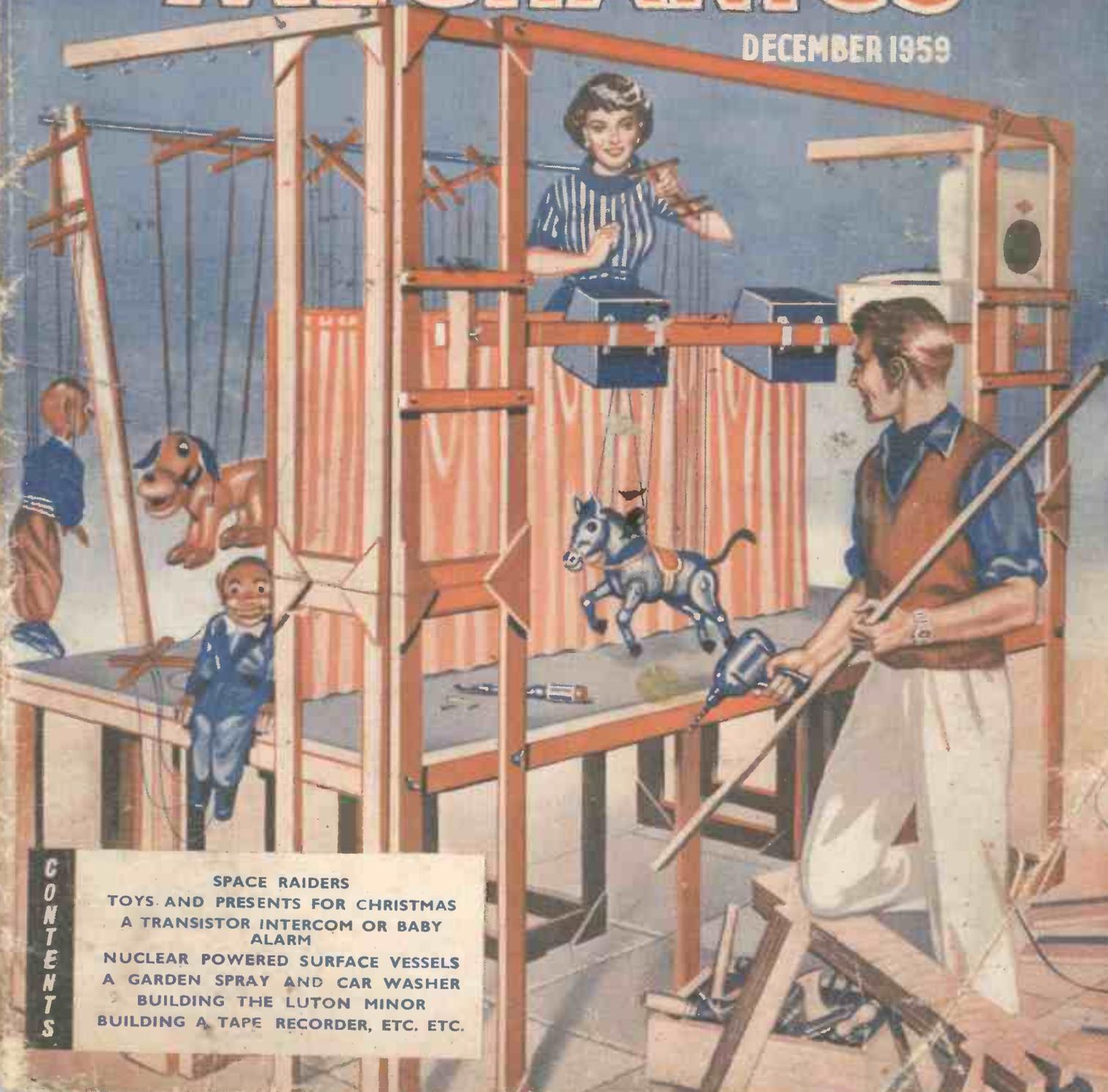


A Portable MARIONETTE THEATRE

13

PRACTICAL MECHANICS

DECEMBER 1959



CONTENTS

SPACE RAIDERS
TOYS AND PRESENTS FOR CHRISTMAS
A TRANSISTOR INTERCOM OR BABY
ALARM
NUCLEAR POWERED SURFACE VESSELS
A GARDEN SPRAY AND CAR WASHER
BUILDING THE LUTON MINOR
BUILDING A TAPE RECORDER, ETC. ETC.

For the expert
CARPENTER
 and
 keen amateur



NEWNES
Carpentry & Joinery

*Packed with Practical Knowledge
 Written by Specialists*

This is your chance to examine without cost or obligation the most up-to-date work of its kind. It is produced to help the carpenter to become a fully-skilled craftsman—keen practical handymen will find it invaluable too! Every aspect of the trade is dealt with comprehensively and concisely. It contains the experience of practical men—who will help you to solve day-to-day problems and implement your knowledge.

Just a few of the many subjects dealt with—**HAND TOOLS**—Saws and Planes, Care of Hand Tools, Workshop Equipment. **TIMBERS**—Conversion and Treatment. Characteristics, Uses and Ordering. **MACHINES AND PROCESSES**—Machine Saws and Benches, Mortising and Bandsawing Machines, Joints and Processes. **DOORS, DADOS AND SKIRTINGS**—Doors and Linings, Panelled and Glazed Doors, Locks, Hinges and Furniture. **SETTING OUT AND WORKSHOP GEOMETRY**—Moulding Mitres and Mouldings, Work of Double Curvature. **WINDOWS, BLINDS, AND SHUTTERS**—Types of Windows, Surrounds and Finishes to Metal Windows, Sunblinds, Window Blinds, Rolling Shutters. **PANELLING, VENEERING, WOOD STAINING and FINISHING. STAIRS, HANDRAILS, CHURCH FITTINGS AND FURNITURE. FLOORS AND TIMBER BEAMS**—Floor Construction, Types of Flooring and Timber Beams, Fixing Rubber Flooring. **ROOFS AND ROOF TRUSSES**—The Carpenter's Steel Square, Cornices. **DOMESTIC APPLICATIONS OF CARPENTRY AND JOINERY**—Entrance Gates and Fences, Greenhouse and Tool Shed Construction. **WORK ON SITE**—Shoring, Centering, and Formwork. Building Acts.

Plus quick reference Consolidated Index.

**USE IT
 FREE
 for 7 days**

This is what you receive without obligation

3 volumes strongly bound in rich dark-blue Morocco.

836 pages giving fullest information and latest practice.

258 explanatory photos.

1,091 Drawings, plans, diagrams.

12 unique data charts in special case — providing selected technical information in convenient form.

2 years' Free Advisory Service on all subjects embraced by the work.

And in Addition—

FREE COPY of "Questions and Answers on Carpentry" — a practical book of reference, profusely illustrated, dealing with problems which face the carpenter on the job. Value 5/-, it is free to every purchaser of Newnes Carpentry and Joinery.

ACTION PICTURES TO HELP YOU

Wherever photographs or a series of drawings clarify an operation, they are included. All the "Action" photographs have been taken in workshops or on actual building sites!

George Newnes Ltd., 15-17 Long Acre, London, W.C.99.

Please send me Newnes **CARPENTRY and JOINERY** without obligation to purchase. I will either return it within 8 days or send 7/6 deposit 8 days after delivery, then ten monthly subscriptions of 15/-. paying 157/6 in all. Cash price in eight days is 150/-.

Name

Address

Occupation

Your Signature C19
 (Or Parent signs if you are under 21)

Tel. (✓) where applicable

| | |
|---------------------|--------------------------|
| HouseOWNER | <input type="checkbox"/> |
| Householder | <input type="checkbox"/> |
| Living with Parents | <input type="checkbox"/> |
| Lodging Address | <input type="checkbox"/> |

**POST NOW
 IT IS TO YOUR
 ADVANTAGE**

The complete work will be sent carriage, paid for you to study at leisure—act now, you will learn much in this way!

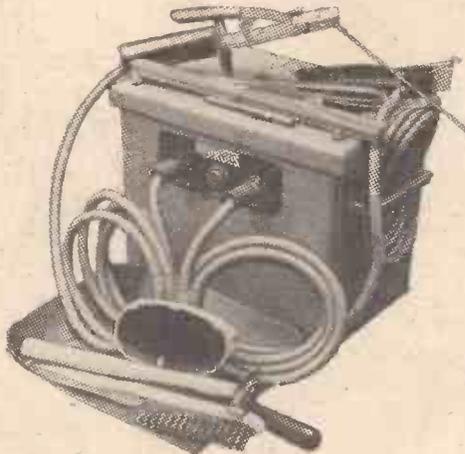
AS REVIEWED IN THIS ISSUE

THE Ideal BUILD-IT-YOURSELF WELDING KIT

TRY IT ON SEVEN DAYS FREE TRIAL

ONLY £25

Complete with all Accessories as shown



Works from Standard Household Power Plug (10-15 amp. A.C.). Welds up to any thickness plate. Brazes down to 26 swg plate. Silver solders, Tins and Surface Hardens. Send Cash or Deposit for Immediate Delivery, or write for Fuller Details. Not a cheap choke set, but a full WELDING TRANSFORMER in heavy gauge welded steel case. Larger models available. 180 amp. £52 (£10.10.0 deposit) and 360 amp. £95 (deposit by arrangement). Thousands in daily use in factories and workshops throughout the World.

H.P. terms, £5 deposit and 6 monthly payments of £3.15.0. Longer terms by arrangement.

UNCONDITIONALLY GUARANTEED

TAYLOR BROS. (MIDDLESBROUGH) LTD.

32 Baker Street, Middlesbrough, Yorks.
Tel. : 45241-2

To : Taylor Bros. (Middlesbrough) Ltd.

Please send me without obligation one of your FM65 welding sets with all accessories on 7 DAYS FREE TRIAL. If I keep it I will send £5 deposit for you to apply for H.P. terms for me, or £25 cash at the end of 7 days. If I return it the matter will be at an end.

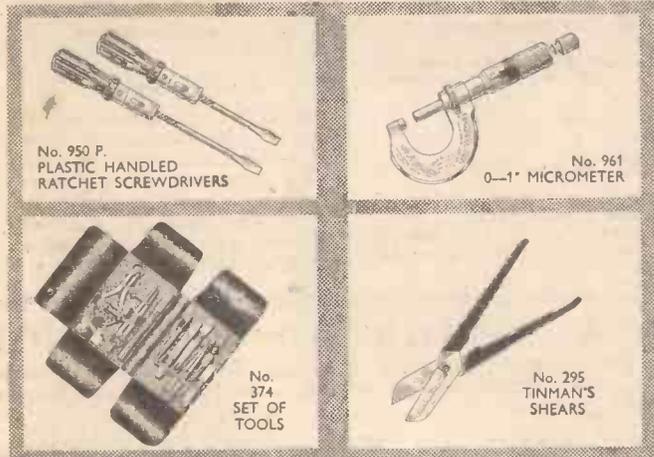
Name

Address



ENGINEERS

PRECISION & HAND TOOLS



No. 950 P. PLASTIC HANDLED RATCHET SCREWDRIVERS

No. 961 0-1" MICROMETER

No. 374 SET OF TOOLS

No. 295 TINMAN'S SHEARS

MEASURE UP TO ANY JOB

The next time you buy tools, remember that it pays to buy good tools, tools upon whose accuracy you can rely. (M&W) tools are made from the finest materials and are guaranteed to conform to British Standard Institution Specifications where they exist.

The next time you buy tools ask your dealer for (M&W) Engineers Precision and Hand Tools.

Write for our free catalogue, mentioning this journal.

MOORE & WRIGHT (SHEFFIELD) LTD., HANDSWORTH ROAD, SHEFFIELD, 13

* Permanent Magnets in action *

Pins and needles

Avoid dangerous loose pins and needles — use a magnet as your pincushion. Every housewife can use a magnet for countless jobs about the home. Ask your tool dealer for the new descriptive literature.



PERMANENT MAGNETS

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

Plastic Steel

TRADE MARK

the new make and mend material

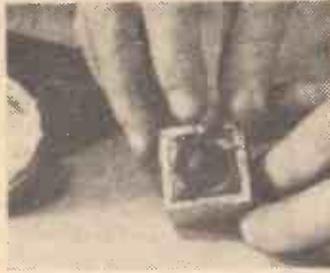
Here is Plastic Steel—the wonderful, new material with hundreds of uses for practical handymen. Plastic Steel is precisely what its name implies: a plastic paste containing 80% steel. You simply add the special liquid hardener, mix very thoroughly, then apply it. It's as easy to use as modelling clay, but in two hours it sets steel-hard. It is steel. *Real steel in plastic form.*

IT BONDS · IT MOULDS · IT FILLS · IT SEALS

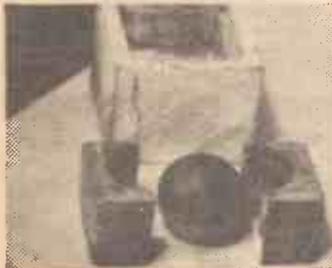
Just look at this simple jig:



A jig to hold a spherical component for drilling. A suitable box coated with mould-release is filled with Plastic Steel.



The sphere coated with mould-release is pressed half-way into the Plastic Steel which is left to harden.



When set the sphere is removed, the mould tipped out of the box and sawn in half.



The sphere is gripped in the mould with a clamp and is held for drilling.

Use Plastic Steel to make gadgets and components, mend tools and appliances, weld broken metal parts, renew stripped threads and

make dies, jigs, moulds. Use it in the house, in the garage, in the workshop, and for hobbies and handicrafts of every kind.



AS ADVERTISED ON TELEVISION

7/9

Plastic Steel

TRADE MARK

A DEVCON PRODUCT

Plastic Steel is made only by Devcon Limited, Nassau, Bahamas. Covered by U.K. and foreign patents.

COMPLETE KIT containing jar of Plastic Steel, phial of hardener and full instructions. Stocked by all good ironmongers and "Do-it-Yourself" Shops.

IN CASE OF DIFFICULTY USE THIS COUPON

To E. P. BARRUS (Concessionaires) LTD.

12-16 Brunel Road, London, W.3.

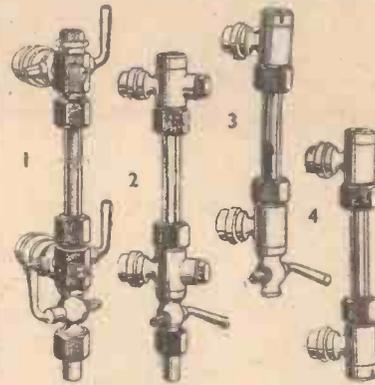
Please advise name of nearest stockist of PLASTIC STEEL.

Mr., Mrs., Miss.....

Address.....

PMCL2

BASSETT-LOWKE finest quality Water Gauges, Engine and Boiler Fittings



1. 3 Cock Pattern
3/16 dia. Glass, £1.18.6
1/2 dia. Glass, £2.2.6
3/8 dia. Glass, £5.10.6
2. Single Cock Type
with union drain cock.
3/16 dia. Glass, £1.1.0
3. Single Cock Type
with drain cock.
3/16 dia. Glass, 15/6
4. Plain Pattern
without drain cock.
3/16 dia. Glass, 10/3
7/32 dia. Glass, 12/6

FULL-WAY WHEEL VALVES (Angle)

5/32 in. pipe
Length overall, 1-7/8 in.
Thread of attachment
3/16 in. x 40
Price £1.1.6

3/16 in. pipe
Length Overall
1 1/2 in.
Thread of attachment
1/2 in. x 32
Price £1.3.6

1/2 in. pipe
Length Overall 2-3/16 in.
Thread of attachment 5/16 in. x 26
Price £1.5.3

5/16 in. pipe
Length Overall 2 1/2 in.
Thread of attachment 3/8 in. x 26
Price £1.7.0

These are a few of the fittings, etc., contained in "The Model Shipping and Engineering Catalogue." A Manual every model engineer should possess.
Price 2/6



PRESSURE GAUGE

These gauges are of the finest quality ever produced. Every gauge is individually tested before leaving our works.

1/2 in. dia. reading to 80, 100, 120 or 150 lbs.
Price, £1.10.0

1 in. dia. reading to 80, 100, 120 or 150 lbs.
Price, £1.10.0

1 1/2 in. dia. reading to 100, 120 or 150 lbs.
Price, £1.13.7

2 in. dia. reading to 100, 120 or 150 lbs.
Price, £1.17.6

Everything for your choice at the

BASSETT-LOWKE model shops

LONDON: 112, High Holborn, W.C.1 MANCHESTER: 28, Corporation St.
Write for leaflets & catalogues to Head Office: 18 Kingwell St., NORTHAMPTON

NEW! DO-IT-YOURSELF TRAINING TECHNIQUE in RADIO & ELECTRONICS

You LEARN while you BUILD...

SIMPLE...PRACTICAL...FASCINATING...

ANNOUNCING—after many years of highly successful operation in the U.S.A. and in Europe—the latest system in home training in electronics is now introduced by an entirely new British training organisation. AT LAST—a comprehensive and simple way of learning—by practical means—the basic principles of radio and electronics, with a minimum of theory. YOU LEARN BY BUILDING actual equipment with the components and parts which we send you. You advance by simple steps using high quality equipment and performing a whole series of interesting and instructive experiments. No mathematics! INSTRUCTION MANUALS and our teaching staff employ the latest techniques for showing clearly how radio works in a practical and interesting manner. You really have fun whilst learning! And you end by possessing a first rate piece of home equipment with the full knowledge of how it operates and—very important—how to service and maintain it afterwards. A full library of magnificent illustrated text books are included with the Courses. IN FACT for the 'Do-it-Yourself' enthusiast, the hobbyist, or those wanting help with their radio career training, or to set up their own full or part-time servicing business—then this new and exciting instructional system is exactly what is needed and it can all be provided at very moderate cost. Easy payments available. Post the coupon now, for full details. There is no obligation.



LOTS OF INSTRUCTIVE EXPERIMENTS AT HOME

BUILD YOUR OWN ● RADIO EQUIPMENT ● HI-FI INSTALLATION ● TEST GEAR

FREE

POST TODAY

No Mathematics!

To: RADIOSTRUCTOR, (Dept. G.38),
46 Market Place, Reading, Berks.

Please send brochure, without obligation, to:

Name.....
Address.....
(809) We do not employ representatives

BLOCK CAPS. PLEASE 12-59

RADIOSTRUCTOR

BRITAIN'S LEADING ELECTRONIC TRAINING ORGANISATION



"I would be completely lost..."

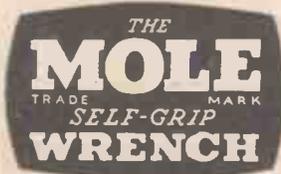
... without my Mole Wrench. It's my third hand; always so very useful for repairs on my car and for all sorts of jobs in the house, too."

You see, it locks on the job at any pressure you wish, leaving both your hands free. Just touch the release lever and—presto!—it's ready again for the next job—super pliers, vice, clamp, wrench all in one tool—the versatile, indispensable Mole Wrench.

7 inch, 12/6d. 10 inch, 15/-

From Ironmongers, Motor and Motor Cycle Accessory Dealers.

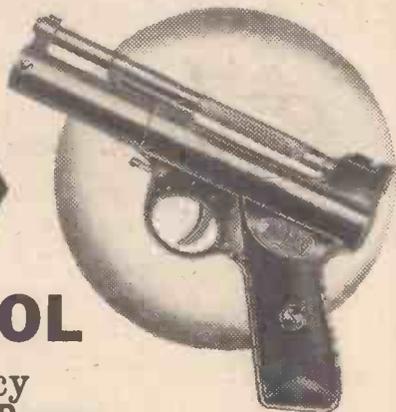
Make sure you ask for a genuine MOLE Self Grip Wrench, and look for the name on it.



If any difficulty write to M. MOLE & SON LTD., B'HAM, 3.



The Pistol you'll be proud to own!



AIR PISTOL

- ★ High Accuracy and Hitting Power
- ★ Perfect Balance
- ★ Robust Construction

Ideal for teaching elements of shooting, these pistols will give endless pleasure to both young and old. Their accuracy and efficiency, typical of all Webley Products, makes them the finest Air Pistols in the world.

Send for detailed Catalogue

WEBLEY & SCOTT LTD.

28 Park Lane, Handsworth, Birmingham 21. Tel: West Bromwich 2821

One of the Windsor Group of Companies

DON'T LET SOLDERING LEAD YOU A DANCE



use **FLUXITE**

Soldering ceases to be a knotty problem the moment you use FLUXITE. Solder flows on easily and smoothly—and stays on. For over half a century FLUXITE has been the choice of craftsman and engineer alike and, in this age, its reliability and speed has made FLUXITE even more in-demand than ever.

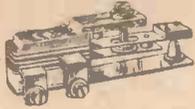
IT SIMPLIFIES ALL SOLDERING



FLUXITE Ltd., Bermondsey Street, London, S.E.1

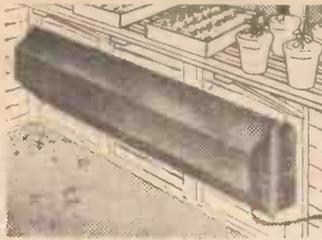
G.M.54

Thermostats



Useful for the control of appliances such as convector, gluepots, vulcanisers, hot plates etc. Adjustable to operate over temperature range 50-550 deg. F., fitted with heavy silver contacts, 8/6. Other types: 1 1/2 amp., 3/6; 5 amp., 2/6; 2 amp. QMB, 5/6; 15 amp., QMB, 15/-; 15 amp., encased wall mounting type, 29/6.

Instantus Heater



Convector heater. Made from heavy gauge sheet steel (galvanised). For greenhouse, workshop, aviary, etc. 500 watt, £1.12.6; 1,000 watt, £2.10.0. 1,000 watt with wired but separate thermostat, £3.17.6. 2K watt free standing or wall mounting, £3.19.6; 2K watt with built-in thermostat, £4.19.6. Carriage and insurance 5/- per heater. ALL ARE GUARANTEED FOR 5 YEARS.

Components Would Cost More



Car Battery Charger—ready-made high output battery charger in stove enamelled sheet steel louvered case. New, complete and ready to work. Rated at 12 v., 4 amps. and variable rate selector for trickle charging, also a meter to show charging rate. Suitable for 230/250 A.C. mains. Special snip price of 55/-, plus 3/6 post and insurance.

Constructor's parcel: to build Pocket 6 Transistor Set as currently being sold at £17.17.0. Parcel comprises motified two-tone cabinet as illustrated, tuning dial, two gang tuning condenser, combined bakelite chassis/printed circuit and easy-to-follow circuit. Costing value 57/6—offered while supplies last at only 29/6, plus 2/6 post. Suitable for your own circuit or to build original circuit. All parts available at highly competitive prices. Do not miss this tremendous bargain.

Unique Opportunity to build Fine Transistor Set



Five Useful Articles

Our 1960 catalogue now ready gives constructional hints and circuits for the following items:

- Moisture operated switch.
 - Simple but clever signal tracer.
 - Versatile power pack costing only 10/-.
 - Instantaneous heater for workshop or den.
 - Six transistor pocket superhet.
 - Photo-flood controller.
- Send for this catalogue to-day, price 2/6 refundable from purchases. All the necessary parts to make this tracer 9/6, post 1/-.

Band III Converters



Suitable Wales, London, Midlands, North, Scotland, etc. All the parts including 2 EF80 valves, coils, fine tuner, contrast control, condensers and resistors.

(Metal case available as an extra.) Price only 19/6, plus 2/6 post and insurance. Data free with parts or available separately, 1/6. Please send two more kits, the one you sent last week is performing magnificently. We receive this sort of letter every day of the week, so if you have hesitated because you thought our kits too cheap you need hesitate no longer.

Miniature Microphone



American made. Dynamic type, real bargain at 2/6, plus 6d. postage.

£100 Worth of Equipment 19/6



The famous R1154—unused but slightly soiled. Covers 200-500 kc/s, 3-5.5 Mc/s and 5.5-10 Mc/s. Has unique "click stop" mechanism. Wonderful breakdown value—meters, relays, switches. Complete with valves—real bargain at 19/6, plus 10/- carr.

1960 All Mains Amplifier



Undoubtedly finest value obtainable in amplifiers—powerful three valve circuit, ideal for dances, parties, etc. Complete with valves, mains transformers, volume and tone controls, but less chassis, speaker and cabinet. Price only 29/6, plus 2/6 post and ins. Data free with parts or available separately 1/6.

A.C./D.C. Multimeter Kit

Ranges: D.C. volts 0-5, 0-50, 0-100, 0-500, 0-1,000. A.C. volts 0-5, 0-50, 0-100, 0-500, 0-1,000. D.C. milliamps 0-5, 0-100, 0-500. Ohms 0-50,000, with internal batteries, 0-500,000 with external batteries. Measures A.C./D.C. volts, D.C. current and ohms. All the essential parts including metal case, 2in. moving coil meter, selected resistors, wire for shunts, range selector, switches, calibrated scale and full instructions, price 19/6, plus 2/6 post and insurance.

Connecting Wire

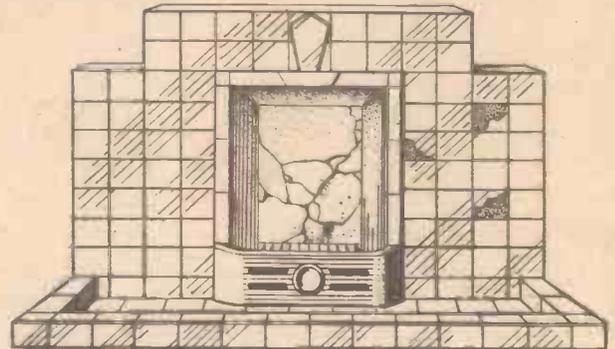


P.V.C. covered in 100ft. coils—2/9 a coil or four coils, different colours, 10/-, post free



FOR REPAIRING FIREPLACES

FOR FIXING LOOSE & BROKEN TILES



IN THE BLUE & WHITE TIN

IN THE RED & WHITE TIN

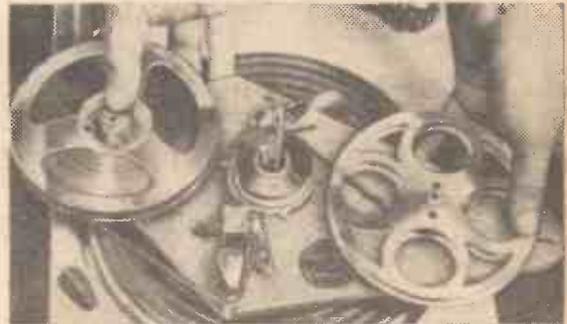
| KOS | PRICES | FIXATILE | |
|-----------|--------|-----------|-----|
| 1 lb..... | 1/9 | 4 oz..... | 1/- |
| 2 lb..... | 2/9 | 8 oz..... | 1/9 |
| 4 lb..... | 5/- | 1 lb..... | 3/- |

From Ironmongers and Hardware Stores

PURIMACHOS LTD. ST. PHILIPS, BRISTOL 2

A REVOLUTIONARY NEW BRITISH INVENTION!

- ★Plays at 7 1/2 per sec. or 3 other speeds
- ★Records direct from radio or microphone
- ★Erase and fast rewind



Results equal to a £50 recorder—yet costs only £13-12s. (or £17-11s. with special moving coil microphone and 600 ft. reel of tape). EASY TERMS

Instantly turns any gramophone into a first-class Tape-Recorder and back into a record-player in a moment!

You simply slip it on to your turntable and you are ready to record direct-from-radio or microphone... the voices of your family... radio programmes... your favourite music—and you can instantly play it back through your own gramophone or radio with Lifelike Fidelity. Made by the people who designed and manufacture radar instruments for Viscounts and Britannias, the amazing Gramdeck now brings full tape-recording and playing facilities to every gramophone owner, at little extra cost.

"Real hi-fi results", "Better than many so-called hi-fi recorders..." These are typical comments of famous technical journals. This wonderful new invention means that any gramophone owner can now add superbly good tape recording facilities to existing equipment, at a fraction of the usual cost. Full details, photos, specifications, Easy Terms, etc. are given in the Gramdeck Book. Send for your copy today—FREE and entirely without obligation.

FREE BOOK—POST NOW

- TO: GRAMDECK (Dept. PM/804)
- 29/31, WRIGHT'S LANE, LONDON, W.8.
- Please send me Gramdeck book—FREE
- NAME
- ADDRESS

"Ingenious—simple... why on earth did no one think of it before!" — THE TAPE RECORDER.



GRAMPHONE TAPE RECORDER

GRAMDECK TURNS A TURNTABLE INTO A TAPE-RECORDER

Electronics (Brislip) Ltd. 42-46, Windmill Hill, Ruislip, Middx. Phone: RUISLIP 3760 Half day, Wednesday.

Electronics (Croydon) Ltd. 286, London Road, Croydon. Phone: CRO 6558 Half day Wednesday.

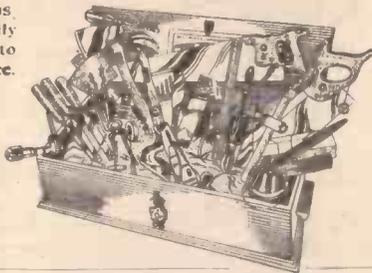
Electronics (Finbury Park) Ltd. 29, Stroud Green Rd., Finbury Park, N.4. Phone: ABBWAY 1949 Half day, Thursday.

Electronics (Manor Park) Ltd. 520, High Street North, Manor Park, E.12.

GAMAGES

RELIABLE 'CRAFTSMAN' TOOL SET

The tools are of superb quality. 38 items as illustrated. Sheffield make and fully guaranteed. They can be relied upon to give many years of satisfactory service. Complete in strong wood chest.

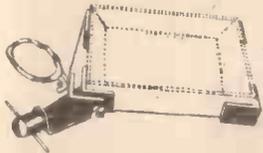


BARGAIN PRICE **£13.10**

Or 12 Monthly Payments of 23/9.

Sheffield made. 33-Tool Set. £9.15.0.
Or 9 Monthly Payments of 22/9.
Carriage Paid in Gr. Britain.

Elwood Multi-Purpose CRAMP



For Fixing, Gluing, Cramping and Pimling in one assembly. One precision-made and accurate corner cramp which is fully adjustable to the length of cable used. This tool does the work of a complete set of corner cramps, etc., and will save you time and money.

COMPLETE **23/6**

Post & Pkg. 1/6.

SHEFFIELD MADE PRESENTATION SAW KIT



Five-bladed Saw Kit, with separate quick-grip handle. Finely tempered blades are accurately set and sharpened. 18in. Rip, 16in. Crosscut, 10in. Tenon, 14in. Compass, 10in. Keyhole. Presentation box, size 24 1/2 x 4 1/2 x 1 1/2in. deep. Insertion of blade and handle takes only an instant and deep engaging slot together with positive action of lever nut ensures rigidity.

COMPLETE SET **26/9**

Post & Pkg. 1/8.

Gamages Tool & Motor Accessory List FREE on request.

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

*Qualified Welders
can earn £30
a week!*

"... a spokesman said the average earnings of a qualified welder on the site would be about £30 to £35."
From a National Newspaper

Why not YOU with the aid of NEWNES COMPLETE GAS AND ARC WELDER

USE IT FOR A WEEK FREE!

The demand for skilled welders is increasing because this modern key technique is being used in more and more factories and repair shops and in specialised construction work. This means high pay for the man who understands his job fully. Newnes COMPLETE GAS AND ARC WELDER supplies the knowledge which would take years to acquire in the normal way. Prove its value to you by 7 days' free examination, without cost or obligation!

2 VOLUMES . 544 PAGES
614 PHOTOS AND DRAWINGS
139 DIAGRAMS AND TABLES

Expert, practical aids on Gas Welding and Cutting Processes, Oxy-Acetylene Welding Equipment and Practice, Generators, Weldable Metals, Rods and Fluxes, Joints and Preparation, Sheet Steel and Steel Plate Fusion Welding, Welding Iron, Cast Iron, Cast Steel and Alloy Steels, Tube Welding, Hard Facing Processes, Aluminium and Magnesium Welding, Welding Copper and Alloys, Bronze Welding, Flame Brazing, Lead Welding, Oxygen Cutting, Oxy-Acetylene Hand Cutting, Underwater Cutting, Oxygen Cutting by Machine, Arc Welding and Cutting Processes, Electric Arc Welding Equipment, Electrodes, Manipulating the Arc, Welding in Horizontal-Vertical, Vertical and Overhead Positions, Metal-arc Welding Procedures, Hard Facing, Carbon Arc Welding, Atomic Hydrogen Arc Welding, Inert-gas Arc Welding, Automatic Arc Welding, Stud Welding, Testing Welds, Shipyard Welding, Electric Arc Cutting, Tables and Data, Qualification Tests, etc.

PLUS CASE OF 14 DATA CHARTS

—containing important technical information in convenient form. Each chart size 9 1/2in. x 13 1/2in. and plastic laminated for long life.



ALSO BASIC KNOWLEDGE FOR IMPORTANT EXAMINATIONS

Lloyd's; Aeronautical Inspection Directorate; Association of Heating, Ventilating and Domestic Engineering Employers; Air Registration Board; and the City and Guilds of London Institute.

EXPERT CONTRIBUTORS
G. F. CHARGE, A.M.Inst.W., Chief Examiner, City and Guilds of London Institute Syllabus 86a. Lecturer on welding theory and practice.

F. D. HUCKLESBY, A.M.Inst.W., British Oxygen Co., Ltd.
S. A. SALES, Manager, Weldcraft Ltd.

EMANUELE STIERI, B.Sc., Specialist in welding and allied subjects.

FOR EVERY OWNER
FREE TECHNICAL ADVICE
BY POST FOR 2 YEARS



NEW DO-IT-YOURSELF PRINTING OUTFIT

£1.17.6
COMPLETE

Everything you need to print your own snaps. Combined safe light and exposing light. Three 4 plate dishes (orange, white and grey). Printing frame with masks. Two graduated measures. Two forceps. Thermometer with case. Con-Sol developer. Acid Fixing powder and full instructions.

JOHNSONS
OF HENDON LTD

FOR CONFIDENCE
IN PHOTOGRAPHY

PRACTICAL FREE GIFT

WELDING ENGINEER'S POCKET BOOK
300 Pages. Value 7/8.
Presented FREE as an additional service to purchasers of Newnes Complete Gas & Arc Welder.



To: George Newnes Ltd., 15-17 Long Acre, London, W.C.99.
Please send me Newnes COMPLETE GAS AND ARC WELDER without obligation to purchase. I will either return the work within 8 days or I will send only 5/- deposit 8 days after delivery, then eleven monthly subscriptions of 10/- until 115/- has been paid. Cash price in 8 days 110/-.

Name.....

Address.....

Occupation.....

Your Signature.....

(Or Parent signs if you are under 21.) GA.5

Tick (✓) where applicable

| | |
|---------------------|--------------------------|
| HouseOWNER | <input type="checkbox"/> |
| Householder | <input type="checkbox"/> |
| Living with Parents | <input type="checkbox"/> |
| Lodging Address | <input type="checkbox"/> |

CHEMISTRY



EQUIP YOUR OWN LABORATORY

Send 3d. Stamp for copy of Complete Price List of Wide Range of Apparatus and Reagents

"EXPERIMENTS IN CHEMISTRY," 1/2

"FORMULAE & TABLES," 1/2

"EASY HOME CHEMISTRY FOR BOYS," 2/10

A. N. BECK & SONS

60 STOKE NEWINGTON HIGH STREET, LONDON, N.16

For garage or workshop

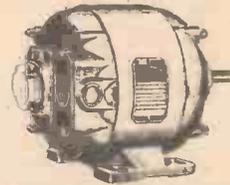


FRACTIONAL HORSEPOWER MOTORS

A.C. or D.C.

AEI motors and associated control gear are second to none in quality and proved performance.

Types and sizes are available to suit any application.



ASSOCIATED ELECTRICAL INDUSTRIES LIMITED
MOTOR & CONTROL GEAR DIVISION NEWCASTLE (STAFFS), ENGLAND

A5441

Huge Purchase High Speed Steel Tool Bits, hardened ready for use, essential to any lathe user, secure your stock now as these are really a good investment. 1/4" square, 2 1/2" long, 6/6 per doz. 5/16 sq. 3" long, 5/8 doz., 3/8" sq., 3" long, 12" doz.; 7/16 sq., 3 1/2" long, 15" doz. Six doz. lots less 10 per cent.

5,000 Taps, 1/8" to 3/8" dia., Assorted Threads, suit M.E. or experimenter, mostly fine threads, twenty assorted, 3/6.

One Ton Ground Silver Steel, 13" lengths, 1/16" to 15/32" dia., doz assorted lengths, 5/6.

1,000 H.S. Morse Taper Shank End Mills, 1/4", 3/8", 1/2" dia., worth 50/-, gift 12/- the three. Also No. 2 M.T. Shank End Mills, 9/16", 5/8", 11/16", 3/4", 7/8" dia., 20/- the set. Secure these now as at this ridiculous price quick clearance is certain.

5,000 Ball Races, standard o.d., 1 7/8" bore, 2 1/2", 3 1/8", 2", 1 1/4", 2", 3/8", 2/6; 1 1/2", 3/8; 5/8; 4/6 each, 6 or 9 mm., 1/- each.

2,000 Hand Reamers, sizes 17/64", 19/64", 5/16", 21/64", 3/8", 7/16", 15/32", 31/64" - 3/8 each, 22/6 the lot. Also 17/32", 21/32", 5/8", 11/16", 4/9 each, 16/- the lot. Both lots, 35/-.

Extra Special Carb. Grinding Wheels Offer, 6"-7" dia, 1/4", 1/2", 3/4" thick, 1/2" or 3/4" hole, 10/- the three, postage 2-. Value over 30/-, 6 for £1, post paid. Ass. grits for tool and cutter grinding, also 5" dia. dish wheels, 1/2" hole, 4/6 each.

2,000 Small H.S. Twist Drills, approx. 1/32"-3/32", 4/- doz. Approx. 1/16"-1/4", 7/6 per doz. Approx. 9/32"-15/32", six for 10/-.

3,000 Circular Split Dies, 1" dia. cutting 1/4", 5/16", 3/8", 7/16", 1/8" Whit., H.S.F., also brass thread, 26 thread all sizes and American N.F. 12/- per set of 5 sizes, 2 sets 22/6, 4 sets 42/6. Taps to suit 12/6 per set, either taper or second or plug, 1" dia. stocks 6/- each.

2,000 Straight Shank End Mills, size 1/8", 5/32", 3/16", 7/32", 1/4", 5/16", 15/- set, also 3/8", 7/16", 1/2" ditto, 12/6 set.

All Items brand new. £1 orders post paid, except overseas.

J. BURKE

192 Baslow Rd., Totley, Sheffield

Inspection at Rear 36 Fitzwilliam St., Sheffield

STEEL SHELVING

72 in. HIGH
34 in. WIDE
12 in. DEEP



£3-15

complete!

- Brand new—Manufactured in our own works.
- Shelves adjustable every inch.
- Heavy gauge shelves will carry 400 lbs. each.
- Stove enamelled dark green.
- 6 shelves per bay—Extra shelves 8/- each.
- Also available in white at £5 per bay.
- Quantity discounts.

Delivered free £3 15s.
Ready for erection.

N. C. BROWN LTD.

Green Lane Wing

HEYWOOD · LANCS

— the manufacturers!

ALL OTHER SIZES available at equally keen prices.

Deliveries Free to England, Scotland and Wales.

Telephone: Heywood 69018 (6 lines)



THE BUSBY BURNER

ON THE "BUNSEN" PRINCIPLE
(Complete with a pair of TONGS)

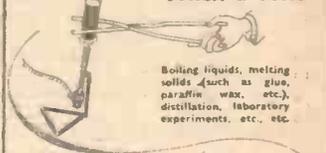
The ideal GIFT for the practical HOUSEHOLDER.

Suitable for Schools, Workshops.

CASH PRICE

5/9

TORCH & TONGS



Glass blowing and bending, hard and soft soldering, brazing, annealing, hardening, tempering, forging, heating rivets, etc., etc.



A really portable blow pipe, easily carried in the pocket, or hung flat on the wall.

Obtainable from local ironmongers or direct from makers on receipt of P.O. 6/- (including postage).

BUSBY & COMPANY LIMITED

BUSCO WORKS, PRICE STREET, BIRMINGHAM

Phone: ASTON CROSS 5066/7

For "Practical Mechanics" readers on 7 DAYS' FREE TRIAL!

AMAZING 3-VOLUME SET SAVES POUNDS and ensures EXPERT RESULTS



JUST OFF THE PRESS!

HANDYMAN & HOME MECHANIC

Complete "HOW-TO-DO-IT" GUIDE to 1001 HOME JOBS!

Specially prepared by practical experts to meet every need of the handyman and householder. Shows, in simple language and crystal-clear pictures, JUST HOW to carry out all kinds of home improvements, do hundreds of jobs in house, garden and garage—even make your own modern furniture, including complete suites! Brings you NEW ideas, NEW methods, NEW WAYS OF SAVING MONEY!

SEE IT—TEST IT FOR YOURSELF—ON 7 DAYS' FREE APPROVAL!

Simply post form below and this great work comes to you for 7 days—no charge—no obligation. Prove for yourself its great value as a do-it-yourself aid! **TWO SUPERB VOLUMES. 696 pages. Nearly 1,500 illustrations and WORKING DRAWINGS.** Special Plan Case contains 24 large Pull-out Sheets showing exactly how to make a grand range of home items—from toys to a greenhouse! **YOURS (if kept after free trial) AT AMAZINGLY LOW COST!** 2 volumes and plan case, bound in durable buckram, 8/- down and 8 monthly payments of 10/- (£4.8.0). Cash price £4.4.0.

Do WOODWORK with the "craftsman touch"

Learn all about timber and how to choose it: tools and their uses: joints: rebating, grooving and finishing: painting, staining and polishing: fitting locks, hinges, etc.: using power tools: arranging the workshop: scores of things to make.



Make a PROFESSIONAL JOB of PAPER-HANGING

A complete "can't-go-wrong" guide (with unique "see how" pictures to illustrate every step) to papering walls and ceilings. Shows how to calculate the amount of wallpaper required, how to get perfect results in the shortest time.



SAVE POUNDS on HOUSE REPAIRS & RENOVATIONS

Here's detailed guidance that will help you to keep your home in good condition. Covers: repointing brickwork: how to deal with defective chimneys, fireplaces, doors and window-frames: how to mend broken windows, sash cords, burst pipes, broken fences, renovate faulty floors and roofs, tiled walls, make pelmets and built-in fittings etc.

Make your own FURNITURE!

Clear instructions and detailed WORKING DRAWINGS to enable you to save pounds by making sound, modern furniture you'll be proud to own! Designs include: Coffee Table, Unit Bookcases, Wooden Light Fittings, Writing Desk, Corner Cabinet, Sideboard, Built-in Cupboards, Kitchen Cabinet, Complete Bedroom Suite.



HOUSE PAINTING made easy!

Step-by-step instruction ensures perfect results with all forms of indoor and outdoor painting. All you want to know about tools and materials, how to treat all kinds of surfaces, deal with doors and window-frames, etc. Covers painting, distemping, staining, varnishing, graining, roller and spray painting, etc.

696 PAGES
Nearly 1,500 PHOTOS & DRAWINGS
8 COLOUR PLATES.

MAKE HER DREAM KITCHEN a reality!

Thanks to this grand book, you'll find it a simple matter to transform a dull kitchen into a bright, modern one! See how to improve the walls, make a smart sink unit, built-in cupboards, etc.



CUT FUEL BILLS this winter!

The colder the weather, the more heat you waste. Learn how, by thermal insulation, you can keep your home delightfully warm with less consumption of fuel. See, too, how to protect water tanks and pipes from frost.

HOW TO CURE DAMP WALLS

Expert advice on the most effective treatments for damp exterior and interior walls and leaky roofs.

ENJOY TROUBLE-FREE RADIO AND TELEVISION

Here's valuable advice that will help you to get the utmost enjoyment from your listening and viewing. Explains how to install sets, trace faults.

A NEW LOOK FOR AN OLD BATHROOM

Full directions to enable you to modernize your bathroom. Includes treating walls and ceiling, boxing in the bath and wash basin, making a window pelmet, etc.



COLOUR SCHEMES for every room

Expert advice on how to use colour to the best advantage: how to plan traditional or modern schemes of decoration. Lovely FULL-COLOUR PLATES suggest exciting colour schemes for every room.

FIRST-AID for shabby or broken FURNITURE

See how you can make old furniture as good as new by clever repairs or re-upholstering. This book makes the job simple—and fun!



DON'T BE IN THE DARK where ELECTRICITY is concerned!

Learn what to do when a fuse blows, how to renew faulty wiring or fittings, how to make extensions to circuits, how to repair all kinds of electrical appliances—heaters, cookers, kettles, toasters, irons, door bells, clocks, vacuum cleaners, washing machines, small electric motors, etc.

NO MORE LEAKY TAPS!

Learn just how to set about re-washing taps, and how to deal with faulty cisterns, drains, etc.



DO THIS NOW!
Just fill in form and post in 2d. stamped, addressed envelope to Dept. E.A.6, Odhams Home Library, Basted, Sevenoaks, Kent, and complete set comes to you on APPROVAL. Offer applies in U.K. and W.I. only, closes Dec. 31. SEND NO MONEY NOW

2 GREAT VOLUMES
plus PLAN CASE containing 24 Pull-out Sheets

Here, for use on the bench, are 24 sturdy sheets (size 18in. by 12in.) providing you with full instructions and detailed working drawings for making:
Kitchen Furniture and Fittings. Sink Unit. Greenhouse. Garden Shed. Garden Furniture. Dining-Room Furniture. Room Divider. Record Cabinet. Table Lamp. Standard Lamp. Divan. Dressing Table. Built-in Wardrobe. Toys, etc. etc.

Main Contents include:
VOLUME 1: Woodwork, Tools, Setting-out Methods, Sawing, Planing, Use of Chisels, Joining, Woodwork, Rebuilding, Grooving and Finishing, Painting, Staining and Polishing, Metal Fittings, Portable Electric Tools, Home Workshop, Things to Make, Furniture Making, Design and full instructions, Metalwork—Metals and their uses, Tools, Measuring Instruments, Filing, Drilling, Nails and Screw Threads, Smith's Work, Soldering, Hardening and Tempering, Lathework, Wood Turning, Metal Turning.

VOLUME 2: House Painting and Decorating, Trepanning and Painting Woodwork, Fainting Metal Surfaces, Painting Asbestos, Hardboard and Bricks, Preparing and Painting, Plaster, Special Finishes, Paperhanging, House Repairs and Renovations—Repairs to Brick and Stone Walls, How to Deal with Smoky Chimneys, Interior Plaster Work, Condensation—Causes and Cures, Wall and Ceiling Boards, Wall Tiling, Wood Floors, Insects in Timber, Treatment of Solid Floors, Floor Covering, Doors and Windows, Replacing Window Panes, Staircase Faults, Pelmets and Built-in Fittings, Furniture Renovation and Repair, Upholstery Work, Shelves and Brackets, Looking after Drains, Garage Work—Fitting out the Garage, Car Maintenance, Bodywork Repairs and Repainting, Motor-cycle Maintenance, Motor Scooters and Mopeds, Cycle Maintenance, Water and Gas Supplies, Water Supply, Gas Supply, Electrical Maintenance, Radio and Television, Working with Hardboard, The Garden and Smallholding, Making and Edging Paths, Crazy Paving, Concrete and Cement Work, Brick Base for a Greenhouse, Garden Pools, Levelling and Draining a Lawn, Wire Netting and its Uses, Fences and Fencing, Gates, Trelliswork and Pergolas, Garden Appliances, Overhauling a Lawn-Mower.

POST FORM AT ONCE! NO SALESMAN WILL CALL!

To: Dept. E.A.6, People's Home Library, Odhams Press Ltd., Basted, Sevenoaks, Kent. Please send me WITHOUT OBLIGATION TO PURCHASE "Handyman & Home Mechanic" (2 volumes and plan case). I will EITHER return the complete set in good condition, carriage paid within 8 days, OR send down payment of 8/- eight days after delivery, followed by 8 monthly instalments of 10/- (£4.8.0). ALTERNATIVELY, I will send £4.4.0 eight days after delivery.

Signature..... Occupation.....
(Persons under 21 will be sent a Guarantor Form) Age, if under 21.....
Put tick where applicable: Cash Terms Householder
Furnished Premises Unfurnished Premises Hotel Live with Parents Lodgings BLOCK LETTERS BELOW
NAME.....
Full Postal ADDRESS.....
E.A.6/Dec. '59.....

Write clearly in margin.

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.

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

ELECTRICAL ENGINEERING
Gen. Elec. Eng.—Elementary & Advanced Elec. Technology — Installations —Draughtsmanship—Supply — Maintenance — Design.

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

RADIO & ELECTRONICS
Gen. Radio Eng.—Radio Servicing, Maintenance & Repairs — Telegraphy—Telephony — Television—C. & G. Telecommunications—Electronic Eng.—Automation—Digital Computers — Analogue Computers—Data Processing—Instrumentation.

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

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.J.Mech.E., A.M.I.C.E., A.M.I.Prod.E., B.Sc., A.M.Brit.I.R.E., A.F.R.Ae.S., A.M.I.M.J., L.I.O.B., A.R.I.B.A., A.M.I.H. & V.E., M.R.S.H., A.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 £20 a week you should send for your copy of this enlightening book **now**—FREE and without obligation.



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

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

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



Practical Mechanics

"The Cyclist" and "Home Movies" are incorporated

DECEMBER, 1959

Vol. XXVII

No. 308

Editorial and Advertisement Offices
 "PRACTICAL MECHANICS"
 George Newnes, Ltd., Tower House,
 Southampton Street, Strand, W.C.2.
 © George Newnes, Ltd., 1959

Phone: Temple Bar 4361
 Telegrams: Newnes, Rand, London

SUBSCRIPTION RATES
 Including postage for one year

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

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

CONTENTS:

| | Page |
|--|------|
| Fair Comment | 105 |
| Toys for Christmas and Presents for the Stocking | 106 |
| A Toddler's Swing | 108 |
| Pedal Power Your Lathe | 109 |
| A Contact Print Viewer | 110 |
| A Transistorised Intercom or Baby Alarm | 111 |
| How to Use Your P.M. Reflecting Telescope | 113 |
| Nuclear Powered Surface Vessels | 115 |
| Use Your Camera for Enlarging | 118 |
| Building the Luton Minor | 119 |
| A Portable Marionette Theatre | 122 |
| A Garden Spray and Car Washer | 125 |
| Science Notes | 126 |
| Building a Tape Recorder | 127 |
| Space Raiders | 129 |
| Letters to the Editor | 134 |
| Trade Notes | 138 |
| Your Queries Answered | 141 |

THE CYCLIST SECTION

| | |
|------------------------------------|----|
| Comments of the Month | 9 |
| How to Keep Warm and Dry | 10 |

CONTRIBUTIONS

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

FAIR COMMENT

THE FAR SIDE OF THE MOON

IN October the first pictures of the far side of the moon were released by the Russians. They were taken by a camera mounted on the rocket Lunik III and later transmitted some 300,000 miles to the earth by radio.

A superficial inspection of the photographs would appear to indicate that there are fewer major features on the far side, but this can by no means be taken as certain. The photographs were taken when Lunik III was directly between the sun and the moon which means that the illumination, so far as the camera was concerned, was directly vertical. These are the worst possible lighting conditions for taking such photographs. It is well known that to avoid these conditions the moon as we see it from earth is never photographed when it is full, but only when waxing or waning. It is the shadows thrown by having the light source at one side which enable astronomers to observe, photograph and recognize features on the moon's surface.

If a sphere is illuminated by a bright light, the point nearest the light source shows the strongest reflection. This reduces gradually, the increasing areas of shadow taking roughly the form of successive crescents, resembling closely the effect seen on the Lunik photographs.

The bright spot appears to be so bright that the photograph was over-exposed at this point and practically devoid of detail. A little more can be seen on the fringes of this area, while towards the edge of the moon's disc farthest from the "highlight," which incidentally is the part of the surface visible from the earth, detail is very much more abundant.

The side of the moon visible from earth has been photographed by many astronomers over a period of about 100 years and new features are still being discovered, so it is not surprising, nor is it disappointing that the first batch of photographs of the moon's far side should not show the intricate detail of some of the best photographs taken from earth. Considering that the space projects of man are in their infancy, the Russian scientists responsible deserve the congratulations and admiration of the world for their very considerable technical achievement in obtaining any photographs—whatever the quality.

Should the over-exposure theory, which we are inclined to favour, not be true and if it is established without doubt that the far side of the moon is as monotonous as it would appear at first glance, then scientists and astronomers are indeed faced with an exciting problem. The extreme contrast between the two sides would certainly have considerable bearing on the several theories of the origin of the moon's characteristic features.

IS IT WORTH WHILE?

SPACE research with its rockets, satellites, etc., is extremely expensive, and it is the opinion of many people that the millions of pounds being spent could be better employed here on earth. Such worthy projects as cancer research, famine relief and the education of backward peoples are often cited as being far more deserving of attention. These, of course, are very urgent problems, but let us not lose sight of the vast potential benefits which may accrue from space research. Before Columbus sailed across the Atlantic, people in Europe were saying much the same thing and with much more reason. It was not then established that the earth was a globe and it was popularly thought that these intrepid mariners would sail off the edge of the world. Think, however, for a moment of the fabulous riches given to the world by the discoveries made by this man and others, who sailed in spite of short-sighted criticism.

These benefits came to us, as we developed technically, merely from the exploration of our own planet. Who knows what might result from the exploration of some of the other worlds in space?

The January, 1960, issue will be published on December 31st. Order it now!

A FOLDAWAY BLACKBOARD

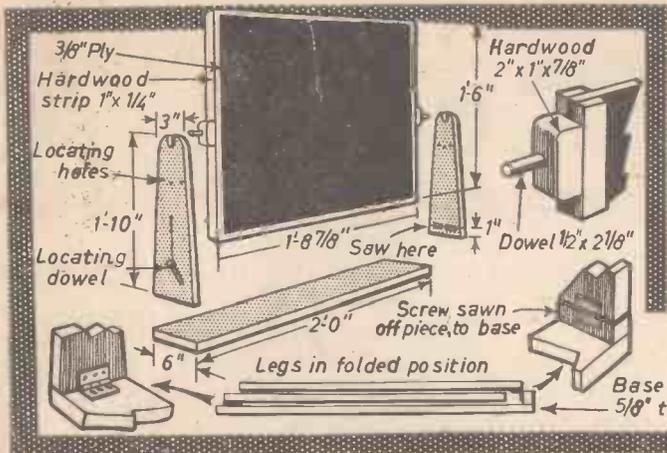
CUT and sand both surfaces of the board very smooth. On these surfaces paint two thin coats of a mixture containing drop black gold size and fine emery powder. If the chalk skids apply another coat of the solution, but this time add more emery.

Edge both sides of the board with hardwood strips and mitre them neatly in the corners. Glue, sandpaper and paint or varnish.

Cut the two swivel blocks from hardwood and glue as shown. Drill $\frac{1}{8}$ in. through the middle of each and into the board for $\frac{1}{2}$ in., a total depth of $1\frac{1}{2}$ in., then glue the dowel hinge-pins in place. $\frac{3}{16}$ in. below each hinge block drill another hole $\frac{1}{8}$ in. diameter to a depth of $\frac{1}{2}$ in.

Cut the base and the two uprights as shown. An inch from the bottom edge of one of the uprights saw it through and hinge. The opposite upright is not cut and is hinged direct to the base on the inside. This allows the uprights to lie flush when folded.

Mount the board between the uprights with a short piece of pencil pushed into the peg hole in the board. Move the board so that the pencil describes an arc and on it drill three $\frac{1}{8}$ in. holes at $\frac{1}{2}$ in. centres. Pieces of $\frac{1}{8}$ in. dowel hold the board rigidly in three alternative positions. Finish with stain and varnish.

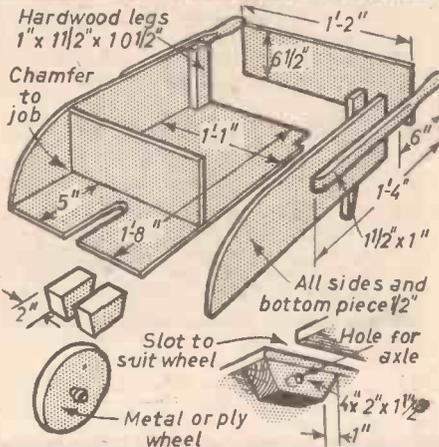


A BOY'S BARROW

CUT the hardwood baseboard first and cut-outs in two corners to accommodate the two legs at the rear. At the opposite end cut a slot wide enough to take any suitable wheel. A wheel could be cut from $\frac{1}{2}$ in. plywood, with a fretsaw. Drill the centre $\frac{1}{8}$ in.

diameter and round off the rim with a file and glasspaper. Cut out the two sides, the back and front from hardwood, then glue and pin them on the base.

Next, cut the two rear legs of the barrow and taper $\frac{1}{4}$ in. at one end of each to $\frac{1}{16}$ in. square at the base. Glue and screw these in place. Cut the handles and round off the grips and the front ends. Screw in position. Push one end of a $\frac{1}{8}$ in. dowel into one of the blocks, fit a $\frac{1}{8}$ in. washer, then the wheel and another washer and finally the second block. Then screw the assembly to the body base with $\frac{1}{8}$ in. woodscrews.



TOYS FOR CHRISTMAS

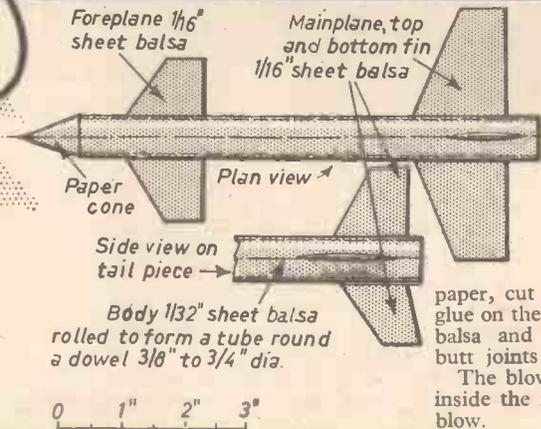
TOYS

A GUIDED MISSILE

THIS model can fly over 60ft. The body is made by wrapping wood round an 8 in. \times $\frac{1}{8}$ in. dowel and butt jointing. Mark a sheet of $\frac{1}{32}$ in. balsa wood into four equal parts by means of three lines running along the length; these are to assist in aligning the fins. Soak it in warm water, wrap it round the former, bind in position and leave to dry. When dry cement the edges of the tube together.

Cut out a 2 in. dia. circle of stiff drawing paper, cut from edge to centre, form into a cone and glue on the front of the tube. Cut out the fins from $\frac{1}{16}$ in. balsa and glue in position using the ruled lined and butt joints as guides.

The blowpipe is a 10 in. paper tube which fits loosely inside the missile body. To fire, hold horizontally and blow.



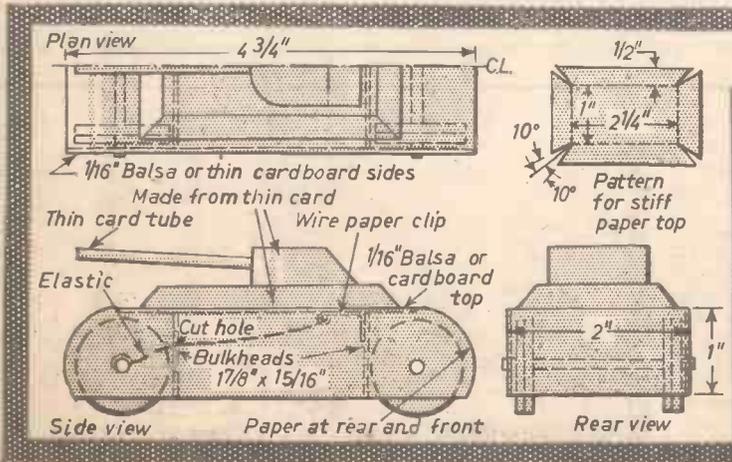
A WORKING MODEL TANK

FIRST mark out the two sides and cut holes for axles in identical positions on both. Cut out and form the top panel and cement tabs inside each corner to hold edges together. Cut the two rectangular bulkheads. The front bulkhead should have a hole in the centre to give clearance for the elastic.

Cut eight 1 in. dia. discs with holes to suit the pencil axles. Cement discs together in pairs to form wheels approximately $\frac{1}{2}$ in. thick. Cut the top and bottom panels of the turret. A $\frac{7}{16}$ in. wide strip of stiff paper forms the turret sides. Roll a paper tube to make a gun. Stiff paper is used for front and rear curved portions of tank.

Drill a small hole in front axle on the centre line. Push the axles through the sides and slide the wheels into place; then cement firmly. Add the top, then cement turret and gun into place, followed by the front and rear curved pieces.

Fit elastic between the axle and cemented paper clip, via the hole in the front bulkhead. Work the model by drawing the tank rearwards along the floor and then letting it go.



THE PUZZLE TUMBLER

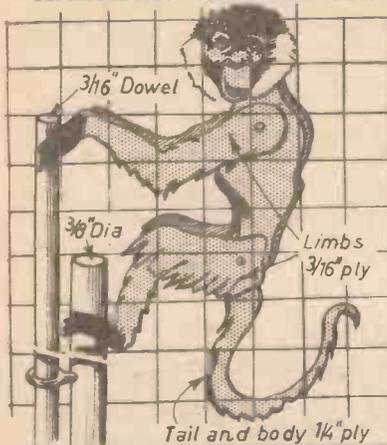
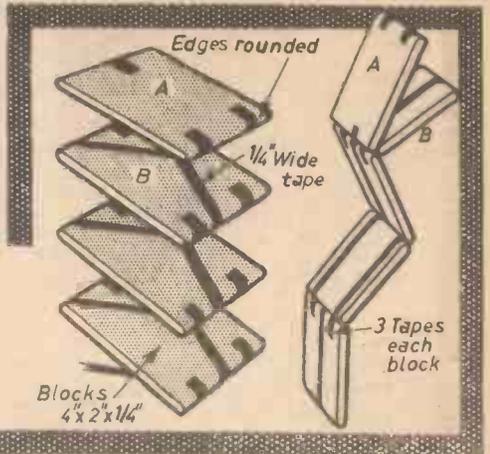
A NUMBER of blocks of wood $\frac{1}{4}$ in. \times 2 in. \times $\frac{1}{4}$ in. are required. Seven give a good effect; 12 is a generous number.

The edges and corners of the blocks should be rounded and all surfaces smoothed with glasspaper. Procure some thin tape about $\frac{1}{4}$ in. wide and cut it into strips long enough to pass along the blocks and over each end by about $\frac{1}{2}$ in., as shown herewith. Three tapes are required for each block and are threaded as shown, being firmly glued at each overlap. They should be taut so that when the blocks lie flat, one upon the other, there is no excess movement.

Paint the blocks with two bright contrasting colours—say red on one side and blue on the other—so that when lying flat the underside of one block contrasts in colour with the upside of its neighbour.

The sketch also shows how the toy should be held to make it work. The top block "A" and the second block "B" are turned upwards, as shown, and, upon the release of "B" the top block "A" will fall and appear to pass rapidly down the chain, first on one side and then the other, until it reaches the bottom. By alternating holding the second block and letting fall the first, the illusion can be repeated *ad lib*.

What really happens is that the second block becomes reversed and falls back again in its former position. This makes it come level with the third block, which at once falls over on to the fourth, and so on to the end of the ladder.

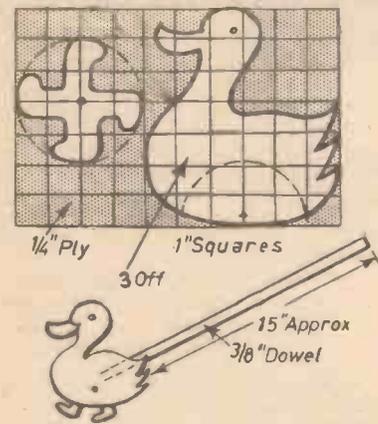


THE CLIMBING MONKEY

THE squares on the drawing represent $\frac{1}{16}$ in. squares. The body can be cut from a piece of $\frac{1}{4}$ in. plywood about $1\frac{1}{2}$ in. wide by $3\frac{1}{2}$ in. long, and the limbs from $\frac{3}{16}$ in. plywood. The thinner dowel is about $1\frac{1}{8}$ in. long, and the other $1\frac{1}{2}$ in. The screw-eye connecting the two is placed about $\frac{1}{8}$ in. from the top of the thick dowel and the eye should be large enough to afford a sliding fit for the $\frac{3}{16}$ in. dowel. Small holes are bored in the body and limbs where shown, and through these are threaded lengths of wire bent over at each end. The tail may be of hairy string and the ears of washleather or felt. The monkey should be painted as realistically as possible.

The toy is worked by holding both dowels near their bottom ends and sliding them up and down quickly.

AND PRESENTS



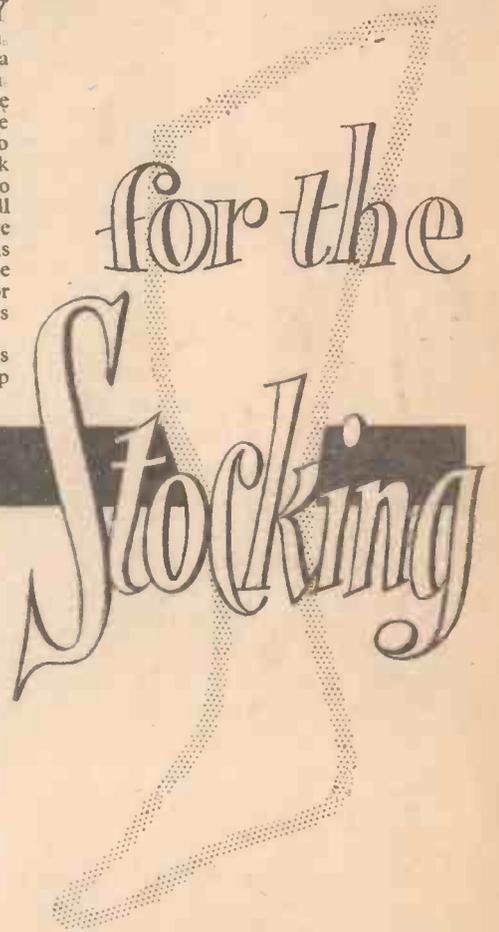
THE WALKING DUCK

FROM $\frac{1}{4}$ in. plywood cut three duck shapes as shown. On one side of each of two of the shapes glue very thin cardboard, one right-hand and one left-hand, so they will be on the inside. From the third shape cut out the semi-circular piece as per dotted line. Glue and pin all three shapes together, the centre shape being the one from which the semi-circle has been cut.

Also from $\frac{1}{4}$ in. plywood, cut out the legs. Drill a small hole in the centre and also in the built-up duck as shown. Pass a thin nail through to enable the legs to revolve freely on it.

A slanting hole is now bored in the rear of the duck to take a suitable length of dowel which the child will hold.

Glasspaper and paint in bright colours.

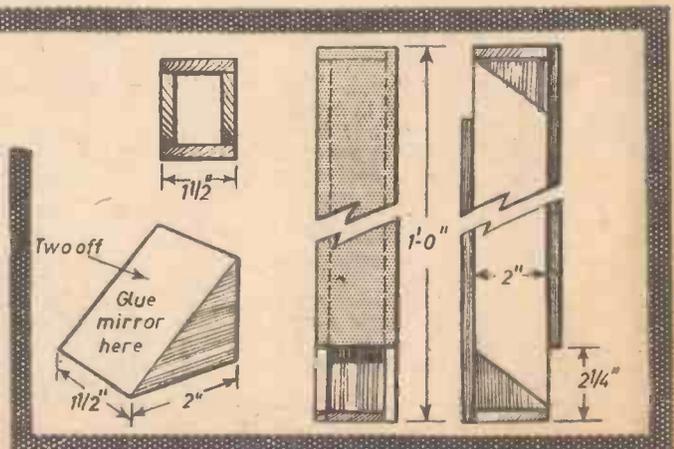


MAKING A HANDY PERISCOPE

HERE is a handy, simple design; easy to make up, but quite efficient in working. Measurements are, of course, entirely elastic within reason. There is no limit to the length, nor to the shape or area of the inside; the mirrors available regulate these dimensions. Suitable ones—ladies' handbag size—can be bought in all stores for a shilling or so. Two will be required.

The mirrors are glued to wooden blocks one side of which has been cut to 45 deg. as shown lower left of the illustration. From the base-size of these blocks construct the sides which can be of $\frac{1}{4}$ in. plywood pinned and glued. Note that before assembling these sides they must be painted a dull black on the inside; under no circumstances must the paint be glossy or the reflections will fog. Note also that two of the sides are shorter by the vertical height of the inclined mirrors and are set at opposite ends. These form the viewing holes.

For the sake of appearance the outside may be painted or stained, or covered with some form of leatherette paper.



A Toddler's Swing

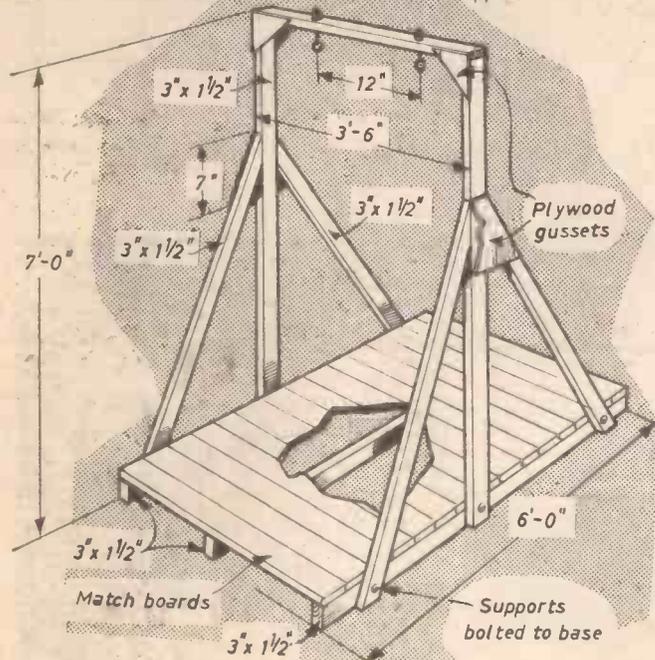
1/2" dia. dowelling drilled to slide up and down the ropes



Handle 1" dia. dowel 12" long

Detail of eye bolt attachment

Metal liner



General details of the swing.

THIS sturdy swing is comparatively cheap and easy to make and, being movable, can be placed in any convenient part of the garden.

Construction

Cut the three base runners first, each of which is 3in. \times 1 1/2in. \times 6ft. long. These are spaced 17 1/2in. apart. Starting at the ends, which must be level, screw or nail in place side by side the lengths of matchboarding. Tongued and grooved panels or floor boarding will do. Cut off any surplus at the opposite ends of the base runners.

Centre Main Frame

Deal, 3in. \times 1 1/2in. is used. Cut two lengths each 6ft. 10 1/2in. and at one end of each drill a 1/2in. diameter hole in the middle of the 3in. face and 1 1/2in. from the end. Cut a cross-piece 3ft. 6in. long and screw this across the two uprights at the opposite end to the holes as shown in the drawing.

The two corners of the frame thus made are reinforced at each side with 1/2in. thick triangular plywood gussets. Cut four of them, each with two sides approximately 9in. long and make sure the angle formed by these sides is a true right-angle. Screw the gussets in the corner of the frame with 1 1/2in. woodscrews.

In the cross-piece, spaced 12in. apart, drill two 1/2in. dia. holes right through to accept the ring bolts and metal liners (see drawing) which can be bought ready made

MAKE IT IN TIME FOR CHRISTMAS

for the purpose. Place large washers under the heads of the bolts and under the nuts.

Prop the frame (or get someone to hold it) in an upright position, astride the base and exactly in the middle. With a pencil, mark through the holes in the bottom of the uprights into the base runners. Drill the runners 1/2in. dia. and bolt the frame in position with 1/2in. bolts, nuts and large washers.

The four diagonal stays are made and fitted next. These are cut from 3in. \times 1 1/2in. deal and extend to within approximately 12in. from the frame top and about 6in. from the base runner ends. Place one piece, roughly cut to length, against the side of the structure already made and check that the centre bolted frame is vertical. When in approximately the correct position (indicated above) mark off in pencil the angle cut necessary. Trim the stay and at the bottom end drill a 1/2in. hole 1 1/2in. from the bottom edge. Mark the

position of this hole in the bottom runner by scribing through the hole in the stay, drill the hole, and bolt stay to runner with a 1/2in. bolt and the usual washers. Secure the opposite end of the stay to the edge of the frame upright with a 2in. woodscrew.

Repeat this procedure with the three remaining stays. The junctions of stays and frame uprights are reinforced on the outside with 1/2in. plywood or hardwood gussets about 7in. deep. Place a 7in. piece of the wood centrally over each joint and draw the outline of the triangular shape formed by the stays. Cut out the shapes, drill them down the centre and along the sloping edges with 3/16in. pilot holes and screw them in place with 1 1/2in. woodscrews.

The Seat

The general arrangement seat details are shown in the drawing. Mark out the shape of the base on 1/2in. plywood or hardwood divided into 1in. squares, cut it out and drill it in the positions marked with holes just big enough to make a neat fit for the rope you intend to use. This should be new sisal rope not less than 1/2in. dia. The local hardware store probably stocks it.

Cut the sides and back in a similar way from 1/2in. wood and then glue and screw them in place. Reinforce the corners if you wish with quarter-round beading. A piece of 1in. dowel 12in. long making a tight glued joint in the appropriate hole forms the "joystick" which can be fitted with a cycle handlebar "grip" at the top.

Sling the chair as shown on the main drawing. A piece of broom handle or thick dowel drilled to take the rope as shown provides an adequate safety bar. Tie large tight knots underneath the chair and bind the rope securely just below the metal liners at the top with thick copper wire.

Prime and paint the entire structure in the usual way or give it a thorough coat of wood preservative. Secure all nuts by "Peening" over the heads of the protruding bolts with a hammer.

YOU NEED

- Deal 3in. \times 1 1/2in. : 60ft. comprising two 7ft. lengths and the rest in 6ft. lengths (main structure).
- Matchboard : 15 lengths 4ft. 6in. long \times 4in. wide or equivalent (base).
- Other wood : 1 piece 2ft. 11in. \times 1/2in. (seat base).
- 1 piece 2ft. 6in. 6in. \times 1/2in. (seat sides and back).
- 1/2in. plywood 4ft. \times 9in. (gussets).
- Miscellaneous : Screws, 1/2in. Whitworth, bolts, nuts, washers, ring bolts, liners, rope, dowel.



NO need to rush out to the shops. Here's one you can arrange now . . . in a few moments . . . in the comfort of your own armchair. A year's subscription for PRACTICAL MECHANICS is the ideal gift for friends who are skilled with their hands . . . or want to be!

But hurry! You must send *now* to make sure that first copies arrive in time for Christmas. Simply send your friends' names and addresses, together with your own and remittances to cover each subscription, to The Subscription Manager (G.2), PRACTICAL MECHANICS, Tower House, Southampton Street, London, W.C.2. An attractive Christmas Greetings Card will be sent in your name to announce each gift.

* RATES (INCLUDING POSTAGE) FOR ONE YEAR (12 ISSUES)

U.K. £1.0.0, OVERSEAS 18s. 6d., CANADA 18s. 6d., U.S.A. \$2.75.

Pedal Power your Lathe

And Details of Some Basic Accessories By R. N. T. Burke

THOSE living in a remote part of the country or whose workshop is far from any supply point will find this pedal-power method of great advantage. The proposed device is cheaper than electrical tools, variable speeds are available, it will not interfere with T.V., it is quiet, and many suitable attachments can be made at low cost.

The main essential is a spindle rotating at a high speed, and this was provided in the original by the headstock of a "Hobbies Handy Bench Lathe," but other machines may be used if they are driven by belt.

As both hands must be left entirely free for operating the tools, it is obvious that the power must be provided by the feet, and by far the best method of using them is by means of the pedals and chainwheel of an old bicycle frame.

The lathe must be mounted upon a bench or stout plank, giving plenty of knee room for pedalling—36in. clearance at least is necessary, but do not fasten the machine down yet.

Pedal Arrangements

Take an old bicycle frame and cut off the tubes as shown in Fig 1, taking care to leave sufficient tube to give 3in. ground clear-



ance to the pedals when the device is screwed to the floor. One inch from the bottom of the "feet" make a small hacksaw cut and hammer in the upper side of the frame tube, making a hole for the fastening screw (Fig. 1). Screw the pedalling frame to the floor beneath the bench at a point directly beneath where the lathe headstock will be.

Pulley Arrangement

Now obtain an old bicycle rear wheel hub—a Sturmey Archer geared type is best as it has a larger hub diameter. It is not necessary for the gears to work as in practice only top gear is used. Drill out four of the spoke holes to 1/4in. dia. and bolt on a plywood disc, 1 1/2in. X 3/4in., mounting the assembly as shown in Figs. 1 and 2 beneath the bench with the chain connected. Take

care that the free-wheel device is working in the right direction, i.e., the nearest side of the plywood discs must be driven downwards when the pedals are operated backwards. Check that the plywood disc runs true and adjust if necessary.

Take a piece of dowel and wrap some rough sandpaper round it. Grip a piece of scrap plywood on either side of it and apply it to the plywood disc, pedalling vigorously until a groove is worn round the periphery. Screw the lathe into position with the driving pulley directly above the disc and cut holes in the bench to allow a belt to pass round the headstock pulley and the plywood disc. It will also be necessary to cut away part of the wooden lathe mounts.

The driving belt can be made from a piece of plastic-covered curtain wire of the expanding type by cutting off one of the end hooks where the thread finishes and screwing half of the threaded piece into each end of the

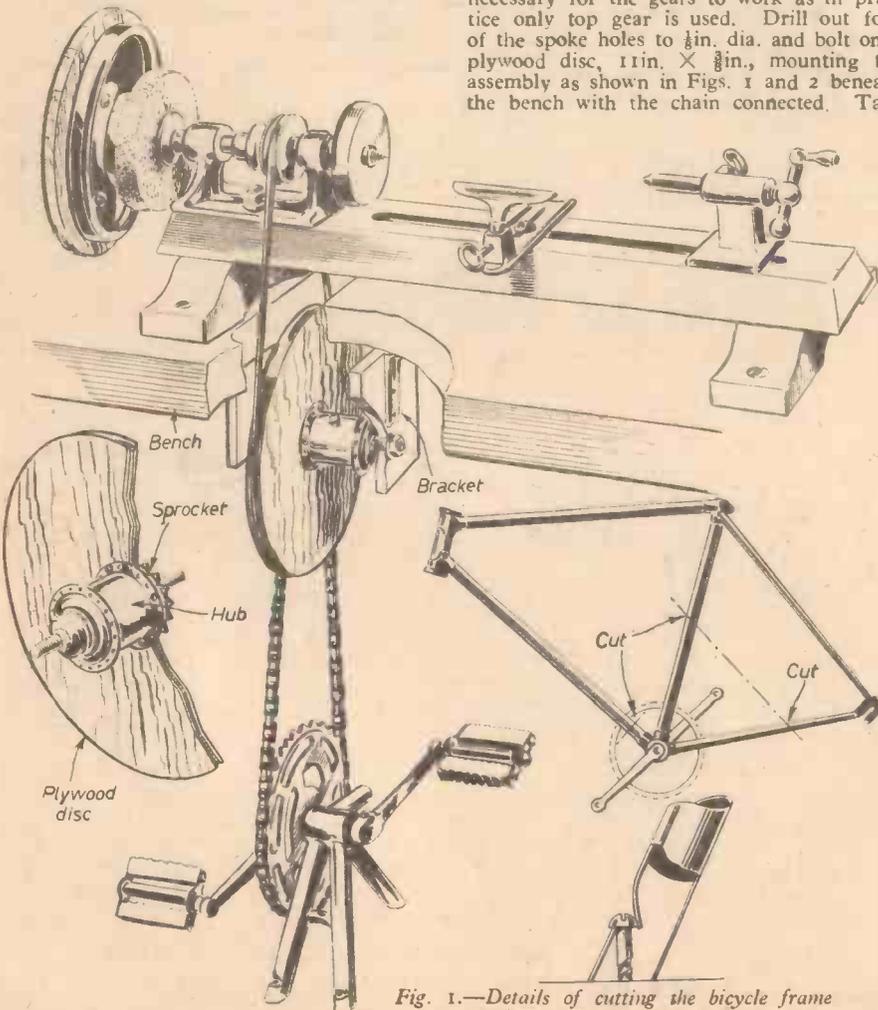


Fig. 1.—Details of cutting the bicycle frame and mounting the assembly.



Fig. 2.—The completed pedal powered lathe.

wire. This might appear to be rather a weak joint, but one has been in use for three years without breakage.

The Drive in Use

High speed and light effort is the secret of power tools success, and throughout the operation of the pedal-driven lathe it is essential to keep the speed high and the load low; neither must it be forgotten that your tools should be kept sharp, as no amount of power will compensate for a blunt tool. There is no difficulty in pedalling whilst keeping a steady hand for manipulation, and the operator will be quite at home with the machine after only a few minutes use.

Some Basic Accessories

The lathe is supplied with a grindstone, two sizes of pulley and a flywheel. The

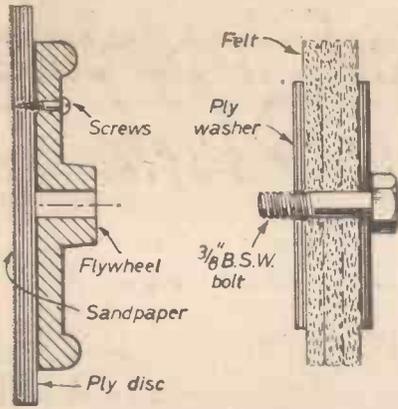


Fig. 3.—Details of the flywheel sander and radial buff.

grindstone may be mounted to the left of the headstock, leaving an inch or so of spindle for the flywheel, which can be converted to a sander. Drill three small holes in the thin part of the flywheel and screw a large disc of stout plywood to the flat side, using short screws that will not pass right through the plywood when driven home (Fig. 3). Mount the assembly on the headstock spindle. Sand the face smooth using the lathe power and glue on a disc of sandpaper after varnishing to prevent the glue making removal

difficult when replacing. If a sanding table is required, it need only be a box standing squarely upon the bench and as high as the centre of the disc.

A $\frac{3}{8}$ in. B.S.W. \times $\frac{1}{2}$ in. bolt will fit into the headstock and thus a plywood (or even hardboard) disc may be bolted to the face of the headstock. Felt or sandpaper glued to them will make a variety of buffs and sanders, and a soft cloth bonnet can be made up to slip on for final polishing. The bolt head gives no trouble, but if desired, it may

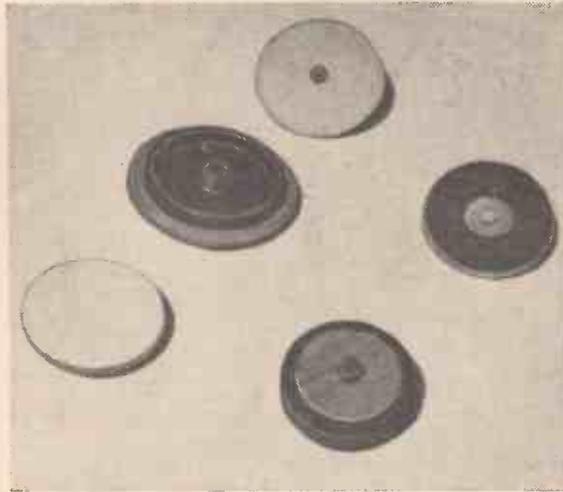


Fig. 4.—Some accessories for buffing and sanding.

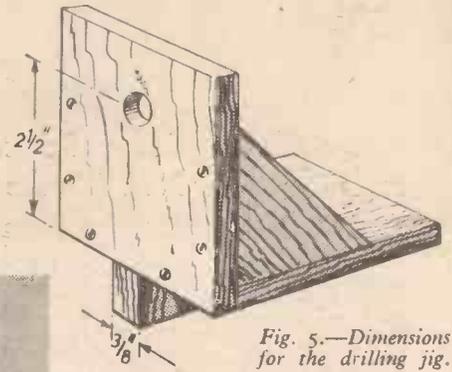


Fig. 5.—Dimensions for the drilling jig.

be filed down to a thin section and the plywood chiselled out to counter-sink it.

A radial buff may be made by using a longer bolt and clamping a number of discs of thick felt between two washers (Figs. 3 and 4).

An extra for the lathe is a drill chuck which fits into the headstock and to this may be fitted a flexible drive also terminating in a chuck. This piece of equipment will prove rather costly unless a Government surplus drive can be found, but fortunately they do appear on the market from time to time. A drill can be used directly in the lathe chuck for small components if a jig is made up as shown in Fig. 5.

YOUR snapshots will take on a new look when seen with the aid of this viewer. It will give you a greatly enlarged image of photographs, drawings, and indeed almost anything up to about post-card size. There are three main parts.

The Magnifying Mirror

That used in the original was a shaving mirror, one side of which magnifies; the reverse side being a plain mirror. The one chosen was swivel mounted with handle and was purchased from a multiple chemists for 2s. 11d.

A Convenient Way to see Your Snapshots By F. D. CROSS

Holder

The snapshot or picture holder is made of metal and is of a type used for displaying small show, or price cards. Enamelled white, it was obtained from a stationers for 9d. A similar one could, of course, be shaped from thin steel metal.

Baseboard

A suitable piece of hard wood should be obtained and cut to the size shown.

Assembly

First remove the handle by sawing off close to where it joins the swivel frame. The remaining two loops (marked X) form a convenient means of anchorage to the baseboard. Two round headed screws with washers pass through these loops and are secured to the end of the base as shown.

All that is now necessary is to position the picture holder, and this is best determined by trial. The best position was found to be about $5\frac{1}{2}$ in. from the mirror. The picture holder is fixed by two panel pins through the back flange, and one through the centre of the picture support trough.



General details and measurements of the viewer.

Transistorised Intercom or Baby Alarm

Two Transistors and Some ex-Government Parts are Used in This Design

By H. S. Thorpe

emitter resistors which are by-passed at audio frequencies. The operation is as follows:—Any increase in collector current gives rise to an increase in emitter voltage, and hence decreases the input voltage between base and emitter, giving a drop in base current and, therefore, a high degree of feedback opposing the original change.



Fig. 1.—The completed unit.

THE unit shown in Figs. 1 and 5 was first intended as a Baby Alarm. The circuit is shown in Fig. 3. Later the switch was fitted to the master unit, enabling the master unit to send to, or receive from, the slave unit.

the master unit, switching it to the input or output of the amplifier, and using it as a microphone or speaker.

Moving Iron Units

Two are required and are

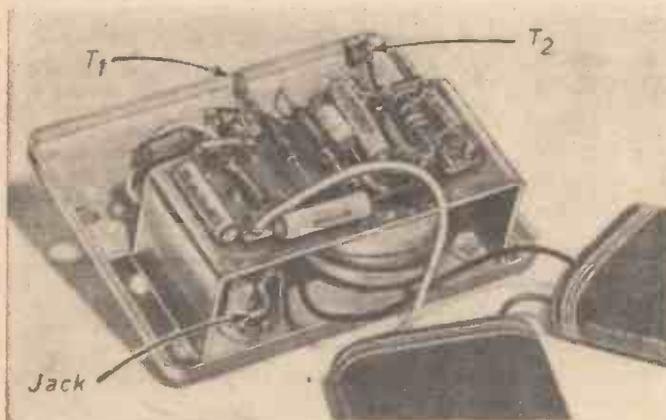


Fig. 2.—A view of the unit with the cover removed.

The master unit consists of the amplifier and a means of switching a moving iron unit to the input or output of the amplifier.

The slave unit consists solely of a moving iron unit at a remote point, the switch in

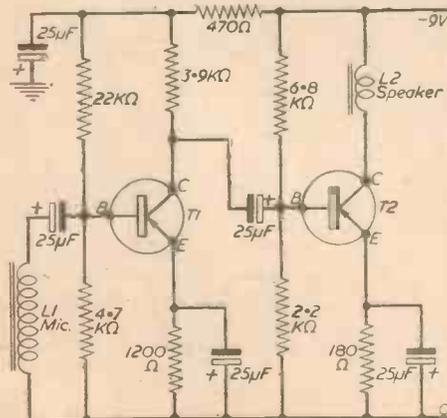


Fig. 3.—Theoretical circuit.

armature on these units is quite free to move between the pole pieces, and the back of each earpiece should be removed to ensure that this is so. The armature can be adjusted if necessary by slackening off the 10 B.A. locknut, and then adjusting the other nut until the armature is central between the pole pieces. Tighten locknut when adjustment is complete.

Amplifier Circuit

The amplifier consists of a transistor (red spot) input stage which is R.C. coupled to the output stage, a yellow-green spot transistor.

They are biased and D.C. stabilised by potential dividers, and

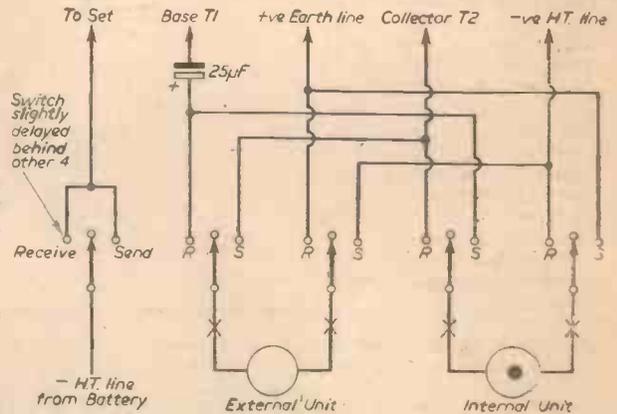


Fig. 4.—Method of switching as an intercom.

readily obtainable on the surplus market, singly, or in low impedance headphones. It is essential that the

Fig. 4 shows the method of switching as an intercom, and it will be seen that in the "send" position the moving iron unit in the master acts as a microphone, and the unit in the "slave" position as a speaker.

When switched to "receive," the master unit becomes a speaker, and the "slave" becomes a microphone.

The first wafer of the switch should have



Fig. 5.—Front view showing battery shelf.

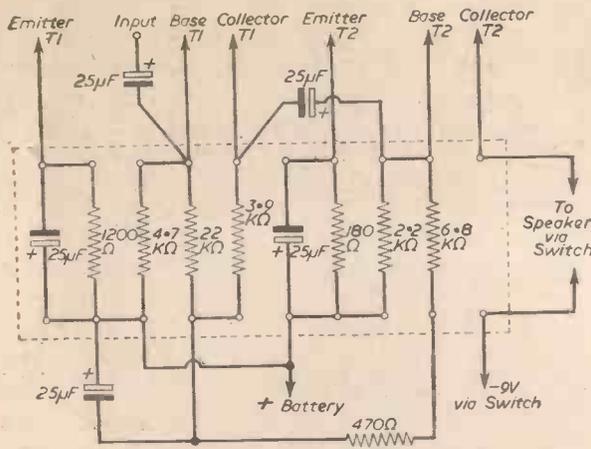


Fig. 6.—The tagboard connections.

its wiper filed to half normal width to delay it slightly behind the other wafers.

This is done to ensure that base and emitter are connected before the voltage supply is connected.

Tagboard

The tagboard connections are shown in Fig. 6. This can be made up of two tag strips, or a Bulgin Type C.125 tagboard can be used. It can be seen mounted on its bracket in Figs. 2 and 8.

The bracket to hold the tagboard is shown in Fig. 7,

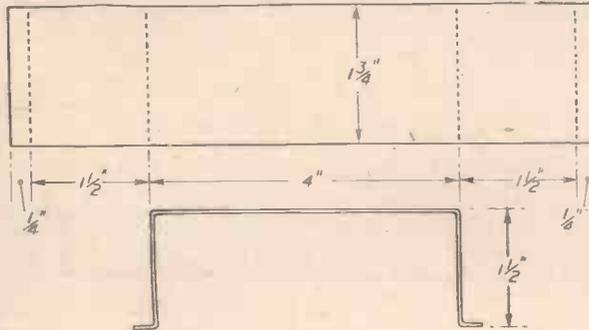


Fig. 7.—Details and dimensions of the tagboard bracket.

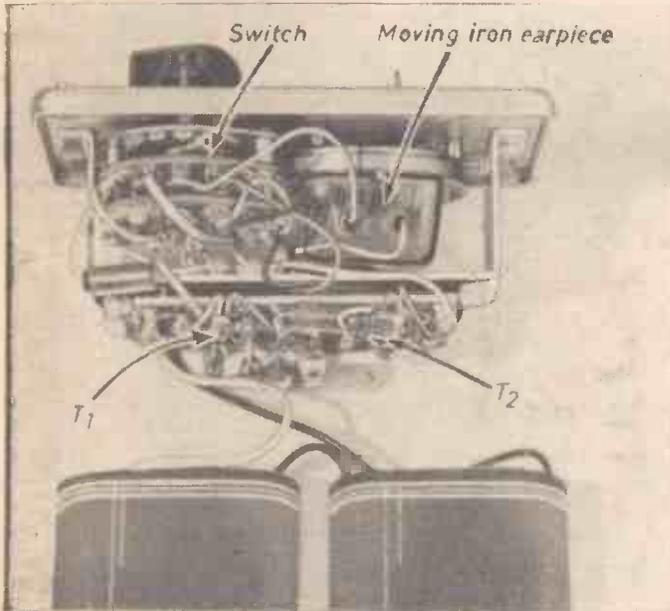


Fig. 8.—A further view of the wiring.

PARTS LIST

- 2 moving iron earpieces.
- 5 25μF 12 v. capacitors. Radiospares.
- 1 22 KΩ resistor. 1/4 w. Radiospares.
- 1 3.9 KΩ resistor. 1/4 w. Radiospares.
- 1 4.7 KΩ resistor. 1/4 w. Radiospares.
- 1 1,200 Ω resistor. 1/4 w. Radiospares.
- 1 6.8 KΩ resistor. 1/4 w. Radiospares.
- 1 2.2 KΩ resistor. 1/4 w. Radiospares.
- 1 180 Ω resistor. 1/4 w. Radiospares.
- 1 470 Ω resistor. 1/4 w. Radiospares.
- 1 transistor Red Spot.
- 1 transistor Yellow-Green spot.
- 1 switch 5-pole 3-way.
- 2 cases. Packard Bell type.
- 2 4 1/2 v. batteries. EverReady 1289.

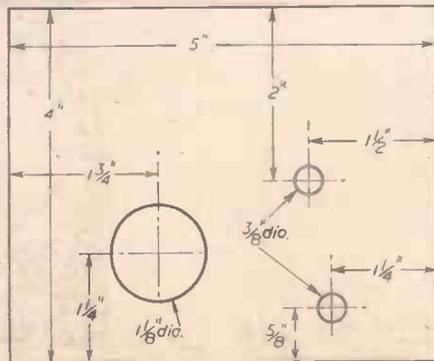


Fig. 9.—Layout of the front panel.

and is made up with 18 s.w.g. aluminium. Fixing holes are drilled to line up with holes in the front of the case, and the tagboard drilling.

An ideal case for both master and slave units is the case of the Packard Bell pre-amplifier, easily obtainable on the surplus market and shown in Figs. 1 and 5.

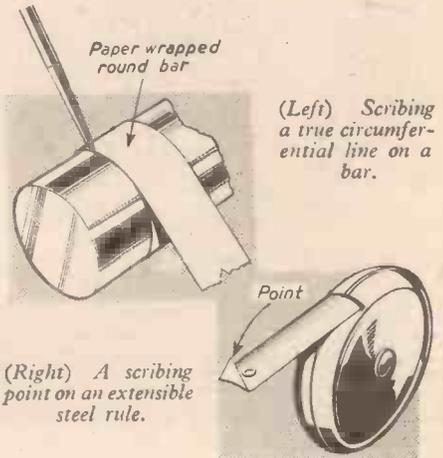
The front panel layout of the master unit is shown in Fig. 9, the slave unit requires drilling for the moving iron unit only.

A length of flex can be permanently connected between units, but a jack and plug on the master unit is recommended. Before switching on, check that the battery polarity is correct!

HINTS & TIPS

To Draw a True Circumferential Line on a Bar

A TRUE circumferential mark can be made on a bar simply by wrapping a piece of paper with a straight edge round the bar and scribing along the edge. This method can be used for metal bar or wooden strip of any noncentrant cross-section. A more permanent tool for the job would get a piece of "fivethou" copper foil.

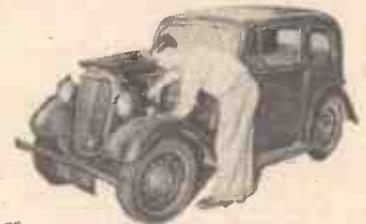


Improving Extensible Steel Ruler

AN extensible steel ruler can be made more useful by forming a point on the end tab which will be found very handy for marking out accurately. The operation can be performed with a file if the tab is made of mild steel, but if it is made of the same material as the ruler a grindstone will have to be used (see sketch above).

PRACTICAL MOTORIST

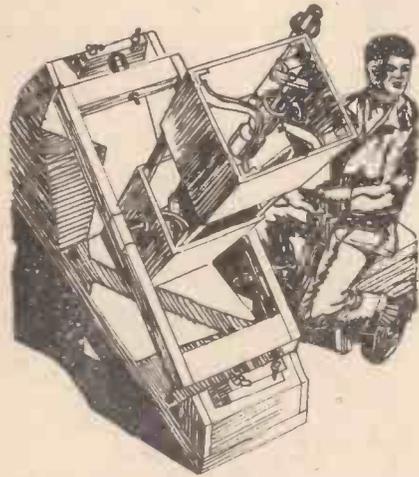
December Issue Now on Sale



Principal Contents

- Overhauling A40 Gearboxes
- Petrol Gauges
- Earls Court, 1960—A Review
- Renovating Your Battery
- A High-pressure Grease Gun
- The Beginner's Guide to the Motor Car
- Lubrication and Your Car
- Maximum Efficiency from the Small Car
- Maintaining Screen Washer Efficiency
- Sunbeam Mark III Overhaul
- Fiat 600 Overhaul
- P.M. Data Sheets
- Current Used Car Prices
- Accessory Review
- Garage Mechanic's Diary

'How to use your P.M. Reflecting Telescope'



Observing Jupiter, Saturn, Uranus, Neptune, Pluto and Comets

By F. W. Cousins

JUPITER is the largest planet of the Sun's family of planets. He is in opposition (due south at midnight) at intervals of 13 months.

He is attended by 12 moons four of which were known to Galileo, these are the brightest of this system and they were the first new members of the Sun's family to be discovered with the telescope. The four Galilean satellites provide us with constant delight. They transit the face of the planet, become eclipsed within his shadow and occulted by his disc.

There is an interesting relation (commensurability) between the mean daily motions of satellite I, II and III such that if n_1 is the mean motion of satellite I the rule may be written in the form

$$n_1 + 2n_3 - 3n_2 = 0$$

This relation derives from gravitational forces and its permanence ensures that all three of these satellites never exhibit similar phenomena at the same time.

The noble disc of the planet which shows some ellipticity is crossed by changing bands comprising dark belts and bright zones; extending substantially along his parallels of latitude (Figs. 1 and 2). Irregularities (spots) may be detected in both the belts and the zones.

The principal work of observation is directed to the determination of the rotation

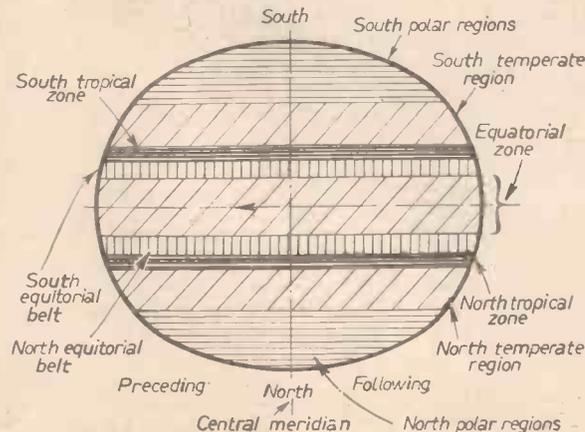


Fig. 1.—The parallel bands of Jupiter. The mean diameter is 85,750 miles and there is a polar flattening 1/15th of the mean equatorial. Jupiter rotates once in 9 hrs. 58 mins.

periods of the planet in diverse latitudes. The planet as a whole is in rapid rotation (approximately 9 hours 58 minutes for his day), but this is different for different parts of the surface.

See *The Planet Jupiter*, by B. M. Peek, Faber & Faber, 1958.

Observing Saturn

Saturn is one of the most beautiful objects to contemplate in a telescope. Even observers with many years of experience confess to an unwearied interest in this magnificent object.

Saturn is the outermost of the so-called naked eye planets. (Uranus was not known to the ancients.)

He is nearly 900

(Figs. 4 and 5). The rings are specified by the letters A, B and C. The main divisions between the rings are named after their

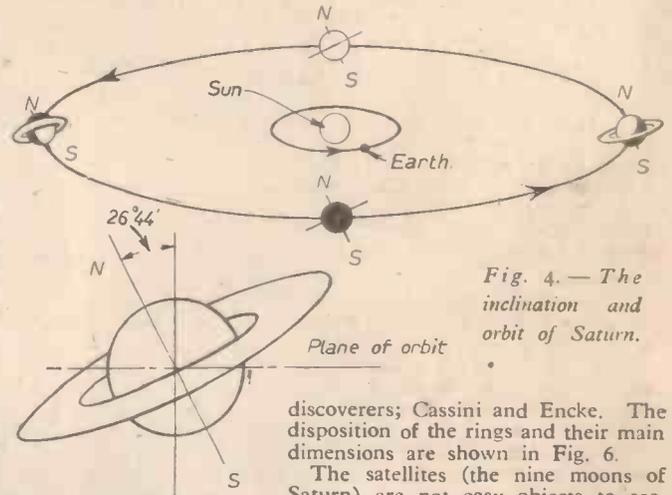


Fig. 4.—The inclination and orbit of Saturn.

discoverers; Cassini and Encke. The disposition of the rings and their main dimensions are shown in Fig. 6.

The satellites (the nine moons of Saturn) are not easy objects to see. At mean opposition Titan has a stellar magnitude of 8.3. All the others are below the tenth magnitude. The position of Titan for the observing months in any year is given in diagrams to be found in *The Handbook of the British Astronomical Association*.

Observing Uranus, Neptune and Pluto

These are so far from the Sun that they do not repay study with a 6in. refractor or reflector. Their positions can be obtained from *The Handbook of the British Astronomical Association*.

Uranus, though a naked eye object was only discovered by Herschel in 1781. It is a greenish disc of 3.75 seconds of arc.

Neptune was discovered in 1846, it shows a bluish-green disc of 2.04 seconds of arc. Pluto, the outermost planet of the Sun's family, does not show a disc.

Observing Comets

By the nature of things we have to wait with patience for the appearance of a bright

millions of miles from the Sun. The luminous system of rings attending the planet and the nine moons form together a system at once unique and of consummate beauty (Fig. 3).

The axis of the globe of Saturn is tilted at an angle of $36^\circ 44'$ to the plane of the earth's orbit and for this reason every half sidereal period (approximately 15 years) the rings appear to vanish, i.e., they are presented edge on to the earth

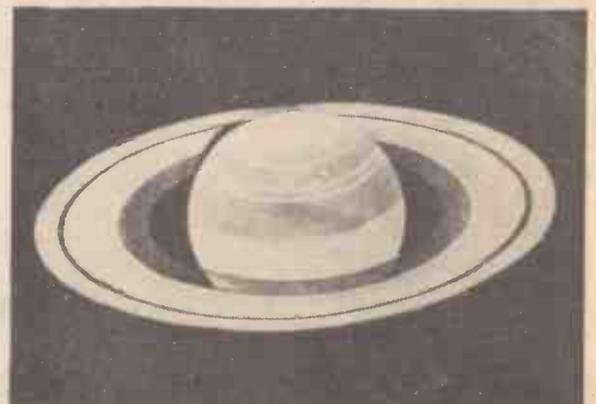


Fig. 3.—The planet Saturn.

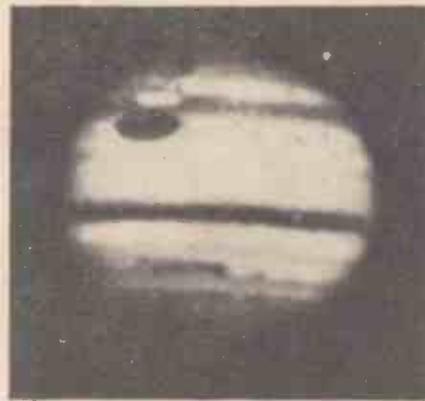


Fig. 2.—A photograph of Jupiter.

comet. Many readers will, however, recall the beauty of the comet Arend-Roland (1956h) a conspicuous naked eye object in the north-western heavens during the evenings of late April and early May in 1956.

When a bright comet is examined in a telescope or in a photograph we are often able to distinguish its components.

(i) The nucleus which is the small star-like point at the centre of

(ii) the coma, a cloud-like mass forming a nebulous light around the nucleus and

(iii) the tail, a large, elongated gas cloud, which appears as the comet approaches close in to the Sun (its perihelion position). The largest nucleus recorded was that of

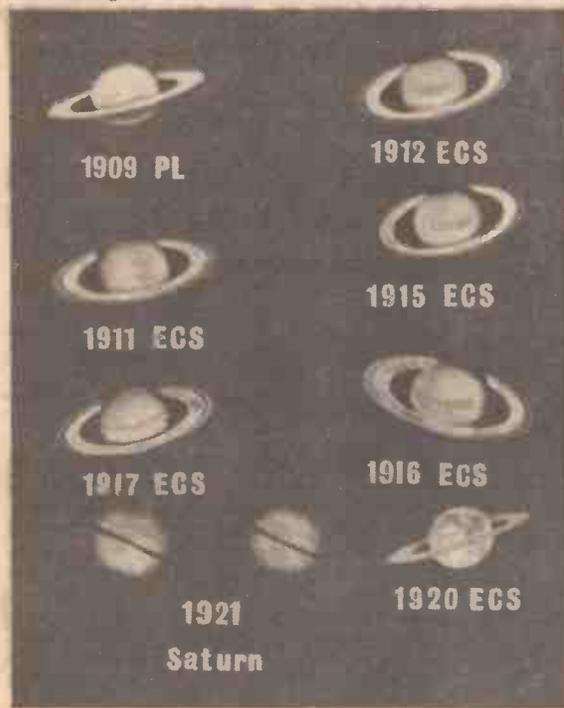


Fig. 5.—Saturn over a period of 12 years, photographed by Dr. Lowell (PL) and E. C. Slipher (E.C.S.) at Lowell Observatory.

Comet 1845 III with a diameter of 8,000 miles. The coma diameter is always in the region of some tens of thousands of miles. The longest comet tail on record was that of the great Comet 1843 I, which stretched over 200 millions of miles; a distance in excess of the diameter of the Earth's orbit about the Sun.

Comet orbits are linked with the classic conic sections. Comets have been known to travel in paths having the shape of the ellipse, parabola or hyperbola with the Sun at the focus in the case of the ellipse at one of the foci.

The orbits are often very elongated, as shown in Fig. 8.

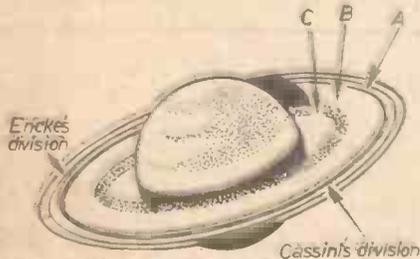


Fig. 6.—Main features of Saturn. Ring B is the brightest and the forces at work on the millions of particles in the rings sweep clean the Cassini and Encke divisions. The dimensions of the ring system are in miles A—169,300—149,000, B—145,500—112,600, C—92,900. Equatorial dia. is 75,160 and Polar 67,200 miles.

The orbit if elliptical is defined by seven elements; if parabolic by five.

The seven elements for the elliptical orbit are (see Fig. 9):

- a the major semi-axis XP.
- e the eccentricity $\frac{XS}{XP} = (b = a\sqrt{1 - e^2})$
- b is the semi-minor axis.
- i the inclination of the orbit plane to that of the ecliptic.
- Ω the longitude of the ascending node.
- ω the argument of perihelion, i.e., angle Ω SP.
- P the period of revolution.
- T the date and time at which the comet reaches perihelion.

In a parabolic orbit e is unity and the curve is an open one. There is no major semi-axis a and no period can be assigned to the orbit.

If you wish to search for comets remember that their movements are not restricted to the Zodiac, as are the major planets. They can appear in any region of the sky.

Use a wide field eyepiece of low power. As soon as it is dark commence sweeping on the horizon 90 deg. or so of the Sun, that is west or south-west after sunset and in the east or south-east before dawn. The reason for this is that most of the brighter comets are discovered in the region



Fig. 7 (Right).—The Arend-Roland Comet.

inside the orbit of Mars and are brightest when nearest the Sun.

Sweeps consist of moving the telescope in a horizontal direction, or substantially horizontal direction, and, at the end of each traverse, raising the telescope slightly half a field—that is to say, a star in the centre of the field is moved to the edge of the field and the sweep repeated. Continue until the telescope is pointing about 70 deg. above the horizon. (70 deg. of altitude.)

If, during the sweep, a fuzzy object is found which cannot be identified with any of the nebulae or clusters in the star atlas (Norton's) an accurate field sketch should be drawn. A 2 in. diameter circle is a good size to represent the boundary of the telescope field. Let the field trail after making the drawing and enter the letters ϕ and f on the pre-

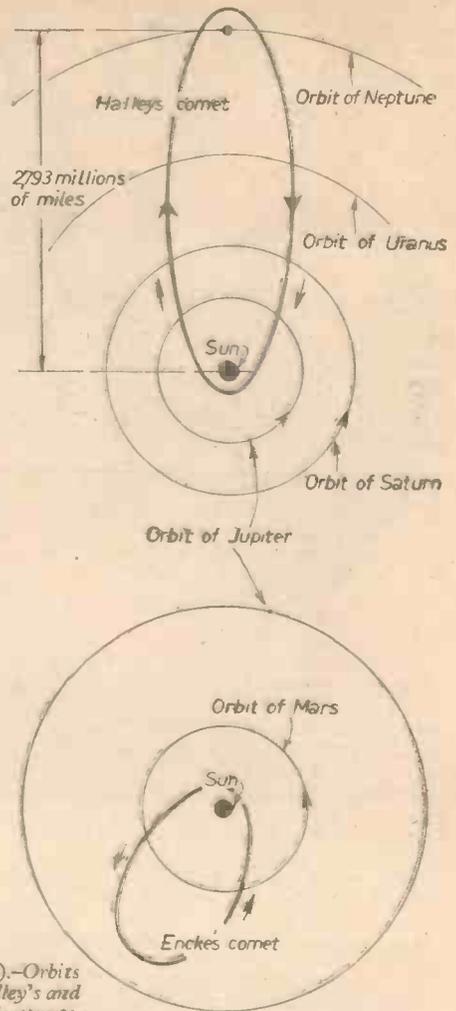


Fig. 8 (Right).—Orbits of Halley's and Encke's comets.

ceding and following sides of the field respectively. Do not fail to record the time. After the sketch has been made examine the field again in about an hour's time, if the fuzzy object has altered position against the stars you may have a comet. If no movement is detected it may be a slowly-moving comet so check again on successive nights.

The position of a new comet should be reported to the nearest observatory.

The following data are essential:

- (1) Date, time (stating whether local standard or universal time).
- (2) Position in R.A. and declination (state epoch).
- (3) Estimation of daily movement in R.A. and declination.
- (4) Magnitude by comparison with neighbouring stars of known magnitude.
- (5) Physical features, nucleus, coma, diameter, tail length, position and angles).

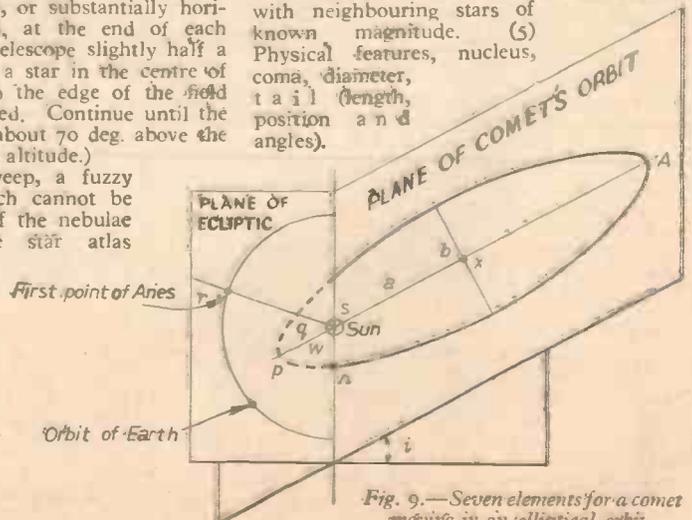
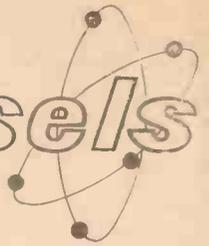


Fig. 9.—Seven elements for a comet moving in an elliptical orbit.

Nuclear Powered Surface Vessels



THE first nuclear powered ship, the submarine *Nautilus* completed a voyage of 62,000 miles without refuelling and proved to the world that nuclear propulsion for a ship is practical. For a conventional submarine to have travelled an equal distance 2,000,000 gallons of diesel fuel would have been required.

The strategic advantages given to a submarine by nuclear power were well appreciated but the success of the *Nautilus* aroused great interest throughout the shipping industry as it was realised that a nuclear powered merchant ship could carry extra cargo in the space made available by the elimination of fuel tanks.

The last four years have seen the change from the "dreams and plans" stage to reality. Russia and the U.S.A. have both commenced the construction of non-military surface vessels; the ice-breaker *Lenin* and the passenger cargo ship N.S. *Savannah*. The latter was launched recently by Mrs. Eisenhower and is rapidly nearing completion.

Nuclear power is obtained from an atomic reaction which takes place in a specially designed vessel called a reactor under controlled conditions. Fig. 1 is a cutaway view of a pressurised-water reactor plant designed for a nuclear-powered ship. This reaction is called *Nuclear Fission* and generates heat which is converted into mechanical work, for our purpose to drive a ship. To make it easier to understand how nuclear power can be applied to a ship it is necessary to understand the basic principles of this reaction.

The Nature of Matter

All matter is composed of atoms which can be visualised as tiny solar systems. There is a group of particles in the centre which is called the nucleus (equivalent to our sun) and around the nucleus several particles called electrons move in orbits, as do the planets around the sun. The nucleus contains two kinds of particles, protons and neutrons. The number of protons equals the number of electrons and determines the chemical properties of the atom, but the number of neutrons only affects the physical properties such as weight. As a result some substances can exist in several forms each having identical chemical properties but different physical properties. These different forms are called isotopes of the substance.

Fission

A material which can be used to produce nuclear fission is said to be fissile. The atoms of a fissile material have a large number of protons in the nucleus and if a neutron is added to the nucleus of such an atom the whole complicated structure splits up into two smaller solar systems each containing approximately half the number

D. A. Watt
Describes How Atomic Energy is Obtained, How the Reactor Works and How it is Applied to Power a Ship

of protons in the nucleus and half the number of electrons moving about the nucleus. These new atoms, called the fission products, have an energy content less than that of the original atom and the balance is given out as heat. Also there are two or three neutrons left over which can be used to cause more fission.

The only fissionable atom existing in nature is an isotope of uranium called U_{235} and the process of fission in such an atom is shown in Fig. 2.

Obviously to generate sufficient quantities of heat to provide useful power one fission alone is not sufficient, therefore the neutrons released must be used to cause more fission. This is what happens in the reactor and is known as a chain reaction. It is shown diagrammatically in Fig. 3 in which it is assumed that two neutrons are available from each fission to cause more fission.

By studying Fig. 3 it will be obvious that if the number of neutrons which causes further fission is greater than one, the reaction increases, and if less than one the reaction dies out. If for every fission one neutron causes a further fission then the reaction continues at a steady rate. This

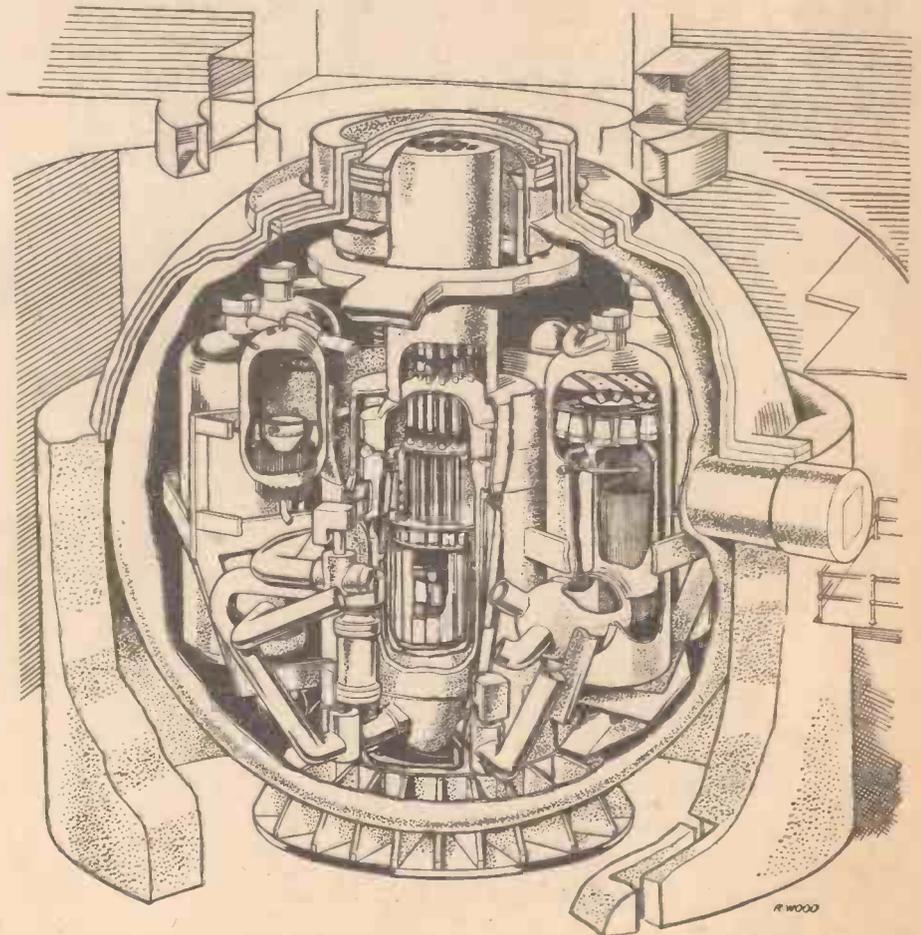


Fig. 1.—A cutaway view of a pressurised-water reactor plant designed for a nuclear-powered ship.

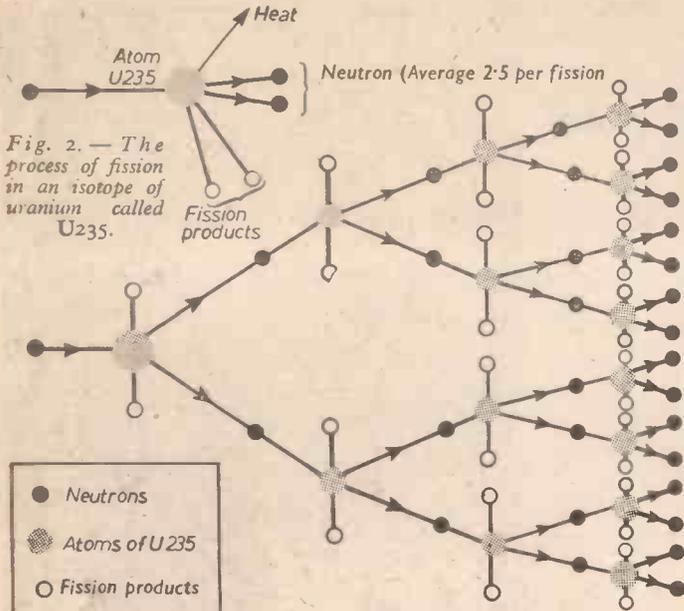


Fig. 2.—The process of fission in an isotope of uranium called U₂₃₅.

fact is the key to the method of controlling the reaction, as we shall see later. The centre part of the reactor where this reaction takes place is known as the core.

In natural uranium there are 140 atoms of a non fissionable isotope called U₂₃₈ for every atom of U₂₃₅, so that if we cause a fission of one atom of U₂₃₅ in natural uranium the continuation of the reaction depends on whether one or more of the neutrons released can strike another atom of U₂₃₅ and not get absorbed in an atom of U₂₃₈. It is, therefore, necessary to do something to ensure that further fission is caused by the neutrons released.

One way of doing this is to increase the number of atoms of U₂₃₅ in the uranium used in the core by a process called gaseous diffusion which is based on the fact that the two isotopes have different weights. Uranium treated in this way is called enriched uranium, but to enrich it to a very great extent would be exceedingly costly.

Using a Moderator

A more attractive solution is offered by the fact that when neutrons are released by a fission they are travelling at very high speed but if their speed is reduced there is much less likelihood that they will be trapped in the atoms of U₂₃₈. To do this the neutrons are made to collide with suitable atoms and in doing so give up some of their energy to these atoms and are slowed down. Materials which are used in this way are called moderators, two very

suitable substances being graphite and hydrogen.

In practice slightly enriched uranium is used in conjunction with a moderator to reduce the size and weight of the core.

Control

Having found a way to ensure that the reaction will continue let us now consider how it can be controlled so that the heat generated can be used to produce power as and when required. We know that the

reaction will continue at a certain rate if every fission produces one neutron which strikes another atom of U₂₃₅.

To be able to increase or decrease the reaction at will we must capture the neutrons which do not wish to cause fissions. This is done by inserting into the core rods of boron or special steel alloys which are capable of absorbing neutrons. The further the rods are inserted the more neutrons are absorbed and vice versa, thus the reaction can be maintained at any desired rate, according to the position of the control rods. Similar rods, called shut-off rods, are necessary and when inserted into the core in an emergency will absorb all the neutrons to completely stop the reaction.

The Coolant and Shielding

The heat generated by the reaction must be removed from the core, otherwise it will overheat and be damaged. This heat is removed by circulating a coolant (gas or liquid) through the core, and it is usually the maximum rate at which the heat can be removed that limits the output of a reactor.

At the core of the reactor intense radio-activity is emitted and to protect operating personnel suitable shielding must be provided.

Pressurised Water Reactor

Although there are many types of reactor at various stages of development the most suitable type for marine propulsion at present is the pressurised water reactor, and has been chosen for both the *Lenin* and the *N.S. Savannah*. It is the most highly developed type, being the only one with which operating experience under sea-going conditions has been established, and it has a relatively low core weight. This type of reactor is shown in Fig. 4. The

moderator is hydrogen but as water is a combination of hydrogen and oxygen it is a very convenient material to use. The core is uranium oxide in a stainless steel container submerged in the moderator. The control rods pass through the top of the reactor into the uranium oxide. The uranium oxide is made from slightly enriched uranium. Metallic uranium cannot be used in the core of this type as it would cause a chemical reaction with the water.

The reactor can be made very compact as the moderator is used as coolant to remove heat from the reactor by pumping it through the heat exchanger. This exchanger generates steam which is used to drive a turbine geared to the propeller shaft. The condensed exhaust steam from the turbine is used to feed the heat exchanger.

A primary shield is placed around the reactor to absorb the greater part of the

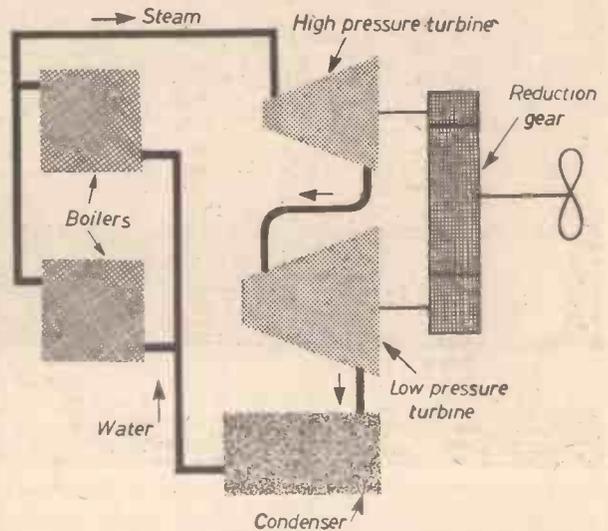


Fig. 5.—The layout of a typical steam turbine-driven ship.

radio-activity, and a secondary shield is placed around all the parts of the system containing radio-active material.

The moderator operates at a temperature of about 500 deg. F. and must be kept at a pressure of 1,750 lb. per square inch, or higher, to ensure that it will not boil (water boils at 212 deg. F. at atmospheric pressure but as the pressure is increased so the boiling point rises).

How the Reactor is Applied

At the present time most ships of large power are propelled by steam turbines geared to the propeller shaft, the steam for the turbines being supplied by two or more boilers. The heat to generate the steam in the boiler furnace is produced by burning fuel oil in the boiler furnace. The layout of a typical steam turbine driven ship is shown in Fig. 5.

If we wish to use nuclear energy to provide the power then all we need do is to replace the boilers with a reactor to provide heat to generate the steam for the turbines. Unfortunately, it is not quite so simple as it may seem owing to the fact that by the very nature of the reaction elaborate safety precautions are necessary, and complicate the design of the plant.

There are three basic design differences between a nuclear power plant for marine use and a land-based set. These are safety considerations, weight and the effects of rolling and pitching.

The latter is relatively easily overcome by equipping the ship with stabilisers which greatly reduce these effects, and the importance of the safety and weight considerations depends to a certain extent on the type of ship considered.

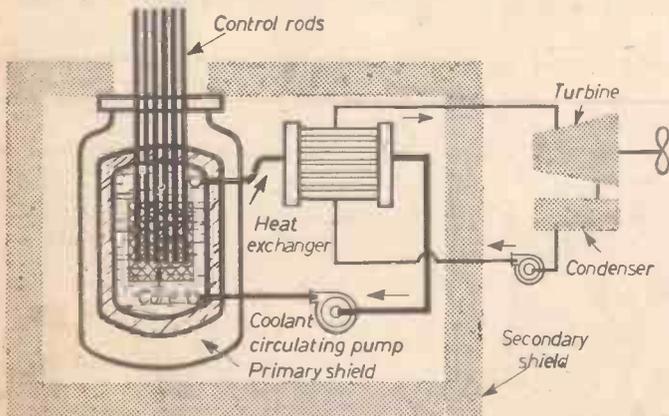


Fig. 4.—This pressurised water reactor is the most suitable type for marine propulsion.

Safety Problems

These are due to radiation and the handling of radio-active materials, and also to the effects of mechanical breakdown of the plant.

The first step in design is to decide what amount of radiation is permissible in the spaces outside the reactor secondary shielding. When this is settled the shielding can be designed to meet these conditions and will be placed as close to the reactor as is practical in order to reduce the weight of shielding required.

Apart from the control of radiation levels it is essential that any radio-active waste material must be handled in a safe way. In the pressurised water reactor all radio-active materials are inside the secondary shield and

The quantity of gases released will be so small that it will be permissible to blow them out with air and release the mixture of air and gases at the masthead. Shielded storage tanks will be needed so that liquid accumulation can be stored for disposal when the ship is in dock.

The containment vessel will be designed so that in the unlikely event of sudden rupture of the reactor or any part of the pressurised system it will have sufficient strength to hold all the radio-active material and to absorb the excessive heat which will be momentarily released by such an accident. It will also be well protected to prevent damage in a collision.

The N.S. Savannah is a passenger cargo vessel and incorporates all the problems of other types of ships. She is 595½ ft. long, 78 ft. beam, 21,800 tons displacement, will carry 60 passengers and will travel at 20 knots. Fig. 6 (reproduced by courtesy of Babcock and Wilcox Ltd.) shows the layout of the reactor plant which is located just ahead of the superstructure in order to reduce shielding weight and to avoid having to provide access to the reactor through the superstructure. Fig. 7 shows the N.S. Savannah during building.

The primary shield is a lead covered water tank containing a 33-inch thickness of water surrounded by lead in graduated thicknesses up to 4 inches. The secondary shield is a combination of lead, polythene and ordinary concrete, the upper portion being 6 inches



Fig. 6.—The top of the reactor pressure vessel for N.S. Savannah in position.

if this shield is constructed as a vessel which can be sealed, any leaks in the system will be collected in it. It is then called the containment vessel. Leaks are liable to occur at the pump seals, valves and the control rod seals, and the wastes that will accumulate are coolant water and radio-active gases. The latter are gases released from the air originally contained in the coolant water.

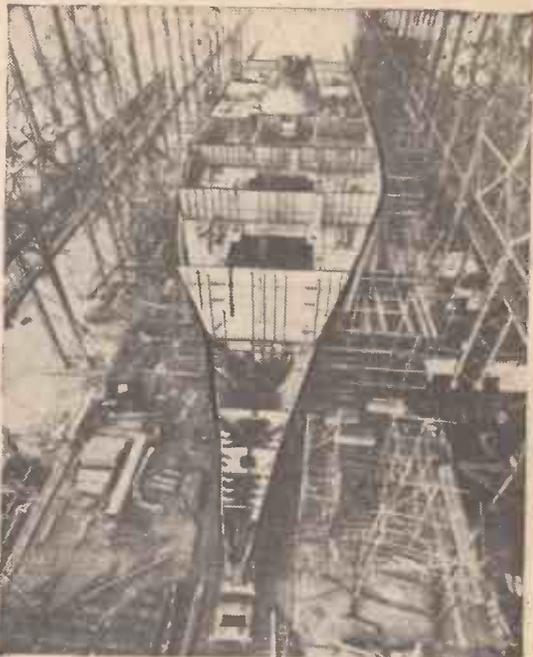


Fig. 7.—The N.S. Savannah in the shipbuilding yard.

of lead plus 8 inches of polythene and 4 ft. walls of concrete for the lower portion. Salt water ballast and fresh water tanks serve as shielding beneath the containment vessel.

Proposals for a British nuclear-powered ship have recently been considered and it was decided to investigate the possibility of applying nuclear power to a fleet auxiliary tanker. Let us hope that this project will be progressed even if such a ship cannot compete economically with other ships at present, as we already lag behind Russia and the U.S.A., who will soon be obtaining valuable operating experience.

No doubt present-day nuclear power plants will in 20 years time seem as antiquated to engineers as the early steam engines do to us to-day. However, without taking these first steps now we cannot hope to keep pace with other countries, which surely we should as we are one of the leading maritime nations.

BOOKS Received

“Sailing Boats,” by Uffa Fox. Over 200 pages. Price 17s. 6d. net. Published by Geo. Newnes Ltd., Tower House, Southampton Street, Strand, London, W.C.2.

UFFA FOX is perhaps the best-known name in yachting and it is to the yachtsman that this book is primarily addressed. If you are not a yachtsman, however, and you read it, you will certainly obtain a better understanding of boats and why people sail them.

The most popular types of sailing craft are all illustrated and described both from the point of view of their construction characteristics and sailing capabilities. There is also a wealth of interesting information that would certainly not be found in the boat plans or the sailing instructions.

A separate chapter is devoted to each of the following craft: International Cadet, R.Y.A. Firefly, R.Y.A. 12ft. Dinghy, International Fourteen Footer, R.Y.A. 14ft. Redwing, Pegasus, International Canoe, 18ft. Jolly Boat, Twenty-four Footer, Catamarans Shearwater III and BellCat. In part two

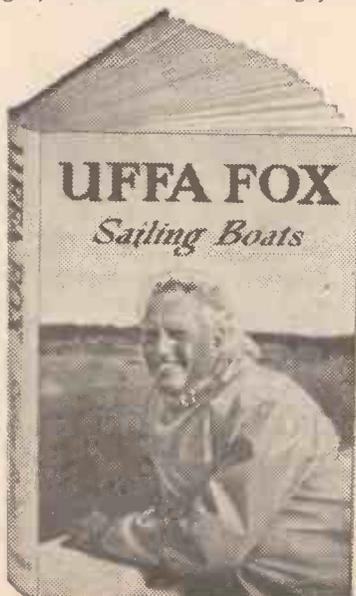
fixed keel craft are dealt with and included are R.Y.A. Flying Fifteen, International Dragon, International One-design, Fresh

Breeze, Lumberjack, Carina and the “America’s Cup” boats. The description of each boat is accompanied by scale plans and a sail plan and in addition most of the boats are shown under sail in a series of magnificent photographic plates.

This is a book written for the enthusiast by the greatest enthusiast of them all and is a volume that no yachtsman should be without.

“Model Radio-Control,” by Edward L. Safford, Jr. Published by Gernsback Library, Inc., 154, West 14th Street, New York 11, N.Y. 192 pages.

IN this book an effort has been made to start at the very beginning, to show what is required to obtain radio control and to present this information in simple everyday language and terms. This is a complete and up-to-the-minute handbook of radio-control of model planes, boats, trains, etc., and it covers all aspects of the subject from theory to construction of coders, decoders and other complex components as well as complete systems. Some of the chapter headings in this well illustrated book are: Servo Motors; Transistors; Practical Receivers; Practical Transmitters; Construction of Coders and Decoders and many others.



Use your Camera for Enlarging

A. E. Bensusan Tells You How to do It

THE horizontal enlarger described here costs only a few shillings to make yet it will produce good quality enlargements of any reasonable size. The need for a separate lens is eliminated by the use of your own camera, provided that this is not of the box or very inexpensive folding type. If the lens is marked "anastigmat," or it has a maximum aperture of f7.7 or larger, the camera is quite suitable for use in this enlarger. The complete arrangement is shown in Fig. 1.

two strips of wood $\frac{1}{2}$ in. \times $\frac{1}{2}$ in., passing No. 2 \times $\frac{1}{2}$ in. wood screws through from the outside of the tin into the wood. A square of opal glass, obtainable in the required size from a photographic dealer, is rested against these strips and a second pair fitted in exactly the same way to hold the glass in place.

The Track

This is made from two pieces of $\frac{1}{2}$ in. \times $\frac{1}{2}$ in. wood. The length will depend on the type of camera used but, if it has a 4 in. focal length lens, as is usual for apparatus taking negatives $3\frac{1}{2}$ in. \times $2\frac{1}{2}$ in., and the enlargements are to vary from just above contact print size, 18 in. would be a safe estimate. As shown in Fig. 3 the track is held together with 6 in. long cross members, $\frac{1}{2}$ in. \times $\frac{1}{2}$ in. in section. No. 6 \times $1\frac{1}{2}$ in. countersunk head wood screws and glue are used to obtain firm joints.

The camera carriage, Fig. 4, is made from wood $\frac{1}{2}$ in. thick \times 3 in. \times $7\frac{1}{2}$ in., with a piece

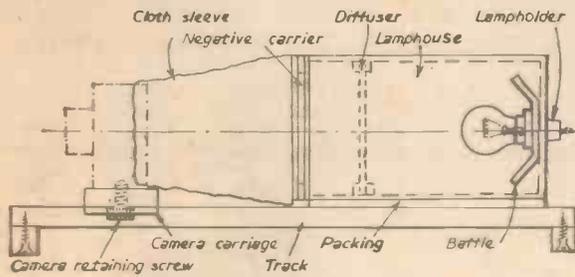


Fig. 1.—General arrangement.

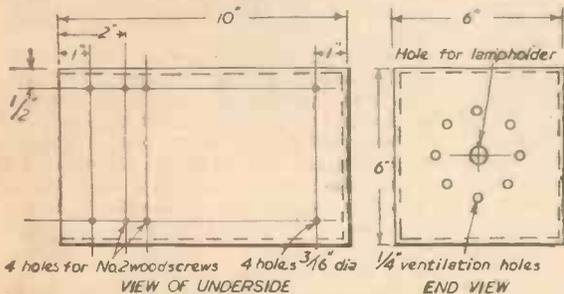


Fig. 2.—Lamphouse.

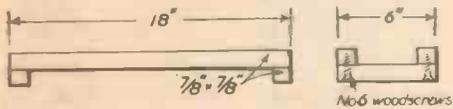


Fig. 3.—Track.

The Lamphouse

First obtain a tin box of suitable size for the lamphouse, say, 6 in. square and 10 in. deep. The size is not critical, but the tin should be large enough to permit free passage of the air around the light bulb and to accommodate a diffusing screen at a safe distance from the end of the lamp. Cut a $1\frac{1}{2}$ in. dia. hole in the end of the tin, to take a standard lampholder, and surround this hole with a number of ventilation holes drilled or punched $\frac{1}{4}$ in. dia. Drill or punch four holes $\frac{3}{16}$ in. dia. to take the fixing bolts as shown in Fig. 2. The lid of the tin is cut and bent to form a light baffle, as shown in Fig. 1, and held under the lampholder ring. The entire interior of the lamphouse is painted white, and a special 75-watt enlarging bulb is fitted.

About 2 in. from the mouth of the tin fit

MATERIALS REQUIRED

- Lamphouse**
 - 1 tin box, approx. 6 in. \times 6 in. \times 10 in. deep, with lid.
 - 4 pieces of wood, $\frac{1}{2}$ in. \times $\frac{1}{2}$ in. \times 6 in.
 - 1 lampholder.
 - 1 75-watt enlarging bulb.
 - 1 6 in. \times 6 in. opal glass.
 - 4 2B.A. \times 2 in. long countersunk head bolts.
 - 4 2B.A. nuts.
 - 8 No. 2 \times $\frac{1}{2}$ in. long wood screws.
 - As required—packing.
 - Track**
 - 2 pieces of wood, $\frac{1}{2}$ in. \times $\frac{1}{2}$ in. \times 18 in.
 - 2 pieces of wood, $\frac{1}{2}$ in. \times $\frac{1}{2}$ in. \times 6 in.
 - 4 No. 6 \times $1\frac{1}{2}$ in. long countersunk head wood screws.
 - Camera Carriage**
 - 1 piece of wood, $\frac{1}{2}$ in. \times 3 in. \times $7\frac{1}{2}$ in.
 - 2 pieces of wood, $\frac{1}{2}$ in. \times $\frac{1}{2}$ in. \times 3 in.
 - 4 No. 6 \times $\frac{1}{2}$ in. long countersunk head wood screws.
 - 1 camera retaining screw.
 - Negative Carrier**
 - 2 pieces of plywood, $\frac{1}{2}$ in. \times 6 in. \times 6 in.
 - 2 pieces of plywood or wood, $7\frac{1}{2}$ in. \times $\frac{1}{2}$ in. \times 6 in.
 - 2 pieces of glass, 5 in. \times 7 in.
 - 2 No. 4 \times $1\frac{1}{2}$ in. long countersunk head wood screws.
 - As required—black cloth.
 - As required—elastic braid.
 - 1 dozen upholsterer's tacks.
- The sizes given may require adjustment according to the camera. All wood sizes are finished sizes, not nominal.

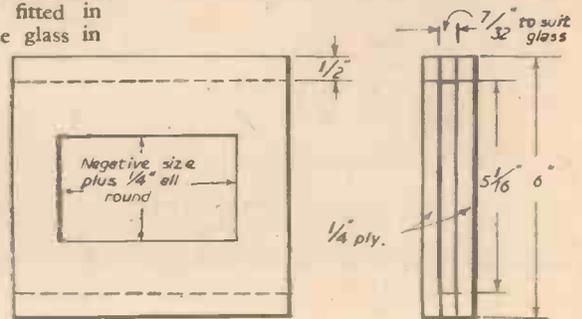
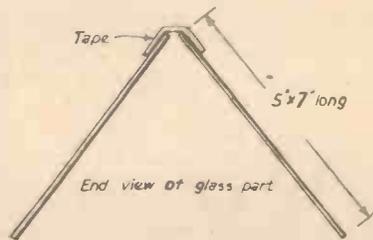


Fig. 5.—Negative carrier.



$\frac{1}{2}$ in. \times $\frac{1}{2}$ in. \times 3 in. secured with No. 6 \times $\frac{1}{2}$ in. countersunk head wood screws and glue at each end, so that the carriage slides smoothly along the track without any side movement. A hole to suit a camera retaining screw, either $\frac{1}{2}$ in. or $5/16$ in. dia., according to the size of the tripod bush, is drilled centrally in the $\frac{1}{2}$ in. thick part.

The centre of the lamphouse must now be adjusted to agree with the centre of the lens in both planes when the camera is mounted on its carriage. This will probably entail packing up the lamphouse to suit.

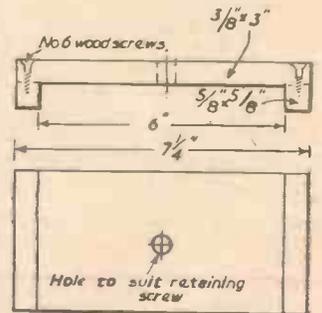


Fig. 4.—Camera carriage.

Negative Carrier

This is made from two pieces of glass 5 in. \times 7 in. in size, hinged together with adhesive tape along one of the longer edges, and containing a 5 in. \times 7 in. black paper mask with a centrally placed cut-out to suit the negative size. Two pieces of $\frac{1}{2}$ in. thick plywood are used to make the static part

(Concluded on page 137)

Building the 'Luton Minor'

(Continued from page 75, November issue)

NEXT we deal with wire bracing. Thread string through the wing ribs between the bracing lugs for the wire bracing to determine the exact run of the wires. The material used for bracing is a hard, stiff wire commonly called piano wire. Form the ends of the wire as shown in Fig. 20. The sleeves are $\frac{3}{8}$ in. long and are made of flattened copper tube. Soft-solder them to the wire—do not braze or silver solder them as the heat will affect the strength of the wire.

One end of the wire fits a 5 cwt. wire strainer or turn-buckle; the other takes an



Part 4 Concludes Construction of the Wings and Starts on the Fuselage

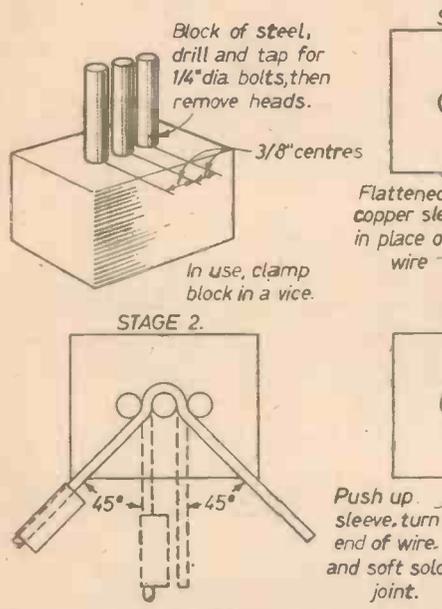


Fig. 20.—How to form an "eye" splice in piano wire.

aircraft shackle, both of which then pick up on the bracing lugs (Fig. 21).

Make each of the four wires in each wing in this manner, thread them through the wing ribs and then remove the guide string. Attach them to the lugs with shackle pins and $\frac{1}{16}$ in. split cotter pins. Leave the wires untensioned for the moment.

Use a large square to make sure that the spars at the root end are in line with each other. Since the wing is really a parallelogram, slight movement of the spars to

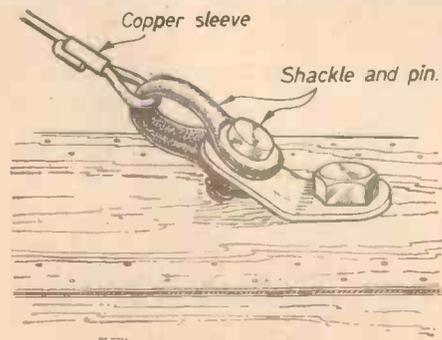


Fig. 21.—Attachment of bracing wires. The other end of the wire is fixed with a turn-buckle.

produce the desired rectangle can be accomplished by adjusting the tension of the wires.

When the wing is trued up, tension the wires just sufficiently to produce a low twang when they are plucked. Overtensioning of the wires can, in extreme cases, cause the splitting of the spar webs and any such pre-stressing of the wing is undesirable.

Wing Tip Bows

Make a simple jig for the laminations of the wing tip bows and, while the bows are setting in the jig, fit the leading and trailing edge members to the wing. Note that the aileron is not yet severed from the rest of the wing.

Make the root end rib. This is cut from $\frac{1}{16}$ in. or 1 mm.

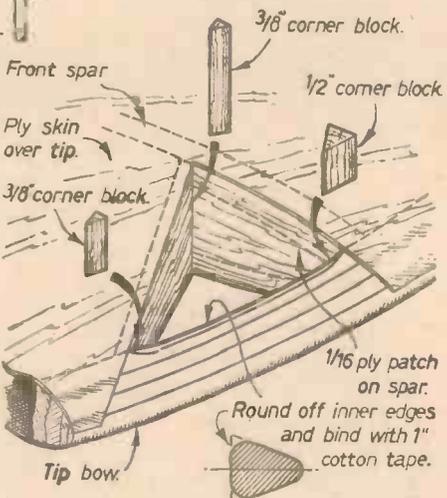


Fig. 22.—Details of the hand hold in the wingtip.

birch ply with a top and bottom capstrip of rib-stock. This is then built on to the spar roots and the drag strut as shown on the plan.

Clean up and fit the wing tip bows. Scarf the bow to the leading-edge member and also the trailing edge. Fit the drag-brace strut in the tip, the hand-hold member (Fig. 22) and also the diagonals which brace the aileron.

Cladding the Leading Edge

We now come to the ply-covering of the

wing leading edge. Remember that once this is done, any twist or warp in the wing will be locked in and the wing will not be true. Bearing this in mind, you are advised to make up three "L" braces, each about 6ft. high with a 2ft. or 3ft. base, to support the wing at right angles with the leading edge uppermost.

Screw the "L" braces to the floor so that one will support the wing at the root end, one at the centre drag strut and one at the tip. Fix to the braces short rigid cross pieces to hold the wing under the front spar. Hang the wing on to these with the top surface of the wing facing outwards.

Pack if necessary under the spar to bring the front spar level. Using "G" clamps and clamping blocks, secure the spar to the braces. Also clamp at the rear spar, packing out as necessary. This arrangement is shown in Fig. 23.

Hang plumb bobs over the front spar at the centre and also at the root and measure the distance between the plumb line and the rear spar where the line passes it. This distance should be the same for both lines; if it is not, then carefully pack between the rear spar and the support and re-clamp. When the measurements coincide, the wing is true and free from twist. Until the leading edge is completely covered, it is inadvisable to move the wing.

Take a straight edge long enough to touch at least three ribs and, working along the leading edge one rib at a time, try to rock the straightedge. Any irregularities in the profile will be shown either as high spots

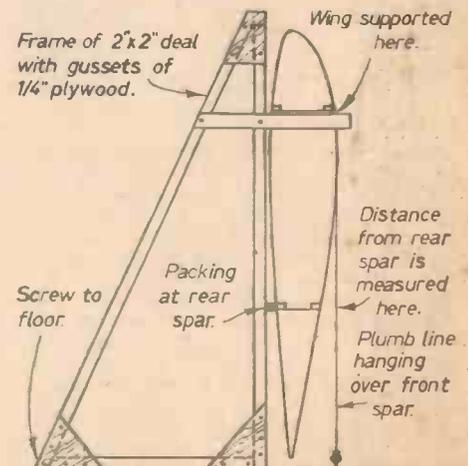


Fig. 23.—Brace the wing to the floor to check alignment before ply-covering the leading edge.

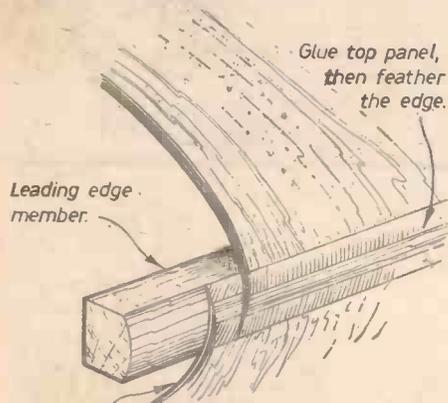
which can be pared away, or as low spots. These latter will require packing glued on and then shaping when dry.

This preparation of the front portion of the wing is very important as, if the ribs are slightly out of profile, the plywood covering will be lumpy. Not only would this be unsightly, but it would affect the performance of the finished aircraft.

Cover the leading edge in sections with separate pieces of plywood, scarfing them together on the job. Cut the plywood long-grained from 4ft. square sheets, half a sheet thus covering a 4ft. length of wing. Trim the sheet so that it can be scarfed on a rib and then pre-form the ply by folding it along the line of the leading edge, pouring boiling water over the outside and inside and clamping it between two planks of wood to the desired radius.

While this is drying, fit strips of packing to both sides of the front spar to support the plywood between the ribs (Fig. 19). Similarly, fit strips of packing on both sides of the rear spar over the aileron gap only. This is to support the fabric. Do not fit this packing to the rear spar over the main part of the wing.

Special clamps are available for pulling



Glue bottom ply before feathering the edge.
Fig. 24.—The joint between the top and bottom plywood panels covering the leading edge between ribs "C" and "D."

the plywood skin over the leading edge but, to save cost, it is quite sufficient to use webbing straps to apply pressure. You will need enough straps to pass over each rib which is to be covered with the ply panel being fitted. They will pass over the leading edge, round under the rear spar (which is padded with clean rag and scrap wood to prevent abrasion) and back up to the leading edge.

Starting from the under side of the wing, liberally glue the spar edge and the rib capstrips as far as the leading-edge member. Position the sheet of plywood and tack it to the spar edge with $\frac{1}{2}$ in. \times 20 s.w.g. gimp pins, placed at intervals of about $\frac{3}{4}$ in. Work up towards the leading edge along each rib

progressively, tacking to the ribs with tacking strips. Now glue the ribs on the other (top) side and the spar edge.

Loop the webbing straps over the leading edge, keeping them as close to each rib as possible, and tension them. Slide battens of wood between the plywood and the straps at each rib and force the plywood into intimate contact with the rib. Take care not to ruck up the plywood or cause "bubbles" in it. If the wood sounds hollow when tapped with the hammer, then there is a bubble or pocket which must be worked out. With tacking strips, tack between the battens through to the rib.

When the first piece has been completed, leave it overnight to dry before slackening off the webbing straps and removing the tacking strips.

Cut a scarf on the outer rib plywood for the next panel using a bull-nosed plane, a file or a chisel. The next panel should be scarfed on the inside before pre-forming to mate the first one.

The tip, where the wing diminishes in depth, must be covered in smaller panels; the last rib A to the rib C is done in one piece; the portion between rib C and rib D is covered in two halves, scarfed on the leading edge (Fig. 24). The tip of the wing, from rib D to the mainspar is covered again in two halves while the remainder of the tip is covered with two panels, one on top and one beneath. The grain of all the plywood should be spanwise.

Now build in the transverse stringers between the root end rib and the first rib A and ply-cover the root, top and bottom, using 1/16in. plywood, spanwise grained.

Carefully cut away the aileron and clean up the rib ends. No control cables are fitted yet.

The starboard wing is made in exactly the same way, but do not forget to glue the block into the mainspar which carries the pilot head. This and the anchor-unit plate must be fitted before the leading edge plywood is fitted.

Building the Fuselage

The method of building the fuselage which is described here is somewhat different to that shown on the plans. On these, the boxing up of the fuselage may present difficulties in aligning the two sides and bending in the bottom longerons at the nose.

The sequence of operations detailed herein has been adopted by Phoenix Aircraft Ltd. to eliminate these possible difficulties. The making of the necessary jigs for bending in the nose is strongly recommended as in

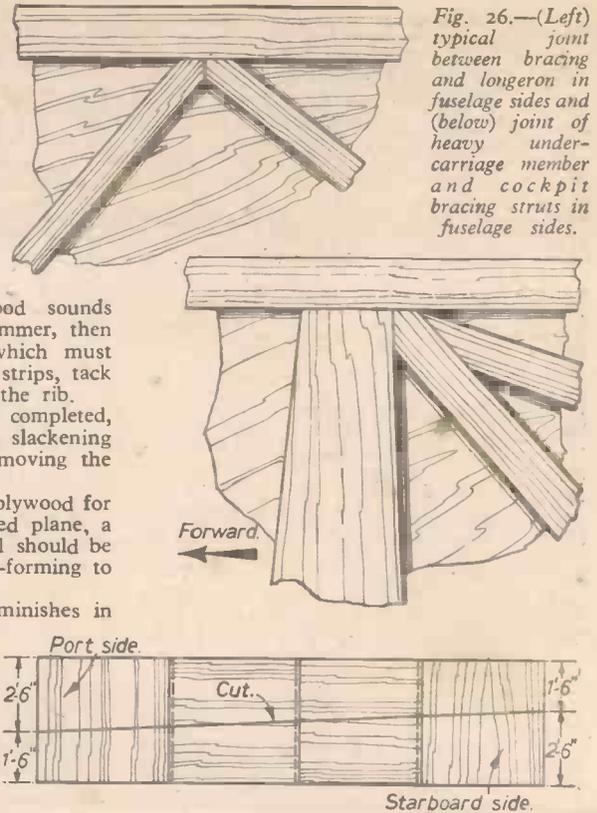


Fig. 27.—Scarving plywood sheets for the sides: Note how both sides may be cut from four sheets of nominal 4ft. width. Direction of the grain is important.

the long run time and effort will be saved and a better job achieved.

Fuselage Side Jigs

The first step is to make a jig to locate the longerons and various members in the fuselage sides, both of which are built flat. As the two sides must be dimensionally the same, but opposite handed, we advise the constructor to make a jig for each side in the manner described here.

By making the two sides next to each other, time can be saved and measurements can be taken to both sides from one centre-line situated near the top longerons. This is clearly shown in Fig. 25.

Since the longerons at the nose end of the fuselage must be left at least 1ft. longer than will be required to aid bending, a clear space of about 17ft. \times 4ft. 6in. will be needed. Ideally, use a level wooden floor and set out the jig as shown in Fig. 25. While wooden blocks must be used to locate the longerons, headless nails may be used to hold in place the various cross members. Do not bend up the bottom longerons in

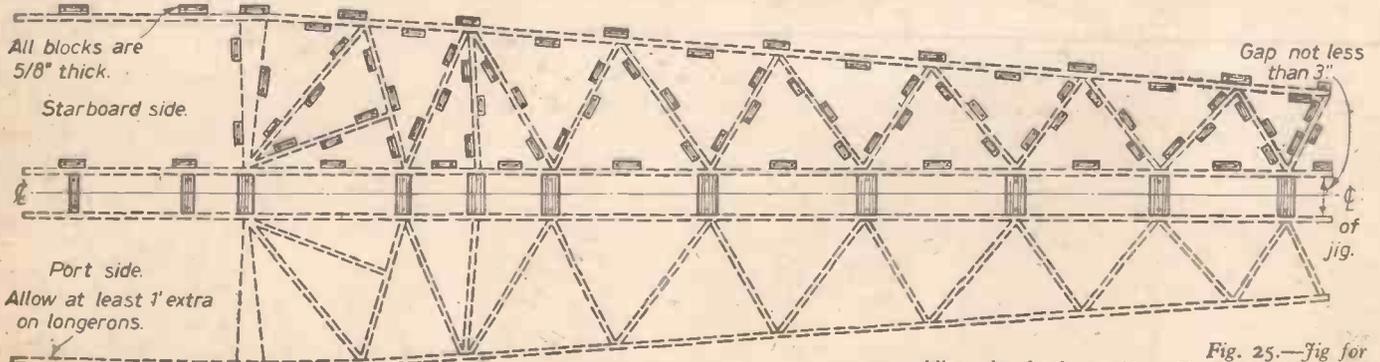


Fig. 25.—Jig for assembling the fuselage sides. If desired, diagonal bracing members may be located between headless nails. Longerons must be located in blocks.

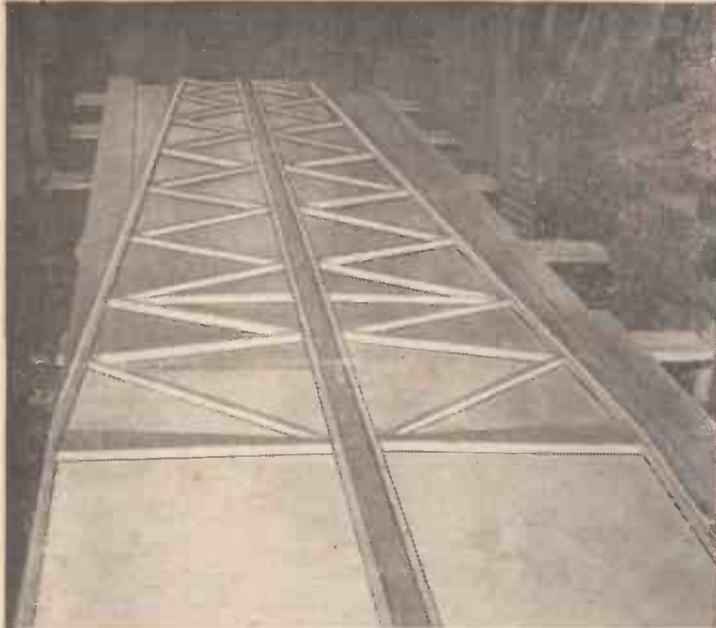


Fig. 28.—Photograph of the fuselage sides (picture by Mr. J. T Hayes, Lincoln).

this jig, but just bring them parallel to the top ones as shown.

Cut and fit the longerons and spruce bracing struts, making sure that the joints are correctly formed as shown in Fig. 26.

Put a piece of polythene sheet or waxed paper under the joints and proceed to glue up each joint carefully and thoroughly. The farthest forward member to be glued at this stage is the heavy cockpit member which takes the undercarriage and lift strut fittings.

Plywood Side-Skins

Now scarf up the ply sheets for the fuselage sides. Join the sheets as shown in Fig. 27. Scarf not less than 1 in 12 and, when set, well sand each side of the joints to remove any surplus glue. Cut the joined sheets as shown in Fig. 27 for the two sides. If desired, the sheets may be cut before scarfing to reduce the length of the scarf joints.

Place the long strip of ply skin over each fuselage side frame in the jig, allowing about 1/2 in. overlap at the top longeron. Fix them temporarily in place with a few

brush. Do not forget to wash it out after use in plain warm water.

With a moistened sponge, evenly dampen the top surface of the ply skin before gluing so that the ply will expand slightly and, when dry after gluing, will contract to form an even, smooth skin in the fuselage.

It is a common eyesore with ply-covered aircraft that, after a time and especially in damp weather, the ply distorts between structural members. This is even more apparent with flat surfaces and this slight moistening, before fixing will considerably retard this tendency.

Fitting the Skin

Enlist the help of an assistant and carefully position the ply skin on the frame. Starting at the top longeron by the heavy cockpit member, begin stapling the ply. Hold the stapling tool at an angle of about

brads and then pencil on the positions of the longerons and all members as a guide for stapling.

Remove the skins. Mix sufficient glue to glue up one side and remembering still not to glue anything forward of the heavy cockpit vertical member, apply glue liberally to the fuselage side frame. This is best done with a 3/4 in. wide paint

45° to the centre-line of the member and staple at intervals of about 1/2 in. Work one bay at a time progressively aft.

To keep within the setting time of the glue, especially in warm temperatures, it may be necessary to glue only a 4ft. length at a time. If this is done, allow an overlap of the next glue application to avoid a possible gap. Repeat this procedure for the other fuselage side.

While the glue is setting, draw out on the floor the plan of the top of the fuselage from the stern-post as far forward as the cross member which is situated 119 1/2 in. from the stern post. Screw blocks of wood to the floor to locate each side of the longerons. The sides will be placed between these blocks inverted so that the fuselage is upside down for the next stage in assembly.

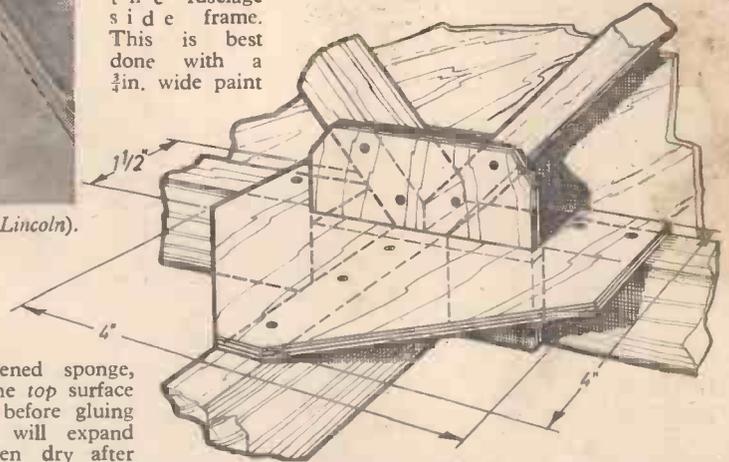


Fig. 30.—1 1/2 in. wide x 2 1/2 in. high x 1/2 in. thick ply gusset slotted over cross member and plate gusset recessed around it.

Remove the two sides from the assembly jig and plane off the surplus ply overlapping at the longerons. Do not as yet trim the excess from the unglued portion forward of the undercarriage member.

Filling Gaps

Examine carefully for any gaps in the gluing along the longerons and bracing. If construction has been done correctly, there should be no gaps but, should any be discovered, force glue under pressure into the gap with a polythene cake-icing syringe.

Check the two sides together and see that the top longerons are flush and free from lumps of dried glue. Sand each joint on the inside of each side. Ideally, use an orbital sanding tool but, if you use a rotary sanding disc in an electric drill, exercise caution as they cut quickly and can remove the base wood in addition to the dried glue.

Remove all the staples with the special tool described in Fig. 2 (October issue).

Fitting Cross Struts

Set the two sides upside down in the plan jig (Fig. 29).

Remember that you now have the fuselage upside down and mark on the positions of all the cross struts in the fuselage bottom (uppermost) as far as the one 109 1/2 in. from the stern post.

Clamp the rear fuselage sides to two straight-edged boards (Fig. 29) and cut and fit the cross members. To support and strengthen these butt-joints, make and fit 1/2 in. plywood saddle gussets as shown in Fig. 30. The saddle gussets at the cross member which takes the 1/16 in. ply bulkhead in the rear fuselage will not be fitted until this bulkhead has been installed as they will need to be shaped to suit. Do not screw the cross members to the longerons.

(To be continued)

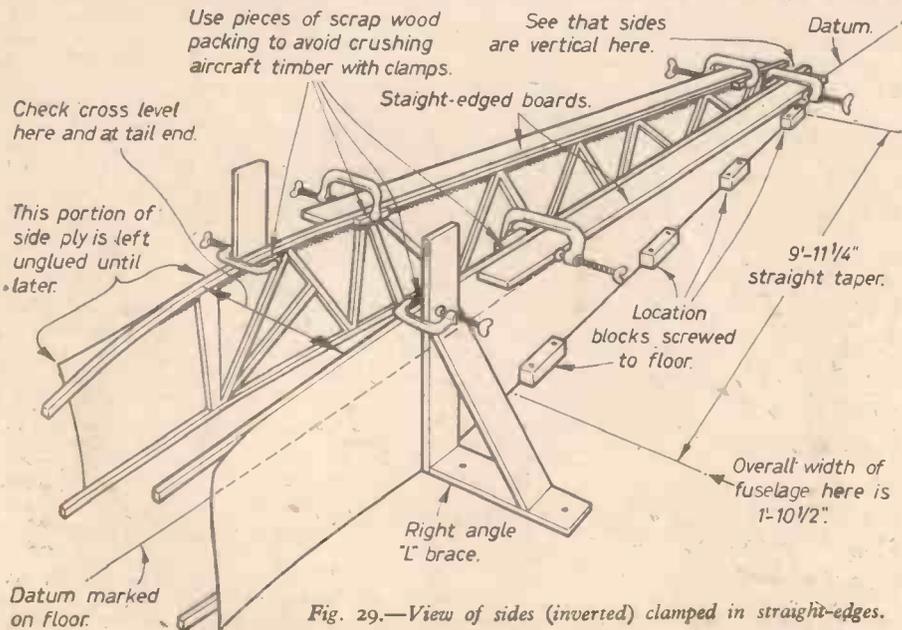
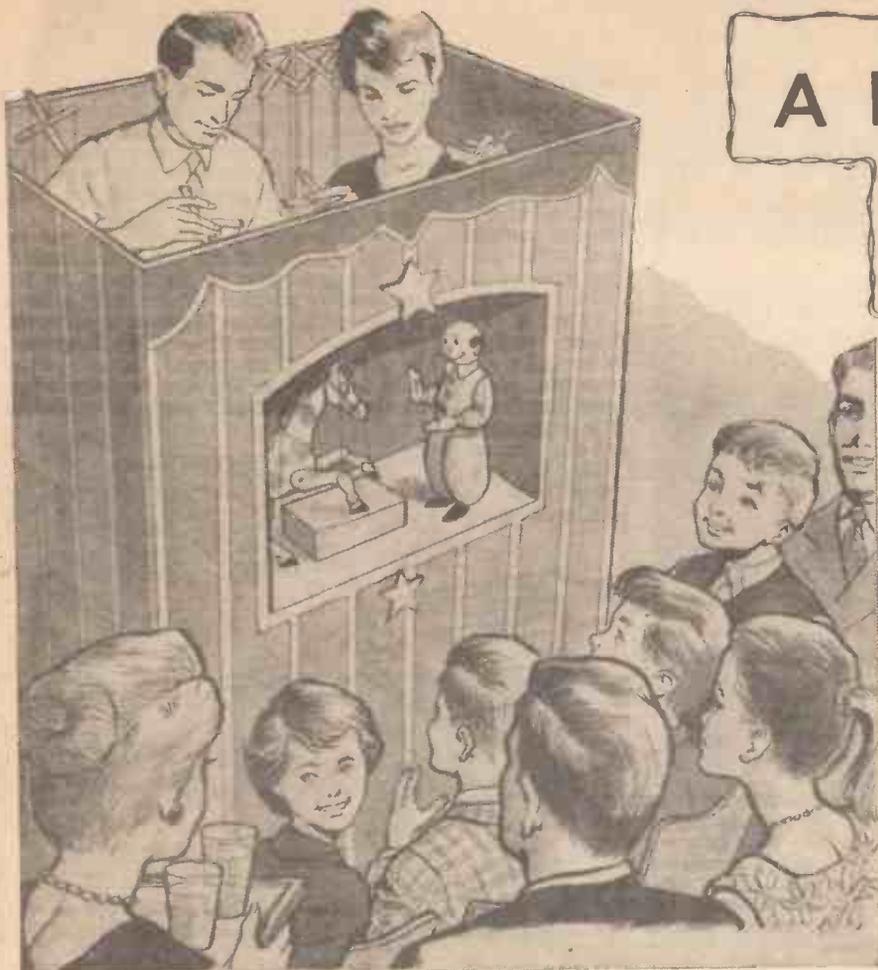


Fig. 29.—View of sides (inverted) clamped in straight-edges.

A PORTABLE MARIO



SUITABLE FOR PROFES

Making the Support Towers

The towers are made throughout in 2in. X 1in. deal planed all round, so that the dimensions will be about 1/4in. under 2in. X 1in. The various frames are made with half-lap joints at the corners and these corners are further reinforced with triangular pieces of plywood 3/16in. thick glued and nailed in position. This construction will give great rigidity to the frames.

The frames are made to fold by the use of 1 1/2in. backflap hinges.

In the main the various parts of the stage are held together with 2in. X 1/4in. Whitworth round-headed screws and wing nuts. A few other sizes are also required, as for example when fixing the lighting rail or leaning rail, but these will be described later.

Three of the shorter towers (Fig. 6) are

THE design of this portable marionette stage renders it suitable for the presentation of puppet entertainments using marionette figures of from 18 to 20in. high. This size figure is the one most commonly used by puppet showmen nowadays. Quite large audiences are able to see the show provided that due attention is given to the question of line of sight.

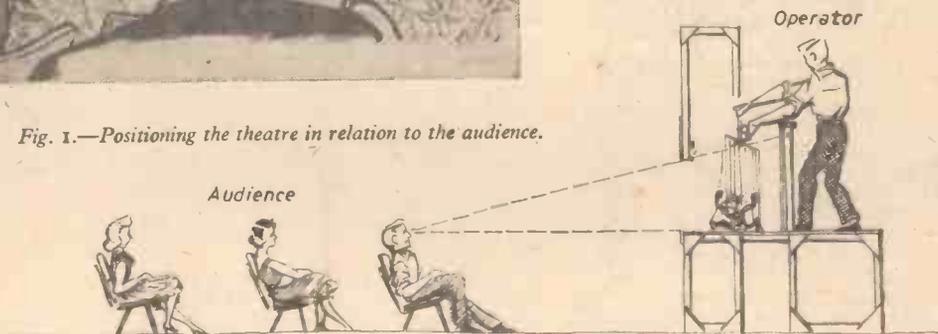
From Fig. 1 it will be apparent that the floor of the marionette theatre must be just over the heads of the front row of the audience if the auditorium has a flat floor.

Secondly, the proximity of the front row of the audience to the stage and the height of the proscenium opening are important. If too near, the front row will be able to see up under the proscenium and so get a view also of the operators, which is undesirable. The question of the height of the leaning rail is important too, as it must be of a convenient height for the comfort of the operators and must bear a relation to the length of the strings of the marionettes.

An interesting point to bear in mind, too, is the relation of the height of the puppet figures to the height of the proscenium opening. When the difference between the two heights is not great, an illusion of greater height is given to the puppets.

The height of the leaning rail is concerned mainly with the comfort of the operators who may have to work for an hour or so non-stop. Consequently this rail is adjusted

Fig. 1.—Positioning the theatre in relation to the audience.



conveniently for the fore-arms of the operator to rest upon it when holding the control stick of the marionette whilst the marionette itself is standing in a normal position upon the stage floor (Fig. 2).

In this design the height of the leaning rail is 3ft. 4in. above stage floor level. Except for specialised puppets, normal figures are strung to the control which is hung on a peg 4ft. 6in. from the floor with the feet of the puppet just resting on the floor.

From Fig. 5, it will be seen that the stage comprises two front towers and three shorter rear towers. The two front towers support the proscenium draperies and drop curtain, lighting bar, record player, etc. The back three towers support the floor upon which the operators walk, the leaning bar supports and a hanging bar protruding towards the rear upon which the puppets are hung when not in use (Fig. 4). The two floors of the stage are made from sheets of 1/2in. plywood, screwed to frameworks of 2in. X 1in. deal. Each floor is made in two parts which are hinged together so that they may be folded up when being transported.

required, each consisting of two wide and two narrow frames constructed to the dimensions given in Fig. 3. The corner joints are sawn as shown and are then glued and



Leaning rail and backcloth

ONETTE-THEATRE

By F. HOOK
SIONAL OR SEMI-PROFESSIONAL USE

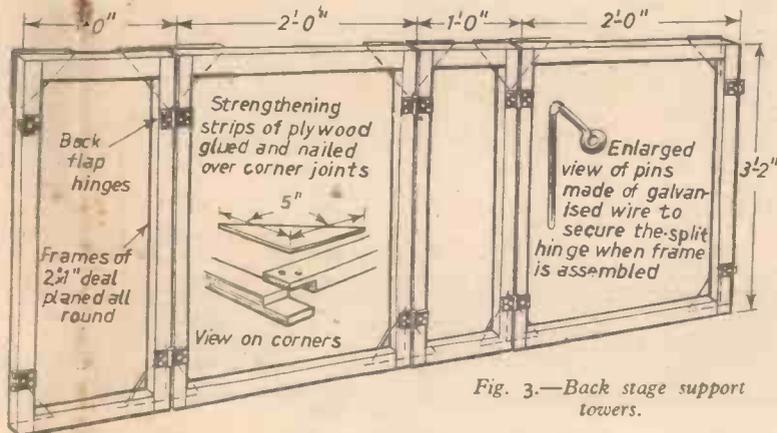
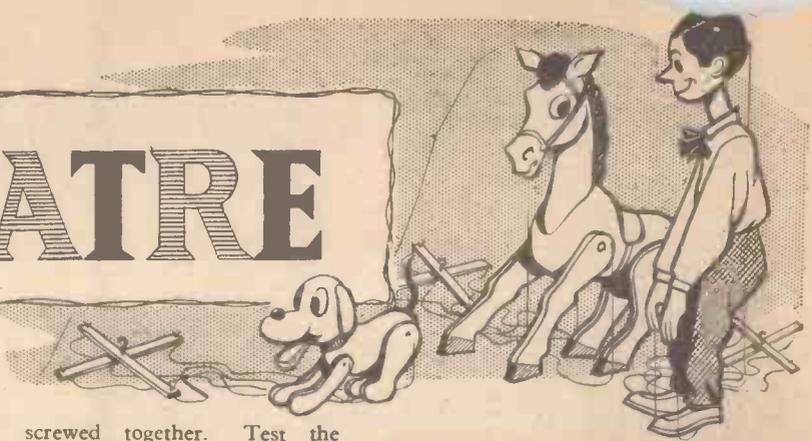


Fig. 3.—Back stage support towers.

screwed together. Test the frames for squareness by measuring across diagonally. These dimensions should be equal. After the frames have been made square the triangular corner pieces are glued and nailed over the corner joints. For all constructional work on the stage it is advisable to use a waterproof glue such as Aerolite, so that if the stage is stored in the damp the joints will not be affected.

When the glue is dry, clean up each frame with a smoothing plane.

Each set of four frames is joined together with 1 1/4 in. back-flap hinges. So that the frames

may be opened out flat as shown in Fig. 3, one pair of hinges has the centre pin knocked out with a punch after one end of the pin has been filed off. When the frame is built up for use, the hinge thus parted is joined together with galvanized wire of suitable thickness as shown in Fig. 7.

The Front Support Towers

The front support towers are constructed in a similar way to those used at the back according to the dimensions given in Fig. 8. One difference is, of course, that a wide and

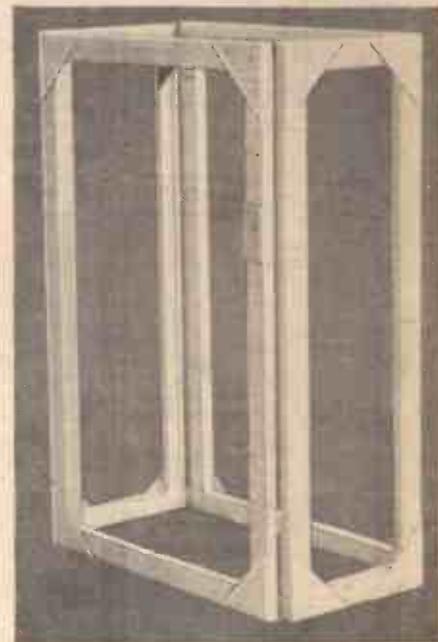


Fig. 6.—A completed small rear tower.

narrow pair of frames when hinged together are hinged end to end with another pair of frames.

Open out the frames in a longitudinal direction and then fold at right angles when the frame will stand erect on a level surface. The longer width frame will be along the front of the stage and the shorter frame will return along the side of the stage. On the top of this return frame is bolted a batten 4ft. long and 2in. x 1in. which serves to hold the curtain draperies along the side of the stage and in the case of the left-hand frame will hold the pulley block used for drawing the proscenium curtain (Fig. 9).

To the top front frame of the assembly are bolted the pieces which serve to hold the light bar.



Fig. 4 (Above).—Back stage, showing puppet rail and puppeteer's platform.

Fig. 2 (Left).—Dimensions of the leaning rail.

Fig. 5 (Right).—The stage consists of two front towers and three shorter towers.

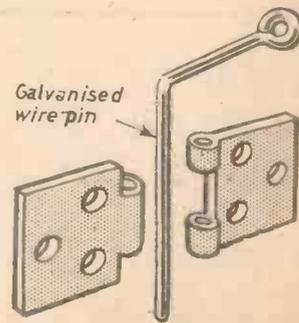
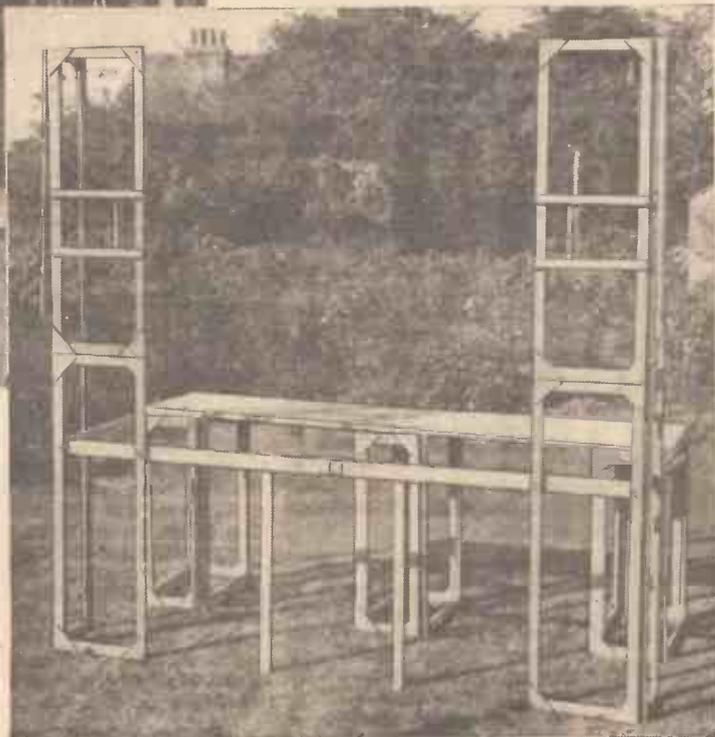


Fig. 7.—Backflap hinge modification.

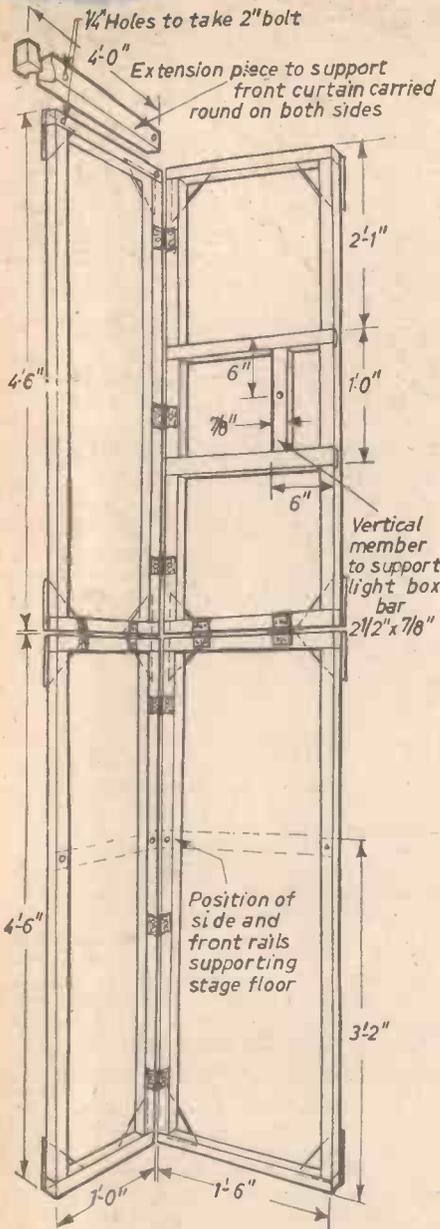


Fig. 8.—Details of left front tower.



Fig. 9.—The batten holding curtains along the side of the stage.

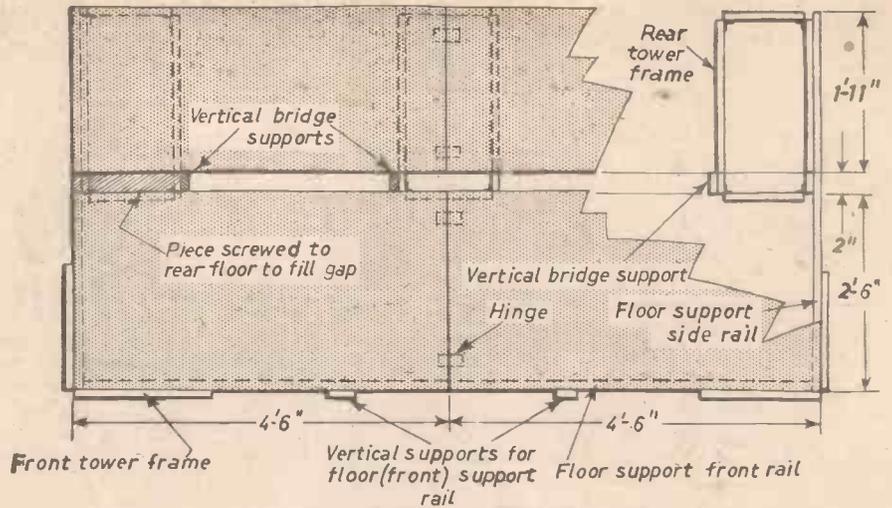


Fig. 10.—Dimensions for the floor of the stage.

On the lower of these frames are several holes which take the bolts which hold the battens joining the front and rear support towers and the front towers to each other whilst supporting the floor. Whilst these positions may be marked in pencil for the time being it is better to delay drilling until the battens have been prepared and are also ready for drilling.

The Side Support Bars

Each of these bars is 54 in. long and 2 1/2 in. x 7/8 in. finished size (Fig. 11). Cramp them in place joining the front tower to the rear tower so that they are on the outside of the rear tower and on the inside of the front tower. Butt the front end of the bar right into the angle of the front tower and place the rear end flush with the back edge of the frame of the rear tower.

The Front Floor Support Bar

This bar is made from two pieces of deal each 4 ft. 4 in. long and 2 1/2 in. x 7/8 in. finished sizes. They are secured together with a single 2 in. backflap hinge, as shown in Fig. 12.

At 12 in. from the hinge joint, two vertical supports, each 38 in. long, are bolted to the floor support. The support bar is then bolted on the inside of the front tower frames with the ends butting against the previously bolted up side door.

With the fitting of these floor support bars it is advisable to stand the towers on a level surface and to hold the bars in place with small G cramps before drilling the various members to ensure that everything is level and vertical.

The Floor of the Stage

There are two parts to the floor of the stage—the front part upon which the puppet actors walk and the rear part upon which the puppet operators walk. Each of these floor sections is divided into two sections

and held together with some zinc backflap hinges so that they may fold back upon each other for purposes of easier transport.

The floors are made from 3/8 in. thickness plywood screwed to frameworks of 2 in. x 1 in. battens. The dimensions of these frames are shown in Fig. 10. The corner points of the frames are halving joints.

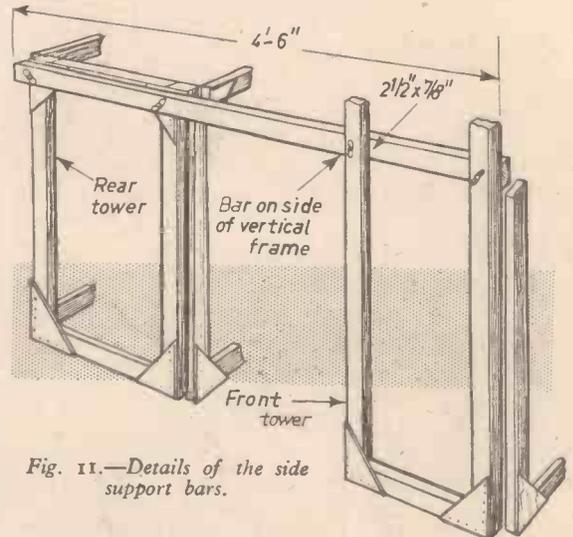


Fig. 11.—Details of the side support bars.

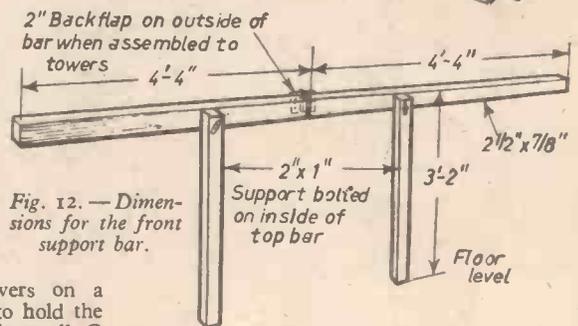


Fig. 12.—Dimensions for the front support bar.

When the floors are placed in position on the stage there is a space left between the two so that the bridge supports, which are bolted to the sides of the rear support towers, may protrude above the stage level. This leaves a gap of about 2 in. in between the floors which can be inconvenient to the operators when adjusting things in the wings. Because of this two pieces of deal 15 in. x 2 in. x 1 in. are screwed to the front edge of the rear floor frames. This is shown in Fig. 10.

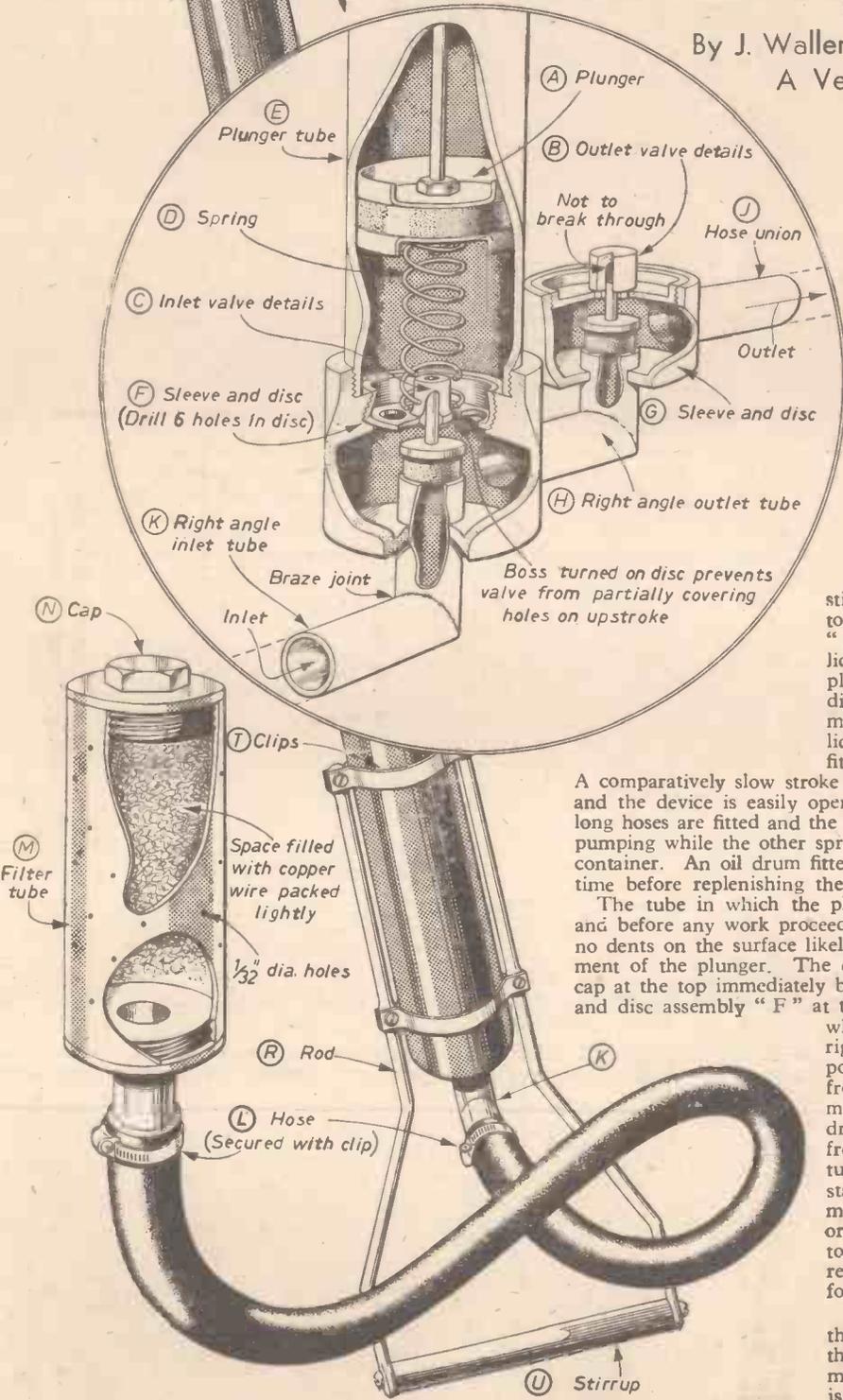
(To be continued in next month's issue.)



A Garden Spray and Car Washer

By J. Waller

A Versatile Pump for You to Make



THIS design of pump played an important rôle during the last war, when it was found to be an efficient method of spraying water on to an almost inaccessible fire. Its present uses are in the spraying of fruit trees and car washing and the emptying of tanks. Boilers and sumps are other instances where the simple pumping action can remove liquid via a long length of tube to a drain. Thus, this design is not new, but is an interesting constructional job, it being possible to make it either from odd pieces of scrap material or by altering an existing hand pump.

Construction

Fig. 1 shows (inset) the lower end of the unit with the casing cut away. The plunger "A" is pushed down to the bottom of the tube and an upward stroke is just about to commence—a situation that causes the outlet valve "B" to shut and also opens the inlet valve "C"; in this case the latter is still seated as the plunger has not risen sufficiently to release the pressure imparted by the spring "D." This lifting action causes water or other liquid to enter the inlet valve and to fill the plunger tube "E," and the reversal of the stroke direction then shuts the inlet valve and immediately lifts the outlet member allowing the liquid to flow unrestricted to the jet or spray fitted to the rubber or plastic tube at that position.

A comparatively slow stroke is required, especially when spraying fruit trees, and the device is easily operated by a single person at ground level, but if long hoses are fitted and the work proceeds from tree to tree, then one person pumping while the other sprays is preferable as this also means using a large container. An oil drum fitted to a simple trolley can be used to increase the time before replenishing the liquid becomes necessary.

The tube in which the plunger operates is a piece of thin wall material, and before any work proceeds on it, a check is essential to see that there are no dents on the surface likely to distort the bore and impede the easy movement of the plunger. The ends are threaded in the usual way to receive a cap at the top immediately beneath the pumping handle, and a similar sleeve and disc assembly "F" at the bottom. The latter is bored to create a box where the valve is fitted and drilled to receive the right-angle tube "K." A built-up assembly is possible from pieces of tube, but a detail machined from a solid piece of brass bar is perhaps made much more quickly if a lathe is available. Holes drilled through the disc allow the water to run from the filter into the box and then to the plunger tube. To facilitate replacement of the valve—a standard water tap fitting—a threaded disc is made and the holes themselves act as tightening or slackening members when it becomes necessary to make a change. Another hole is drilled to receive the second right-angle tube "H," which forms part of the outlet valve assembly.

This member at "G" is constructed in much the same manner as the previous sleeve, but on this occasion no holes are provided as a tightening medium. Instead a short length of hexagonal bar is brazed into a hole in the disc and this allows the use of a small spanner when it becomes essential to remove the disc and replace the washer. The

Fig. 1.—The completed pump with (inset) a cutaway view of the lower end. Part of the filter casing has also been removed.

hole in which the shank of this washer slides is not drilled completely through otherwise water will leak at this point. Again the bottom and side wall is drilled for the right-angled tubes, and these also are preferably brazed in position as this prevents the parts turning on the threads when in use—an action that will certainly take place if the tubes are screwed into the sleeves at this point. Incidentally, the question of whether to use the usual Jubilee type of clip for the hose or to utilise a screwed coupling is a matter of choice. The latter are readily obtainable from ironmongers and allow a quick uncoupling of the hose and the instalment of another in a matter of seconds.

The coiled spring "D" is made large enough to pass over the extension piece machined on the disc. There is no need to restrict this clearance because the plunger, on moving up and down, will take the spring with it and thus pass over the extension at every stroke. The spring is closed and the nut on the piston holds it to that member because it makes a more secure hold than attempting to attach it to the disc extension. The piston follows orthodox practice adopted for these details and suitable cup washers are obtainable from ironmongers to fit the bores of most tubes. Failing this source of supply, it does not take long to make a piston from some fairly soft rubber with a pair of washers each side similar to those depicted in the drawing.

The Filter

A filter is essential unless it is proposed to pump only perfectly clean water, but as the general usefulness of this equipment is appreciated, many other tasks are likely to be undertaken which make the installation of a filter unit an essential feature of the design.

Construction is shown in Fig. 1. Again a length of thin wall tube is used, threaded

internally at each end for the hose union and cap with a host of small $1/32$ in. holes drilled through the walls. The union must fit tightly or, alternatively, if the threads are slack, the flange fixed to prevent it unscrewing by making two or three centre pops round the joint where the two parts meet. The cap is shown with a hexagon, but this is optional. A nut brazed to the turned detail is one way of making it, but a square filed to provide a spanner hold is also satisfactory.

Fill this tube with wire wool—the copper or brass variety is obtainable for approximately 1s., and does not rust. The steel pot scourer is useless for this purpose because after a short period it will disintegrate. Pack the wool loosely, replace the cap and then the filter is ready for use. It will not, of course, stop every minute fragment in the water, but as pieces of straw can pass through the $1/32$ in. holes it will stop such material from eventually passing on to the valves.

The Stirrup

The stirrup is made from simple bent rods with either a wood or brass lower piece for the foot, and these are adjusted according to the height of the person most likely to use the pump. The stirrup is arranged at right-angles to the hoses, as shown.

Variable Hose Size

While most readers are content to supply and fit a single size of hose and inlet and delivery connections, this is not always a wise method to adopt because it does restrict to a large degree the usefulness of this equipment. For instance, the emptying of a car sump where the plug was so battered that it was impossible to again apply a spanner meant that the sump required dismantling from the cylinder block for the removal of this dirty oil. To overcome the problem of

the car being out of action at that time, a long piece of clear plastic hose was attached to the pump and fed down the filler tube, whereupon it was a simple matter to dispose of the oil in a suitable bucket. While this was not, of course, an ideal solution to the normal oil draining procedure, it did mean that fresh oil was supplied until it became possible to take off the sump and drill out the offending member. Therefore, make adaptors to fit a large and small hose.

Using The Pump

Spraying trees has already been mentioned and a thorough clean with fresh water from the bucket will prevent any corrosion. The pump will obviously empty water butts or tanks, despite the fact they are covered with slime, and again a wash will remove all the dirt the filter will pick up. Similarly the pump will spray a garden fence with creosote, and a wash in petrol leaves it clean and ready for the next task, or it can remove all the water from a fish pond much better than the bucket method because the inlet hose can reach the inaccessible corners which normally require a mopping up operation before the pond is considered dry. A similar arrangement to the oil pumping procedure previously mentioned, but this time reversed, can fill the crankcase, gearbox or rear axle, and as the latter is situated in an awkward position, the careful pumping from a can is much better than endeavouring to run the lubricant from a tin after that item has been filled from the larger can.

Practically all liquids (with the exception of acids which naturally have a corrosive effect on the parts) are easily pumped with this accessory and the design is so arranged that cleaning is comparatively easy. Whether the spraying of whitewash or distemper could be undertaken is a matter of conjecture, but there appears no reason why this is not possible if the liquid is not too thick.



Space Fuel of the Future?

PLANS exist at present for increasing the efficiency of sources of power already in use, i.e., liquid and solid propellants and nuclear energy and electricity, but it has also been suggested that use be made of the plasma or energy belts which exist in space. At present this is merely an imaginative idea, but successful utilisation of this energy would mean that space craft could travel almost indefinitely, obtaining their fuel as they go.

Our Latest Radar

SO much information is collected so quickly by modern radar that data processing equipment (electronic brain) is necessary to sort it out and present an up-to-the-minute picture of the tactical air situation. A long-range warning, as well as range, bearing and height data, is given.

Undersea Research Vessel

A SUCCESSOR to the Bathyscaphe, based on the same principles but of entirely different shape, is being designed in America. In appearance it will resemble a submarine, rather than a sphere. It will be 9ft. in diameter and will weigh 83 tons. A pressure resistant sphere at the forward end will house the crew of three and all the control, navigation and recording equipment. A similar sphere aft will contain all

the batteries and automatic equipment. Between the two will be situated a ballast tank and a compartment to house the equipment used to obtain and store samples from the sea bed.

Model Van de Graaff Electrostatic Generator

DESIGNED for school laboratories and capable of producing nearly half a million volts, this model Van de Graaff electrostatic generator can be bought for only £46. It is produced by Messrs. W. B. Nicolson (Scientific Instruments) Ltd.

Re-entry Problem

ONE of the problems scientists have to face when designing a manned space vehicle is protecting the occupants from the searing heat which will result when the space ship re-enters the earth's atmosphere. Heat shields have been constructed and are in process of being tested. One is a 3in. thick 6ft. diameter sheet of beryllium—a material capable of absorbing vast quantities of heat and the other is of the ablating type. These materials, as they grow hot, melt vaporise or flake off, thus dispersing heat.



The Fairey Rotodyne, the world's first vertical take-off airliner in flight at Farnborough recently.

earth) run up to the speaker output jack. All these leads are left long at present for later soldering to the panel when this is fixed.

The Two Smaller Sections

These are the sections holding controls VR1, VR3, R27 and switch S2 (see Fig. 18) and the bracket for condenser C10. The condenser is dropped through the bracket so that it clears the bracket above.

The sections as so far wired up may now be assembled and the interwiring completed. This covers the wiring from S2 across to VR3 and to the monitor and amp. jacks on the panel, the heater leads and H.T. lead from the magic-eye brought down to the side strip on the "mid-amplifier" chassis, and connections completed to the other controls concerned on the panel. It is essential when fitting VR1 in position, that its tags face outwards; if this is not done it will not be possible to wire this later from the pre-amplifier section.

The wiring of this latter section will be given next, as the wiring is critical in parts and so additional care is necessary.

Wiring the Pre-amplifier

The wiring of the pre-amplifier strip is rather more critical than the units already described, and some care should be exercised to follow the wiring diagram of Fig. 19 as closely as possible.

The majority of the components are mounted on paxolin boards of about 1/16in. thickness, and self-riveting type tags are used, being punched into the panels as the figure indicates. Alternatively, in the absence of such tags, ordinary double-ended solder tags may be used, secured by 8 or 6 B.A. bolts. In this latter case, care should be taken to use countersunk screws, so that there can be no possibility of the underside shorting out to the metal chassis when the boards are positioned. In this respect, of course, the spacing from the chassis should be at least 1/8in., the actual positions of the fixing screws being immaterial so long as there is no possibility of shorting. Note particularly that the preset control VR2 is mounted on the larger paxolin board, the spindle only protruding through the metal-work of the chassis.

Next month's instalment will give valve base and heater run details, describe assembly and an alternative output and also deal with testing.

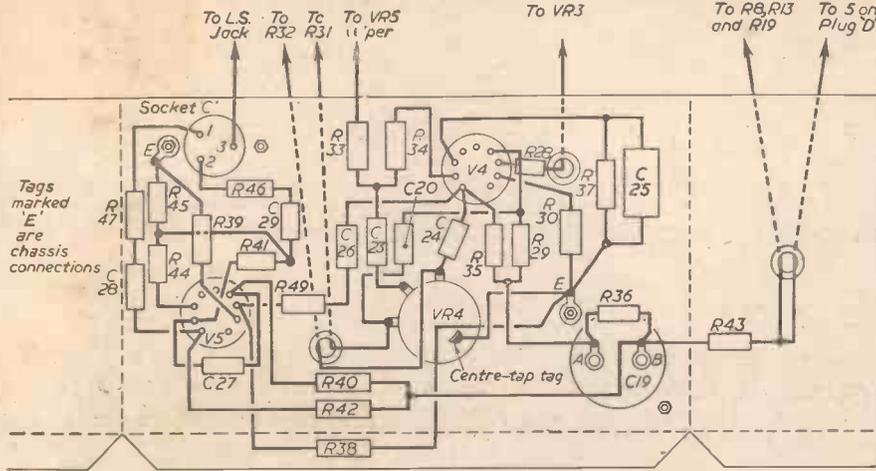


Fig. 17.—Mid-amplifier wiring.

to the holder pins of the magic-eye that a clearance is left in line with the holding bush as a 1/4in. spindle has later to pass through this. To be safe from short circuit risk, it is as well to use a length of 1/4in. insulated rod (such as paxolin) for the spindle.

The "Mid-amplifier" Chassis

This is best wired next as the wiring here is again not critical. This chassis carries the valve stages V4 and V5, the input point being derived from the slider of the gain control VR3, and the output terminating in socket "C." Fig. 17 gives the wiring. Condenser C19 (8 + 16 μF) is dropped through the chassis so that it does not foul the small strip carrying VR3 and S2 above, and the positioning of VR4 on the chassis must be beneath the appropriate panel hole bush when this latter is mounted (treble gain). Tag boards and strips may be used as necessary under the chassis, particularly for holding the larger condensers C20, C24, C28 and C29. The heater and H.T. leads are brought out at the end to a tag strip which is clearly seen in the photograph (Fig. 11). They should

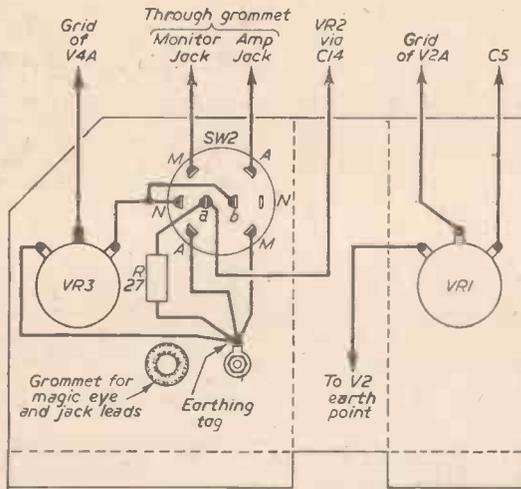


Fig. 18.—A point-to-point wiring diagram of the control strip.

not be soldered just yet as other leads have to be wired here later. The slider input from VR3 comes down to V4A grid through a short piece of screened lead, also seen; this can be free for the time being, of course. The leads up to VR5 are run up similarly (three unscreened) and condensers C21, C22, R31 and R32 are wired across the actual control. Two further leads (one

ANSWERS TO READERS' QUERIES ABOUT THIS DESIGN :-

- 1.—The Collaro Deck is obtainable from most radio dealers. Messrs. Lasky's Radio, 370, Harrow Road, Paddington, W.2, can supply.
- 2.—Wire the recorder in normal 22 s.w.g. single P.V.C. insulated wire, with stranded 22/0076 for the heater leads.
- 3.—Messrs. T.R.S., Ltd., 70, Brigstock Road, Thornton Heath, who supply the special mains transformer, can also supply a complete resistor and condenser kit, also the valves. Messrs. Osmor Radio Products, Ltd., can also supply kits. Their address is 418, Brighton Road, Croydon, Surrey.
- 4.—Total cost of the recorder should be about £40, including the deck.
- 5.—Readers should design and make their own cabinet, but a model suitable for modification might be obtained from Premier Radio, 207, Edgware Road, London, W.2.
- 6.—We regret that in the components list one of the 25 μF electrolytics has become changed over with one of the .25 μF paper, but the main circuit diagram is correct.
- 7.—The value of C1 in Fig. 1 should be .25 μF. This is not in the components list, and in addition seven more .05 μF condensers should be included. C1 is a 0.25 μF paper condenser and the 150 v. condensers are C1, C18 and C35.
- 8.—R49 is not given in the circuit, but will be mentioned later in the series.

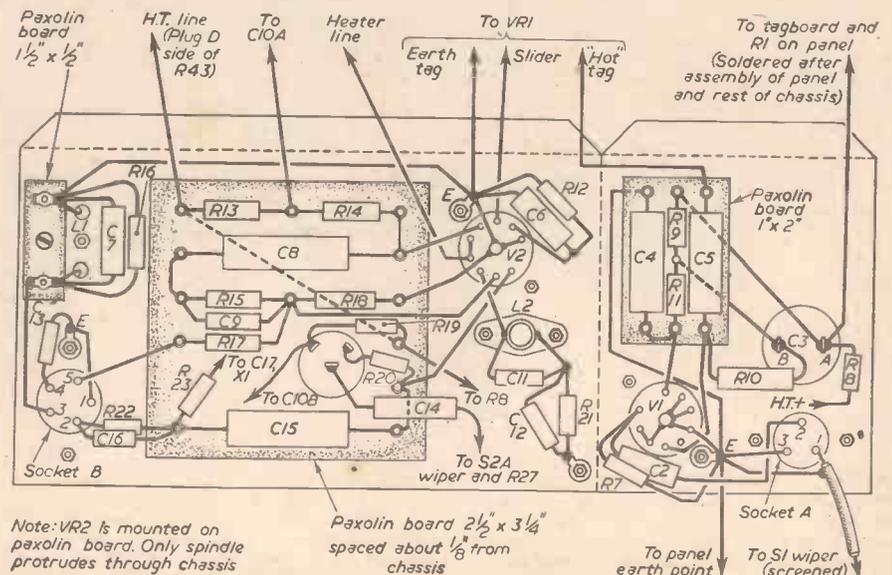


Fig. 19.—Wiring details of the pre-amplifier.

SPACE RAIDERS



Some Amazing Disappearances Discussed in the Light of Modern Knowledge of U.F.O.s By "Theorist"

An Artist's impression of the Mary Celeste mystery as explained by the author.

IN January, 1957, at a Press conference in Washington, Rear-Admiral Delmar Farney, former head of the U.S. Navy's guided missiles programme, declared quite emphatically that unidentified objects were frequenting the earth's atmosphere. He said that there were signs that these objects or machines were under intelligent control. He was also sure that no agency either in the U.S.A. or in the U.S.S.R. could be capable of duplicating the speeds and accelerations which radar and observers indicated these flying objects as being able to achieve.

Evidence which supports the Admiral in each and every particular has accumulated enormously recently and one is led inevitably into speculation about these remarkable phenomena. In the past there have been some amazing happenings which indicate that reasoning beings of extra-terrestrial origin may well visit our planet from time to time. The present intention, however, is to touch on deeper issues involving these strange visitors. These concern the sudden and very mysterious vanishings of men and machines; vanishings which to this day are totally unexplainable in terms of the hazards and dangers inherent in our earthbound wanderings. An analysis is attempted only in the final episode related, for those which precede it appear to speak for themselves in no uncertain manner. The questions asked are: "were these people kidnapped?" If so, were they carried off by beings from another planet?

discover the missing plane and succour the two airmen.

Eventually the plane was found in a typical desert zone and the eager rescuers made haste towards it. They were mystified by what they discovered on arrival. Careful examination of the aircraft revealed that mechanically it was intact and flyable. The two officers were not to be found from that day to this. What the searchers did find apart from the machine, however, was visible evidence which has continued to intrigue the imagination ever since. They discovered that two distinct sets of footprints—side by side—were impressed in the sand from the aircraft to a point some fifty yards away from it. Beyond this point the footprints ceased abruptly, the ground from then on presenting a smooth and quite undisturbed sandy surface. No second sets of steps were found leading back to the plane.

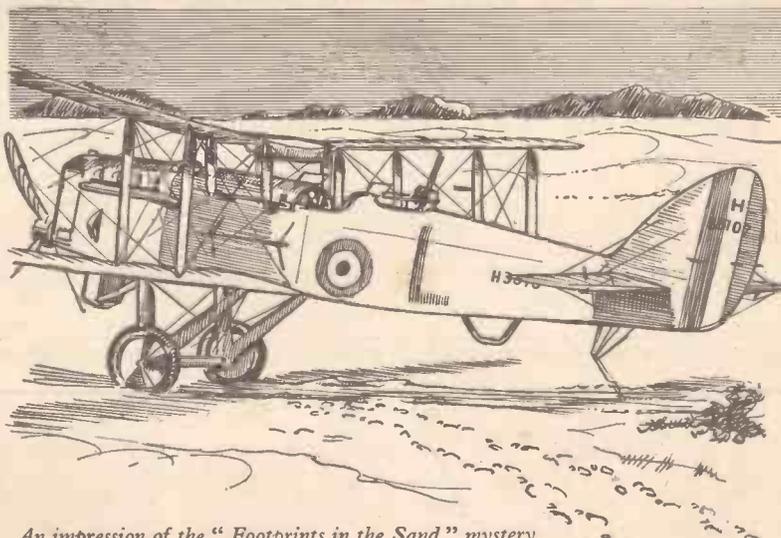
A Mass Disappearance

On December 5th, 1945, five Avenger

Fort Lauderdale and informed them that he thought he was off course. He sounded anxious. Thereafter, further messages from the flight came in at irregular intervals, each growing more worried in tone and more certain that the compasses on all five aircraft were not functioning normally. An approximation of their position was ultimately received from the flight some two hours after take-off. They thought they were a little more than 200 miles north-east of the home base. Immediately a Martin Mariner manned by a crew of twelve or thirteen took off in an attempt to intercept the Avenger flight and guide it home. No further contact could be made with the five Avengers, and when shortly after take-off the huge rescue plane was called for a position check—it, too, failed to respond. All six planes offered a curtain of silence and disappeared utterly and completely from the eyes of man.

A Jet Aircraft Kidnapped

Late one afternoon in March, 1955, U.S. Air Force pilot Eugene Metcalfe was flying over Illinois. The sky was very clear and he had no difficulty in defining a jet aircraft which was approaching him on a parallel course. Suddenly, he was amazed to see a huge saucer-form machine loom up behind the oncoming plane. A large aperture was visible in the rim of the saucer-form and the ill-fated jet and its crew were instantly engulfed by the intruder. The giant access door closed and the huge machine zoomed out of sight at a fantastic speed. No trace of the jet plane has ever been found. This laconic report by an experienced flyer and the ultimate statement that a jet plane had failed to return to base, must surely be accepted as proof that indeed strange things do happen in our atmosphere; and that amongst those strange phenomena we must admit the presence of extra-terrestrial machines manned by sentient beings.



An impression of the "Footprints in the Sand" mystery.

Footprints in the Sand

On a day in 1924, two experienced flyers, Flight Lieutenant W. T. Day and Pilot Officer D. R. Stewart, took off in a biplane from a base in desert monopolised Iraq, presumably on routine patrol. Some hours later anxiety was expressed back at the base, for the plane had failed to return. If the flyers had been forced down in a desolate region by engine failure, their plight could quickly become serious, especially if one or both happened to be injured in landing. A search party was organised at once to

bombers of the U.S. Air Force took off from their base at Fort Lauderdale in Florida. They were on a practice flight. It was a routine operation which would entail them covering a distance of scarcely more than 400 miles before landing back at their departure base. Just over an hour after take-off, the leader of the flight (each Avenger carries a crew of three) contacted

Visitors from Space

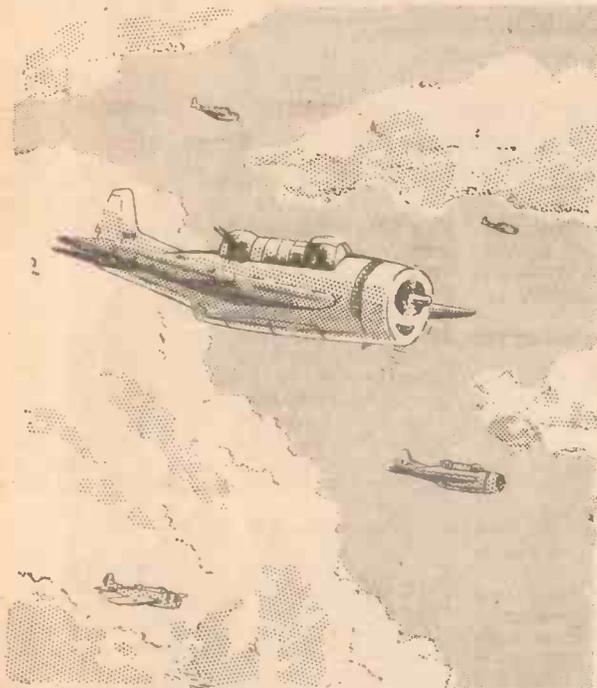
Whether one accepts or refuses the past statements that beings from other planets have been interviewed by people on earth, the possibility of such a meeting cannot be logically ruled out if it is agreed that extra-

terrestrial machines frequent our atmosphere. An interesting point which emerges from these alleged meetings is the repetition of a confession by the strangers that they indulge in a certain amount of scientific collecting. This practice when applied to human beings is, of course, nothing less than kidnapping.

One more case involving the complete disappearance of human beings is cited below and a reasoned explanation attempted.

The Mary Celeste

On December 5th, 1872, the barque *Dei*



These aircraft are Avenger bombers of the type which featured in "Mass Disappearance."

Gratia was situated in the Atlantic about 300 miles from Gibraltar, her destination. In fair weather at mid-afternoon her crew sighted a brig or brigantine with her sails partially set. With only a light breeze blowing, this circumstance was rather odd and, added to this, the ship was swinging about as though not under proper control. Becoming curious, the Captain of the *Dei Gratia* brought his ship closer, and it was then seen that in fact no one was at the helm of the strange ship. Realising that something was definitely amiss, a boat was lowered from the *Dei Gratia* and the Captain and three of his crew set off to investigate the mystery. Coming alongside the vessel they saw that she was a brigantine named the *Mary Celeste* (not *Marie Celeste* as is usually and wrongly quoted). They boarded her.

Everything on deck appeared to be in order, except that the ship's boats were missing. Going below, the investigators searched the ship from stem to stern without discovering anybody aboard her. That there had been people present quite recently, was confirmed in various ways. On a table in the captain's cabin a meal was set. Two or three cups of tea had scarcely been touched and a boiled egg with the top removed stood in an egg-cup. There was also a watch hanging on a hook—it was still ticking. The stove in the galley was still warm although it had been cleaned out, and in the forecabin, seamen's clothes and personal belongings were quite undisturbed. The only occupant of the ship the investigators found was a cat which was asleep and apparently in good condition. Every-

thing pointed to a sudden desertion of the ship, but there was no sign of violence. Apart from the absence of the ship's boats, the only other inanimate thing which was missing was significantly enough the ship's chronometer. The *Mary Celeste* herself was in good shape and showed no signs of having encountered heavy seas. Strange marks, however, were discovered on the bows a foot or so above the waterline. They were long, narrow grooves as though gouged by a pair of enormous pincers in attempting to seize the ship at the forward end.

It was eventually established that the *Mary Celeste* sailed from New York with Captain Briggs in command. He was a man of unquestioned integrity. Accompanying him were his wife, his small daughter and a crew of seven. It also came to light that the ship sailed with but one of its usual two boats, the other having been damaged beyond repair whilst the ship was lying at anchor in New York harbour.

Various Explanations

Many ingenious explanations have been put forward over the years in attempting to solve the mystery of the *Mary Celeste*, but each one appears to fall down on some vital point. The dominating factors are the absence of disorder on board the ship and the complete disappearance of the ship's boat. The warm stove strongly indicates that at least one person had only recently left the ship. As it was a perfectly clear day and almost calm, with the ship making only modest headway; it would seem unlikely that a heavily loaded boat could have gone unobserved by the *Dei Gratia* or other craft in the area. Piracy must be ruled out as obviously the greatest material prize was the *Mary Celeste* and her cargo, both of which were left intact. Besides, it is unlikely that the ship could have been boarded without some skirmish taking place, with resulting disorder above deck. Nothing of this sort was found.

That the desertion of the ship was a purely voluntary action is equally untenable as an explanation. If one can imagine the Captain and the rest of the ship's complement leaving the ship in one small boat, on some trivial pretext, then why should the chronometer have been taken? The missing chronometer indicates that the abandonment was intended to be permanent.

It has been suggested that homicidal madness roamed the decks of the *Mary Celeste*. This is inconceivable, however, when we ask how a person so afflicted could, without hindrance, despatch all his victims and leave no single clue of violence?

Even if this unlikely massacre did occur, then how did he dispose of his victims? If he disposed of them in the sea, how was it that no trace of them could be found—not even a trace of clothing? Further, if the deranged person thereafter left in the ship's boat, it is not very likely in his state of mind that he would remember the chronometer. If he suffered remorse and jumped overboard, he would neither require the ship's boat nor the chronometer in his act of self destruction.

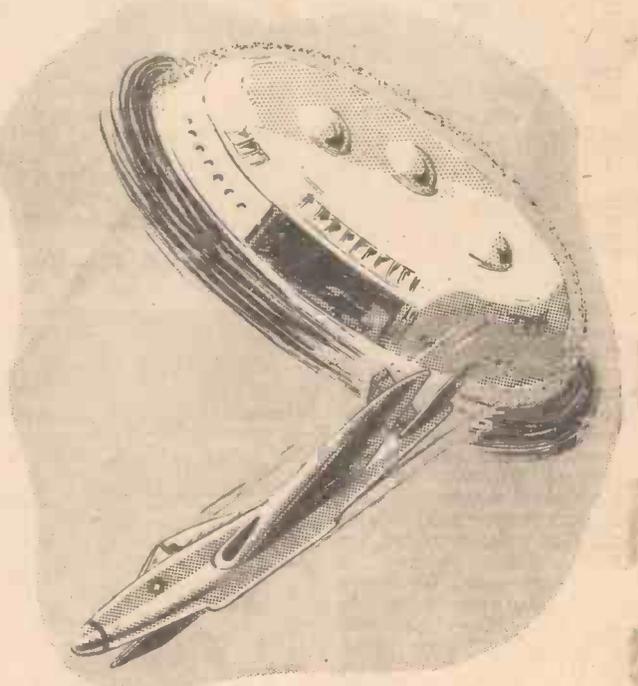
Mutiny Eliminated

Mutiny is not reconcilable with the casual and peaceful atmosphere which apparently prevailed aboard the *Mary Celeste* immediately prior to the desertion. If the Captain and his family succumbed to the treachery of mutineers, there appears to be no reason why the latter should not have sailed away their ill-gotten prize.

Any theory which purports to explain the mystery of the derelict and which infers the liaison of Captain Briggs with members of any other ship, is fundamentally weak. For apart from the high reputation of the Captain, he also possessed a substantial share in his ship's cargo.

A Marine Monster

Another suggestion is that the ship was attacked by a marine monster, which at first seized hold of the bows of the *Mary Celeste* thereby creating the strange grooves previously mentioned. Being unable to draw the ship down, the creature suddenly transferred its attentions to the persons aboard and annihilated them as they appeared on



The kidnapping of an American jet aircraft.

deck. For the argument to be initially tenable it would seem that a certain amount of superstructural damage to the ship could be expected. Evidence of such damage was not present, however. The *coup de grace* for this idea of a sea monster is easily discerned in the absence of the ship's boat. In such circumstances there would be very little future in launching the boat—it would be jumping out of the frying-pan into the fire.

An Aerial Raider

Many of the difficulties encountered in
(Concluded on page 133)

When you use a Screw! use a Rawlplug too!

With Rawlplugs you get a stronghold for every size of screw in any masonry—brick, concrete, stone, slate, tile, etc., etc. It is so simple to drill the hole with the appropriate Rawltool or Metalide drill, insert the Rawlplug and drive home the screw, that you will soon become an enthusiastic Rawlplug user—and all your fixtures will be safe. You can start with the simple POPULAR OUTFIT which costs only 3s. 0d. and when you become proficient the larger outfits are available for your skill.



HANDY BOXES

Handy shilling boxes of Rawlplugs. Assorted sizes of Nos. 8, 10, 12 and 14 are packed for easy storage and selection.

50 RAWLPLUGS FOR 2/3

This divided window box holds 50 Rawlplugs assorted over Nos. 8, 10 and 12 gauges in three different lengths of each size. Incorporated in the lid of the box is a useful gauge to help you to select the right size screw for the Rawlplug.



for masonry drilling the easy way

Here is a cheap reliable masonry drill for the household handyman. Four sizes are made for use in a hand brace or suitable electric drill. Just what you need for that occasional domestic fixing job.

| | | | |
|---|---|---|---|
| No. 8 (3/16") Green Wallet 5/6 | No. 10 (7/32") Blue Wallet 6/- | No. 12 (1/4") Brown Wallet 6/6 | No. 14 (9/32") Grey Wallet 7/- |
|---|---|---|---|

Each Metalide drill is packed with an instruction leaflet in a strong plastic wallet with transparent window.

The most efficient, precision made, long lasting masonry drill is the Rawlplug DURIMUM (with the free re-sharpening service). We strongly advise this drill for continuous drilling (such as industrial operation) 17 Sizes from No. 6 (3/8") to No. 30 (1") and a long series for drilling right through walls. Prices are from 9/6 each. For drilling glass use the special DURIMUM GLASS DRILL. Made in nine sizes from 1/8" to 1/2" at 6/6 to 10/6 each. Free Re-sharpening Voucher with each drill.

1/- & 1/6

1/-

1/-

10 1/2

All Purpose Adhesive. Clear. Waterproof. Heat-proof. Insulating. Handy tube 1/-, Large tubes 1/6d. DUROFIX is undoubtedly the finest value for money today. It has such a wide range of applications from simple woodwork repairs to fine china, porcelain and glassware that no home should be without a tube. Commercial tubes 5/-; 1-lb. tins 2/9; 1-lb. tins 10/6.

Real Wood in Putty Form. In dexterous fingers surprising things can be done with Rawlplug PLASTIC WOOD. Models can be made and coloured, intricate mouldings rebuilt, splits in wood made good and, what is more it will stick firmly to any non greasy surface—metal, glass, vulcanite, plastic, earthenware, etc. Can be cut, planed and sanded to glass smooth finish. Colours:—Natural, Oak, Mahogany, Walnut. 1-lb. tins 2/3; 1-lb. tins 3/9; 1-lb. tins 6/6.

Animal glue of tremendous strength. This popular ready to use DUROGLUE is the handyman's friend. It can be used for that immediate need and replaced in the toolbox for another day. It is strong, reliable and for woodwork an ever ready aid to fixing and repairs. It is also suitable for many other materials but not for those washed in hot water. 1-lb. tins 2/6; 1-lb. tins 4/8.

For quick easy repairs to Metalware. This scientific preparation in paste form can be applied in a few seconds and dries in a few minutes. Metal utensils in the house, garage or garden can be put into good condition again by the intelligent use of Rawlplug PLASTIC METAL without heat or soldering iron. Not suitable for wireless or electrical connections.

Rawlplug
**DO-IT-YOURSELF
OUTFIT**

12/6

*The handiest
of handy
outfits for
the handyman*

Here is the latest innovation from the Rawlplug Company. Seven popular Rawlplug products packed into one attractively printed box.

One handy box of No. 8 assorted Rawlplugs. One No. 8 Metalide Masonry drill in plastic container. One 1/6 tube Durofix. One tube Natural Plastic Wood. One tube Duroglue. One card Fuse Wire. Six No. 316 Rawlnuts (for making vibration-proof fixings to thin and hollow materials). One 64-page Rawlplug instructional handbook.

This assortment of Rawlplug products will find many uses in the home. Selling at 12/6 it makes an ideal present for the wife to buy for her husband or the handyman to buy for himself.

Rawlplug Do-it-Yourself Outfits are now in the shops. Why not call in to your local Rawlplug dealer and ask to see one now?



1/9

Non Slump Sealing Compound. For keeping water out of wood and glass joints; packing metal pipe joints, for sealing together articles subjected to vibration and excesses of heat and cold, etc., this Rawlplug DUROLASTIC has everything. It sticks; it sets into a rubbery compound that will not crumble, crack or decay, it can be painted. For outdoor jobs it is incomparable.

3 Steps to

Success!

FACE THE FACTS . . .

Ask yourself these questions: Could I be making fuller use of my abilities? Holding down a better job? Earning better money? If the answers are 'yes', then face the position squarely. And do something about it—before it's too late!

MAKE YOUR DECISION

Once you are *determined* to succeed—and have decided to take action—nothing can stop you. But you need guidance. With the help of I.C.S. training you can reach the top faster and stay there longer.

TRAIN WITH I.C.S.

I.C.S. tuition is expert yet simple to follow, covers hundreds of Courses yet is completely individual. You work at home, as a 'class of one', in your own spare-time. And you set your own pace. This is the way I.C.S. have coached many hundreds of thousands to success. They can do the same for YOU!

The many subjects which I.C.S. teach are listed on the right. Complete the coupon below and post it off to us today. In return, we will send you a FREE BOOK with full details — without obligation.

FILL IN THIS COUPON TODAY

INTERNATIONAL CORRESPONDENCE SCHOOLS
(Dept. 169G), Intertext House, Parkgate Road, London, S.W.11.

Please send me FREE BOOK on

NAME..... AGE.....
(Block letters please)

ADDRESS.....

OCCUPATION 12.59...

Examination Students are coached until successful.

ADVERTISING & SALESMANSHIP

General Advertising, Copywriting, Radio & T.V. Advertising, Commercial Travelling, Sales Management, Retail Selling, EXAMS. Joint Inter., A.A. & I.P.A. Finals, I.S.M.A., U.C.T.A.

ARCHITECTURE & BUILDING

Architectural Design, Clerk of Works, Bldg. Construction, Bricklaying, Trade Courses, EXAMS. R.I.C.S., I.Q.S., L.I.O.B., Inst. Clk. of Wks.

ART

Art Training (basic), Commercial Illustrating, Oils & Water-Colours, Figure Drawing, Lettering,

COMMERCIAL TRAINING

Bookkeeping, Costing & Accountancy, Office Training, Secretaryship, Shorthand & Typewriting, EXAMS. I.C.W.A., C.I.S., C.C.S., A.C.C.S., Inst. Bkkeepers.

CIVIL ENGINEERING

Highway Engineering, Structural Engineering, Reinforced Concrete Eng., Town & Country Planning, EXAMS. I.C.E., I.Struct.E.

DRAUGHTSMANSHIP (State Branch)

Drawing Office Practice, Mechanical Drawing, Structrl. & Architectrl. Drwgng., Maths & Machine Drawing.

ELECTRONIC ENGINEERING

Electronic Computers, Electronic Equipment, Computers & Industrial T.V.

FARMING & HORTICULTURE

Arable & Livestock, Pig & Poultry Keeping, Farm Machinery (Maintenance), Smallholding, Flower & Vegetable Growing, Complete Gardening, EXAM. R.H.S. General.

FIRE ENGINEERING

EXAMS. Inst. of Fire Engrs., Fire Service Promotion.

GENERAL EDUCATION

Languages, Good English, EXAMS. G.C.E. subjects at Ordinary or Advanced Level, E.J.B.C.P.

MANAGEMENT

Industrial Management, Business Management, Office Management, Personnel Management, Hotel Management, Work Study, Foremanship, Storekeeping, EXAMS. Brit. Inst. of Mangmt. Inter., Final & Cert. in Foremanship.

MECHANICAL ENGINEERING

Wide range of subjects incl. :- Workshop Practice, Diesel Engines, Refrigeration & Welding, Engineering Maths., Production Engineering, EXAMS. I.Mech.E., Soc. of Engrs., Cert. in Foremanship, C. & G. Cert. in Machine Shop Engineering.

MOTOR ENGINEERING

Motor Mechanics, Running & Maintenance, Road Diesels, Owner Drivers,

PHOTOGRAPHY

The Amateur Photographer, EXAM. P.D.A.

RADIO, T.V. & ELECTRICAL

Radio Engineering, Radio Servicing, T.V. Servicing & Eng. Practical Radio (with kits), Electricity Supply, Electricians, EXAMS. Brit.I.R.E., Soc. of Engrs., C. & G. Certs. for Telecom. Technicians, Radio Amateurs, Radio Servicing (RTEB), Elec. Engrg. Practice, Electrical Installations.

WRITING FOR PROFIT

Short Story Writing, Free Lance Journalism,

AND MANY OTHER SUBJECTS

incl:
Police Entrance
Industrial Instrumentation
Petroleum Production
Dressmaking

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

ICS

the world's largest correspondence school | over 6 million students

(Continued from page 130)

trying to provide a rational explanation of this great sea mystery are overcome if an aerial raider is postulated. If such a raider did appear it must have been of extra-terrestrial origin, as the year was 1872. No aircraft built on earth ranged over the vast Atlantic at that time. The sequence of reasoning in such a theory is simple but convincing as it adequately covers the suggestion of complete surprise, alarm, and almost instant desertion of the ship. Let us reconstruct the drama in terms of this theory.

The Threat of Curiosity

It is daytime and the Captain and his wife and child are in his cabin. A light meal has been prepared. In the galley the cook has sometime previously prepared and served the main meal of the day and is just now tidying up the galley, having cleared the stove out in preparation for the efficient re-laying of the fire for the next day's operations. The rest of the crew members are about their duties above deck. The setting is peaceful, and no threat to the tranquillity of routine tasks exists—at least those ten souls riding the lonely ocean are utterly unaware of any such threat.

Suddenly, commotion breaks out on deck. A seaman comes scrambling down the rigging from his task of correcting some fault of the ship's sails. With terrified gestures he draws the attention of his colleagues to a disc or sphere, which hovers a few hundred feet above but slightly to one side of the *Mary Celeste*. The water directly beneath the disc is extremely turbulent. The strange machine is about 40ft. in diameter, and an eerie blue light shimmers over its surface as it turns in the afternoon sunlight, with an insatiable curiosity peering through its numerous portholes. Almost as weird and demoralising is the loud humming sound which the

machine emits—similar to the drone of some mighty organ.

In a few moments all aboard are present, gazing with acute apprehension at the strange entity. Captain Briggs, accustomed though he is to handling sudden emergencies, is on this occasion disconcerted and inwardly alarmed. The object is neither bird nor beast. It is obviously threatening them, as it refuses to leave the vicinity of the ship. Perhaps this terrific form will bring about the destruction of the ship. These thoughts flash through the mind of Captain Briggs as he tries vainly to reassure his wife and child.

Now the disc is moving in closer to the ship and the rest of the crew have become panic-stricken. This panic is understandable as none of these seamen had ever witnessed any form of aerial machine. Hastily the ship's boat is manned. The Captain's wife implores her husband to abandon ship, and he, excusably under the circumstances, agrees to accompany them. If the ship is to be inevitably destroyed, then it is obviously his duty to try and defend his family and crew. There is little time to collect anything, but the Captain even in this apparently dire situation, manages to secure the chronometer before joining them in the boat.

The Ship is Lost

Slowly they draw away from the *Mary Celeste*, as the cause of their departure hovers menacingly around the ship. Precious minutes slip by, then, to the immense relief of all in the boat, the disc starts to ascend. Higher and higher it rises until it vanishes into the blue of the stratosphere. Immediately Captain Briggs orders the boat to be put about and returned to the ship. Soon it is apparent, however, that their chance of regaining the brigantine is remote. She has sailed out of range of the heavily loaded boat.

Into Space

We could leave the theory at this point, but the non-discovery of the ship's company, boat or even oars, suggests a startling climax.

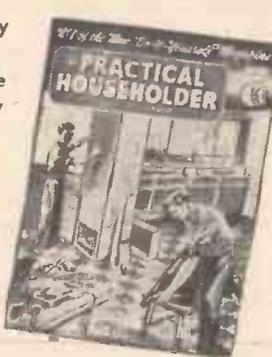
If the disc was a scoutship, it would certainly report the presence of living beings to its parent ship. As it was an oceanic setting where the incident occurred, the circumstances would allow the parent ship to descend and gather the boat and its occupants. An attempt may have been made to capture the *Mary Celeste*, as indicated by the strange marks on the bows of the ship. Either the intruders decided that she was too large to collect as a specimen of earthly conveyance; or they were interrupted in their task. A quick warning from a scoutship of the approach of other surface vessels, would be sufficient to send the vast parent spaceship into the rarified air of the upper atmosphere . . . and beyond.

Summing Up

An argument which may be advanced against this aerial raider theory is that other ships have been known to vanish completely along with their personnel. In some instances no trace of humanity or wreckage has been found. Why not attribute the same fate to the *Mary Celeste*?

The argument is sound, provided we admit a storm or similar phenomenon of sufficient intensity to act as the annihilating agent. However, once more the good condition of the brigantine contradicts the probability of such a happening. One just cannot imagine all members of the ship voluntarily leaving in the boat, to row themselves into extinction. In the absence of an aerial raider, and in the fair conditions prevailing over the area at the critical time; no matter why they left the ship, the boat and its occupants had a certain chance of surviving and being discovered at an early date. Instead, they utterly vanished, leaving the *Mary Celeste* to go sailing into history as the most remarkable derelict of all time.

The National Do-It-Yourself Magazine
PRACTICAL HOUSEHOLDER
 January Issue on Sale Shortly 1/6



Principal Contents
 Thermal Insulation Means Comfort and Economy
 Stool Styled for Comfort
 Make Your Own Windows
 Mr. America Builds His House
 Beginner's Guide to Woodwork
 Tea Trolley Trike
 Home Heating by Oil
 Dressing Table for a Spare Corner
 Making a Nursery Cupboard
 A Sectional Fitted Wardrobe
 Review of Modern Floor Coverings
 Roofs for Outhouses and Sheds
 Keep Electrical Appliances Safe
 How to Build Storage Space into a W.a.
 A Record Cabinet, Etc. Etc.

PUZZLE CORNER

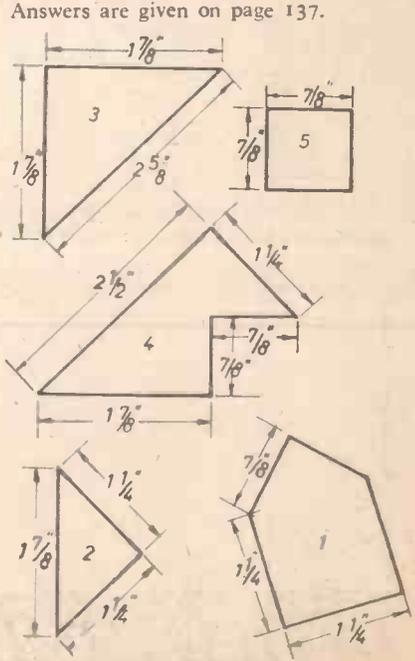
1.—Water, Water Everywhere! submitted by D. Ewins.
 A SHIP-WRECKED dinghy has enough water to last 13 days if each man has 1 quart per day. After 5 days a certain amount is spilt and on the same day a man dies. If the water lasts out as long as had been first expected how much was spilt?

2.—Beat the Clock.
 A MAN'S watch loses 10 secs. per day and his clock gains 10 secs. per day. If he synchronizes them on June 1st at noon, when will they next show the same time?

3.—Sum-it Meeting.
 OUT of 6 Americans and 7 Russians, 3 of each were to be chosen to attend a conference. One American fell ill, however. By what proportion was the number of combinations for the meeting reduced?

A PUZZLE YOU CAN MAKE
 4.—"The 5 Piece Square," submitted by Ian Still.
 A TWO-AND-THREE-QUARTER inch square has to be completed, using all the 5 pieces shown on the right. If you want to try it yourself, draw the pieces shown in Fig. 1 on to thin card. When you have solved it you can make a stronger job to try out on your friends by using plywood

or plastic. Cut out accurately from a 2 3/4 in. square with a fret saw leaving sharp edges and corners. Clean up with fine glasspaper. To prevent anyone tracing out the lines of the grain in the wood and solving the puzzle easily, cover with two coats of thin lacquer paint of a suitable colour.



Pieces and dimensions.

Answers are given on page 137.

Letters to the Editor

The Editor Does Not Necessarily Agree with the Views of his Correspondents

A LUTON MINOR TESTIMONIAL

SIR,—I have been most interested in the series of articles about the construction of the Phoenix Luton Minor Aircraft, which you are printing in your most excellent journal.

Since I have recently had the opportunity to fly a home-made Minor which the owner wished to sell, I thought that perhaps the impressions of a colleague and myself might be of interest to your readers.

It was with some trepidation that we set out to try the Minor, which we rather expected to be disappointing and probably under-powered with its two-cylinder J.A.P. engine. However, we were most agreeably surprised to find that it is so easy and simple to fly and that the engine is more than adequate.

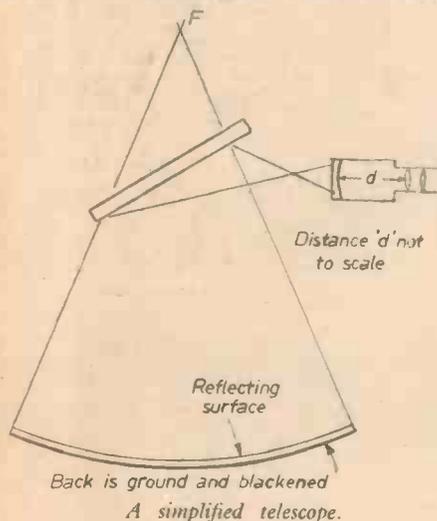
In the Minor you feel that the aeroplane

is part of you, and its quick, light controls make it a delight to fly. My first landing was far from perfect, but I found that the undercarriage was very forgiving and I did not bounce at all. I then found that by looking over the side I could easily see the wheel and judge my height to the inch, and several perfect landings seemed almost too simple to be true.

After less than half an hour each in the Minor, both my colleague and I had completely fallen for it, and our opinions were confirmed when we watched a Phoenix pilot put the Minor through its paces. Its turning circle beats anything that I have seen fly, and its manoeuvrability in the hands of an expert is quite amazing. I am in no way connected with Phoenix Aircraft Ltd.—
FRAZER MUSGROVE (Welwyn).

TWO SIMPLE TELESCOPES

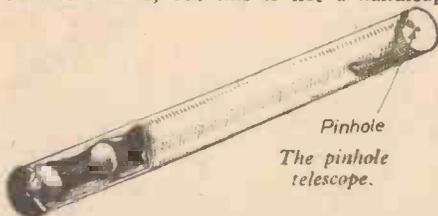
SIR,—I read your recent articles on building a reflecting telescope and found them very interesting. However, I cannot, at the moment, afford to make



such an instrument; but I have made a simplified telescope which some readers may find interesting.

The mirror is made from the glass face of a broken alarm clock. I noticed that this had a focal length of 5 in., but as there were two images—one from the back and one from the front of the glass, I roughened the back (to make it ground-glass) with emery

cloth then painted this side with black printers' ink and then oil paint. The image, of course, is not as bright as a silvered mirror, but this is not a



when the moon and the brighter planets are observed.

When the focal length is increased by using a concave lens, as in the Barlow lens, it is possible to achieve a magnification of up to 100x.

If the glass is toughened-glass then it is liable to break easily once the surface has been roughened, and a wooden shape should be cut to support it. As the edge of the glass in most clocks is a slightly different shape to the rest—although this is rarely more than $\frac{1}{16}$ in.—a piece of black card may be cut to the shape of the edge and stuck on.

Another simple telescope, which is ideal for observing the sun, is a pinhole telescope. After all, we have pinhole cameras so why not pinhole telescopes, too? The focal length of the pinhole will be exactly its distance from the eyepiece assembly. The pinhole can be made with a No. 10 sewing needle into a piece of tinfoil stuck to thin cardboard.—JAMES SAUNDERS (Cardiff).

CAN MAN DEFINE NOTHING?

SIR,—Referring to the human ability to understand nothing (A. M. Coppins' letter in the September issue), it seems to me that the root of the matter lies in our conceptions of substantiality and ultimate causes.

The whole of man's understanding is absolutely derived from the world of physical things and, briefly speaking, any entity not physical cannot be accepted by our senses and is so barred from the mental picture of the outside world. In trying to understand such entities as God, resource must be had to physical comparisons to give the conception of God any meaning, therefore

man's most noble attributes are used to describe God.

In the case of the "nothing" of empty space we can only recognise this as a substance-lacking void, any figure it may have being of a nature we are physically unable to prove.

This brings us to query the reality of matter itself. Whereas we can understand substance as being composed of molecules, atoms and ultimately of energy, we cannot ascribe any physical character to energy to enable us to understand it because it is the basis of all matter. It is therefore an

(Continued at top of col. 3)

unknowable entity, and yet we understand it well and accept it as a commonplace thing purely by its interactions.

Briefly speaking then, we may say that anything which cannot be described by, or compared with, anything physical must be for ever beyond our understanding although we may quite comfortably accept its existence.

In this way the ultimate creation of energy must be a thing we can never understand and only when this established energy begins to form into electrons, protons, neutrons, etc., and these into atoms, can we begin to build a mental picture.

We can therefore only comprehend "nothing" as being the absence of anything physical.—R. B. TAYLOR (Kent).

Temperature Indicating Paints

SIR,—I should like to enlarge the answer given to J. G. Huggins in the September "Your Queries Answered," regarding the tempering of tools.

Paints have been developed in Germany which change colour when a critical temperature is reached. When they are cold they are painted or sprayed on to the metal. They contain temperature sensitive pigments and accuracy to within plus or minus 9°F is claimed, thus avoiding the necessity for a continuous watch on thermometers. They can also be used in crayon form to give a quick check on an already hot surface.—
F. W. WOODWARD (Wallasey).

Clock Designer and Builder

SIR,—You may be interested to hear details of two clocks which I have designed and built at home. The mechanism of one of these, a chiming clock, is shown below. When the clock needs re-winding the clock face door swings open and remains open for $3\frac{1}{4}$ minutes and then closes. During the late afternoon and evening the face and figures are automatically lit while striking. The clock strikes from 10 a.m. to 9.30 p.m. It was built in 1922.

My other timepiece is a calendar clock and was built in 1939. This indicates the time, the date, month and year and reminds the user of Leap year and when the clock needs winding. Both of the clocks were built from scrap materials and both have been running now for many years.—
GEORGE WHITTLE (Penally).



Mr. Whittle's chiming clock.

READERS'

SALES AND WANTS

The pre-paid charge for small advertisements is 6d. per word, with box number 1/6 extra (minimum order 6/-). Advertisements, together with remittance, should be sent to the Advertisement Director, PRACTICAL MECHANICS, Tower House, Southampton Street, London, W.C.2, for insertion in the next available issue.

PERSONAL

ENGINEERS DRAWING and Design Service. Grad. L.E.D. Lowest terms. Box No. 11.

FOR SALE

HOUSE SERVICE METERS, credit and prepayment; available from stock. Universal Electrical, 221, City Road, London, E.C.1.

PULLEY CLUTCHES

Suitable for small power drives, lathes, etc. 3 1/2 in. Crowned pulley for flat belt, easily adapted to mount extra Vee pulleys. Perio line. Originally sold at 65/- for high speed textile machines. Will last lifetime. Not second-hand; all unused. Complete with drawing and text showing how to adapt. 22.6 post free.

E. S. ALEXANDER & CO., 14, CATEATON ST., MANCHESTER, 3.

ASTRO TELESCOPE MAKING. Standard Ramsden Push-in Eyepieces, 4in., 4in. 3/4in., focus. 35/-; s.a.e. list. Object Glasses from 10/6; Eyepieces from 15/6. Newtonian Mirrors, Diagonal Mounts, Focusing Mounts, Tripods, Terrestrial Telescopes and Microscopes, W. Burnet, Grand Sluice, Boston, Lincs.

FLEXIBLE SHAFTS, Grinding Wheels, Ceramic Insulators. Govt. surplus: s.a.e. for list. S. Midgley, Hedden Road, Haworth, Keighley.

TELESCOPES, Eyepieces, Finders, Mounts, etc. S.A.E. for list. Woodthorpe Instruments, 12, Revesby Road, Woodthorpe, Nottingham.

AIR COMPRESSORS, single cylinder, two stage, 21/2 cu. ft. min. at up to 450 p.s.i.; suitable for spraying, etc.; condition as new but slightly store soiled: cost over £10; bargain at 35/- each. Air Lines, 40ft., new. 30/- Cooper, 10, Fowler Street, Nechells, Birmingham, 8.

GOVERNMENT SURPLUS AND MANUFACTURERS CLEARANCE

VACUUM PUMPS, EDWARDS TYPE 4, As New, £4-10-0 ea.
BALL RACES, 1" x 1" bore, 1" x 3/16" bore, 1" x 1" bore, 1 1/8" ea., 1" x 1" bore, 2/- ea., 2 1/2" x 1" bore, 3/6 ea.
HYDROMETERS, Acid, 3/- ea.
MIN. MOTORS, 4 1/2 v. reversible totally enclosed, 5/- ea.
NIFE CELLS, 1.2 Tramp, 3 1/4" x 2 1/2" x 1 unused, 5/- ea., 48/- doz.
PRISMS, Magnifying 1-3/16 in. sq., 2/6, on adj. frame, 2 filters, 5/- ea.
MORSE KEYS, Small, 2/- Medium, 3/-, Larger, 3/6, Large Cov., 10/-
KEY SWITCHES, P.C.O., 2/6 ea.
GERM. DIODES, 1/- ea., 10/- doz.
OCTOPUS Ball Race Removers, £8.
VAR. SLIDERS, 10 ohm, 30w. for chargers, train controls, etc., 3/- ea.
MICROPHONES, Carbon, 5/6, Insets, 2/6, Tannoy, 7/-, Throat, 4/6, Buttons, 2/-, Trans., 4/6, Acos Cry, 3/1, 2/6.
TOGGLE SWITCHES, 1/-, PANEL FUSE HOLDERS, 1/6, 12-WAY CONN. BLOCKS, 1/6, INDOOR AERIAL WIRE, 1/6 100 ft., 3.5 BULBS, 2/6 doz. METERS, 50-0-50 Microamp, 3 1/2" dia., 37/6 ea. Dual range 0-5 v, 0-100 v FSD 1 m.a., 20/- ea., 50-0-50 Micro, 30/-, FERRITE ROD AERIALS, Med. and Long Wave, 10/- ea., Ferrite Rod only, 2/6.
I.T.A. AERIALS, New, 3 element 22/6; 5 element, 27/6. Co-ax cable 6d. per yd.; air spaced, 9d. per yd.
HEADPHONES, Moving iron, low impedance, 6/-; high, 9/-; balanced armature, low, 10/-; high, 15/-; moving coil, low only, 12/- per pair.
SWITCH SOCKET & PLUG, 5 amp, 3 pin, metal case, 5/- ea., 12-24 V.D.C. MOTORS GEARED Small and powerful, 4-8 r.p.m., 25/- ea. Works from mains with suitable transformer and rectifier, i.e., 12 v., 116/-; 24 v., 30/- extra.
MICROSWITCHES, 2/- ea., 20/- per doz.
RUBBER TORCHES, Ex-Cinemas, less batteries, 3/6 ea.
A.C. AERO SPARK PLUGS, 18 mm. New, 2/- ea., 20/- doz.
110 v. A.C. MOTORS, 1/8 h.p., £2.0-0.
BLOWERS, MOTORIZED, 3 phase, 440 v., 1 h.p., £7.10-0 ea. Cost about £40.
PRESSURE GAUGES, 250 p.s.i., 12/6 ea., 18" EX. FANS, flameproof, 230 v., 1 phase, £10.
1 1/2 in. HERBERT DIE HEAD, £7.10-0.
12-WAY P.V.C. Cable, Screened and P.V.C. Covered, 2/6 yd.

HUGGETT'S LIMITED
 2/4, PAWSON'S ROAD, WEST CROYDON, SURREY.

FOR SALE (Continued)

COMPRESSORS FOR SALE.—Twin Piston with tank, 2 1/4 c.f.p.m., £4. Single Cyl., £2. All types Motors, S.A.E. for list. Dept. P.M.9, Wheelhouse, 13, Bell Road, Hounslow, (HOU 3501.)

APPARATUS AND CHEMICALS.—A gigantic price reductions. Save pounds! Special offers; catalogue free Scientific and Technical Supplies (Notm.), Ltd., 286, Alfred St., Central Nottingham.

BAKELITE CABINET
 BRAND NEW
 Ideal for small receivers, converters, etc. Colour brown, attractive design. 12in. x 7in. x 5 1/2in. P. & P. 3/3. 5/9
P. & P. COMPONENTS LTD., 219, ILFORD LANE, ILFORD, ESSEX. Phone 1 L.F. 0295.



CHEAP GOVERNMENT SURPLUS. Sale of 300 tons Mechanical, Electrical Tools, Instruments, Optical, Nuts, Bolts, Screws, Washers, etc. Free list 4,000 items, 100 useful mixed lots. K. R. Whiston (Dept. M.P.S.), New Mills, Stockport.

MUFFLE/CRUCIBLE FURNACES Chamber, 7in. x 4in. x 3in., hardening stress relief etc., 200/250v., 1k.W., 37/6. "Paytox", 57, New Road, Rubery, Birmingham.

BRAND NEW HYPODERMIC SYRINGES 5/1
 WITH 2 SPARE NEEDLES
 excellent for precision oiling, etc.
 SIMA Serum Glass 2 c.c. Wonderful value. Each 5/1. Per doz. 54/-
 SIMA Needles. Stainless Steel. Sizes 12, 17 or 18. Per doz. 4/-
 All Orders Post Free.



G. ROGER SMITH
 (Dept. 7), Syringe Supplies,
 38, OLD FARM RD., LIVERPOOL, 23

4 1/2 in. Planing and Rebating Machines, 30in. overall, adjustable cut, heavy ballraces, £6/10/- Also 5in., 6in. and 8in. Planers at low prices. Combined 5in. Planer and 8in. Circular Saw (a really useful machine), £10/5/-. Heavy duty combination Woodworking Lathes from £10/15/- Build your own Circular Saw cheaply; Circular Saw Spindles from 45/- Full range for saws up to 30in. diameter. All machines fully guaranteed. Send 6d. for full lists and save pounds. Orton Lathes, Falcon Works, Costessey, Norwich, Dept. P.M.

NEW 3JET GAS BLOWPIPE
 3 Flames on one spot—intense heat. Melts 12 s.w.g. copper rod. Ideal for Brazing, Lead-burning, Soldering, Glass-blowing, etc. Will weld small aluminium parts (instructions supplied). Self-blowing—works off domestic gas supply.
 A must for your workshop Price 5/11 Post 6d.
 Copy of "Secrets of Soldering and Aluminium" included. Easy Brazing Rod, Flux, 1/3. Aluminium Welding Rod & Flux, 1/6.
P. WREN Mfr. Co., Wollastan, Wellingborough.



PATENTS
PATENTING SERVICES. Advice. Qualified agent. C. L. Browne, 114, Greenhayes Ave., Banstead, Surrey.

WOODWORKING

WOODWORKING MACHINES. All cast-iron constructed. Complete Saw Benches, 7in., £4/15/-; 8in., £5/10/-; 10in., complete motorised, £30. Planers, 5in., £12; Bowl Turning Heads, £4; with 8in. Saw Tables, £7/10/-. Lathes, £7/10/-; Combination Lathes, £10/10/-. Motors, Pulleys, Belts, etc., 12 months' written and money refunded guarantee. 4d. stamp for illustrated booklet. James Inns (Engineers), Marshall St., Nottingham.

SAWBENCHES, 8in. to 30in. from £9; Motorised, £13; Petrol Portable, £44. Planers, Bandsaws, Lathes, Saw Spindle and Planer Assemblies, Logging and Firewood Machines, Chain Saws, Engines, Motors; deferred terms. Send 1/9 for handbook, catalogue and bargain offers. List free. Beverley Products, South Thoresby, 47, Alford, Lincs.

TOOLS

PORTABLE POWER TOOLS, new, used, bought, sold, exchanged, terms. Arthur Drysdale & Co. Ltd., 58, Commerce Road, Wood Green, London, N.22. (Bowes Park 7221.)

TOOL BARGAINS
 Please send sixpence in stamps for up-to-date price list of High Class Tools, and details of "Agency" terms.
 American Pattern Adjustable iron jack planes, 4in. x 2in., best Sheffield Irons. 22.6 post paid.
ROSS & ALEXANDER (LONDON) LTD.
 165-167 BISHOPSGATE, LONDON, E.C.2



GENUINE DISPOSAL.—Black and Decker D 500 Drill plus 10 attachments; everything new; full maker's guarantee; bargain, £7 lot. Details from Box 9.

HOBBIES

CATALOGUE NO. 14 Government Surplus and Model Radio Control, over 500 illustrated items. 2/- (refunded on purchase). P/P 6d. Arthur Sallis Radio Control Ltd., 93(B), North Road, Brighton.

CIRCULAR GLASS DISCS, 6in. x 1in., with abrasives, 6in. pitch, etc., £2/15/-, cash refund guarantee. H. Gibbs, 75, Portmanmoor Rd., Cardiff, S. Wales.

SEREN ASTRONOMICAL SUPPLIES
 Warehouse Road, Stebbing, Dmumov, Essex.
EQUIPMENT FOR ASTRONOMERS
 Mirrors, eyepieces, focusing mounts, spiders, etc. Do-It-Yourself kits. S.A.E. for free details.

NEWTONIAN TELESCOPE MAKING
 6in. Mirror Blank and Tool (cut plate glass as cut), 35/- per pair. Grinding, Polishing Kit (powder, pitch, rouge), 27/6 per kit. Rectangular Aluminium Optical Flats for 6in., 15/- each. All post free. S.A.E. for lists. L/J. Mays & Co., 20, Clover Road, Timperley, Altrincham, Cheshire.

GILMOUR-VALE GAS TORCHES
 For town and Calor Gas. Self blowing, 19/6, 25/6 & 31/6 each. GAS SOLDERING IRON, 11/9 each. All Soldering & Brazing Materials supplied. Full details, price list and 10-page instruction book. 3d. stamp.
G. M. VALE & CO., 55, Park Road, Wellingborough, Northants.



HANDICRAFTS

MARQUETRY VENEERS, 12 assorted veneers 5/- post free; send 3d. for list. Frank Coles (Veneers), 76, Rivington Street, E.C.2.

NEW MUSICAL BOX KITS

FROM 19/9 COMPLETE. Movements only from 11/9. Please send 3d. stamp, or call for new FREE illustrated brochure. Trade supplied.
SWISSCROSS LTD. (Dept. V), 202, Tulse Hill, London, S.W.2.

JEWELLERY

JEWELLERY, simply made. Brooches, Earclips, Pendants. Free catalogue. Also Marcasites, Webbs Handicrafts, 46, Burnway, Hornchurch, Essex.

SILVER WIRE, 99.9% pure, 20 s.w.g., suitable for making real silver jewellery, 5/- yd. minimum, 1/6 per foot over. Post paid. R. G. McClelland, 1, Beulah Road, Epping, Essex.

FIBREGLASS

PLASTIC UNITS

Experimental Glass Fibre Unit, 14/9. Plastic Metal for Gear Casting, Plastic Dies, etc., 14/3. Porcelain-hard Cold Setting Finish for food preparation surfaces, baths, washing machines, etc., 16/9 pt. in white, cream, black, sky blue, red, clear and aluminium. S.A.E. for information list, price list, etc. **SILVER DEE PLASTICS** (Dept. 3), Hartington, Staveley, Chesterfield, Derbyshire.

WATCHMAKERS

WATCH REPAIR SERVICE, unrivalled for reliability and speed, coupled with reasonable charges. Part jobs welcomed. Material supplied. Hereford Watch Co., 13, St. Owen Street, Hereford.

WATCH PARTS

For all makes of watches, tools, instructional books, etc. Special Kits for beginners. Send 6d. for "Super Bargain Catalogue." T. G. LOADER (Dept. B), Watchmakers Mail Order Service, Milestone Road, Carterton, Oxford.

LEARN to be a Watch and Clock Repairer in your spare time and earn extra money at home. We can supply everything you need at unbeatable prices, including instructional books. Swiss watchmakers' tools, watches, watch and clock movements, lathes, cleaning machines, all spare parts for watches and clocks, etc. We also have a fine selection of musical box movements and kits. Send 9d. P.O. for bumper bargain catalogue. The Watchmakers Supply Company (Dept. P.M.), Carterton, Oxford.

PHOTOGRAPHY

2IN. X 2IN. Projector and Enlarger Castings, Bellows, etc. S.A.E. for details. V. J. Cottle, 84a, Chaplin Road, Easton, Bristol, 5.

BELLOWS, Camera, Enlarger. Process. Industrial Collapsible Machine Guards. Beers, 4, St. Cuthbert's Road, Derby. (Tel. 41263.)

FOREIGN STAMPS

STAMP COLLECTIONS Valued and Purchased at highest prices. Send to John Lister Limited, 186, Shaftesbury Avenue, London, W.C.2.

MAGIC

BE A HOUDINI! "Escapology Secrets" revealed, price 6/-. Handcuffs, Leg-irons, Shackles, all kinds for sale. (Lists 6d. deducted.) Deville, 12, Carlton Avenue, Romiley, Stockport.

Continued overleaf

ELECTRICAL

ALL TYPES OF ELECTRICAL GOODS at extremely competitive prices, e.g., 5 amp. Twin Cable, 35/- 100 yards; Lampholders, 7/- doz.; 5ft. Batten, 49/-; quality and immediate despatch guaranteed. Request list. Jaylow Supplies, 93, Fairholt Road, London, N.16. (Telephone: Stamford Hill 4384.)

CHEMISTRY We supply apparatus and chemicals for the young scientist. Lists—Send 4d. stamps.

BIOLOGY We have a student's microscope at £5 10s. Leaflet—3d. stamp.

RADIO & ELECTRONICS Transistors are fascinating to work with. Loudspeaker radios need small batteries only. Learn how! Notes on transistors—8d. stamps.

MORGO EXPERIMENTAL SUPPLIES 8 and 10 Granville Street, Sheffield 2 Tel.: 27461

FLUORESCENT LIGHTING FITTINGS for workshop and home. Complete range from 5ft. to 18in. (also circulars) at lowest prices anywhere. S.A.E. for illustrated leaflets and list of Control Gear Kits, callers welcome. We are fluorescent Lighting Specialists: E. Brill, Dept. C, 125A, Northcote Rd., London, S.W.11. (Battersea 8960.)

SELF STARTING Synchronous Motors, 200/250 volts, 50 cycles. Complete with detachable geared mechanisms, 10/- each. James S. Graham & Co., 64, King Charles Road, Surbiton, Surrey.

BRAND NEW BROOK ELECTRIC MOTORS
Single Phase, 1 h.p. 1,500 r.p.m. £7.10.0
h.p. 1,500 r.p.m. £9.12.6
H.P. TERMS h.p. 3,000 r.p.m. £9.12.6
AVAILABLE. h.p. 1,500 r.p.m. £11.0.0
h.p. 3,000 r.p.m. £11.0.0
Fully guaranteed by makers, approval against cash. Carriage paid mainland. State voltage.

P. BLOOD & CO. ARCH STREET, RUGELEY, STAFFS.

MODELS

WORKING MODEL, 2-masted Cornish Fishing Luggers, 20in. x 5in., 65/-, post free. Leaflet 3d. stamp. Vintage Models, Mevagissey, Cornwall.

HOME BOAT BUILDING

EASY TO FOLLOW KITS to build a Boat at home—for Cabin Cruisers, Runabouts, Canoes, Prams, Dinghies and Enterprise Sailing Dinghies. Brochure from: Wyvern Boats (Wessex) Ltd., Milborne Port, Sherborne.

EDUCATIONAL

★ LEARN ★
RADIO & T/V SERVICING

for your **OWN BUSINESS/HOBBY**

by a new exciting no-maths-system, using practical equipment, recently introduced to this country.

FREE Brochure from:—

RADIOSTRUCTOR

DEPT. G80, 46, MARKET PLACE, READING, BERKS, 12.59.

MATHEMATICS. Physics. Electronics, courses for G.C.E., etc.; Grammar School education not required; from 5/- weekly. Write: Senior Tutor, Tutorials, 200, Buchanan Street, Glasgow.

SITUATIONS VACANT

A.M.I.Mech.E., A.M.Brit.I.R.E., City and Guilds, G.C.E., etc. bring high pay and security. "No pass—no fee" terms. Over 95% successes. For details of exams and courses in all branches of Engineering, Building, Electronics, etc., write for 148-page handbook—free. B.I.E.T. (Dept. 9678), London, W.8.

MISCELLANEOUS

AQUALUNG and Compressor Equipment. Ballraces and Miscellaneous Items. Lists 3d. Pryce, 157, Maiden Road, Cheam.

"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.

PHOTOELECTRIC Parking Light Switch will switch your lights on at dusk, off at dawn, automatically, while you are at work, in bed, or away from home. Controlled by light. Transistorised. Negligible consumption (.008amp.). Protect your car at night, avoid accidents, fines; save your battery. Kit of parts 52/6; built and tested 57/6, instructions only 1/- Pat. applied for. "St. John's Radio," 158, St. John's Hill, S.W.11. (BAT 9838.)

"ARCMOBILE" ARC WELDING SETS



ARCMOBILE U
£17 10 0
Including delivery.

A complete self-contained Arc Welder using standard flux-coated electrodes of 14g. and 16g. 210/250 V. A.C. Mains consumption 13 Amps. Welds sheet metal down to 22g. and steel and iron section up to 3/16in. thick in a single run. Heavier sections can be welded by multiple runs (building up). Infinitely variable welding current by hand-wheel. Maximum welding current 86 Amps. Minimum 15 Amps. Weight 85 lbs. Dimensions: 11in. high, 12in. wide 13in. long.

HARMSWORTH, TOWNLEY & CO.
JORDAN STREET, KNOTT MILL MANCHESTER, 15

ROGERS 31/33 NELSON ST. SOUTHPORT
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 ... 6/4
Rectifiers, 8/12v. at 6 amps. ... 1/-
Air Jacks, 5in. stroke ... 17/6
Winker Units, 6 or 12 volt ... 6/6
Mains Transformers, 18v. 6 amp. 35/-
Garnet Cloth, 4in. wide, Per yd. ... 9d.
Motorised Water Pumps ... 7/-
Circular Saws, 6in. 11/6; 7in. 13/8, etc.
Instrument Cases, 12in. x 8in. x 6in. New ... 7/3
Plugs & Sockets, 7 point ... 2/-
Telephones, New, Modern ... 18/-
Bevel Gears, 3in. & 2in. Pair 4/6
Races, Belts, Valves, Pulleys, Pumps, Brass, Steel, Aluminium, etc.
May we send our free list of hundreds of interesting items? Stamp, please.

BUILD YOUR OWN CANOE
Printed illustrated instructions 1/6
TYNE FOLDING BOATS LTD.
206 Amyand Park Road, St. Margaret's, Twickenham, Middx.

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. 130, 28-31, Wright's Lane, London, W.8.

The School of Careers

Chrome-Vanadium Spanner Sets
Branded line by reputable German maker in top-quality S/V Steel with polished heads and accurate jaws—FULLY GUARANTEED.

- SET 1
O.E. Whit. 6 spanners.
1-1. 20 - plus 1/6 p.p.
 - SET 2
RING Whit. 5 spanners.
1-1. 30/- plus 1/6 p.p.
 - SET 3
Short O.E. Whit. 5 spanners.
1-1. 16/- plus 1/6 p.p.
 - SET 4
Short RING Whit. 3 spanners.
1-1. 9/3 plus 1/- p.p.
- Sets available in S.A.E. plus 1/- per set, same p.p.

These spanner sets are outstanding value at unparellel prices. Order NOW, send P.O. to—
TOOLS & TACKLE POSTAL SUPPLIES
(Dept. P.M.), 4, Frenob Row, St. Albans

PLAY THE PIANO

REED ORGAN or ACCORDION in 3 months

New Home method. Definitely the easiest and quickest. Even if you have never played a note, you will be able to read music at a glance.



Write today without obligation for **FREE LESSON** state instrument

KLAVARSKRIBO INSTITUTE (BZ.7), 67 HIGHBURY NEW PARK, LONDON, N.5

GOVERNMENT SURPLUS BARGAINS

MULTI-PURPOSE MOTORS. Low voltage, with gearbox, 24 v. D.C. but good at 12 v. or lower. Two shafts, 1 and 16 R.P.M. at 12 v., 6 and 24 R.P.M. at 24 v. Operate 3 sets of cams and also plunger giving powerful lateral thrust. Takes under 1 amp. Wonderfully versatile motor. Each 95/-, post 2/-.

LOW VOLTAGE MOTORS. 6/12 v. Each 7/6, post 1/6.

BATTERY CHARGING TRANSFORMERS, 11 v. and 17 v. A.C. (for 6 and 12 v. Charging at 11 amp.) Each 17/8, post 1/6.

RECTIFIERS to suit above. Each 7/6, post 1/- (These transformers and rectifiers will run above motors.)

TELEPHONE HANDSETS (two in series with battery make intercom.) Each 17/6, post 1/6.

MAINS VOLTMETERS. 0-300 v. A.C. Each 25/-, post 2/-.

TRIPODS, 38in. long. Very rigid (not telescopic). Easily adapt to camera etc. Each 12/6, post 2/6.

MOTORS. 200/250 v. A.C. D.C. F.H.P. approx. 80 watts. High Speed, 1in. shaft. (Converted ex R.A.F. motor generator—power about equal to sewing machine motor.) Useful addition to workshop. Each 30/-, post 2/6.

Send 3d. stamp for list of other motors, transformers, pumps, lamps, switches, etc.
MILLIGANS
2, Harford Street, Liverpool. 3. Money Back Guarantee.

The perfect present for that boy—

SCOUT ANNUAL

Edited by REX HAZLEWOOD

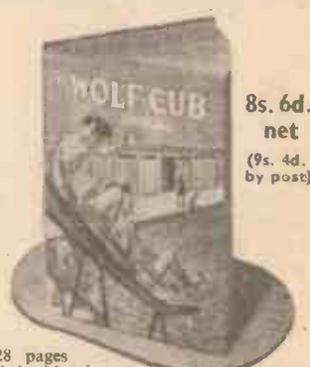


12s. 6d. net
(13s. 8d. by post)

224 pages of text with sections of quizzes, facts, cartoons and adventure. Approximately 200 illustrations in line plus 16 pages of attractive photographs and a three-colour jacket.

and for the younger one—

WOLF CUB ANNUAL



8s. 6d. net
(9s. 4d. by post)

128 pages filled with adventure stories about Cubs, with jokes, puzzles, hints and tips for Cub tests. This well established Annual contains many cartoons and illustrations throughout and has a bright, two-colour jacket.

FROM ALL BOOKSELLERS . . . or in case of difficulty write to the publishers, C. Arthur Pearson, Ltd., Tower House, Southampton Street, London, W.C.2.

PEARSON

BE AN ASTRONOMER

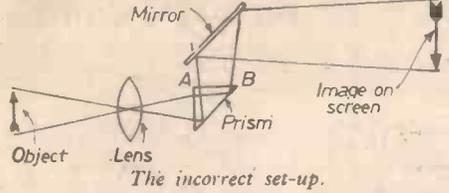
THIS UNIQUE PROFESSIONAL EQUIPMENT FROM 5/- WEEKLY

Moon at close range, Saturn's rings, Sputniks . . . the universe! 2in. to 4in. dia. Precision Telescopes from 99/6. Refracting and Reflecting. Mag. 53x. to 240x. Tripods, Standard Eyepieces, Moon Maps, Planispheres, Star Charts, etc. Stamp for particulars and lists.

J.K.M. Holmes & Co. Ltd., (Dept. P52) (Scientific Instrument Makers), Martins Bank Chambers, North Shields.

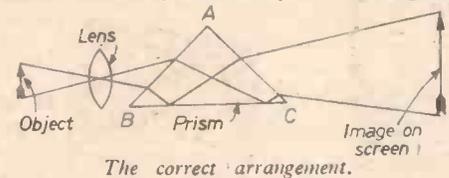
EPISCOPE PRINCIPLES

SIR,—Re the query on the episcopo principle in the "Your Queries Answered" section of the October issue of PRACTICAL MECHANICS the arrangement shown in the diagram would not produce an erect image.



As shown above, the image would be inverted by the lens then the rays would be only slightly refracted by the prism, causing the angle of divergence to be decreased: then, at the sloping face of the prism, they would be totally internally reflected exactly as though a mirror were used. Finally, at the face AB the rays would be refracted outwards slightly, thus increasing the angle of divergence to the same angle as that before the light entered the prism, thus a mirror could be substituted making no difference in the result. As you have correctly stated this will not effect a vertical reversal of the image. The correct set-up is shown by my diagram below.

As can be seen, only one prism is required. At the face AB the rays of light are refracted slightly downwards. They strike the face BC at an angle greater than the critical angle, are totally internally reflected to the face AC, where they are once again

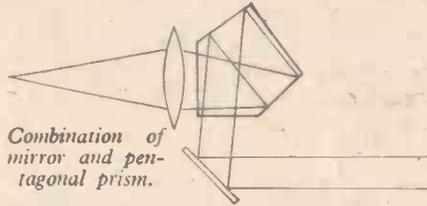


refracted to travel along their original course but having been vertically reversed in the process, thus giving an erect image. This image is, however, still laterally inverted,

i.e., the left-hand side of the object appears at the right-hand side of the screen and vice versa, thus, if this is undesirable, a second prism may be inserted but turned through 90 deg. so that it will reverse the image laterally instead of vertically.

Another method would be to simply use another lens to reverse the image produced by the first lens.—ROY MCALLISTER (Bury St. Edmunds).

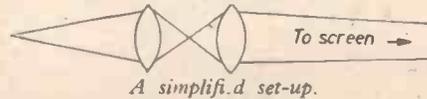
SIR,—Re your reply to F. Miller, "Episcopo Principles," the diagram is wrong in one important particular—the right-angled prism as illustrated would act as a mirror giving total internal reflection on the hypotenuse surface with no displacement of image by the right-angled surfaces. The tracing of the rays as given follows no known laws of optics.



Your correspondent can get what he wants by a combination of mirror and pentagon prism in both the vertical and horizontal directions, but this would be very complicated and quite expensive.

A much simpler method is to have two lenses, the front one focusing on the aerial image of the rear. This front lens reverses laterally and vertically in one optical operation. Again, owing to the size of lenses and the corrections needed in each the price would be high.

I think F. Miller would be well advised to be satisfied with his reversed image.—H. F. STENSON (Birmingham, 20).

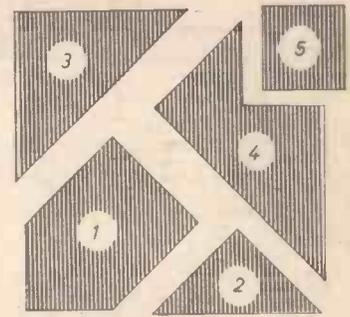


WARNING TO HOME JEWELLERY MAKERS

SIR,—Concerning the home jewellery-making article in your October issue, readers should note that if they sell any of the pieces they make, they may be liable to be registered with H.M. Customs and Excise and to pay purchase tax. The usual £500 per annum exemption limit does not apply to certain classes of goods, of which jewellery is one. Anyone who contemplates selling home-made jewellery would be well advised to consult his local Officer of Customs and Excise first.—PRESS AND INFORMATION OFFICER (H.M. Customs and Excise).

ANSWERS TO PUZZLE CORNER

1. Two gallons, i.e., the dead man's ration for the remaining eight days.
2. They are 8 mins. farther apart every day.
- ∴ After 90 days they are 12 hours apart, i.e., they read the same time. So that occurs on August 30th of the same year.
3. Total ways initially = 2,800.
Total ways finally = 1,400.
- ∴ The number was reduced by 50 per cent.
4. The five pieces fit together as shown below.



PERSONAL TRANSPORT OF THE FUTURE

SIR,—Will the roads of the future be in the air? In my opinion they will not, at least not in the foreseeable future. However, they should be and will be ultimately.

I base this opinion on the "negative thinking" of the powers-that-be to road problems.

It was patently clear to all after the war that chaos would result and the opportunity existed then to encourage private flying, yet the policy was to discourage it as much as possible.

As an ex-wartime and peacetime pilot I have a certain amount of sympathy and understanding of the potential dangers to airline planes if even one per cent. of private motorists were to take to the air as a serious means of transport and not just as a sport, but at the same time I do believe that the problems and dangers could be overcome by suitable design of the machine and stringent regulations.

As regard suitability of design I believe that there is already in existence a machine ideally suited to the purpose, it is, I believe, of American origin and the principle roughly is as follows:

It is circular in shape and may be considered as an ordinary aerofoil section wing bent to form a circle—leading edge cut like a doughnut.

An ordinary engine-powered air blower sucks air over the aerofoil section to provide the main lift aided by jet action of expelled air downward giving vertical lift. At suitable

altitude, forward thrust from a small propeller air jet gives forward propulsion when the machine flies upon the more usual aerodynamic principle.

Such a machine has, therefore, every desirable feature. Vertical take-off, forward and backward flight, and none of the dangers of the helicopter design, i.e., rotating wing.

In the absence of a true weightless or gravitation resisting machine, the above mentioned would appear to be the most practical proposition which could be manufactured in numbers to sell at certainly no more and possibly less than the average family motor-car.

I believe that the realisation of popular air transport leading to the end of the big road chaos lies upon the authorities giving "blessing" to the scheme. At the moment the exact opposite is the case, and until there is a reversal of this attitude my answer to the leading question is a definite No.—P. HANCOCK (Middlesex).

A Hydrometer

SIR,—In your September issue you were advising a correspondent on how to make an alcohol test for home-made wine. I have an instrument for this purpose which works satisfactorily, which I purchased from Messrs. Loftus, of Tottenham Court Road, London, price 7s. 6d. This instrument is made entirely of glass and is, therefore, easily kept clean. An advantage over the one which you suggested is that no distillation is needed.—J. H. PENZER (Stourbridge).

Use Your Camera for Enlarging

(Continued from page 118)

of the carrier, and each has an aperture cut centrally and about 1/4 in. larger all round than the negative size (Fig. 5). Two pieces of wood, about 7/32 in. thick X 1/2 in. wide and 6 in. long, act as spacers and are glued between the pieces of ply. The precise thickness of the spacers will, of course, depend upon the glass used. The entire wooden part of the carrier is screwed to the track with No. 4 X 1 1/2 in. long countersunk head wood screws, after being packed up in the same way as the lamphouse. The glass section of the carrier should be able to slide freely in the slot without excessive sideplay.

A sleeve of black cloth is attached around the edges of the negative carrier, using upholsterers' tacks, and the other end is fitted with an elastic band so that it grips the camera body firmly. If the camera back does not come off completely it can generally be swung well clear.

The enlarger is now ready for use, and detailed instructions on the actual technique can be obtained from any of a wide range of standard textbooks. In the present case the enlarging paper is pinned or taped to a vertically positioned board or a wall and the size of the image adjusted by moving the entire enlarger nearer to or further away from the paper. Sharp focus is obtained by sliding the camera carriage along the track.

TRADE NOTES

A REVIEW OF NEW TOOLS, EQUIPMENT, ETC.

Combined Arc Welding and Brazing Set

MARKETED by Taylor Bros. (Yorkshire) Ltd., 32, Baker Street, Middlesbrough, the F.M. 65 combined arc welding and brazing set is the smallest model of a range of industrial welding equipment made by Ferrous Transformers, Ltd. Designed for industrial use, the machine is more robust than the usual amateur equipment and is capable of undertaking a wide range of welding brazing and silver soldering work. It will give a full output of 65 amps. from a 15 amp. domestic power point and using one all-purpose 14 s.w.g. electrode ensures that welding becomes a simple operation under conditions not usually



The combined arc welding and brazing set in use.

D.I.Y. Printed Circuits

THE production of a kit by Messrs. Proops Bros. Ltd., 52, Tottenham Court Road, London, W.1, has now made it possible for amateur radio and television enthusiasts to make their own printed circuitry. The kit, which costs 19s. 6d., or 21s. by post from Proops Bros., contains everything necessary, including three sheets of laminate, four bottles of chemicals, i.e. etchant, resist, solvent and cleanser. The case which contains the kit is used as the etching bath, the lid forms a working drip tray and the final items included are a brush, a suction cup handling tool and a set of instructions. This latter, in addition to giving comprehensive step-by-step instructions, includes sections on circuit design. Apart from its obvious utilitarian advantages this kit should provide the enthusiast with a fascinating extension to his normal range of interests.

Plaster Hardener

MESSRS. VINATEX LTD., Devonshire Road, Carshalton, Surrey, have just developed a new product, namely Vinatex Plaster Hardener SP10, which is ideally suited for hardening plaster. It also increases its break and bending strength, reduces the porosity of the plaster, enabling painting to be done almost immediately and reduces surface defects, such as small air holes. The price is 25s. per half gallon can, or 35s. for one gallon.

Tile Saw

DAFILES LTD. are now marketing a blade which will profile-cut glazed ceramic wall tiles up to $\frac{1}{4}$ in. thick.



The tile saw in action.

This blade, known as the New Formula "Tilefile," fits any standard roin, hacksaw frame and, as with all Dafile products, has teeth all round, thus enabling any shape to be cut.

The tiles to be cut can be marked out, using a china-clay pencil, and the line followed with the "Tilefile" blade.

Broken tiles are very rare with careful use of the "Tilefile," thus its cost (3s. 10d. retail, including frame adaptors) is very promptly compensated.

Change of Address

MESSRS. LIGHT SOLDERING DEVELOPMENTS LTD. have now moved to 28, Sydenham Road, Croydon, Surrey. The existing telephone number remains the same.

New Wolf Accessories

TWO new accessories are now available for use with Wolf power units, they are a speed reducer unit, known as the "Lo-Speed" and an orbital sander, the "Supersander," shown in the photograph.

The speed reducer unit is easily attached and incorporates two trains of spur gears to give a ratio of 4:1 and speeds between 600 r.p.m. and 350 r.p.m. according to the power unit used. It costs 42s. 6d.

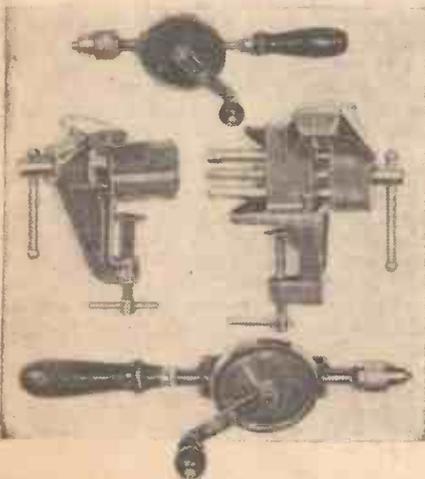
The orbital sander can be fitted with new sander sheets very easily by placing them against a hexagon roller and tightening a screw. To eliminate vibration, the drive is transmitted through a vulcanised rubber disc which forms a cushion between the working head and power unit. Price is £5 17s. 6d., including six sanding sheets and a sponge rubber pad. A range of accessories is available as extras.



The "Supersander".

Fabrex Tool Range

THE tools shown in the photograph below are the first of a new range to be marketed by Fabrex Tools Ltd., a new



The Fabrex tool range.

company formed by the makers of "Record" tools, C. & J. Hampton Ltd. The smaller drill, priced at 14s. 6d., takes up to $\frac{1}{4}$ in. drills and the larger double pinion model up to $\frac{5}{16}$ in. drills. The price of the latter is 23s. 6d. The table vices have jaws of $2\frac{1}{2}$ in. and 3 in. and are priced at 13s. 6d. and 24s. 6d. respectively.

Bridges 6in. Super Saw Kit

TO introduce their new 6in. Super Saw Kit, Bridges are offering the kit at £19 2s. 3d. This represents a price saving of £1 if the contents, listed below, were purchased individually.

A $\frac{5}{16}$ in. MK IV "Neonic" safety drill.

A NuRip portable saw with 6in. Nu-Rip saw blade.

A Multi-Purpose saw table.

A 6in. Combination saw blade.

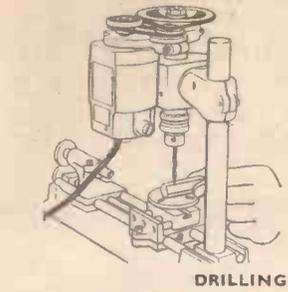
A booklet "Let's Get Started."

Powered by the latest Bridges "Neonic" drill, this new kit has been designed to cover every sawing operation likely to be needed by the home workshop enthusiast—it also has much to offer the industrial user with a small joinery shop. Each item in the kit is already well established in the Bridges range.

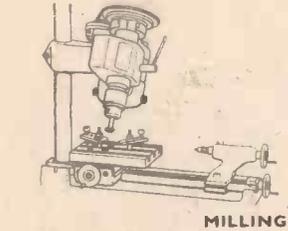
UNIMAT

THE MOST COMPLETE 10 IN 1

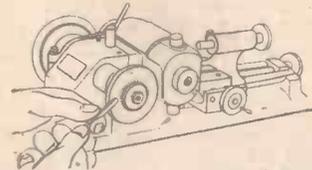
MINIATURE WORKSHOP



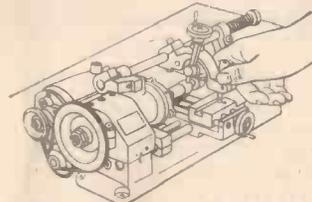
DRILLING



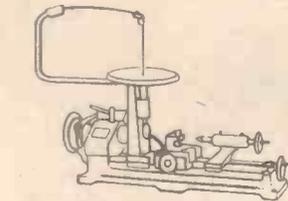
MILLING



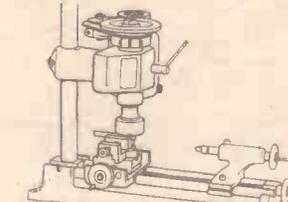
POLISHING and GRINDING



THREADING ATTACHMENT



JIG-SAW ATTACHMENT



TOOL and SURFACE GRINDING

With UNIMAT you can easily build—Locos, cars, structures and scenery all with one machine tool! You can quickly turn drive wheel tyres, electric loco disc wheels, axles with outside journals, bushings, unmachined wheels, or even build centrifugal clutches! You can also cut spur gears, grind valve gears, drill holes and cylinders. You can mill steam loco main from axle slots and gear holes, construct all kinds of scenery and structures. PORTABLE AND COMPACT: UNIMAT is a precision tool that quickly converts into 10 machines performing all operations on just one base! Takes up less space than a typewriter and operates on ordinary 230-250 A.C./D.C. current. UNIMAT is simple to operate—the easy-to-follow instruction manual tells you how.

Yours for 27/- down

& 8 monthly payments
of £3.11.9

CASH PRICE £26.17.6

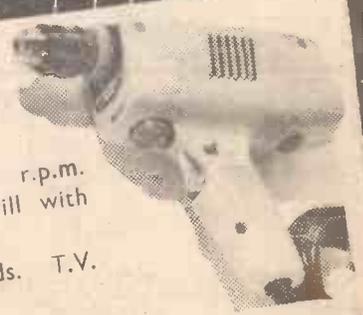
Selectamatic

4500-TWO SPEED DRILL

3/8in. Capacity
Speeds 2,500 & 4,500 r.p.m.
The ONLY 2-speed drill with
POWER TO SPARE.
Correct cutting speeds. T.V.
and Radio suppressed.

YOURS for 11/- DOWN
AND 8 MONTHLY PAYMENTS OF 29/4

CASH PRICE £10.19.6



POST THIS COUPON TO-DAY

Please send me details of Unimat
 -Selectamatic

NAME.....

ADDRESS.....

SELECTA POWER TOOLS LTD.
Hampton Road West, Hanworth, Feltham, Middx
A Member of the ELLIOTT GROUP P.M.

HIGHSTONE UTILITIES

SIGHTING TELESCOPES AND RANGE-FINDERS. Many types in stock from 17 6. post 3/-. Please state requirements.

SOLDERING IRONS. Our new streamlined iron is fitted with a Pencil Bit, 200/250 v. 50 watts, 11/6. post 1/-. Standard iron with adjustable bit, 200/250 v. 60 watts, 13 6. post 1/-. Heavy Duty Iron, 150 watts, 19/6. post 1/6. All parts replaceable and fully guaranteed.

Small Soldering Irons, for use on gas, 1/4. post 8d. Resin-cored solder for easy soldering. 6d. buckets or large reels 5/-, post 9d.

S.R.A.F. 2-valve (2 volt ill.) MICROPHONE AMPLIFIERS as used in plane intercom. In self-contained metal case; can be used to make up a deaf-aid outfit, intercommunication system, or with crystal set; complete with valves and fitting instructions, 20/-, post 2/-. Useful wooden box to hold amplifier, 2/- extra.

AMPLIFIERS, less valves, but containing resistances, condensers, transformers, switches, etc., 10/-, post 3/-.
SPARKING PLUG NEON TESTERS. with vestpocket clip, 3/3. and with gauge, 3 6. post 4d. S.B.C. Neon Indicator Lamp, for use on mains showing "live" side of switches, etc., 2/6. post 4d. Neon Indicator, complete with condenser (pencil type), with vestpocket clip, indispensable for electricians, etc., 7 6. post 5d.

BELL TRANSFORMERS. These guaranteed transformers work from any A.C. Mains, giving 3, 5 or 9 volts output at 1 amp. operate bulb, buzzer or bell. Will supply light in bedroom or larger, etc. PRICE 9/9. post 1/-. Similar Transformer but with output of 4, 8 or 12 volts, 13/6. post 1/6. BELLS for use with either the above or batteries, 6/6. post 6d.

CRYSTAL SETS. Our latest Model is a real radio receiver, which is fitted with a permanent crystal detector, 12 6. post 1/-. Spare Permanent Detectors, 2/- each. When ordered separately, 2 6. With clips and screws, 2/10. post 3d. Special Crystal Diodes, 2 6. post 3d. Headphones, brand new, S. G. Bro. G.E.C., etc., 23/- and super-sensitive, 30/- a pair, post 1/6.

HEADPHONE IN GOOD ORDER. 6/- Better quality, 7 6 and 10/-. Balanced armature type (very sensitive), 13/6. All post 1/6. New Single Earpieces, 3 6. Balanced armature type, 4/6 (Two of these will make an intercom set or Baby Alarm). F.R.A.F. earpieces, 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 6d. Wire Bands, 6d.

HAND MICROPHONES with switch in handle and lead, 5/6. Tannoy, 7/-. Similar instrument, moving coil, 8/6. All post 1/6. Mask type with switch, 3/6. post 6d. Mike Buttons (carbon), 2/-. Moving Coil, 3 6. Transformers, 5/-. All post 4d. each. Throat Mikes, 5/-, post 7d.

MORSE KEYS. - Standard size keys wired to work Buzzer or Lamp, 3/-. post 8d. Slightly smaller keys, 2 6. post 6d. BUZZERS, 4 3. post 5d.

Terminals, brass 2BA, mounted on strip, 6d. pair. 0005 Airspaced Variable Condensers, 2/6. post 8d. 24 volt, 15 mm. M.E.S. Bulb (for motor) 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 4d. Also 150 mA. and 250 mA., same price. Ex-G.P.O. Telephone Twin Bells, with box, 5/-. post 1/6. Single Telephone Bell, 3 6. post 9d.

TELEPHONE HAND GENERATOR. G.P.O. type, giving 70 volts for ringing bells, etc., 8/6. post 2/-. Telephone hand comb sets, 12/6. post 1 6.

G.P.O. UNISELECTOR SWITCHES. 8 bank, 20-way, 20/-, post 2/-. Bargain Parcels of really useful equipment, containing Switches, Meters, Condensers, Resistances, Phones, etc., 10/-, or double assortment, 17/6; treble, 25/-. All carriage 3/-. This country only.

METERS. 20 amp. 2in. m.c. 8/6; 25 v. 2 in. m.c. 8/-; 150 v. 2in. m.c. 10/-; 3 5 amp. 2in. T.C., 6/-; 4 amp. 2in. T.C. in case with switch, 9/6; 100 mA. 2in. 7/6; 2 1/2 post extra. Meter units containing 2-500 microamp. movements, 9/-, post 1/6.

CATALATORS for Starter Batteries. Are not very much larger than the Filler Plugs they replace, but they automatically condense the hydrogen and other corrosive gases back into liquid, obviating the necessity of continual "topping up" so that your battery will give a more efficient service, for a much longer period. There is nothing to wear out, they will last indefinitely - so the first cost is the last.

CATALATORS are a must for Batteries and House Lighting Plants, and in Boats, where the risk of hydrogen explosion and fire is so great.

CATALATORS are 5/- each, 15/- set of 3. 30/- set of 6. Please state size of Filler Plug, and make of Battery. Money refunded if not completely satisfied.

HIGHSTONE UTILITIES

58 New Wanstead, London, E.11

New Illustrated List sent on request with 3d. stamp and S.A.E.



A NEW 8 1/2 inch NEWTONIAN REFLECTOR

Approved by Britain's leading observers and astronomers. Range of magnification 50X-600X. The precision aluminised paraboloidal mirror has a focal ratio of F/6 and is of Pyrex low-expansion glass. The equatorial mounting is equipped with slow motions in declination and right ascension. Weight 3 1/2 cwt.

We are also in the course of producing two smaller equatorially mounted Newtonian Reflectors—a 4in. and a 6in. The approx. prices will be £32 and £100 respectively.

For the junior astronomer we offer a simple refractor of magnification 30X. Supplied in strong presentation box for the price of 35.6. A table tripod can be provided for 12.6 extra.

FRANKS BOOK OF THE TELESCOPE (132 pp. illustrated). From your bookseller or direct. 5 6 post free.



£220 EX-WORKS

FULL TECHNICAL DETAILS ON REQUEST

CHARLES FRANK

67-75 Saltmarket, Glasgow, C.I.

'Phone Bell 2106/7 Grams: Binocam Glasgow.

Scientific instrument makers since 1907 and actual makers of telescope mirrors, flats, etc. Britain's greatest stockist of new and used binoculars, telescopes, photographic apparatus, etc. Catalogue on request.

FREE POCKET MANUAL

"How to fit STEAM TRAPS"

Unique guide to the correct selection and installation of steam traps for mains drainage, heating systems, process steam units of all kinds; including best condensate-lifting installations. Concise directions; clear illustrations. Copies free on request to:

SPIRAX-SARCO LTD.

(TECHNICAL DEPT.), Cheltenham, Glos.

AUTOMATIC (TIME) SWITCHES

New and reconditioned 15 day clock-work and electric switches

from 35/-

Send S.A.E. for illustrated details to:-
DONOHUE (TIMERS)
1 & 2 UPPER NORFOLK ST., NORTH SHIELDS, NORTHUMBERLAND

You Can Become a

HANDICRAFTS TEACHER

Experience not essential

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

We definitely guarantee "NO PASS-NO FEE"

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

BIET BRITISH INSTITUTE OF ENGINEERING TECHNOLOGY

591, College House, 29-31 Wright's Lane, London, W.8.

METALS & ACCESSORIES

Send now for Free Lists

ALUMINIUM BRASS, COPPER STEEL etc.

Sheets, Angles, Sections etc.

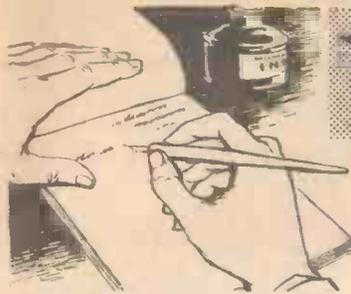
CLAY BROS. & CO. Dept. H.1
6a, Spring Bridge Road, Ealing, W.5
(Phone Ealing 2215)
2 mins. Ealing Broadway Stn. Opposite Benthalls
PERSONAL SHOPPERS WELCOMED

INTRODUCING A NEW

PORTASS S.C. LATHE

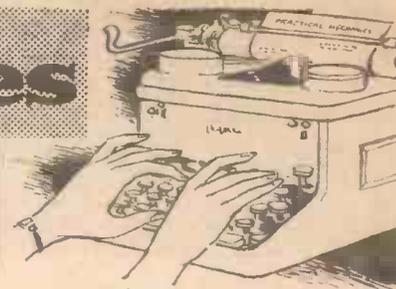
3 1/2 in. x 17 in. Backgeared Bench Lathe, complete with Faceplate, catchplate, backplate, change wheels, etc. Flat or vee drive, 228.10.00. Cash or terms. Satisfaction guaranteed or refundance refunded in full. Ex Works. Details, Dept. P.M.

CHARLES PORTASS & SON
Buttermere Works, SHEFFIELD, 8



Your Queries

Answered



Christmas Tree Novelty

THIS Christmas I am going to install a Christmas tree with the usual decorations, lights, etc., and would like to illuminate the tree from the bottom, with a beam of light, which would change colours in rotation, so as to give the impression of movement. Can you suggest a method of carrying out this project?—J. M. Green (Co. Donegal).

AN arrangement similar to that used in some electric fires, where hot air rising from a bulb rotates a fan, would be suitable. The fan could be cut from thin metal, and be about 3in. in diameter, being pivoted on a thin wire or pointed rod so that it turns easily. The bulb would be directly below, and a cylinder some 4in. long or so can be attached to the fan, to enclose the bulb. Openings are cut in this cylinder opposite the bulb, and covered with transparent coloured material. As the coloured light has to be directed upwards a mirror at 45 deg. should be fixed near the cylinder. Unnecessary light can be trapped by enclosing the equipment in a three-sided box with top.

Making Insecticide

PLEASE tell me how to prepare a fly spray solution, containing either D.D.T. or some other suitable insecticide.—G. T. Evans (Staffs).

ASSUMING that you have D.D.T. (dichlorodiphenyltrichloroethane) in powder form, all that is necessary is to make a liquid suspension in kerosene.

An alternative insecticide could be: Benzene hexacholide obtainable from: B. D. H. Ltd., Graham Street, London, E.C.1.

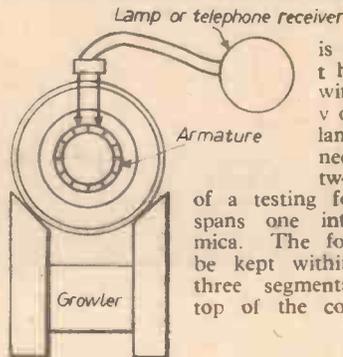
Testing Electric Motors

I WISH to carry out small motor repairs but have only A.C. current. Could you tell me the best way to drop test armatures for shorts, etc., and field coils for resistance.—Philip McEnroe (Newcastle-on-Tyne).

FOR the testing of armatures you could use a "growler" fed from the single-phase A.C. supply. In order to test a small armature this is placed on the poles of the growler as indicated. A short-circuited armature coil will be indicated by a steel feeler gauge vibrating when the feeler bridges the armature slot. The feeler should be applied to the top armature slot, the armature being

turned round to test the slots in turn. In order to determine whether a short circuit is in a coil, or between the commutator segments, a knife may be used to bridge the commutator segments. If a spark is noticed when the knife blade then breaks contact with one segment the short circuit is in the coil. If no spark is noticed the short circuit is between the commutator segments.

In order to locate reversed leads and open circuits as well as short circuits the armature



Using a growler for testing a motor.

while the armature is revolved a step at a time. A change of light from the lamp indicates a defective coil.

In order to test the resistance of field coils you could use a resistance test set in which a hand-driven generator and ohmmeter are incorporated. Messrs. Evershed and Vignole supply a useful set which can be used for resistance of insulation resistance measurements. In order to carry out volt drop tests in field coils we suggest that the best way would be to obtain a D.C. supply from a transformer and metal rectifier with smoothing capacitor, or to use an A.C. to D.C.

RULES

Our Panel of Experts will answer your Query only if you comply with the Rules given below

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.

motor generator set or converter. Volt drop tests on armatures could be carried out with D.C. obtained from a 12 or 24 volt accumulator, which could be trickle charged from the A.C. mains.

3-D Projection

PLEASE tell me the principle of operation of a 3-D projector.—W. Mitchell (Cardiff).

THE usual method is to project right and left pictures through vertical and horizontal polarising screens, viewing the combined image with spectacles having one vertical and one horizontally polarised glass, so that each eye can see only the correct image. The polarising screens cannot be made at home. It is also necessary to have the projector lenses and systems very well matched so that both images coincide exactly except for the normal stereo displacement.

Equipment for building up such a system, such as screens, etc., may be obtained from large suppliers of photographic equipment, such as Wallace Heaton, 127, New Bond Street, W.1, or R. F. Hunter Ltd., 51/53, Gray's Inn Road, W.C.1. The cost for equipment giving a satisfactory result is not low.

Mirroring Perspex

PLEASE tell me how I can mirror the inside of a blue Perspex bowl.—L. Lewis (Northampton).

THE following preliminary stages must be carried out with vigorous scouring out with clean water after each stage, except where indicated.

1. Scour thoroughly with a proprietary kitchen scouring powder on a cotton-wool pad.
2. Degrease with carbon tetrachloride.
3. Fill completely with 10 per cent. solution of potassium cyanide (very poisonous).
4. Fill completely with acid potassium dichromate and keep this solution in the bowl for one hour.
5. Wash out thoroughly with clean, cold water. This must be done after each stage described above.
6. Fill bowl with a saturated solution of stannous chloride and wash with water once only, so that there remains a molecular film of stannous chloride on the surface of the perspex.

Silver solution:

A. Silver nitrate, 100 gms. per litre; potassium hydroxide, 50 gms. per litre.

The P.M. Blueprint Service

- 12 FT. ALL WOOD CANOE. New Series, No. 1, 4s.*
- COMPRESSED-AIR MODEL AERO ENGINE. New Series. No. 3, 5s. 6d.*
- AIR RESERVOIR FOR COMPRESSED-AIR AERO ENGINE. New Series. No. 3a, 1s. 6d.
- "SPORTS" PEDAL CAR. New Series. No. 4, 5s. 6d.*
- F. J. CAMM'S FLASH STEAM-PLANT. New Series. No. 5, 5s. 6d.*
- SYNCHRONOUS ELECTRIC CLOCK. New Series. No. 6, 5s. 6d.*
- ELECTRIC DOOR-CHIME. No. 7, 4s.*

- ASTRONOMICAL TELESCOPE. New Series, Refractor. Object glass 3in. diam. Magnification x 80. No. 8 (2 sheets), 7s. 6d.*
- CANVAS CANOE. New Series. No. 9, 4s.*
- DIASCOPE. New Series. No. 10, 4s.*
- EPISCOPE. New Series. No. 11, 4s.*
- PANTOGRAPH. New Series. No. 12, 2s.*
- COMPRESSED-AIR PAINT SPRAYING PLANT. New Series. No. 13, 8s.*
- MASTER BATTERY CLOCK.* Blueprints (2 sheets), 4s. Art board dial for above clock, 1s. 6d.

- OUTBOARD SPEEDBOAT. 11s. per set of three sheets.
 - P.M. TRAILER CARAVAN.* Complete set, 11s.
 - P.M. BATTERY SLAVE CLOCK, 2s. 6d.*
 - P.M. CABIN HIGHWING MONOPLANE. 1s. 6d.*
 - P.M. TAPE RECORDER.* (2 sheets), 5s. 6d.
- The above blueprints 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 blueprints.

Make up these two solutions in separate beakers and when the salts in each are dissolved, add the potassium hydroxide solution slowly, with stirring, to the silver nitrate solution. A brown precipitate will form. Now add 10 per cent. ammonia in water to the mixture until the brown precipitate just disappears. Put the whole bulk into a clean bottle and label "A."

B. Rochelle salt, 1.7 gms. per litre; nitrate, 2.0 gms. per litre.

Put this into a separate bottle and label "B."

The preparation of these solutions, "A" and "B" must be done before the process of cleaning described in the first part of these notes is started.

Silvering Perspex:

Immediately upon reaching stage 6 of the preparation, i.e., after once rinsing out the stannous chloride, pour simultaneously and as nearly as possible equal proportions of "A" and "B" into the bowl to whatever level you wish to silver and leave undisturbed for about 10 minutes to 20 minutes.

At the end of 10 minutes tip the bowl to see how the deposition of silver is behaving and if it appears satisfactory tip the solution away and wash out the bowl with cold water; distilled water is preferable.

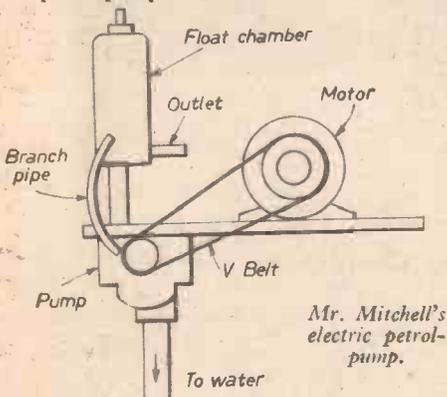
Note: Use distilled water when making up solutions "A" and "B."

If the first attempt is not successful dissolve the silver in strong nitric acid, wash bowl thoroughly and start again.

A warning should be given here about the highly explosive nature of ammoniated silver solutions and their residues. While the solutions "A" and "B" are perfectly safe for storing, the process of ammoniating should not be allowed to take up too much time. It should not be done at a temperature higher than 65 deg. F. and ammoniated solution "A" should under no circumstances be kept. Further, all unused and spent ammoniated "A" and "A" + "B" solutions should be swilled away with copious amounts of water, and all utensils thoroughly rinsed to avoid the retention of dried material which will almost certainly contain silver azide.

Self Priming a Pump

I HAVE acquired a second-hand electric petrol-pump which I intend to use for



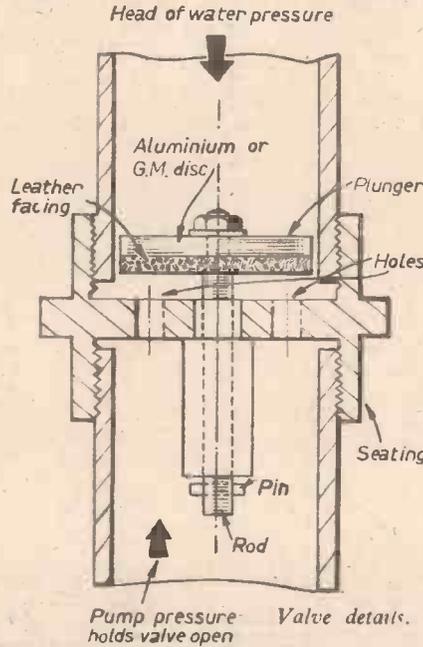
pumping water from a well to a header tank on the hill behind my house. Unfortunately I cannot get this pump to prime itself, and wonder if you can supply me with a working diagram. The pump was originally used for dispensing petrol at a garage and I know it should be self priming. The well is about 25ft. to water level and there is 15ft. of water. I have fitted a foot valve. It does pump quite well once it is going.—A. L. Mitchell (Wolverhampton).

In order to overcome this problem you must install a valve on the delivery side of the pump which will close automatically

when pumping ceases and "hold" a head of water and prevent it flowing back through the pump unit into the well.

The sketch below shows how to arrange this valve. If you possess the facilities, the manufacture is a simple matter, but any firm of pump suppliers should be able to provide one from their stock.

A ring with a series of holes or apertures as the seating and a plunger which is lifted by the water pressure are the two main items



of this assembly. This plunger remains in the open position all the time the pump is lifting water from the well, but immediately the latter is turned off the water in the long pipe to the top of the hill exerts pressure simply by gravity and holds the plunger down on the seating. It is, of course, necessary to retain the plunger in the seating otherwise the pressure will cause it to leave the bore in that member, but this arrangement while depending on the design you adopt, can be a simple pin driven across the shaft. We suggest that you make the plunger head of aluminium or gunmetal which has been machined away as much as possible in an endeavour to lighten it, and a plain disc of leather or similar material will ensure there is no leakage from the apertures. If possible, fit this valve as a separate unit as this simplifies replacement.

Soda Water Syphon

WOULD you please tell me how the ordinary siphon soda water bottle functions?—H. Heaton (Salford).

ALTHOUGH the soda water holder is known as a siphon it does not work on a siphon principle. The glass outlet tube is only taken to the bottom of the bottle to ensure collecting the whole of the liquid. It is the pressure contained in the soda water (by injection) that causes it to be forced out when the valve is opened. The soda water is blown out and is not siphoned.

Connecting Fluorescent Tubes

MY petrol electric plant has an output of 2 amp. at 230V A.C. (actually 500-watt) and it is desired to run 10 20-watt fluorescent tubes with, if possible, current to spare for a radiogram (taking some 100 watts). The light fittings that I have contain a choke (ballast) and starter switch only (no P.F. condenser). The tubes are 20-watt.—F. Hossell (Seychelles).

IF the lamps are designed to start on 110/115 volts you could connect two lamps in series with each other and in series with a 40-watt ballast choke. A 115-volt starting switch should then be connected across each tube. In order to improve the power factor you could connect a capacitor across each pair of lamps. A capacitor or capacitors will be necessary to enable high power factor operation to be obtained.

Reflecting Telescope

I AM thinking of building your 6in. Astro reflecting telescope, but would like to know if each different diameter mirror has its own standard focal length.—J. Sydenham (Leicester).

THERE is no specific focal length for each diameter of mirror. A 6in. diameter mirror can be figured to give a focal length of 42in.

$$f/7 \left(\frac{42}{6}\right) \text{ or } 48\text{in. } f/8 \left(\frac{48}{6}\right) \text{ or } f/9$$

focal length 54in. It depends on what is wanted.

It is better to keep to f/7, 42in. focal length so that the tube length is short.

Speedboat Construction

I AM building a 12ft. speedboat and would like to know if ordinary aluminium sheet can be protected successfully against sea water corrosion. Also would a Ford 8 h.p. engine be big and fast enough to drive the boat at a good speed?—B. Palmer (Swansea).

PURE aluminium sheet can be treated to resist sea water by merely ensuring it is properly painted. Alloys of aluminium would be better and harder and anodised sheets would be ideal.

For amateur use we strongly recommend the use of marine ply before aluminium sheet.

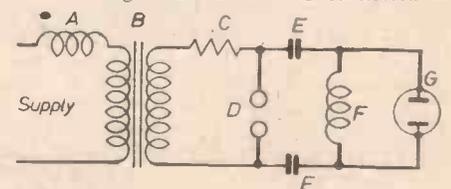
An 8 h.p. Ford engine would be satisfactory for an inboard engine. It is presumed this query is raised because such an engine is available cheaply, otherwise an outboard motor has many advantages for a small speedboat, not the least of which is the simplicity of installation.

Pulsating Lamp

I WISH to make a variable pulsating-lamp to produce a stroboscopic effect for the inspection of "running machinery."

Please suggest a suitable circuit.—B. E. McCanking (Sheffield).

YOU could use the circuit shown below. A large inductance A is connected in



Circuit for a pulsating lamp.

series with the primary windings of the transformer B. This transformer may have a step-up ratio of, about 60:1 and is designed so that its core is saturated during the greater part of the magnetic cycle when the primary current is low. The secondary winding is connected through the 2MΩ resistor C to the spark gap D, one side of which is earthed. The neon lamp G is fed through the two capacitors E with a small inductance F across the lamp. Variable frequency of flashing is obtainable by using a variable resistor at C. The secondary voltage charges the capacitors E until their potential difference is sufficient to break down the spark gap D. When this occurs an impulse is generated which causes the lamp to light with a bright flash.

ETCH-YOUR-OWN PRINTED CIRCUITS

MINIATURISE and PROFESSIONALISE

with your own printed circuitry **21/-** post free

ETCH-Your-OWN Kits give every constructor the opportunity of turning out a dozen and one novel pocket-sized units or building more elaborate apparatus from two or three highly efficient sub-assemblies with losses and stray capacities cut to a minimum.

Each kit contains more than sixty square inches of laminated board and sufficient chemicals to make dozens of printed circuits: additional laminated board can be supplied to order. All materials are of high quality, completely safe to handle, and are carefully prepared to ensure fine definition and consistently satisfactory results without laboratory technique or precision control.

Supplied complete with specially comprehensive instruction book giving advice and examples on translating theoretical circuits into printed circuit layouts ready for etching.

PROOPS BROS LTD Dept. M
52 Tottenham Court Road, London, W.1
Telephone: LANgham 0141
Hours 9-6 p.m. Thursdays 9-1 p.m. Open all day Saturday.

TAKE UP PELMANISM

And Cultivate Your Natural Ability



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:

- JUDGMENT
 - INITIATIVE
 - WILL-POWER
 - OBSERVATION
 - PERSONALITY
 - SOCIAL-EASE
 - DECISIVENESS
 - SELF-CONTROL
 - CONCENTRATION
 - SELF-CONFIDENCE
- AND A HOLD-FAST MEMORY

Pelmanism develops these qualities quickly, and permanently. They become habitual processes manifesting themselves smoothly and evenly, and largely without conscious effort.

The Pelman Course is taught by correspondence only. There are no classes to attend. The problems of each Pelmanist are considered separately by highly trained, sympathetic instructors. Under this

understanding system, even the most timid gains self-confidence.

The Pelman training for successful living has been proved by over a million men and women of every type and calling.

Remember—Everything you do is preceded by your attitude of mind.

Send for Free Book

The Pelman Course is simple and interesting and takes up very little time. The books are printed in a handy pocket size, enabling you to study them when travelling or in spare moments during the day. You can enrol on the most convenient terms.

The Course is fully described in a book entitled *The Science of Success*, which will be sent to you gratis and post free, on application to:

PELMAN INSTITUTE,
130, Norfolk Mansions,
Wigmore Street, London, W.1.
WELbeck 1411

POST THIS FREE COUPON TODAY

Pelman Institute
130, Norfolk Mansions, Wigmore Street, London, W.1.

"The Science of Success," please.

Name

Address

Established over 60 years.
Pelman (Overseas) Institutes. Delhi
Melbourne. Durban. Paris. Amsterdam

MIDLAND INSTRUMENT CO.

HARR & STROUD RANGE-FINDERS, 1-metre base, 14X, as illustrated and described in October P.M. New, unused condition, cost nearly £200. Our price £25. Carriage: 100 m. 7/6, 200 m. 10/-, 300 m. 12/6, N.I. 20/-.

TRIPODS, stained wood or steel, 40 in. long, weight 5 lbs. An ideal folding tripod for cameras, telescopes, etc., 12/6, post 2/8. Correct brass heads to fit these tripods with 5/16 in. dia. base, has two micrometer control knobs, one rotating head through 360 deg., the other up to 50 deg. elevation and 10 deg. depression; heads are a perfect fit for all British and U.S. type elbow telescopes, 12/6, post 2/-.

GEARSETS, mounted and unmounted, 18 gears in all from 1 to 31n. dia., also shafts, bearings, ratchets, pawls, springs, washers, etc. A useful model maker's parcel, approx. 1 lb. weight, 3/6, post 1/8.

TELEPHONE SETS, consists of two combined microphones and receivers, coupled by 20ft. twin flex, providing perfect 2-way communication. Self-energised—no batteries required; flex can be extended up to 1 mile if required. Complete set, ready for use, new, unused, 12/6, post paid.

RECTIFIERS, selenium full-wave bridge, 12 v. 1 amp. 3/6, post 9d; ditto 12 v. 2 amps, 5/6, post 1/-.

LENSES, high-grade achromats, 40 mm. dia., 3 1/2 in. F.L. or 42 mm. dia. 3 in. F.L. Ideal for enlargers, viewers, etc., new and perfect, 7/6 each, post 6d.

BENDIX MOTOR GENERATORS, size 4 1/2 in. long, 2 1/2 in. dia., 3/16 in. shaft; easily converted to A.C. mains motor. New, unused, 7/6, post 2/-.

CARLISLE FUSE BOXES, black japanned steel, hinged lid, contains 12 Sydlok fuses each 15 amp. 250 v. New, unused, 12/6, post 3/6.

AIR COMPRESSOR GAUGES, 0-150 lbs. sq in., 2 1/2 lb. main and 5 lb. sub-divisions, flush panel mounting, fitted brass union. New, boxed, 7/6, post 1/3. Many other bargains. Send stamped addressed envelope for Lists.

MIDLAND INSTRUMENT CO.,
MOORPOOL CIRCLE,
BIRMINGHAM, 17
Tel.: HAR 1308



1/2" CAPACITY 15" BENCH DRILL

A PRECISION BUILT MACHINE TOOL
WEIGHT 154 lbs. 5 SPINDLE SPEEDS

Cash Price: **£37.5.0** Pillar model also available.

Deposit: **£3.14.6** (3 phase)

Balance in 8 monthly payments of: **£4.13.3**

THE FINEST TOOL SHOPS IN LONDON!

PARRY & SON (TOOLS) LTD. 329-333 OLD STREET, LONDON, E.C.1.



'Zyto' DO-IT-YOURSELF TOOL KIT



A Superb set of full size, fully guaranteed tools specially selected for the home craftsman. 47 tools including Stanley adjustable Iron-plane, Brace, Chisels, Bits, Hammers, Hand Drill, Screwdrivers, etc., and also a first-class instruction book.

* Illustrated leaflet of "Zyto" tool kits post free.*

33/- FIRST PAYMENT
8 MONTHLY PAYMENTS
OF 41/6. CASH PRICE £16/10/0.

Illustrated catalogue of tools and machinery for wood and metalwork. 2/6 refunded on first order of 40/-.

S. TYZACK & SON LTD

341-345 OLD STREET, LONDON E.C.1.

Telephone SHO. 8301
Ten lines.

"CATALOGUE"

Our new Catalogue No. 14 has 500 items nearly all illustrated. Radio Control Government Surplus, etc. Price 2/- Refund on Order. Post 6d.

TIME DELAY UNITS

This unit consists of a small geared escapement mechanism, which is wound by pressing a button at the side of the case and is electro-magnetically released when 12-24 v. is applied. This unit will operate from a 12 v. supply, and is ideally suitable for modification to a rudder unit for model boats, etc., when fitted with a miniature motor—such as Ever Ready. The unit is in a small die-cast box, approximately 2 1/2 in. x 2 1/2 in. square and 2 in. deep and is easily removable. Price 6/-, post 1/6.

12 VOLT MOTOR

CM 3 Type, 2,000 r.p.m. approx., at 1 amp. under load, 8 amp. no load. Will also operate on 6 volt about half output. Weight 11 oz. Size 2 1/2 in. long, 1 1/2 in. wide, 1 1/2 in. high; shaft 1/8 x 3/16 in. dia. Ideal for boats up to 4ft. Price 25/-, Post 1/6. Brand New Condition.

MASTER CONTACTOR

10-hour clockwork movement with contacts that make and break every 1/2-second, also fitted with thermal switch and suppressor gear all contained in a neat metal container, forms basis for making time switch, etc., brand new 12/6, post 1/8. This is an ideal unit for plugging into transmitter when carrying out receiver tests single handed. Delivers 1 sec. pulses.

REMOTE CONTACTORS

12 v. to 24 v. stepping mechanism, 120 impulses for 1 rev. of pointer, glass front, resetting-control, on/off switch, flex, etc., will make an ideal 0-120 magnetic counter for coil winding, etc. Brand new 7/6, postage 1/6. Has sound possibilities as electric pendulum clock. Will work in conjunction with Master Contactor.

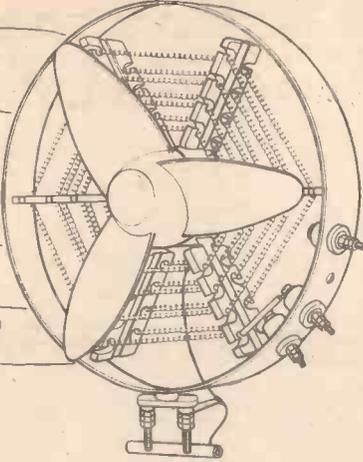
TWO-PIN PLUG AND SOCKET

This plug has a locking device and once the two portions are plugged together it is impossible for them to come apart unless the knurled ring is rotated on the socket. Fitted with 1 1/2 in. length of cable and new and boxed. Price 2/6, plus 1/- post. Suitable for trailers, caravans, etc. 25/- per doz., post 2/6.

ARTHUR SALLIS RADIO CONTROL LTD.

93, North Rd., Brighton. Tel. 25806

COLD AIR
TEMPERATE
WARM
HOT
VERY HOT



MULTI-HEAT BLOWER UNIT

HERE'S SOMETHING REALLY EXCITING FOR THE PRACTICAL MECHANIC. A compact Mains Blower Unit all ready for fitting into your own casing or ducting. Enabling you to construct: Clothes Drying Cabinets, Forced Draught Convector Heaters, Fan Cooling for Warm Weather, Greenhouse Heaters and Ventilators; all at a fraction of the cost of manufactured equivalents.

The unit comprises a top quality shaded pole motor of superb precision operating at a speed of 2,600 r.p.m., with a consumption of 18 watts. The rotor is die cast with a precision ground spindle in 'Oilite' bearings which are self aligning.

The Heater Unit consists of dual spirals which enables loadings of 1 or 2 kW. to be used. The 3-bladed fan is of the very latest aero-dynamic design and displaces 280 cubic feet per minute. A small resistance is incorporated in the motor circuit which allows the fan to run at half speed. This feature together with the dual elements allows of six different temperatures. Send us a 4d. stamp for details or we will send on 7 days' approval against remittance.

PRICE: £4/15/3. Carriage & Packing: 3/3.

THE TECHNICAL SERVICES CO., BANSTEAD, SURREY

For other items, Heater Cables, etc., send 6d. for Catalogue.

Light as a feather!



SET No. 535T
PRICE 35/-

Here is an entirely new conception of cycle lighting. The ultra lightweight headlamp of this model weighs only 5½ ozs.—perhaps not quite as light as a feather—but it's the perfect answer for the keen clubman who wants light without weight. This compact set will give years of reliable lighting at any speed. Finished in chromium plate throughout.



CYCLE DYNAMO LIGHTING SETS

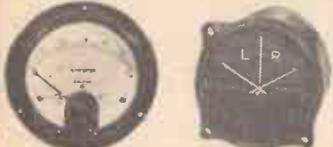
H. MILLER & CO. LTD

ASTON BROOK STREET BIRMINGHAM 6

Wilkinsons EST. 1921

TELEPHONES
EASY TO FIX
WIRING DIAGRAM FREE

Telephone Set Type "A" ringing and speaking both ways on a 4-core cable. Very loud and clear over any distance. The handsets are as usual, and the set is complete except wire, 4-core at 8d. per yard or 2-core at 3d. per yard extra. Price 75/- set, post 3/6. Set "B." Two headphones connected to breast microphones, with leads, plugs and fitted carrying cases. Join instruments together with two wires and 1½ volt battery for a super intercom. 25/-, post 3/6. Set "C." Similar to set "A." Instead of P.O. Type handsets, two P.O. Desk Type Instruments are supplied; with usual drawer in base. Complete and ready for use. Price 150/-, post 7/-. TELEPHONES SOUND POWERED. No batteries required. Just connect with twin flex for clear speech. Transmitter Receiver Units, 4/6 ea. Twin Flex, 4/6, yd. Post 1/-.



METERS GUARANTEED

| F.S.D. | Size | Type | Price |
|--------------|----------------|-------|-------|
| 50 Microamps | 2 1/2 in. | MC/FR | 70/- |
| 100 | 3 1/2 in. | MC/FR | 70/- |
| 250 | 3 1/2 in. | MC/FR | 55/- |
| 500 | 2 1/2 in. | MC/FR | 25/- |
| 1 Milliamper | 2 1/2 in. | MC/FR | 35/- |
| 5-0-5 | 2 1/2 in. | MC/FR | 20/- |
| 30 | 2 1/2 in. | MC/FR | 12/6 |
| 100 | 2 1/2 in. | MC/FR | 12/6 |
| 200 | 2 1/2 in. | MC/FR | 12/6 |
| 5 Amperes | 2 in. | MC/FS | 27/6 |
| 15 | 2 in. | MC/FR | 10/6 |
| 25 | 2 1/2 in. | M/FR | 7/6 |
| 30-0-30 | 2 in. | MC/FR | 15/6 |
| 50-0-50 | 2 in. | MC/FS | 12/6 |
| 20 Volts | 2 in. | MC/FS | 10/6 |
| 40 | 2 in. | MC/FS | 10/6 |
| 300 | A.C. 2 1/2 in. | M/FR | 25/- |

CROSS-POINTER METER with 2 separate 100 microamp movements. 22/6. Post 2/-.
ROOM THERMOSTAT. Adjustable 45 to 75 deg. Fahr. 250 volts 10 amp. A.C. Ideal for greenhouses, etc., 35/-, post 2/-.

INSPECTION LAMP. Fits on forehead, leaving hands free, battery case clips on belt. 7/6, post 1/6. Takes E.R. Battery. No. 1215, 2/9, post 9d.



VACUUM PUMP AND COMPRESSOR
Many Uses in Workshop or Laboratory.

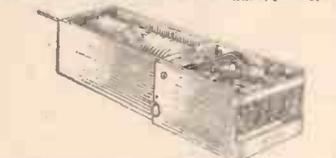
This is an Edwards type 4, with 1/16 in. shaft, coupling, oil-filter and union for tubing. £6.10.0, post 3/6.

10 AMP. BATTERY CHARGER. Here is your chance to purchase a brand new unit worth £40! For our special price. £17.10.0, carr. 20/-. Specification: Input 200/250 volts A.C. 50 cycles. Output 10 amps. 22 volts D.C. Controlled by two 4-position switches for fine and coarse control which enables 6 to 24 volt bats. to be charged. Brand new with 0/12 ammeter. Fused A.C. and D.C.



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.

SWITCHES. 1 hole fixing, 3 amp. 250 volts. 1/8 each. 12/- doz.
TERMINAL BLOCKS 4/- doz., or box of 50 for 15/-, 3-way, 8/- doz., 50 for 22/6, post 1/6.



MAGNETIC COUNTERS. 12 amp., 30 ohms 2-5 v. D.C. 15/- each, post 1/6.
VEEDER-ROOT MAGNETIC COUNTER. General purpose type with zero re-set. 800 counts per minute up to 999,999. 45 volt D.C. 55/-, post 2/6.
SMALL COVERED RELAY. 400 ohms, 2 make (heavy duty) contacts with terminal block. Very compact. 7/6 complete, post 8d. Large Quantities Available.

ROTARY CONVERTERS. Input 12 D.C. Output 230 A.C., 50 cy. 135 w. In fitted case with variable resistance. 0.300 voltmeter. The ideal job for television where A.C. mains are not available. £10 carr. 15/- Special connectors one fitted with 6ft. heavy duty flex and clips for D.C. side. 10/- set, post 1/-.
CONVERTER ONLY 12 volt or 24 volt. £8/10/- Carr. 7/6.

BATTERIES. Portable Lead Acid type 6 volts 125 amp. hours. In metal case 16in. x 8in. x 11in. (Two will make an ideal power supply for our 12-volt Rotary Converters.) Uncharged £8/10/-, carr. 15/-, 24 volt 85 ampere. £15/-, carriage 30/-.

VACUUM PUMP. Brand New. 7 cu. ft. per min. 10 lbs. per sq. in. at 1,200 r.p.m. Rotary Vane type 35/-, post 3/-.

SOLENOIDS. 12 volts D.C. with a 3 1/2 in. lever, very powerful. 5/- each, post 1/6.

SYNCHRONOUS MOTOR. 200/250 volts A.C. 60 r.p.m., suitable for electric clocks, etc. 25/-, post 2/6.

SYNCHRONOUS MOTOR. with gear train driving 5 dials 1/10th hr.—10,000 hrs. 27/6, post 2/6.

MAINS MOTORS. Capacitor 230 volts A.C. 1/40th h.p. 1,400 r.p.m., 55/-, post 3/6.

SMALL MOTORS. 12 volts D.C. 3,000 r.p.m. with speed governor in end cap. 2in. x 1 1/2 in. 12/6, post 2/-.

GEARED MOTORS for the model maker, small but powerful 12/24 volts A.C./D.C. 4/8 r.p.m., 35/-, post 2/6.

GEARED MOTORS. 220-Torque. 15lb. in. 240 volts A.C. 175 r.p.m. in Klaxon 210, carriage 15/-.

MOTORIZED FUEL PUMPS. 24 volts D.C. 400 g.p.h. Pulsometer type with range for fitting on side of tank. Plessey type also available for use with pipe system. Either type 55/-, carriage 3/6.

VARIABLE TRANSFORMER. Input 230 volts. Output infinitely variable 0-230 volts and 0-270 volts. 9 amp. Bench or panel mounting. £15, carriage 12/6.

NIFE BATTERIES. Nickel cadmium, 6 volts 75 amps., crated and connected. Alkaline filled. Brand new 27/10.0, cge. 15/-.

MAP READING LAMPS. EX-R.A.F. NAVIGATOR'S CHART MAGNIFIERS. 3in. lens complete with batteries, bulb and dimming switch. 12in. long, 37/6, post 2/6.

L. WILKINSON (CROYDON) LTD.
19 LANSDOWNE RD. CROYDON SURREY
Phone: CRO 5117 Grafton: WILCO CROYDON

WATSON'S SPECIAL OFFERS



STUART TURNER
4 h.p.
£19.10.0
Carr. 30/-

These are extremely neat and compact water-cooled units complete with Centrifugal clutch suitable for many Marine or Industrial purposes. Slightly used, tested before despatch and very special value.
METAL RECTIFIER BATTERY CHARGER.—Input 200/250/150 A.C. output to charge 12 cells at 6 amp. Max. In metal case, 18" x 18" x 8". Really exceptional value, £4.15.0. Carr. 7/6.
WESTINGHOUSE BATTERY CHARGERS.—Type R.G.C. 12 90 volt at 8 amp. Control switching suitable from one 6-volt battery to max. output. Tested and Guaranteed. PRICE £19.10.0. Carr. 20/-.
NEOPRENE SOUNDING BALLOONS.—Uninflated 3 ft. to 14 ft., inflated 8/6 each. Post 1/6.
PRESSURE GAUGES.—In brass 0-120 lb. 1 1/2" diam. 6/6 each. Post 9d.
COIL SPRING BELTS.—1 1/2" x 12" long, extends to 15". Any number can be joined together. 20 for 4/6. Post 9d. Hundreds of other bargains available. Send 6d. Stamp for Illustrated List.
WICO MAGNETOS.—Single cylinder anti-clock rotation with impulse starter Brand new. 70/-, Post 3/-.
B.T.H. VERTICAL MAGNETOS. 4, cylinder clock or anti-clock. Brand New. £5.10.0. Post 3/6.
EASTERN MOTORS, ALDBURGH, SUFFOLK
Phone 51



THE CYCLIST

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

Vol. XXVIII

No. 447

COMMENTS OF THE MONTH

The Future of Herne Hill

A NEW lease of life has been granted to London's Herne Hill track, which has been steadily losing money over the past few years for its lessees, the B.C.F., formerly the N.C.U. This comes about as a direct result of the London County Council taking over the track from the B.C.F. The buildings are somewhat dilapidated and about £5,000 would be needed to restore them. The B.C.F. has decided that it can no longer afford to carry such a liability. Disposal of the lease might have meant that the track would no longer be available to the general public, so the L.C.C. is to take it over under the Physical Training and Recreation Act of 1937.

The terms of the transfer are that the lease will be relinquished without a premium, but the estimated £5,000 liability for making good defects in buildings, etc., will also be accepted by the L.C.C. The original lease has 25 years to run, but a special extended lease of 42 years has been arranged at £600 per year. More money—about £7,000—is to be spent on improvements to the track, the stands and the refreshment building; the athletics track is to be resurfaced and its use revived.

The present system of letting to clubs, etc., is to continue and until specifically announced, the B.C.F. will continue with the administration as at present.

Audible Warning—is it Necessary?

Anyone who uses the roads, particularly the main roads, regularly must have at some time wondered what the purpose of audible warning is. Its prime purpose, i.e., that of giving a polite warning of approach, seems to have been lost and instead loud blasts are used to express the annoyance of drivers delayed for a few moments, or alternatively to frighten other road users out of the way by sheer volume of sound. Surely this is misuse of something originally intended to serve a purpose far less violent!

When one considers that so many drivers only use their horns in this way, the thought arises, "Is audible warning necessary at all?" It has been abolished in Gibraltar for some years now and there is no reason to believe that the accident rate has risen as a result. It is true that drivers there, particularly taxi drivers, have evolved their own method of audible warning by banging with the flat of the hand on the outside of their vehicle's door, but this is preferable to the raucous and discordant din produced by modern motor horns. Paris, too, has more recently forbidden the use of audible warning.

An alternative, perhaps, to abolition—a word which is always an anathema to a freedom loving people—is to fit only horns tuned to one key. Think how much more pleasant it would be to receive warning of a vehicle's approach by the sound of a pure note like that of a trumpet, instead of a raucous and brassy belch of the type now so common; but this must remain a pipe dream for the modern motor horn is not designed with beauty in mind but instead strident urgency is the theme. There is one point in its favour, however, it prevents a tendency to stop to listen to a pleasant sound instead of jumping for one's life!

Our New Minister of Transport

There cannot ever have been many cycling M.P.'s and fewer still with Cabinet rank. It must therefore be a very rare occasion when we have a cycling Transport Minister, as we now have. Mr. Ernest Marples, M.P., is a very enthusiastic cyclist

will be very difficult to solve. The twin problems of inadequate roads and too much road traffic will provide headache No. 1 and the ever growing road casualty figures will provide another. Perhaps, however, as Mr. Marples' road experience has been gained from a different viewpoint to that of his predecessors, he will have a new approach to the problems.

It is unlikely that Mr. Marples will bring about any sweeping changes which will particularly affect cyclists, but it is certain that any legislation affecting cyclists will be assured of at least one sympathetic and understanding ear. Perhaps, too, he will be able to do something to clarify the position with regard to racing on the open road.

1960 Tour of Britain

Next year this event is again to be sponsored by the Milk Marketing Board and together with the B.C.F. who will promote it, they have decided to restrict entries to



This lovely house with its lakes and glorious parkland is at Osterley, Middlesex.

and has been for many years. He started cycling as a boy and still cycles both for business and pleasure. He rides round London to business appointments and his bicycle also carries him to the House of Commons. He usually spends his holidays abroad in company with his wife—and their bicycles!

Minister of Transport is not an enviable post at the present time and Mr. Marples has inherited a number of problems which

amateurs only. There will be teams to represent England, Scotland, Northern Ireland and Wales. There will be regional teams representing the South, the North, London, the East Midlands and the North West. Teams from the Army and the R.A.F. will also take part and invitations have been sent to Belgium, Holland, Sweden, Russia and East Germany. The race will be run from 6th to 18th June, starting and finishing in Blackpool.

HOW TO KEEP

WARM and DRY

Clothing and Protection are Discussed
for Those Who Cycle All the Year Round

THERE is no reason to let cold winds and winter weather prevent you from cycling all the year round. It is possible to keep warm on a bicycle and at the same time look smart, particularly now when manufacturers are producing many lines specially for the cyclist. Clothing has been standardised to a certain extent among clubmen to produce what is almost a uniform; but, in the author's opinion, they have discovered the best clothing formula for cycling. The cyclist in the heading photograph is wearing it.

Obviously, when riding a cycle, the legs are the only part of the body which move to any great extent. This means that heavier clothing will be required for the upper half of the body.

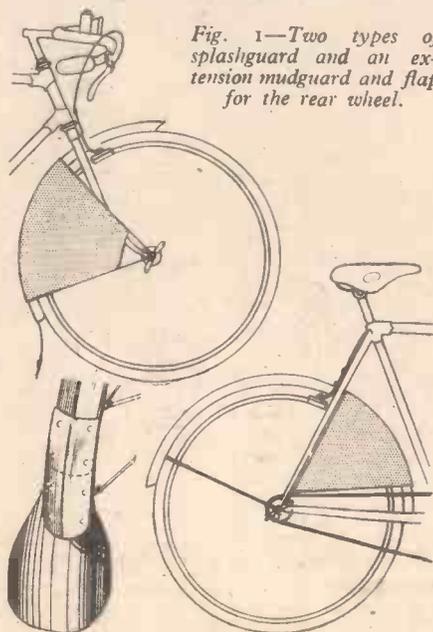
Warmth is best provided by a woollen jersey over the normal shirt, etc., but to keep the heat in, a windproof covering of some sort should be worn. One of the many types of showerproofed zip jackets is best for this. Not only are they proof against wind and light rain, but they are extremely smart in appearance. Always buy one of these jackets hip length, as waist length garments are inclined to ride up the back, due to the rider's position on a sports machine. This, of course, applies equally to the jersey or sweater worn underneath. Perhaps even more efficient for protection against the weather is the Anarak type of jacket. Originally designed for climbers, these do not open down the front but are pulled over the head and zipped up tight round the neck. Draw cords are fitted at the waist and in the hood, enabling this to be fitted tightly round the face. They are hip length and the waist and cuffs are elasticated to keep out the wind. They are perhaps not as smart in appearance as many of the tailored jackets, but they are extremely efficient and comfortable.

Nether Garments

At one time, standard winter equipment for the cyclist always included plus fours, but few riders wear these today. The snags were that the bulky folds of material were inclined to get mixed up with the chain, and in wet weather they held an excessive amount of water, picked up from the front wheel. Much more suitable is

the modern substitute of "plus two's" which retain all the advantages of plus fours, i.e., large reinforced seat, ample room for leg movement and absolute freedom at the ankles.

Jeans are worn a great deal by the modern cyclist; they have the advantages of no loose flapping folds of material and of being substantially windproof. Not every rider, however, can obtain enough freedom of movement in them, and extracting and replacing a handkerchief while riding demands manoeuvres worthy of a trick cycling contortionist. Corduroys are bulky and not really windproof. Better than these are whipcord or Bedford cord trousers which are reasonably windproof and extremely hardwearing. Trousers specially for the cyclist are being made on the lines of plus fours, but closer fitting, with reinforced seats and elasticated waists. These are perhaps the best answer of all. Freedom of movement and a reasonable degree of windproofing are the main requirements.



Socks and Shoes

If there has been invented a satisfactory way of keeping the feet warm on a bicycle, the author for one would be very glad to hear about it. However, a fairly heavy pair of long wool, or wool and nylon socks is a help and a pair of cycling shoes heavier and more roomy than usual, may help even more. Choose cycling shoes without flaps as these serve only to get tangled up with the toeclips. Relaxing the pressure of toeclips and straps may help to keep the feet warm. If it is possible to move the toes, circulation will be improved.

Gloves

A certain amount of flexibility of hand movement must be maintained so that brake levers may be handled quickly and effectively and therefore gloves of fairly thin texture are advisable. Gauntlets are not necessary, although they should be long enough to prevent the wind from passing up the sleeves. Mitts with four fingers in one portion and the thumb separate are satisfactory and probably warmer than ordinary gloves.

Headwear

This again is a matter of choice. Many men wear the modern style of "County" cap while others favour a beret of one style or another. Some take the opportunity of wearing something unconventional. The beret and the time-honoured "peasant" scarf are popular among the ladies.

Keeping Dry

This, as distinct from keeping warm is the other problem facing the winter cyclist.

The main necessity, of course, is a good cape. The modern style of waterproof is made in plastic, although good quality oil-skin capes are still popular. The things to look for when buying a cape are: ample skirt size, thumb tapes and waist tapes, ventilation in the back and a good strong zip or press studs.

For keeping the head dry, there are few things better than a sou'wester, either of plastic or oilskin. Some riders claim that a cap is better because it keeps rain off the face and out of the eyes, but the sou'wester stops it dripping down the back of the neck.

Opinion is divided on the wearing of leggings. Some riders maintain that there is little advantage as condensation causes as much dampness as the rain would if they were not worn. However, of the many types available the most comfortable and those giving the most freedom are the type which cover the foot and fit close to the leg to just above knee height. These will keep shoes, socks and trousers dry and condensation can be kept to a minimum by travelling slower and not getting too hot. For the more leisurely rider heavier and more capacious leggings are available.

Mudflaps and Wheelguards

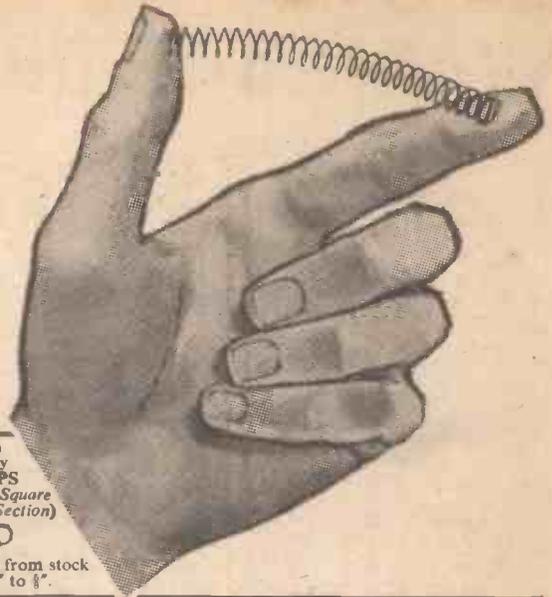
Preventing water from being splashed up from the tyres is half the battle in keeping dry on a bicycle. Good wide mudguards, fitted as close as possible to the wheels and a large mudflap on the front guard will do a great deal to help. A splashguard added to this as shown in Fig. 1 will reduce the water splashed up even more. A splashguard will help on the rear wheel as well and, if riding in company with others, a rear mudguard extension and a mudflap on the back wheel will be appreciated by those riding behind (see Fig. 1).

Could this be the spring you're looking for?

Then you'll find it down below

Whatever you need in the way of springs you'll find in the range of TERRY'S BOXES OF ASSORTED SPRINGS — compression, expansion, long, short, light, heavy — the lot. Just the job for you experimental

people—a simply unlimited assortment from our tremendous range of springs of every variety. The boxes shown here are only a few examples—why not let us send you our illustrated list showing them all?



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

Cut production costs with Terry Wire CIRCCLIPS (Square Section) We can supply from stock in sizes from 1/4" to 1/2".

TERRY'S ASSORTED SPRINGS

Herbert Terry & Sons Ltd, Redditch, Worcs.

(Makers of Quality Springs, Wireforms and Presswork for over 100 years)

*Have you a Presswork problem? If so let us have it and we'll help to solve it for you.

HT 24E

NYLON • P.T.F.E.

Rod, Bar, Sheet, Tube, Strip, Wire

No quantity too small • List on application

BRASS • COPPER • LIGHT ALLOYS
ALUMINIUM • BRONZE

H. ROLLET & CO. LTD.

6, CHESHAM PLACE, LONDON, S.W.1
SLOane 3463

Also at LIVERPOOL LEEDS MANCHESTER BIRMINGHAM

DRILTRU MEDDINGS

1 1/2" CAPACITY 15" BENCH DRILL

A PRECISION BUILT MACHINE TOOL
WEIGHT 154 lb. 5 SPINDLE SPEEDS

£37.5.0 (complete—3 phase)

(Chuck guard not included.) Pillar model also available.
Available from all machine tool merchants—write now for full details, to the manufacturers:

W. J. MEDDINGS LTD., Ipswich Rd., Trading Estate, Slough, Bucks.
One of the Largest Manufacturers of Drilling Machines in the U.K.

SERIES III NUCLEAVE PRESS

CROPS RIVETS PUNCHES

Ask your Tool Dealer or send for details to:—

Sole Manufacturers,
FITZNER LTD.
197-199, KINGS ROAD,
KINGSTON-ON-THAMES

THE FAMOUS HARRIS ELECTRIC WELDER

and Complete Kit For Welding, Soldering, Brazing and metal construction & repairs in the home, on the car or cycle. Instant heat 6,000° F. Works from 6v. or 12v. car battery or transformer from A.C. mains. Complete kit of Welding Tools, 8ft. cable, slip, carbons, cleansing fluid, fluxes, filler rods, goggles, instructions, hints. Thousands in daily use. As supplied to Dept. of H.M. Government, I.C.I., Standard Telephones, etc. Welds all Metals up to one-eighth inch. C.O.D. IF REQUIRED

57/6

Obtainable only from: Post & Packing 2/6.
HARRIS ENGINEERING CO. (Dept. P.M.36)
289 Kingsland Road, London, E.2.

Terms: Dep. 12/6, p. & p. 2/6 & 5 wkly pmts. of 10/-

NEST OF DRAWERS

Overall size 7" wide x 5" deep x 11" high. 12 drawers, each measuring 3" wide x 4 1/2" deep x 1 1/2" high. Useful storage for the engineer, motorist and householder for nuts, bolts and small components.

Green enamelled. £1. P. & P. 3/-.

RIVETING SYSTEMS LTD.

JORDAN STREET, KNOTT MILL
MANCHESTER, 15

THE ONLY CONCRETE GARAGE WITH A BRICKWORK FINISH & UNDERFELTED TILED ROOF

FROM **£33.11**

- ★ To match existing property.
- ★ "Little time" built.
- ★ Ready portable.
- ★ Fireproof.
- ★ Erection Service.
- ★ Approved by local authorities.

FREE Send for FREE Garage & Portable Building COLOUR BROCHURE. Easy Terms.

Cradwill TILES LTD.
Northants. Tel.: Burton Latimer 533 & 554.
(Dept. ME.16), Kettering.

ASTRONOMICAL TELESCOPE

COMPLETE AND READY FOR USE FOR **25! ONLY** PLUS 2/- P. & P.



THIS WILL ENABLE YOU TO KEEP AN EYE ON SPACE!

THIS POWERFUL REFRACTING TELESCOPE WILL SHOW YOU—

Jupiter and its moons—Saturn and its system of rings—the fantastic landscape of our own moon in great detail—Nebulae and Star Clusters invisible to the naked eye—and a host of other astronomical marvels.

Lens system of high grade optical glass. Magnification 33X (1,000 times in area). Unbreakable lightweight construction. 1 1/2 lbs. in stowing case (supplied). 2ft. 4in. long. Each telescope individually tested.

Stamp with enquiries please.

SPACE-AIDS

Dept. MB, Raleigh Mews, Raleigh Street, Nottingham.



CONDOR

S L I C E D

For real value and flavour

4/1 PER OZ.



IT'S A GALLAHER TOBACCO

NEW CABLES & FITTINGS

TOUGH RUBBER CABLES

| | Per yd. | 25 yds. | 50 yds. | 100 yds. | |
|--------------------------------------|--------------------------------|---------------------------------------|---|--|---------------------------------------|
| 1/044 Twin | 64d. | 12/6 | 22/6 | 43/4 | |
| 1/044 3-core | 9d. | 17/3 | 31/3 | 60/6 | |
| 3/029 Twin | 3d. | 15/6 | 29/6 | 55/9 | |
| 3/029 T. & E. | 91d. | 18/3 | 34/8 | 66/9 | |
| 7/029 Twin | 1/- | 24/3 | 47/6 | 93/10 | |
| 7/029 T. & E. | 1/4 | 31/6 | 59/9 | 118/2 | |
| 7/044 Twin | 1/11 | 46/- | 87/6 | 171/- | |
| Twin Lead, 50 yds. | 1/044 | 48/6 | 7/029 | 89/6 | |
| VIR 50 yds. | 3/029 | 12/- | 7/029 | 19/- | |
| Earth Wire, 100ft. | 7/029 | 11/- | 7/029 | 7/9 | |
| Twin PVC Transp. Flex, 50 yds. | 10/- | Twin Twisted, 25 yds. | 11/3 | 50 yds. | 21/- |
| TRS PVC Lead Cables of all sizes. | Holder, C.G. | 8/- | Batten, doz. | 12/- | |
| Roses, 2-plate, 8/- | 3-plate, doz. | 9/- | June Boxes, Sml. | 11/- | |
| Lge., doz. | 13/- | Switches, 1-way | 18/- | 2-way doz. | 24/- |
| White Switches, 1-way | 24/- | 2-way, doz. | 30/- | Flush Switches, 1-way, 18/- | |
| 2-way, doz. | 24/- | Ceiling Cord, 6in., 1-way, 5/- | 2-way, 6/- | 2 amp. 2-pin Sw. plugs and tops, ea. | 3/- |
| 5 amp. 3-pin Sw. plugs and tops, ea. | 5/6 | 15 amp. 3-pin Sw. plugs and tops, ea. | 9/- | 13 amp. 3-pin, ditto, A.C. only, ea. | 7/6 |
| Wood Blocks, 3 x 1 1/2 x 1 1/2 | 5/6 | 3 x 3 x 1 1/2 | 7/6 | 5 1/2 x 3 1/2 x 1 doz. | 9/- |
| White, 3 x 1 1/2 x 1 1/2 | 7/- | 4 x 1 1/2 x 1 1/2 | 9/- | Cable Clips, Sml. | 2/9 |
| Med., grs. | 3/3 | 10 amp. D.P. Insulated Sw. fuse, | 9/- | 21 amp. Ironclad 2-way 15A. Spltr., | 13/6 |
| 30 amp. Ironclad D.P. Switchfuse, | 19/6 | 60 amp. Metal D.P. Sw. fuse, | 49/- | Sw. gear, Fusebox, Spltrs., all types. | Lamp Bulbs, 15, 25, 40, 60 watt, 12/- |
| 75 watt, 25/- | 100 watt, 17/- | 150 watt, 24/- | 200 watt, doz., 30/- | Carbon Bulbs, 230 v. 16 C.P., doz. | 20/- |
| Immersion Heaters, 3 Kw., 50/- | Single Car Cable, 10 yds., 3/- | 100 yds., 25/- | Conduit and Fittings, 1in. and 1 1/2in. Industrial Reflectors, Tubular Heaters, Fluorescent Fittings, Time Switches, and all electrical equipment. Full lists on request. Single items supplied. Satisfaction guaranteed. Terms: Cash with order; carriage paid if over 45; orders of 420 or over less 5 per cent. discount. Open Daily, Inc. Sat., 9 to 1, 2 to 6; Thurs. 9 to 1. Callers welcome. | | |

LONDON
WHOLESALE WAREHOUSE
165 (P.M.), QUEENS ROAD, PECKHAM, S.E.15
Tel.: NEW Cross 7143 or 0899

BODYBUILDING

For fast and permanent results in building a well-muscled physique, backed up by strength, stamina and speed, there is nothing to equal

MAXALDING

The individually planned courses are conducted by post to any part of the world and can be carried out successfully under all conditions of life.

FREE LITERATURE

Profusely illustrated with 200 photographic reproductions of pupils from 15 to 65 years of age, the explanatory literature will be sent without cost or obligation of any kind on request.

All Maxalding correspondence is mailed in sealed envelopes without any external advertising.

MAXALDING (P.1), SHEPHERDSWELL, DOVER, KENT



A teenage pupil showing control and development of the upper-back muscles.

SOLID LEATHER BLACK ARMY DESPATCH RIDERS BOOTS ONLY 25/-
NEW. Send 25/- plus 3/- post, handle on free 7 days' appro. Cash plus return postage refunded if not worth 66.6.0. Take to dealer for independent valuation. Full chrome leather of finest quality, calf length. Soles and heels of finest HEAVY LEATHER, sewn, pegged and riveted. By best makers, every pair bearing maker's name, which cannot be published. For M/Cyclists, Outdoor Workers, Riding, Fishing, etc. Ideal Jackboot. Sizes 5 to 8, 11 & 12. Unissued. Also LONG WHITE wool sea socks, only 7/6 pair. **LISTS FOOTWEAR.**

OFFICERS' 4in' MILITARY KAPOK FILLED LINING FULL LENGTH STORM COAT
These were limited issue for one short Arctic Convoy only. Full length Fawn Duck Stormproof coats. Specification: 1. Outer coat. 2. Separate inner proofing. 3. Woollen material part lining, plus. 4. Kapok filled lining quilted for complete heat insulation. Double breasted, waterproof, protection in rain, wind and cold. Neat, not bulky. High storm collar is wool cloth lined. Front double thickness windproof cuff sleeves, two large pockets. Ideal motorists, outdoor workers, motor cyclists, town or country. Reduced price 34 to 36, 39 11. 38 to 40, 5/- extra. 42 to 44, 10/- extra. Special 46, 63/- Post, 3/7. Less than a quarter of cost! **LISTS.**

FOR YOUR CONVENIENCE — EASY NO DEPOSIT INTEREST FREE DEFERRED TERMS ON ALL GOODS

RECORD PLAYER CABINET R.P.2

A beautifully styled cabinet. Made by a famous manufacturer. In polka dot cloth with clipped lid and carrying handle. Size 16 x 14 1/2 x 8 1/2 in. deep. Will take B.S.R. Monarch 4-speed Autochanger and 7 x 4 in. elliptical speaker and most of the modern portable amplifiers. All of which we stock. Send for FREE catalogue.



69/6

Carr. & Ins. 4/6.

EXTENSION SPEAKERS, 19/9



Polished oak cabinet of attractive appearance. Fitted with 8in. P.M. speaker W.B. or Goodmans of the highest quality. Standard matching to any receiver (2-5 ohms). Switch and flex included. Ins. carr. 3/9.

8in. P.M. Speakers, 8/9 (Post 2/6) 7 x 4in. Elliptical Speakers, 19/6 (Post 6 1/2 in. P.M. Speakers, 12/6 (2/6) 9 1/2 x 4 1/2 in. Elliptical Speakers, 22/6 (2/9)

DUKE & CO. (Dept. H.12.) 621/3, Romford Rd., Manor Pk., E.12. Telephone: ILF. 6001/3.

No fuses to bother with when you fit a magnetic switch to your 12-volt Train or Model supply and also Battery Charger. Cuts out at 2 amps. on overload or dead short. Easily fitted. 13/- P.P.
OUR WELL-KNOWN TRANSFORMERS. Input 200/240 v. Output tapped 3 to 30 volts 2 amps., or tapped 5.11.17 volts 5 amps. 24/6 each. P.P.
F.W. METAL RECTIFIERS. 12 v. 1 a., 7/6. 3 a., 13/6. 4 a., 17/6. 6 a., 27/6.
MOTOR CYCLE OR SCOOTER BATTERIES. 6 v. 10AH. Hard Rubber Case with cover. Size 5 x 5 x 1 1/2 in. Weight 3 lbs. 15/- P.P. Also ideal for model use.
RELAYS. We have large stocks of assorted types from 3/-.
LIGHTWEIGHT PENCIL BIT SOLDERING IRONS by famous maker. 200/240 v. 25 w. Indicator light in handle. (List price 24/6). 16/6. P.P.
KEY SWITCHES from 3/-. **TOGGLE SWITCHES.** DPDT, 3/6. **MICRO SWITCHES,** M and B, 5/6.
NICKEL NIFE BATTERIES. 1.2 v. 2.5 a., 6/-. P.P. 3 x 2 1/2 x 1 in.
ARMY MORSE KEYS, 3/-. **LIGHTWEIGHT H/R PHONES** 17/6. P.P.
OUTPUT MAINS TRANSFORMER AND RECTIFIER, 12 v., 1 a., 19/6. P.P. 4 a., 41/-.
W.W. RHEOSTATS. 12 v. 5 a., 10/6. 12 v. 1 a., 2/6. P.P.
SET OF 7 H/S TWIST DRILLS 1/16 to 1/2 in., 4/- P.P.

Post order only to:
THE RADIO & ELECTRICAL MART
29, STATION APPROACH, SUDBURY TOWN, WEMBLEY, MIDD.

HEADQUARTER and GENERAL SUPPLIES LTD.
(DEPT. PMC/50), 196-200, COLDHARBOUR LANE, LOUGHBOROUGH JUNCTION, LONDON, S.E.5. Open all Saturday. 1 p.m. Wednesday.

The ideal gift for all photographers who are seriously interested in obtaining the best results . . .

NEWNES COMPLETE AMATEUR PHOTOGRAPHY

Edited by M. LILLINGTON HALL

This is a book designed to help and interest every amateur photographer, from the casual snapshotter who is just beginning to learn, to the expert who is exploring new fields.

Completely up-to-date, it deals with all the newest and most exciting developments—colour (including processing and printing), stereo photography, "available light" photography, photomicrography, underwater photography, and many others.

CONTENTS

SECTION I—THE CAMERA AND HOW TO USE IT

By M. Lillington Hall, M.A.

Chapter

1. The Camera Lens
2. Shutters
3. Viewing and Focusing
4. Choosing a Camera

SECTION II—FILMS, EXPOSURE AND LIGHTING

5. Film Materials By T. L. J. Bentley, D.I.C., A.R.C.S., B.Sc.
6. Exposure By T. L. J. Bentley, D.I.C., A.R.C.S., B.Sc.
7. Exposure Aids By T. L. J. Bentley, D.I.C., A.R.C.S., B.Sc.
8. Light Filters By T. L. J. Bentley, D.I.C., A.R.C.S., B.Sc.
9. Artificial Lighting Equipment By R. W. Unwin, A.R.P.S.
10. Flashlight Photography By R. W. Unwin, A.R.P.S.
11. Electronic Flash By R. W. Unwin, A.R.P.S.
12. Exposure and Lighting for Colour Photography By M. Lillington Hall, M.A.

SECTION III—PICTURE MAKING

13. Pictorial Photography By Margaret F. Harker, F.I.B.P., F.R.P.S.
14. Composition in Colour By M. Lillington Hall, M.A.
15. Portraiture By Herbert Williams, F.R.P.S.
16. Indoor Photography by Available Light By Bernard Cuthbert, A.R.P.S.

17. Architectural Photography By Margaret F. Harker, F.I.B.P., F.R.P.S.
18. Night Photography By Bernard Cuthbert, A.R.P.S.
19. Action Photography By M. Lillington Hall, M.A.
20. Stage Photography By Lancelot Vining, F.I.B.P., F.R.P.S.
21. Telephotography By Gerhard Schwartz, A.R.P.S.
22. Underwater Photography By Norman Lewis, F.R.P.S.
23. Close-up Photography By Gerhard Schwartz, A.R.P.S.
24. Document Copying By Gerhard Schwartz, A.R.P.S.
25. Photomicrography By Douglas F. Lawson, A.I.B.P., A.R.P.S., F.Z.S., M.B.O.U.
26. Stereo Photography By the Marquess of Ely
27. Abstract and Trick Photography By Leonard Smith, A.R.P.S.
28. Technique with the Miniature Camera By Lancelot Vining, F.I.B.P., F.R.P.S.

SECTION IV—THE DARKROOM

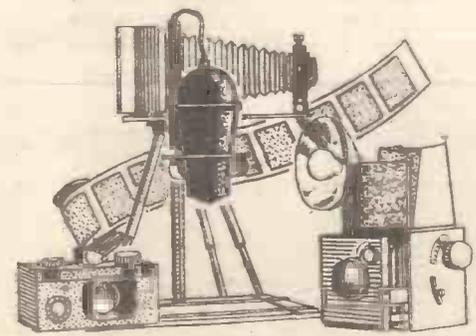
29. Darkroom Equipment By Val Drumm, A.I.B.P., A.R.P.S., M.B.K.S.
30. Developing the Negative By George L. Wakefield, F.I.B.P., F.R.P.S.
31. Negative Faults and Their Cure By George L. Wakefield, F.I.B.P., F.R.P.S.
32. Colour Developing By George L. Wakefield, F.I.B.P., F.R.P.S.
33. Printing By Val Drumm, A.I.B.P., A.R.P.S., M.B.K.S.
34. Enlarging and Projection Printing By Val Drumm, A.I.B.P., A.R.P.S., M.B.K.S.
35. After Treatment of Prints and Special Printing Processes By Val Drumm, A.I.B.P., A.R.P.S., M.B.K.S.
36. Colour Printing By George L. Wakefield, F.I.B.P., F.R.P.S.

SECTION V—SLIDES FOR PROJECTION

37. Making Slides By J. S. Waring, F.R.P.S., F.R.S.A.
38. Projecting and Viewing Slides By C. W. Long

APPENDIX

Notes on Clubs, Examinations, Competitions and Exhibitions, Bibliography, Index.



This entirely new work replaces the famous AMATEUR PHOTOGRAPHY (now out of print after nine editions).

30s. net
FROM ALL
BOOKSELLERS

or in case of difficulty use the C.O.D. Order Form on the right—

400 pages • 64 plates • 30s. net

ORDER HERE

Please send me Cash on Delivery one copy of

NEWNES COMPLETE AMATEUR PHOTOGRAPHY (30s. net)

Name

Address

Send no money now, simply complete and post this form to GEORGE NEWNES LTD., Tower House, Southampton Street, London, W.C.2. You pay on delivery, plus normal C.O.D. charges. (If you prefer not to pay charges send a remittance for 31s. 6d.)

P.M./December, 1959

NEWNES

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. Spearight & Sons, Exmoor Street, London, W.10. Sole Agents for Australia and New Zealand—Gordon & Gotch (A/asia), Ltd. Sole Agents for South Africa and Rhodesia—Central News Agency Ltd. Subscription Rate (including postage): For one year, Inland 20s., Overseas 18s. 6d., Canada 18s. 6d.

"Practical Mechanics" Advice Bureau. COUPON This coupon is available until December 31st, 1959, and must be attached to all letters containing queries, together with 6d. Postal Order. A stamped addressed envelope must also be enclosed. Practical Mechanics. December, 1959.

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.

| | |
|--------------------------|----------------------------|
| Acro. 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 | | |
| Costs & Accounts | Carpentry & Joinery | | |
| Surveying & Levelling | Building Inspector | | |
| Clerk of Works | Building Draughtsmanship | | |
| Quantity Surveying | Heating and Ventilating | | |

GENERAL, LOCAL GOVERNMENT, ETC.

| | |
|----------------------------|---------------------------|
| Gen. Cert. of Education | Common. Prelim. Exam. |
| Book-keeping (all stages) | A.C.I.S., A.C.C.S. |
| College of Preceptors | A.C.W.A. (Costing) |
| Woodwork Teacher | School Attendance Officer |
| Metalwork Teacher | Health Inspector |
| Housing Manager (A.I.Hsg.) | Civil Service Exams. |

BECOME A DRAUGHTSMAN—LEARN AT HOME AND EARN BIG MONEY

Men and Youths urgently wanted for well paid positions as Draughtsmen, Inspectors, etc., in Aero, Jig and Tool, Press Tool, Electrical, Mechanical and other Branches of Engineering. Practical experience is unnecessary for those who are willing to learn—our Guaranteed "Home Study" courses will get you in. Those already engaged in the General Drawing Office should study some specialised Branch such as Jig and Tool or Press Tool Work and so considerably increase their scope and earning capacity.



★ OVER SEVENTY YEARS OF CONTINUOUS SUCCESS ★

NATIONAL INSTITUTE OF ENGINEERING

(In association with CHAMBERS COLLEGE—Founded 1885)
(Dept. 29)

148, HOLBORN, LONDON, E.C.1

SOUTH AFRICA: E.C.S.A., P.O. BOX NO. 8417, JOHANNESBURG
AUSTRALIA: P.O. BOX NO. 4570, MELBOURNE

FOUNDED 1885 - FOREMOST TODAY

**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

(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.)

