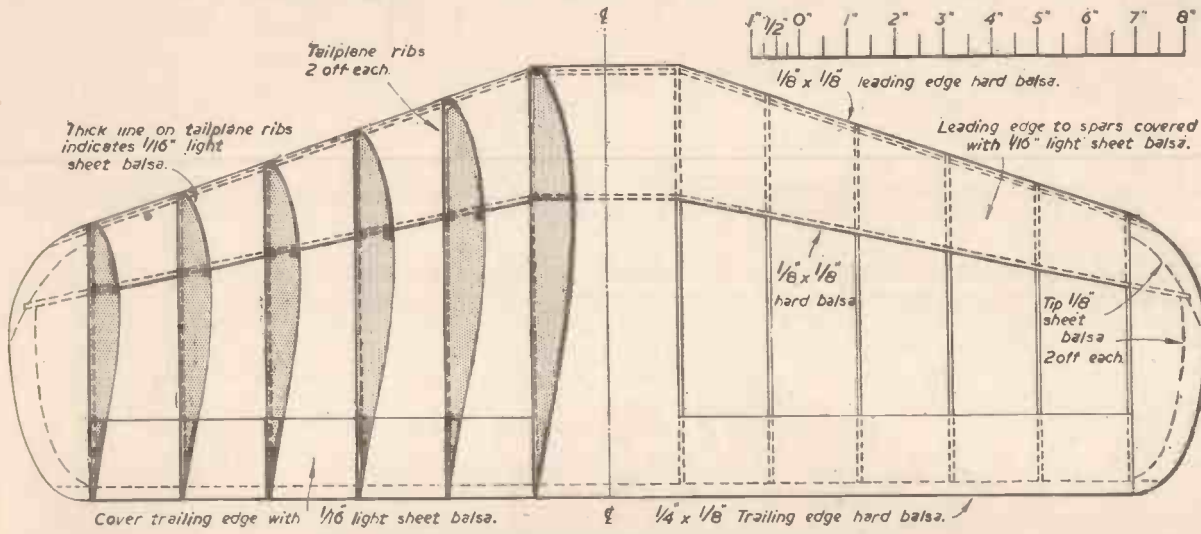


Fig. 12.—Scale drawing, showing details of the tailplane.

**Home-constructed Radio-control Equipment**

This article is intended mainly for the model aircraft enthusiast and consequently all the radio equipment mentioned is commercially made. The series of articles, recently published in PRACTICAL MECHANICS, however, entitled "Radio Controlled Models" included comprehensive instructions for building, installing and operating radio receivers, transmitters and other equipment, and many readers will, no doubt, prefer to build and use these in conjunction with the "Radio Rook." Finally, before any transmissions are made a licence should be obtained from Radio and Accommodation Department, Headquarters Building, G.P.O., St. Martins-le-Grand, London, E.C.1.

like a dart. It should glide nose slightly down, but flat. If it rears up in a stallish flight, put 1/4 in. packing under the tail end of the fuselage and tailplane. If it dives too steeply put in a nose packing above the front end of the tailplane between tail and fuselage. Get the glide perfect by these methods, and then never alter it, for the model must glide properly when the power ends.

Now try power flight. Too stallish a flight under power is adjusted by a little more down-thrust of the engine, or vice versa. This is automatically built into the engine platform, and no change is likely to be required, unless you have an unusually powerful motor. If the model turns to the left too much under power, point the engine slightly more to the right by altering engine bolts. The engine should look right from above, looking forward, about 2 or 3 deg.

Try flying with radio, having the rudder to only half travel at first. Launch into wind, and allow the model to climb a little, then give very swift and small bursts of rudder, weaving

a tiny one right, and follow up with another short left and so on. Later you can provide the rudder with full travel, and having gained height (good height), you can try some long periods with the rudder and start learning how to stunt. When the engine finally cuts you should steer the model by short turns into wind for the landing, with a final approach dead into wind.

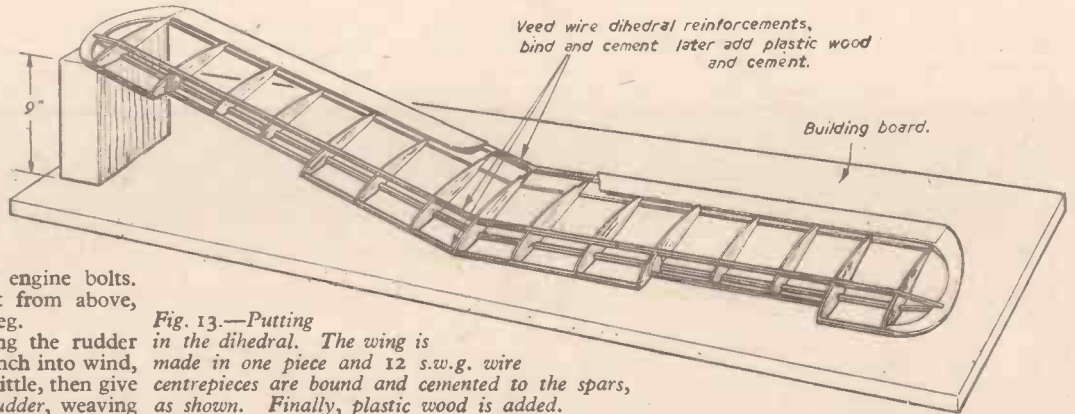
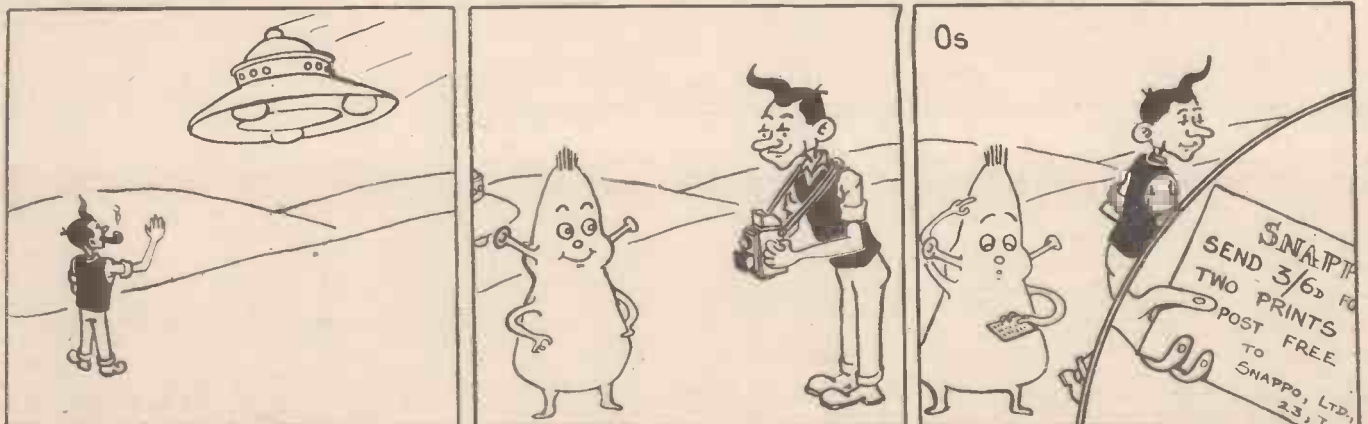
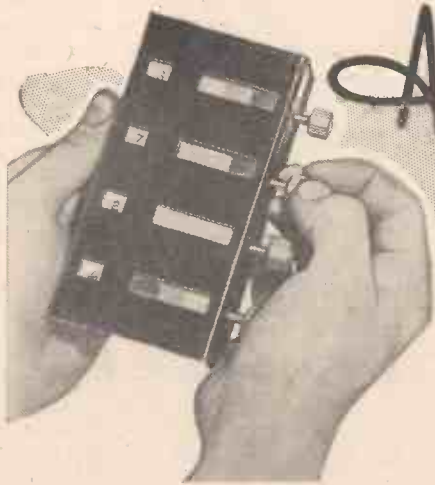


Fig. 13.—Putting in the dihedral. The wing is made in one piece and 12 s.w.g. wire centrepieces are bound and cemented to the spars, as shown. Finally, plastic wood is added.

**ANDY MANN**

**THE PRACTICAL MECHANIC**





# A Computer for the game of Nim

A Device Which Ensures That the User Will Always Win

By P. DOWDING, A.M.I.Mech.E.

**A** YEAR or two ago a computer or "electronic brain" was seen which was playing the game of Nim and could not be beaten. The little computer to be described here will enable its operator to obtain similar results although not fully automatically. It is, however, very easy to operate and is completely reliable, and its operator can be quite sure of winning each time.

### The Rules of Nim

Matches are arranged in any number of rows and any number in each row. The player and his opponent may, in turn, remove any number of matches from any

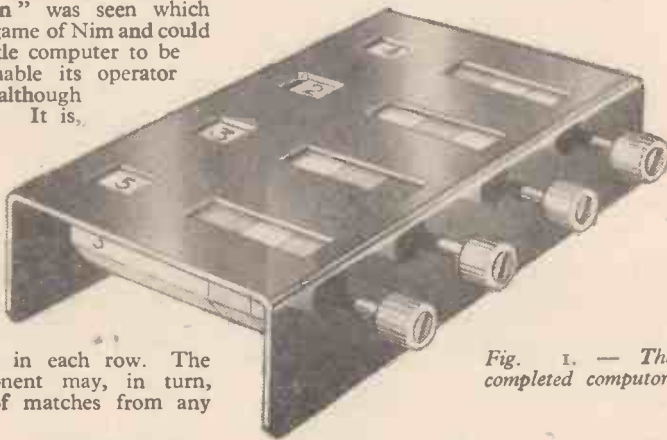


Fig. 1. — The completed computer.

Red 'one' all other Nos. 1-5  
black.

1	W	W	B	
2	W	Y	W	
3	W	Y	B	
4	G	W	W	
5	G	W	B	
6	G	Y	W	
7	G	Y	B	

W. White.  
G. Green.  
Y. Yellow.  
B. Blue.

counting or tallying on their fingers. It has been suggested that twelve would be a more convenient number, as it is divisible by two,

Decimal	Binary
1	I (2 <sup>0</sup> )
2	IO (2 <sup>1</sup> )
3	II
4	IOO (2 <sup>2</sup> )
5	IOI
6	III
7	IIIO
8	IOOO (2 <sup>3</sup> )
9	IOOI
10	IOIO
16	IOOOO (2 <sup>4</sup> )
32	IOOOOO (2 <sup>5</sup> )

Clearly, then, in the computer, the number ten would be represented by the following pulses: on, off, on, off.

Without going too deeply into the matter, it may be said that by converting from the decimal system to the binary system, simple rules may be made for Nim.

### A Sample Game

Let us assume that the matches are set out as follows:—

Row	Binary Number
a	2 <sup>2</sup> 2 <sup>1</sup> 2 <sup>0</sup> I I I
b	I I I I I
c	I I I I I
d	I I I
Totals (decimal)	3 3 3

three, four and six, whereas ten can only be divided by two and five. If such a system were ever introduced it would be necessary to invent two new symbols for the extra digits.

The binary numbering system became important when the digital computer or "electronic brain" came into being. As this system uses the base of two, numbers can be

Fig. 2.—A developed view of a drum giving the colour sequence.

row; in fact, a whole row may be taken. The object of the game is to continue in this manner until all of the matches are removed, but the person who is forced to take the last match is the loser.

It would be as well for those not familiar with the game to play two or three times in order that the subtleties are fully appreciated.

### Mathematical Theory

The game lends itself to mathematical treatment and, providing that certain rules are obeyed, it is possible for a player to beat a less knowledgeable opponent every time. These rules are difficult to work out mentally and the computer is designed to do the job instead.

To understand the mathematics of this game it is necessary to know something of the binary numbering system. In everyday life we are accustomed to counting in the decimal system, in other words, our calculations are made to a base of ten. The number ten was almost certainly chosen by our primitive ancestors because of the convenience of

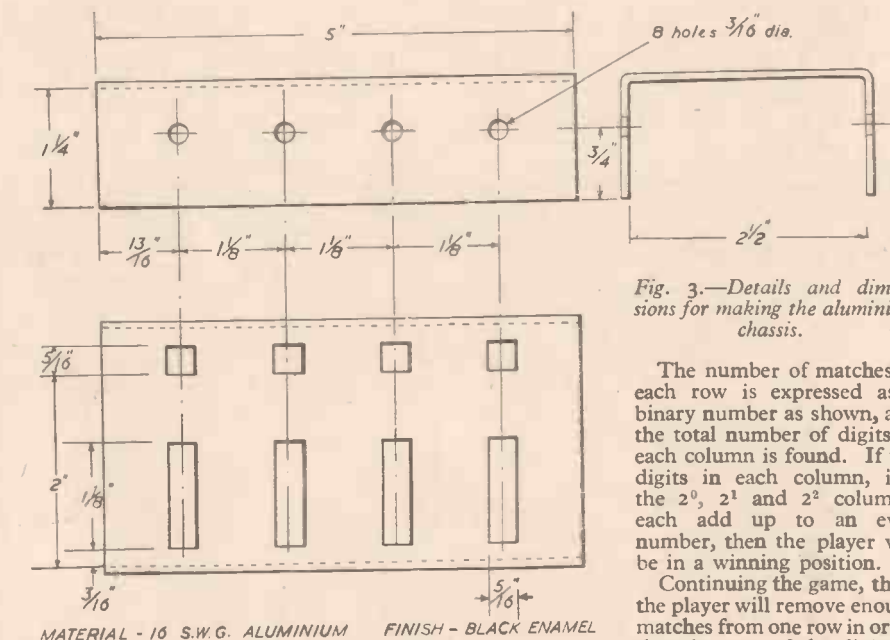


Fig. 3.—Details and dimensions for making the aluminium chassis.

The number of matches in each row is expressed as a binary number as shown, and the total number of digits in each column is found. If the digits in each column, i.e., the 2<sup>0</sup>, 2<sup>1</sup> and 2<sup>2</sup> columns, each add up to an even number, then the player will be in a winning position.

Continuing the game, then, the player will remove enough matches from one row in order that the sum of the digits in

each row will be an even number. Hence by removing all of the matches from row (a), the position will be:—

represented by a series of electric pulses. In order to clarify this statement some binary and decimal numbers are compared.

Row	Binary	number
b	I I I I I	110
c	I I I I I	101
d	I I I	11
Totals		222

Let us now assume that the opponent does not know these rules and he takes, say, three matches from row c so that the position is :

b	I I I I I	110
c	I I	10
d	I I I	11
Totals		131

now the player will take five matches from row b

b	I	1
c	I I	10
d	I I I	11
Totals		22

Without proceeding further, it can now be seen that, although the opponent has many possible

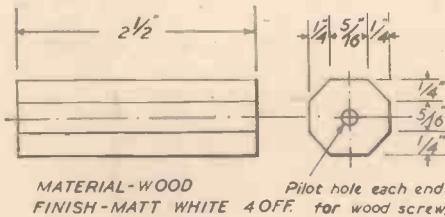


Fig. 4.—Details and dimensions of the drum.

moves, he cannot win. For example, if he takes all of row d, the player will take row c and the opponent will be left with row b. Alternatively, if he takes one from row c, the player will take two from row d. Then the opponent takes one row, the player another and the opponent the last. By considering all of the possible alternatives it can be seen that the player is truly in the winning position.

There is just one small departure from the "even sum of digits rule." Supposing that

the game takes the following form :

a	I I I I I	101
b	I	1
c	I	1
Totals		103

According to the previous rule, we should take all of row a. Our opponent would then, of course, take row b, and we would be left with the last match. Thus the second rule is that if there are two rows containing one match and one row containing any other number, then the correct play is to take all but one match from the last row. It will then be seen that the player will be in a winning position. This second rule will only come into operation towards the end of the game, if at all, and can be very easily applied.

### Construction of the Computer

As can be seen from Fig. 1, it consists of an aluminium chassis and four drums. The developed view of a drum (Fig. 2) should be compared with the table of binary and decimal numbers, and it will be seen that each binary number is represented by coloured blocks. Different colours are used for the 2<sup>0</sup>, 2<sup>1</sup> and 2<sup>2</sup> digits in order that each column may be quickly identified.

The chassis, although originally made from aluminium could be made from stiff cardboard if metal-working facilities are not available. All the details and dimensions necessary are given in Fig. 3. The four drums are all identical, and are made from wood. Starting with a piece of square section, the corners are planed off at 45 deg. to produce the correct shape, as shown in Fig. 4. Each drum may be given a coat of flat white paint, and when dry, the other colours added. The numbers should be marked on with indian ink. The operating knobs were made from turned brass buttons soldered to wood screws, as shown in Fig. 5. Small cupboard door knobs with screws moulded in could be used instead. After assembly the drums should revolve freely.

### Using the Computer

Each drum is moved in turn so that the number appearing in the small window is equal to the number of matches in the equivalent row. If there is an even number of green,

yellow and blue blocks showing, i.e., nought, two or four green ; nought, two or four yellow; and nought, two or four blue, then the operator is already in a winning position, and the opponent should be invited to move first. If, however, there is an odd number in any or all of the columns, then one drum should be turned until the correct state is found, remembering of course, that matches can only be taken away and not added.

It may be thought that it will be necessary to experiment with each drum in turn in order to find the row that needs attention. In actual fact, however, after a few games, a quick

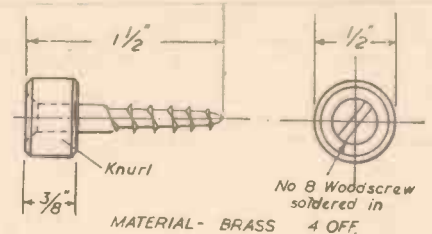


Fig. 5.—The operating knobs.

glance will be all that is required in order to determine which row needs adjusting. Having made this adjustment, the number of matches in the equivalent row is reduced to the number shown in the small window. If it is necessary to move a drum into the blank position, then, of course, all of the matches in that row are removed.

When the operator has made a move, his opponent may make his move, but he cannot be displaced from his superior position. The procedure is repeated right to the end of the game.

Occasionally the special rule relating to two rows of one plus a third row, will have to be applied. If this is the case, then a reminder will appear on the computer so that the figure one on each drum is painted boldly in red. This situation will in any case, as previously mentioned, only occur towards the end of a game.

Although the theory of the computer is a little complicated, in use it will be found to be surprisingly easy to manipulate.

# Making Luminous Paints

## Some Formulæ for Experiment

**D**URING the course of the year we have a very large number of requests from readers who wish to make luminous paints or inks. The formulæ given below should provide a good basis for those who like to experiment in this direction.

A base or vehicle is needed to carry the actual paint and this can be made from the following ingredients: Zanzibar or Kauri copal, 6 parts; oil of turpentine, 24 parts; pure linseed oil, 10 parts.

First melt the copal and dissolve in the turpentine, strain and add the linseed oil, which has been previously heated and allowed to cool. The resulting solution completes the base or vehicle of the luminous paint.

The paint itself is composed of 10 parts of the base; 1 1/2 parts of barium sulphate; 3 parts of white zinc sulphide; 1 1/2 parts of calcium carbonate; and 9 parts of luminous calcium sulphide. To obtain the last-mentioned chemical it may be necessary to send away to a manufacturing firm, as calcium sulphide is not in general use. It is listed by Messrs. Griffin & Tatlock, Ltd., Kemble Street, Kingsway, W.C.2.

### Coloured Luminous Paints

Red can be made by mixing together 30 parts of the base; 1 part of madder lake; 4 parts of barium sulphate; 3 parts of sulphide of red arsenic, and 15 parts of luminous calcium sulphide.

The formula for green luminous paint is 12 parts of base; 2 parts of green oxide of chromium; 2 1/2 parts of barium sulphate; 8 1/2 parts of luminous calcium sulphide.

For yellow luminous paint, the following are required: 12 parts of base; 2 1/2 parts of barium sulphate; 2 parts of barium chromate; 8 1/2 parts of luminous calcium sulphide.

For violet luminous paint, use 21 parts of base; 2 1/2 parts of ultramarine violet; 4 1/2 parts of cobaltus arsenate; 5 1/2 parts of barium sulphate; and 18 parts of luminous calcium sulphide.

### Luminous Ink

This is very easily made by mixing a small quantity of calcium sulphide with thin gum water. Anything written with this ink must, however, be exposed to daylight before it will become luminous. If you wish to avoid the trouble of making the ink, or cannot obtain

the calcium sulphide, similar luminous writing can be done, by inserting a piece of phosphorus in a penholder and writing with that.

### Ghostly Light

Articles dipped in olive oil, which contains a small amount of phosphorus, give out a weird greenish light that is excellent for amateur theatricals, where ghostly lights, etc., are needed for a good effect. The bottle containing the olive oil and phosphorus also makes a novel nightlight, for when the cork is taken out of the bottle, a light immediately appears to enter the bottle, running down from the neck to the surface of the oil, and if the cork is placed back this light will continue to glow for some time.

✱—————✱

## THE MODEL AEROPLANE HANDBOOK

An Important Work

By F. J. CANN

312 Pages, 303 Illustrations, 12/6, by post 13/-

Construction and Principles of All Types

Published by

GEO. NEWNES LTD., TOWER HOUSE,  
SOUTHAMPTON STREET, STRAND,  
LONDON, W.C.2

✱—————✱



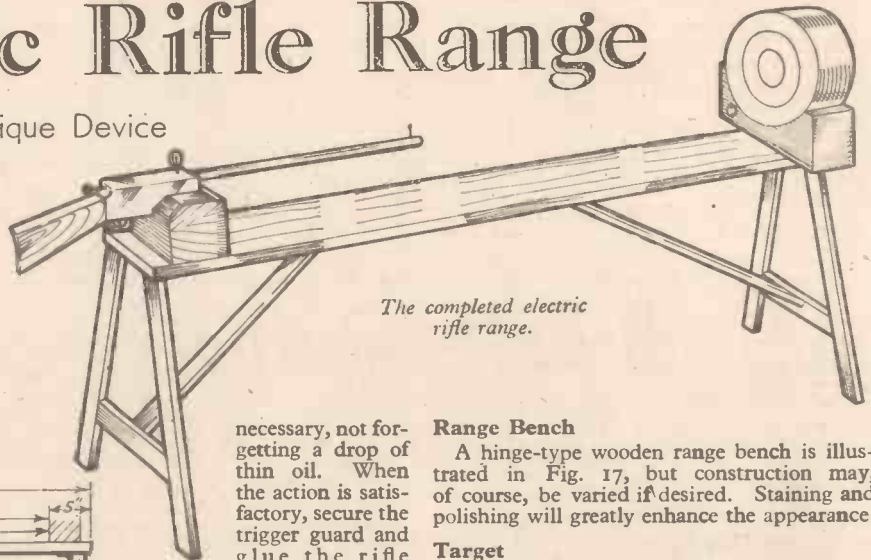
# An Electric Rifle Range

## Try Your Skill Indoors With This Unique Device

(Concluded from page 512, September issue)

By R. BRIERLEY

**T**HE simulator shown in Fig. 16 is built up from wood faced with brass washers. Each washer has a short wire soldered to its rear, which runs through a small hole in the bobbin to connect with a rear terminal bolt. Small countersunk screws secure the washers to the bobbin, which must be a tight fit in the simulator box. The centre target pin is insulated from the inner washer. Inspect all components prior to assembly of the rifle unit.



The completed electric rifle range.

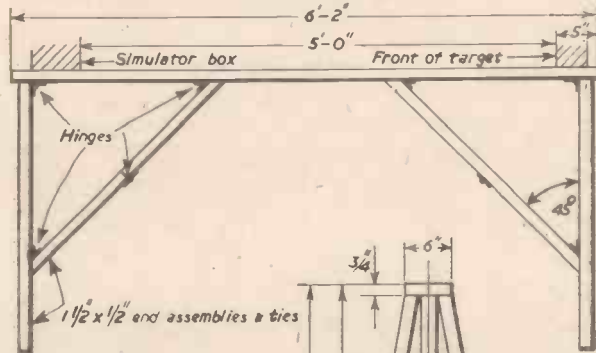


Fig. 17.—Side and end views of the range bench.

### Assembly of Rifle Unit

Check the assembly of the firing mechanism. The rifle is "loaded" by withdrawing the bolt until the sear clicks into position to retain it. It is aimed at the target, and "fired" by pressure on the trigger which releases the sear, allowing the bolt to jump back to the unloaded position. Proceed by threading the other end of the rod through the wrapper plate and screwing the knob tightly on to the rod end. Eight No. 6 screws secure the wrapper plate to the butt, sear spring block and body block. Test the firing action and make any adjustments

necessary, not forgetting a drop of thin oil. When the action is satisfactory, secure the trigger guard and glue the rifle barrel into the body block, ensuring the front sight is vertical. The rear sight is screwed into hole A (Fig. 13).

### Range Bench

A hinge-type wooden range bench is illustrated in Fig. 17, but construction may, of course, be varied if desired. Staining and polishing will greatly enhance the appearance.

### Target

The 10in. diameter target (Fig. 18) is constructed as a separate unit. A semi-circular rear wooden piece is cut first and this is screwed to the base together with the wooden front piece or saddle. The tinfoil or

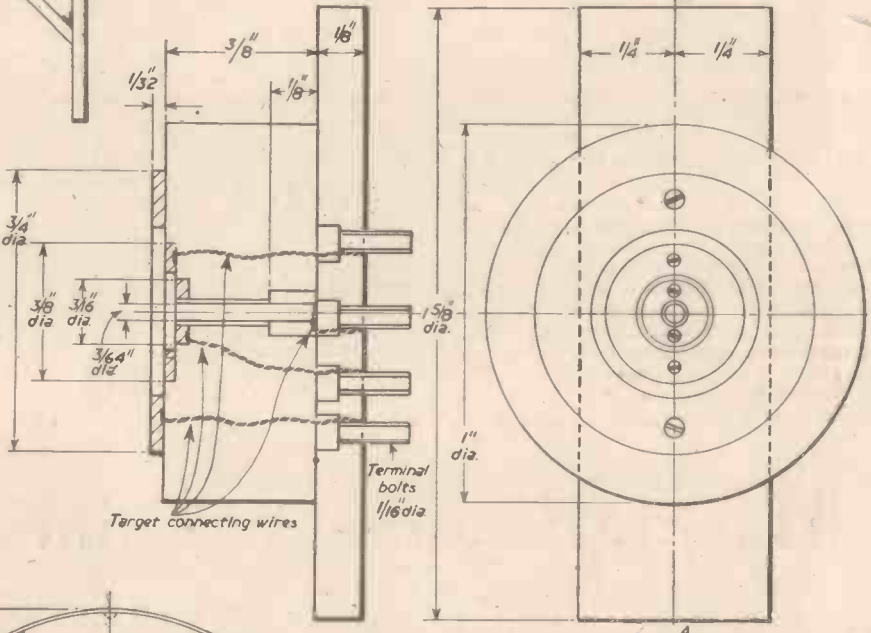
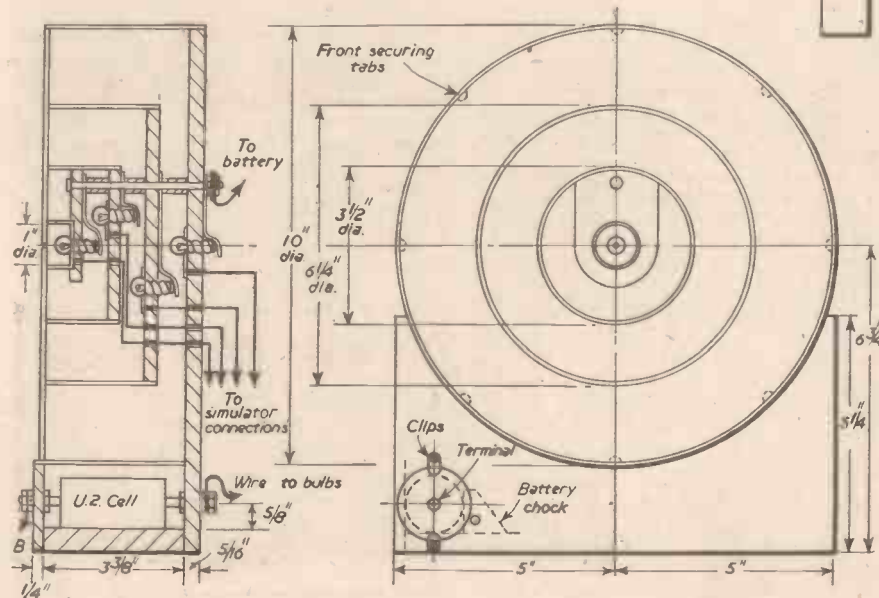


Fig. 16.—The target simulator.  
Fig. 18 (Left).—The target.



metal casing forming the outer target portion is then screwed to this saddle. Should a suitable piece of material be available for this casing, the size will be approximately 4 1/2 in. x 3 1/2 in. long, but this length may be made up of short lengths of tinfoil, folding them together or lapping one over the other. Two similar but smaller units which form the internal compartments of the target are assembled individually in the same manner. Bulb contact strips are positioned with a single screw in each case. Connecting wires may be soldered to the front contact strips at this stage. In the case of the leading and centre compartment, the backing strip is soldered to the cylindrical piece in order to support same. Bulbs may now be mounted in each compartment and tested. Assemble compartments, commencing at the centre piece or "bull," threading its connecting wire through the hole in the rear of the next compartment and dropping a spacing ferrule on the bolt

between compartments. Continue in this way, finally tightening the nut and adding a terminal nut for the battery connecting wire.

A Perspex disc 10in. diameter is most suitable for the front, which is retained by tabs around the periphery. Coloured, transparent papers may be stuck to the inner side of the Perspex if desired. To allow access to the battery a 1½in. diameter hole is bored at the front target base, a combined cover and

terminal being secured with two clips. A small wooden chock serves to retain the battery.

#### Final Assembly

The target and rifle unit may either be screwed to the range bench or may locate on dowels to facilitate storing. Set the units carefully in the position shown in Fig. 17, and align by running a piece of thread from the

small hole in the target centre through the two sights. Set the rifle mechanism in "fired position," with the dart on the simulator centre or "bull." Adjust the front sight until the thread is "dead centre" within the bead hole. Tighten all mounting screws and check alignment. Couple up the battery wires and test each circuit before finally screwing the top shield in position. The unit is then ready for use,

this in two directions and the point of intersection of the folds gives the centre, and the template is placed once more on the drum.

#### Filling the Drum

Now the drum is placed ready for filling, with the first hub in place, the spindle protruding through the hole in the base. Because of this it will be found necessary to raise the drum an inch or so off the floor.

The filling can now be commenced. Three small buckets of chippings, two of sand and one of cement are more than enough for this size roller. A zin. covering should be worked into the bottom to hold the hub in place and pieces of the spokes, bent in all directions, threaded through the spoke-holes in the flange, to key the hub in place. As the filling continues put in any odd bits of heavy metal, iron bars, etc., which you may have lying around. A few pieces of chicken netting will help to reinforce the concrete.

One point which must be borne in mind is that the inner ends of the spindles must not be set in the concrete. I avoided this by putting a metal tube between the hubs, as shown in Fig. 2. Being cut to the correct length, this had the advantage of holding the upper hub at the correct height until the concrete set. When the filling is complete the drum should be left undisturbed for a fortnight.

The handle is a matter which will be determined either by individual taste or by the material available.

The completed roller, which is shown in Fig. 3, is an extremely handy size, weighing a little over 1 cwt. and handling quite effortlessly.



**T**HE usual home-made garden roller has a spindle running in a hollow tube, without bearings of any sort, and this obviously makes hard work of lawn rolling. A roller with ball bearings is a vast improvement.

Obtain a five-gallon oil drum and cut out one end with an old-type tin opener. In most cases the seam will be on the side of the drum, so the cut will have to be made actually on the side, too, and, of course, just below the seam. This will allow the roller to be more easily removed from the drum when the concrete is set. For the same reason, the inside of the drum should be greased or oiled before use, and stood on end.

Next, get hold of the complete hubs (with some spokes, if possible) from two old front bicycle wheels. One of these will be set in the concrete at each end of the drum, but before they are ready for use the spindles must be moved along to one end, so that this extra length will protrude from the ends of the roller, for the handle to fix on to. To do this

it will be best to dismantle the hub completely, repack the bearings with grease, and thoroughly clean the thread. Be sure to hold the job over a box of some sort, which will catch the ball bearings as they drop out. Fig. 1 shows a hub in section, and moving the spindle along is merely a matter of unscrewing

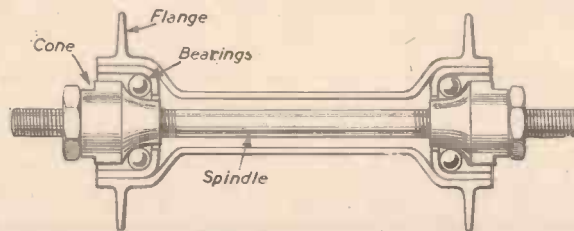


Fig. 1.—Section through a front cycle hub.

the cone at one end and tightening the other to correspond. So that this adjustment shall remain permanent on the end which will be set in the concrete it is a good idea to ruin the thread either side of the cone. The outer cone will be adjustable, so only needs a lock-nut.

A circular hole must now be cut in the bottom of the drum, just large enough to allow the cone to pass through. The flange will, therefore, rest on the inside of the bottom of the drum and prevent concrete from running through when the drum is being filled. When cutting this hole I was fortunate enough to get hold of a tool called a tank-cutter, which is used in an ordinary brace. Most plumbers would, I imagine, count them as part of their kit.

To find the centre point for this hole upturn the drum, press a sheet of newspaper on top so that an impression of the edge of the drum is made on the paper. Cut around the impression, obtaining a circular piece of paper, the exact size of the drum. Fold

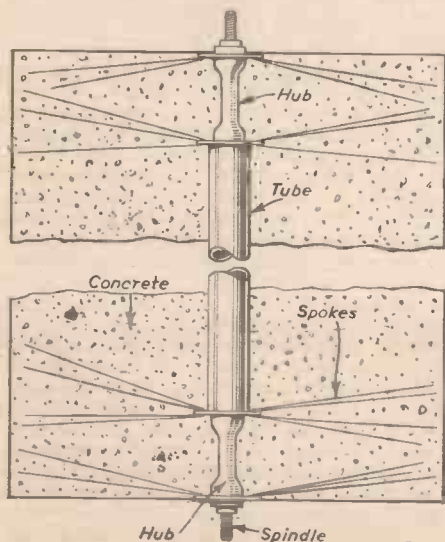


Fig. 2.—How the hubs are positioned.



Fig. 3.—The author's roller.

# Using Lenses

## No. 2.—Telescopes and Compound Systems

By F. G. RAYER



**S**OME optical devices require a number of lenses, it being impossible to accomplish the desired result without these. For example, several lenses are necessary in a microscope designed to give high magnification, while further glasses may be required to obtain an image the right way up, as in a telescope. Though such arrangements become a little more complicated than do simple magnifiers and similar devices satisfactory optical assemblies can easily be achieved when the correct method is known.

It is important to remember that the manner in which a lens functions depends upon the relationship between image and object distances, as well as the focal length. Fig. 1 will help to make this clear. Here, A may be considered the object of which an enlarged image B is to be obtained. This

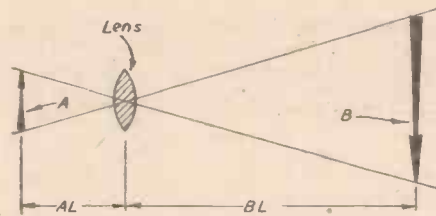


Fig. 1.—Object and image distances.

### Optical Bench

The separation required between lenses can easily be found by trial, if the lenses can be placed at various distances apart. This may readily be achieved by using an optical bench, or strip of wood marked in inches. Small blocks of wood under the lenses will bring their optical centres in line, when necessary, as indicated in Fig. 2, and they may be held upright by modelling clay or any other suitable material.

A test of this kind is always wise before making a microscope, telescope or other apparatus with several lenses, in order that the best spacing may be found from the scale or ruler. This will avoid making lens tubes too long, or the reverse, and the distances can be ascertained accurately and the mounts and tubes fashioned to suit. It is impossible to hold the lenses in the hands, especially with more than two, but when arranged as in Fig. 2 they can be looked through exactly in the same way as the finished equipment.

### Microscopes

These are considered first, because the same optical system is often found in a telescope, with the addition of an object lens. A microscope may consist of two lenses mounted in a tube, as shown at A in Fig. 3, though additional glasses will usually be present. The two-glass microscope has disadvantages, one of which is the relatively long tube length—as much as 2ft. may be required. For this reason it is not often employed, though it does have practical applications, especially in low powers, where the tube does not require to be long.

Three or more glasses are more usual, as greater magnification is obtainable with short

tubes, and a four-lens microscope magnifying approximately 20X is shown at B. The magnification may be increased by using an objective (lower lens) of shorter focal length or by using an eye-piece (upper lens) of greater magnification. Magnification can also be increased by employing a longer tube. The separation of all lenses can be fixed, focusing being carried out by varying the distance between objective and stage. The usual mirror directs light up through transparent objects.

With multiple lens systems stray light is reflected from the inside of the barrel con-

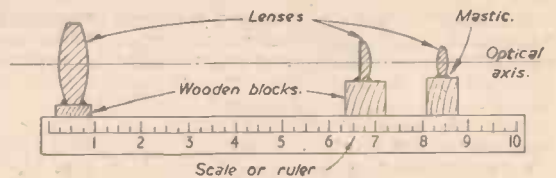


Fig. 2.—An optical bench.

is exactly what happens in a lantern or projector, for example, A being the plate or slide and B the screen or picture produced. As the image is larger than the object enlargement has taken place. The same lens may be used for reduction, in which B would be the object and A the image. This arises in some equipment, such as a camera, B representing the scene photographed and A the much-reduced image on the film.

The magnification will be at maximum when A is the object, AL the focal length of the lens, and BL very great. As distance BL is reduced, distance AL requires to be increased, to maintain a sharp image. This continues until AL and BL are the same, when object and image will both be at the same distance from the lens, equal to twice its focal length. A simple example of the practical outcome of this may be found in a projector—as the projector is moved away from the screen the picture increases in size, but the lens needs to be slightly nearer the slide for sharp focus. The ability to vary magnification in this way can be used in telescopes, microscopes, etc.

When calculation is required the Linear Enlargement can be found from the formula:

$$\frac{BL - F}{F}$$

where F is the focal length of the lens, and BL the distance from lens to image (Fig. 1).

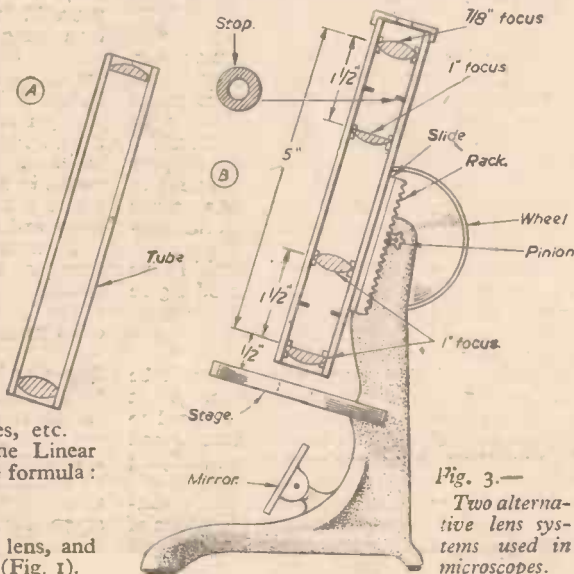


Fig. 3.—Two alternative lens systems used in microscopes.

taining the lenses, reducing the clarity and contrast of the image. This can be avoided by inserting stops between the lenses—discs with small centre holes. Such stops also increase definition by cutting off the extreme edges of the lenses, where aberrations are most severe.

The manner in which a microscope magnifies will become most clear after considering the optical system of a telescope, where the presence of a virtual or aerial image is most readily demonstrated.

### Astro Telescope

The astronomical telescope gives an inverted image of the object upon which it is directed, and a typical type is shown in Fig. 4. The object lens is an achromat, as this gives best definition, and will have a focal length of about 16in. to 20in. in small hand telescopes, increasing to 30in. to 40in. in types requiring a tripod. Other things being equal, the final magnification of the telescope will increase as the focal length of the object lens is increased, and observatory telescopes have lenses (or mirrors) of extremely long focal length.

When the telescope is directed at an object at infinity, an aerial image of the object will be formed at the distance of the focal length, as in Fig. 4. This aerial image may be observed by placing a sheet of ground glass at this point. However, when the instrument is in normal use, the aerial image is virtual only, not being made actual or observable by the presence of such a screen. Instead, a short focus lens, or eyepiece giving high magnification, is arranged to observe the

aerial image. The final result, to the observer, is thus a magnified impression of the aerial image, or enlarged view of the object upon which the telescope is directed.

The same arises in a microscope, except that the distance from object to lens is now smaller than that from lens to image (see Fig. 1). As a result, an enlarged aerial image is cast at a certain plane in the tube, which is observed by the eyepiece. As the object/lens distance (AL in Fig. 1) is modified, so the

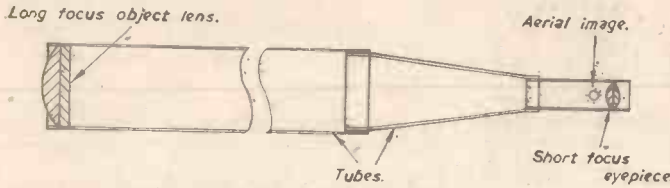


Fig. 4.—Astro telescope.

lens/aerial-image distance (BL) changes, as explained. Sharp focus is thus such a setting that the aerial image coincides with the position of focus of the eyepiece.

When an image is cast by a lens it is upside down, and this explains the inversion in the astro telescope. In order to obtain an image the correct way up the eyepiece must invert the aerial image. This can be done by erector glasses, a prism, or by using any form of reversing magnifier system for the eyepiece end of the telescope. The microscope system at B in Fig. 3 inverts the object observed, and is thus perfectly suitable for a terrestrial telescope (one showing objects the correct way up). The complete optical system of such a telescope is shown in Fig. 5, the object glass being of any convenient focal length. For a telescope to hold in the hand 10in. to 14in. would be suitable. Greater magnifications would be difficult to apply successfully unless the telescope were on a tripod.

Only the distance between object glass and eyepiece assembly need be adjustable, so that the aerial image can be brought into sharp focus. Apart from using an object glass of longer focus, magnification may be increased by using an eyepiece assembly of shorter focus, or greater magnifying power.

The terrestrial telescope optical system is not used when erection of the image is not required, since some loss of light and detail arises in the extra lenses required. The four small lenses in Fig. 5 will be spaced exactly the same as those in Fig. 3; and stops may usefully be added. The distance between object glass and tube, for infinity, will be the focal length of the object glass plus the lower focus of the eyepiece assembly ( $\frac{1}{2}$ in. in the example). For viewing nearer objects tube and object glass must be separated slightly. A movement of 1in. to 2in. will normally be ample, but this is best tested on the optical bench, as it will be impossible to focus near objects if the adjustment is too limited.

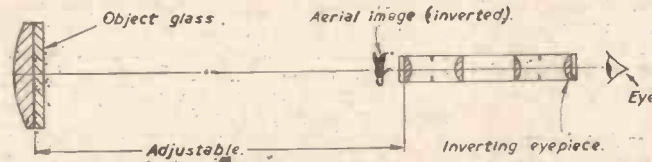


Fig. 5.—Optical system of terrestrial telescope.

For the highest magnification an object glass of very long focus is required, and an eyepiece or eyepiece assembly of very short focus. Exact calculations are likely to prove disappointing or inaccurate, especially with ex-Service or other lenses where the exact focal length is not known. However, a good approximation to the magnification of a telescope may be found by measuring the distance between object glass and image, as thrown upon a screen, and the focal length of the eyepiece assembly, and dividing the former by the latter. For example, a 30in. object lens and  $\frac{1}{2}$ in. eyepiece assembly would give a telescope with a power of 60X.

#### Light-gathering Ability

As binocular or telescope magnification is increased, the brilliance of the image falls. This also depends on the light collected by the object glass, from which it will become

apparent that large object glasses will give a brighter view.

With binoculars magnification and light-gathering power are usually expressed by a set of figures, such as (a) 8x30, (b) 6x25, (c) 10x50, (d) 8x50, or whatever the case may be. Here the first figure gives the magnification. Both (a) and (d) would thus magnify 8 times, while (b) has a magnification of 6 and (c) of 10. The remaining figures give the diameter, in millimetres, of the object glass, this being an indication of the brilliance of the image. Both (c) and (d) have lenses 50 mm. in diameter, while (a) has a lens 30 mm. in diameter and (b) one of only 25 mm.

The significance of these figures will become more apparent from Fig. 6. This shows two object glasses, one of 30 mm. and one of 50 mm. diameter. At first sight the difference may appear of no great importance. However, the light-gathering ability of the lens depends on its area

—and the area of the 50 mm. glass is almost three times that of the 30 mm. glass, so that an image of nearly three times the brilliance would be expected. It is for this reason that lenses (or mirrors) of very large diameter are used in astronomical telescopes, where the light may be exceedingly poor. For small telescopes of this kind a lens 2in. to 3 $\frac{1}{2}$ in. in diameter is good,

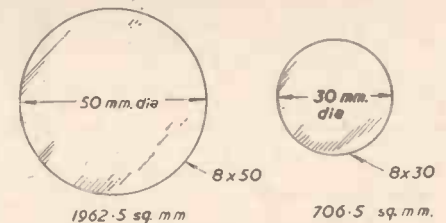


Fig. 6.—Binocular objective ratings.

while a lens 1in. to 1 $\frac{1}{2}$ in. will do well for the terrestrial telescope, since magnification will be lower.

## Science and Observation

By Prof. A. M. LOW

### Travel Sickness

CAR-, train-, flying- and sea-sickness are all unpleasant, but the car type is one of the most mysterious. The basic reason, no doubt, is that many cars are still sprung like a stagecoach. Designers have forgotten that every wheel should be independent and the moving parts so light that they will do the jumping instead of the passenger.

Cures are rather weird, except for the various chemicals which partly paralyse the balance apparatus near our ears. Some find that sucking a lemon is good, perhaps because it distracts the attention, or it may have some astringent action which is useful. Others find that glucose helps, or they suck barley-sugar.

Queerest of all, I learn from correspondents to the press regarding this subject that to put a piece of brown paper on your back under a coat is a good plan. Another says that to sit on a folded newspaper means certain safety. My view is that these are positively super-schology. But I at once begin to think of electrical insulation, or even the generation of electricity by friction between coat and paper, or

between where you sit down and brown paper.

Then I recollect the brown paper and spark experiment, when by pulling the dry paper under your arm quite nice sparks can be drawn from it with the knuckle. An alternative possibility is that the paper provides a slippery seat, and thus the innumerable little jerks as each cylinder fires or as the car progresses (not smoothly) forward do not reach the body undamped.

The point is: which is best? Should I slide as if rowing in an outrigger, or should I glue myself to the seat?

### New Fuels

I BELIEVE that many new fuels will be employed by our grandchildren. What we now regard as explosives will be used to release their energy in a suitable manner and this will help us to have such things as flying cars.

From the many suggestions as to the conversion of coal to oil comes the obvious idea of mixing the two. The coal would be in a form so finely divided that it would remain sus-

pending in the oil almost indefinitely.

I saw recently an ingenious method of deciding how quickly coal was settling in a vessel containing oil. You can make the test yourself. Imagine a small glass tube suspended by a string about 2ft. long. The tube is filled with the oil-coal mixture. By giving the tube a push it naturally swings from side to side on its string. It is, in fact, a pendulum.

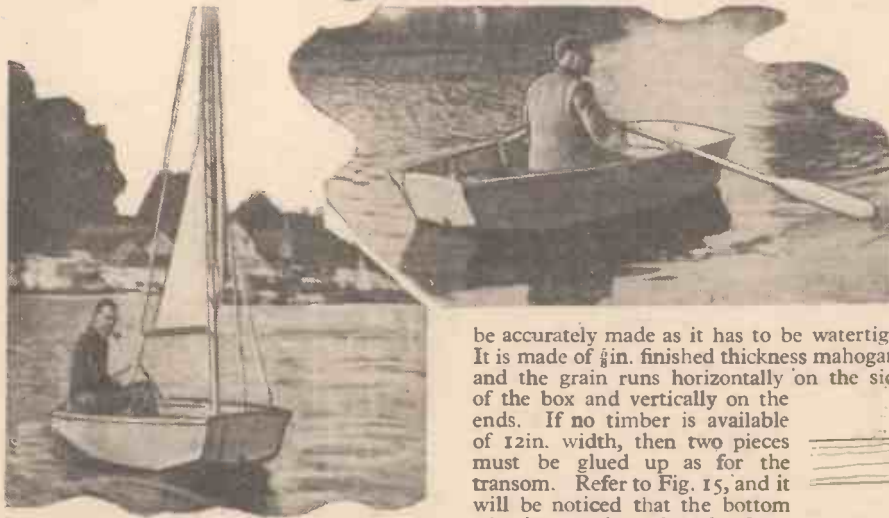
A pendulum depends for the rate of swing upon its length from the point of its support to its centre of gravity. So when the coal settles in the tube the centre of gravity of the whole vessel containing the coal and oil falls lower and lower in this tube.

By measuring the pendulum's swing it is very easy to determine the rate at which the pendulum is altering its effective length by virtue of the coal gradually falling down out of its surrounding oil.

### Sun-ray Houses

THERE is an experimental house heated by the sun alone. The heat is collected by copper plates, and passed to storage casks where it is stored in glauber salt. Fans extract hot air as required. Nearly 30 tons of salt is used to store up the heat and the house can be kept at 70 deg. even if there are 10 successive sunless days. Not very helpful in an English winter!

# Building an 8-FT. Sailing Dinghy



An All-wood Family Craft  
Which Can be Carried on  
the Car Top

By FRANCIS HOOK

(Continued from page 501, September issue.)

be accurately made as it has to be watertight. It is made of  $\frac{3}{8}$  in. finished thickness mahogany, and the grain runs horizontally on the sides of the box and vertically on the ends. If no timber is available of 12 in. width, then two pieces must be glued up as for the transom. Refer to Fig. 15, and it will be noticed that the bottom edge is curved so that the front end is only about 10  $\frac{1}{2}$  in. tall. This curve can be worked on the edge of a piece of thin plywood to fit to the hog and then the shape can be transferred to the side pieces of the box. It is helpful to cut and work these curves to shape before the box is glued and screwed together, so that only a little fitting will be required before screwing the box to the hog.

The position and direction of the screws fixing the box to the hog are shown in Fig. 16. It is as well to screw the box in place first of all without the jointing gasket and Seelastic to

casing, coated liberally on both sides with Seelastic-sealing compound, and screw the casing back in place. As an additional precaution for making a waterproof joint, quarter-round beading can be fitted round the casing bedded in Seelastic compound as shown in Fig. 16.

**T**HE next operation is to cut the slot in the keel for the centre board to pass through. This slot should be marked out accurately 12 in. long x  $\frac{3}{8}$  in. wide and positioned 9 in. forward of Frame No. 2. It is important that the width should be an easy fit for the plywood centre board so as to allow for any expansion when in the water. A good method of making this slot is to bore a series of holes with a centre bit on the centre line of the keel and to join them up into a slot with a pad saw. Trim up the sides with chisel and file and glasspaper smooth. Fig. 2 in the August issue shows the approximate position of the centre board.

### Centre Board Casing

Having made the centre board slot the trunk may be made to take it. This box must

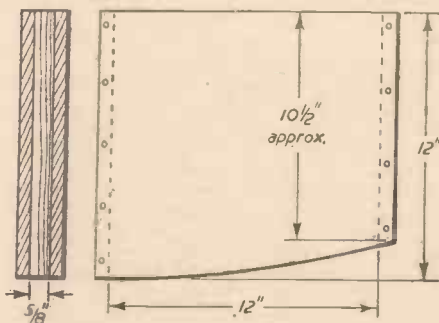


Fig. 15.—The centre board casing.

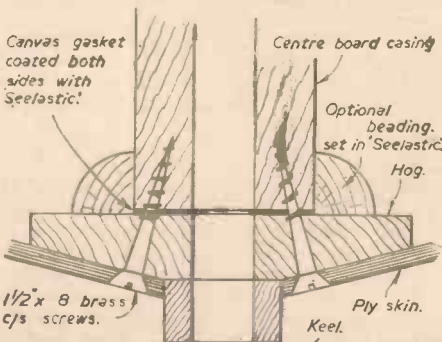


Fig. 16.—Fixing the centre board casing

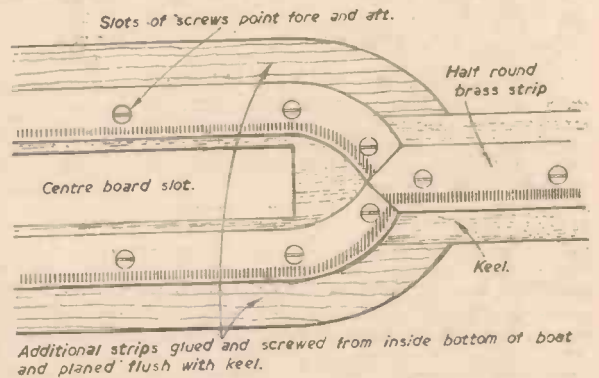


Fig. 18.—Reinforcing the keel and centre board slot.

### Making the Centre Board

The centre board is made from  $\frac{3}{8}$  in. resin bonded plywood. The length is 33 in. and the width 12 in. The lower end is shaped as in Fig. 17. At the top end two tenons are sawn and are morticed into a capping piece 13  $\frac{1}{2}$  in. x 1  $\frac{1}{2}$  in. x  $\frac{3}{8}$  in. The joints are secured with glue and an added precaution is to pin the tenons with dowels. The fore and aft edges of the centre board are faired off to prevent resistance and drag in passing through the water.

### Keel Rubbing Strip

At the keel and skid is the point where friction in hauling the dinghy ashore and during launching will do the most damage, and the paint at this point will be removed quickly. It is usual to guard against this by fitting a brass rubbing slip along the length of

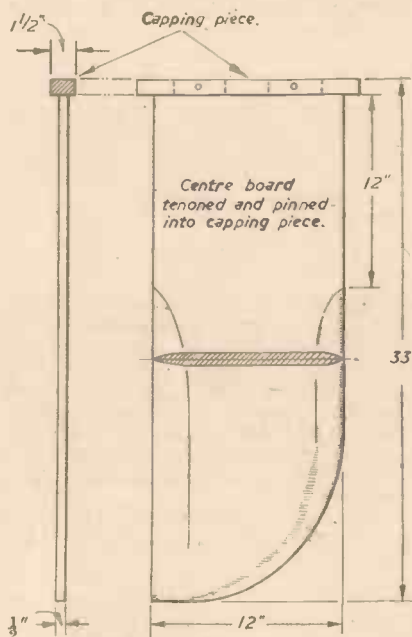


Fig. 17.—Details and dimensions of the centre board.

make sure the fitting is good. To help in this fixing two sash cramps may be used, being passed up through the casing and gripping the top of the casing and the keel. When this trial fixing is satisfactory take down and fit a thin canvas gasket between the hog and the

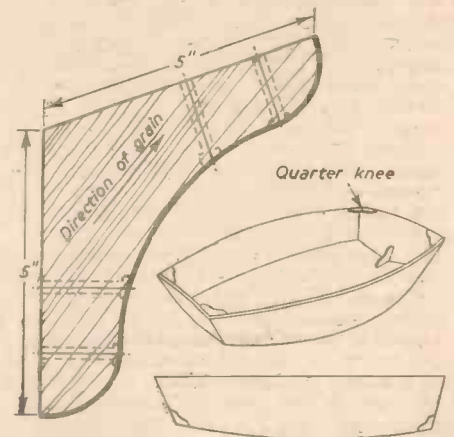


Fig. 19.—Making and fitting knees.

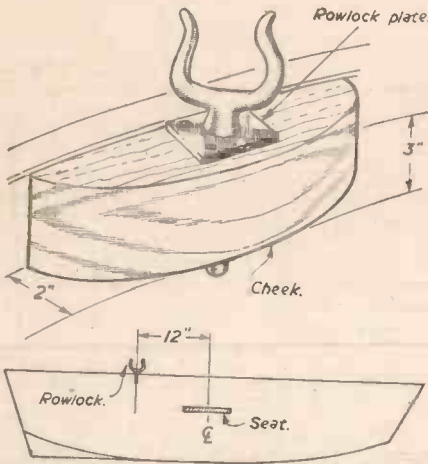


Fig. 20.—The rowlocks and rowlock cheeks.

the keel. Half-round brass strip specially made for the job may be purchased and secured with brass screws, the heads of which are well countersunk.

Because of the centre board slot this brass strip cannot be in one continuous piece. A separate piece is used each side of the centre board slot and these are mitred into the fore and aft pieces as shown in the diagram. Fig. 18 and also in Fig. 13.

A certain amount of abrasion also occurs at the chines. As this rubbing will be taken by the plywood bottom skin it is essential also to protect this edge. This can be done with brass strip, or alternatively, to save expense, a hardwood moulding can be used and renewed from time to time as it wears.

In such a case it is suggested that these strips should be fixed into place after the painting of the boat.

### Seats and Seat Risers

The seats are supported on risers which are strips of mahogany 1½ in. x ½ in. running from the bow to the transom on either side of the boat, see Fig. 14. They are housed a ½ in. into the side futtocks and are screwed into place. The top edges of the risers should be 7 ½ in. down from the sheer line if the seats are made of the ½ in. plywood, i.e., the top side of the seats would be 7 in. down from the sheer line. A more substantial but heavier seat could be made of ½ in. mahogany.

The stern seat and seat amidships are both 12 in. wide and the bow seat is 8 in. wide.

The fitting of the seats, so as to get a snug fit against the curved sides of the boat, is quite a tricky job. It is helpful to make a thin cardboard template first of all to fit in the place of the seat, and this is used to mark off the length of the underside of the seat. Remember that the edge of the seat will slope outwards from this length, and allowance must be made for this fact.

The forward seat in the bows is very useful for the oarsman when taking out the family party. The boat is on an even keel and he is in a position to keep an eye on the younger members of the party. For the lone fisherman or sailor the seat amidships is ideal. Thus two pairs of cheeks must be provided for rowlocks (Fig. 2).

The seat amidships is housed round the centre board casing to a depth of 1 in. in order to give rigidity to this casing.

Here the seat is supported by a small block of wood screwed through the seat on to the end of the casing. In the case of the stern seat,

beside the support at the risers, it may be necessary to support it in the middle with a piece of 2 in. x 1 in. running down to the hog.

If the dinghy were to be exclusively used for sailing it might be as well to do away with the stern seat, as it is quite impossible to use this seat when under sail due to the use of the tiller.

### Making and Fitting Knees

Six knees are required, sawn from oak or elm 1 in. thick. To get the correct shape cut out a piece of thin card to the correct angle and transfer the shape to the wood. When doing this arrange the grain of the wood as in Fig. 19 so that should the knee become fractured at any future period the parts are held firmly by the screws.

Having marked out the shape of the knees, cut them out with a tenon saw and bow saw and smooth up to shape with plane and spokeshave. The straight edges are bevelled to suit the slope of the sides of the boat. The knees are screwed and glued in

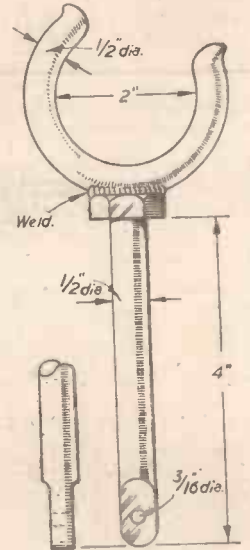


Fig. 21.—Details for making rowlocks.

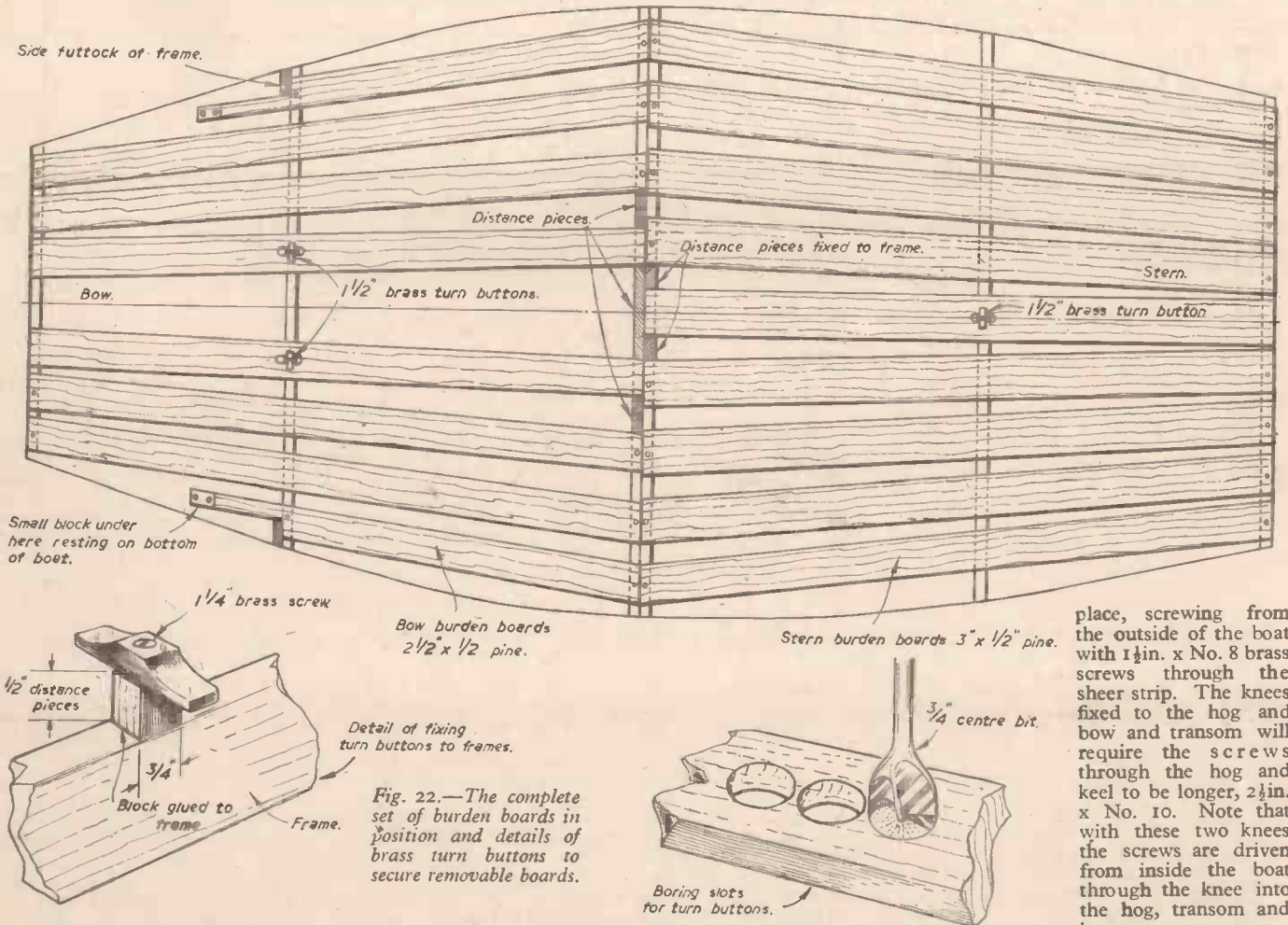


Fig. 22.—The complete set of burden boards in position and details of brass turn buttons to secure removable boards.

place, screwing from the outside of the boat with 1 ½ in. x No. 8 brass screws through the sheer strip. The knees fixed to the hog and bow and transom will require the screws through the hog and keel to be longer, 2 ½ in. x No. 10. Note that with these two knees the screws are driven from inside the boat through the knee into the hog, transom and bow.

When all the knees and seats have been made and secured, the three supports across the tops of the frames may be removed. The horns left on the frame side members may now be sawn off flush and a quarter-round

order to be able to locate easily the removable strips.

The three removable boards are held in place by three brass turn buttons, as shown in Fig. 22. They are mounted on small distance pieces, which are glued to the frames.

The fixed boards are spaced out equally and are screwed in place with some 1in. x No. 6 brass countersunk screws. Note how the two outside boards in the bow are cut round the side futtocks of frame No. 1. The burden board may be seen in position in Fig. 23.



Fig. 23.—The completed hull.

spokeshaved on each end. The top edge of the plywood sides may also be smoothed off with a smoothing plane so as to run in smoothly with the sheer strip, the transom and bow.

**Rowlock Fittings**

When fitting the rowlocks it must be borne in mind that they must be positioned 12in. from the centre of the rowing thwart or seat. A pair of rowlock cheeks, as shown in Fig. 20, are made from a piece of 3in. x 2in. mahogany and screwed from the outside through the sheer and the plyside. The shank of the rowlock is usually 1/4in. diameter and a hole this size is drilled through the cheek. A small rowlock plate surrounds this hole and it is recessed into the cheek to be flush with the surface and then screwed in position.

**Rowlocks**

A pair of galvanised rowlocks may be bought for about 7s. 6d. Alternatively, they may be made by welding the shaped ring to the top of a 4in. bolt head as shown in Fig. 21. A flat is filed on either side of the end and is drilled to take a cord, which is used to secure the rowlock to the seat riser, so that it may not be inadvertently pulled out and dropped overboard when shipping an oar. The rowlocks when cleaned up can be sent to the platers for galvanising.

**The Burden Boards**

There are several ways of making up sets of burden boards, but that shown here is quite simple. The method of setting out the boards is shown in Fig. 22. There is a bow set and a stern set. The former strips are made from pine 2 1/2in. x 1/4in., and the latter from pine 3in. x 1/4in. For

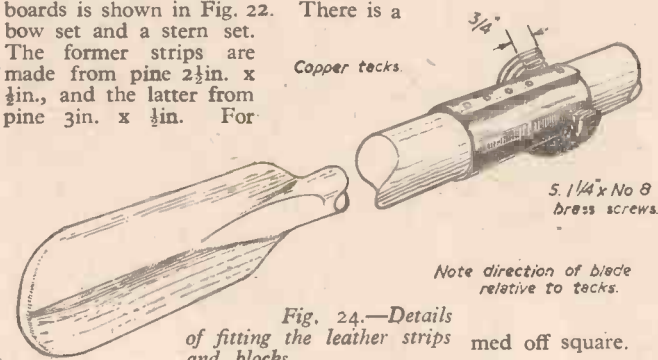


Fig. 24.—Details of fitting the leather strips and blocks.

convenience, at the bow end two boards are made removable; the ones on either side of the centre board casing. At the stern the centre strip only is made removable.

The stern burden boards rest on frame No. 2 at their forward ends and on a ledge 1/2in. x 1/2in. glued and screwed to the transom. Ledges for the bow set of boards are glued and screwed to the bow board and to the forward side of the bottom futtocks of the No. 2 frame. Spacers or distance pieces are screwed to the frame as shown in Fig. 21 in

**Making a Pair of Oars**

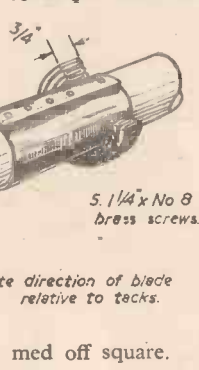
If the builder of the dinghy makes himself a pair of oars he will save approximately £4. It is suggested that the type with flat blades should be attempted at first. These are made out of spruce and consist of the centre handle, made from 2in. x 2in. timber, which runs right through to the bottom of the blade. The latter part is made up with two pieces of spruce 24in. x 2 1/2in. x 1in. glued and dowelled to the handle.

First of all plane up the material for the handles and the blades. Whilst the handles are still in the 2in. x 2in. section mark out the positions of the 1/4in. dowels and drill. When this is done mark out and work the taper on the handles, which should start 24in. from the one end and taper down to 1in. at the blade end. Glue up the blades and set aside to dry.

When the joints are set work may commence on rounding down the handles and fairing off the blades to shape as shown in Fig. 25. Recourse will have to be made to smoothing plane, bullnose plane, spokeshave, rasp, file and glasspaper in order to obtain a fine finish.

It is usual to varnish the oars although the blades are sometimes painted to match the boat.

At 21in. from the handle end a piece of thin leather 6in. wide is wrapped round the oars and secured with copper tacks. It should be noted that when making the nailed overlap to the leather the nails should be on top when the oar rests on the rowlock. So that there will be a port and starboard oar. Thus the one illustrated in Fig. 24 is for use on the port rowlock. The leather blocks are made from some 1/4in. wide strips of shoe leather; three to each block. These strips are well wetted and then bent around the handles. Drill a hole through the centre of the length of each piece and screw into position with a 1 1/4in. x No. 8 brass screw. Then work the leather round into place and hold there in a vice whilst two screws on either side are fixed, i.e., five screws are used for each block. The ends are carefully trim-



Note direction of blade relative to tecks.

**Painting and Varnishing**

No two builders of small craft will have the same opinion as to the correct method of finishing off the craft. Certainly it would seem sacrilege to cover the beauty of the mahogany transom and bow with paint, so that varnish only is indicated here, at least for the first years of the boat's life. It is usual to varnish the seats and the burden boards. The bottom and sides of the dinghy can be enamelled.

Whatever the final finish is to be, paint or varnish, the bare wood must be thoroughly

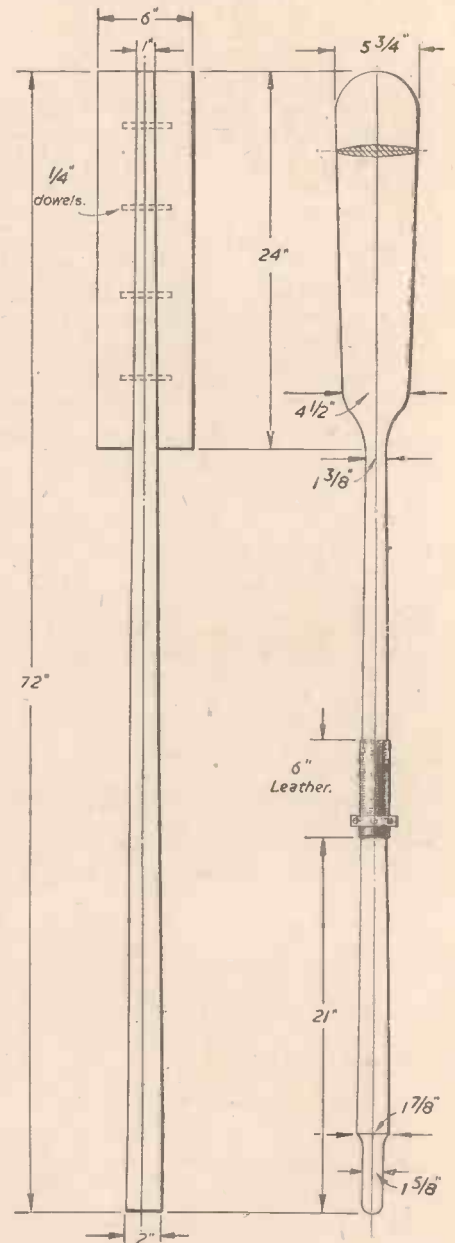


Fig. 25.—Rounding handles and shaping blades.

prepared by rubbing down first with middle No. 2 glasspaper and then with No. 1. On no account rub across the grain of the wood, but keep all the time with the grain. Dust the woodwork down and all is ready for the paint-brush. It is strongly recommended that only first-class marine paints and varnish be used.

For the varnished surfaces a priming coat of varnish diluted with half its volume of turps is used. This mixture is well brushed into the wood and allowed to dry out. The priming coat is well rubbed down with fine glasspaper and dusted down. Then follows the application of three coats of normal boat varnish, each coat being allowed to dry thoroughly, followed by a light glasspapering before the application of the next coat.

If surfaces are to be painted, first of all apply a coat of pink priming, which should be well brushed into the grain of the wood. When this is dried out rub down well with fine glasspaper.

For this boat the quantities of paint required are one quart each of priming, under-coat and top coat, together with a quart of boat varnish. To this can be added, say, a quart of turps substitute.



Fig. 1.—A view of the  $\frac{1}{16}$  in. to 1ft. Bassett-Lowke model.

THE original vessel was constructed by John Brown & Co., Ltd., of Clydebank, for the passenger and cargo service of the Cunard White Star, Ltd. She is a twin screw one class vessel of length overall of 534 feet, 500ft. between perpendiculars. She has a sister ship named the *Parthia* which was built by Harland and Wolff, of Belfast, in 1947. The *Media* was the largest vessel launched on the Clyde in the year 1946 and the first to be completed for the Cunard White Star Company since the *Queen Elizabeth* in 1940. She made her maiden voyage from Liverpool to New York on August 20th, 1947.

Figs. 1 and 2 illustrate a facsimile model, externally, by Messrs. Bassett-Lowke, Ltd., of Northampton, and thanks are due to them for permission to reproduce them. Their model is to a larger scale, viz., 1/48 in. or  $\frac{1}{16}$  in. to 1ft.

Other particulars of the original vessel are:

Extreme breadth ...	70ft.
Load draught ...	30ft. 2 $\frac{1}{2}$ in.
Gross tonnage ...	13,700.
Net tonnage ...	7,481.95.
Service S.H.P. ...	13,700.
Maximum S.H.P. ...	15,000.
Passengers ...	250.
Crew ...	184.
Cargo capacity ...	371,430 cu. ft.
Speed, knots ...	17.

The lifeboats are of steel and are carried by Welin MacLachlin gravity davits fitted well above the heads of people on the promenade deck. It will therefore be seen that in modelling these boats their exteriors will be carved smooth and will show no longitudinal planks or seams.

**Forming the Hull**

The model is to be to a scale of 1/16 in. to 1ft.; the length will be approximately 33in. and the beam 4 $\frac{1}{2}$ in. An outline drawing in sheer and a deck plan will be seen in Fig. 3, whilst Fig. 4 gives all the necessary particulars for the dimensions of the hull. From both of these drawings it will be seen that above the load water line the outline is the same as the prototype, but that below it is different. It was made so because it is proposed to make it wholly of metal and as large a displacement as possible is required.

To model this hull in sheet metal instead of wood will reduce the amount of time and the labour taken in making enormously. It is simply a matter of bending the vertical strip of metal in a horizontally curved direction, making the underwater curve at the stern to a smaller camber than the above-water portion. This will be best done by dividing the two sides of the hull on the centre of the stern and cutting the underwater parts shorter

than the upper portion. A tinplate strip will be needed to cover the seam in each case. Where the upper and lower portions over-reach a tin plate, cut to fit the two curves, will be added on a length of angle brass soldered as shown in Fig. 4 and in Fig. 5.

**The Bottom Plate**

Now the whole of this upper portion of the hull must be made and soldered to a bottom plate which is to be cut from sheet copper of as nearly as possible No. 24 s.w.g. This is to be flanged upward by beating it over the curved edge of a shaped hardwood board; either oak or birch will do, 1in. thickness, say, 5in. wide by 32in. long. Draw a centre line down the middle of this and on each side mark off the dimensions given in the plan Fig. 4. Join up the points arrived at with draughtsman's curves and saw cut to the curved lines, keeping the saw carefully square with the surface of the board. On one side and edge of the shaped board, either with plane or spokeshave, produce a rounded corner of about  $\frac{1}{4}$ in. radius. It would be best to cut a cardboard template for this curve, so as to be sure of getting it equal all the way around. Now on the centre line of the copper drill, say, three holes to take No. 4 round head screws, one in the middle and one each towards either end. Then soften the copper by getting it red hot equally all over, and quenching it in cold water. Cut the edge

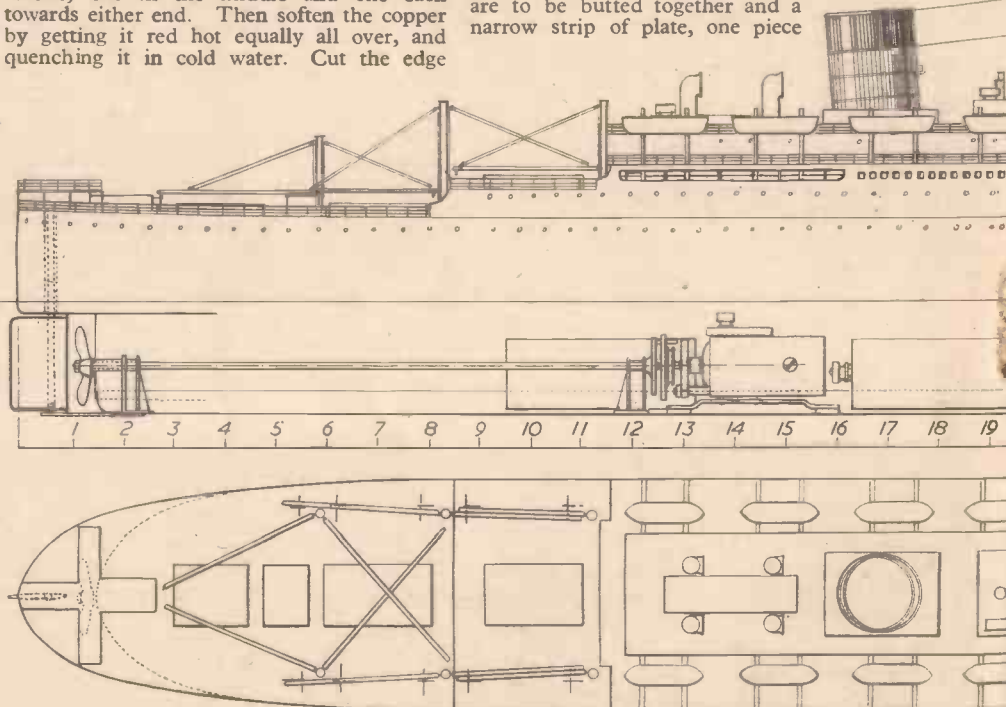
of the copper to an outline following the shape of the board, but about  $\frac{1}{8}$ in. larger all around, screw it to the side of the board on which you produced the rounded corner and commence beating the edge of the plate over. The best tool to use for this beating will be made of beech. There is a plumber's tool which can be bought which will be ideal for the purpose. It has a long head of half-round section with a flat on one side and a handle at one end, all formed from one piece of beech. The beating is done with the flat side. The blows must be delivered with a dragging motion, a little at a time, all around. Continue the beating until the curve is completed and the upturned edge is standing square with the bottom.

# Modelling the CUNARD

Should the plate show any signs of buckling or inclination to fold, take it off the board and anneal it again by heating it. Flatten it and screw it on the board again and proceed with the beating. Do not forget the dragging blows in the direction in which the plate is to be bent: this will assist considerably in producing the required shape. When beating is completed take the plate off the wood, file the beaten edge and thoroughly tin it with solder, wiping off any surplus. A large soldering bit will be best for doing both the tinning and the soldering.

Apply the tinplate upright sides, making sure that these are square with the bottom. Start at the bows and solder on, working backwards to a point at the centre of the stern; here cut off the superfluous tinned plate. Then do the other side. At the stern the plates must not overlap; they are to be butted together and a narrow strip of plate, one piece

Scale Draw  
Detailed Ins  
Building this  
By E. W.



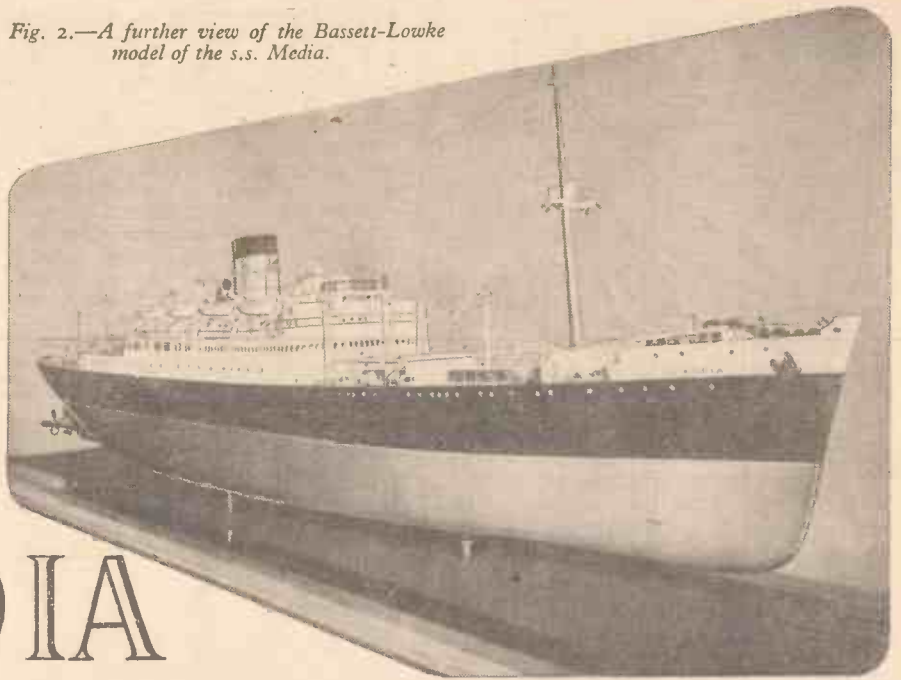


below and another above the break, which will be below the L.W.L., will be soldered over the joints, the strips being laid on the inside of the hull. The three holes in the copper bottom which received the holding down screws can now be closed by three pieces of tinned plate, letting the solder fill the holes and be filed off flush with the outside of the plate.

**The Rudder and Propeller Bearing**

The details of this part will all be clear from Fig. 5. Whereas the prototype vessel has twin screws the model is provided with only one, and this is placed on the centre line of the ship. Drill for the propeller shaft bearing through where the tinplate fishplate is. Make two bearing brackets soldered down on a brass plate and in these solder a piece of thin brass tubing of about 5/16in. diameter. At the front end of this there is a brass collar having a 1/4in. hole in its centre. Having made the bearing, apply it to the stern and see that the tube enters the hole prepared

Fig. 2.—A further view of the Bassett-Lowke model of the s.s. Media.



# S.S. MEDIA

wings and  
structions for  
Model Liner  
TWINING

for it, at the same time ensuring that the bracket plates stand fair and upright on the copper bottom; if all is in order put the propeller shaft through the bearing and see that this lies along the hull parallel with the centre line. Then solder the tube in place and at the same time solder the bottom plate of the bearing to the copper. The

propeller should be 1 1/2in. diameter; it should be three bladed and it is suggested that it is purchased from Bassett-Lowke, Ltd. Pack the tube with soft cotton wick, thoroughly well greased, and compress it by pushing in the propeller hard. The wick will be best wound, not too tightly, around the shaft. Be careful to wind it so that the turns are opposite in direction to that in which the propeller

rotates, so that it tends to unwind as the shaft revolves.

**The Rudder**

The upright shaft or post is a brass tube having a diameter of 3/16in. and long enough to extend from a brass strip, screwed by two countersunk screws to the underneath face of the copper bottom, a fraction of an inch above the deckline.

This deck will be flush with the tinplate sides of the hull. At this point the rudder shaft will have a short lever pinned to it which will be made with bend downward and will make a friction grip on the deck. The rudder itself is a vane made from stout copper foil or very thin brass. It will be formed of a doubled-back piece of the copper foil extending from the trailing edge on one side, around the forward part and go back again to the trailing edge, where the two sides of the foil will be soldered together. It must be boxed in with four little pieces of copper foil cut with scissors to shape and soldered at both forward and after sides at top and bottom. This means lightness, for although it is underwater it will be filled with air. There is to be a ring of

copper wire around the shaft, both above and below the rudder, to serve as washers.

**The Motor**

To propel the boat, a polarised motor from Bassett-Lowke's catalogue is used. It is called the "Marine"; it has a base 2in. wide by 3 3/4in. long and its weight is 11 1/2 ounces. It is wound for six volts and dry batteries will provide the current. At the motor end of the propeller shaft an additional bearing will be wanted. This is exactly like the other, but the brass tube actually fits the shaft without a bush, i.e., it makes a running fit, therefore get a bit of tube with a 1/4in. hole, probably a short piece of the same as the rudder post will suffice to make it.

**The Decks and Superstructure**

The main deck will be in three pieces, all 1/4in. thick, of white waterproof plywood. These will be secured with metal screws tapped into an angle, soldered 1/4in. down inside of the hull, as shown in Fig. 5. The first piece of deck will extend from the bows to the commencement of the superstructure; the second will include only the superstructure and will go back to a point immediately forward of the second derricks, and the third from this point right to the stern. The second portion, as will be seen, will be much the longest of the three and this is the part which will most often have to be removed to get at the motor and batteries—the latter especially since they will require renewing from time to time.

This superstructure should be as light and as strong as possible, and is made of fairly thick Bristol-board of, say, 10 or 12 sheet thickness. If Bristol-board is not employed it would be best to use hardwood about 1/16in. thick, although Bristol-board, which is made up of layers of hard white paper, will be the best. Whichever is used it must be cut with a knife, the said cutting being done downward on glass, a piece of plate glass for preference.

When all the pieces are cut, and allowance must be made for overlapping either of the sides over the ends or of the ends over the sides, every piece must be soaked, whether of Bristol-board or of wood, in a solution of celluloid. This can be done by dissolving shredded celluloid in amyl acetate; this may also be bought from electrical firms, where it is used as a lacquer. Soak for about

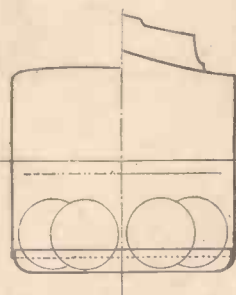
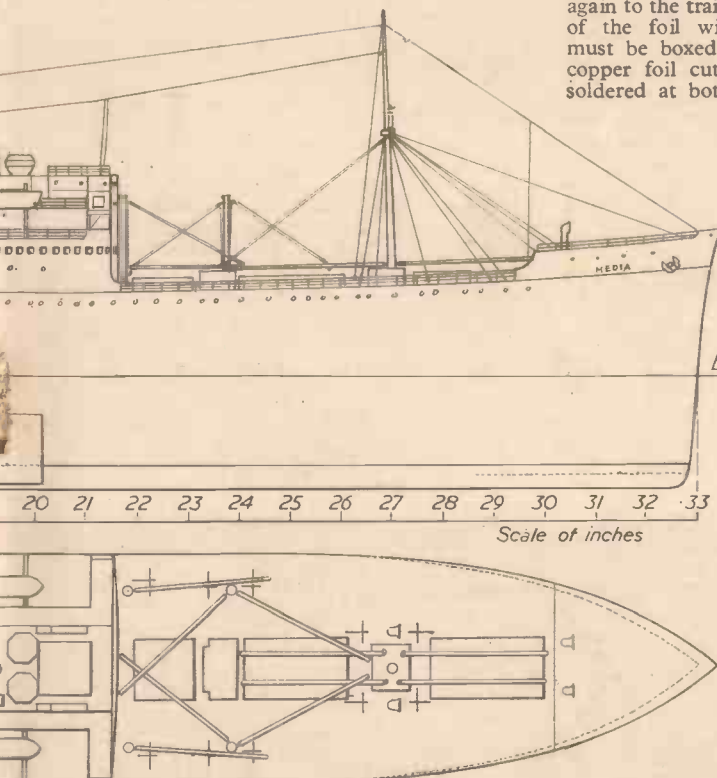


Fig. 3.—General arrangement of model of s.s. Media. Outline drawing in sheer and deck plan.

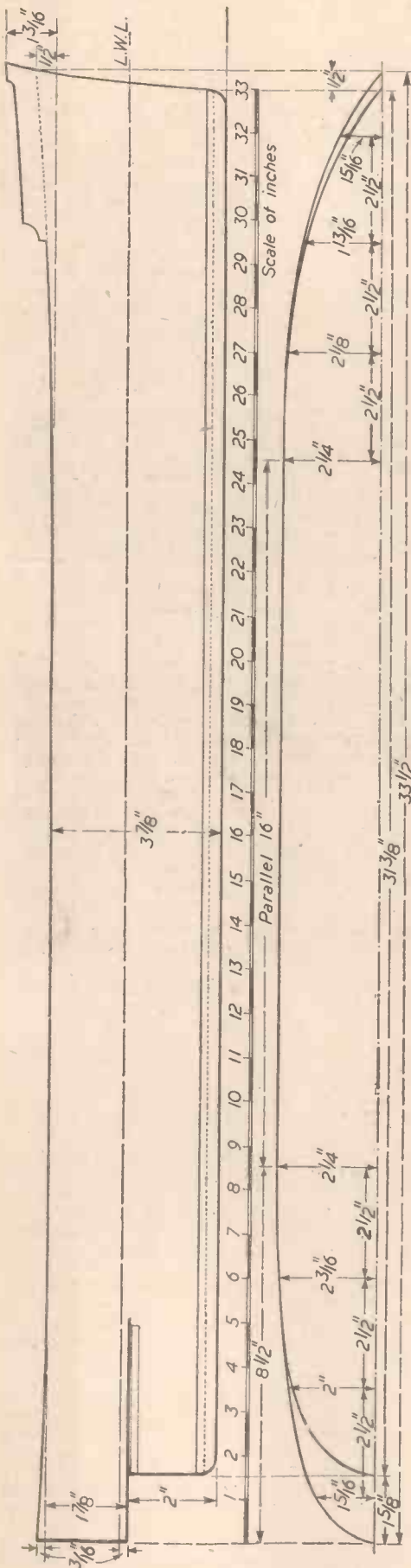


Fig. 4.—Measurements for the hull.

24 hours, remove the pieces and lay them on fine wires stretched horizontally so that they may dry from both sides, which drying should be completed in about six hours. Then they are jointed and built up with "Durofix," which is another cellulose cement. The use of the lacquer will strengthen the model and render it quite waterproof. Everything which cannot be soldered on the model must be stuck with Durofix, and the whole superstructure can be so cemented to the middle portion of the deck. At all important angles it will be advisable to insert lengths of squared wood, about 1/4 in. square, to strengthen the joints. The strips will be stuck in and completely surrounded with Durofix.

**The Funnel**

I have drawn this circular in the plan, Fig. 1, but actually it is a little longer in a fore and aft direction than it is athwart ship. To make the funnel, obtain a piece of wood and turn it circular; then, on opposite sides, either plane or file it to 1/16 in. less each side, blending off the two flats to make a nice sweeping oval. Now wrap a piece of fairly stout paper around it and next a piece of Basildon Bond notepaper. Coat the outside of this with the lacquer or with Durofix, and then put on successive layers of the notepaper until you have formed an elliptical tube a full 1/32 in. thick. Slide this off the wood, remove the first paper, see that the shape of the tube remains correct and lay it on one side to dry.

When it is dry stick with lacquer four threads around it with a rather thicker thread at the top. Again allow to dry and then cut the tube to its correct height, square with the centre line at the top and at the correct raking angle at the bottom.

**The Boats**

These can be planed to a uniform section in one length; the section is shown in Fig. 6. This wooden strip is then cross-cut for the eight boats all to equal lengths shaped with a chisel or a penknife at the ends for bows and sterns. The davits can be cut either in Bristol-board with the knife or fretsaw from plywood, but I advocate using the cardboard.

Cranes or hoists are shown in Fig. 7. These are simple but fiddling to make and so are the winches (Fig. 8). The crane uprights had better be made from 1/4 in. square boxwood, unless it is preferred to make them from brass tubing of the same diameter. The tube will give a perfectly true outline, but there is a difficulty in making attachments to it except by soldering and the bottom ends would have to be wood filled in order to cement them to the decks. If the boxwood is used take a length measuring exactly 1/4 in. each way and plane the corners off it, making it into an octagon. Then drill a 1/16 in. hole through a steel plate and so make a drawplate. With a file rub around

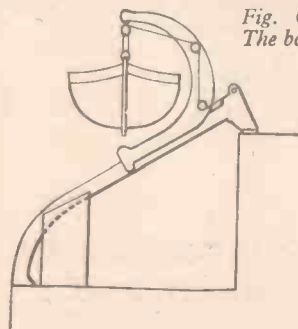


Fig. 6. (Left).—The boat launching gear.

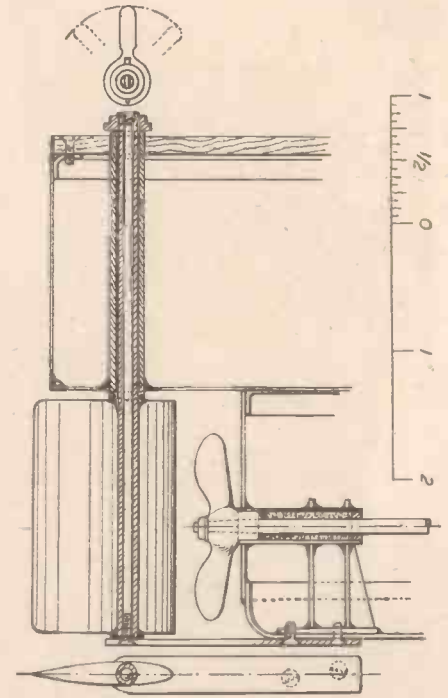


Fig. 5.—Details of the rudder and propeller

the end of the wood strip, which has been made octagonal, until it is circular, then introduce it into the hole in the plate; push it until there is enough through to pull on and continue pulling until the whole strip of wood is through. You will find that the edges of the plate are sufficiently sharp around the hole to cut the wood and convert the octagonal form to circular. The booms will be a little smaller in diameter but greater in length and each one tapers at both ends. Each of the uprights and booms will have blocks upon them: these can be made with threads of silk, having little oval pieces of cardboard cemented on each side with the thread between. When the cardboard pieces are blacked they will make good representations of blocks. If wood is used for the crane uprights they should be cemented into holes in the decks for making them secure.

**The Winches**

Fig. 8 is a near enough drawing of one of the crane winches to be looked upon as correct. The drawing is made many times larger than these winches will be on the model, as may be seen from a critical examination of the photograph Fig. 9. These winches are each driven by an electric motor and are readily made by turning the parts in boxwood. Each is made from, say, three pieces of wood; the base, which is a little square or rectangular block; then comes a turned piece for the driven shaft and last of all the motor and the worm shaft. All of these are mounted one above the other in the order and manner

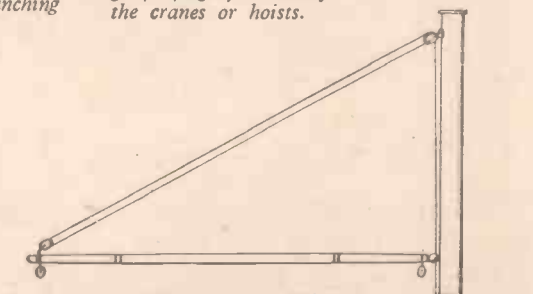


Fig. 7. (Right).—One of the cranes or hoists.

shown. There will be in all 20 of the winches to make, so I do not expect that any fine details will be put into them, but they ought certainly to be shown on the ship even if they are of simplified form.

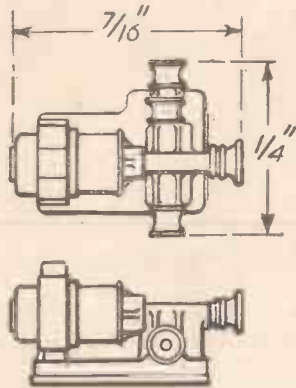


Fig. 8.—An enlarged view of one of the winches.

The hatches and deckhouses are simple rectangular blocks of wood, stuck down on the decks and call for no comment, but the docking bridge, at the extreme stern, will call for some care in making and fitting. It would be almost impossible to guard against injuring

this at some time or another and, I think, that strong pins, of dressmaker's kind, inserted into the deck with the heads soldered underneath a metal, cross shaped piece of plate will be the best way in which to make it. The head of the cross, the forward portion, can be drilled and screwed down to the little wooden deck-house which comes below it. This will involve a slight departure from the full-size ship because it will make the house a little higher than it should be, but it is of greater importance that the bridge shall be there and be strong enough to stand up to ordinary usage. The bridge is well shown in the photograph of the Bassett-Lowke model Fig. 9.

There are many bollards on the vessel, especially upon the forecastle, and there are about 20 at the stern. These are all double pins and I leave it to the model maker to decide whether he will put them in. It will be a simple matter to do so since they will be made from ordinary dressmaker's pins cut off to correct lengths under the heads and inserted, with heads uppermost, into tiny drilled holes.

**Finishing**

Paint and enamel the whole of the inside of the ship grey. Other parts which would be pale grey will be the mast, the crane columns, the winches, the tops of all hatches and the tops of the deckhouses. The funnel lower part will be vermilion. The funnel top will be black as will also be the vertical sides of the hatches and the whole of the outside of the hull from the waterline up to the main-deck line. All bollards and crane pulley blocks are black, also the winding drums of the winches. All deckhouses as regards the vertical sides will be pure white, including the superstructure from the top of the hull proper upwards. The stern bridge and the fore-castle are also white. Then at the waterline there is a fine white line, which can be drawn with a draughtsman's ruling pen. This line marks the upper boundary of a below waterline colour, which is Indian red. All of these can be distinguished in the photographs except,

perhaps, the vermilion on the funnel. The top of the funnel casing and the rectangular base on which the funnel is mounted will be black. The decks are mostly of wood colour. These actually are of wood, but I would paint them a creamy white or creamy brown. The alternative to painting will be to waterproof them with about three coats of the colourless celluloid lacquer.

The reader will have to decide where he will put the motor starting switch and to what it shall be fastened. The circuit will be most simple, just a make-and-break switch lever, opening and closing the circuit from one side of the battery and one side of the motor. It cannot be fastened to any deck because these are removable and the switch must be left in the hull when decks are off. At the stern it can be reached easiest and the best place for it will be on the starboard side fixed close up under the deck. The lever in such case can be about 1 1/2 in. long and have a total movement of only about 1/4 in.

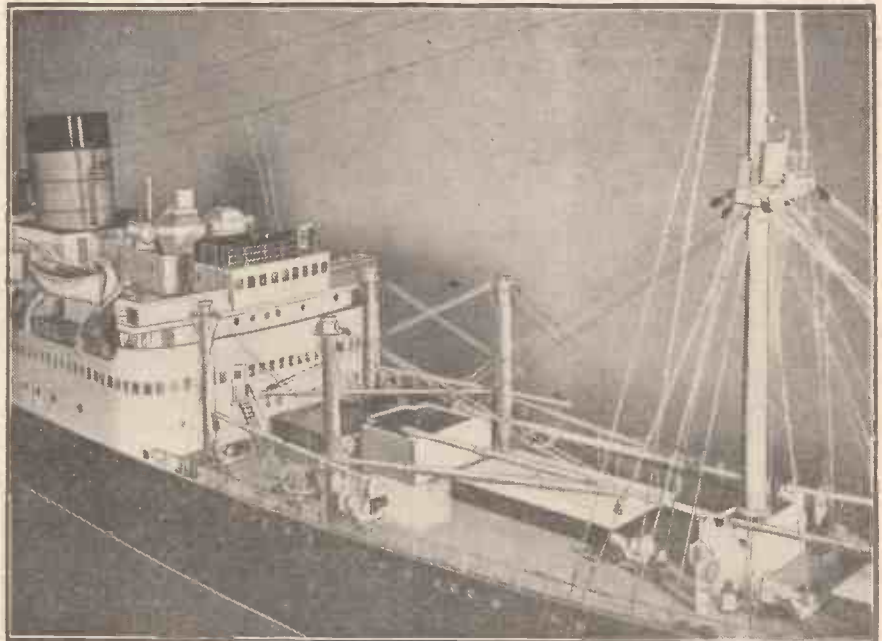


Fig. 9.—A further view of the Bassett-Lowke model showing the bridge structure.



**The U.S. Space Satellite**

IT has been disclosed that for the first two rocket stages in Project Vanguard, liquid fuels will be used and the third and final stage will use a solid propellant to send it speeding round the earth in outer space. A solid-propellant rocket was chosen because of its simplicity. Such a rocket consists essentially of a combustible charge in a container, an igniter and a nozzle for the escape of the gases. Liquid-fueled rockets were chosen for the first and second stages because it is easier to guide that type of rocket.

**Synthesis of Granite**

A FRENCH professor has succeeded, for the first time, in creating the synthesis of granite. The experiment was carried out on natural glass, obsidian, from the Lipari islands. A few grammes of glass were subjected to a temperature of 500 degrees centigrade and a pressure of 3,000 atmospheres. In a few days

the French professor obtained fragments of rock which were entirely crystalline with the mineralogic constituents of granite.

**A New Sandwich**

THE NEWEST sandwich is tubular in shape. It is moulded into the form of a Swiss roll, and the meat is injected automatically by a machine which then packs the sandwich and passes it on to the refrigerator to be stored.

**Underwater Engine**

AT a school of instruction run by the diesel manufacturing firm of F. Perkins, Ltd., a six-cylinder Perkins diesel engine is mounted inside a 400-gallon steel framed tank with Perspex sides. Under demonstration, the engine is started and the tank filled with water. Rising above the surface are four pipes—the air intake, the exhaust, the fuel and lubricating oil intakes.

**Electronic Brain's Task**

CALCULATIONS involved in a vast new British Railways mileage scheme, it is estimated, would have occupied 50 clerks for five years, but an electronic computer which the British Transport Commission has borrowed will take less than a year. Estimation of nearly 50,000,000 potential distances is

involved in the scheme, which is used to calculate charges.

**Ice Age Discovery**

BONES of animals living as long as 20,000 years ago have been found recently on the island of Caldy, south of Tenby, Pembrokeshire. These Ice Age relics include bones and teeth of rhinoceros, mammoth and cave bear. Caldy is the westernmost place where palaeolithic remains of this early period have been found in Wales.

**First Transatlantic Telephone Cable**

THE first transatlantic telephone cable has been completed and the final length of line was brought ashore at Clarenville, Newfoundland, recently.

**The "Flying Jeep"**

THE E.P.9 "Flying Jeep," which has been recently introduced, is the first Percival plane for 20 years. It is a light high-wing monoplane and uses an American engine. It is designed for crop spraying but can be adapted to carry five passengers or for use as a flying ambulance.

Indexes for Vol. 23 of PRACTICAL MECHANICS now available, price 1/3.

# A USEFUL TOGGLE PRESS

There are numerous jobs in a garage or small home workshop where a small toggle press would prove extremely useful because the action is so quick and facilitates removal of bushes, pins or rivets in a matter of seconds. A screw type press, while exerting a high pressure, is often rather cumbersome to apply while holding the details with one hand, and though time is not really an important feature in the same way as it influences production in a workshop, nevertheless jobs which require holding with one hand while the other manipulates the press are seldom easy to perform, and the faster the machine can be operated the easier the task becomes.

With this in view the design of this toggle press was undertaken; bearing in mind what material was available and whether the processes were feasible without sub-contracting any item. For this reason welding was introduced as a means of building the body and provided there is no attempt to reduce the sections to a comparatively small thickness fabricated articles of this nature give every satisfaction—in fact, in some respects for these small presses steel is superior to iron and there is little chance the frame can distort.

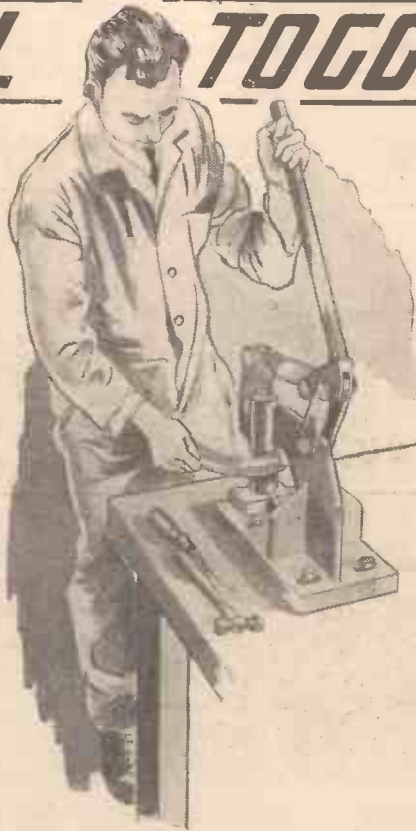
This little machine is also capable of punching holes through thin steel plate if a die is made to fit the base, but readers are not advised to attempt larger holes than  $\frac{1}{4}$  in. diameter, and not through plate greater than  $\frac{1}{16}$  in. in thickness.

A variety of punches and dies ranging from round to rectangular are an asset and well worth the time taken to make them because there are frequently operations in the garage where fitting time is saved simply by having the correctly shaped tool to hand. All manner of materials are easily punched—aluminium, fibre washers, copper foil, rubber, cardboard and leather are but a few this versatile machine can handle, and if set up on a bench remote from the normal activities it can be applied as a nibbling press—nibbling being the cutting out of different shapes by merely manipulating the sheet and cutting out sections at each press stroke until the complete profile is accomplished. Such work is slow, but it frequently happens that this course is the only way to make the form other than employing hammer and chisel methods.

### The Design

There is nothing original about any small press of this type—it merely follows orthodox practice, although it borders on the lightest class of machine tool, but such a design scores heavily on the grounds of simplicity because it comes within the scope of every reader.

The central frame is made from a piece of  $\frac{1}{2}$  in. mild steel plate—black material is suitable because, other than a coat of paint after a brief rub down, finish is not important. The base immediately underneath the punch ram is a rectangular section of mild steel—again of the black variety—but if a circular bed is preferred, then a piece 2 in. diameter is sufficient.



A Practical Tool for the Home Workshop or Garage

By K. VERDEN

Incidentally, if a slightly larger press is envisaged, a reader can double the dimensions given here with the exception of the frame thickness of  $\frac{1}{2}$  in.—a piece of  $\frac{3}{4}$  in. steel is adequate for the larger size machine. However, for general purposes these sizes are strong enough and there is little need for the larger version.

Ribs have been added to each side of this

$\frac{1}{2}$  in. thick frame member—not because it will distort under a load, but because any additional feature likely to strengthen the machine, or to make the design more efficient, is well worth including; and these ribs are so simple and easily attached. The frame is high and deep, but at the same time a fairly deep throat has been added to facilitate the passage of any large piece of material under the punch. There is no point in making this deeper unless the reader is prepared to make the frame wider where this occurs.

Fig. 1 shows a die in position on the assembly, and these are items which, though requiring a little care, readers can undertake as the occasion arises. Similarly, the punches if made from silver steel, hardened and polished will give long service and simply mean turning the ends concentric with the shank portion. The material held in a lathe collet to ensure true rotation is the best method of locating the metal.

There is no need to make either of these details a drive fit in their mating members—an easy slide fit is preferable because it eliminates the prospect of them “sticking” and so making it difficult for anyone to remove a part should it fracture or when another of a different size is required.

To facilitate the manufacture of this fabricated frame or body the ram hole and the bore in which the dies subsequently locate are made the same diameter, and this allows the frame to be clamped to the boring table of a lathe and a boring bar to be run right through both holes without resetting the tool. In boring this hole maintain the  $\frac{1}{2}$  in. diameter to a close tolerance—say,  $.750^{+.0005}_{-.0000}$  in. Keep

to the standard dimension if possible as this later assists when the dies are made; it is not then necessary to stop continually to refer to a note regarding the size the hole was previously made, and such dimensions as .753 in. diameter or .747 in. are avoided. A smooth hole is essential and perfect parallelism is necessary, especially where the ram hole is concerned.

### Case-hardening the Details

A refinement is the case-hardening of the holes in each link, and the outside diameters of the fitting pins are an asset, as this reduces wear to a minimum and prolongs their life—in fact, if this process is carried out and the holes and pins carefully polished to remove any scale left after the heat treatment, they should never need replacing.

There are several good case-hardening powders on the market which will give a sufficient depth of case for these items. No similar recommendation is made for the frame and ram because, in the case of such large components as these parts, few readers will possess the facilities for performing the operation, as there is no advantage in hardening one part and not the other, the ram also has been left in a soft condition. However, to help compensate for any likely wear to the hole and shaft, a fairly

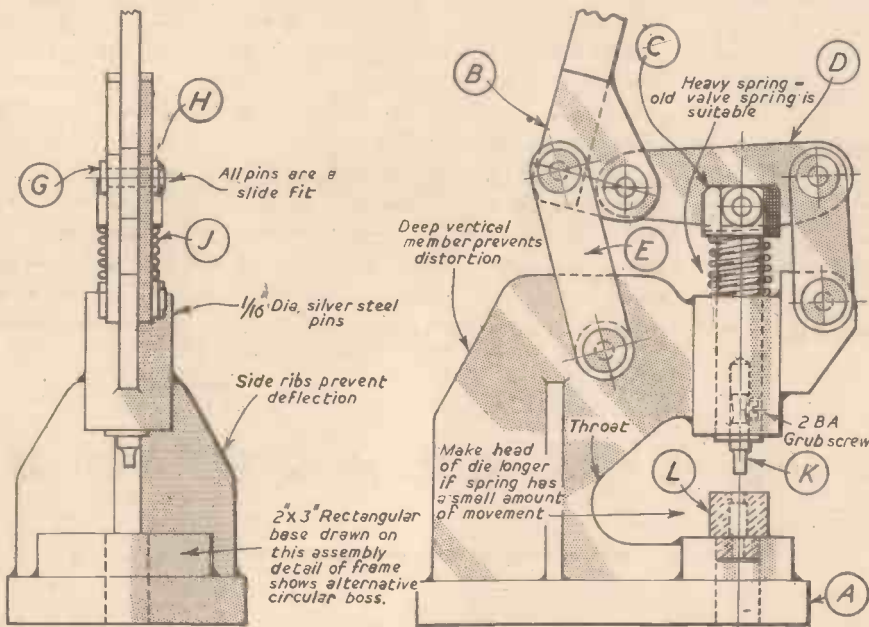
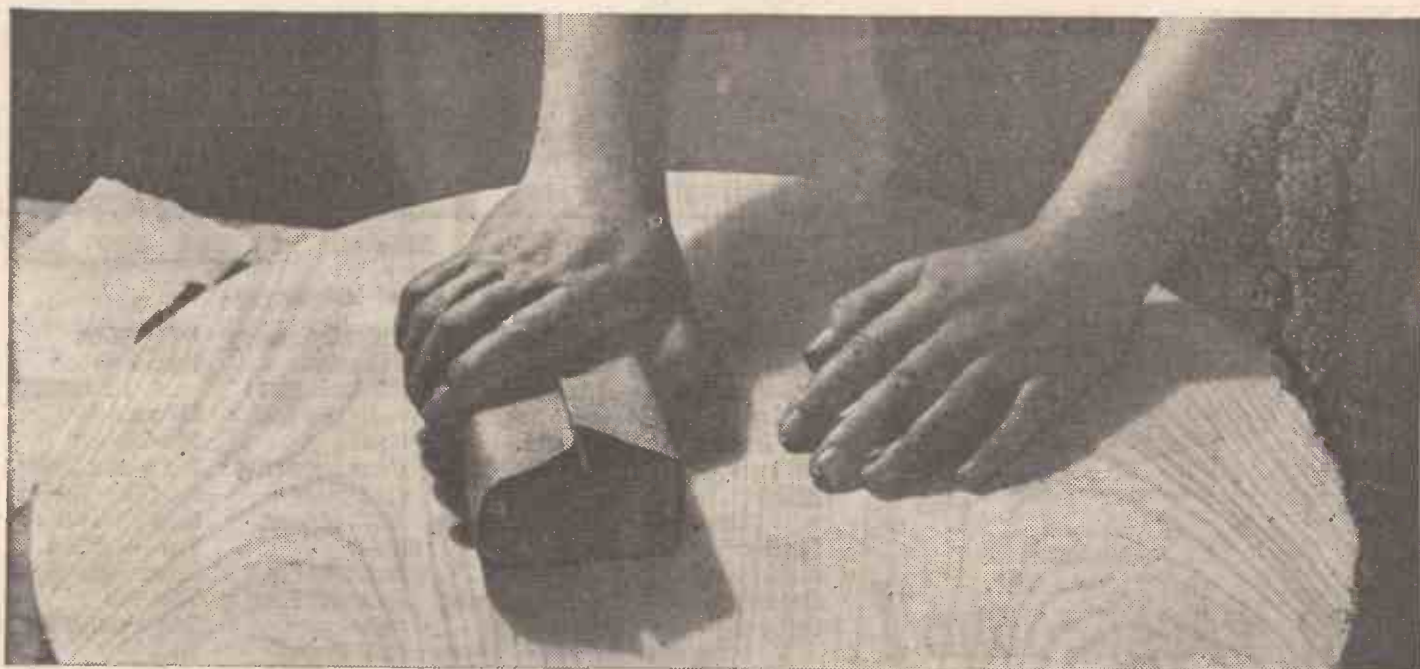


Fig. 1.—The assembly drawing of the press with a die in position; readers should note the rather massive base necessary to reduce distortion to a minimum, and the ribbed framework which will resist deflection.

(Continued on page 37)

# Craftsmanship deserves a triumphant finish



## abrasive papers and cloths by CARBORUNDUM

**GARNET COATED PRODUCTS** For woodworkers, CARBORUNDUM make papers and cloths coated with grains of specially prepared garnet. Careful factory preparation and size-grading of the tough, hard-wearing garnet grains produces abrasives that do better work than glasspaper can, and go on doing it longer. Garnet-coated papers by CARBORUNDUM are excellent for woodworking. They are available in a wide range of grit sizes from coarse (for really fast, easy removal of material) to very fine (for producing super smooth finishes).

**ALUMINIUM OXIDE AND SILICON-CARBIDE GRAINS** Papers and cloths coated with ALOXITE\* (aluminium oxide) or silicon carbide grains are made in grades and grit sizes suitable for woodwork, for all classes of metal finishing, and for rubbing down paintwork on metal or wood.

**WATERPROOF PAPERS FOR USE ON CLOGGING MATERIALS** For sanding or rubbing down materials of a clogging nature, CARBORUNDUM make special waterproof papers with silicon carbide grains. These papers can be rinsed in water during

*\*Regd. Trade Mark*

use, whenever the abrasive becomes clogged with material removed from the work. They are specially suitable for rubbing down paintwork, whether in house decorating, or on car bodies, or other metal or wooden surfaces.

**ELECTRO-PLATING PROCESS** Compared with grains of crushed glass or of natural emery, grains of silicon carbide or of ALOXITE are more regular in shape, and are tougher, more enduring. In the manufacture of all their finer-grained waterproof papers, CARBORUNDUM use an electro-static coating process for depositing the grains. An electro-static field arranges the grains so that they stand on end in the adhesive that binds them to the paper. These electro-coated papers make work easier and quicker because the cutting edges of the grains are more effectively presented to the work. This is a typical example of the care that CARBORUNDUM take to manufacture the best coated papers and cloths you can buy.

Coated abrasive products by **CARBORUNDUM**



*From your local tool shop or hardware store*



**— FROM E.M.I. INSTITUTES  
BROCHURE ON THE LATEST  
METHODS OF HOME TRAINING**

**CAREERS — HOBBIES — NEW INTERESTS**  
**PRIVATE AND INDIVIDUAL TUITION IN YOUR OWN HOME**

Over 150 Courses including :—

- |                  |                     |                     |                     |
|------------------|---------------------|---------------------|---------------------|
| Accountancy      | Draughtsmanship     | Marine Engineering  | Refrigeration       |
| Advertising      | Economics           | Mathematics         | Retail Shop         |
| Automobile Eng.  | Electrical          | M.C.A. Licences     | Management          |
| Banking          | Engineering         | Mechanical Eng.     | Salesmanship        |
| Book-keeping     | Electrical          | Metallurgy          | Secretaryship       |
| Building         | Installations       | Motor Engineering   | Shorthand & Typing  |
| Business         | Electronics         | Photography         | Short Story Writing |
| Management       | Engineering Drawing | P.M.G. Licences     | Short Wave Radio    |
| Carpentry        | Heating &           | Police              | Sound Recording     |
| Chemistry        | Ventilation         | Production Eng.     | Telecommunications  |
| Civil Service    | Engineering         | Production Planning | Television          |
| Commercial       | High Speed Oil      | Radar               | Time & Motion Study |
| Subjects         | Engines             | Radio Amateurs      | Tracing             |
| Commercial Art & | Industrial Admin.   | Certificate         | Welding             |
| Drawing          | Jig & Tool Design   | Radio & Television  | Workshop Practice   |
| Customs &        | Journalism          | Servicing           | Works Management    |
| Excise Officer   | Languages           | Radio Engineering   | and many others.    |

Also courses for University Degrees, General Certificate of Education, B.Sc.Eng., A.M.I.Mech.E., L.I.O.B., A.C.C.A., A.C.I.S., A.M.Brit.I.R.E., A.M.I.I.A., A.F.R.Ae.S., A.M.I.M.I., A.C.W.A., A.M.I.E.D., City & Guilds Examinations, R.S.A. Certificates, R.T.E.B. Serv. Cert., etc.

**OUR BACKGROUND!**



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

**The only Home Study College operated by a world-wide manufacturing organisation**

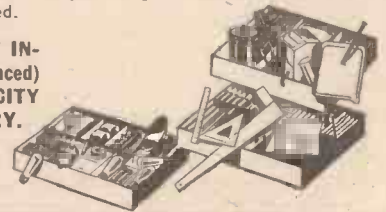
**EMI INSTITUTES**

An Educational Establishment associated with the E.M.I. group of Companies including 'HIS MASTER'S VOICE', MARCONIPHONE, etc.

**NEW! LEARN THE PRACTICAL WAY HOME COURSES — WITH EQUIPMENT**

Whether you are a student for an examination, starting a new hobby, intent upon a career in industry or running your own business — these Practical Courses are intended for YOU. With these outfits, which you receive upon enrolment, you are given instructions that teach you the basic principles in the subject concerned.

**COURSES WITH PRACTICAL EQUIPMENT INCLUDE: RADIO (Elementary and Advanced) TELEVISION · MECHANICS · ELECTRICITY CHEMISTRY · PHOTOGRAPHY · CARPENTRY.**  
Also Draughtsmanship · Commercial Art Amateur S.W. Radio Languages.



**Courses from 15/- per month**

**POST THIS COUPON TODAY**

Please send without obligation your FREE brochure.  
E.M.I. INSTITUTES, Dept. 144, 43 Grove Park Road, London, W.4.

NAME..... [BLOCK CAPS PLEASE]

ADDRESS.....

SUBJECT(S) OF INTEREST.....  
OCTOBER (We shall not worry you with personal visits) L.C.75

long bearing has been provided and this should give many months of usage before it becomes necessary to bush the frame and touch up the shaft. Again, there is no point in performing this work at this stage and the reader can defer making the bush until the job becomes really essential.

**Other Operations**

Practically every process where a localised pressure is needed is feasible.

Making small vees is another example where this press is useful, and though generally the right-angled variety is associated with this type of bending obtuse or acute angles are just as easily made if the correct tools are provided. The reader could apply the press for a part and then gently push the two leaves together, making a double thickness of material.

The removal of rivets from brake shoes is

perhaps the job most associated with a small press, and the construction of this simple machine will soon repay for itself on this work alone. Numerous small sheet metal brackets are possible with only the simplest of tools, and because the general repair garage is frequently called upon to attach various gadgets for customers the larger style of machine is extremely useful for this class of work. Again, it proves itself an asset and eliminates much handwork in the nature of filing and drilling.

**In General**

Details of the fabricated assembly and drawings showing the dimensions for the remaining parts will appear in the next issue, and these should enable any garage to construct this machine. Care in machining is, however, urged because this is eventually reflected in the

work produced on the machine. For instance, a worktable perfectly square with the ram and die holes is of first-rate importance and this does much to reduce the risk of fractured punches. Users should remember that only a slight amount of misalignment will cause them to break, and when dies are also applied this usually means the edges of these parts are chipped and require regrinding before they are again of any use.

In order to prevent any distortion developing in the frame after machining, a good flat surface is necessary on which to stand the finished product, especially as there is also the risk that the holding-down bolts can cause the base to warp as pressure is applied. A surface plate is the ideal situation for the press, or alternatively a substantial wood bench some 3in. thick if the timber is not distorted.

*(To be continued)*

# An Auto-Switch for Model Control

## Transmitters

A Handy Unit for the R/C Enthusiast

By "SPARKS"



Fig. 1—The completed apparatus.

rotating at 1 r.p.m. (e.g., that of the second hand) is possible.

The cam needs to be of small diameter or friction may stop the clock. A 1/4 in. diameter piece of ebonite rod about 1/2 in. long, filed flat one side, and drilled for the spindle, is satisfactory. If the hole

is of such a size that the cam is a tight push fit no fixing is necessary. Unless the second hand is to be removed and the cam fitted in its place it will be necessary to loosen the one clock plate so that the spindle can be removed for the cam to be fitted. The parts are then replaced exactly as before.

The clock mechanism actually used was obtained from ex-Service stock, and many of these will be seen advertised. Though they only run for some hours they are very suitable for this purpose. One such mechanism widely advertised has no 1 r.p.m. spindle but one rotating once in 75 seconds, and this is equally suitable. A clock already to hand could also be used if not too small.

**Wiring and Indicator**

When initially tuning-in it is helpful to know when the transmitter is radiating to avoid confusion, and a bulb is wired in parallel with the transmitter L.T. circuit for this

purpose. This is desirable, for otherwise the reduction in anode current often encountered near minimum settings of the receiver tuning condenser due to increased quenching may be mistaken for the carrier.

Fig. 3 shows the circuit. Though the H.T. circuit is keyed the L.T. circuit is interrupted here to allow the bulb to be used without

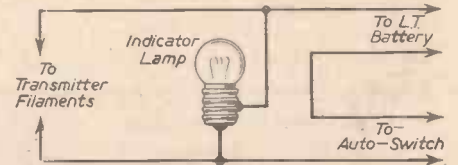


Fig. 3—Electrical circuit.

EXCEPT for a first test to see that the equipment is working, adjustment of a model control receiver requires to be done at some distance from the transmitter. Only when this is so can both transmitter and receiver have their full aerials connected, thus allowing the equipment to be adjusted under actual working conditions, and enabling maximum reliable range to be discovered. When such adjustments are being made to the receiver it is very troublesome to have to return frequently to the transmitter, to switch it on and off, if no second person is available to do this. To overcome this difficulty a simple type of clockwork switch will be found very useful, and this is the arrangement which is described here and shown in the photograph (Fig. 1).

With the auto-switch in circuit the transmitter radiates for roughly 30 seconds and is off for the remaining 30 seconds of each minute. When the signal is present the receiver can be adjusted for maximum dip in current, and tuned correctly. When radiation ceases quench adjustment for maximum anode current can be made and the relay also set appropriately. As the cycle is repeated the receiver can be carried to a greater distance and renewed adjustments made until no further improvement is possible. Finally, the receiver relay will be opening and closing regularly at 30-second intervals in accordance with the transmitter at maximum range.

The mechanism shown in Fig. 2 consists of two thin strips of brass about 2in. long and 1/4 in. wide, bolted to an insulating block. This block is fixed to a convenient point on the clock frame so that operation from a spindle

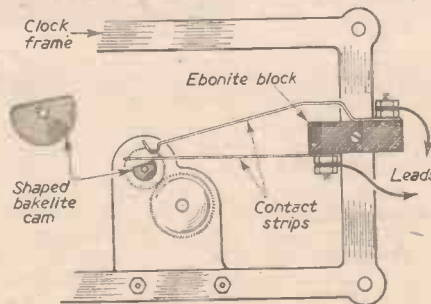
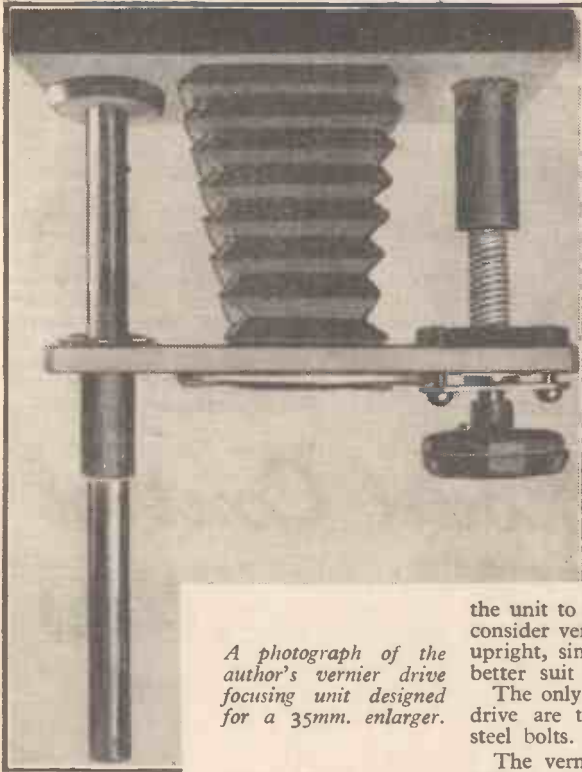


Fig. 2—Fitting contact mechanism.

complication. With a 2 volt accumulator supply a 2 volt or 3.5 volt bulb is satisfactory, the latter also suiting a 3 volt dry battery L.T. supply. The bulb should be clearly visible, but it is no longer necessary to observe it once the receiver has been tuned, as the regular rise and fall of the anode current meter will then show when the transmitter is radiating and when it is not.

In practice maximum range will be obtained with the relay set so that it is just held down when the transmitter is not radiating. This can be done during any appropriate half-minute. Tuning is then adjusted, together with aerial damping and quenching, to obtain maximum drop in anode current during those periods when the transmitter is radiating. When distance between transmitter and receiver has been so increased that reliable relay operation grows impossible, then the maximum range of the equipment has been exceeded and the model must be kept inside this limit unless control of it is to be lost.

**WATCHES:**  
**ADJUSTMENT AND REPAIR**  
 By **F. J. CAMM**  
 6th. Edition  
 6/-, By Post 6/6  
 From George Newnes, Ltd., Tower House,  
 Southampton Street, Strand, W.C.2



A photograph of the author's vernier drive focusing unit designed for a 35mm. enlarger.

**T**HE unit described below costs a little under ten shillings. It can be built by any handyman using the most elementary tools, and the performance of the finished job compares well with the average commercial model.

This description is strictly that of a unit designed for 24 x 36mm. negatives, using a 2in. Wray Supar lens. At the same time it will be obvious that this construction style can be used to build a unit capable of dealing with much larger negatives.

Before commencing work the prudent constructor will assemble all his components. This is particularly essential in respect of the bellows, since the size of these determines the entire lay-out of the job.

### The Vernier Drive

This piece of W.D. surplus equipment is the motive power of the unit. Originally part of an astro-navigational instrument it is constructed of the best materials, machined to a high degree of precision. The drive mechanism consists of a male threaded stem, machined from bright brass, terminating in a black rubber-covered handwheel at one end, with approximately 2in. of  $\frac{3}{8}$ in. diameter thread at the other. A captive steel screw plate, with two steel bolts, is fitted above the handwheel. A fine steel shim is also provided. Above this is a removable retaining block. The retaining block is already drilled to accept the male stem and the two captive bolts, see Fig. 1.

The retaining block must be sawn in half, since in its original use the vernier drive controlled a sheet of much thinner material than the  $\frac{3}{16}$ in. plywood used for the lens panel. The bolts fitted do not protrude through the block if this is not done, and it would be difficult to remove the bolts and replace them with longer ones. Furthermore, if the block was left at its original thickness the range of travel of the lens would be seriously reduced. The cutting is a simple matter with a hack saw, and both portions of the block should be retained.

The female element of the drive is a sleeve, internally threaded to accept the stem. At the top of the sleeve is a flange, which is

turned over to provide a right angle bracket drilled on the upright portion to take two screws. In the model described the upright portion was sawn off to leave a flat flange. This flange was drilled to take two wood screws. A constructor who wishes to vary the unit to suit his own negative size should consider very carefully before sawing off this upright, since the right angle bracket might better suit his particular requirements.

The only additions required to the vernier drive are two 4BA nuts to suit the captive steel bolts.

The vernier drive complete costs 3s. 6d., and is available from Messrs. Millican, Brownlow Hill, Liverpool, who advertise in this journal.

### The Bellows

It is hardly practicable for most workers to make a suitable bellows. Standard bellows are advertised in the classified advertisements page of PRACTICAL MECHANICS. Another fruitful source of supply is a camera repairer. My own bellows cost half-a-crown and measure approximately 1 $\frac{1}{2}$ in. by 3in., tapering to 1 $\frac{1}{4}$ in.

# A VERNIER DRIVE FOCUSING UNIT

An Efficient, Simple and Inexpensive Component for Enlargers and Projectors

By J. C. LOWDEN

### Bellows Frames

These are really optional, and serve only to reinforce the ends of the bellows. Two pieces of the thinnest sheet aluminium are cut to suit the last fold of each end of the bellows. The larger sheet is pierced with a rectangular aperture slightly larger than negative size. In the case of the 35 mm. model the aperture measured 1 $\frac{1}{4}$ in. by 1 $\frac{3}{4}$ in. A sharply pointed knife was used to cut out this aperture. The smaller frame was drilled with a 1in. diameter hole (to suit 2in. Wray lens cell). Both frames were then drilled at the corners to suit fine wood screws and carefully coated with "Joy" camera-black paint, see Fig. 1.

### Guide Rod and Sleeve

This item was made from domestic curtain rod (tubing) as sold in most hardware stores. The guide rod is a 6in. length of  $\frac{3}{8}$ in. diameter tube. At one end of the tube is soldered a brass washer,  $\frac{3}{4}$ in. outside diameter, with a  $\frac{3}{8}$ in. hole. The brass coating makes the soldering a simple job, and it is not difficult to set the washer at right angles to the tube (see Fig. 2).

The spare portion of the retaining block from the vernier drive now comes in very useful. The central hole will accept the  $\frac{3}{8}$ in.

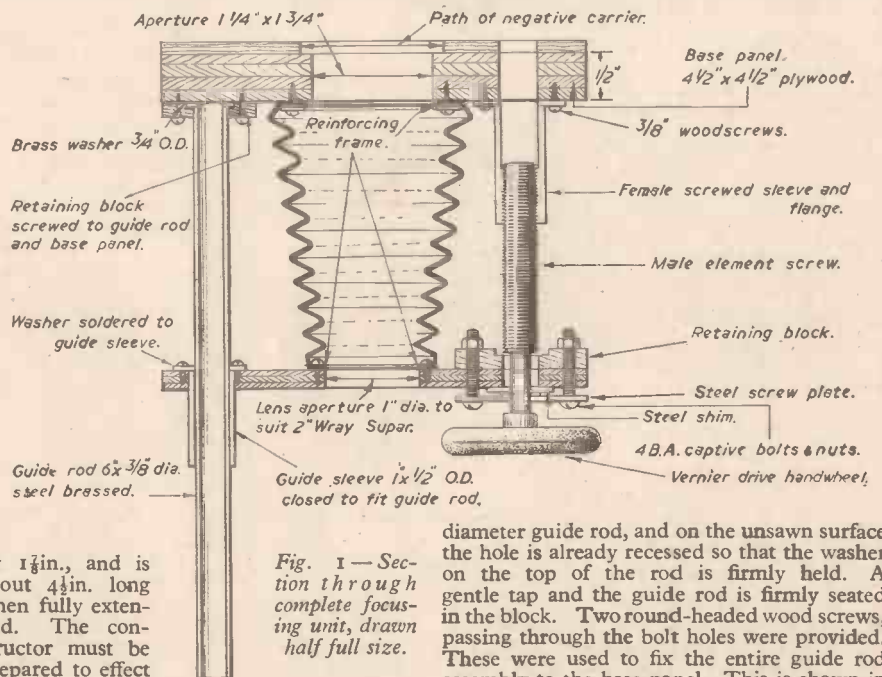


Fig. 1—Section through complete focusing unit, drawn half full size.

by 1 $\frac{1}{2}$ in., and is about 4 $\frac{1}{2}$ in. long when fully extended. The constructor must be prepared to effect minor repairs to a bellows obtained from such a source, but the absolute degree of light-proofing and close folding required in a camera is not usually called for in an enlarger. In most cases a little tidying up of the ends, and a coat of bellows dope will produce an adequate result.

diameter guide rod, and on the unsawn surface the hole is already recessed so that the washer on the top of the rod is firmly held. A gentle tap and the guide rod is firmly seated in the block. Two round-headed wood screws, passing through the bolt holes were provided. These were used to fix the entire guide rod assembly to the base panel. This is shown in Fig. 1.

The guide sleeve was made from a 1in. length of the "next size" curtain rod. It was quite a loose fit on the rod when purchased, but was easily reduced. A stout bladed hack-saw was used to cut along its length. The cut

(Continued on page 41)



REPLACE STRIPPED THREADS IN MINUTES WITH THIS ...



# HELI-COIL Handyman SCREW THREAD REPAIR KIT

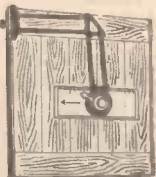
Simply drill out the old thread, tap with the Heli-Coil Tap supplied and insert the precision-made, stainless steel, HELI-COIL... it's as easy as that, literally done in minutes and with no skill required. You then have a new armourclad thread which is far stronger than the old, and will not strip, wear or corrode and will outlast the rest of the component. The Kit contains all the special tools needed and a generous supply of new threads.

Available in the following sizes:  
 $\frac{1}{2}$  in.,  $\frac{5}{16}$  in.,  $\frac{3}{8}$  in.,  $\frac{7}{16}$  in. and  $\frac{1}{2}$  in. in B.S.F. and B.S.W. threads (other threads available in other Kits).  
 Price: 29/- to 40/- per Kit according to size and thread.

**"YOU NEVER KNOW WHEN A THREAD WILL GO"  
 BE PREPARED WITH A HELI-COIL "Handyman"**

Ask at your Tool Dealers or, if in difficulty, write to

ARMSTRONG PATENTS CO. LIMITED, EASTGATE, BEVERLEY, E. YORKS.



**NAVIGATORS' CHART BOARDS**, an ideal draughtsman's board, selected 7-piece polished wood, 17 in. x 17 in. x  $\frac{1}{2}$  in., fitted brass parallel motion drawing arm hinged to board edge slide, with lock screw, free arm end fitted protractor marked in degrees, also ruled perspex straight edge 10 in. x 3 in. x  $\frac{1}{8}$  in., each with locking device, board back has rubber or felt lined feet, with pencil holder, value today 70/-, our price new and boxed, 25/-, post 2/6.  
**ACHROMATS** by Boss or Taylor/Hobson, new and perfect. 5 types, all 40-mm. dia., f/1.7, f/2, f/2.3, f/2.7, f/3, focal lengths are approx. 2 1/2 in., 3 in., 3 1/2 in., 4 in. and 4 1/2 in. respectively. unmounted 10/- post 6d., ditto in brass mounts 12/6, post 1/-.

**HUGHES 12-VOLT SHUNT MOTORS**, taking 1.25-amps. light, and up to 2-amps on load, 5,000 r.p.m., external terminations for reversing, oil impregnated bearings,  $\frac{1}{2}$  in. shaft, size 3 in., long, 1 1/2 in. dia., weight 20 oz., a superior and powerful motor, original cost over £7, our price new unused, 10/-, post 1/3; 2 for 20/-, post paid; ditto, fitted reduction gears, giving a final drive of either 160 or 320 r.p.m., state which required, 12/6, post 1/6; 2 for 25/-, post paid. **K TYPE CYLINDER LOCKS**, deadlocking and thiefproof, has 7 concentric tumblers instead of the usual 5 in line, interchangeable with ordinary cylinder locks, for right- or left-hand doors, no need to specify, complete with 2 keys and all fittings, instruction booklet, list price 18/9, our price new boxed, 6/-, post 1/6; 2 for 10/-, post paid. **CHARGING AMMETERS**, 0-11 amps. D.C. flush panel mounting, requires 1 1/2 in. dia. aperture, brand new, 5/6, post 7d. **GEAR UNITS**, contain 15 various light and heavy gears, some in aluminium diecast case, the others in clock type frame. exceptional value, unused, 5/-, post 1/6. **INFRA-RED RECEIVERS TYPE SC3157**. A hand-held instrument for direct viewing of otherwise invisible sources of infra-red, consists of the focusing optical system, infra-red filter, image inverter cell, eyepiece magnifier, with length of screened H.T. cable, requires 2 kV. to 4 kV. taking infinitesimal current to operate, size 6 in. long, 2 1/2 in. dia., weight approx. 1 lb. new, unused, fraction of original cost, 15/-, post 1/6. **HAND GENERATORS**, fitted enclosed gearbox, also auxiliary open gearbox, detachable folding handle, generates 28 v. 175 amp. L.T. and 300 v. 90 amp. H.T., complete with data to convert to an efficient 200/250 v. A.C./D.C. motor, with final drives of approx. 60, 12 and 18 r.p.m., new, unused, an exceptional bargain, 17/6, post and packing 2/6. **G.E.C. RECTIFIERS**, selenium full-wave bridge, output 12 v. 14 amp. brand new stock, 10/-, post 9d., ditto 12 v. 4 amp. 15/-, post 1/-, mains transformers to suit both these rectifiers, 200/250 v. input, at 15/-, post 1/6 and 20/-, post 2/-, respectively. **HIGH-LOW IMMERSION HEATERS**, 230/250 v. 2,000 watts, removable link for 3-heat control, plated copper stem 18 in. long from fixing screw, removable brass top termination cover with insulated cable bush, new, unused and guaranteed, 35/-, post paid. **JOHN OSTER (U.S.A.) MOTORS**, 12 v. 1.4 amp. D.C. shunt, speed 5,600 r.p.m., fitted enclosed reduction gearbox, with 2 outlet shafts in-line with motor,  $\frac{1}{2}$  in. dia. 1 1/2 in. long, 1 1/2 in. between centres, providing very powerful drives of 6 and 24 r.p.m., also another shaft at right angles to motor, which has a fine adjustment  $\frac{1}{2}$  in. linear reciprocating movement at 24 times a minute, size overall 7 1/2 in. long, 3 1/2 in. wide, 3 in. high, easily the finest of ex-Govt. motors, well worth £12, our price, as brand new, 30/-, post 1/6; 2 for 60/-, post paid. **MAINS BLOWERS**, 200/250 v. A.C./D.C.,  $\frac{1}{2}$  amp. 5,000 r.p.m., consists of the motor with attached enclosed fan, end funnel intake 1 1/2 in. dia., side outlet 1 1/2 in. x 1/2 in., plinth base 4 1/2 in. x 5 in. finish black crackle and aluminium die-cast, size overall 9 in. long, 5 in. high, 4 1/2 in. wide, weight 7 1/2 lbs., a very superior blower, fraction of original cost, 25/-, post 3/-.

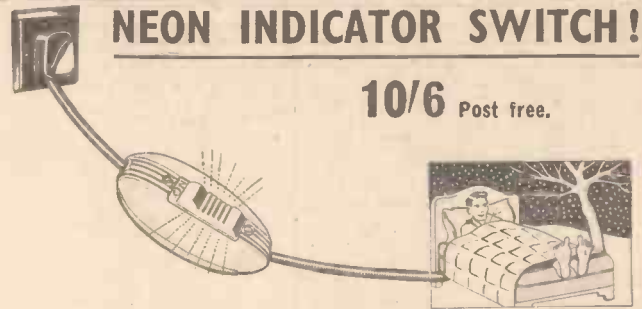


**CARLISLE FUSE BOXES**, 6-way double pole, consists of a black japanned metal case with front hinged lid size 9 1/2 in. x 7 in. x 4 1/2 in., contains 12 Sloydok fuses, 15 amp. 250 v., value 60/-, our price brand new, 15/-, post 3/-. **SHADED POLE MOTORS**, U.S. manufacture, 12 v. A.C., speed 1,500 r.p.m., fitted  $\frac{1}{2}$  in. dia. shaft, size 3 in. x 2 1/2 in., new unused, 7/6, post 1/4. Send s.a.e. for current bargain lists. Tel: HAR. 1308

MIDLAND INSTRUMENT CO., Moorpool Circle, B'ham, 17

# NEON INDICATOR SWITCH!

10/6 Post free.



FIT THIS TO YOUR ELECTRIC BLANKET AND BRING IT UP TO DATE.

Double Pole Break, A.C.-D.C. Silver Contacts, Improved Cord Grip, Simple Wiring. Modern Streamline Styling in Cream Bakelite.

SUITABLE ALSO FOR ANY OTHER APPLIANCE WHICH REQUIRES A VISUAL INDICATION THAT IT IS ON (SOLDERING IRONS, ETC.)

**\* SEND 4d. IN STAMPS NOW FOR OUR ELECTRICAL CATALOGUE \***

DESCRIBES FULLY OUR RANGE OF ELECTRICAL SUNDRIES—WITH IDEAS FOR THE HOME HANDYMAN—OVER 300 ITEMS—

## THE 'MAGSTAT'



This is a precision bi-metal thermostat for the control of alternating currents of up to  $\frac{1}{2}$  amp. at 240 volts. The temperature range lies between minus 50 deg. F. and plus 250 deg. F. An ingenious magnetic snap action is incorporated which gives freedom from radio interference. The operating temperature is altered by rotation of the adjustment screw, clockwise for increase and anti-clockwise for decrease. Dimensions 2 in. x  $\frac{1}{2}$  in. x  $\frac{3}{8}$  in.

PRICE: 5/6 each. Post 3d.

## \* SUPPRESSIT \*

(TELEVISION SUPPRESSOR KIT) For the suppression of Domestic Motor Driven Appliances. Comprises two chokes and two condensers mounted on a card with wiring instructions. Ideal for Vacuum Cleaners, Hairdriers, Sewing Motors, etc., up to 1 amp. Price 3/6. Post Free.

## REPLACEMENT ELEMENTS

FOR DOMESTIC ELECTRICAL APPLIANCES We stock over 200 types of element replacements for Fires, Irons, Kettles, Hairdriers, Toasters and Boiling Rings. Send for Catalogue.

WE HAVE A REPUTATION FOR HIGH QUALITY THERMOSTATS AND LIST SOME OF OUR STOCK ITEMS HERE:

**THERMOSTAT. CS.** Convector Thermostat for Space Heaters and Low temperature Ovens. 15 amps., 250 volts A.C. 40/80 deg. F. 25/-, post 5d.

**THERMOSTAT. MB.** For control of Electric Immersion Heaters up to 3 kW. 90/190 deg. F., 15 amps., 250 volts A.C. £2/0/0, post 9d.

**THERMOSTATS. PF.** Room Thermostat, 15 amps., 250 volts A.C. 5 in. x 1 1/2 in. x 2 in. A beautiful instrument. Temp. ranges 30/90, 40/100, 40/80, 60/100 deg. F. as required. £2/0/0, post 6d.

### GREENHOUSE THERMOSTAT

Type ML. Constructed especially for the amateur gardener. The scale plate is calibrated "High-Medium-Low" and has a temperature range of 40-90 deg. F. Current capacity is 10 amp., 250 volts A.C. Differential 4-6 deg. F. Size 4 1/2 in. x 2 in. x 1 1/2 in.

PRICE: 35/- Post 6d.

**THERMOSTAT. BW/1.** 3 amps., 250 volts A.C. For control of hot-plates, vulcanisers, etc. 50-550 deg. F. 15/6, post 4d. We are only too glad to send illustrated leaflets on any of these Thermostats if you will send a S.A.E. stating which model interests you.

### IMMERSION HEATERS

We can offer a wide range from 2 to 4 kW, and in stem lengths 1 in. to 42 in. Please send for our catalogue.

Model PJ. Miniature Thermostat for control of domestic Electric Irons and special-purpose machines where space is limited. Capacity: 5 amps., 250 volts A.C.  $\frac{3}{8}$  in. x  $\frac{3}{8}$  in. x 1 1/16 in. Single screw fixing. Price 9/3. Post 3d.

**THE TECHNICAL SERVICES CO.**  
 SHRUBLAND WORKS · BANSTEAD · SURREY

# INTERESTING BARGAINS SATISFACTION OR REFUND

**ASTRO COMPASS MK II**  
Supplied in good condition in sturdy box with instructions for use in Astro Navigation and star identification—also instructions for conversion to Dumpy Level. 25/- post free.



**RUDE STAR FINDER & IDENTIFIER**  
Ex. R.A.F. Navigators' equipment. Consists of star base and 7 templates covering lats. 0-70 N. and S. Makes star finding and identification relatively easy. With maker's instructions in leatherette wallet. 5/- p. & p. 9d.

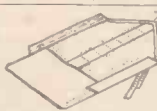
**PRESSURE GAUGES**  
Boost -6 +24 p.s.i.  
Air... 0-80 p.s.i.  
Air... 0-1,000 p.s.i.  
Hydraulic 0-1,000 p.s.i.  
Air... 0-2,000 p.s.i.  
6/- each post free.



**GOVERNOR UNITS**  
Precision made mechanism, designed for Aircraft, with many other mechanical adaptations. 4in. overall, brand new, 3/9 post free



**TOOL ROLLS**  
Approx. 15in. x 8in. with 6 divs. and pocket. Stock-rolled clearance price 3 for 2/6 or 8/- doz., post free.



**NEW NYLON PARACHUTE CORD**  
Approx. 3/4" diam., the thicker cord used for the giant cluster parachutes, very strong and durable supplied in any continuous length up to 230 yds.; 6d. per yd., p. & p. 8d. any order.

**WEBBING**  
Brand new, double thickness parachute webbing 1 1/2" wide, 13ft. long, hook one end, loop the other, 7/6. p. & p. 1/3.

**TRIPODS**  
Light (5lb.) wood tripods 38" legs, brass top, which can be adapted to take any instrument or camera or can be easily converted into a useful ARTIST'S EASEL, ex. govt. and complete with handy carrying sling, 15/- p. & p. 2/6.

## Polythene

Tough transparent TUBULAR film. Sold by the yard in these widths and any length you wish. 2" 4d., 4" 6d., 6" 9d., 12" 1/-, 18" 1/6, 24" 2/-, 36" 3/-, 48" 4/-. Prices per yd., please add 6d. p. & p. to total of order.  
Tubular film opens up to double stated width, thus 48" tubular makes 96" sheet.

Effectively sealed into bags by the heat of a match. There are innumerable applications in industry and home for protection against dust and damp with POLYTHENE of which Moist-proof Bags are something we all need. SAMPLE FREE. S.A.E. please.

**EYESHIELDS**  
An extremely useful form of eye protection for industry or motor cycling. Brand new anti-gas type, clear, 3/6 per doz., 36/- gross, post free.



**TERRY CLIPS**  
Sizes 1/4in., 1/2in., 3/4in., 1in. Handy assortment of five dozen/retail value 20/-, 7/6 p. & p. 1/3.

**WOVEN GLASS FABRIC**  
TYGLAS Y1 and Y5 sold by the yard at half usual prices. Full details and samples SAE please.

### STAINLESS STEEL CONTAINERS

Ex M.O.S., 20 Gauge 18/8, stainless steel. Complete with outer lid as illus. plus inner anti-splash lid, both lids locked secure by depressing handle. Size 16in. x 11in. x 11in. Cap. 6 gal., 5/7/6, carr. paid.



**ELASTIC SHOCK CORD**  
Cotton covered, 3/4" diam., 1/- per yd.; 1" diam., 1/8 per yd. Postage 6d. per order.

**GROUNDSHEETS**  
Familiar ex-service cape type, all in good condition, 7/8 each, p. & p. 1/6, or 3 for 2/1/- post free.

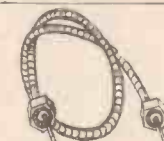
**DIAL THERMOMETERS**  
100/300 degrees Fahrenheit. Brand new, clearly marked 4" dial, sensitive metal clad element projects 8" from back, suitable for dipping into liquids, or affixing to ovens and tanks. Exceptional value 35/- p. & p. 2/6.



**REV. COUNTERS**  
Brand new, calibrated 1000/5000 r.p.m. 3" dial operates 4 : 1 ratio, 20/- post free. Makers' price about £7.10.0. Flexible drives to fit, patterns A, B, C, D, E, J as advertised below.



**NYLON BRAID**  
3/4" wide, soft, easy to handle, and ideal where lightness plus strength is required. 32 yds. breaking strain 1,900 lbs., 32/- post free. 64 yds. breaking strain 1,360 lbs., 50/- post free.



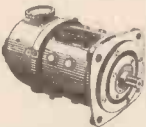
**FLEXIBLE DRIVES**

Patt.	Length	Cable	Outer	Price
A	9"	.25"	.43"	2/6
B	15"	.25"	.43"	7/6
C	30"	.25"	.43"	12/6
D	60"	.25"	.43"	15/-
E	72"	.25"	.43"	20/-
F	92"	.23"	.45"	22/6
G	240"	.14"	.33"	30/-
H	36"	.50"	.94"	45/-
J	36"	.43"	.83"	13/-

Pattern K, a 16ft. drive intended for really heavy duty, full details not available at time of going to press will be supplied to interested inquiries.  
Patt. H is heavy duty drive with base plate and bearings.  
P. & P. 1/8 per drive extra; 3 or more post free. Post free with rev. counter.

**MOTOR CYCLE COVERS**  
**GIANT BOMBER WHEEL COVERS**, will give complete protection, tea-cozy fashion, to 250, 350 machines and scooters, etc. Made to the usual high standard of all R.A.F. equipment. Will remain completely waterproof for years. 17/6. p. & p. 2/6.

**GENERATOR/MOTOR**  
12 volts 750 watts. Can be used as generator or motor app. 1 h.p. without modification. Weight 26lb.; body 3" x 5" dia.; splined 1" drive shaft. Many uses, lighting sets, battery chargers and all types of portable power supply. Brand new in well-made wooden case, 75/- carr. 7/6.



**NEW AIRCRAFT FUEL TANKS**  
Length 66"; depth 14"; width 24". Weight 60lb. Capacity 80 gallons. 2 apertures 1 1/2" diam. Brand new bullet-proof self-sealing rubber tanks, made of 3" sponge rubber probably cost over £100 each; a real opportunity for the bargain hunter with ideas, at 25/- each, carriage 10/-.

**NEW ALUMINIUM FUEL TANKS**  
Capacity 46, 60, 114, 383, 580 gallons. Well baffled internally, drawings available. SAE please.

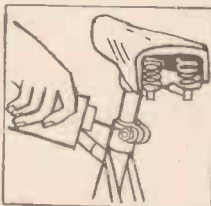
**TRANSPARENT PLASTIC SHEET**  
Clear as glass, flexible, does not crack. Sheet size: 50in. x 26in.  
Thickness .010 ... per sheet 8/6  
Thickness .020 ... per sheet 18/-  
Thickness .030 ... per sheet 21/-  
P. & P. 1/- per order.  
Samples free S.A.E. please.

# RUSTED FITTINGS?



Free them quickly with

# Shell Easing Oil



Here's the way to free those rusted fittings! Free them quickly, too. Shell Easing Oil is sure and swift, penetrates deeply to loosen and free.

From nuts and bolts to taps and pipe joints, from bicycle frames to window catches, Shell Easing Oil is the answer to your rusted parts problem.

Shell Easing Oil comes in a handy 8 oz. tin with special pourer spout to eliminate waste.

SHELL EASING OIL is very handy in the house. Buy some to-day—good ironmongers stock Shell Easing Oil.



# WODEN WOODWORKERS TOOLS

ACCEPTED BY DISCRIMINATING Craftsmen WHO DEMAND THE BEST

**CRAMPS**

Steel Sash cramp No. 104, also steel "T" Bar cramps.

**PLANES**

Rabbit and Fillister No. 78.

Jack Plane W5

and smooth planes, jointer planes and Woodworkers Metal Bench planes.

**VICES**

Woodworkers Vice No. 189

and many other types of Engineers and Fitters vices, Pipe vices and Vice Stands.

**WE INVITE YOU TO WRITE**

Please send 52-page catalogue of Woden Tools.

Name .....

Address .....

County..... P.M.4

# STEEL NUT & JOSEPH HAMPTON LTD WODEN WORKS WEDNESBURY STAFFS.

## MYERS & FOULKES PHONE LEY 1013

DEPT. PM, 187/188 THE ARCHES, GROVE GREEN ROAD, EIL.

tube was then put in the jaws of the vice, the guide rod slid inside, and the jaws closed until a firm sliding fit was achieved. A seam of solder was run over the cut, and the bore of the sleeve was polished up with steel wool.

To secure the guide sleeve, a brass washer, pierced with a  $\frac{3}{8}$  in. diameter hole, was soldered over one end of the guide sleeve. Before soldering, two holes were drilled in the washer, diametrically opposite to each other. These were to allow the guide sleeve to be screwed to the lens panel. The sleeve is shown in Fig. 2.

The exterior of the guide sleeve was then painted with "camera black"—the guide rod, of course, being left bright to avoid sticking.

The cost of the guide rod and sleeve was 8d. The tube sells at 1d. per inch, plus 1d. for the two washers.

**Base and Lens Panels**

These panels, as specified, were made out of stout plywood. A worker who so prefers may use metal or plastic.

After cutting to size, the panels should be set out as in Fig. 3. The base panel is drilled with the hole "A,"  $\frac{3}{8}$  in. clear diameter, on the centre line. This hole is to allow the passage of the threaded stem. The negative aperture "B" is cut dead centre, and measures  $1\frac{1}{4}$  in. by  $1\frac{3}{4}$  in. The dotted centre C shows the location of the upper washer of the guide rod.

The lens panel is next treated. Hole "A.I," which is  $\frac{3}{8}$  in. diameter, was drilled on the centre line  $\frac{1}{2}$  in. from the edge. Two holes  $\frac{3}{16}$  in. diameter were also drilled on each side of this hole. These were to accept the captive bolts of the vernier drive. The hole "D" is the lens aperture, drilled to suit the lens available. In the case of the Wray Supar 2in., this aperture measures  $\frac{1}{2}$  in.

holes provided. One portion of the retaining block is slid down the stem, the bolts passing through the holes in the block. The nuts are then screwed down hard.

**Assembling the Base Panel**

The female element of the vernier drive is now screwed over the centre of the  $\frac{3}{8}$  in. hole "A" on the base panel, and the guide rod

screwed to the base of the lamphouse, leaving a track for the negative carrier. As there are as many different types of negative carriers and lamphouses as there are enlargers, each constructor will wish to make his own arrangements. The completed unit is shown in the heading photograph.

**Performance**

The movement of the unit is sweet, positive and quick, the full range of travel being achieved with fifteen turns of the handwheel. The minimum image size obtained from a 35mm. negative, with the bellows at full extension is just under  $\frac{1}{2}$  in. —  $\frac{1}{2}$  reduction. It is hardly likely that the average worker would ever require such a degree of reduction, but this is in itself a valuable safeguard. Even when working at 1 : 1, such as when printing positive slides by projection, a considerable length of thread is firmly engaged. There is no danger of any unwary extra half-turn bringing the entire lens panel assembly adrift.

At the other end of the scale, sharp focus was obtained on an image measuring 8in. by 12in.—a 64 times multiplication of area. This is very much my own limit of enlargement—a much greater degree would inevitably bring out complications of grain. For those who insist on greater enlargements, however, the maximum size could be increased by passing the female elements of the vernier drive through the base panel, thus bringing the lens a  $\frac{1}{2}$  in. nearer the negative. This gain would, of course, be offset by the increase of the minimum image size.

**Use in Projectors**

The basic design of this unit could be used for a filmstrip and slide projector, provided that the range of travel required for the longer focus lens, usually employed in projectors was carefully worked out before commencing construction.

**PARTS LIST**

- Base Panel  $4\frac{1}{2}$  in.  $\times$   $4\frac{1}{2}$  in.  $\times$   $\frac{1}{2}$  in. plywood.
- Lens Panel  $4\frac{1}{2}$  in.  $\times$   $2\frac{1}{2}$  in.  $\times$   $\frac{3}{16}$  in. plywood.
- 1 Vernier Drive, complete.
- 1 Small Camera Bellows.
- 1 Guide Rod 6in. of  $\frac{3}{8}$  in. (nominal) O.D. Brass Curtain Rod.
- 1 Guide Sleeve 1in. of  $\frac{3}{8}$  in. (nominal) O.D. Brass Curtain Rod.
- 2 Washers, Brass,  $\frac{3}{8}$  in. O.D. with  $\frac{3}{8}$  in. diameter hole.
- Woodscrews, Nuts 4 B.A.

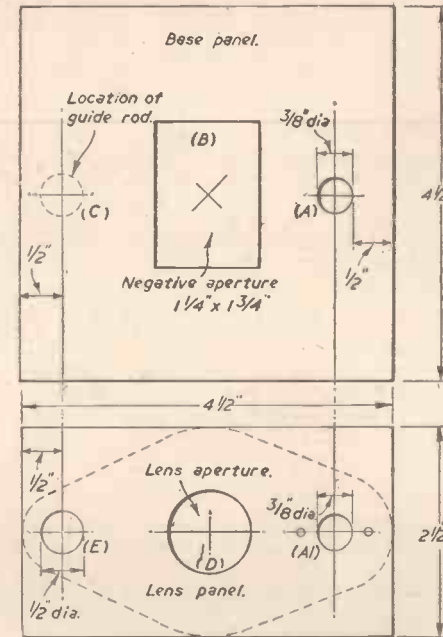


Fig. 3.—The base and the panels.

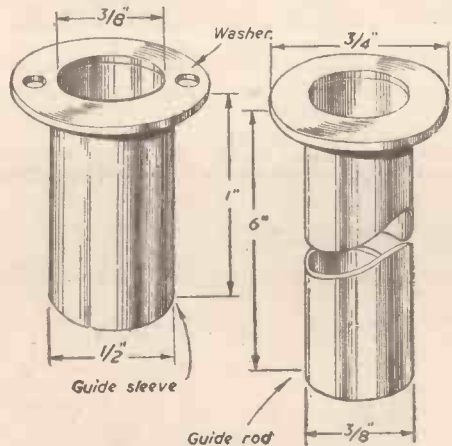


Fig. 2.—Details of the guide rod and sleeve.

diameter. Hole "E" is to accept the guide sleeve. It measures  $\frac{1}{2}$  in. diameter and was drilled on the centre line  $\frac{1}{2}$  in. from the edge.

When setting out the panels, it is important that the centres of the "paired" holes should coincide exactly, and it was found advisable to set out one panel and then clamp the two together. The centres were then drilled through with a fine drill. In the case of holes "A" and "A.I," these were drilled together.

After the cutting and drilling was completed, the surplus wood of the lens panel was trimmed to the dotted outlines. This trimming lightens the panel and gives it a more professional appearance. To finish, both panels were painted "camera black."

**Assembling the Lens Panel**

The guide sleeve is pushed through the  $\frac{1}{2}$  in. diameter hole and the washer screwed to the upper surface of the panel. The vernier drive stem is pushed through the  $\frac{3}{8}$  in. diameter hole and the captive bolts eased through the

set in position over the pencilled circle. The remaining portion of the retaining block is slid over the guide rod and carefully screwed to the base panel.

The two panels are united by passing the guide rod through the sleeve, and marrying up the two elements of the vernier drive. After a preliminary test of movement only minor adjustments were needed.

After testing, the ends of the bellows were liberally coated with "Casco" casein glue. The internal frames were put in position and fine screws driven through bellows, frames, and into the base panel. The lower or lens end of the bellows was similarly secured to the lens panel.

The now completed focusing unit was

**THE PRACTICAL HOUSEHOLDER**

EDITED BY F. J. CAMM

October Issue Now On Sale

Price 1/3

Order Your Copy Now

**Principal Contents**

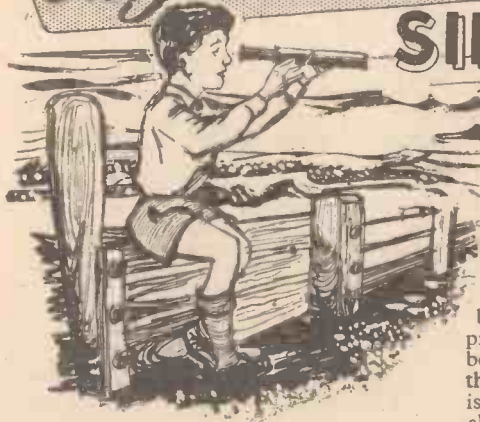
- A Child's Roll Top Desk ; Cutting Glass ; Dampness in Buildings ; Wiping a Joint ;
- Fixing Formica ; A Simply Built Newspaper Rack and Bookcase ; Domestic Heating Boilers ;
- Installing a Bath ; Taking Care of Your Paint Brushes ; Modernising Your Home with
- Hardboard ; Renewing a Stone Sill Throating ; Secret Locks ; Carpentry Joints and
- Their Uses ; A Space Saving Door Conversion ; Your Querles Answered and many
- other interesting articles.



# Our Junior Section

## SIMPLE TELESCOPE CONSTRUCTION

### The Basic Principles Involved



**T**HE chief essentials of a refracting telescope are first a lens or combination of lenses which forms at its focus an image of any object viewed, and, secondly, a lens or system of lenses which will magnify that image. The first is called the object glass and the second constitutes the eyepiece. In practice the object glass is mounted at one end of a long tube and the eyepiece at the other end, provision being made for varying the distance between the two for focusing.

Reference to Fig. 1 shows a cheap and simple way of making a small telescope. M is the main tube, D the draw-tube for focusing, O is the object glass, C the cell carrying the latter and E the eyepiece.

#### The Object Glass

This can be either a double-lens achromatic combination or a single plano convex or double convex lens. "Achromatic" means that the lens does not give any false colour round objects viewed; and the terms "plano convex" and "double convex" indicate a lens flat on one side and convex on the other, and convex on both sides respectively. The double achromatic lens, of course, gives the best results and costs more, but a single lens object glass will answer quite well for a first venture. Any manufacturing optician will supply what is required; or one of the lenses from a pair of long focus circular type spectacles will do. To ascertain the focal length measure the distance from the lens to

#### The O.G. Cell

Any small circular tinplate or cardboard box can form this part of the instrument, provided it is of correct size. The cell should be about 2½ in. long and slightly larger inside than the diameter of the glass. The O.G. is pushed into the cell and held in place by a short length of tubing glued against it on either side as shown in Fig. 2. It is important to have the object glass at right angles to the axis of the tubes because if it is askew, distortion will result.

#### The Draw Tube

This carries the eyepiece and provides for varying the distance between the latter and the objective for focusing. The draw tube should slide easily but firmly in the main tube and should be long enough for plenty of it to remain inside the latter when fully extended for use (see Fig. 1).

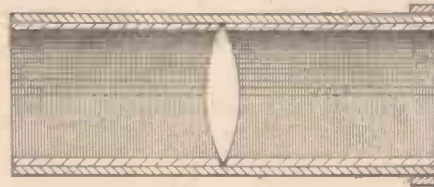


Fig. 2.—Method of mounting the object glass in its cell.

A narrow rim should be attached to the outside end of the tube to prevent it from being accidentally pushed right into the main tube. It is an advantage to have similar rims on the O.G. cell and the eyepiece for the same reason.

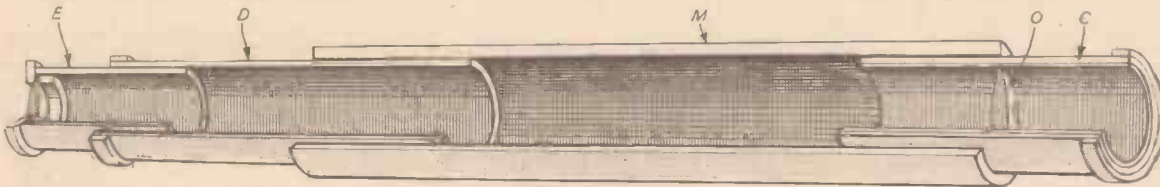


Fig. 1.—The complete telescope.

a sheet of white paper on which it forms the sharpest and smallest image of the sun or other distant object.

#### The Main Tube

Brass, tinplate or cardboard will answer the purpose, so long as the tube is straight and round. A very light and strong tube can be made by rolling paper with glue to the required thickness on a wooden or metal former. A smooth round broom handle will sometimes answer admirably. The tube should be a few inches shorter than the focal length of the objective to allow for varying the distance between it and the eyepiece for focusing, and it should be large enough inside to take the O.G. plus its mounting (see Fig. 1).

#### The Object Glass

The object glass of a telescope refracts or bends the rays of light from any object so that when they have passed through it they converge and cross, forming an inverted image of the object (Fig. 3). Astronomical eyepieces receive these rays after they have crossed at the focus, so that with such eyepieces everything looked at appears upside down. This does not matter in the least for viewing celestial objects (which have no real top or bottom), but it obviously would not do at all when the telescope is used for terrestrial purposes. For this reason a different eyepiece must be used for day use.

Professionally made telescopes have what are called "erecting" eyepieces for terrestrial

purposes. These have additional lenses which put the image right way up again; usually two lenses are used. However, for the sake of simplicity, a single plano convex lens may be mounted in a short tube as shown in Fig. 4 and at E Fig. 1. If the lens is much smaller than the cardboard tube, the inside of the latter must be packed by gluing inside paper strip. The lens is held in position by being sandwiched between two packing rings as



Fig. 3.—How an inverted image is formed.

shown. The convex side is placed outermost.

#### Type of Lens Required

In determining what lens to buy remember that the shorter its focus the higher the power and vice versa. The rule is: focal length of eyepiece divided into focal length of object glass gives the magnifying power. For example, an eyepiece with a focal length of 1 in. divided into O.G. of 18 in. focal length will give a magnification of x18. This is a very suitable power for a small telescope with 1½ in. O.G., especially if the latter is merely a simple spectacle lens. By doubling the focal length of the objective or reducing that of the eyepiece by half, you can double this power; i.e., make it 36 instead of 18. For day or look out purposes we must use an eyepiece which receives the rays from the O.G. before they have crossed at the point of focus, so that the object viewed will not be inverted. This means a plano concave lens must be used instead of the plano convex. A small lens of this type should be chosen

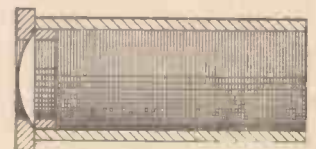
with not too deep a curve, and the concave side should be placed next to the eye. It is mounted in exactly the same way as described for the other one.

#### Concluding

#### Hints

Before putting the various parts together all internal surfaces should be given a coat of dead black to prevent reflection. Optician's

Fig. 4.—How the eye lens is mounted in a short tube.



dead black is best, but failing this, Indian ink or stencil ink will do quite well. The outside of the instrument may be varnished or painted. For viewing objects in the night sky much better results will result if some sort of stand is made.

Telephone: MUSEUM 9594

# H. FRANKS

58-60, NEW OXFORD ST., LONDON, W.C.1

**HOOVER BLOWER MOTORS.** Ref. 10K18/15. 12/24 volts, as recommended for car heater system in recent issue of P.M., price, including instructions for making car heater and adapting for 6 volts, 32/6 each.

**REDUCTION GEAR BOXES,** made by Werle-Korff Gear Co., U.S.A., fitted in die-cast case, 3/16 in. diam., 1/16 in. thick, base plate four hole fixing, input spindle 3/16 in. diam., output 1/2 in. diam., reversible, ratio 286 to 1, max transmission capacity, 1/30th h.p., 20/- each.

**DITTO**—Ratio 108 to 1, input and output spindles 3/16 in. diam., 20/- each. Special quotation for quantity.

**DRAYTON "TYPE R.R. MOTOR UNITS,** 230 volts A.C., 50 cycles, 25 watts, cont. rating final speed 37 r.p.m., unused, £5 each.

**STAINLESS STEEL AERIAL WIRE,** gauge 7/015 in. 1,600ft. reels, ideal for soil heating, electrifying fences, etc. Per reel 37/6.

**ELCO SYNCHRONOUS CLOCK MOVEMENTS,** 200/250 volts A.C., 50 cycs., with spindles for hours, minutes and seconds, in bakelite, dustcover, 3in. diam., 2in. deep with flex lead, 1 hole fixing, up to 1/8 in. panel, 22/6 each.

**ELBOW TELESCOPES,** 8 x 45 mag., built-in gratule. Ideal for day or night use, rifle ranges, etc., unused, 52/6.

**MINIATURE 12/24 D.C. MOTOR-GEAR BOX UNITS,** final speed to 6 to 10 r.p.m., overall size 4 1/2 in. x 3 in., 32/6.

**NEW SOUND-POWERED TELEPHONE HANDSETS,** G.P.O. pattern. Will make efficient 2-way inter-com. no batteries required, 50/- per pair.

**ALTIMETERS,** sensitive type, Kollman, Mk. XIVB. Reads to 45,000ft. by means of 3 pointers, indicating nearest 20ft. millibar scale and adjusting knob. Unused, 41/- each.

**EX-NAVAL RIGHT ANGLE TELESCOPE,** C.R.P. Mk. 1, made by Cooke, Troughton & Sons, Ltd., fitted filters, 10 x magnification, overall length 13 1/2 in., weight approx. 14lb., £4.17.6.

**CLOCKWORK DRIVEN TIMERS** variable, 5 to 30 mins. Fitted 15 amp A.C. contacts. Totally enclosed, crackle finish, 17/6 each.

**VENNER SYNCHRONOUS MOTORS** 200/250 v. A.C. 50 c/s. 3 watts. Final Speed 30 r.p.m. Ideal for Timers, etc. 16/6.

**FRACTIONAL MOTORS,** 1/100th h.p. 200/250 volts A.C./D.C. Length 3 1/2 in. Diam. 2 1/2 in. Double-ended spindle 1/2 in. diam. Unused, 30/-.

**A.C. MAINS DRIVERS,** 200/250 v. 4 1/2 in. per 1/2 in. pull. D.C. resistance 200 ohms. Ditto 3 1/2 in. pull. D.C. resistance 300 ohms. 10/6 each. Discount given for large quantities.

**STEP-DOWN TRANSFORMERS,** input 120/230v. A.C., 50 cycles, output 2 windings 4.2, 4.2v. 10 amps, ideal soil heating, spot welding, 22/6.

**FOSTER "L.T. TRANSFORMERS,** input 230/250 volts, 50 cycles, output 12 volts, 60 amps., 30/- each.

**P.V.C. 3-CORNER CABLE,** White Flat, in 100 yard coils, 75/- per coil.

**EX-AIR MIN. GEAR PUMPS,** Type RFP/1 made by Rolls-Royce, size approx. 6 1/2 x 5 1/2 in. x 5 1/2 in., 27/6.

**SELF-PRIMING IMMERSION PUMP (Electric) Ex-Air Min.** Fitted 24v. D.C. motor, will work on 24v. A.C. Overall length 20 1/2 in., delivers approx. 150 g.p.h. Ideal for use in caravans, boats, etc., 37/6.

**NEW "HEAVY DUTY" Ex-R.A.F. COMPRESSORS,** pressure 45 lbs. per sq. inch, internal spline 1/2 in. diam. ideal for paint spraying, lab. use, 47/6.

**HOOVER BLOWERS,** 200/250 volts, A.C./D.C., 300 watts, 7 1/2 in. diam., 6in. deep. Outlet 1 1/2 in. diam. Fitted carrying handle, Flex and Plug. Unused, 25.2.6.

**PRESSURE PUMP UNITS,** Operated by 24 volt A.C./D.C. motor, develops 10 lbs. pressure or vacuum. Complete with 10ft. lengths of pressure hose, cables and connectors, etc. Compact unit fitted in metal case, 6 x 4 x 4 in. Made in U.S.A. Ideal for laboratory use, etc. New, 24 each.

**8in. DIAM. VENT-AXIA EXTRACTOR FANS,** 24v. D.C. or 35v. A.C. Fitted suppressor units. Ideal for caravans, yachts, etc. Unused, complete in transit case, £4.7.6.

**ROTARY RHEOSTATS,** Type H. 25 ohm 2 amps. 5 1/2 in. diam. Unused, 12/6 each.

**WESTERN ELECTRIC BLOWER MOTORS,** available 12 volts D.C. or 110 volts A.C./D.C. Suitable for car heaters, projectors or miniature vacuum cleaners, etc. Size 4 1/2 in. x 3 1/2 in. approx. Price 29/- each.

**TUFNOL PULLEYS,** fitted ball-races, 3 1/2 in. external, 3/8 in. internal bore. U-shaped groove, 3/8 in. wide, 3/8 each, 37/6 per doz.

**"CREED" MOTOR-OPERATED TAPE WINDERS** fitted 230v. A.C. motor, coupled to gear-box with slipping clutch. Final speed 25 r.p.m. approx. New, 65/- each.

**FULL MAILING PRICE LIST 6d.**

# GAMAGES

The Wonderful Store for the Practical Mechanic

Nowhere else can you find such an amazing variety of tools and materials for the Practical Mechanic as at Gamages. There are always many special offers at real money-making prices.

## 'NIBBLEX' Regd. SHEET METAL CUTTER

Attachment for Electrical or Pneumatic Hand Drills

Available in two sizes:—'Minor'—suitable for cutting mild-steel sheets 19 S.W.G. and upwards. Fits 1/2 in. drill chuck. 'Major'—suitable for cutting mild-steel sheets of 15 S.W.G. and upwards. Requires 5/16 in. or 3/8 in. drill chuck. Small radii circles and curves can be executed with either model, leaving a smooth clean finished edge.

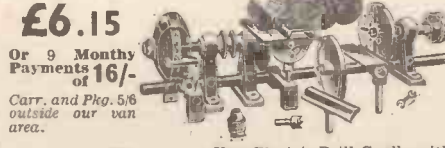


After-treatment is virtually unnecessary. Cutting can commence from inside a sheet of metal by making a small hole to allow the insertion of the 'Nibblex' cutter head.

Minor 66/- Dies 12/6 Post 1/3. Spare punches 7/6.  
Major 99/- Dies 17/6 Post 1/6. Spare punches 10/6.

## 'PICADOR' Home Handyman UNIVERSAL LATHE

Can now be powered by any "Wolf Cub," "Black & Decker," "Handy Utility" or "Bridges" Tool Power 4 in. capacity Electric Drill. Robustly constructed to give long trouble-free service. For Turning, Sawing, Sanding, Drilling, Grinding, etc. Fitted with Porous and Granite Impregnated Bronze Bushes. Weight 12 lb. Parts can be purchased separately. Carton size 25 x 6 1/2 x 6 1/2 in. deep, with 24 in. tube bed.



£6.15 Or 9 Monthly Payments 16/- of Carr. & Pkg. 5/6 outside our van area.

New Electric Drill Cradle with flexible drive as illustrated 23/- extra. 38 in. Lathe Bed to accommodate the new cradle 2/6 extra.

Electric Drills Extra.

SPECIAL NOTE:—A special adaptor is required for Bridges Electric Drill. 2/- extra.

## 'PICADOR' VERTICAL DRILL STAND

This press provides extra leverage, accuracy and control for any of the famous Electric Drills, "Tee" slotted base.



66/- Carr. & Pkg. 4/- Adaptor for Wolf Cub or Bridges Tool Power drills 2/6 extra.

No adaptor is required for the Black & Decker drill.

GAMAGES • HOLBORN • LONDON • E.C.1. HOLBORN 8484

## SWISS MUSICAL MOVEMENTS

One tune, 18 teeth 18/- ea. Also extra stock 1 & 2 tune 22 teeth; 1 & 2 tune 28 teeth; 1 & 2 tune 36 teeth; 1 & 2 tune 41 teeth. Ballerina THORENS and Miniature Jewel movements. Solid Walnut box kits 21/- each. Jugs, Jewel boxes, Toys and Chalet Kits. Command Performance movements by REUGE.



Also full range of Timex Watches now available. Trade enquiries also invited. Electric movements now in stock.

## FREE METWOOD ACCESSORIES

55 CHURCH ST., WOLVERTON, BUCKS Tel.: Wolverton 3028

# BRASS, COPPER, DURAL, ALUMINIUM, BRONZE ROD, BAR, SHEET, TUBE, STRIP, WIRE

3,000 Standard Stock Sizes. NO QUANTITY TOO SMALL. List on application.

**H. ROLLET & CO. LTD.**  
6, CHESHAM PLACE, LONDON, S.W.1. SLOane 3463.  
Also at LIVERPOOL, LEEDS, MANCHESTER, BIRMINGHAM.

## HIGHSTONE UTILITIES

**Soldering Irons.** Our new stream-lined iron is fitted with a Pencil Bit. 200/250 v. 50 watts, 11/8, 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/-. 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) Microphone Amplifiers** as used in piano 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 2/6. Useful wooden box with partitions to hold amplifier, 2/- extra.

**Sparkling Plug Neon Testers,** with vest-pocket clip, 3/3, and with gauge, 3/6, post 3d. S.E.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 vest-pocket 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 ladder, etc. PRICE 9/-, post 1/-. Similar Transformer but with output of 4, 8 or 12 volts, 12/6, post 1/-. Transformer with similar output, but with fused secondary and earth terminal, 18/-, post 1/-. 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), 22/6, 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? 7/6, 12/6, post 10d. Spare Permanent Detectors, 2/- each. When ordered separately, 2/6. With clips and screws, 2/10, post 3d. Headphones, brand new, S. G. Brown, G.E.C., etc., 23/-, and super-sensitive, 30/-, pair, post 1/6.

**Headphones in Good Order,** 6/-. Better quality, 7/8 and 10/-. Balanced armature type (very sensitive), 13/8. All post 1/6. New Single Earpieces, 3/6. Balanced armature type, 4/6 (two of these will make an intercom set). 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 Cords, 1/3 a pair, post 3d. Replacement Bands, 1/3, post 4d. Wire Bands, 6d. (All Headphones Listed are suitable for use with our Crystal Sets.)

**Hand Microphones with switch in handle and lead, 5/8. Tamoy, 7/-. Similar, instant, moving coil, 8/8. All post 1/-. Mask type with switch, 3/8, post 6d. Mike Buttons (carbon), 2/-. Moving Coil, 3/6: Transformers, 5/-. All post 4d. each.**

**Morse Keys.**—Standard size keys wired to work Buzzer or Lamp, 3/-, post 8d. Slightly smaller keys, 2/6, post 6d. BUZZERS, 3/8, or heavy duty, 4/6, 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. 1 1/2 in. packet of 10, 2/6, post 3d. 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.

**Bargain Parcels,** of really useful equipment, containing Switches, Meters, Condensers, Resistances, Phones, etc., 10/-, or double assortment, 17/6; treble 25/-.

**Meters,** 20 amp. 2in. m/c, 8/6; 150 v., 2in., m/c, 10/-; 3.5 amp. 2in., T.C., 6/-; 4 amp., 2 1/2 in. T.C., in case with switch, 9/6; 100 mA 2in., m/c, 7/8; Meter units containing 2-500 microamp. movements, 9/-, post 1/3.

Money refunded if not completely satisfied.

## HIGHSTONE UTILITIES

58 New Wanstead, London, E.11 Letters only.  
New Illustrated List sent on request with 2d. stamp and S.A.E.

## THE MULTI-PURPOSE LIGHTER FUEL

# PETROL-PAK



**1-  
5 oz**

- Removes Stains & Grease-spots
- Ideal for Watch Cleaning, etc.
- Suitable for Petrol Blowlamps
- Lead-free—leaves no residue

10oz. Tin or Bottle 1/11

CAPSULES LTD · STRETFORD · LANCS

## SAVE ON REPAIRS WITH GLASS FIBRE

Kit I—18/6 Kit II—28/6 Kit III—33/6  
Postage 2/-

Kits for Cars, etc., £9-10-0, £15-10-0,  
£20-10-0

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" Booklet, 1/6d.

## WESTPOLE MOTORS LTD.

Westpole Avenue, Cockfosters, Barnet, Herts. Barnet 3615 & 9474.

### GENUINE GOVERNMENT STOCK NEW UN-ISSUED TRENCH COATS

24/11  
NO MORE TO PAY



A Raglan style Fawn 100% Storm and Windproof coat. Made of the toughest woven proofed texture you have ever seen. Two vertical through pockets. Where can a more durable, more practical, or generously tailored Service or Civilian wear coat be obtained at such a price? Previously an impossible price but now you can have one. Sizes 36 to 40 chest for only 24 11/- post, etc., 2/6. Sizes 42 to 44, 5/- extra. Only 15,000 available. Hurry! Hurry! Hurry! Cash back if a hurricane affects this coat!

### 50,000 PAIRS, BRAND NEW ALPINE COMMANDO FRENCH THEATRE OF WAR ANKLE BOOTS



5/9  
PAIR  
POST ETC 1/6

Made specially of all leather uppers and special supple leather soles for quiet tread. Brand new footwear supplied with solid leather laces and high ankle therefore ideal for motor cyclists, farm workers, factory workers or outdoor sporting activities, etc. Exceptionally comfortable and completely silent in use. Sizes 8 to 11 only. 5/9 Pair. Post, etc., 1/6. How can you miss this bargain? Special built-in Gussitted leather tongues makes them water resisting. Send quickly. 3 PAIRS 17/6. POST FREE. STATE SIZE. LISTS CLOTHING. TERMS.

## HEADQUARTER and GENERAL SUPPLIES LTD.

(DEPT. PMC/12), 196/200, COLDHARBOUR LANE, LOUGHBOROUGH JUNCTION, LONDON, S.E.5. Open all Saturday. 1 p.m. Wednesday.

## METALS AND ACCESSORIES

ALUMINIUM, BRASS, COPPER, STEEL, ETC.

Angle, Sheet, Tube, Foil, Strip, Channel, Rod, Bar, Wire, Moulding, Etc., Etc. Tin Plates, Silver Steel, Expanded Metal, Blanks, Rivets, Springs, Etc. Tools, Drills, Taps, Dies, Screws, Etc., Etc.

Formica, Perspex, Pegboard, Paxolin, Ebonite, Curtain Rail and Rod, Adhesives, Etc., Etc., and many other items for use in Home, Workshop, Etc.

Large or Small quantities.

Quotations by Phone or Post.

COMPARE our PRICES. (2d. Stamp for List.) MAIL ORDER SERVICE

## CLAY BROS. & CO.

6a SPRINGBRIDGE ROAD, EALING, W.5

Phone: EALing 2215

2 MINS. EALING BROADWAY STATION, OPPOSITE BENTALLS

# 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  
Aircraft Maintenance  
Building  
Carpentry  
Chemistry  
Commercial Art  
Diesel Engines  
Draughtsmanship  
Electrical Engineering  
Electric Wiring

Accountancy Exams.  
Auctioneer's Exams.  
Auditing  
Book-keeping  
Civil Service  
Commercial Arith.  
Costing  
English  
General Education  
Geography  
Journalism

GENERAL CERT. OF EDUCATION R.S.A. EXAMS

Forestry  
Locomotive Engineering  
Machine Design  
Mechanical  
Engineering  
Motor Engineering  
Plumbing  
Power Station Eng.  
Quantity Surveying  
Radio Engineering  
Road Making

Languages  
Mathematics  
Modern Business  
Methods  
Police Subjects  
Salesmanship  
Secretarial Exams.  
Shorthand  
Short Story Writing  
and many others

Sanitary Science  
Steam Engineering  
Surveyor's Exams.  
Surveying  
Telecommunications  
Television  
Textiles

FREE

TO THE BENNETT COLLEGE (DEPT. J.76N), 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

Train your  
mind to  
SUCCESS

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

Junior Section

# A Simple SHOCKING COIL

A SHOCKING coil, which is really an induction coil of simple form, depends for its action upon the peculiar property of electricity, by virtue of which, when one coil of insulated wire through which an intermittent current of electricity is caused to flow is placed within another coil, a current of electricity is induced in the outer coil. The inner coil in this case is called the primary coil and the outer one the secondary coil. In order that the electromotive force in the induced current shall be sufficiently high to cause a shock, the primary coil is wound round a laminated iron core, while the secondary coil consists of a much larger number of turns than the primary winding. An intermittent current

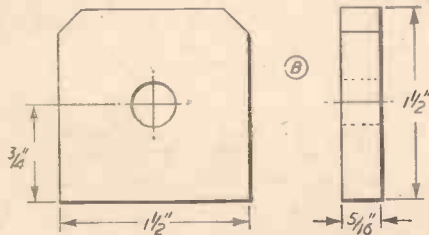


Fig. 1.—Construction of the supporting cheeks.

is caused to flow in the primary coil by means of a rapid make-and-break device which will be described later. It is on the rapidity of the make-and-break action that the strength of the shock depends.

**Construction**

For the baseboard (see A in Fig. 4) a piece of wood 6in. long, 3 1/2in. wide and 3/4in. thick will be required. Ordinary deal will answer quite well and this can afterwards be stained and polished. Two pieces of wood 1 1/2in. square and 5/16in. thick will also be required for the end cheeks, as shown at B in Fig. 1. These support the core and windings.

With a 5/16in. centre-bit make a hole in the middle of each cheek to allow the ends of the core to pass through. Chisel off the top corners and well rub the sides and edges of the cheeks and baseboard with fine glasspaper.

For the core obtain a coil of florist's soft iron wire and without undoing the coil cut out a portion 4 1/2in. long. The part to be cut out must be bound round tightly with another piece of wire to prevent the strands coming loose when severed. The best way to cut the wire is to use a sharp-edged cold chisel and hammer. The bundle of wire can now be straightened out and the jagged ends filed square. To facilitate this operation apply some flux to the ends of the wire and dip them in molten solder. It will now be found that it is quite an easy matter to square up the ends with a file.

Now take the core and proceed to cover it with a layer of thin brown paper, the edges of which overlap 1/4in. and are stuck down with a little glue. This paper wrapping should be 3 3/4in. wide so as to allow 1/4in. of the core to be bare at each end, as indicated at CC (Fig. 2).

**Winding the Coils**

We shall now require 5yds. of No. 22 cotton-covered copper wire for the primary winding and 26yds. of No. 28 wire (also cotton covered) for the secondary winding. Take the paper-covered core and proceed to wind on the primary wire, leaving a free end of at least 6in. to start with, the same

An Easily Made Piece of Apparatus to Amuse Your Friends

amount being left at the finishing end as shown at D (Fig. 2). The last one or two turns must be bound round tightly with thread to prevent the coil from unwinding. Apply a coating of shellac varnish and cover the coil with thin brown paper. When dry wind on the secondary wire, leaving about 6in. at each end for connections. After binding the last two turns with thread another application of shellac varnish can be given and allowed to dry.

**Mounting the Coils**

The coils are now ready for their casing, which consists of a cardboard tube covered with a piece of velvet, which gives the completed coil a pleasing finish. Obtain an ordinary postal tube, about 1 1/2in. o.d., and cut off a piece 3/4in. to 1in. long, keeping the ends as square as possible. Cut a piece of velvet just to cover the tube, and glue the edges down to the cardboard. Now place the coils in the tube, make little nicks in the ends of tube for the connecting wires to pass through, and then glue on the wooden cheeks. One end of the iron core should project about 1/16in.

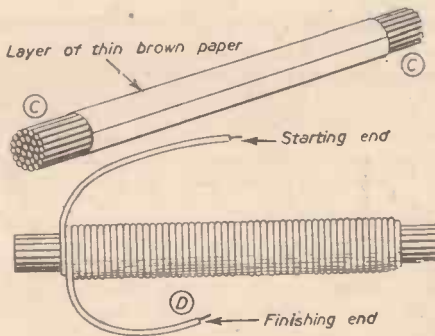


Fig. 2.—Coil winding details.

past the face of one cheek as shown in Fig. 4. Fix the coil in position on the baseboard by two screws driven into each cheek from underneath.

**Contact Breaker**

This consists of an armature spring, sup-

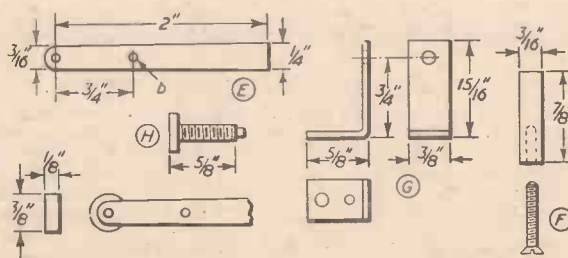


Fig. 3.—Details of the contact breaker.

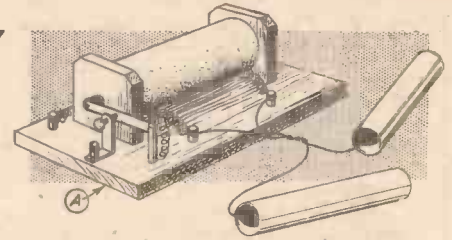


Fig. 4.—The completed shocking coil.

porting piece, contact screw and bracket. For the armature spring cut out a piece of thin, springy sheet brass, about No. 35 gauge, to the shape shown at E (Fig. 3). The little armature is a soft iron disc 3/4in. in diameter and 1/4in. thick. A hole should be drilled through the centre of it so that it can either be screwed or riveted to the end of the spring.

The contact piece on the spring is of silver, and for this a link from an old silver watch chain can be used. Straighten the link out

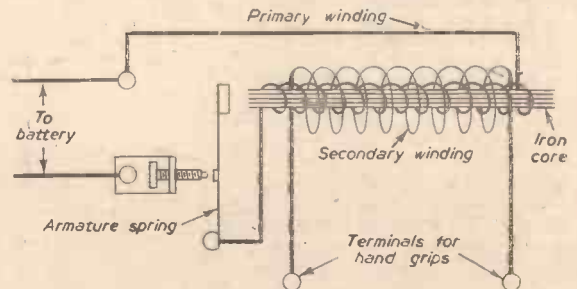


Fig. 5.—The circuit.

and, after cutting off a piece 1/4in. long, insert it in the hole made at b and burr it over on both sides of the spring by tapping with a light hammer until a flat surface of silver is formed about 1/4in. diameter.

A piece of brass rod 3/16in. dia. and 1/2in. long will now be required, and this should have a hole drilled and tapped in one end to take the stem of a countersunk screw, as shown at F. At the top end a flat can be filed sufficient to take the width of the armature spring, which can then be neatly soldered to the pillar, as shown in Fig. 4.

The bracket G, for the contact screw, can be bent to shape from a piece of sheet brass about 1/16in. thick after drilling the two holes near one end for the fixing screw and terminal stem and drilling and tapping the hole near the other end for the contact screw. For the latter obtain a brass screw with a milled head if possible, and in the end drill a small hole and solder in a short piece of silver wire from the watch-chain link, leaving about 1/16in. projecting, as shown at H (Fig. 3). Fix the bracket to the baseboard with a small round-headed brass screw and a terminal as shown in Fig. 4. See that the end of the silver wire on the contact screw touches the centre of the silver contact piece on the armature spring when the latter is in its normal position. Screw another terminal into the baseboard in the position indicated in Fig. 4.

**Making the Connections**

Each piece of free wire from the coil should be formed into a spiral, as shown in Fig. 4. This is done by winding the wire around a smooth rod of either wood or metal about 1/4in. dia., giving a neater appearance to the coils.

Bare each end of the covered wire by scraping with a penknife. Fix one end under the terminal near the corner of the baseboard, and clamp the other end of the primary under the brass pillar which supports the armature spring (see Fig. 4). Clamp the ends of the

secondary wire under the two terminals which are arranged to take the ends of the flexible wire attached to the hand-grips.

The coil can now be tested by connecting up to a single dry cell, the leads from the latter being connected to the two terminals at the ends of the primary winding, as shown in Fig. 5.

On adjusting the contact screw so that the silver point presses lightly against the contact piece on the spring the latter should begin to vibrate at a rapid rate and continue to do so while the current is flowing. This shows that the primary winding is all right. Now

place the tip of a finger of each hand lightly on the two terminals attached to the secondary winding, when a shock will immediately be felt.

For the hand-grips two pieces of thin brass tubing about 4in. long and 1/4in. dia. will be required. A piece of ordinary twin flex, about 3ft. long, serves for the connecting leads. The wire is opened out at each end, two of the ends being soldered to the grips inside one end.

This shocking coil may also be used with a morse tapper, if the latter is available. Connect the coil in series with a pocket-lamp battery

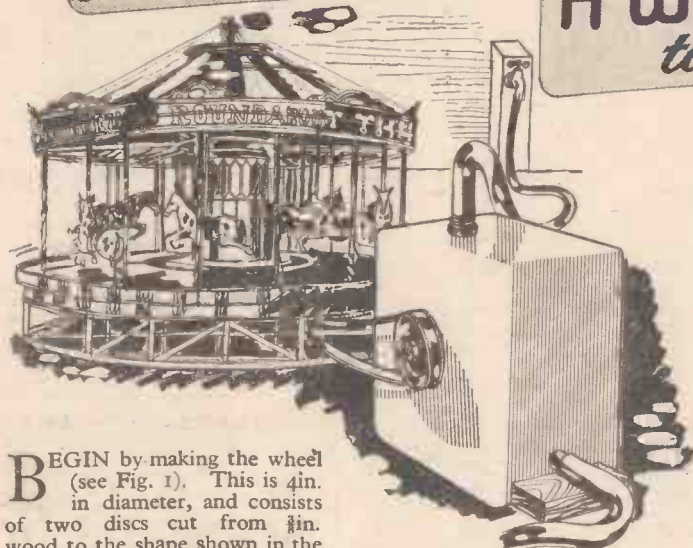
or two dry cells and a morse tapper. Depress the key and adjust the contact screw until the armature vibrates with a gentle hum. The coil should now be giving a smart shock. When using the coil in this way see that it does not get pulled off the table. The tapper key enables one to give a shock without having to manipulate loose wires. Many of the parts from an old electric bell may be used in constructing this shocking coil. It is worth pointing out that the shock felt is entirely due to voltage; no current flows.

The shocks delivered by the instrument described in this chapter are harmless.

## Junior Section

# A Water Motor to Drive Your MODELS

A Powerful and Inexpensive Source of Power Made from Simple Materials

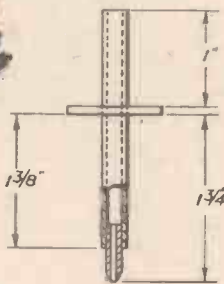


**B**EGIN by making the wheel (see Fig. 1). This is 4in. in diameter, and consists of two discs cut from 1/2in. wood to the shape shown in the sketch and secured together with brass screws, the grains being crossed to prevent warping.

### The Buckets

Around the periphery of the wheel are 12 buckets cut from sheet brass. The quickest way to make them is to cut a cardboard pattern to the measurements given in Fig. 2 and placing it upon the brass scribe round it. Cut out the blanks and drill them; then shape them by hammering around a piece of rod or tube 1/4in. in diameter. Bend the tabs at the dotted line and attach each bucket to the wheel with two screws (see Fig. 2). Note that all screws and metal parts used—with the exception of the shaft—should be of brass, not iron, which would quickly rust and require renewal. The shaft is a piece of mild steel

Fig. 3.—Details of the nozzle.



### The Case

To make this cut, four pieces of 1/2in. wood and join together with screws to form a frame 7in. square and 2 1/2in. deep. It will be noticed in Fig. 1 that the base of this frame projects 1in. at each side. This is to give a convenient means of clamping the motor in position when in use. Cut the back and the front of the case from 1/2in. wood, and at the exact centre of each drill a hole for the shaft and bush it with a small piece of brass tube.

### The Nozzle

The inlet pipe with nozzle is shown in detail in Fig. 3. It is made from a piece of

1/4in. brass tube, the nozzle being formed by soldering a piece of smaller tube into the end. A flange cut from sheet brass, and having three holes drilled in it, is soldered to the tube at the position shown. Drill a hole in the top of the case to receive the tube and secure in position with three round-headed screws. The outlet pipe is a piece of 1/2in. brass tube, which fits tightly into a hole in the side of the case as close to the bottom as

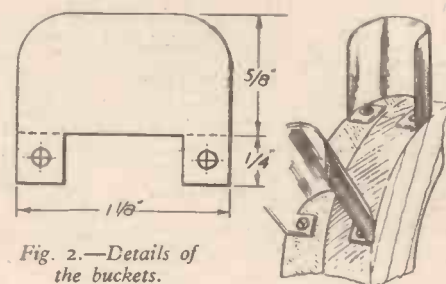


Fig. 2.—Details of the buckets.

possible. Centre the wheel in the case by fixing two collars on the shaft either with grub screws or solder. Screw on the back and front of the case, fix a pulley on the end of the shaft and the motor is complete.

## Items of Interest

### Power from the Earth

**A**TTEMPTS are being made to use the natural heat of the earth. Our world is so relatively new that it is still hot inside, but at depths which are easy to reach temperatures are not very high. By burying steel pipes, a liquid can be pumped into them until the earth's heat is absorbed. This hot liquid is then brought up for use as a heater. So far, the results are not economic but the sponsors say that cities could be warmed by this means without any cost for fuel. Maintenance is the difficulty.

### Wings for All

**T**WO German flying inventions are worth a thought. One is a small device of the helicopter type which can be strapped to the shoulders. It has no engine, but the wearer can jump from a high building in safety. Another uses a small engine, so that the user can rise in the air with the machine strapped to his back. Total weight is that of a light motor-cycle; it can easily be lifted by the user. If such machines came into use they would confirm "Mother Shipton's" prophecy made centuries ago!

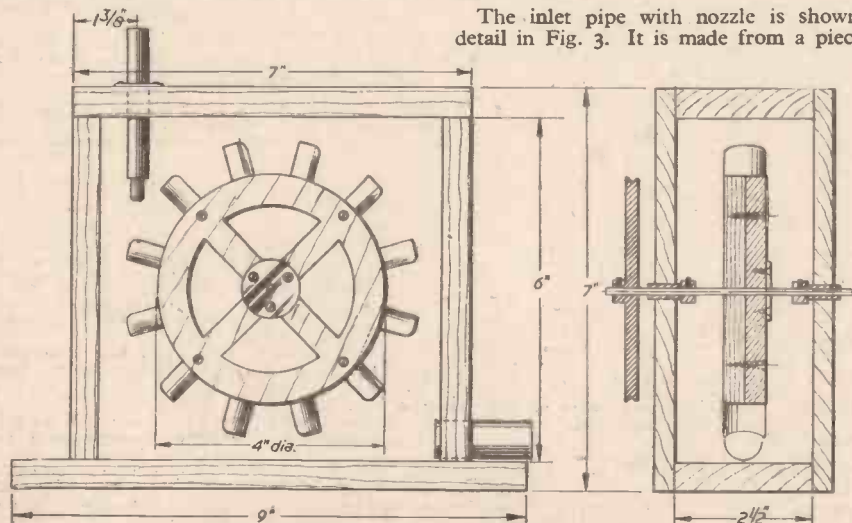


Fig. 1.—Side and end views of the water motor.





**GOVERNMENT SURPLUS BARGAINS**  
**GEARBOXES.**—Similar to those described in "P.M." (Aug.) for Electric Mixer. Each 10/- post free.  
**GEARBOXES.**—As above but complete with 200/250 v. A.C./D.C. Motor. Each 28/6, post free.  
**TRIPODS.**—Unused. 38in. long only 5 lb. wt. Immensely strong. Carrying sling. Brass cap easily adapted to camera, etc., etc. Each 12/6, post 2/6.  
**ASTRO COMPASS MK. II.**—As described in "P.M." for Theodolite and Camera Pan/Tilt Head. Each 17/6, post 2/-.  
**LANDING LAMP MOTORS.**—12/24v. D.C. 20/30 v. AC. 2 amps 1in. shaft. Each 12/6, post 1/6. Similar type motor with gear and quadrant as described for SELF-OPENING GARAGE DOORS "Prac. Motorist". Aug. '54 (copy of article with motor if desired). 25/-, post 1/6.  
**TRANSFORMERS.**—Input 200/250v. A.C. Output tapped for 3, 4, 5, 6, 8, 9, 10, 12, 15, 18, 20, 24, 30v. A.C. Max. 2 amps. Excellent for motor cars. 21/-, post 1/-.  
**RECTIFIERS.**—Full wave. Max D.C. output 30v. 2 amps. 21/-, post 1/-.  
**CAR HEADLAMP or SPOTLIGHT.**—Brand new. 6in. dia. Double contact holder for main/dip or spot. Black finish. Normal single hole fixing. Each 25/-, post 2/-.  
 Send 3d. stamps for list of Motors, Telephones, Transformers, Pumps, Lamps, etc., etc. Hundreds of Bargains.

**MILLIGANS**  
 24, Harford Street, Liverpool, 3.  
 Money Back Guarantee.

**ROGERS 31 NELSON ST., SOUTHPORT**  
 Compressors. Ex W.D., 3 cu. ft. 55/6  
 Abrasive Discs. 5in. Ass'd. doz. 3/6  
 Terminal Blocks. 12 way ... 1/3  
 Generators. D.C., 6v., 12v., 250 v. ... 12/6  
 Motorised Pumps ... 69/-  
 Thread Gauges. 28 arms ... 4/9  
 Whitworth Screws. 144 Ass'd. 5/9  
 H.S. Drills. 12 Assorted, to 48 ... 4/6  
 Fibre Washers. 144 Assorted 3/6  
 Meter Rectifiers. A.C. to D.C. ... 3/9  
 Self Tap Screws. 100 Assorted ... 3/-  
 Copper Rivets. 12 doz. Assorted 1/4  
 Saw Bench Tops, with ball race spindle, pulley, etc. 18in. x 10in. 52/6  
 Rectifiers. 6/12 v. at 1 amp. ... 7/8  
 Meters. 0-15 v. or 0-25 Mc. ... 10/6  
 Air Jacks. 8in. Stroke ... 14/6  
 Boost Gauges for Car Use ... 6/9  
 Winker Units. 6 or 12 volt ... 6/6  
 Circular Saws. 6in., 11/8, 7in., 13/8 etc. etc.  
 May we send our free list of hundreds of interesting items? Stamp please.

**THE "HOLWAY" OILER**  
 Price 4/9 each  
  
 Packing and postage 9d. extra.  
 An ideal tool for Engineers, Modelists and Handymen. Suitable for oiling intricate parts of clocks, sewing machines, typewriters, etc. Useful for applying flux when soldering and for the treatment of wood worm.  
 Send to HEGA PRODUCTS LTD., (Dept. 3), 2D, Holloway Road, London, N.7. Trade supplied. Phone: North 5178.

**TIME SWITCHES**  
 Hand Wound, 35-day, by Venner. Beautiful movements. 24-hour dial. Ideal for Shop Windows, Poultry, Process Timing, etc. Complete in metal case, 45/-, p. & p. 2/6.  
**ELECTROSURP,**  
 120 Fore Street, Exeter.  
 Phone: 56687.

**MAKING A TELESCOPE?**  
 Reflecting mirrors from £4. 4in. and 6in. Achromatic objectives.  
**BRAND, Astro Works,**  
 253, BRAMFORD RD., IPSWICH, Suffolk.

(Continued from previous page)  
**TUITION OR TECHNICAL TRAINING**  
**INCORPORATED Practical Radio**  
 Engineers home study courses of radio and TV engineering are recognised by the trade as outstanding and authoritative. Moderate fees to a limited number of students only. Syllabus of Instructional Text is free. "The Practical Radio Engineer" Journal, sample copy 2/-, 6,000 Alignment Peaks for Superhets, 5/9. Membership and Entry Conditions Booklet, 1/-, all post free, from the Secretary, I.P.R.E., 20, Fairfield Road, London, N.8.

**MISCELLANEOUS**  
**THE BENDELLE CHART** solves bend allowance problems and slide rule type calculations, 7/6, post free. Whittaker Enterprises, 233, Pear Tree Avenue, Bitterne, Southampton.  
**"FORTUNES IN FORMULAS."** 900-page American book of formulae. American technical hobby and other books covering every interest. Stamp for lists. Herga Ltd. (Dept. P2), Hastings.

**90,000 PIANISTS**  
 have learned to play the piano beautifully with the aid of my POSTAL lessons. Everything is so clearly explained that, even if you do not know a note, you will with only half an hour's practice each day, become a proficient pianist in 9-12 months. Ordinary music; no freakish methods. My class is seldom less than 2,000 pupils. I have taught over 60,750 and I CAN TEACH YOU. Free Book and advice. Say if Beginner, Mod. or Adv.  
 Mr. H. BECKER, 668, The Hall, Centurion Road, Brighton, Sussex.

**CONVERT your TV**  
 Do it yourself. It's so easy. Save money and get B.H.C. and I.T.A. Commercial at the flick of a switch. You simply place our Silver TV Converter on or near your TV set. No alterations to your set—just connect with mains and aerial. Packed complete with easy instructions. Only 21/- down and 6 monthly of 21/- or cash £6.60. Money Back Guarantee.  
**EX-W.D. PURCHASE INTER-COM FIT**  
 2-way speech. Incl. 4 RAF Transm.—Receiver Units. 100ft. Wire & illus. Instr. Ideal Phone, Mike, Walkie Talkie, Baby Alarm, etc.  
 10/-  
**John Bull** (PM 10), 246, High St., Harlesden, N.W.10.

**FOR YOUR ELECTRIC DRILL**  
 Whether it's a Black and Decker, Wolf, Bridges or any other  
**SET OF 5 WOOD TWIST BITS**  
 in fitted plastic case. 12/6 post paid  
 1/4" 5/16" 3/8" 7/16" 1/2"—  
 1/4" round shanks.  
**SET OF TWIST DRILLS FOR METAL**  
 in fitted frame. 5/6 post paid  
 1/16" 3/32" 1/8" 5/32" 3/16" 7/32" 1/4"  
 Suitable for any Electric Drill.

Our Only LONDON ADDRESS  
**S. TYZACK & SON LTD.** 341-345, OLD ST. LONDON, E.C.1

**FREE DRAWINGS**  
 showing  
**STEAM and HOT-WATER INSTALLATIONS**  
 Readers of "Practical Mechanics" are offered, without charge or obligation, useful drawings showing correct installations of thermostatic control, steam trapping and automatic air venting equipment on a wide variety of steam and hot-water heating and process applications. Ask for current list from which to select.  
**SPIRAX-SARCO LTD.**  
 (TECHNICAL DEPT.)  
 Cheltenham, Glos.

**12/6! CRYSTAL RADIO**  
 Build the new "WINNER" crystal set—only a screwdriver and pliers required. Complete set of parts with building instructions, 12/6 post free. Easy-to-follow building instructions alone, 1/-, Send P.O. 1/- or 12/6 to:  
**BLANCHARD'S RADIO,**  
 (Dept. M1)  
 13, Gainford Gardens, Manchester, 10

**BUILD YOUR OWN REFRIGERATOR,** all components available at reasonable prices. Frigidaire flowing cold units, £5; small units, Kelvinator, etc., £4; 1/2 h.p. heavy duty Motors, £3; Chrome Cabinet fittings, new, £1; money back guarantee; s.a.e. for list and schematic diagram. Wheelhouse, 13, Bell Road, Hounslow. (Phone: Hounslow 8749.)

**DRAWING DEVICE** ensures skill without experience. Newbery, 245, Goldhawk Rd., W.12.

**RUBBER MOULDS** for Plaster Ornaments, Wallplaques, etc. Sample and list, 4/11; trade enquiries invited. Castmoulds (Dept. M), 43/45, Waller St., Hull.

**PARABOLIC** Astronomical Mirrors, new and secondhand, bought and sold, S.A.E. for details. Hinds, 4, Keswick Gardens, Ruislip, Middlesex.

**CONVERT your TV**  
 Do it yourself. It's so easy. Save money and get B.H.C. and I.T.A. Commercial at the flick of a switch. You simply place our Silver TV Converter on or near your TV set. No alterations to your set—just connect with mains and aerial. Packed complete with easy instructions. Only 21/- down and 6 monthly of 21/- or cash £6.60. Money Back Guarantee.

**EX-W.D. PURCHASE INTER-COM FIT**  
 2-way speech. Incl. 4 RAF Transm.—Receiver Units. 100ft. Wire & illus. Instr. Ideal Phone, Mike, Walkie Talkie, Baby Alarm, etc.  
 10/-  
**John Bull** (PM 10), 246, High St., Harlesden, N.W.10.

**ARC WELDING TRANSFORMERS**  
 Continuously rated. Special low consumption models. For 220/250v. A.C. single phase or 40/40v. supply:  
 85 amps maximum output ... £9.10.0  
 100 " " " " ... £12.0.0  
 160 " " " " ... £17.10.0  
 200 " " " " ... £22.0.0  
 With Illustrated Instruction Book. Built-in regulator giving infinitely variable welding output down to 10 amps. £2.15. First class standard modern Transformers. A SPOT WELDING UNIT FOR USE WITH THESE IS AVAILABLE.

**FLEXIBLE DRIVES**  
 6ft. long, with 1" drill chuck. For drilling, polishing and light grinding. Runs in both directions. Can be used with Wolf and other hand drills. 44/- post paid.

**ELECTRIC MOTORS**  
 Ad. Patter. 54458. Easily converted to 220/250v. A.C. as described in P.M. previously. When converted deliver 1/10th h.p. at 3,000 r.p.m. Ample power and correct speed to drive SEWING MACHINE. Doubled-end spindle, each end 1/2" long x 1/4" dia. In ballrace. Suitable for small drills, double-ended grinders, etc. Price Under, 20/-; Converted, 24/6. P. & P. 2/-. Sewing Machine Pulley, 2/6. 2" Grindstone with adaptor, 5/6. 2" Mop with adaptor, 3/6.

**24/12v. MOTORS, 1/3rd H.P.**  
 D.C. only. Size 6" x 3 1/2". Spindle 1" will drive boats, pumps and machinery. At 24v. 3,300 r.p.m., 18 amps 13 h.p. At 12v. 1,600 r.p.m. 10 amps, 1 h.p., 24/6. P. & P. 2/-.

**MOTORIZED BLOWERS**  
 12v. or 24v., please state which. Fan enclosed in 7" cowl with generous inlet and outlet. Make excellent CAR HEATERS. Useful for forges, brazing, etc. A.C./D.C. Consumption 1 1/2 amps. Unused. 28/-.


**TRANSFORMERS**  
 All continuous rating, 220/250v. A.C. input. Low Voltage Lighting, Battery Charging, etc., type T/344: 30, 24, 18, 12 and 6v. at 12 amps. £4.5.0. Rectifier to suit, £2.18.0. Brazing, Soldering, Soil Heating and Light Spot Welding, type RU/91: 12, 9, 6 and 3v. at 65 amps. £4.5.0.  
 Heavy Brazing, Medium Spot Welding, etc., type EC/300, 5v. at 300 amps. £4.5.0. For American Drills, Motors, Washing Machines, etc., on British Mains, type AT/21 (Auto Transformer). Input 220/250v. Output 110/120v. at 6.5 amps. £4.5.0.  
 For Plating & Spot Welding, type OC/400: 6v. at 400 amps, £8.15.0. Type HC/500: 5v. at 500 amps, £8.15.0. For Heavy Plating & Spot Welding, type C/1,000: 6v. at 1,000 amps, £10.10.0.

**"POP" RIVET GUNS**  
 (Lazy Tongues)  
 For motor body, sheet metal and fabrication work. With universal collet to take all sizes of rivets, £3.18.6. P. & P. 2/-.  
**"POP" RIVETS**  
 1/8", 5/32" and 3/16", 7/9 per 250, 18/- per 1,000 of one and the same size. Mixed "Pop" rivets, 12/- per 500, 17/- per 1,000. Send stamp for leaflet.

**HARMSWORTH, TOWNLEY & CO.**  
 Jordan St., Knott Mill, Manchester 15

Glorious Health-Giving **SUNSHINE**

**A £7 SUNRAY LAMP**  
 for only £4

**SUNSHINE**  
  
 Bathe in the wonderfully luxurious Ultra-Violet and Infra-Red Rays of the "SCIENTIFIC" COMBINED SUNRAY LAMP. SUNLAMP and get a MARVELLOUS TAN. Unsurpassable quality of emission. Wonderful for RHEUMATISM, etc.

**£4 ONLY** Complete with goggles.  
 Send S.A.E. for Illustrated Brochure to Dept. 55 SCIENTIFIC PRODUCTS, Cleveleys, Lancs.

**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. 189 29-31, Wright's Lane, London, W.8.  
**"NO PASS—NO FEE"**

**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 Tool, 9 ft. cable, clip, carbon, 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.  
 Obtainable only from: Post Free U.K. only. HARRIS ENGINEERING CO. (Dept. P.M.10) 269 Kingsland Road, London, E.2  
 57/6

**ACCURATE HARDHITTING Webley AIR PISTOLS**  
**AIR RIFLES - ACCESSORIES**  
 Write for catalogue WEBLEY & SCOTT LTD. 106, WEAMAN ST., BIRMINGHAM 4, ENGLAND

# Letters to the Editor

The Editor Does not Necessarily Agree with the Views of his Correspondents



## Commutators for Small Electric Motors

**SIR,**—Having purchased three 00 gauge electric locos, I have the following general observations to make in respect of these locos which may be of interest.

My experience is that the permanent magnets with which these locos are fitted seem to lose power in time, with the result that they lose pulling power and run slow.

The commutator is in my opinion too thin in construction and wears too quickly, possibly because of lack of thicker sections to dissipate heat. The magnets' loss of power plus early wear of the commutator cause the loco to fail electrically, it being otherwise mechanically sound.

I rewind the armatures myself and also make my own commutators and in this connection readers may be interested in the construction of these minute pieces which cannot always be purchased to exact size required.

The procedure is as follows. Select a fairly thick copper tube of outer diameter required for finished commutator and cut to correct length, forming a copper cylinder (A) in sketch, which will eventually be finished commutator. Next select a spindle same size as armature spindle and wind on the former continuous paper strip (glue each turn) to form centre for copper cylinder (B).

Glue paper centre and slip over the copper cylinder, which should be a tight fit and should run true on the spindle when spun. When glue is dry, put spindle through cylinder centre and cut two deep grooves all round the copper tube, one groove round the top and one groove at the bottom; this is done with a fret saw (fine blade). The grooves must be deep, but be careful not to go right through, see C in sketch.

The next stage is to cut carefully through the cylinder longitudinally in three places (with fretsaw). Do this carefully so that the segments are not disturbed and remain on the paper centre.

To complete, tightly wind about five turns of cotton thread in the top and bottom grooves (D) and wipe glue in to fix. The cotton must not stand proud of the grooves.

By this method I made a very true commutator at the first attempt; soldered the armature connections to it and fitted it to a model loco, which operates perfectly.

Because of the apparent loss of power of the permanent magnet I turned it into an electro magnet by fitting a distance piece between the pole pieces and winding with similar size wire as on the armature. Better results are obtainable if slightly larger gauge wire is used.

A piece was cut out of the chassis to accommodate the now electro magnet.

The loco so fitted now operates well on either A.C. or D.C., at 15 to 20 volts, but

it is not so easily reversible as with permanent magnet fitting.

Probably a smaller cylindrical commutator than that used in 00 gauge locos would never be required and it is doubtful if a commutator so small, solid and so accurate could be made at home by any other method than that described.

The use of thick copper tube is important in my view to allow for heat dissipation and to give the commutator long life. The actual measurements of commutator made for 00 loco are given at A in the sketch.—**J. H. MITCHELL** (Leamington Spa).

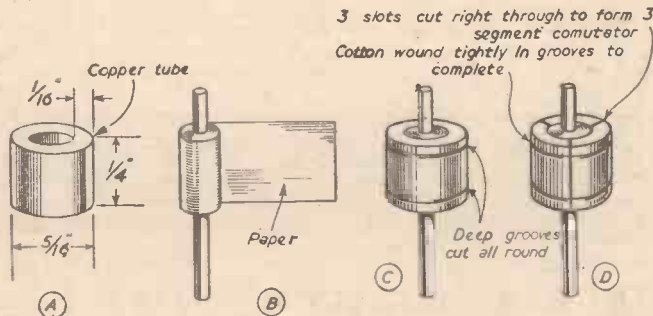
## Making a Transfer

**SIR,**—In reply to D. G. Brinjes' (Maidenhead) query in the July issue of PRACTICAL MECHANICS, make a solution of water, starch and washing "blue" to the consistency of cream (the amount of "blue" gives the depth of colouring).

This is then applied to, say, tracing or grease-proof paper on which is drawn the desired design.

When dry it can be transferred to the most delicate of cloths by means of a warm iron.

Used needlework papers can be re-used by this method, the advantage being that when the fabric is washed it leaves neither stain nor mark.—**D. E. BANKS** (Workington).



Stages in Mr. J. H. Mitchell's method of making small commutators.

## Garden Fountain

**SIR,**—Regarding the query from F. Evans (page 430, July issue), many advertisers in PRACTICAL MECHANICS offer small 24-volt motors and pump units. I would suggest that one of these be purchased together with a suitable transformer. The transformer should be kept in the house and the low voltage only taken outside.

A drain hole from the pool should be about 1/2 in. bore and the fountain pipe proper be about 1/2 in or 5/16 in. with a 3/16 in. jet.

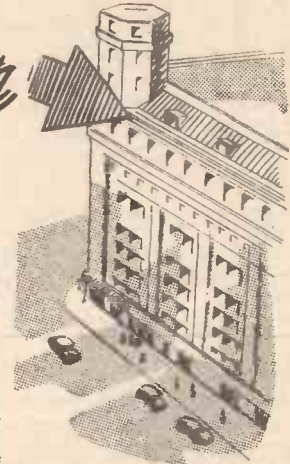
It is difficult to give more precise dimensions without a definite motor and pump but I would suggest the fountain pipe does not project more than 1 ft. above the water.—**JAMES K. NICHOLSON** (Lancs.).

## Air Compressor Safety Valves

**SIR,**—On page 486 in the August issue of PRACTICAL MECHANICS, a query regarding Air Compressor Safety Valves is dealt with

and the reader is referred by you to various firms.

As you will observe from the displayed advertisement relating to our products on page 438 of the same issue we are manufacturers of spray painting equipment and we are in a position to supply the type of equipment which is the subject of your reader's enquiry.—**B. E. N. PATENTS, LTD.**



## Chinese Concentric Balls ; Tube Bending Machine

**SIR,**—Re your reply on Chinese Balls, page 486 August issue; these were not "carved," but turned and bored. The whole process is described in Volume IV of Holtzapfels "Turning," which every turner should read. It gives the basic principles of all mechanical work and the methods used a century ago, employing simple tools.

Regarding the Tube Bending Machine, page 451 of the August issue, it would be simpler and quicker, when forming the half-round groove in the guide, to place two pieces of plate together and drill edgewise through where they meet, discarding one piece.—**J. E. D.** (Tyne Dock).

## Flying Saucers

**SIR,**—My question on the above subject is: "Having got so near to the Earth, why don't these things land?" Several writers have pointed out that there is nothing new about them; they were seen (under a different name, of course) in various parts of Europe some 300 years ago.

Then (disregarding the "known" landings, now almost universally discredited), why are they taking such a long time to make up their minds to land? It cannot be gravity difficulties because they have been seen at low levels where gravity has about the same value as at surface.

It cannot be atmospheric trouble either. If they had only been seen about 50 miles up, like small noctilucent clouds, their protagonists would have a strong argument: "They are afraid to enter our atmosphere because they have not yet conquered the problem of motion through such a dense medium... they have no materials that will stand up to the pressure when travelling through at high speed..." Landing implies emerging from the vessel, and I admit there could be trouble with pressure on their bodies, but, as a supporting point, it can be negated. Someday our own spaceships will get within a few hundred miles of the Moon. Does anyone believe it will take another 300 years to obtain the knowledge that will implement a landing? I do not think so.

Supporters of the F.S. could reply plausibly that, after a hundred years and more of experiment in diving technique, men have only been able to descend a few trivial fathoms—and the 7-mile depth still faces them. This, too, can be negated, for if in course of time men get down 6 1/2 miles (as they may well do), I am prompted to repeat my question: "Does anyone believe

**EVERY CYCLIST'S POCKET BOOK**  
7/6 or 7/10 by post from the offices of this journal.

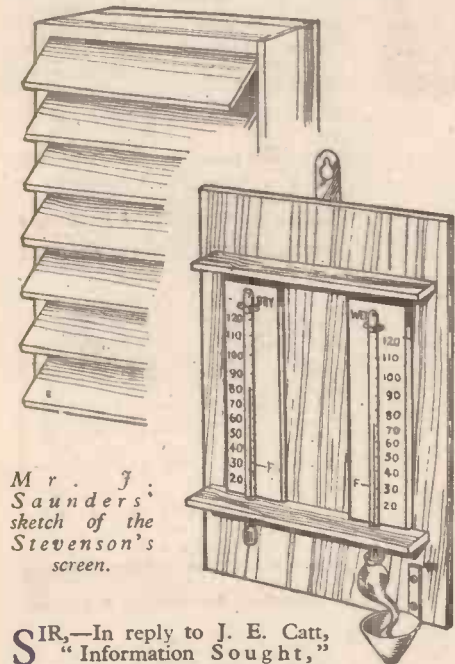
it will take 300 years to cover the remaining  $\frac{1}{4}$  mile?" Are the Martians afraid we may be hostile? Did that stop our early explorers from landing among aggressive peoples? Our hope is that the planets may be inhabited. My view on the F.S. coincides, I think, with yours and with the great majority of your readers, which is, that there could be such things and, if so, they will be strictly of terrestrial origin. If they are manned, their occupants, instead of being those funny little wights beloved by cartoonists, would prove to be just the plain *hominines* we rub shoulders with in the street.—P. BOWN (Northampton).

**Stevenson's Screen**

SIR,—In reply to Mr. J. E. Catt, "Information Sought," August, 1956, issue, regarding the housing of meteorological instruments, may I suggest that he buys an excellent Meteorological Office publication on this subject entitled "Instructions for Making Thermometer Screens of the Stevenson Type" (Form 63). It is published by the Stationery Office, York House, Kingsway, London, W.C.2, price one shilling.

This booklet gives constructional details down to the last nail and inch of wood, quoting dimensions which are standardised and make the temperature readings comparable to others and useful.

Both the Bilham and Stevenson screens are given, the difference being in size, the Bilham having accommodation only for thermometers, i.e., generally smaller dimensions.—M. H. O. HODDINOTT (Chester).



Mr. J. Saunders' sketch of the Stevenson's screen.

SIR,—In reply to J. E. Catt, "Information Sought," August, 1956, issue, the following may be of use. As the sketch shows, the screen is a simple box, about the size of a domestic medicine cabinet, with a louvered door which allows the free passage of air but prevents the entry of rain. Naturally, the size of the screen depends upon the size of the thermometers, but should be as large as possible so that ventilation may be complete. So that the effects of radiated heat from the sun may not influence the readings of the thermometers the screen is usually painted white.

The screen is used to cover the hygrometer which is an instrument for measuring the moisture content of the atmosphere. The most widely used hygrometer is based on Mason's principle and consists of a combination of two thermometers, placed within not less than 3in. of each other. The bulb of one is kept damp with a small piece of cambric

tied loosely on, and a few strands of lamp wick, two or 3in. long, hang down into a cup of water.

The hygrometer measures the humidity of the air. Evaporation takes place when air is dry and so the moisture dries off the cambric thus reducing the temperature of the wet bulb thermometer. Consequently, the drier the air the greater will be the evaporation. When the air is moist there is less evaporation and the difference between the readings is correspondingly less. On the other hand, in very dry weather the wet bulb is sometimes as much as 10 degs. lower than the dry bulb.

—JAMES SAUNDERS (Cardiff).

**Actuator Modification for Radio Controlled Aircraft**

SIR,—Having just purchased an E.D. standard actuator and converted it to the "Bonnerised" system described in your

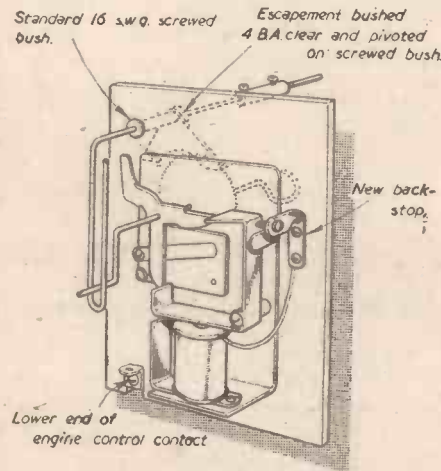


Fig. 1.—Mr. Cartwright's improved actuator.

July issue of PRACTICAL MECHANICS, I was very puzzled to find that I could not stop the starwheel in the intermediate positions. Presuming that the escapement wheel pawls required slowing, I weighted them, still with negative results. I then found what your contributor seems to have overlooked—that the current saving device was only giving sufficient pull at the first signal.

Subsequent signals were passing through the full coil resistance, cutting the amps down, so that unless I reduced the air gap between magnet and armature or put up with 300 mA consumption in the hold-on positions, I could do nothing but stop left rudder.

To avoid the complications involved in reducing the air gap, I decided upon the

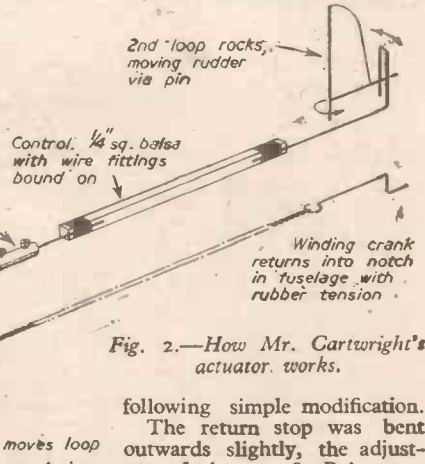


Fig. 2.—How Mr. Cartwright's actuator works.

following simple modification.

The return stop was bent outwards slightly, the adjustment being restored by an 8 B.A. set-screw mounted in a "split and nipped" tapped hole in a stout bracket, which was mounted on the paxolin panel just clear of the actuator chassis. The lead was then carefully removed from the existing springy-bronze contact and soldered to the new back stop. The shorting circuit is thus completed at every return of the armature and not as before at every complete revolution of the neutral star arm. I would stress that the new fitting must be rigid otherwise a buzzer action will be experienced. Mine was made from a short piece of  $\frac{1}{4}$ in. wide silver solder strip, see sketch, Figs. 1 and 2.

I use a standard chain sprocket from a toy construction kit,  $1\frac{1}{4}$ in. dia. and with 18 teeth. A new bush is fitted having  $9/16$ in. hole.

Returning the drive spindle to the same side as the rubber hook enables the actuator to be mounted just behind the receiver amidships. This keeps the weight in the right place and increases the length of the rubber motor. Winding can be done from the rear without access to the interior, and wiring, having possible capacity effect, is shortened considerably.—EDWARD CARTWRIGHT (Lincs).

**Wind Generator Plant**

SIR,—In reply to A. J. Banwell in July P.M. I have a 12 volt Sims-Bosch 4-pole slow speed dynamo that required rather a high speed to start generating. I cut the connections between the two field coils, and connected one brush to end of one coil and the other end of coil to other brush. The first brush again to starting end of the other coil and other end of coil to the other brush. Thus I can coil string around the shaft and it generates at (I should imagine) about a hundred r.p.m. There is a snag: when driven by windmill after about a week the commutator becomes black and fails to generate. I use a home-made wooden propeller 6ft. long, 4in. wide and zin. thick.—J. W. B. (Stoke-on-Trent).

**PRACTICAL MOTORIST**  
AND  
**MOTOR CYCLIST**  
Edited by F. J. CAMM  
October Issue Now On Sale

Principal Contents: Fitting Windows to Vans; A Roof Rack for 30/-; Maintaining The Car Radio; Making & Fitting Hot Air Ducts; Overhauling the 1-2 & E Morris 8; Temperature Recording; Petroleum Products for the Motorist; Shock Absorber Modification; Building a Steel-Framed Garage; Motor Cycle Valve Timing; Building a Child-Adult Sidecar; A Garage Mechanic's Diary; and many other interesting articles.

FOR WORKS, LABORATORY OR HOME USE

THE "DERMIC" OILER

5/9 Post Free

As supplied to Official Departments and Undertakings, Engineering, Aviation and Electrical firms, etc. 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. Can also be used for the clean and efficient application of soldering fluid. Packed in box with full instructions. 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

This **ELORA** SOCKET SET



20/- DOWN

This giant set of ELORA 1/4 in. Sq. Drive Socket wrenches of Chrome-Vanadium Steel with bright Nickel finish and in a handy, blue crackle enamel metal case, it comprises a Reversible Ratchet, Speed Brace, T-Handle, 5in. and 10in. Extensions, Universal Joints, 7 Whit. Sockets 1/8in. to 1/2in., and 10 American Sockets 3/8in. to 7/8in. Cash £7.4.6 or £1 dep. and 7 m'nthly pay's of £1. Also large set of 10 Whit. Sockets, 1/8in. to 3/4in., and 12 American Sockets, 3/8in. to 1in. Cash £9.9.9 or 25/- dep. and 7 monthly pay's of 26/6. List Free.

BARGAIN DISTRIBUTORS, Dept. 16, 5, SILVER STREET, LUTON

CHILTON ELECTRIC HOME HAIR CLIPPER

Keep short hair-styles smartly trimmed with the Chilton. Gives the professional comb-and-scissors action. Slip comb off and use to tidy neck hair. Useful for children's hair, also for men too busy to visit barber. Plugs into lamp-holder. Complete with plug. A.C. only. 210/250v. £4.14.6 cash or 2/6 deposit and 6 month payments of 17/- 12 months' guarantee. ALSO hand clippers 16/-



save time. money

2/6 DEPOSIT

Send for list of other Bargains.

SPARKS' DATA SHEETS

THE UNRIVALLED SERVICE  
If you are thinking of making a Radio, a Portable, an Amplifier or a S.W. Set, you may be wondering which "Constructional Sheet" to buy. If so, note this:

SPARKS' DATA SHEETS  
Enjoy a world-wide reputation—and that is Fact not Fancy—for Simplicity, High Efficiency and truly Trustworthy Designs.

FULL SIZE PRINTS  
Do not confuse Sparks' Data Sheets with F'scap pages of diagrams. The first is, well, what it is, whereas the second is an "architect's" print of a draughtsman prepared plan of a Fully Tested and Guaranteed Design, solely produced as a Design and not just to sell components. If in doubt, ask the Technical Press, the Trade or any of the 100,000 plus well satisfied users of Sparks' service. A 21d. STAMP SECURES MY LATEST LIST.

L. ORMOND SPARKS (M), VALLEY ROAD, CORFE CASTLE, DORSET

MODEL BOATS

Plans : Kits : Engines : Etc.

4d. in stamps for Lists.  
LAWRENCE MODEL SHOP  
106, LAWRENCE ROAD,  
LIVERPOOL, 15.

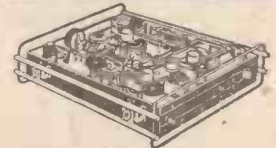
MAKE A RADIO

NO SOLDERING—only a screwdriver and pliers needed. FULL-SIZE plans and easy-to-follow building instructions for 8 sets, 2/6 post free.  
CRYSTAL RADIO KITS at 10/6, 17/6 and two at 21/- post free.  
EXPERIMENTAL KIT NO. 1, builds 4 different crystal sets, 27/6 post free.  
"BASIC," a very simple 1-valve set, 35/- post free with valve and batteries.  
"NEW ECONOMY 1," 52/6 post free.  
"NEW ECONOMY 2," 82/6 post free.  
"PERFECT ONE," £3 post free.

Send S.A.E. for list—or send 2/6 P.O. for building instructions for all 8 sets.

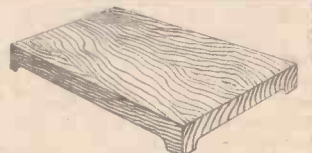
BLANCHARD'S, DEPT. RM,  
13, Gainford Gardens, Manchester, 10

BOMB SIGHT COMPUTOR



FOR THE MODEL MAKER  
Packed with beautifully made gears, Driving Shafts, Bearings, Gyroscopes, Motors, etc., all of which have unlimited use. Every model maker will find that one of these computors will save pounds, and hours of labour.  
Price £2.12.6 carr. paid

SURFACE TABLES



First grade Surface Tables at a price the Model Maker can afford. These Tables are either as new or new. Planned to an extremely high degree of accuracy. Limited quantity only.  
6" x 12" £4.10.0 carr. paid.  
12" x 18" £5.10.0 carr. paid.  
Also larger Industrial Surface Tables. Prices on application.



BLACKBUSHE AIRPORT,  
CAMBERLEY, SURREY  
Phone: CAMBERLEY 1600

You simply pour out these

NOVELTIES

with NEW LIQUID PLASTIC

Here's the hobby to make your spare time pay dividends. You simply choose your mould and pour out beautiful castings. We supply everything, including instructions. Start right away—no training needed. Send 1/- (refunded on first purchase) for exciting book and market details. No obligation.



QUALITY PLASTICS LTD.

Dept. P.M.11 · BRENTWOOD · ESSEX

THIS IS The Fraser SAW SHARPENER

NOW filling a long-felt want of the craftsman and handyman. Ensures accurate and uniform depth of teeth. Simple to use. Takes less than 30 minutes. All steel construction. 8in. long. Case hardened guide and rollers. 50,000 sold in Australia and New Zealand during the past three years. Now obtainable in this country.

RETAIL PRICE 21/- CARRIAGE PAID.

From Ironmongers, tool merchants, or the manufacturers:

BORER ENGINEERING (TOOL) CO.

(DEPT. P.M.), 54, PARK LANE, CROYDON, SURREY

TRADE ENQUIRIES INVITED

DO YOUR OWN ELECTRO-PLATING

AND SAVE ££'s

NEW INVENTION replates metals and gives a hard chrome finish. Complete only DuKROME 13/6 Outfit (Large Outfits 25s. 0d.) Also "DUSILVA" Outfits at 15s. 0d. deposit genuine silver plating. Send P.O. now, or for details and plated sample send 4d. (stamps) to:


A. DUTCH & CO.  
Monkhams Lane, Woodford Green, Essex.



CHEMISTRY APPARATUS

Send 2d. stamp for COMPLETE PRICE LIST

Booklets:  
"Experiments" 10jd.  
"Formulas" 10jd.  
"Home Chemistry" 2/8  
Post Paid.



BECK (Scientific Dept. A)  
60 HIGH STREET,  
Stoke Newington, London, N.16

SILVER METAL AND GLASS

Trade materials: no "toys." Books: Silvering Old Mirrors, 2/9; refunded off material; cost 6d. ft. Electroplating, 109 pages, 6/8; with salts and silver anode, 11/6. All plating materials 16-30/- Inform. and sample bangle. 2/6; refunded. This offer is invaluable. We advertised "P.M." Aug. '45/Feb. '49.  
CANE & CO. (ARGENTA)  
BRIGHTLING, ROBERTSBRIDGE SUXSEX.

RATCHET & REVOLUTION COUNTERS

PLEASE ASK FOR CATALOGUE  
Instrument Division  
B. & F. CARTER & Co., Ltd., Bolton 5



SPECIAL OFFER G.E.C. & B.T.H. GERMANIUM CRYSTAL DIODES

1/- each. Postage 2½d.  
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.  
TUENOL 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 Coiled 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

PORTASS LATHES

DIRECT PERSONAL SERVICE.  
LARGE DISCOUNT FOR CASH.  
NO INTEREST CHARGED for easy terms.  
CAN ANYONE DO BETTER ?  
1/- for Lists, please. Dept. P.M.  
BUTTERMERE WKS., Sheffield, 8

# Trade Notes

## The Solascope

PRODUCED by H. H. Freeman & Co., 44, London Road, Kingston, Surrey, the Solascope is a rotary guide on similar lines to the more familiar photographic exposure calculator. However, instead of indicating exposure, movement of the centre disc reveals a mine of information relating to the solar system. Over 1,000 facts and figures are included pertaining to the sun and planets, including space travel computations. Three models are available: one, of double-sided three-piece construction and showing all the planets, costs 9s. 6d. and two others, each of two-piece construction and showing half of the planetary system, cost 5s. 6d. each.

## New Range of Wolf Portable Electric Drills

MESSRS. WOLF ELECTRIC TOOLS, LTD., have started production of a new range of industrial portable electric drills. They range from  $\frac{1}{4}$  in. to  $\frac{1}{2}$  in. capacity and are an extension of the existing range of  $\frac{1}{4}$  in. to

The new Wolf electric drill.



$\frac{1}{2}$  in. heavy duty industrial drills. The most important new feature of these machines is that the inside of the switch handle and switch handle cover adjacent to the live switch parts are covered with a permanently moulded layer of insulating material. A further feature of interest is that they are fitted with continuously rated motors, giving them extremely high penetration speeds. Prices range from £17 15s. to £20 5s.

## Fonadek Telephone Amplifier

THE unit shown in the photograph is brought into operation when a call is received by placing the receiver on it (an act which leaves the user's hands



The Fonadek telephone amplifier, which incorporates a loudspeaker and a microphone.

free). This action switches on a microphone and loudspeaker, enabling any number of persons to join in the conversation, speaking at some distance from the telephone, and listening by means of the loudspeaker at the same distance. If greater amplification is required an external loudspeaker may be used and a multi-amplifier for connecting the Fonadek with loudspeakers in other parts of a building is available.

Prices are—

- Battery-operated model, 16 guineas;
- All-electric model, £23 10s. od.;
- Multi-amplifier, £12 10s. od.;
- External loudspeaker, 3 guineas.

The manufacturers are Messrs. Fonadek (Branson) Limited, Knightsdowne House, Vivian Road, Birmingham, 17, and the unit is also

(Right)—The "Do-it-yourself" soldering kit.



obtainable from leading office equipment dealers and radio and TV suppliers.

## Sawing and Woodturning Booklet

FROM Messrs. Black and Decker we have received No. 3 of a series of booklets published by them on the use of their tools and accessories; this one is entitled "Sawing and Woodturning" and contains hints and tips on the use of the relevant Black and Decker units in some of the many jobs on which they can be employed. The previous two booklets were "Drilling" and "Sanding and Polishing." All three booklets are available free to owners of home handyman electric tools and application should be made to Black and Decker Limited, Harmondsworth, Middlesex.

## The "Do-it-yourself" Soldering Kit

THIS kit is a combination of some of the latest soldering products of Perdeck Solder Products Ltd., Waltham Abbey, Essex, and the Valtock "2000" blowlamp, made by Valtock Ltd., 6, Sherwood Street, Piccadilly Circus, London, W.1. No soldering iron is necessary. The small and lightweight blowlamp is constructed of solid brass, nickel plated and produces a small but intense pencil flame. If required it may be carried in the pocket.

The terms "paint," "paste" and "putty" when applied to these solder products are illustrative of the texture of the solders and

each is designed for use in different types of soldering work. Also included in the kit is a "tinning salt," which is used for tinning through rust, paint or other corrosion. The chief advantages are simplicity and economy in use, combined with high efficiency. A photograph of the kit appears on this page; it includes tins of solder paint, solder paste and tinning salt, Valtock blowlamp, mixing dish, a brush and a wiper. The price of the kit is 39s. 6d.

## Dunlop Valve Inserts

ALL roadster type cycle tubes made by Dunlop for the replacement home market from now on will be fitted with the Dunlop Easypump valve insert. The insert is interchangeable with the rubber sleeve type and replacements can be purchased for 1s. per packet of two. Use of the Easypump insert means that far less effort is needed to inflate a tyre, air retention is improved and pressure checking is possible.

The G.20 Dunlop pressure gauge is available for this purpose and retails at 8s. 6d. (Two inserts are included with each gauge.)

## Mawhood Bros. Ltd. Address—Correction

WE have been informed that the address given for the above firm on this page in our August issue was not correct. The correct address is: Palm Tree Works, Trippet Lane, Sheffield, 1.

## Model Boat Building

6th Edition

By F. J. CAMM

5/-, By post 5/8

From GEORGE NEWNES, LTD.,  
Tower House, Southampton Street,  
Strand, W.C.2



# Your Queries Answered

similar way and it can be applied with a brush. Polyvinyl acetate is obtainable from most of our advertisers of plastic materials.

Vinyl Products, Ltd., Butter Hill, Carshalton, Surrey, have, also, a good range of synthetic lacquers which you could also use for the above purpose, taking care not to employ those which dry with a slight permanent tackiness.

## Casting Materials

**I WISH to make some model seagulls with outstretched wings to ornament ash trays I have made. I have an ideal model with about a 3in. wing span which is made of metal.**

### 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.

**I have purchased some Fleximould and have succeeded in making a good mould. What is a suitable casting mixture for use with the Fleximould?—F. Aust (Plymouth).**

**FOR making the model seagull you could use ordinary plaster of Paris slaked to paste consistency with a solution of 10 parts of**

gelatine in 90 parts of water. This would be slow setting, but the method is a cheap one and it would not involve the use of heat and thus destroy the mould.

If you require to use a metal you should employ Wood's metal which can be obtained from British Drug Houses, Ltd., Poole, Dorset. This alloy melts about 68 deg. C. and costs about 21s. a lb.

Another possibility is the use of Vinamould resin which is obtainable from Vinyl Products, Ltd., Butter Hill, Carshalton, Surrey.

A further alternative would be to use "Catacast" resin supplied by Catalin, Ltd., Waltham Abbey, Essex. This is a phenol-formaldehyde synthetic resin, which is supplied in the form of a syrup and which, after mixing with a small amount of "acid accelerator," sets within about 24 hours to a transparent mass.

## Protection Against Paint Solvents

**CAN you please tell me of a solution which I could apply to the ends of a cylinder made from bitumised cardboard, which would make the cardboard roller impervious to paint solvents, particularly turps, and also which would be waterproof?—R. Colebourne (Southsea).**

**THERE are very many different kinds of paint solvents, and there is no single substance with which you could coat the cardboard and which would render it impervious to every possible type. For most purposes a thick coating of shellac dissolved in methylated spirit would be quite suitable. This would hardly disturb the bitumen within the cardboard but it would *not* render the cardboard impervious to any solution of paint softener containing alcohol. It would be quite resistant to turpentine (genuine or substitute) and also to paraffin, naphtha, etc. It would also be waterproof.**

Another very cheap method is to use a rather thick solution of ordinary glue. Paint this on hot with a brush in three separate layers, giving each layer time to dry before the next one is applied. You will, in the end, thus obtain a shiny coating like varnish on the surface. When this has been attained, brush it over with a mixture of commercial formalin and water (equal proportions) and then allow it to dry. The formalin treatment will insolubilise the glue layers, rendering them waterproof and the glue itself will be impervious to most paint solvent liquids, including all alcohols and methylated spirit.

## Heat Proofing Saucepan Handles

**CAN you tell me of any substance that I can use to mould over metal saucepan handles and so render them heatproof?—R. Bamber (Surrey).**

**HEAT-RESISTING** saucepan handles are generally moulded and pressed on to the existing metal handle of the pan in a specially designed press. On a small scale this would hardly be possible for individual working. We suggest that you wrap the metal handle tightly with fine string. A wooden or cardboard mould must then be constructed to slip over the string-bound handle, giving about 3/16 in. clearance. Both handle and mould are then clamped rigidly in a vertical position and the casting mixture poured into the mould and allowed to set. One good mixture is equal quantities of magnesite and fine asbestos powder, this being slaked to mortar consistency with a solution prepared by dissolving 40 parts of magnesium chloride in 60 parts

## Storing Cement

**I BUY cement in the usual 1 cwt. bags, but often do not use it all at one time. What is the best way to keep it?—R. C. Duffus (Angus).**

**A VERY** simple way of overcoming your difficulty is to keep the cement in its original three-ply paper container and to drop the whole package into an ordinary, well-lidded galvanised dustbin of the common type. The dustbin should be kept in a warm place, preferably above an oven, stove or near hot-water pipes.

If you cannot avail yourself of the necessary warm, dry situation, the only alternative is to lay over the top of the open ended dustbin (after the cement bag has been placed therein), several layers of sacking (hessian) which have been impregnated with oil. The top is then pressed down over these layers, making a forcible, tight fit. The dustbin should be stood on several bricks at a height of about 1 ft. above the ground, thus enabling a good draught to be set up underneath it. The oiled sacking will act as a barrier to the ingress of moisture and will keep the cement in good condition for months.

A combination of the above methods is, of course, very good, but, provided you can avail yourself of a good, warm situation, we find that the provision of oiled sacking across the top of a bin is not necessary.

## Flexible Gloss Finish on Rubber

**WHAT is the solution or hard gloss finish that is applied to rubber Wellington boots? I have experimented with several solutions on scrap rubber, and have obtained a good glossy black finish, but after rough handling the solution runs into minute cracks. Is there a suitable lasting finish that can be applied?—L. V. Cole (Northants).**

**A SIMPLE** solution to provide a good gloss on rubber Wellington boots is a solution of shellac in methylated spirit. This is made to about paint consistency and is wiped on thinly with a soft pad or flannel. This resists water and is readily removed from the rubber by means of methylated spirit. It is also capable of taking a semi-matt wax finish by the use of any good floor polish.

If you want to colour the shellac finish merely dissolve a little black or brown dye, in the shellac polish. The dyes must, of course be of the spirit-soluble variety. Another solution would be made by dissolving 15 parts of polyvinyl acetate in 85 parts of warm, methylated spirit. This may be dyed in a

## THE P.M. BLUE-PRINT SERVICE

- 12FT. ALL-WOOD CANOE. New Series. No. 1, 3s. 6d.\*
- 10-WATT MOTOR. New Series. No. 2, 3s. 6d.\*
- COMPRESSED-AIR MODEL AERO ENGINE. New Series. No. 3, 5s.\*
- AIR RESERVOIR FOR COMPRESSED-AIR AERO ENGINE. New Series. No. 3a, 1s.
- "SPORTS" PEDAL CAR. New Series. No. 4, 5s.\*
- F. J. CAMM'S FLASH STEAM PLANT. New Series. No. 5, 5s.\*
- SYNCHRONOUS ELECTRIC CLOCK. New Series. No. 6, 5s.\*
- ELECTRIC DOOR-CHIME. No. 7, 3s. 6d.\*
- ASTRONOMICAL TELESCOPE. New Series. Refractor. Object glass 3in. diam. Magnification x80. No. 8 (2 sheets), 7s.\*
- CANVAS CANOE. New Series. No. 9, 3s. 6d.\*
- DIASCOPE. New Series. No. 10, 3s. 6d.\*
- EPISCOPE. New Series. No. 11, 3s. 6d.\*
- PANTOGRAPH. New Series. No. 12, 1s. 6d.\*
- COMPRESSED-AIR PAINT SPRAYING PLANT. New Series. No. 13, 7s. 6d.\*
- MASTER BATTERY CLOCK.\* Blue-prints (2 sheets), 3s. 6d. Art board dial for above clock, 1s.
- OUTBOARD SPEEDBOAT. 10s. 6d. per set of three sheets.
- LIGHTWEIGHT MODEL MONOPLANE. Full-size blue-print, 3s. 6d.
- P.M. TRAILER CARAVAN. Complete set, 10s. 6d.\*
- P.M. BATTERY SLAVE CLOCK, 2s.
- "PRACTICAL TELEVISION" RECEIVER (3 sheets), 10s. 6d.
- P.M. CABIN HIGHWING MONOPLANE. 1s.\*
- P.M. TAPE RECORDER\* (2 sheets), 5s.

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.

of water. Another mixture can be prepared by making a thick paste of bakelite varnish and powdered asbestos.

Asbestos powder in various grades is obtainable from Turner Bros., Asbestos Co., Ltd., Rochdale, Lancs., or from Bell's Asbestos and Engineering Ltd., Bestobell Works, Slough, Bucks. Magnesite can be obtained from Messrs. Everitt and Co., Ltd., 40, Chapel Street, Liverpool 3. Magnesium chloride is supplied by Messrs. S. Pitt and Co., Ltd., 95, Bath Street, Glasgow.

**Silver-grey Finish on Steel**

**I WISH to obtain, on steel, the silver-grey finish which is rapidly becoming popular on such things as front lamps of cycles. Can you help?**—R. E. Matthews (S.E.5).

**THERE** is no satisfactory method of obtaining the silver-grey finish on steel by chemical methods alone. This finish on commercial articles is always an applied lacquer. Two good lacquers of this type are available from Messrs. Wm. Canning Co., Ltd., Gt. Hampton Street, Birmingham, 18. They are "Auralene No. 699," which is a cellulose medium to which bronzing powders have to be added and "Colorite No. 1304," which is a transparent coloured cellulose lacquer. One or other of these, we feel sure, would fulfil your purpose.

If, however, you wish to attempt the colouration by purely chemical methods the steel would have to be brass-plated beforehand and then immersed in the following bath until the colouration has developed:—

- Arsenious oxide ... 75 grams
- Hydrochloric acid ... 1 litre

(the arsenic oxide is dissolved in the acid, during which highly poisonous fumes are evolved).

Since, however, this solution gives a rather dark-grey colouration we doubt whether it would be suitable for the purpose which you have in mind. The plain or pigment-lacquering method is undoubtedly the one for your needs, this, as we have stated, being the commercial procedure.

**Waterproofing an Elm Bowl**

**I HAVE** an elm rose bowl which is porous. Would you please inform me of a method of making this permanently waterproof without destroying the polished surface?—R. Crocker (Bracknell).

**YOU** do not tell us whether the elm rose-bowl is polished within or without, but, in actual fact, it will be a rather difficult matter to make the bowl permanently waterproof without injuring its present polish. The only way we can suggest is that you give both inside and outside of the bowl three separate coatings of a suitable moisture-resisting synthetic varnish. We recommend for this purpose the toluene solution of polybutyl methacrylate which is made by Vinyl Products Ltd., Butter Hill, Carshalton, Surrey. This varnish dries within about 30 hours at ordinary temperatures and it will impart a high continuous glaze to the surface on which it is laid.

**A Honing Stone**

**I WANT** to make a honing stone and I would like to know what bonding substance to use with such materials as corundum, carborundum and emery. Also whether it is possible to use other materials for padding, and sources from which these can be obtained.—E. Williams (Leicester).

**A VARIETY** of bonding materials can be used in the construction of modern abrasive wheels, these including various clays, mineral cements, rubber compounds and various synthetic resins. Each of these

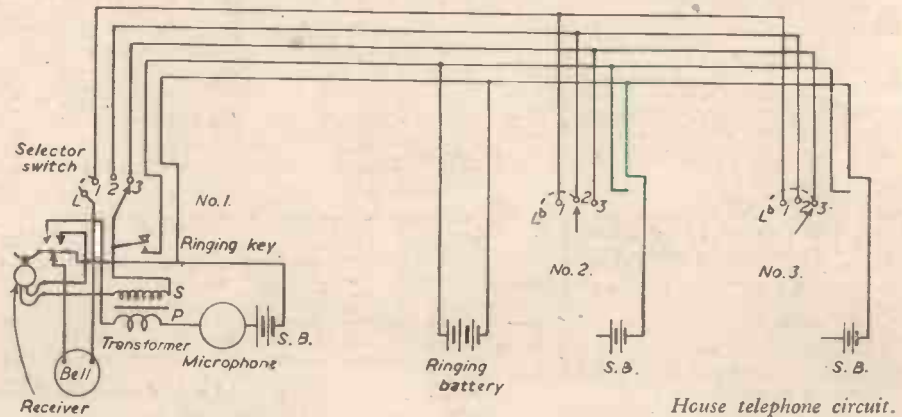
materials has its own particular advantages—and disadvantages. For average use the following formula for a grinding wheel material is quite effective:

- Abrasive grains ... 100 parts (by measure).
- China clay ... 12.5 " "
- Sodium silicate (waterglass) ... 12.5 " "

Mix the ingredients well. Tamp the resulting paste into moulds, allow to air-dry until the block can be handled safely. Then heat it to 300-400 deg. F. for a day or more until the reaction between the clay and the silicate has produced an insoluble bonding material.

**can fix up a two-way system satisfactorily but I am having trouble with the polarity of batteries on a three-way system. The handsets I am using are ex-G.P.O., similar to the ones in present use. I am also using a switch hook arrangement to charge connectings from bell to handset.**—L. Harwood (Middlesbrough).

**THE** following circuit diagram may be suitable for your purpose. Each set of instrument connections are identical except that the L connection from the bell of No. 1 set is connected to No. 1 stud of the selector



**House Telephone Circuit**

**COULD** you let me have a circuit for a three-way house telephone system preferably using a central battery? I

switch; whilst the L connection of No. 2 set is connected to No. 2 stud of the selector switch and so on. A central ringing battery is employed, with individual speaking batteries.

**Information Sought**

Readers are invited to supply the required information to answer the following queries.

**Wire Bending Jig**

**PLEASE** give details for the construction of a jig for bending wire to make fittings to hook on to a pegboard.—J. McDONNELL (Southend).

**Using Ex-Government Equipment**

**CAN** ex-R.A.F. elbow telescopes be used for ordinary land observation without any alteration? I have some Ex-Naval telescopic gun sights, but these have no magnification. How can they be altered for use as an ordinary telescope?—C. O'LEARY (Dublin).

**Stoved Varnish**

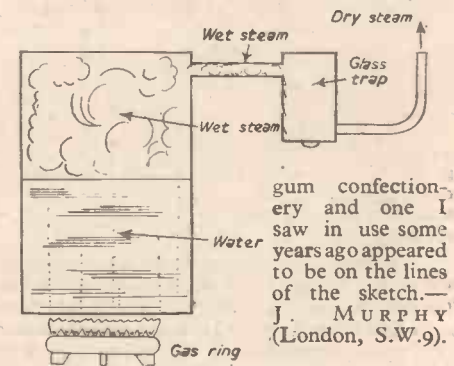
**PLEASE** give me a formula for stoved varnish, temp. 150-200 deg. F. and shellac based if possible. It is for use on small wood carvings, etc., on which I wish to obtain a finish superior to normal brushwork, and also to seal the wood more effectively.—E. J. ALLEN (Beds).

**"Wet-Dry" Indicator Mechanism**

**I WISH** to repair the "Wet-Dry" indicator on a 30in. mercurial barometer of which all the mechanism is missing, only the dial being left, at the top of the barometer case. Can you tell me the principle of the mechanism, which I believe involves the use of straw and gut?—W. HANCOCK (Radnor).

**Producing Dry Steam**

**I WISH** to produce a small jet of dry steam, which will be required to last about 15 minutes. Can you give me the address of a firm making such apparatus or tell me how to make it myself? It is required to glaze



gum confectionery and one I saw in use some years ago appeared to be on the lines of the sketch.—J. MURPHY (London, S.W.9).

**Telescope Optical System**

**WHAT** is the order of assembly of the following parts, which comprise a "Fairfax" 18x telescope (length extended, 11 1/2 in.)?

- Two lenses 3/4 in. focal length.
- One lens 1 1/4 in. focal length.
- One light-stop, aperture 5/16 in.
- One hollow fibre spacing-piece 9/16 in. long.
- One hollow fibre spacing-piece 2 1/2 in. long.

All these parts are 9/16 in. external diameter. The eyeshield which screws on to the end of the tube has an aperture of 7/16 in. and the object-glass is 3/4 in. effective diameter, with a focal length of 7 in.

Would you also explain the principle governing the magnification factor?—W. MAY (Essex).



# NEW! THE PRACTICAL WAY

of learning **RADIO • TELEVISION • ELECTRONICS**  
**AMATEUR S.W. RADIO • MECHANICS • PHOTOGRAPHY • CARPENTRY • ETC • ETC**



**DO IT YOURSELF!**  
 IN YOUR OWN HOME — IN YOUR OWN TIME

An entirely new series of courses designed to teach Radio, Television and Electronics more quickly and thoroughly than any other method. Specially prepared sets of radio parts are supplied and with these we teach you, in your own home, the working of fundamental electronic circuits and bring you easily to the point where you can construct and service radio receivers, etc.

Whether you are a student for an examination; starting a new hobby; intent upon a career in industry; or running your own business — these Practical Courses are ideal and may be yours at very moderate cost.

With these outfits, which you receive upon enrolment and which remain your property, you are instructed how to build basic Electronic Circuits (Amplifiers, Oscillators, Power Units, etc.) leading to designing, testing and servicing of complete Radio and Television Receivers.

**OTHER COURSES WITH PRACTICAL EQUIPMENT INCLUDE:**  
**RADIO (Elementary and Advanced) • TELEVISION MECHANICS • ELECTRICITY • CHEMISTRY • PHOTOGRAPHY CARPENTRY.**

**Also Draughtsmanship • Commercial Art • Amateur S.W. Radio • Languages • Simple Electrical Repairs in the Home • Painting and Decorating • Etc. • Etc.**

With these outfits, you are given instructions that teach you the basic principles in the subject concerned.

**NEW TELEVISION COURSE** including a complete set of equipment dealing with the design, construction and servicing of a high quality television receiver.

**COURSES (with equipment)** also available in many other Engineering subjects.  
**COURSES FROM 15/- PER MONTH**

Photograph of EMI factories at Hayes — Our Industrial Background



An Educational Organisation associated with the E.M.I. group of Companies including 'HIS MASTER'S VOICE', COLUMBIA, etc.



To E.M.I. INSTITUTES,  
 Dept. 144, 43 Grove Park Road,  
 London, W.4.

NAME .....  
 ADDRESS .....

SUBJECT(S) OF INTEREST.....  
 Oct. (We shall not worry you with personal visits) I.C.76

**ELECTRO MAGNETIC COUNTERS**



Post Office type 11A, counting to 9,999. 2 to 6 volts D.C. 12/6 each, post 1/6.

**INSPECTION LAMP.**—Fits on forehead, leaving hands free, battery case clips on belt, 7/6, post 1/6. **TRADE** supplied. Case lots of 50, £12/10/-. Cre. paid in England. Takes E.R. Battery No. 1215, 2/9, post 9d.

**VENT-AXIA FANS.**—Brand New. Silent running. 230/250 volt A.C. 130/-. 12 volt D.C. 90/-. Post 3/-.  
**CHARTBOARDS.**—Complete with pantograph arm, perspex scale, protractor head. Ideal as a drawing board, 17in. square. Brand new, 25/-. Post 3/-.  
**HEADPHONES, Balanced Armature.**—Very sensitive sound powered 12/6 pair. Post 1/6. 2 pair car provided 2-way communication without batteries.

**ROTARY CONVERTERS.**—Input 24 v. D.C. Output 100 watts at 230 v. A.C. 150 watts at 200 v. 92/6, also available in metal case with switch, 105/-. Cre. 7/6.  
**ROTARY CONVERTERS.**—Input 24 v. D.C. Output 150 watts at 230 v. A.C. 200 watts at 220 v., in wood case with 0/300 voltmeter, 4 position switch and voltage regulating resistance, 150/-. 12 v. Input 170/-. Cre. 10/-.  
**BULKHEAD FITTING.**—9in. diam. flat tripod type, suitable for lamps up to 100 watt, complete with pushbar switch lamp-holder. Ideal for farm buildings, garages, greenhouses, etc. Brand new, 17/6, post 2/6.  
**ROOM THERMOSTAT.**—Adjustable 45 to 75 deg. Fahr. 250 volts 10 amp. A.C. Ideal for greenhouses, etc., 35/-. Post 2/-.  
**MOTOR.**—12 volt D.C., 1 1/2 in. x 2in. approx. 3,000 r.p.m. with speed regulator in end cap. A precision job, 12/6, post 1/6.  
**GEARED MOTORS.**—4 r.p.m. at 12 volts, 8 r.p.m. at 24 volts, very powerful, supplied with a suppressor which can easily be removed. 35/-. Post 2/6.  
**TERMINAL BLOCKS.**—2-way fully protected No. 5C/430, 4/- doz., 50 for 15/-, or 100 25/-, 3-way, 8/- doz., 30/- for 50. Post 1/6.  
**VARIABLE RESISTANCE.**—160 ohms, 2 amps. on 10 1/2 in. Twin Ceramic formers with control handle. Suitable for dimming, etc., 35/-. Post 2/9.  
**TELEPHONE SETS, MODERN DESK TYPE.**—£5/17/6 per pair complete.  
**WALL TYPE** also available, 2 complete units £25. Batteries 5/6. Twin Wire 5d. per yd.  
**RELAYS, HIGH SPEED SIEMENS 1,700 +1,700 ohms.**—just the job for radio-controlled models, 21/- each. Post 1/3.  
**INSPECTION LAMPS** with wire guard, strong clip. S.B.C. Holder, 22ft. C.T.S. flex. Ideal for all car owners. 17/6, post 2/6.  
**CHARGING RECTIFIERS.**—Full Wave Bridge 12 volts 2 amps., 13/6, 4 amps., 22/6. 2 amp. Transformers 24/-, 4 amp. 27/3, post 2/-.  
**GENALEX EXTRACTION FANS.**—230/250 volts 50 cy. Induction motor, 1,350 r.p.m. 85 watts, 9in. blades, silent running, £6/15/-. Cre. 7/6.  
**A.C. MOTOR.**—230 volt, 50 cy., 1/50th h.p., 3,000 r.p.m. Series with governor, 60/-. Post 3/-.  
**A.C. MOTORS, 1 third h.p. 1,425 r.p.m.** 1 shaft, Ball Bearings, 230/250 volts. Continuous rating. Brand New. £8/10/-. Cre. 30/-.  
**A.C. MOTORS, Capacitor 230 volts 1/20 h.p. 1,425 r.p.m., 7in. x 6in. overall, £8/10/-. Cre. 5/-.  
**12/24 VOLT D.C. MOTORS** with double-ended shaft 2in. x 3in., 8/6, postage 1/6.  
**HEADPHONES, HIGH RESISTANCE.**—4,000 ohms. New, 12/6 pr., post 1/6.  
**SWITCHES.**—A row of 5 in a flush mounting bakelite moulding 5 1/2 in. x 1 1/2 in. x 2in. Ideal for model railways, 5/6, post 1/6.  
**VACUUM PUMPS or Rotary Blowers.**—Ex R.A.F. Brand New. 7 cu. ft. per min. 10 lbs. per sq. in. at 1,200 r.p.m. Size 6in. x 4in. x 4in., 2 x 1/2 in. shaft, 22/6 each, post 2/9.  
**PORTABLE ELECTRIC BLOWER.**—220 watts 220-230 volts. Enclosed type with handle, 8ft. of metallic flexible hose and nozzle, 7 yds. C.T.S. flex. 130/- complete. Carriage 7/6.  
**VOLTMETERS, D.C.**—0-20, 0-40, or 0-300. 2in. Flush, 10/6 each, post 1/6.  
**INSTRUMENT RECTIFIERS.**—Full wave Bridge 1 mA., 8/6; 5 mA., 7/6; 50 mA., 5/- ea., post 9d.  
**CELL TESTING VOLTMETERS.**—3-0-3. In leather case with prods, 25/-. Post 2/-.  
**VOLTMETERS for A.C.** Mains 50 cy. reading 0 to 300 volts with clear 5in. dial only, 60/-. 2 1/2 in. Flush, 25/-. 0-15 volts A.C./D.C. 2 1/2 in. Flush, 15/6. Post 1/6.  
**AMMETERS.**—2in. Flush Moving Coil D.C. 0/30, 10/6; 0/50 or 50-0-50, 12/6 ea. Post 1/6.  
**JACK PLUGS.**—2 contact, with round bakelite screw on cover, 2/6 each, 27/- doz.  
**LOUDSPEAKERS.**—P.M. 12in. Plessey, 3 ohms, special price 32/6, post 2/-. Also 10in. in Portable Wood Case 17in. x 17in. x 6in. complete with flex and plug in special compartment, only 50/-. carriage 5/-.  
**WILCO ELECTRONICS**  
Dept. P. M.  
204, LOWER ADDISCOMBE ROAD, CROYDON.**

**RIGHT!**



for good braking

USE **Fibrax** BRAKE BLOCKS

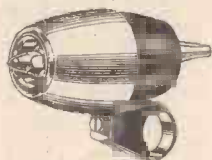
FOR SURE STOPPING AND A LONG LIFE

FIBRAX BRAKE BLOCKS stand up to the toughest test—the split-second emergency. Yet they brake smoothly and firmly. Two types: **SOFT RED** for alloy rims, **BLACK** for steel rims.

Ask your dealer for "FIBRAX"

FIBRAX LTD., 2 TUDOR STREET, LONDON, E.C.4

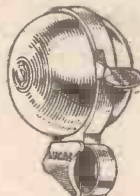
For Miles More Enjoyment



No. 75 "COMET" BELL  
Incorporating the famous Lucas Chassis type of mechanism. Chromium plated dome, red plastic centre and trigger lever (registered design). 6/6



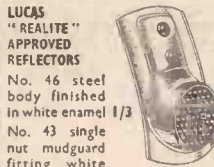
CYCLOMETER  
For 24, 26, 27 and 28" wheels. Complete with striker. 7/6



No. 32 REVOLVING DOME BELL  
Double chime with Lucas brass bell, metal dome, clear ring. Chromium 10/6



"GEM" CYCLE LOCK  
A strong effective safeguard against theft. Chromium 5/6



LUCAS "REALITE" APPROVED REFLECTORS  
No. 46 steel body finished in white enamel 1/3  
No. 43 single nut mudguard fitting white enamel. 1/-



**LUCAS**

"King of the Road"  
Cycle Accessories

JOSEPH LUCAS (CYCLE ACCESSORIES) LTD · CHESTER STREET · BIRMINGHAM 6

**GALPIN'S**  
ELECTRICAL STORES

408, HIGH STREET, LEWISHAM, S.E.13.

Tel.: Lee Green 0309. Nr. Lewisham Hospital.

TERMS: CASH WITH ORDER (No C.O.D.)

All Goods sent on 7 days' approval against cash

**MAINS TRANSFORMERS.** Input 200/230 volts OUTPUT 0/9/18 volts at 3/4 amps., 25/- each; another output 12 1/2/0/12 volts 2 amps., 25/- each; another suitable for soil heating, garage lighting, etc., 4 volts 20 amps. twice, 35/- each.

**EX-GOVT. ROTARY CONVERTORS** 24 volts D.C. Input 50 volts 50 cycles, 1 phase at 450 watts. OUTPUT (complete with Step Up Transformer) from 50 volts to 230 volts, £13/10/- each or CONVERTOR only £9/10/- each.

**EX-NAVAL ROTARY CONVERTORS** 110 volts D.C. Input. Output 230 volts 50 cycles 1 phase 250 watts capable of 50 per cent. overload, in good condition, guaranteed weight approx. 110 lb. £13/10/- each.

**SPARK COILS** complete with trembler, at spark on 4 to 6 volts, 17/6. P./P., 1/6.

**TOTE SWITCHES** multi contact, with operating gear, large 25/-, small 15/-.

1/2 **H.P. D.C. MOTORS**, 110 volts, 3,000 r.p.m., new, large size, 35/-; starters to suit N.V.R., 25/-.

**MAGSLIP** motors, 50 volts A.C., large size, as new, 8/6. P./P., 1/6. **TRANS-MITTER TYPE**, 3in., 15/- P./P.

**IRON CLAD** safety switches, 2 pole, DP/DT 250 volts, 60 amp., new, 18/6. P./P. 1/6.

**D.C. MOTORS**, 24 volts, large size, 8/6. P./P., 1/6.

**ROTARY CONVERTORS**, with all smoothing and control, input 28 volts, D.C., output 300 volts, 260 mA, 150 volts, 10 mA and 14.5 volts at 5 amp., all outputs are D.C., as new, 45/-. P./P., 2/6.

**LARGE METER** movements, fairly low F.S.D. average 6 in deflection, very high quality, 7/6. P./P., 1/6.

**MOVING COIL** meters, all 2 to 3 in. dia., damaged cases or glasses, 3 for 10/-, guaranteed one sound meter; 6 for 18/-, two sound meters, no junk, all are, or suitable for, M/A meters.

**MAINS TRANSFORMERS** all 200/250 volts primaries (New). Heavy duty Output combination of 0/6/12/18/24/30/36 volts 4/5 amps., 38/6 each. Ditto 6/8 amps., 51/6 each. Ditto 15 amps. Output, 75/- each. Another with combination of 0/6/12/18/24 volts 6/8 amps., 51/6 each. Ditto 10/12 amps., 58/6 each. Ditto 25/30 amps. Output, 85/- each.

**MEDIUM SPOT WELDER TRANSFORMERS.** Input 200/250 volts, OUTPUT combination of 0/2/4/6/8/10/12 volts at 50/70 amps., £7/7/6 each. Ditto 120/150 amps. Output, £8/10/- each.

**PRE-PAYMENT 1/- SLOT METERS** 200/250 volts A.C. 10 amp. size only, 100 per cent. overload set at 2d. per unit (guaranteed 12 months), £3/17/6 each. Ditto credit type 10 amps. only, 25/- each.

**RECTIFIERS FOR CHARGERS** 6 or 12 volts Output 2 amps., 9/6 each, 4 amps., 22/6 each. **MAINS TRANSFORMERS** to suit, 25/-.

**EX-CANADIAN EX-GOVT. ROTARY TRANSFORMERS** for No. 19 receiver. Input 12 volts A.C. OUTPUTS 275 volts 110 M/amps.; also another output of 500 volts 50 M/amps. completely smoothed, 30/- each.

**AUTO WOUND Voltage changer TRANSFORMERS.** Tapped 0/110/200/230/250 volts 200 watts, 48/6 each; 350 watts, 57/6 each; 500 watts, 76/6 each; 1,000 watts, £6/5/- each; 1,500 watts, £8/5/- each; 3,000 watts, £17/10/-.

**EX-R.A.F. ROTARY TRANSFORMERS** Input 24/28 volts D.C. OUTPUT. 1,200 volts 70 M/amps. 1/2 hour rating, 10/- each. Ditto 18/24 volts D.C. Input 450 volts 50 M/amps., Output constant, 25/- each. These latter ones can be used as motors off A.C. mains with a little alteration.

**ROTARY CONVERTORS.** Input 24 volts D.C. Output 50 or 100 volts A.C. 500 cycles 1 phase at 300 watts, £8/10/- each. Any TRANSFORMERS made to order within 7 days from date of order. Please ask for quota. Numerous other items in stock. Please ask for quotation. Clients in Eire & Northern Ireland, please ask for quotation as to carriage charges. The above charges only apply to England.

Open all day Saturday. Splendid odd bargain for visitors.



VOL. XXV

OCTOBER, 1956

No. 411

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.

Under Government Control

THE much debated clause introduced as an amendment at a very late stage has now become law and it will become operative as soon as the Minister "appoints" a day. It is unlikely, however, in view of what the Minister has since learned, from me and from others, that the clause will be rigidly interpreted. Yorkshiremen have been behind the opposition from start to finish. They have been determined to impose their will, right or wrong, with the arrogant pugnacity of some who come from the county of broad acres. Unfortunately, however, their methods have recoiled on them. They hoped to eliminate the trouble between the various bodies over massed-start races (not "in line" if you please!) by the underhand method of inspiring a last-minute clause in the Road Traffic Bill.

It will be to the lasting discredit of the National Cycling Union that they first started the attack on the B.L.R.C. by underhand methods when the League was first formed by approaching the Ministry of Transport in an effort to get League racing stopped. My own investigation in this matter at the time showed that the only opposition received by the M.o.T. had been promoted by the N.C.U. and the R.T.T.C. As a result of our representation, the League was left for about a dozen years to run its events and those 12 years have proved that this form of racing has none of the dangers attached to it which were thought up. It has a much cleaner record year for year than time trials, and although the clause has now become law we have told the Minister that he would be ill-advised to act upon it. Contrary to ill-formed statements in a contemporary, the R.T.T.C. did nothing to stave off the threat of Government control. The League was the first to do that. That particular journal has continued to attack the League, in support of the Yorkshire point of view, right from the start, and it has on many occasions mis-stated the facts or suppressed them altogether. It is certain that had all of the bodies combined to quash the clause it would have been withdrawn. Two bodies, however, saw a chance of killing the League. Cyclists will, therefore, know to whom to apportion the discredit of the manoeuvre which brought about Government control of road sport. As I have said, however, the Minister is now aware of the vendetta which has been waged against the League, and it is unlikely that the efforts of the Yorkshiremen will have much effect.

100 Miles in Less than 4 Hours!

R. C. BOOTY, of the Ericsson Wheelers, returned the astonishing time of 3 h. 58 m. 28 s. in the Bath Road

Hundred Scratch Time Trial which took place on Monday, August 6th. This is the first time in the history of sport that anyone has averaged just over 25 miles an hour for four hours in an unpaced trial.

This is cycling history and we hope that the cycle trade, which is usually so tardy in acknowledging the feats of those who bring so much publicity to the sport and industry, will suitably acknowledge this great milestone in the history of cycling sport.

Incidentally, it is noted that of the 100 entrants, of whom 93 started and 74 finished, not one was a member of the Bath Road Cycling Club Ltd., whose activities to-day are very much limited to social functions, arguments and internecine conflicts, with an annual dinner thrown in where they can exhibit the "Barf Road Spirit." What a pity it is that it does not give some time to training riders of the calibre which made the club famous some years ago. No Barf-roader has won the B.R. 100 since 1920—when Leon Meredith was the winner.

The "Oats"

THE "Oats," the thousand-mile amateur cycle race organised by the B.L.R.C., is undoubtedly the toughest stage race ever put on in Britain. This year's race, the third, started in Skegness on August 11th, the eight stages finishing at Manchester, Morecambe, Rhyl, Aberystwyth, Barry,

Weston-super-Mare, Lee-on-Solent and Worthing. All stages were of 115 miles or more in length, except the last one, which was of 85 miles. The race organiser, Mr. Vic Humphrey, who was mainly responsible for the route, had picked a really tough course. Weather conditions, however, were often so bad that at the finish of the event only 45 riders were left of the original entry of 79.

Strong westerly winds and gales impeded the riders for the first six stages and made the race a punishing one for them. Some of the roads used were merely rough and narrow tracks, and flints and stones caused numerous punctures and spills. The hilly nature of the road made hard work for both riders and the following caravan of cars and service vehicles.

In spite of these appalling conditions, however, the machines stood up to the battering they received remarkably well. Only one case of frame breakage was reported—this frame was of foreign make. The winners of the team prize were the Southern Counties Team, the King of the Mountains was J. Nicholson of the Tees Side team, and in the general classification, the winner was R. McNeal, of the North-Eastern Counties team, the second being G. Taylor, of the Warwickshire team, and the third being R. Killey, of the Merseyside team.

Safety Bumpers and Canal Tracks

A MIDLAND cyclist has made two suggestions which he thinks would make for safety. One is that cars should have pneumatic buffers which he thinks, in case of collision, would cause less injury than the present somewhat useless steel bumpers. Unfortunately, for this idea, it would not work. The impact of a car weighing one and a half tons travelling at a speed of, say, 40 miles an hour, even with pneumatic bumpers would cause serious injury, and if the unfortunate person collided with did bounce from the bumper he would probably bounce under another vehicle. Another of this cyclist's ideas, which seems excellent on the face of it until one stops to think about it, is that the disused canals in this country (and there are many of them) should be filled in and used as exclusive roads. Unfortunately for him, however, he could not have worked out the quantity of material required, nor the cost of filling in. That alone would make the idea quite impracticable. The idea of a cow-catcher bumper of the type fitted to American locomotives has often been suggested. Under test, however, it was found that the "body" (in this case a well-stuffed sack) was merely precipitated under the wheels of vehicles passing the other way.

480 in 24 Hours

DENIS WHITE recently covered 480 miles in 24 hours. This was in the Wessex 24. To average 20 miles an hour for 24 hours' continuous riding ranks with the performance of R. C. Booty as the two outstanding events of the last decade of cycling history and, as with Booty, I hope these events will be suitably recognised by the industry, as well as by the sporting bodies. Unfortunately, neither of these two events received much publicity in the daily Press.



Clatterford Shute—a picturesque lane leading from Carisbrooke Castle to the village.

# Choosing the Right Bicycle

Make Sure the Bicycle You Buy Will Suit All Your Requirements



Fig. 1.—A typical cycle for daily use—the Hercules Artisan.

**B**UYING a cycle is not the simple matter that it may at first appear. Many people walk into a shop, look at the range offered for their inspection and then choose the one that is enamelled in their favourite colour or the one advocated by the dealer. It is probably not until they come to use it that they find out it is not really suitable for their needs.

Decide first what the cycle is to be used for, i.e., cycling to work, touring, or camping, or perhaps racing or club riding, then exactly what type of machine will do the job best.

## The Utility Cycle

There is a wide choice of makes and it is up to the purchaser to ensure that the one he chooses has all the features he will need. The machine should, primarily, be robust so that it will be a long time before it is necessary to replace worn parts. The most suitable model is the upright type, equipped with a comfortable, well-sprung saddle, strongly made wheels, shod with heavy tyres, dynamo lighting, rubber pedals, rod and lever brakes and—most important—adequate mudguards. A chain-case is not an absolute necessity, but may be preferred by the purchaser. If the daily journey is over a hilly road, a hub three speed will be found of great benefit, but make sure that the "normal" gear is between 65 and 70 and a little lower on a lady's machine. Useful also is a carrier over the rear wheel for dispatch case or tool bag, etc. All the major firms of cycle manufacturers produce a machine of this type and a typical example is shown in Fig. 1.

## The Machine for the Tourist

The tourist's requirements are likely to be more specialised and individual and the type

of mount most suitable will vary accordingly. In general, the best machine for the tourist will have a light frame, made from Reynolds 531 tubing, wheels with rims of the Endrick type, shod with one of the many medium weight touring tyres available. Cable brakes are necessary with Endrick rims and there is a wide choice available. The very well-known and well-tried cantilever brake is now back on the market and this is ideal for the discerning tourist. Many riders who carry a great deal of weight prefer to use hub brakes.

The rider who travels with little baggage will easily be able to carry this in a large touring bag, fitted under the saddle and carried on one of the lightweight supports now available. Those who prefer to carry more of their worldly goods with them, and particularly the camper, will require panniers.

## The Hand-built Frame

Hand-built frames are by no means for the racing man only, and many touring enthusiasts have frames made to their own specification. Usually they specify 531 or other lightweight tubing and prefer a frame of stouter construction and longer wheel-base than that of the racing man. A long wheel-base (42-44in.), when combined with frame angles of 72 deg. parallel and long fork rake, as shown at A in Fig. 3, gives the maximum stability and comfort to the long-distance rider. Ordering a frame in this way also enables the purchaser to suit himself about such things as the type of headset, siting of pump pegs for a 15in. or 18in. pump, position of lamp brackets, grease nipples, etc., incorporation of special fittings for derailleur gears and brake cables. The camping enthusiast would, no doubt, specify special lugs on the seat-stays for fitting panniers, obviating once and for all the nuisance of slipping pannier frames.

## The Machine for the Clubman

The clubman has the widest choice of all. A lot depends on whether his club is a touring club or a racing club and also on what type of racing he is likely to favour. There are many mass-produced cycles on the market similar to that shown in Fig. 2 designed specifically for the club rider, but the majority of them still prefer to order their own frame and accessories to build up the machine themselves. The new-

comer to club riding would be wise to order a good all-round machine. The frame could be of either lugged or welded construction, being built from lightweight tubing.

Frame size will depend upon the physique of the purchaser, but he should be able to

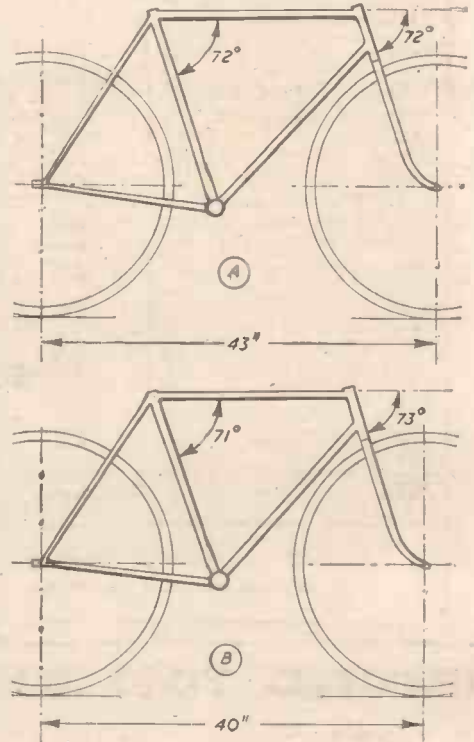


Fig. 3.—Frames for the tourist and club rider.

sit on the saddle, with the ball of the foot on the pedal at its lowest point, and the leg being still comfortably bent at the knee. A further test is to be able to pedal comfortably using the heels. To find the most suitable frame size by measurement, take the inside leg measurement and from it subtract 10in. to account for crank length and height of saddle and saddle pillar. Frame size is measured from top of saddle lug to centre of bottom bracket spindle.

A frame slightly smaller than is really required is far better than one that is too large. Frame angles should be either 73 deg. head and 71 deg. seat tube, as shown at B, Fig. 3, or 72 deg. parallel. Bottom bracket height should be adequate to ensure clearance when cornering on a fixed wheel and there should be sufficient clearance in the rear triangle to enable 27in. wheels to be used. All the usual brazed on fittings should be specified.

A very wide choice of accessories is available, but the clubman, in general, is conservative in his choice. Wheels consist usually of lightweight hubs, double-butted spokes and steel road-racing rims, fitted with lightweight tyres. For handlebars, handlebar extensions and saddle-pillars, alloy is often favoured, although many riders prefer the heavier steel fittings. Handlebar extensions are usually from 2in. to 3in. in length and one of the most popular shapes of handlebar bend is the "Maes." Narrow, unsprung leather saddles of the Brooks B17 type are most popular and brakes of the alloy hooded lever variety are almost universal.

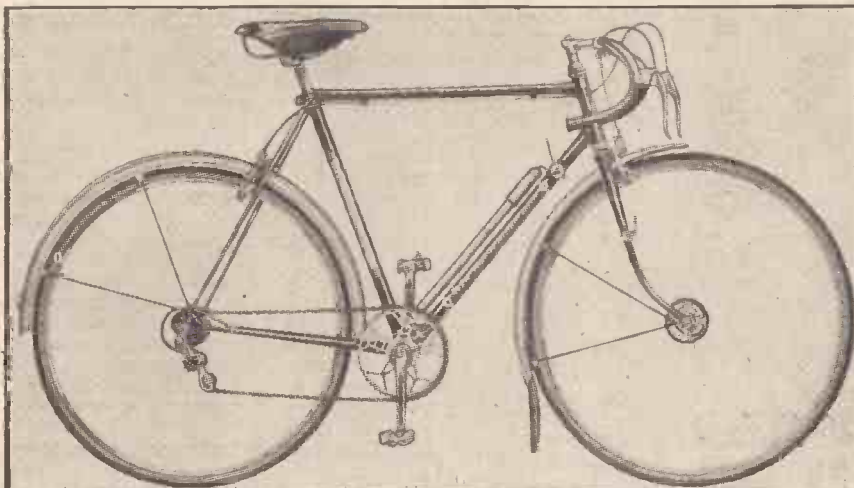


Fig. 2.—The B.S.A. "Tour of Britain" sports cycle, designed to appeal to the clubman.

# HALFORDS The shop for MOTORISTS



### BATTERY CHARGERS

"Davenset" Type "J", as illustrated, charges 6 or 12 volts at 1 amp. ... 78/6  
 "Atlas" Type "A.I." charges 6 or 12 volts at 1 1/2 amps. ... 67/6  
 Halfords first quality charger at a remarkably low price. Charges 6 or 12 volts at 3 amps. ... 95/-  
 Higher output chargers always in stock.

### PETROL CANS

With side strengthening strips, carrying handle, brass neck and cap. Painted one standard colour.  
 1 gall. 8/3  
 2 gall. 9/6

### SWITCHES

Metal top with fibre base on/off, tumbler switch ... 1/6  
 Toggle switch. One hole fixing, with screwed terminals 2/6. Push-pull switch, with black or white knob 3/6. "Joy-Stick" for steering column with illuminated knob, 6 or 12 volts ... 19/6

### ANTI-FREEZE

Don't wait till the last minute when supplies are scarce. "Blue-col" and Holt's.  
 Pints ... 2/-  
 Quarts ... 15/6  
 3-gallons ... 30/-  
 Gallons ... 58/-  
 "Syncol" quarts ... 15/6

### CAR LIGHTING

"Desmo" reversing lamp, chromium plated 6 or 12 volts ... 25/-  
 Parking Lamp ... 7/-  
 All chrome plated Parking Lamp sets, complete with bracket, plugs, socket and bulb, 6 or 12 volt ... 12/6  
 Stop-Tail Lamp Flush fitting. Red Diakon Lens, Chrome plated on Brass rim, pair ... 18/11  
 Full range of regulation size reflectors in stock from ... 2/-

### OILS & GREASES

All the leading Multi-grade Oils, in sealed cans. Castrolite pints, 2/3; quarts 4/-; gallons 4/3  
 Mobiloil Special. Quarts 5/-; gallons 18/4  
 Duckhams, Q.5500. Quarts 4/10; gallons 18/8.  
 Energol Visc Static. Pints 2/8; quarts 4/10; gallons 17/10.  
 Shell X.100, 10W/30. Pints 2/8; quarts 4/10; gallons 17/10.

### MIRRORS

Exterior fitting 4in. flat glass E.B. and C.P. ... 5/6  
 Interior fitting 6in. x 2 1/2in. ball adjustment. Gun finish. ... 3/6  
 Wing fitting "L.E.H." 4in. cranked arm. Chrome finish ... 16/6

### HUB DISCS

For Austin, Hillman and Morris from ... 6/-

### INSPECTION LAMPS

Mains Inspection Lamp, with wooden handle, less bulb and cable ... 7/11  
 Combined Parking and Inspection Lamp to work from car battery ... 17/4  
 Others from ... 12/-

### HYDROMETERS

Junior hydrometer. Robust glass barrel, accurate float ... 5/6  
 Large capacity, high grade for easier scale reading ... 8/8  
 Spare floats from ... 2/-

### HOLT'S SPECIALITIES

Halfords stock a full range of Holt's specialities including:—  
 RADFLUSH, PRE-WONDAR-WELD, WONDARWELD, BRITECT, CLEANSEALER, FOGOFF, DE-ICER, RADIATOR INHIBITOR, WINTER SCREEN WASH.

### GREASE GUNS

"Tecalmit," Mazak finish ... 16/6  
 "Nubrex," pistol grip, push-on type ... 27/6  
 "Nubrex," cartridge grease model ... 59/6

### WATER POURERS

For distilled water. "Creators" plastic pourer, fits any bottle top ... 1/-  
 "Exide" plastic pourer, fits any bottle top ... 2/9  
 "Lucas" as illustrated for motor car batteries ... 5/6

228 Branches throughout England, Scotland and Wales.

## HALFORD CYCLE CO LTD

HEAD OFFICE: 45 CARPENTER ROAD, EDGBASTON, BIRMINGHAM 15

## SELECTED TOOL BARGAINS

**PATENT SAW SHARPENER**  
 Pat. No. 725,911  
 You can sharpen your saws accurately and quickly with this ingenious tool: hardened steel rollers and guide ensure uniform depth of teeth. An absolute boon to all woodworkers, makes a very difficult job extremely simple. Suitable for hand, tenon and dovetail saws. Price 21/-, carr. paid complete with instructions.

High grade **ENGINEERS' BENCH VICES** slightly stock soiled. All steel jaws, square thread screw, width of jaws 3", 3 1/2", 4", 30/-, 45/-, 58/6. Carr. paid.

Best quality **HANDSAWS**, skew back finest Sheffield steel blades, ground thin to back; polished handle, brass screws; 22" blade, 21/-; 26" blade, 22/6. Post paid.

American Pattern **ADJUSTABLE IRON PLANES**. Sheffield Steel Double Irons, Smooth Planes, 9" x 2", 26/- post pd. Jack Planes, 15" x 2", 32/6, post pd.

Super quality **HANDDRILLS**. Helical cut gears double flintion, 3 jaw self-centring chuck 0-1 capacity. Hollow handle for drills and bits. Complete with set of drills 21/-, Post pd.

12" **COMBINATION SQUARE** with mitre, level and scriber, specially suitable for carpenters. Steel rule marked inches eighths and sixteenths. PRICE 8/8, post pd.

Best quality Sheffield **CARPENTERS' CHISELS**. Polished ash handles. Sets of 5: 1, 1 1/2, 2, 3, 4. Price 21/- Set. Post pd.

Sets of best quality **CHROME VANADIUM TWIST DRILLS** complete in plastic wallet. Sets of 7: 1/16th to 1/2 x 132. Price 5/6 Set. Post pd.

Sheffield made **HALF TWIST CENTRE BITS**. Quick and easy cutting, brace shanks. Sets of 5: 1, 1 1/2, 2, 3, 4. Price 13/6 Set. Post pd.

## TAKE UP PELMANISM

And Cultivate Your Natural Ability

**PELMANISM**  
 WORLD WIDE AND WORLD FAMOUS

In every man and woman are certain qualities already being developed or awaiting development. Social life and the exigencies of earning a living develop these qualities, but sometimes slowly and often unevenly so that whilst there may be progress in one direction there is stagnation and frustration in another. The Pelman Course is designed to quicken the development of all qualities and aptitudes, the more significant of which are:

Reduced Fees for Her Majesty's Forces. (Apply for Services Enrolment Form.)

The Pelman training for successful living has been proved by over a million men and women of every type and calling.

- Send for Free Book
- The Pelman Course is simple and interesting and takes up very little time; 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:
- JUDGMENT —SOCIAL-EASE  
 —INITIATIVE —DECISIVENESS  
 —WILL-POWER —SELF-CONTROL  
 —OBSERVATION —CONCENTRATION  
 —PERSONALITY —SELF-CONFIDENCE  
 AND A HOLD-FAST MEMORY

### HOW TO LEARN LANGUAGES

The Pelman Languages Institute teaches French, German, Spanish and Italian, without translation. Write for particulars and specimen lesson of the language that interests you, which will be sent gratis and post free.

Reduced fees for H.M. Forces.  
 Pelman Languages Institute,  
 130, Norfolk Mansions, Wigmore St., London, W.1.

**PELMAN INSTITUTE**,  
 130, Norfolk Mansions,  
 Wigmore Street, London, W.1.  
 WELbeck 1411/2  
 Established over 60 years.  
**PELMAN (OVERSEAS) INSTITUTES**. DELHI, 10, Alipore Road. MELBOURNE: 396, Flinders Lane. DURBAN: Natal Bank Chambers (P.O. Box 1489). PARIS: 178, Boulevard Haussmann. AMSTERDAM: Prinzengracht 1021.

## S. TYZACK & SON LTD. 341-345, OLD STREET, LONDON, E.C.1 SHOREDITCH E301

### All Fine Offers!

P.M. Loud Speakers. 12in. Goodmans "Audiom". 10 watts 15 ohms, brand new and boxed, £4.19.6, postage 2/6.  
7 valve I.F. Strips. 10 Mc/s, 8/-, post paid.  
Telephone Constructor Parts. G.P.O. Wall type for Office-to-Works, House-to-Garage, etc. Polished wood box 8in. x 6in., fitted Carbon Mike, magneto bell, switch hook and contacts, transformer and condenser, connection strip and long magnet, bell, receiver, 50/- per pair, complete with hand magneto generators and wiring diagram. Carr. and pack., 5/-.  
G.P.O. Candlestick Telephones, table type, carbon mike in moulded bakelite case, switch hook and contacts, receiver and cords, 21/- per pair, post 3/6.  
G.P.O. Mike Buttons, 1in. dia., carbon granules with mica diaphragm, 1/6, post 9d.  
G.P.O. Transformer, 2/6, post 9d. — Auto Transformers. 230/115 volts, 500 watts, Met. Vick., totally enclosed in metal case, £5, carr. 5/-. Write for special leaflet.  
D.C. Generators. 500 watts, 50/68 volts, 10 amps, 1,000 r.p.m., £12.10., carr. and pack. 10/-. 12 volt, 10 amps, 1,500 r.p.m., 75/-, carr. 5/-. Extra open type, 12 volt cut-out, 5/-.  
A.C. Lighting Plants 230 V.A. Alco Lyon, suitable for running television sets where no mains are available. 230 volts A.C., 50 cycle output, £30. Carr. at cost. Write for leaflet.  
Ammeters. 2in. dia., 0-20 amps D.C. moving coil, 10/-, post 1/-.  
Voltmeters, 2in. A.C./D.C. moving Iron 0-15 volts, 10/-, post 1/-. 3 1/2 in. A.C./D.C. Moving Iron, 0-300 volts, 30/-, post 1/6. D.C. moving coil 2in. voltmeter 0-300 volts, 12/6, post 1/-.  
Magnetic Counters. G.P.O. surplus in good condition, read to 9,999, 5/-. post 1/-. Magnets. The Alni Disc Magnet, 3/4 in. dia., 3/4 in. thick with 1/16 in. centre hole, 3/6, post 6d. Circular Horseshoe Magnets, 1 1/4 in. dia., 3/4 in. thick, 3/4 in. polar gap with drilled hole, 2/6, post 6d.  
The Lesdix Table Mike. 4in. dia., crackle case with chrome ring, fitted best quality carbon mike and special mike transformer. Terminals for battery and output all mounted on chrome base, 17/6, post 2/-.

### ELECTRADIX RADIOS

214, Queenstown Road, London, S.W.8  
Telephone: MACaulay 2159

### WATSON'S SPECIAL OFFERS

**CHORE HORSE**  
12/15V  
300W  
£17.10.0  
CARR. 12/6

These are fine generating sets ready for use. Also Briggs & Stratton to same specification £17.10/-. Carr. 12/6. Both sets slightly used, tested and with Three Months' "Same-as-Maker's" Guarantee.

**COMBINED TEMPERATURE AND VACUUM GAUGES.**—30° to 212° F and 0-30 Vacuum 2 1/2" square illuminated dial with 20" armoured capillary tubing. Brand New, 22/6 each. Post 2/-.

**JUNCTION BOXES.**—2 way, 6/- doz. 3-way, 7/- doz. Post 1/3. Useful for many low-voltage wiring purposes.

**ANTI-VIBRATION MOUNTINGS.**—1" square. Four for 2/-. Post 9d.

**DELCO MOTORS**  
22/6  
CARR. 3/-

Suitable for use on 50/110/115 v. A.C. 3 ph. 50/60 cycle.

**SMALL D.C. MOTORS.**—27.5 v. 1/50 h.p. 3" long 2" diam. 8/6. Post 1/3.

Hundreds of other bargains available. Send 4d. Stamp for **MONSTER ILLUSTRATED LIST**.

**AIR DRIERS.** Approx. 15 in. overall, 2 1/2 in. dia. with 2 ft. rubber tubing. Extremely useful where a supply of dry, clean air is required. New and Boxed, 8/6. Post 2/6.

**EASTERN MOTORS, ALDEBURGH, SUFFOLK, PHONE: 51**

**Leading factors in Road Safety**

**LIGHTING EFFICIENCY. . .**  
MILLER Cycle Dynamo Lighting—with its sturdy design and construction, steady powerful beam at all speeds, and unflinching trouble-free service—is the most efficient and economical cycle lighting on the road to-day.

**MILLER**

H. MILLER & CO. LTD. ASTON BROOK ST. BIRMINGHAM 6

### NEW CABLES & FITTINGS

#### TOUGH RUBBER CABLES

	per yd.	25 yds.	50 yds.	100 yds.
1044 Twin	8/4d.	15/-	29/6	58/-
1044 3-core	11/4d.	21/-	41/6	83/6
3029 Twin	11d.	19/6	38/-	75/-
3029 T. & E.	1/4d.	23/6	46/3	91/3
7029 Twin	1/5	32/6	64/3	127/-
7029 T. & E.	1/8d.	41/-	80/6	158/6
7044 Twin	50	98	123/-	245/-
Twin Lead, 50 yds.	3/029	69/3	7/029	112/9
VIR. 50 yds.	3/029	17/3	7/029	28/3
Earth Wire, 100ft.	7/029	12/6	7/029	7/9
PVC Transp. Flex. 50 yds.	10/-	20/-	39/-	78/-
Maroon. 25 yds.	12/6	50 yds.	22/8	TR8.
VIR Lead Cables of all sizes.	Holders, O.C.			
8"- Batten. doz.	12/-	Roses, Brown, 8/-		
White, doz.	10/-	Jnc. Boxes, Sml. 11/-		
Lge., doz.	13/-	Switches, 1-way, 13/-		
2-way, doz.	24/-	White Switches, 1-way, 24/-		
2-way, doz.	30/-	Flush Switches, 1-way, 15/-		
2-way, doz.	24/-	Ceiling Cord, do. 1-way, 5/-		
2-way, 8/-		2-way, 8/-		
2 amp 2-pin Sw. plugs & Tops, ea.	3/-	5 amp 3-pin Sw. plugs & Tops, ea.	5/6	15 amp 3-pin ditto, A.C. only, ea.
6/-		Wood Blocks, 3 x 1, 5/-		3 x 1, 7/6
		3 x 1, 6/-		5 x 3 x 1, 6/6
		5 x 1, 7/-		1 h.p. do. 135/-
		8 x 1, 9/-		Cable Clips, Sml. 2/9
		Med. grs. 3/3		15 amp D.P. Insulated Sw. fuse, 9/8
		21 amp. Ironclad, 2-way, 15A. Sptr., 13/6		30 amp Ironclad D.P. Switchfuse, 19/6
		Metal 5-way Consumer Unit, 42/6		5 amp. Sw. gear, Fuse bds. 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, 230v. 16 C.P. doz., 20/-		Immerison Heaters, 3kw., 65/-
		A.C. Motors, 1 h.p. 200/220 v. 110/-		1 h.p. do. 135/-
		Single Car Cable, 10 yds., 3/-		100 yds., 25/-
		Conduit & Fittings, Tin and Tin Industrial Refractors, Tubular Heaters, Fluorescent Fittings, Time Switches, Electric Motors and all electrical equipment. Full lists on request. Single items supplied. Satisfaction guaranteed. Terms: Cash with order; carriage paid if over £4; 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 (PM), QUEENS ROAD PECKHAM, S.E.15  
Tel. 1 NEW Cross 7143 or 0890.

**PLEASURE AND PROFIT**

**SILK SCREEN PRINTER**  
with ALL SUPPLIES & FREE COURSE!

**PRINTS IN SIX COLOURS** This is the great new printing and colouring process for amateurs or professionals alike and all hobbyists. Its versatility is enormous. It will print a few copies, or hundreds, to a professional standard, in solid colours, or intricate designs, on cloth, paper, wood, glass, metal, etc. Print greeting cards, toys, models, drawings, paintings in full colour, photographs, type-script. Fluorescent colours, suede flock and novelty finishes. Transfer papers for printing your own transfers also available. Can also be used as first-rate duplicator with any typewriter. Nowhere else is such a large and comprehensive outfit offered for so little money. As supplied to H.M. Government, Educational Authorities, Printers and private users throughout the world. Thousands testify to the quality and amazing value. Do not miss this opportunity.

—ON PAPER, WOOD, CLOTH, PLASTICS, etc.

**AMERICAN PUBLISHERS SERVICE**  
(Graphic Arts Div.),  
DOCKING ROAD, SEDGFORD, NORFOLK

This IS the **BARGAIN OF THE YEAR**  
**COMPARE THE VALUE SEE WHAT YOU GET!**  
Large 16in. x 12in. PRINTING-FRAME. Stout Laminated WOODEN BASE. Patented ADJUSTABLE HINGES (for printing on material up to 1/2 in. thick). Fine Quality SQUEEGEE SIX CONTAINERS COLLOURS—Red, Blue, Yellow, Green, Black, White. STENCIL FILM (design traced and applied with hot iron). STENCIL CUTTERS and HOLDER. Register Guides, Masking Tape, etc., etc. And FREE 10/- COURSE giving step by step procedure for every application of process, including PHOTO STENCILS, DAYGLO, FLOCK finishes, etc.

for 47/6 post paid  
REFUND GUARANTEED IF NOT APPROVED WITHIN 7 DAYS.

**MASON MASTER**  
**TUNGSTEN CARBIDE TIPPED DRILLS**

For clean round holes in bricks, concrete, tiles and marble. Ideal for the handyman and essential to the craftsman. Self-clearing, rapid in penetration, silent and shock free in operation. Drills the hole where you want it. The secret of their remarkable cutting power is in the special Tungsten Carbide Tip which has revolutionised drilling technique in building and allied trades.

A "REXINE" WALLET which fits neatly in the waistcoat pocket is given FREE with sets of "Mason Master" "S" Drills.

Set D 3 drills, diameter 5/32, 3/16, 7/32. 4, 9/32, 5/16, 11/32. 1, 4/8 deposit and 6 monthly payments of 15/8. CASH 89/6. P.P. & L. 1/6.  
Sets A, B and C can also be supplied.

**BRIDGES NUCLEAVE PRESS CROPS · PUNCHES · RIVETS**

Exerts 2 tons pressure yet only weighs 8 1/2 lbs. Versatility is the keynote of the Nucleave Press. Designed for punching, nibbling, cropping and riveting in a variety of materials; it has innumerable uses in engineering, leather and plastic industries. A useful multi-purpose tool for the home craftsman. Supplied complete with the following tools: 1 set of punches and dies; 1 pair of cropping tools; 1 riveting punch. 1 short riveting die. 1 long riveting die. CASH 5/5. P.P. & L. 3/- or 12/11 dep. and 8 monthly payments of 12/11.

**WE CAN SUPPLY RECORD MECHANISMS VISES; details from —**  
(Dept. G.M.1.),  
**Douglas Jordan Ltd.**,  
3 Corbetts Passage, Rotherhithe New Road, London, S.E.16.

24 v. Blower Motors as used for Hedge Trimmer, 18/9. 10K6/115 12-24 volts 30/- for car heater.

Transformers, input 200/240 v. Sec. tapped 3-4-5-6-8-9-10-12-15-18-20-24-30 volts at 2 amps, 22/-, 17-11-5 volts at 5 amps, 22/9. 17-11-5 volts at 1 1/2 amps, 16/9. 6.3 volts, 2 amps., 8/6. 12 months' guarantee.

Model Makers' Files with handles. Set of 6 assorted in wallet. 10/-.

Selenium Rectifiers F.V. 12-6 volt, 100 mA 4/-, 1A, 8/6, 3 A., 14/9, 4 A., 23/6. 6 A., 30/-, 250 v. 100 mA H.W., 10/6. 300 mA., 17/6.

Miniature 12 or 6 v. Relays. 10 amp. Silver Contacts. SM, DM or SM and B, SCO, 8/6. Also 1 1/2 v. DCO, 8/6.

M/c Microphones with matched transformer, 15/9.

Chrome Vanadium H.S. Steel Twist Drills. Sets of 9, 1/16in. to 3/4 in., 3/9. Sets of 7, full size, 6/-, Sets of 13, 10/-, All in wallets.

12 v. D.C. Relays-S.P. D.C. 25 amp., 8/6. Rheostats, 12 v. 1 A., 2/6. 12 v. 5 A., 10/6. New 6 v. or 12 v. Oak Vibrators, 4 Pin, 8/9.

Fishing Rod Aerials. Sets of 3, 9/-. Sets of 2, 6/-, plus 1/6 Rail Charge.

Uniselector Switches 50 point 3 bank 50 v. D.C., 26/-. Also 50 point 2 bank 12 v. D.C., 21/6.

Veeder Counters, 24/50 v. D.C. 0-9999, 15/6.

Handy Screwdriver Kit in Wallet. 3 Standard, 2 Phillips and Scriber, 9/6.

Chrome Car Extension Aerials, 1ft. to 4ft., 13/6.

Nife Batteries. 1.2 v. 2.5 A. 2 1/2 in. x 3/4 in. x 3/4 in., 6/-. Ideal for models.

Relays. We can supply any D.C. voltage and Contact Combination.  
All Carriage Paid in U.K.  
Lists Sent on Request.

**THE RADIO & ELECTRICAL MART**  
309, Harrow Rd., Wembley, Middx. N.R. The Triangle.  
Telephone: WEMbley 6655

# MAKE SOUND JOINTS SIMPLY BY USING **Multicore**

## 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.**



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.

## ARAX MULTICORE

**FOR METAL FABRICATION**  
(Not wire-to-tag joints)

Contains 2 cores of Arax flux—so fast that even blue steel spring can be soldered without pre-cleaning. Flux residue is easily removed with water.

**SIZE 8 CARTON**  
5/-

Handymans Carton 6d.



## 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. 3/8 each



## 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.



## MULTICORE SOLDERS LTD.,

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

# CONDOR

**SLICED**

*Real Value*



**IT'S A  
GALLAHER  
TOBACCO**

Over 75 years  
experience and worldwide  
reputation for quality

# THORNTON

**DRAWING INSTRUMENTS**  
TECHSET SERIES STANDARD QUALITY  
JAYWESS SERIES STUDENT QUALITY  
KINWEST SERIES SCHOOL QUALITY



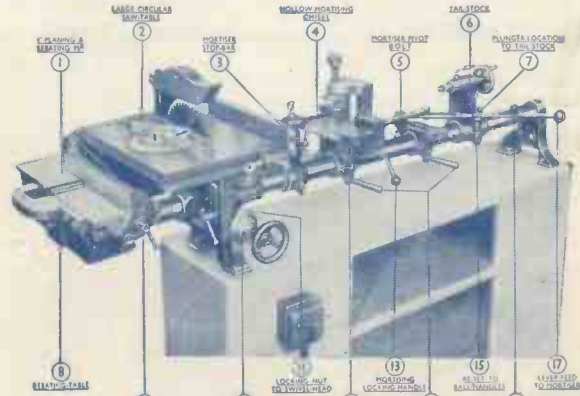
Write for  
illustrated leaflets  
and address  
of your  
nearest stockist to

**A. G. THORNTON LTD.**  
P.O. BOX 3, WYTHENSHAW, MANCHESTER

MANUFACTURERS OF FIRST QUALITY DRAWING INSTRUMENTS  
P.I.C. SLIDE RULES AND DRAWING EQUIPMENT

## Send Now

for New Brochure detailing all points and interesting features; answered questions you would ask, showing machines in use and articles such as toys, patterns and turnery made on these machines. Ask also for details of fittings to the "Coronet" range and other makes. Is long hole drilling a problem to you? Send now for details of BORING ATTACHMENT and long drills, to suit any lathes



### FITTINGS AND ACCESSORIES FOR ALL LATHES:

- CUP CENTRE No. 1 Morse Taper Shank.
- 4 Prong DRIVING CENTRE (Positive Drive for large or small work.)
- GRINDING WHEEL ARBOR No. 1 Morse Taper—suit any machine with No. 1 Morse Taper.
- REVOLVING CENTRE
- 5" WOBBLER—Ploughs— $\frac{1}{8}$ " to  $\frac{1}{4}$ ". Index for quick setting and fine adjustment.
- TURNING TOOLS, set of six 18" overall, beautifully handled.
- WOODSCREW CHUCK to suit any machine No. 1 or 2 Morse.
- 3 Jaw CHUCK and Self Centering 4 Jaw Independent Chuck.
- COMPOUND SLIDEREST—for wood and metal turning.
- ELECTRIC MOTORS, Brook  $\frac{1}{2}$  and  $\frac{3}{4}$  h.p.
- GRINDING WHEELS, SLIPSTONES, etc.

Write: Dept. P.M., enclosing stamp, for Catalogues showing photographs and price, etc.

**CORONET TOOL CO.** 8, MANSFIELD ROAD, DERBY  
Also at CITY ROAD MILLS, DERBY.

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, Eymoor Street, London, W.10. Sole Agents for Australia and New Zealand—Gordon & Gotch (A/sia) Ltd. Sole Agents for South Africa—Central News Agency Ltd. Subscription Rate (including postage): For one year, Inland 18s. 6d. Overseas 17s., Canada 17s.

"Practical Mechanics" Advice Bureau. **COUPON**  
This coupon is available until October 31st, 1956, 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, 1956.

# Free Guide — SUCCESS IN ENGINEERING

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'gmt. & 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	Carpentry & Joinery	Building Inspector
Costs & Accounts	Building Draughtsmanship	Heating and Ventilating	
Surveying & Levelling			
Clerk of Works			
Quantity Surveying			

## 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	Sanitary 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

(Dept. 29)

### 148, HOLBORN, LONDON, E.C.1

SOUTH AFRICA: E.C.S.A., P.O. BOX NO. 8417, JOHANNESBURG

## FOUNDED 1885 - FOREMOST TODAY

## 132-PAGE BOOK FREE! SEND FOR YOUR COPY

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

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

SEND OFF  
THIS COUPON  
NOW AND BE  
ALL SET FOR  
SUCCESS

(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.)