• Making an Aqualung •

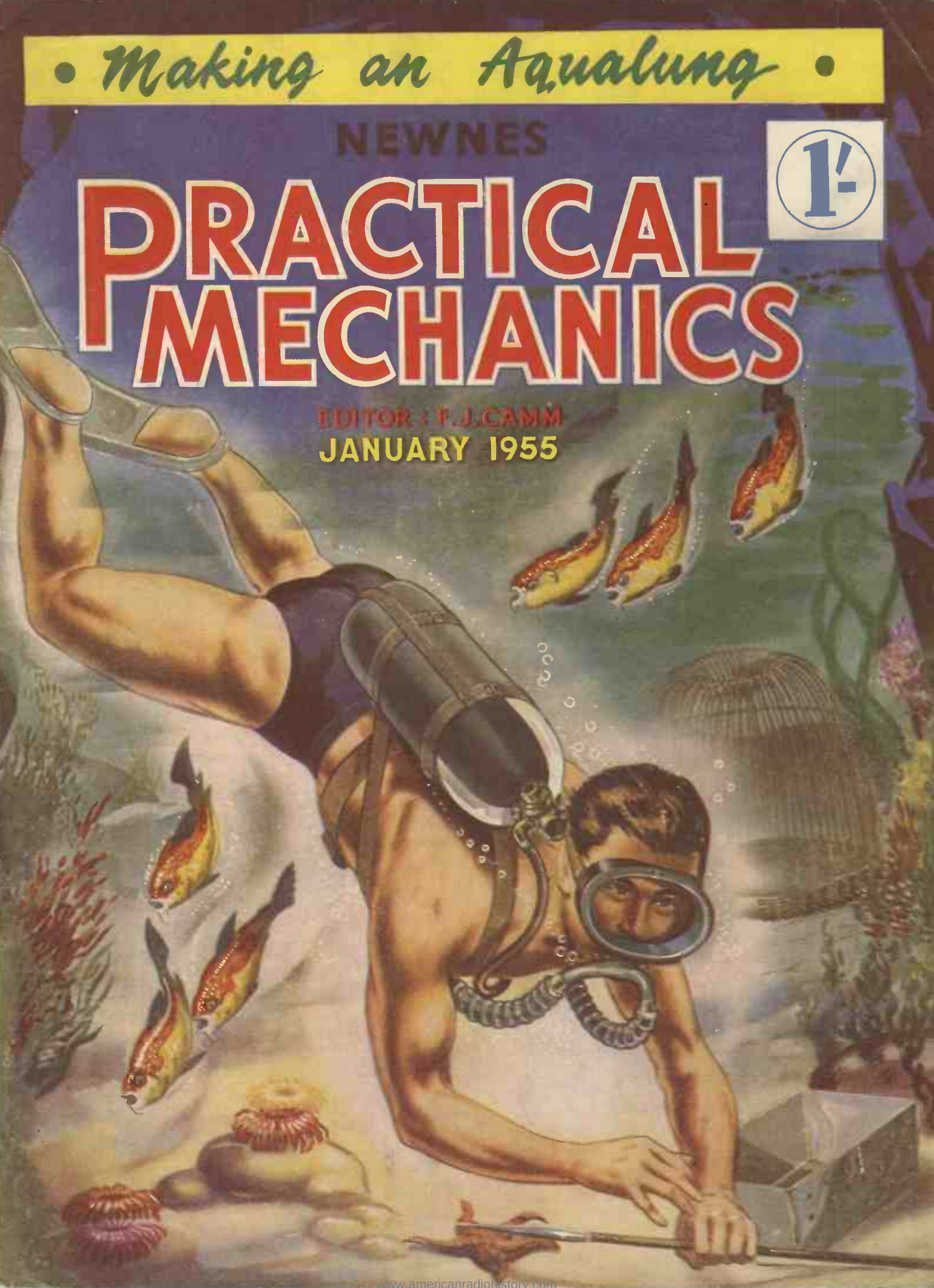
NEWNES

PRACTICAL MECHANICS

1/-

EDITOR : F. J. CAMM

JANUARY 1955



How's this FOR CONCENTRATED WORK LIGHT?

Down a little!

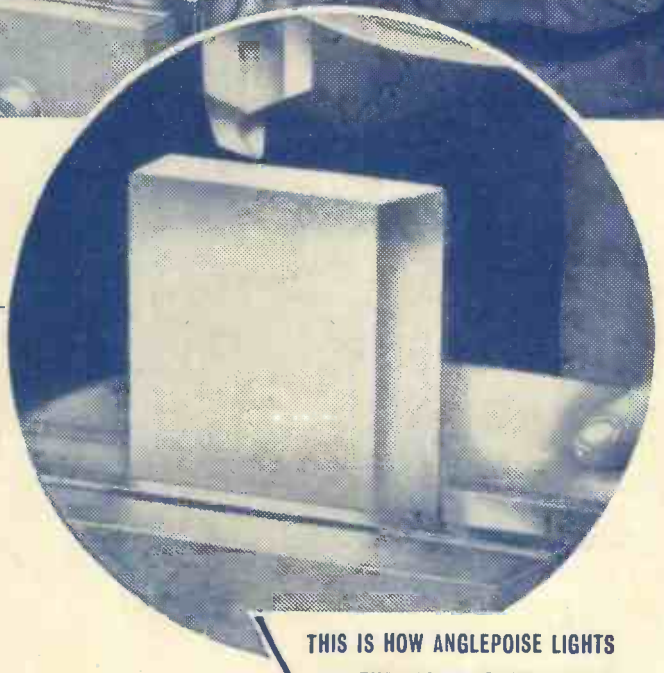
Still nearer!

Right on the job!

AN OPERATOR working under the best working conditions does a better job. Give your operatives ANGLEPOISE Lamps on their machines, it will pay dividends in accuracy and output. This lamp has everything—instant adjustability, throws a clear concentrated beam right on the work, 'follows' the job at a touch, takes and holds any required angle, moves out of the way as required.

Every drawing office, workshop and machine room should have its battery of ANGLEPOISE Lamps—why not yours? Send today for our fully descriptive Booklet P.M

Sole Makers: **HERBERT TERRY & SONS LTD**
REDDITCH • WORCESTER • ENGLAND

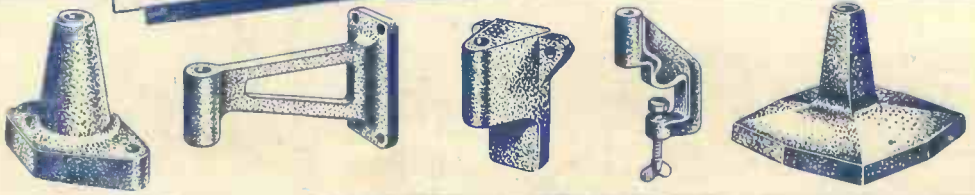


THIS IS HOW ANGLEPOISE LIGHTS UP THE JOB IN STRONG RELIEF— SAVING EYESTRAIN AND FATIGUE

TERRY ANGLEPOISE LAMPS

Pat. all countries

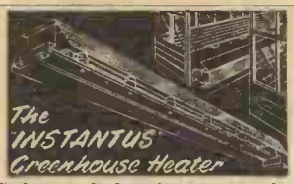
SOME ALTERNATIVE BASES FOR ALL MODELS



JMT8

ALLMAINS THREE

Build yourself a handy midget A.C./D.C. 3-valve mains receiver giving powerful reception over long and medium waves. All component parts, including valves, coils, resistors, etc., but not loudspeaker and cabinet (available if required) will cost you only 19/6 plus 1/6 post—data available separately 2/-, post free.



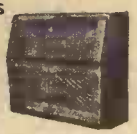
4ft. long made from heavy gauge sheet steel (galvanised). 1 kW, suitable A.C. or D.C. Price £2, or with thermostat £3.15.0. Note: The thermostat mounts separately and will control up to three heaters.

CRYSTAL SET

Two wave-band bakelite case, germanium crystal—gets "Home" and "Light" anywhere without batteries. 18/-. Headphones, 15/6 pair.

CABINETS

THE BUREAU



Beautiful cabinet elegantly veneered in walnut and finely polished. The control board, revealed when the front is dropped, is left uncut to suit your own equipment. Size approximately 30in. high, 32in. wide, and 16in. deep. Price 16 guineas—Carriage 12/6.

THE CONTEMPORARY

Also in the modern trend is this very stylish "G" Plan console. Veneered in oak with contrasting mouldings — control board again uncut—size 30in. x 15½in. Price £8.15.0, carriage, etc., 12/6.

2 TORCHES 2/6

Hand Lamp—takes twin cycle battery with switch and removable coloured discs for signalling. Round pocket torch with magnifying lens. 2/6 the 2.

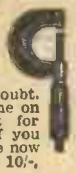
BE PREPARED for a cold winter by making our low cost Electric Blanket. 27 yards of special heater wire and blueprint, 20/-. Blueprint only 1/6. Alternatively make a Bed Warmer. Constructional data 1/6.

Complete kit comprises 40 watt control unit, starter lamp, lamp holders, clips and wiring diagram. Price, less tube, 22/6, plus 1/6 post. With tube, 30/-, plus 3/6 carriage.

"CHIMELITE"

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

1in. MICROMETER



Exceptional purchase enables us to offer a 1in. precision micrometer at the very low price of 10/-. A micrometer is an essential part of an engineer's equipment. You, no doubt, will have found the need for one on many occasions in the past for measuring wire gauge, etc. If you act quickly you can acquire one now at the remarkably low price of 10/-, post free.

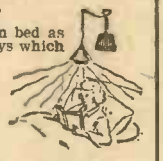
NOW A.C./D.C.

We can now offer a kit of parts suitable for making a multimeter to measure A.C. volts as well as D.C. volts, milliamps and ohms Price for kit containing all the essential items including moving-coil meter, metal rectifier, resistors, range selector, calibrated scale, etc. etc., is 19/6, plus 1/- post and packing. The D.C. only version is 15/- plus 9d. post and packing.

MAKING A CONVECTOR

250 elements—ideal for use with home-built convectors, towel rails, airers, etc. etc.—price only 2/6 each, post and packing 6d.

INFRAY LAMP



Means real comfort in bed as it emits Infra Red Rays which warm and keep you healthy.

● Economical. ● Costs only ½d. per hour (elec'y at 1d. per unit). ● Absolutely safe, no health or fire risk. ● Ideal for many other uses—over pet's basket, rearing pup, chicks, over desk, work bench, etc. ● All complete and ready to work.

Price 36/-
Post & Packing 2/-.

ELECTRIC CLOTHES HORSE

Warms room as it dries clothes, towels, etc.—stove enamelled rails—A.C. or D.C. 650 watts. Size 3ft. x 3ft. x 5in. Made to sell at 12 gns., fully guaranteed only £3.19.6. carr. 7/6.

CLEVELAND CAR BATTERY CHARGER

gives 1½ amps. charge — uses everlasting metal rectifier and robust double-wound mains transformer—in metal carrying case, with leads and croc. clips.

Price 6 volts 29/6, 6 or 12 volts 39/6. Post 2/6.

MAKE A RADIO

Using our parts in one evening you can make an all mains 4 valve radio with bakelite case, then you will be giving a £12 present which costs you only £5.15.0, or £2 deposit. (Carr. and insurance 5/-.) Data book 1/6.

WELDING TRANSFORMER

Totally enclosed and fitted High, Low and Off Switch. Intermittent output 4 volts 1,000 amp. continuous output 40 150 amp. Ideal welding, pipe unfreezing or as power unit for spot welder. Price £4.10.0. carr. and pack. 7/6.

A WONDERFUL CHRISTMAS PRESENT

Non-Mains absolutely safe Children of all ages enjoy playing records and will be overjoyed to own the fine portable illustrated alongside. This uses the Garrard spring motor and a 2-valve battery amplifier. The case is in two-tone imitation crocodile/lizard skin. Special price £9.17.6. carriage 7/6 extra.

ELECTRONIC PRECISION EQUIPMENT, Ltd.

Post Orders should be addressed to:
DEPT. I, RUISLIP, MIDDLESEX.

Personal shoppers, however, should call at any of our following branches:

42/46, WINDMILL HILL RUISLIP, MIDDX. *Phone: Ruislip 5780*
● **29, STROUD GREEN ROAD, FINSBURY PARK** *Phone: Archway 1049*
● **152/153, FLEET STREET LONDON, E.C.4.** *Phone: Central 2833*

and 249, KILBURN HIGH ROAD, KILBURN, LONDON, N.W.

IT IS EASY TO MAKE THESE LUXURIOUS ELECTRIC BLANKETS

★ NEW EXTENDED RANGE

DRAWINGS AND INSTRUCTIONS : for Single Heat Blanket. 60in. x 30in. Price, 1/6. Post Free.
Or with 27 yds. Heater Cable. Price, 20/-. Post Free.

DRAWINGS AND INSTRUCTIONS for Three Heat Blanket. 60in. x 30in. Price, 2/-. Post Free.

Or with 2 x 27yds. Heater Cable, 2 Temp. set thermostats, 1 3-Heat Switch, 18in. Triple, 23/36 Flex, and 3 yds. twin 23/36 Flex. Price, 45/-. Post Free.

For personal use, or as a much-valued gift, an electric blanket, is the ideal thing, and it's so much cheaper to make one from the materials we supply for it. When made, your blanket is equal in all respects to those costing many times more in the shops. Current consumption is negligible and the benefits it gives are beyond measure. Absolutely safe. Easy to make. This blanket is a boon to health and comfort.

DRAWINGS AND INSTRUCTIONS : for Single Heat Blanket. 60in. x 50in. Price, 1/6. Post Free.
Or with 30 yds. of Heater Cable. Price, 30/-. Post Free.

DRAWINGS AND INSTRUCTIONS : for Three Heat Blanket. 60in. x 50in. Price, 2/-. Post Free.
Or with 2 x 30 yds. Heater Cable. 2 Temp. set thermostats, 1 3-Heat switch, 18in. Triple Flex and 3 yds. twin 23/36 Flex. Price, 55/-. Post Free.

DRAWINGS AND INSTRUCTIONS : for Single Heat Heating Pad. 16in. x 12in. Price, 1/6. Post Free.
Or with 8 yds. of Heater Cable, 3 yds. twin 23/36 Flex, and ON/OFF switch, 2 Temp. set thermostats. Price, 22/6. Post Free.

DRAWINGS AND INSTRUCTIONS : for Three Heat Heating Pad. 16in. x 12in. Price, 2/-. Post Free.
Or with 2 x 8 yds. Heater Cable, 3 yds. twin 23/36 Flex, 18in. triple 23/36 flexible and 1 3-Heat switch. 2 Temp. set thermostats. Price : 27/6. Post free.

SUPPRESSIT

(TELEVISION SUPPRESSOR KIT)

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

REPLACEMENT ELEMENTS

FOR DOMESTIC ELECTRICAL APPLIANCES

We stock over 200 types of element replacements for Fires, Irons, Kettles, Hairdryers, Toasters, and Boiling Rings.

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

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

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

THERMOSTAT. PF. Room Thermostat. 15 amps., 250 volts A.C. 5in. x 1¾in. x 2in. A beautiful instrument. Temp. ranges 30/90, 40/100, 40/80, 60/100 deg. F. as required. £2/0/0, post 6d.

THERMOSTAT. BW/1. 3 amps. 250 volts A.C. For control of hot-plates, vulcanisers, etc. 50-550 deg. F. 15/6, post 4d.

We are only too glad to send illustrated leaflets on any of these Thermostats if you will send a S.A.E. stating which model interests you.

AMMETERS

Moving Iron. A.C./D.C. 0/5 amps., 1¾in. dial. Projection mounting. Price 18/-. Post 1/-. As above but 0/10 amps. Price 18/-. Post 1/-.

GREENHOUSE THERMOSTAT

Type ML. Constructed especially for the amateur gardener. The scale plate is calibrated "High-Medium-Low," and has a temperature range of 40-90 deg. F. Current-carrying capacity is 10 amps. 250 v. A.C. Differential, 4 to 6 deg. F. Dimensions : 4¼in. x 2in. x 1¾in. Price 35/-. Post 6d.

Model PI. Miniature Thermostat for control of domestic Electric Irons and special purpose machines where space is limited. Capacity : 5 amps. 250 v. A.C. ⅜in. x ⅜in. x 11/16in. Single screw fixing. Price 9/3. Post 3d.

Model SN/40. 1 amp. 240 v. A.C., 50-250 deg. F., 5/6. Post 3d.

FIRE BARS

No. 41. Bowed. 3in. x 9½in. 7/6 ea.
No. 42. Bowed. 3in. x 7½in. 7/4 ea.
No. 43. Bowed. 3½in. x 8½in. 7/6 ea.
No. 44. Bowed. 3½in. x 8½in. 7/6 ea.
No. 45. Flat. 3in. x 9½in. 7/6 ea.
No. 46. Flat. 2½in. x 7in. 7/4 ea.
No. 47. Bowed. 3in. x 9½in. 9/- ea.
No. 41. Suitable for Sunbeam, Revo, Belling, Dudley, Swan.
No. 42. Suitable for Small Revo and various types.
No. 46. Suits Belling, Brightglow.
No. 47. Suitable for Creda.

SPIRALS

No. 70.	Spiral,	1,500 w.	2/9 ea.
No. 70a.	Spiral,	1,000 w.	2/2 ea.
No. 70b.	Spiral.	750 w.	1/10 ea.
No. 70c.	Spiral,	600 w.	1/5 ea.
No. 70d.	Spiral.	500 w.	1/4 ea.
No. 70e.	Spiral,	200 w.	1/2 ea.
No. 70f.	Spiral,	100 w.	1/1 ea.

CAR HEATER ELEMENT
No. 87. 6in. x 1¾in., 200/250 v. 100 w. ... **6/3** ea.

ANEROID BAROMETER

AS SOLD FOR 5 Gns. YOURS FOR 5/- DEPOSIT

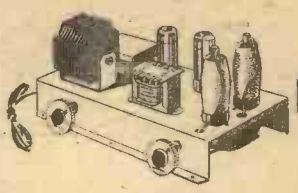
Balance by monthly payments of **11/-**

or 55/- CASH.

A well-made and accurate instrument of handsome appearance and great sensitivity. Offered at half the usual price. **BRAND NEW** and in perfect order. Make splendid gifts.

THE TECHNICAL SERVICES CO.

SHRUBLAND WORKS . BANSTEAD . SURREY.



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T.V. TUBES. 3 MONTHS' GUARANTEE

MAZDA CRM121-A-B, and a few other makes and types. Picture shown to callers, no catch. Not ex-W.D. Carriage and Insurance, 15/6 extra.

SPECIAL OFFER of tubes with burns or cathode to heater shorts. 30/-, plus carr.

AMPLIFIERS.—77/6, push-pull, 4 valve and rec. ; full tone range variable. Output 3-7-15 ohms ; matching. A.C. or Universal. Post 2/6.

AMPLIFIERS.—57/6. 4 watts, 3 valves. Switched tone range 3-5 ohms. Good quality. A.C. or Universal. Post 2/6.

AMPLIFIERS.—7/6. Ex-W.D., as new, complete with drawings and suggested uses (less valve). Post 1/6.

LADIES ONLY ! Treat the lady and yourself to a heated blanket for the home, 37/6 brings a complete heater kit that a lady can fit by herself *unaided*—with free drawings.

FIRESIDE "RIPPINGILLS" HEATER.—77/6. For the home, works or office. Although these are used ex-W.D. they have all been overhauled and work perfectly (paraffin). Carriage 2/6.

BURGLAR ALARMS.—3/9. Brand new, made by Truvox, in self-contained unit, consists of bell and trip device mounted in metal cover. Works off 4½ volt battery. Post 1/3. Battery for above, 1/6 incl. post. New Ever Ready.

12" T.V. TUBES £5

SPOTLIGHTS.—8/6. Butlers, new ex-W.D., 7¼in. dia., 6¼in. deep. Pre-focus fitting. Post 1/6. Bulbs for these lamps : 6 volt, 36 or 48 watt, and 12 volt, 30, 36 or 48 watt. 4/6 each, post free.

H.T. BATTERIES.—1/9. All-dry + L.T. 1½ volt. min. ; 40 volts. 60 volt + 1½ volt All-dry at 3/9. 67½ volt personal portable type at 3/9. 60 volt at 3/9. Post on H.T. batteries 1/9 each.

V.H.F. RECEIVER.—6 valve. 17/6, ex-W.D., new condition ; 6-channel switching. Receives T.V. sound, police, fire and amateurs. 30.5 to 40 mc/s., I.F. 7 mc/s. Post 2/6. Drawings and conversion data for this 1124 set FREE with each set.

NICKEL CHROME WIRE, 2/6 each spool, in tins of .014 at 50 yds., and .032 at 25 yds. Post 6d.

VALVES from 1/9 each.

Catalogue for (2½d.) STAMP ONLY, please.

VERSATILE!

Make spray painting a pleasure and obtain that professional finish by using a B.E.N. Model IM Spray Gun.

The Model IM is a pressure feed internal atomising spray gun designed to handle a wide variety of finishing materials such as oil paints, cellulose and synthetics, distempers, plastic emulsion paints and all kinds of insecticides and fungicides.

Requires only 2 cu. ft. of air per minute and can be used with even the smallest compressor.

Send for Publication CB.109 giving full details.

BEN MODEL **IM** SPRAY GUN

B. E. N. PATENTS LTD. (Division of Broom & Wade Ltd.) P.O. Box No. 10, HIGH WYCOMBE, BUCKS.

HIGHSTONE UTILITIES

Soldering Irons. Our new streamlined iron is fitted with a Pencil Bit. 200/250 v. 50 watts, 11/6, post 6d. **Standard Iron** with adjustable bit, 200/250 v., 60 watts, 13/6, post 6d. **Heavy Duty Iron**, 150 watts, 16/6, post 8d. All parts replaceable and fully guaranteed. **Small Soldering Irons**, for use on gas, 1/4 post 4d. Resin-cored solder for easy soldering 6d. packets or large reels 5/-, post 9d.

Ex-R.A.F. 2-valve (2-volt) Microphone Amplifiers as used in 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 with partitions to hold amplifier, 2/- extra. Ditto, less valves, 10/-.

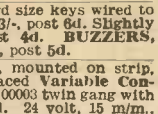
Sparking Plug Neon Testers, with vest-pocket clip, 3/3, and with gauge, 3/6, post 3d. **S.B.C. Neon Indicator Lamps**, for use on mains showing "live" side of switches, etc., 3/6, post 4d. **Neon Indicator**, complete with condenser (pencil type), with vest-pocket clip, indispensable for electricians, etc., 7/6, post 5d.

Bell Transformers. These guaranteed transformers work from any A.C. Mains, giving 3, 5, or 8 volts output at 1 amp., operate bulb, buzzer or bell. Will supply light in bedroom or larder, etc. PRICE 9/-, post 8d. **Similar Transformer** but with output of 4, 8 or 12 volts, 12/6, post 10d. **Transformer** with similar output, but with fused secondary and earth terminal, 18/-, post 1/-. BELLS for use with either the above or batteries, 6/6, post 6d. **"Big Ben" Chimes.** Housed in Cream Plastic Case. Easily connected to give Two-Note Chime from Front Door, and Single Note from Rear. Operated from 6-9 volt Batteries or Transformer (shown above), 21/2, post 1/-.

Crystal Sets. Our latest Model is a real radio receiver, which is fitted with a permanent crystal detector. Why not have a set in your own room? 12/6, post 8d. Spare Permanent Detectors, 2/- each. When ordered separately, 2/6. With clips and screws, 2/10, post 3d. Headphones, brand new, S. G. Brown, G.E.C., etc., 23/-, and super-sensitive, 30/- a pair, post 1/-.

Headphones in Good Order, 6/-. Better quality, 7/6 and 10/-. Balanced armature type (very sensitive), 13/6. All post 1/-. **New Single Earpieces**, 3/6. Balanced armature type, 4/6 (two of these will make an intercom. set). Ex R.A.F. earpiece, 2/6, all post 4d. **Headphones** with moving coil mike, 15/-. Similar phones with throat mikes, 12/6, post 1/-. **Headphone Cords**, 1/3 a pair, post 3d. **Replacement Bands**, 1/3, post 4d. **Wire Bands**, 6d. **(All Headphones listed are suitable for use with our Crystal Sets.)**

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



Black & Decker ¼in. Drill (as illustrated). Universal A.C. or D.C. motor, fully suppressed against interference, £5.19.6, post 2/6. **B. & D. 5in. Sander Polisher**, as above, but the addition of side handles makes it an ideal tool for waxing and polishing cars, furniture and floors, sanding to remove paint or rust, etc., £8.7.6, post 2/6, or complete with sander and polishing kit, which includes ¼in. chuck for drilling, lambswool bonnet and pads, polishing and sanding discs, £9.17.6, post 2/6. **B. & D. Lathe** for use with either of the above, £5.5.0, post 2/6. **B. & D. Bench Stand**, for use with either drill or sander, £3.7.6, post 2/6.

Morse Keys.—Standard size keys wired to work Buzzer or Lamp, 3/-, post 6d. Slightly smaller keys, 2/6, post 4d. **BUZZERS**, 3/9, or heavy duty, 4/6, post 5d.

Terminals, brass 2BA, mounted on strip, 6d. pair. .0005 Airspaced **Variable Condensers**, 2/6, post 4d. .00003 twin gang with trimmers, 2/6, post 4d. 24 volt, 15 m/m., **M.E.S. Bulbs** for model railways, etc., 1/- each, 10/- doz., post 4d. **Wander Plugs**, Brass, 1/6 doz., post 4d. **Fuses.**—1 amp., 1¼in., packet of 10, 2/6, post 3d. Also 150 mA. and 250 mA., same price. Ex-G.P.O. Telephone **Twin Bells**, with box, 5/-, post 1/-. **Single Telephone Bell**, 3/6, post 6d.

Bargain Parcels, of really useful equipment, containing Switches, Meters, Condensers, Resistances, Phones, etc., 10/-, or double assortment, 17/6 ; treble 25/-. All carriage 2/3. This country only.

Meters. 20 amp. 2¼in. m/i, 12/6. 15 v., 2¼in. m/c., 9/6 ; 150 v., 2in., m/c., 10/- ; 3.5 amp., 2in., T.C., 6/- ; 4 amp., 2¼in., T.C., in case with switch, 9/6 ; 100 mA. 2in., m/c., 7/6 ; Meter Units containing 2-500 microamp. movements, 7/-, post 1/-.

Money refunded if not completely satisfied.

HIGHSTONE UTILITIES

58, New Wanstead, London, E.11

Letters only.

New Illustrated List sent on request with 1½d. stamp and S.A.E.

Black & Decker ELECTRIC TOOLS ON EASY TERMS

UTILITY

5in. PORTABLE SAW ATT. FOR USE WITH ¼in. DRILL.

CRAFTSMAN'S LATHE AND ¼in. DRILL.

Build up your home workshop stage by stage on easy terms. The ¼in. drill shown drills, polishes, sands and grinds and can be used with the vertical stand & lathe, besides other attachments. Write for free full catalogue and easy terms schedule.

	CASH PRICE	Deposit	8 Mthly of
¼in. Drill	£5.19.6	14/8	14/8
¼in. Stand	£3. 7.6	8/3	8/3
Craftsman's Lathe	£5. 5.0	12/10	12/10
5in. Portable Saw Att.	£3. 5.0	8/-	8/-
Lathe Saw Table	£2.15.0	6/9	6/9
¼in. Drill	£12. 7.6	30/3	30/3
¼in. Stand	£5.10.0	13/6	13/6
5in. Sander/ Polisher ...	£8. 7.6	20/6	20/6
5in. Sander Polisher Kit ...	£9.17.6	24/2	24/2
¼in. Drill Kit ...	£11.17.6	29/1	29/1
Disc Sanding Table Att. ...	£1.12.6	3/11	3/11
6in. H.D. Saw ...	£17. 5.0	42/2	42/2

When ordering please send Cash Price or Deposit and state Mains Voltage. All items are post free.

THE "I & G" UNIVERSAL SAW

Fits any electric hand drill. Will Jig saw, Cross cut, Rip Saw, Hack saw, etc. Complete with attachments and two extra saw blades. Send for leaflet.

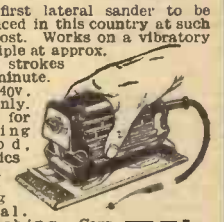
NO Vibration —Robust —Light

Cash Price **49/6** Post Free.

OR EASY TERMS if purchased with any BLACK & DECKER equipment, 6/- deposit and 8 monthly instalments of 6/-.

THE AMAZING "I & G" LATERAL SANDER-POLISHER!

The first lateral sander to be produced in this country at such low cost. Works on a vibratory principle at approx. 12,000 strokes per minute. 200/240v. A.C.only. Ideal for sanding Wood, Plastics and burnishing metal. Polishing Cars, Furniture, Leather, Silver, etc. Complete with flex, sandpaper and polishing cloth.



75/- Post Free.

1" PRECISION MICROMETER

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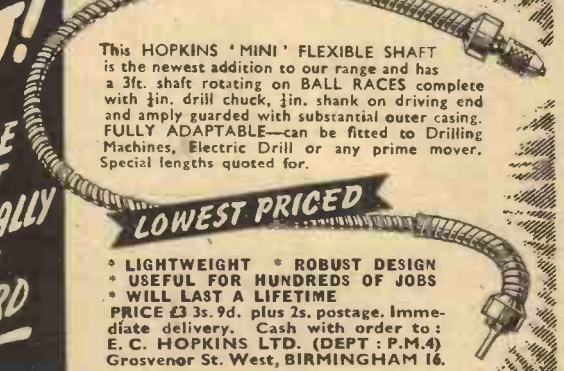

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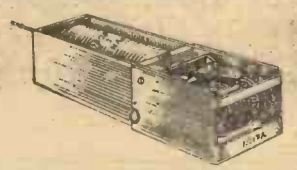

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VOL. XXII. No. 253 Editor: F. J. CAMM JANUARY, 1955

Under-water Swimming

FIRST popularised during the war, when Frogmen were able to steal under water up to the hull of an enemy ship and blow it up, under-water swimming is now practised in almost every country in the world. The growing interest in this country and particularly among readers of this journal is responsible for the appearance in this issue of constructional details for under-water swimming apparatus. It may be practised by swimmers of only average ability, and it opens up a new world to those interested in aquatic life.

It is true that in this country it may only be practised for about a third of the year, but the numbers taking up the new sport have increased almost daily, and sub-aqua clubs have been formed to encourage the sport and for an interchange of experiences among those of kindred interests. As far as I am aware this journal is the first in this country to publish constructional details of an aqualung. The contributor responsible for the design has had long experience of the sport, which opens up great possibilities for marine study.

The Development of Technical Education

THE Chancellor of the Exchequer, speaking at the 292nd Anniversary Dinner of the Royal Society in London, said that massive plans for the development of technological education are in hand. That is all to the good, but I should have been more impressed had he also announced similar plans for a revival in the love of craftsmanship which was existing up to the beginning of the present century and which made this country a leading industrial power. Indeed, we trained the craftsmen for the world and now we are short of them. I have long held the view that the stress today is too much on technical education and too little on the manual crafts; factories are top heavy with those who have obtained their B.Sc. degrees, but who could not operate a simple machine. In fact technical education, in my view, is proceeding on the wrong lines. It trains the brain only and not the hands. I am fortified in this view by the opinion

FAIR COMMENT

By

The Editor

of some leading British industrialists, a few of whom admit that there is room for the science graduate in industry. A larger number shake their heads at them.

Before the war the country spent about £3,000,500 on civil research as against £20m. today. The Imperial College in London is to be developed and there are "huge projects" of development proceeding in Manchester, Glasgow, Leeds and Birmingham. There is no shortage of technicians, but there is a shortage of skilled craftsmen, and I suggest that it is time the Government gave a lead in this direction. The City and Guilds of London Institute does a great deal, but it needs more funds and greater encouragement.

Canada's Flying Saucer Project

THE Canadian Minister of Trade, Commerce and Defence recently stated that Canada worked for 12 months on a flying saucer project. They took it beyond the drawing-board stage, but although nearly £34m. was spent on development and experimental work it never left the ground and it never reached a stage ready for a test flight. He doubts whether any country in the world has a flying saucer, and so do I.

The Canadian saucer was oval shaped. Since publication of various articles on the subject in this journal I have received many letters from reliable witnesses who have seen weird objects. One of my contributors, Mr. C. J. Williamson, of Scalloway, Shetland, sends me a report of what he and his wife observed in the sky over Scalloway in the spring of 1942. "We were up on the hill overlooking sea level, when a bright object seemed to drop earthwards towards the houses of the town. When it appeared inevitable that it would strike earth it swerved and, mark, without a pause, went off at right angles to its path of descent. It vanished out over the sea in a matter of a few seconds. In fact, the whole apparition held the view for only a matter of perhaps four or five seconds.

"My first impression was that I was observing the descent of a meteorite in daylight, but the complete right angle turn at the end rules such a phenomenon out. My wife's impressions were similar to my own. The strange object was very bright and reflected the brilliant sunshine with the same degree of reflectivity as one gets from sunshine on the chromium fittings of a motor car. As you will understand, it was entirely impossible to attribute a shape to the object owing to this dazzle which made it just a blob of flashing brilliancy.

"I should like to report another incident. In 1933 there fell a fireball of exceptional brilliancy over the Shetlands. It lit up Shetland, Orkney, Caithness and even the Faroe Islands and Western Norway. A Mr. King who was then working with the B.A.A. and myself gathered full reports of its passage, speed and end point.

"I noted, in an odd sort of way, that this apparition fell on the night that the planet Mars passed closest to the earth. The date was March 5th, if I remember correctly. I did not attach any significance to this happening, but merely noted it.

"At the date of the next Martian opposition a flaming ball fell again on the night of nearest approach and again at the next opposition if my memory does not fail me.

"I wrote an account of the falling meteorites at Martian opposition time and deposited it with the Union Bank of Scotland, Ltd., Lerwick, Shetland, where it lies safely even now."—F. J. C.

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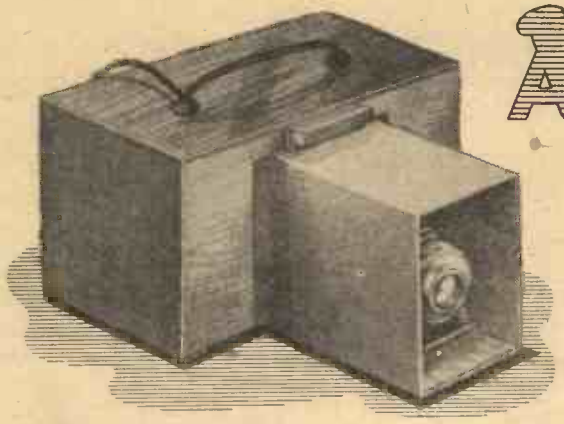


A Reflecting Enlarger

A Method of Construction Which Dispenses with the Use of Condensers

By H. A. ROBINSON

IN making any enlarger, getting an absolutely even flood of light over the negative is of paramount importance.

A condenser gives an even flood at once, but to be fully satisfactory this must be considerably larger than the negative in question and can become a very bulky and expensive item.

The enlarger described here, however, needs no condenser or ground glass diffuser, and solves at once the problem of even lighting over a good area. The principle used is reflection.

The general idea of a reflecting enlarger is shown in Fig. 1. The lamp-house (A) contains two equal powered bulbs which throw their light on to the plain white surface (B). In front of this and shielded from direct rays from the lamps is the negative (C), which is thus illuminated solely by *reflected* light from the surface (B). Beyond the negative comes the lens (D) and further out still the usual easel (E).

A reflecting enlarger is particularly simple and inexpensive to construct, especially as one's own camera can be made to supply the enlarging lens. A loose lens, however, can be incorporated.

Construction

Start with the lamphouse. This is a box 12in. × 6in. × 7½in., as Fig. 2, made up of two sides 12in. × 7in., two end-pieces 7in. × 5½in., and base and top 12in. × 6in. For the sides, base and top ¼in. wood is used, but ⅜in. for the ends. The sides overlap the ends and the base and top overlap the sides and ends. Several small diameter screws are put in at each place of joining. For the moment the top is left off.

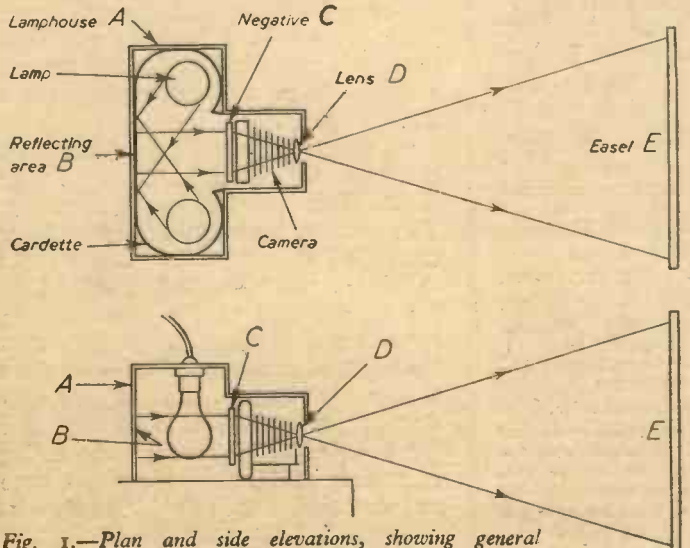


Fig. 1.—Plan and side elevations, showing general principle of the reflecting enlarger.

At the mid-front, and at a level equal to that of your camera lens when standing open, take out the aperture (a) equal in size to the negative from which enlargements will normally be made, i.e., 2¼in. × 3¼in., 2¼in. × 2¼in., etc. Cut it vertically for 2¼in. × 3¼in., and other rectangular shapes.

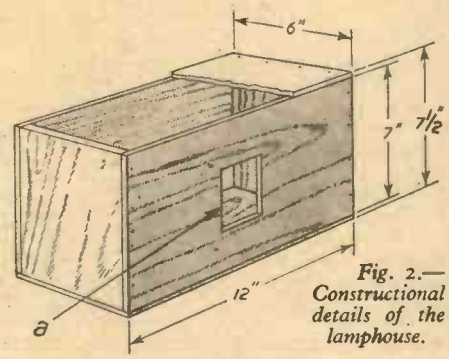


Fig. 2.—Constructional details of the lamphouse.

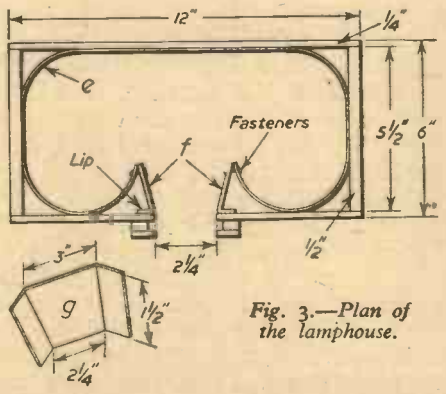


Fig. 3.—Plan of the lamphouse.

Now obtain a strip of white cardette, 2ft. 6in. long and 7in. wide, also two strips of stiffish card, 7in. × 2¼in. Make a ¼in. lip on each of these latter by scoring and bending over one of the longer sides. Glue these strips as (f) on each side of the opening inside box, see Fig. 3. The strips have to make "wings" set at about 15 deg., and they are fixed at this by gluing in two spacers cut and bent as (g), one at the top and the other at the bottom. These are also of card.

The strip of cardette is now sprung into position as (e), its outer ends being fastened to the outer edges of the (f) pieces by several ordinary two-pronged paper fasteners. Locked together thus, cardette and strips sit very firmly in the box, the area of cardette right in front of the aperture lying flat against the back.

Making the Lid

At positions shown in Fig. 4, bore two holes of just sufficient size to take the tops of the kind of lamp-holder that finishes in a ⅜in. constant-diameter cylinder. The tighter the tops are in the holes the better. Wire the holders in parallel and insert them in position as in Fig. 4 (E). The holders with their bulbs (100 watt pearl) can be adjusted a little by pushing up and down, which is handy to get maximum brilliancy. When the correct position is found the holders are locked by winding insulating tape round where the holder tops and wires enter the wood. If in the correct position the holder rings are tight up to the lid so much the better.

Finally, put a torpedo switch in the flex at some suitable point and an adapter to go in a light socket at the farther end.

If all has gone well the lamps will drop nicely into the bays made by the reflector

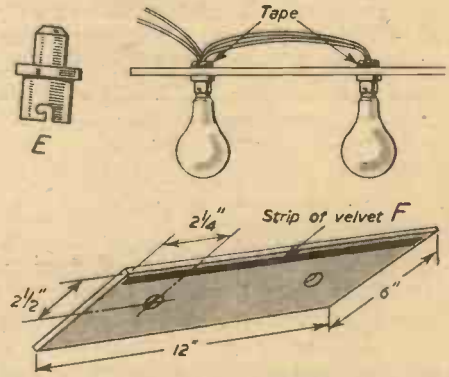


Fig. 4.—Details of the underside of the lid and the lamps.

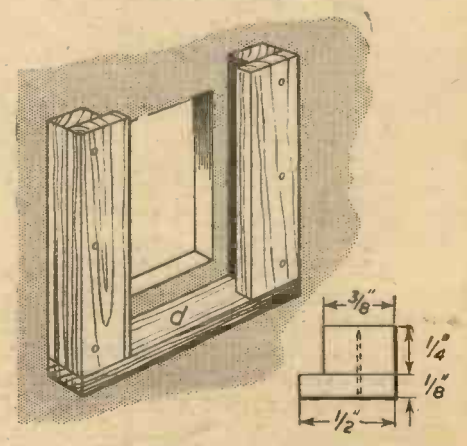


Fig. 5.—The guides for the negative carrier.

card, and screws into the end pieces secure the lid in position. No light must escape forward and if the top seam is doubtful a strip of velvet should be glued along the under side of the lid, ¼in. from the edge as in Fig. 4 (F). This will give all the baffling necessary.

Before finally fitting the lid, there is a little more to do to the box, for guides set either side of the opening (a) are needed to take the negative carrier. They are made up of two strips of 3¼in. wood as in Fig. 5, the one ¼in. thick and the other ⅛in., their widths being ⅜in. and ¼in. respectively. Three screws each holds them to the box front. A single strip (d), not lipped, goes horizontaly at the bottom. For 2¼in. × 3¼in. film the guides are set 3¼in. apart.

The Negative Carrier

Fig. 6 shows the sandwich that holds the negative without glass. It is two rectangles of 1/10in. card, 3¼in. × 6in. (again for 2¼in. × 3¼in. films) with a 3in. × 2in. opening taken out near the bottom of each. The cards are held together by a hinge of thin cloth (silk would do) fastened on the inside, as (m).

Two pieces of paper (k) are glued by their

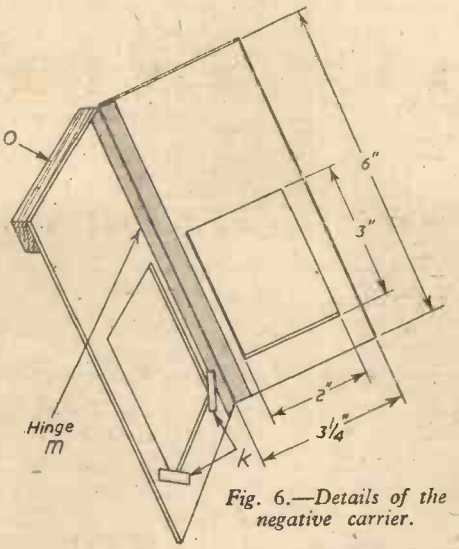


Fig. 6.—Details of the negative carrier.

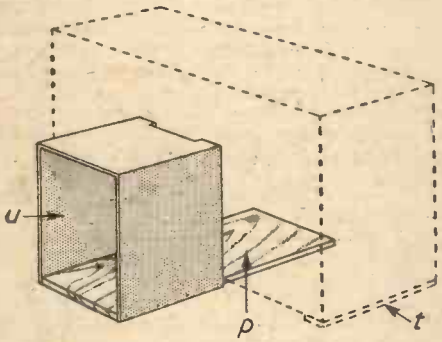


Fig. 7.—The shield for the camera.

ends across the lower corners of the opening to give two small pockets into which the points of the film are pushed to prevent slipping while the carrier is being inserted. Lastly, put the strips of wood (o) along the top of one half of the carrier which is to help easy inserting and pulling out. Fasten with several short pins and glue.

Required now is the shield (u) Fig. 7, which just fits over your own particular camera when standing, as close round the top and sides as possible.

This is the part of the design which allows a photographer to use his own instrument, and as size has to be to suit the special conditions no absolute dimensions can be given. The shield, however, is bent from a single length of fairly stiff card of about 1/10in. or ⅛in. thickness—its lower edge being fastened by several short screws to a ¼in. strip (p), and the top back edge cut away to take the negative sandwich. The ¼in. strip is 12in. long and wide enough to just fit between the sides of the shield.

The lamp-house is screwed on to the other end of (p), two pieces (t) then being fastened at the ends of the box, of the same height as (p) to give steadiness.

The seam between the card and box front is completed with wide tape glued into position and blackened, which prevents light leakage, and holds the card shield firmly. The tape is shown in Fig. 8.

Using the Enlarger

The camera is set in the covered way with its back off and lens open at "time." Focus on an easel set in front is obtained by sliding the whole instrument in and out a little. After focusing, the light is switched off and the exposure made, when the sensitive paper is in position, by switching on the light again for the requisite number of seconds.

Should your camera not be a type that can be readily used, then a loose lens can be used, by still building the projecting cover as 7, and then making a second cover as (y) Fig. 8. This has no base or back and just fits over the first, the lens (level with the negative) being put through an aperture in front and held there by its flange, or screwed in.

The cover is made of a ¼in. top and front with thinner sides, all held together by lines of sprigs. Its lower edges slide on a wider version of (p), the first shield (u) now being secured to separate rectangle (w), which is then fastened to the longer piece below.

This "chocolate box lid" arrangement is quite efficient, letting no light forward and being quite a good substitute for bellows.

An easel for the printing paper can be made with a whole plate printing frame secured

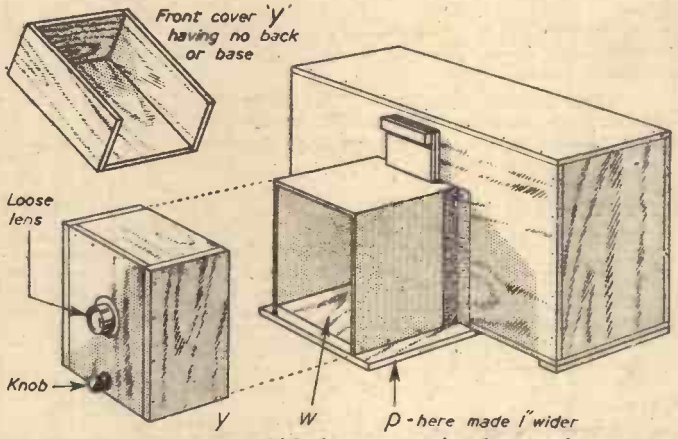


Fig. 8.—An arrangement which does not require the use of a camera.

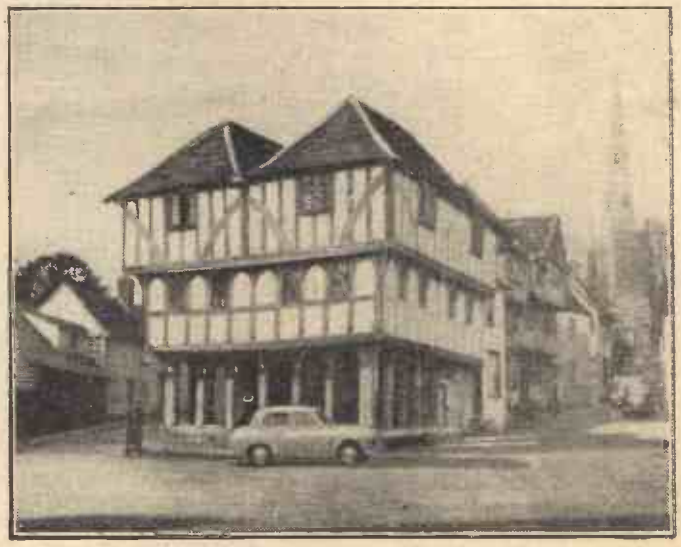
upright to a base by an angle iron, and with its back made into one piece by a cross strip, and hinged at the bottom so that it falls outward as one unit.

A final point. It has been said that no stray light must escape forwards towards the easel with its sensitive paper. Have a good look from the front and see if any does appear to escape round your camera. If it does put a sheet of card over the front of the shield as a baffle with an opening for the lens taken out of it. With the "chocolate box" method no stray light can possibly make its way to the easel.

A Fine Model

Mr. Marsh's model.

THE two photographs below help to show the remarkable degree of accuracy which can be attained in architectural modelling. The model of the old Market House at Thaxted is used as a book-end and was made some years ago. It is made up of over 300 separate pieces of timber, while the white panels are actually solid plaster; the roof and chimney are protected by a cement compound. The modeller was Mr. C. Marsh, of Bolton, Lancs, and it took a year to build.



The old Market House at Thaxted, Essex.

An Agitator for the Gas Wash Boiler

A Useful Device for Construction by the Home Handyman

By L. S. JORDAN

THE unit described below was made up during the war when electric washing machines and the like were unobtainable. Though somewhat crude in construction, it proved quite effective and considerably reduced the manual work involved during the weekly wash. Whilst readers will probably be able to suggest many refinements, the description given is of the unit as it was actually made.

The unit, as shown in Fig. 1, consists simply of a wooden cover, which fits in place of the normal hinged lid of the boiler, on the underside of which is a wooden paddle operated by means of the handle on the top side. The sectional view shown in Fig. 2 will make the construction quite clear.

The Cover

This is constructed, as shown in Fig. 3, from well-seasoned beech, planed on both sides to approximately ¾in. thick. The cover itself is shaped to fit into the shallow recess on the boiler top normally occupied by the hinged lid. The cross-batten on the underside of the cover is made a good fit in the boiler top so that the unit remains firm whilst in use.

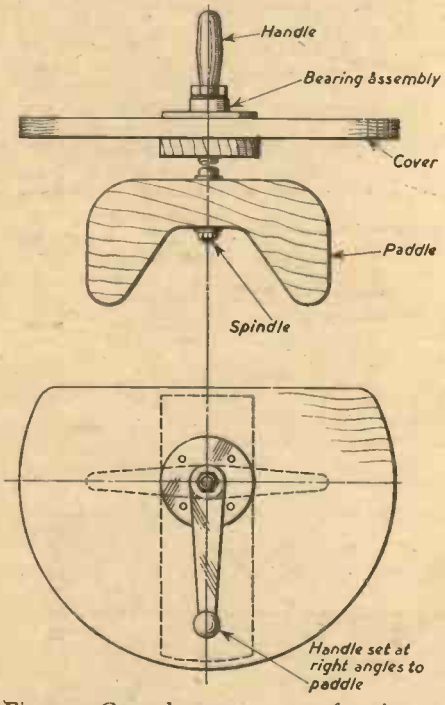


Fig. 1.—General arrangement of unit.

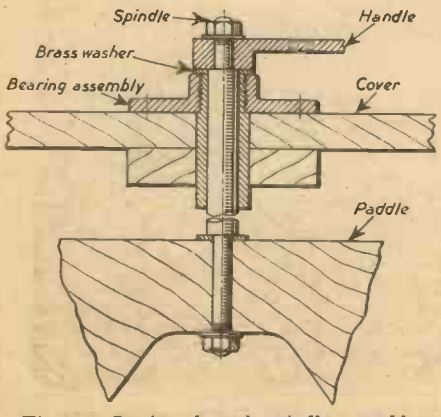


Fig. 2.—Section through spindle assembly.

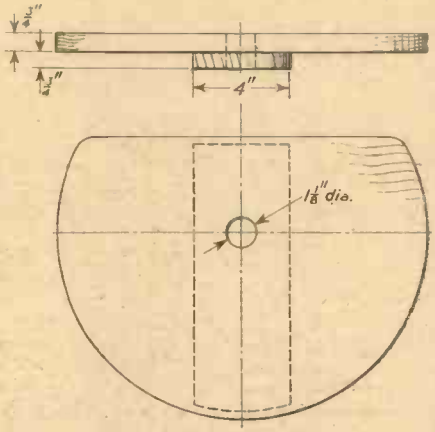


Fig. 3.—The cover.

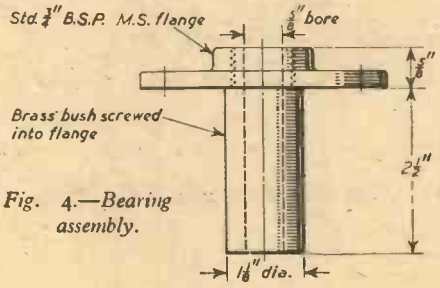


Fig. 4.—Bearing assembly.

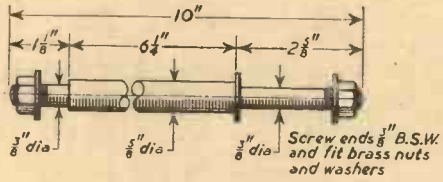


Fig. 5.—The spindle.

Through the lid, at a point coinciding with the centre of the boiler, a hole is required, 1⅛in. diameter, to suit the bearing bush.

The Bearing Assembly

This is constructed from a standard ¾in. B.S.P. mild steel flange drilled for four countersunk screws, into which is screwed the brassbearing bush, as shown in Fig. 4, the bush being bored so as to be an easy running fit on the spindle.

The spindle is made from a piece of ⅜in. diameter stainless steel bar, fitted where shown in Fig. 5 with brass nuts and washers. Each end is to be screwed ⅜in. B.S.W. for approximately ¾in.

The Handle

Shape this from a piece of ⅛in. mild steel plate and weld on a boss. The wooden handle is nothing more or less than an ordinary file handle drilled right through and counterbored at the top for the fixing screw. Details are shown in Fig. 6.

The Paddle

As shown in Fig. 7, this is cut and shaped from a piece of well-seasoned beech, 1¼in. thick, with the central hole a tight fit on the spindle. After shaping, the paddle requires careful finishing with glasspaper to remove all rough edges.

Assembly

After all parts have been carefully checked over and the rough edges removed, they should be assembled as shown in Figs. 1 and 2, the bearing assembly being secured to the cover with four countersunk brass screws. Having set the handle at right angles to the paddle, these must then be securely tightened up.

It is advisable to put the unit into use, first, when boiling overalls or the like, in order to boil out any juices, etc., from the wooden parts. After allowing to dry thoroughly, the whole unit, with the exception of the paddle, can be given two coats of a heatproof and waterproof paint in order to give it a more presentable appearance.

In use it will be found that the best results are obtained when the handle is moved backwards and forwards through approximately 120 deg.

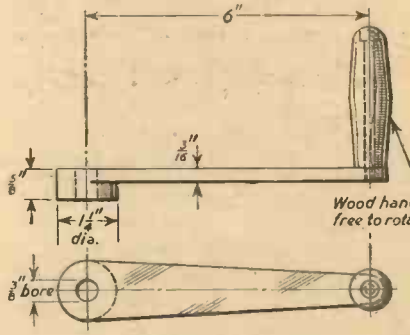


Fig. 6.—The handle.

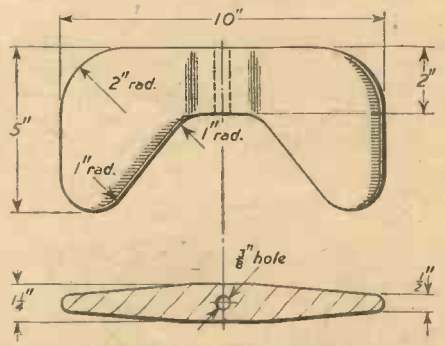


Fig. 7.—The paddle.

An AUTOMATIC Interval timer

An Instrument for the Wireless-photographic Enthusiast

By B. LUMB

THIS timer will principally appeal to other wireless-photographic enthusiasts and is designed to eliminate the drudge of hand switching the enlarger every time an exposure is to be made. To use, one simply dials the time required and presses the re-set button. The light will then automatically go out at the end of the chosen interval. To focus the negative a by-pass switch is provided which allows the light to be on as long as required; this feature is also useful when composing the scene in the masking frame.

The principle is that of charging up a capacitor through a resistor. Referring to Fig. 1, a negative voltage is applied to R.C. The voltage across C will exponentially rise in a time dependent upon the time constant of C.R. As the voltage across C rises, in a negative sense, the grid of the triode will follow it and thus the anode current will be continually falling. If a sensitive relay is inserted in the anode circuit, then at some definite time after the bias has been applied the current through the relay will fall sufficiently to de-energise it.

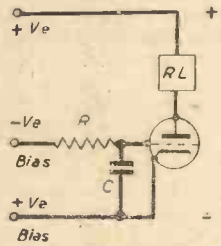


Fig. 1.—The principle of charging up a capacitor through a resistor.

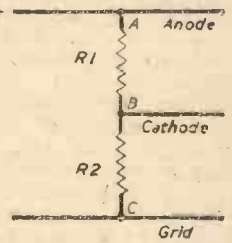


Fig. 2.—How the bias is derived from a potentiometer.

A separate bias supply is not necessary, as it is derived from a potentiometer across the H.T. supply. Fig. 2 illustrates the principle. Resistors R1 and R2 are placed across the H.T. source. Now B is negative with respect to A, the anode point. B is taken to the cathode. C is also negative with respect to B, so that if it is taken to the grid the desired result has been achieved, that is making the grid negative to the cathode.

Fig. 3 shows the final evolved circuit. All valves are miniature B7G types, the EF91 being strapped as a triode, but normal-sized types may be used if desired. Again a valve rectifier has been used in the original model, but a metal rectifier may be substituted. The stabiliser V2 has been added to counteract the effect of varying mains voltages, but if the reader is fortunate enough to have an unvarying mains supply, then it, and its associated limiting resistor (R2), may be omitted.

The relay used has three pairs of contacts, one heavy duty

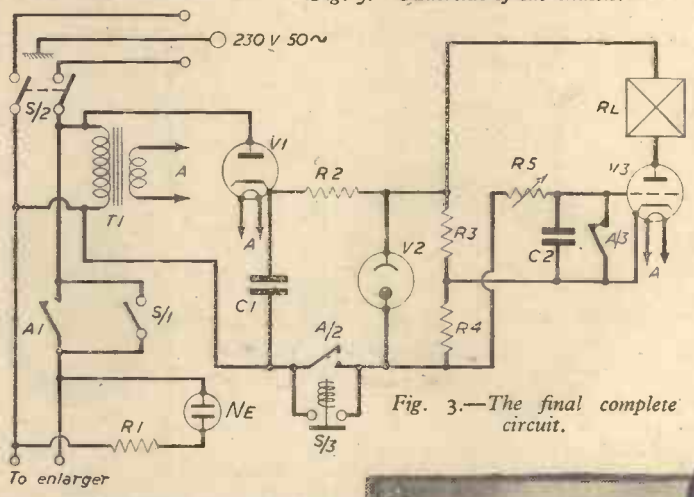


Fig. 3.—The final complete circuit.

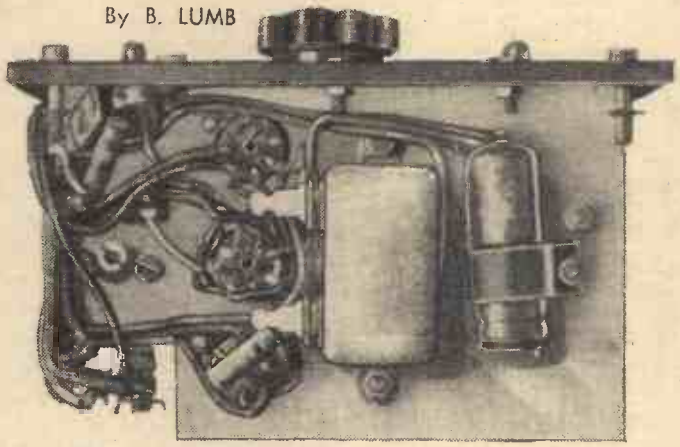


Fig. 5.—Underside of sub-chassis.

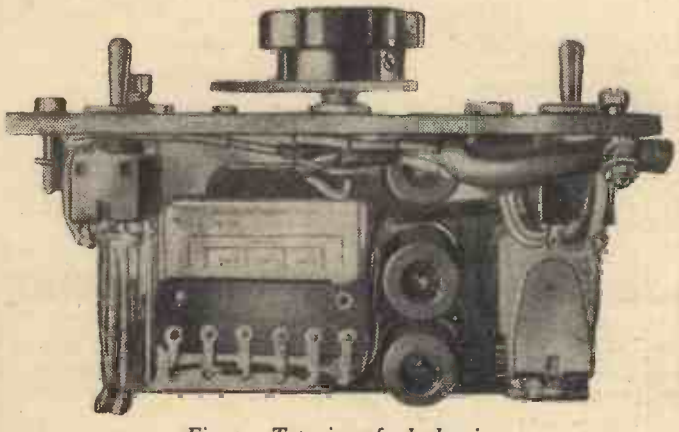


Fig. 4.—Top view of sub-chassis.

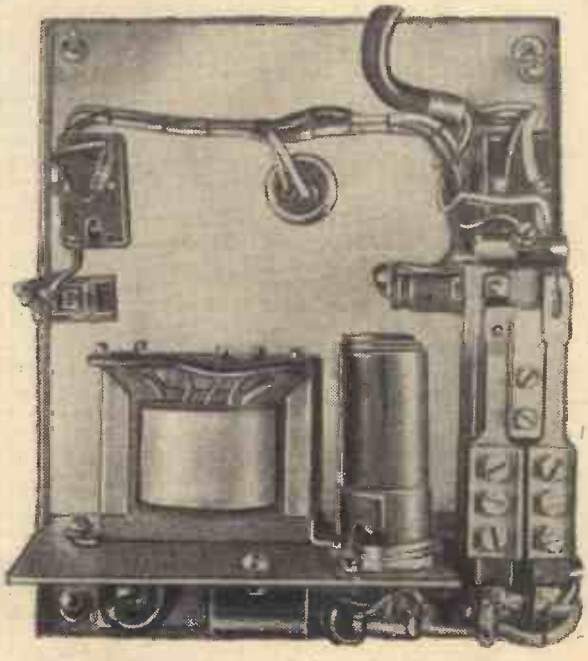


Fig. 6.—A general view of the underside of the cover.

make, one normal make and one break. When the push button S3 is pressed, H.T. negative is applied to the cathode of V3 and the relay will be energised. Heavy duty contact A/1 completes the circuit to the enlarger, A/2 is a self-holding contact so that it is unnecessary to keep S3 depressed and A/3 removes the short across C2. When the cycle is complete and the relay breaks, then A/3 will short circuit C2 and so completely discharge it ready for the next operation. The author was fortunate enough to have in his possession a surplus relay, reference 10FO/1205, having a coil resistance of 42,000 ohms; however, any coil down to about 2,000 ohms should prove satisfactory in operation.

LIST OF COMPONENTS

S1	...	S.P.S.T.
S2	...	D.P.S.T.
S3	...	Push-button
T1	...	6 volt 1 amp.
R1	...	470 kΩ (½ watt)
R2	...	10 kΩ (½ watt)
R3	...	100 kΩ (½ watt)
R4	...	4.7 kΩ (½ watt)
R5	...	3 MΩ variable
RL	...	42,000Ω coil (2 make, 1 break)
C1	...	0.25 mfd., 400 v. working
C2	...	25 mfd., 25 v. working
NE	...	G.E.C. (M.B.C. fitting)
V1	...	EY91 Mullard
V2	...	SM95 Cossor
V3	...	EF91 Mullard

C1 is a reservoir capacitor and although it has a low value it is sufficient to give the necessary H.T. level to operate the stabiliser.

The miniature neon forms a useful check when calibrating as well as indicating when the timer is in operation, and bromide paper is insensitive to its light. The whole unit was built into a compact box and the wording added using transfers.

The range using the constants given is 0-20 seconds, which is ample with the enlarging lens used. It may be extended if desired by adding resistors in series with R5 via a suitable switch, the value of the resistors being of the order of megohms. A higher resistance potentiometer could be used, but the scale would become too cramped at the lower end. A note of warning here: the time constant of R5, C2 may not be used to calculate accurately the timing of the circuit as the value of the bias used, and the break current of the relay contribute towards the final timing. However, once fixed, the timing is perfectly constant.

In conclusion the unit has been in operation for six months and has given completely trouble-free service.

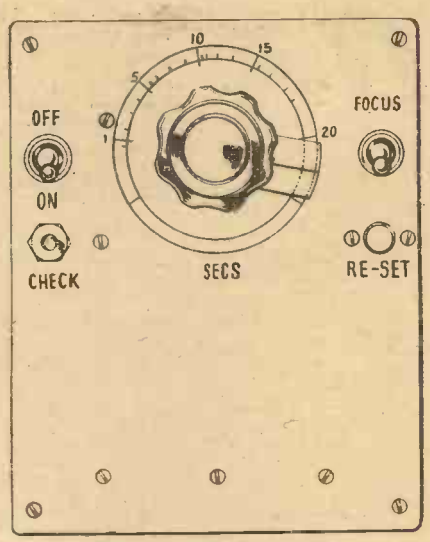


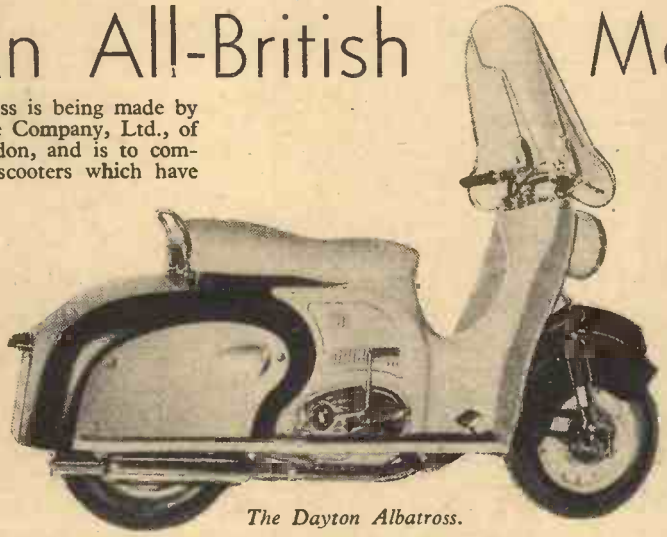
Fig. 7.—The front panel.

An All-British Motor Scooter

THE Dayton Albatross is being made by the Dayton Cycle Company, Ltd., of Park Royal, London, and is to compete with the foreign scooters which have remained unchallenged on the British market for four years.

The Albatross was first conceived by Dayton's joint managing director, Mr. Frederick Durman. The prototype was successfully tested at Goodwood in May and the first production machine was completed last October.

Unlike other scooters on world-wide sale, the new British Albatross is big and fast. It has a pressed steel body with rubber-treaded running boards, and large leg-shields.



The Dayton Albatross.

Although ideal as a runabout, it is designed from the start-as a comfortable long-distance, two-seat tourer with a high cruising speed. It is powered by a 225 c.c. Villiers two-stroke engine and it is claimed that it can cruise all day at 55 to 60 m.p.h. The top speed is over 65 m.p.h. and the petrol consumption more than 80 m.p.g.

An unladen weight of 280 lb. gives a power to weight ratio of 1.2 lb. per c.c. The engine is cooled by air ducts.

Among the luxuries of the Albatross is a car-type facia panel complete with 70 m.p.h. speedometer, ammeter, key-operated ignition switch, separate lighting switch and a choke-control knob. In front of the panel is a big, 7in. Miller headlamp.

Aircraft-type 6in. Alfin brake drums are fitted to a motor scooter for the first time and another unusual feature is the luxurious suspension system; there are Earles-type forks in the front and swinging arms at the rear.

Large wheels contribute to the Albatross's unusually comfortable ride; split rims and pull-out wheel spindles enable wheels and tyres to be quickly removed from the machine and also from each other.

The Albatross uses the latest British equipment and is one of the simplest machines to drive and maintain. Even greasing is unnecessary because bonded-rubber bearings are used throughout the frame assembly.

Deliveries to distributors will begin in a few weeks and the price of the Albatross, which has nearly twice the speed and power and most of the "extras" of its Italian and German competitors is £152 5s. 0d. Purchase tax brings this up to £182 14s. 0d., on the home market. Windscreens and luggage grids are available as extras.

The following is a brief specification :—

Engine :

Villiers Mk. 1H 225 c.c., single-cylinder two-stroke. *Bore :* 63 m.m.; *Stroke :* 72 m.m.; *Carburetter :* Villiers type S.25; *Lubrication :* Petrol mixture.

Gearbox :

Villiers four-speed positive-stop, in unit with engine; *Primary transmission* to four-plate clutch by pre-stretched endless chain running in oil bath chaincase; *Gear selection :* by rocking pedal on right-hand side; *Overall gear ratios :* 4.7, 6.2, 8.93 and 14.38 to 1.

Frame and Forks :

Single-tube spine construction frame, approximately S-shaped to provide underslung cradle for engine; four engine-mounting points; swinging-arm rear suspension; Earles-type front fork; two telescopic suspension units (combined hydraulic damper and helical spring) at front and rear.

Wheels :

Pressed-steel with split rims, equipped with 4.00 by 12 Dunlop tyres; alloy hubs; pull-out spindle for quick wheel detachment.

Brakes :

Internal expanding; 6in. Wellworthy Alfin (light alloy bonded to steel liner), finned drums front and rear.

Electrical System :

Ignition, flywheel magneto. A.C. current from magneto is passed through selenium-type rectifier to convert to D.C. current for charging six-volt battery; 7in. Miller headlamp; Miller combined stop and tail lamp; electric horn.

Equipment :

Saddle : sponge rubber, leather-covered dual seat. *Tank :* two gallons, filler beneath saddle. 70 m.p.h. speedometer; ammeter; key-operated ignition switch separate from lighting switches; panel choke control and conventional motor cycle handlebar controls.

Finish :

Two-colour enamel—dark blue and pastel blue-grey; dark green and stone.

Dimensions :

Overall length : 76in.; *wheelbase :* 52in.; *ground clearance :* 6in.; *saddle height :* 29in.; *weight :* 280 lb.; *power to weight ratio :* 1.2 lb. *per c.c.*

Any further information may be obtained from the manufacturers—the Dayton Cycle Co., Ltd., Park Royal Road, London, N.W.10.

Home-made Fishing Tackle

A Series of Articles Describing the Construction of Various Types of Fishing Rods and Reels

5.—A Competition Rod

By C. W. TAYLOR, M.I.E.T.

THE modern match angler is usually keen to have tackle which is best suited to his task, and among his tackle should be found a special lightweight rod with a sensitive action in the tip.

The design requirements usually call for a rod with a total weight of a few ounces, rigid for most of its length, with a fast-striking action in the tip. These requirements generally necessitate a considerable amount of work on the part of the rod builder, and in order to obtain rigidity plus lightness thin-walled timber of comparatively large size is used for both butt and middle joints.

In some expensive rods the correct wall thickness is obtained by boring out the joint timber, and as previously explained, a good deal of work is involved.

The following article deals with a 12ft. three-joint rod and entails, perhaps, the least amount of work for this type of rod.

The Rod Timber

Butt joint: $\frac{7}{8}$in. diameter Spanish reed, 48in. long.

Middle joint: two pieces of timber spliced together: one piece Spanish reed $\frac{7}{8}$in. diameter, 40in. long; one piece Tonkin bamboo, 9/16in. diameter, 10in. long.

Top joint: two pieces of timber spliced together: one piece Tonkin bamboo $\frac{5}{8}$in. diameter, 16in. long; one piece built cane tapering 3/32in. to 3/16in. wide across the hexagon flats, 32in. long.

Spanish reed is a thin-walled fragile material, very light in weight, and is eminently suitable for butt and middle joints of long and light rods. It can be obtained from rod-material suppliers.

Tonkin bamboo is a tougher, heavier material and is useful for rod joints in smaller sizes.

The built cane top is made by the process described in the first article of this series in the September, 1954, issue. The flat to be planed on the former tapers from 1/16in. wide to 7/64in. in a length of 32in.

The Joint Ferrules

In order to keep the weight down, many competition rods are not fitted with metal joint ferrules. Such rods have the ends of the joints carefully whipped to prevent splitting of the bamboo, and a simple timber to timber joint is used. Light metal joint ferrules can, however, be made using duralumin tubes. The two ferrules of each complete joint should be turned to an accurate push-fit, and the ends which go on the bamboo or reed should be turned to about .020in. wall thickness for about a $\frac{1}{2}$in. length (see Fig. 2). This reduced portion is later whipped tightly to the rod timber.

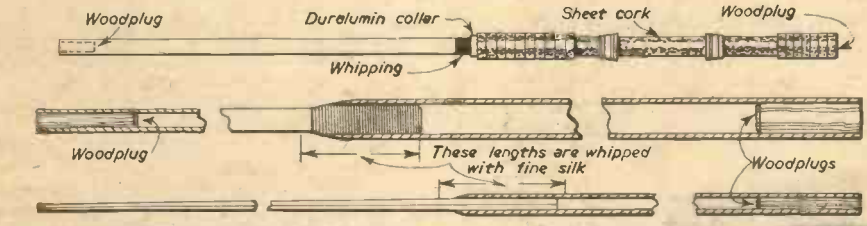


Fig. 1.—The three joints showing the unshaped cork handle and the top and middle joint splices.

The Handle Fittings

A set of fittings are required for the cork handle; these consist of a collar, winch rings, butt cap and rubber button, and were shown in previous articles. The fittings for this rod handle should be in duralumin, and these can be bought at many tackle shops. Those readers who have a lathe will be able to turn their fittings, but it should be remembered that the winch rings are a sliding fit on the cork handle and it will, therefore, be necessary to obtain first a good idea of the diameter of the finished cork handle.

The Line Rings

On all good rods the line rings or runners should be the type that stand away from the joint; earlier types are now obsolete. The tip ring and the butt ring should be lined with agate or substitute, or porcelain. It is advisable to fit a large butt ring about $\frac{5}{8}$in. or $\frac{3}{4}$in. diameter bore for use with a fixed spool reel. The tip ring should be as light as possible and may be either a swan neck or Hopton ring. The line rings are shown in Fig. 3.

The Butt Joint

Both ends of the 48in. length of Spanish reed are temporarily whipped with thread for about 3in., and two plugs of light wood (obechi or hard balsa are ideal) 2in. long are turned or filed to a snug fit in the ends of the reed. The plugs are then glued in the ends of the reed. "Casco" cold-water glue is used throughout this work.

The 22in. cork handle is made partly with short lengths of cork bored $\frac{3}{4}$in. diameter and partly with 1/16in. sheet cork. Both may be obtained from rod-material suppliers. This method of making the handle is adopted because, owing to the fact that the butt reed diameter is $\frac{3}{8}$in., a handle made entirely of short lengths of cork would be too thick and clumsy.

A pencil mark is made 22in. from the bottom end of the reed and the temporary whipping is removed when the glue on the plug has set. The first 6in. of the handle is then built by glueing in position on the reed some of the short lengths of cork. These should be about $1\frac{1}{4}$in. outside diameter and $\frac{5}{8}$in. long. Thus about 10 corks will be

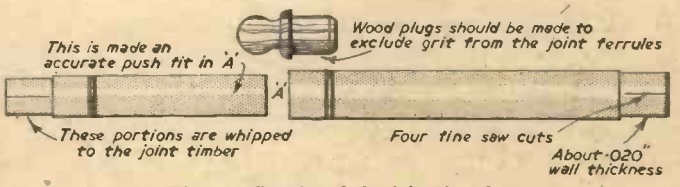
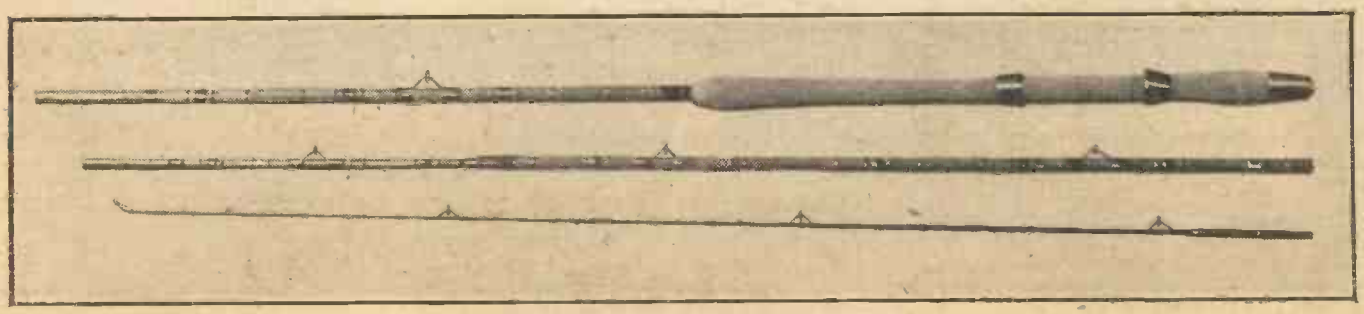


Fig. 2.—Details of the joint ferrules.



A competition rod of the author's own make.

required for this portion and about seven corks for the other end of the handle.

The piece of sheet cork should be 12in. long and this must be carefully cut to width so that when wrapped round the reed the longitudinal edges butt closely together and are practically invisible.

The reed is then coated with glue, the cork is wrapped round and bound tightly to the reed with a binding of ½in. wide tape.

The winch rings will slide along the sheet cork portion of the handle, and when the glue has set and the tape binding has been removed, the winch rings should be fitted, followed by the remaining seven corks for the lower end of the handle.

The corks at both ends of the handle are next shaped with a file and sandpaper to receive the collar and butt cap, and these two fittings can next be glued in position.

If the duralumin ferrule has been specially bored to suit the end of the reed, everything is straightforward. In the case of other joint ferrules or tubes, one must be chosen which is slightly larger than the reed, since the latter must not, in any circumstances, be

Fig. 3.—The line rings.

reduced in diameter. A slightly larger ferrule is made to fit by putting on the reed a whipping of thread or silk of a suitable gauge. The whipping is soaked in Casco glue and this is allowed to set hard. This procedure is used where necessary on all the joints.

Having fitted the ferrule, the reduced portion is tightly whipped down with thread.

The Middle Joint

The piece of ¾in. diameter Spanish reed is considered first. A temporary whipping is put on each end of the reed for about 3in., and a 2in. long wood plug is made as before to fit snugly in the end which will join the butt ferrule. The plug is glued in position.

We can now consider the short piece of 9/16in. diameter Tonkin bamboo. The larger end of this piece is to fit into the end of the Spanish reed for a length of 2in. and is built up, if necessary, to the bore diameter of the reed by a suitable whipping soaked in glue. The other end of the Tonkin bamboo is next temporarily whipped and into the bore is glued a 2in. long hardwood plug. None of the wooden plugs mentioned up to this point

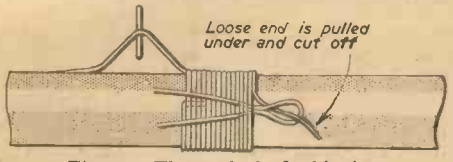


Fig. 4.—The method of whipping.

should fit so tight as to cause splitting of the reed or bamboo.

When the glue has set the joint ferrules may be fitted in the manner previously described, using, if necessary, a suitable whipping soaked in Casco glue to build up the diameter to suit the ferrules. *The timber must not be reduced* to suit a smaller size ferrule !

Having fitted the ferrules at both ends of the joint, the reduced portions should be tightly whipped down with thread.

The temporary whipping at the splice should be removed when the glue has set, and the end of the reed is filed off to a neat taper, as shown in Fig. 1. A permanent whipping of fine silk is then put over the splice.

The Top Joint

The two pieces of timber are spliced together in a similar manner to the middle joint. Both ends of the piece of Tonkin bamboo are temporarily whipped and the slightly larger end, which receives the ferrule, is plugged with a hardwood dowel 2in. long.

The larger end of the built cane can, if necessary, be whipped as before to ensure a good fit in the bamboo. The two pieces are then glued together.

When the glue has set the temporary whipping is removed ; the bamboo is neatly tapered down to the built cane, and a permanent silk whipping 2in. long is put over the splice.

The duralumin ferrule is next fitted and tightly whipped to the bamboo.

Whipping the Timber and Rings

Spanish reed should be whipped at close intervals (about every inch) for strength, and for this work and for whipping the rings to the rod, a fine grade silk or " Sylko " should be used. The method of whipping is shown in Fig. 4, and was also shown in previous articles. Each whipping should be " fixed " and made smooth by applying clear cellulose varnish or French polish, and with the finger pressed on the whipping the rod joint is rotated. This sticks down the fine hairs which would otherwise spoil the appearance of the whipping when the final coats of varnish are applied.

Fig. 5.—The appearance of the finished rod, showing the ring spacing.

It is suggested that nine rings are used for the rod, five on the top joint, three on the middle joint, and one on the butt joint. The spacing is indicated in Fig. 5.

Finishing the Rod

The rod should be finished by applying two or three coats of copal varnish. To obtain a good finish on the rod, dust must be avoided, and the use of a closed room which is not often used is an advantage. A large empty cupboard in which the varnished joints can be stood up, will also prevent dust settling and spoiling the appearance.

The brushes used for varnishing the rod should always be washed clean and dried *before* applying the varnish since brushes are one of the many sources of dust.

New Automatic Steering Device

SOMETHING entirely new in automatic steering devices has been introduced by The Marconi International Marine Communication Co., Ltd. It is a compact, simple but highly-efficient " electronic helmsman," designed particularly for small craft such as yachts, drifters and trawlers, although larger vessels with powered steering can also make use of it. It does not depend on a gyro-compass installation for control, but merely on a small magnetic and high-frequency electronic assembly powered by a 12 volt or 24 volt battery or from 110 volt D.C. mains. Once the ship is set on her course the device may be switched on and will then hold her " as she goes," firmly correcting any tendency to yaw, whatever the cause.

Electronic Light

GENERAL SARNOFF, chairman of the board of the Radio Corporation of America, said recently that the discovery of electronic amplification and conversion of light will enrich life for all. A first benefit from this research will be bigger and brighter television pictures in the home. The TV tube of today will eventually be eliminated and will be displaced by a thin, flat screen like a picture on a wall, or perhaps a portable easel-like frame to stand on the living-room table.

The pictures would be controlled from a little television box no bigger than a jewel case or a cigar box, no cabinet being required. The television box will contain all the controls —tuning, volume, light, station selector—and a knob will enable the image to be made larger or smaller, and in black-and-white or in colour to suit the eye and mood.

Electronic light will also provide substitutes for present types of light used for illumination and the electronic light amplifier may be expected to lead to devices which will make vision possible in darkness. These will add greatly to the safety of our transportation. The perils of night driving, too, are likely to be reduced.

G.E.C. Magnetic Sorting Bridge

THIS instrument enables non-destructive tests to be carried out on ferrous samples and is particularly suitable for use in the aircraft and automobile industries as well as in other branches of engineering.

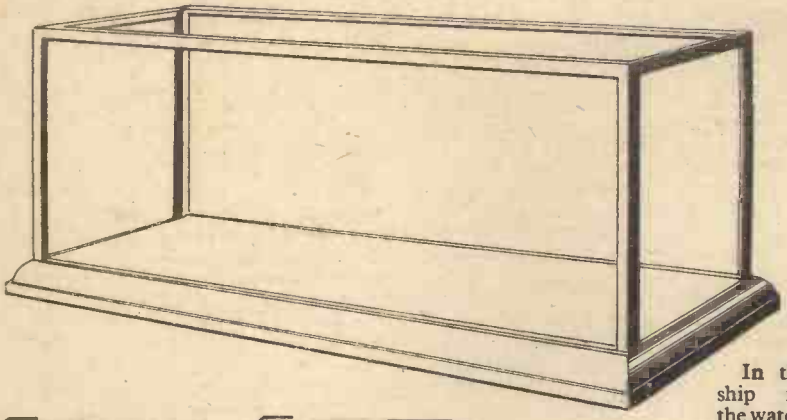
The sample under test and a known standard component are both subjected to a varying magnetising force, and the instrument is arranged so that any difference between the resulting hysteresis effects obtained from the two samples is displayed on a cathode ray tube. Since the hysteresis effect is linked directly with the chemical composition, hardness and other characteristics of a ferrous sample, this procedure enables ferrous metal parts to be tested rapidly and completely against a known standard.

The Fairey Delta 2 which is to investigate the characteristics of flight and control at transonic and supersonic speeds in level flight. It is powered by a Rolls-Royce Avon turbo-jet engine.

SHOWCASES for MODELS

Their Construction and Finishing, with a Note on the Choice of Wood

By E. W. TWINING



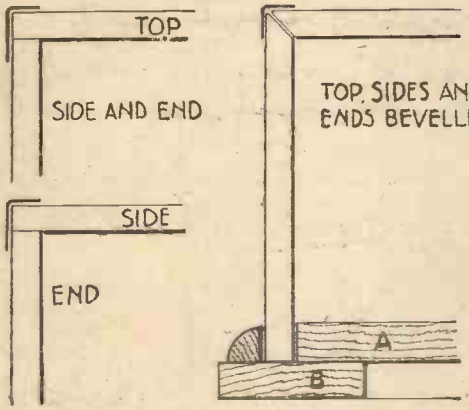


Fig. 1 (Above and Left).—A very small showcase.

THERE can be no questioning the fact that all models worthy of the name should be protected equally from dust, damp and from unauthorised and meddlesome fingers. At the same time, whilst they are so protected they need to be properly displayed, so that from the miniature the original prototype can be visualised and, in the model itself, the workmanship be seen and admired. The only way in which all these ends can be achieved is, of course, by putting models under glass cases. Now the term "glass case" covers a multiplicity of sizes, of designs and of worthiness. The sizes can vary between a few inches in length to many feet. In design it can take the most simple form from the putting together of five small pieces of glass by the *passe-partout* method to high-class cases in figured woods and plate glass which in themselves are attractive pieces of furniture, and this leads us to the matter of worthiness. The case can be severely plain but must be well made and finished, of good materials and be perfectly polished; not necessarily brilliant polish, for fine effects can be got by matt or semi-matt finish.

The relative sizes of cases to those of the models which are to go in them is a matter of importance. No hard and fast rules can be laid down because so much depends upon the subject of the model, especially upon the shape of it, but whatever is represented the case must not fit it too closely nor must there be too great a space around; if there is a discrepancy either way it will appear that the case was originally made for some other object. The only example which the writer can think of in which the limits of size in the case are fully utilised for the model is that of the relief map, town-planning schemes, and certain other architectural models.

For Ship Models

In the case of ship models of the waterline variety these are often put upon crinkled glass or other surface, representing the sea, which is not taken to be a part of the model so much as forming a realistic base on which to place the vessel. It is the overall length and beam of the ship alone which is the factor for deciding the size of the showcase. Of course, if two or more ships are on the same sea, one perhaps in advance of the other, or others, and all obviously steaming, as indicated by bow waves and wakes, then the whole assembly can be treated differently and the sea becomes a part of the subject. Where the model is a single unit, in which the length greatly exceeds the width, as in a single ship, a locomotive with its tender or a road vehicle, then the length of the showcase may exceed that of the model by not less than one-fifth of the length of the model. Thus in the matter of a locomotive: if the length of the model over the buffers is, we will suppose, 4ft. 2in., the case should measure, inside, not less than 60in. which is 5in. clearance at each end. The same principle applies to the width, though here the clearance may, with certain classes of models, be slightly increased. In the matter of height, if there are slender parts upstanding, as, for instance, the masts of steamship models and the jib of a crane, these parts may very nearly touch the top of the case. In sailing ships and barques, especially if the sails are set, the top clearance should be greater and be nearly equal to the ends. It is the general mass of the model which should be considered in determining the size and proportions of the case.

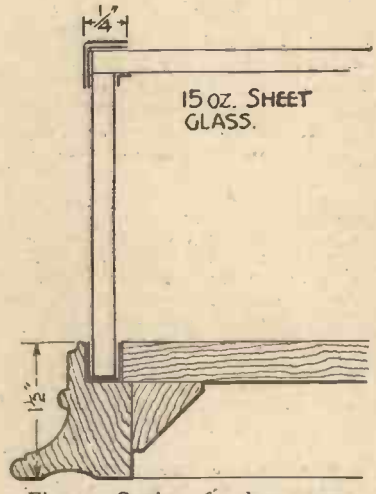


Fig. 2.—Section of a larger case.

Construction

Now we will deal with construction of cases, small, medium-sized and large. The latter are intended to cover cases not larger than, say, 6ft. in length. The writer has, in the past, had to design and often construct in his works cases far in excess of this measurement; but these were chiefly for architectural models, cities, docks, etc., which fall outside the scope of the average model maker whose requirements are never likely to exceed a size of 6ft.

Commencing with the smallest size, Fig. 1 shows a case measuring about 6in. by 2in. by 2½in. high. It can be made from 15 oz. sheet glass, but it is better if the thin glass from old photographic negatives are used from which the film of emulsion has been stripped. The cutting can be readily done with a wheel glass-cutter using a wooden straight-edge as a guide. The top should overlap the sides and the sides overlap the ends. The five pieces are stuck together with paper. Now *passe-partout* paper can

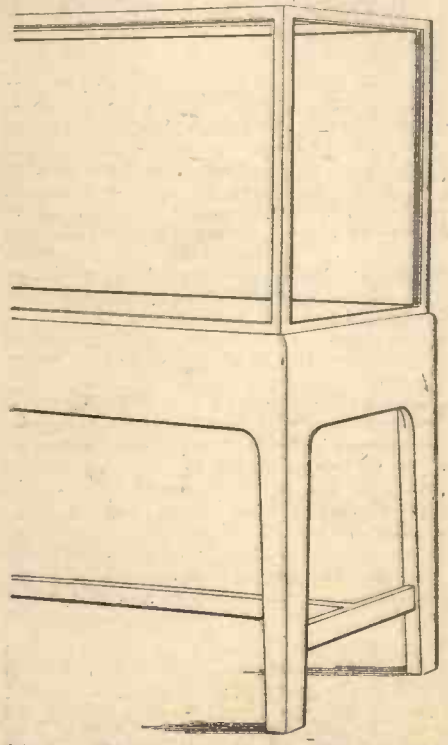


Fig. 3.—Showing one end of a table-case from 3ft. to 4ft. 6in. long.

be used, but the writer has found that the rolls of brown "gumstrip," which can be bought at stationers' shops, have a better adhesive on them.

Passe-partout appears to be coated with gum and is inclined to curl up and leave the glass after a time, whilst the "gumstrip," despite its name, has a thick coating of glue upon it and never comes away from the glass.

If the glasses are put together just as they are cut, with square edges, the overlap of the paper on the sides from the top glass and from the sides over the ends has to be twice the depth, thus cutting off some of the view of the model and giving the case a heavily-framed appearance. The best thing to do is to bevel the glasses as shown on the right of Fig. 1 and so mitre them all round, leaving only the bottom edges. This bevelling can be readily done on a sheet of medium emery cloth stuck down on a flat board. Holding each glass at 45 deg. angle work it edge or end-wise, using a little turpentine as a grinding flux. There is no need to polish the bevelled edges though they can be finished on a fine sheet of emery if thought fit. Note that the bottom edges of the sides and ends will be left square, and it will make a good job to lightly grind them square. It will be seen that the effect of this bevelling will be to make all the binding strips of paper the same width all round, as shown in section on the right and in the general view of the showcase.

The drawing shows the wooden bottom, A, stuck on the glass with Seccotine and the Bristol board over this blackened with waterproof Indian ink, shellac varnished.

For the outside visible edge of the base a polished black picture moulding was used, the mitred corners being made at 90 deg. to the normal for a picture frame, so that the rebate which would take the usual picture glass receives the upright sides and ends of the showcase.

Cases on Legs

Whilst most cases of less than 3ft. long are made without legs to stand on an ordinary table or sideboard, there are some which because they have to go into exhibitions, or for other reasons, have to be made self-contained and have their own legs to stand on the floor. A modern design for such a case is illustrated in Fig. 3, whilst Fig. 4 shows details of the construction of the glazed cover, which, in sizes up to about 3ft. by 2ft. by 18in. high, can be built as one unit; that is to say,

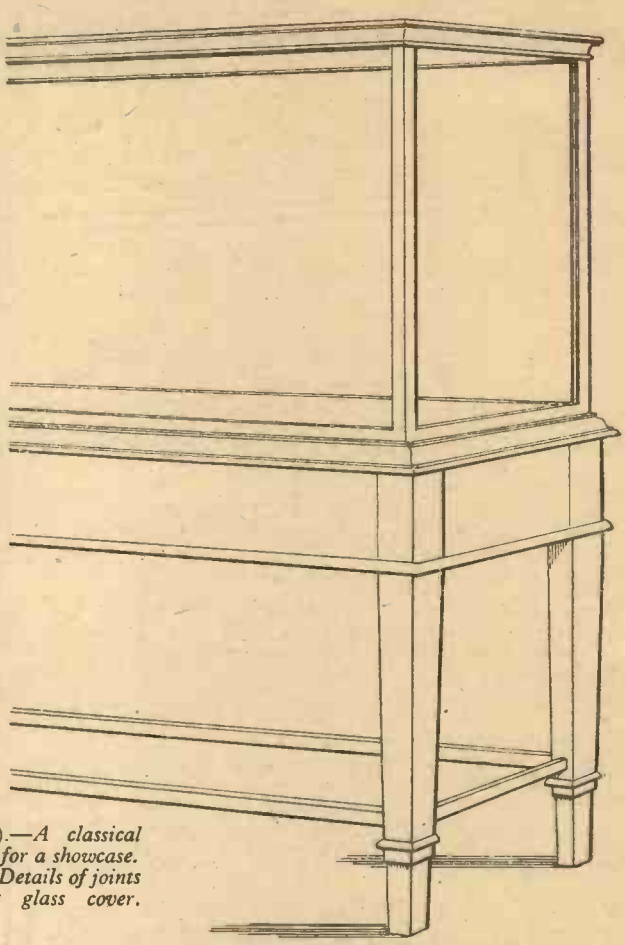
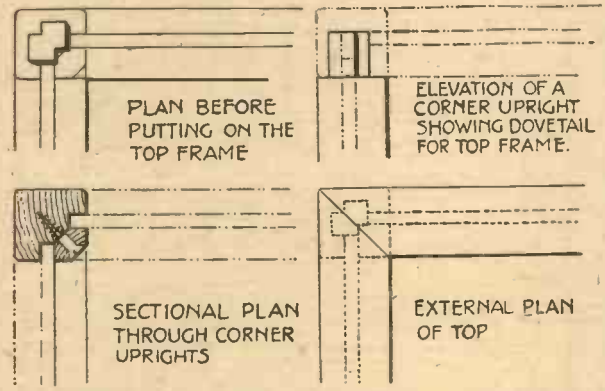


Fig. 6 (Right).—A classical orthodox design for a showcase.
Fig. 4 (Left).—Details of joints in single unit glass cover.



wood joints can be glued, rebate strips fitted and temporarily removed, the case stained and polished, and, lastly, the sheets of glass inserted and secured with the rebate strips. There are several ways in which the joints can be made at the corners where three frame members come together; one of the best is that shown in Fig. 4, where the top frame and the bottom frame each have their rails mitred and the vertical members are cut, each with a form of dovetailed tenon at top and bottom. These tenons will key the mitres of the upper and lower frames together and at the same time make a good long glued joint. In the drawing the lettering refers to the top frame only, but it will be understood that it applies equally to the bottom joints.

The cross-sectional sizes of the members will depend upon the overall size of the case and to some extent upon the weight and thickness of the glass. Since all of these vary considerably according to circumstances it is impossible to lay down any rules, but they may for a case whose greatest measurement is 2ft. be ⅜in. square; 2ft. 6in., ½in. square; 3ft., 1in. square, and up to 4ft., 1¼in. square. Above this last size it would be advisable to make the case so that it can be taken apart as separate frames.

The drawing, Fig. 5, is self-explanatory; it shows the construction of the table portion of the case illustrated in Fig 3.

Figs. 6 and 7 show the design and construction for a more classic and usual form of case. To make this either a vertical spindle machine would be required or a set of moulding planes. Alternatively, the timber could be taken to a wood-working machine shop to have the mouldings cut.

In both of the drawings, Figs. 5 and 7, the cross-sections of the woods are indicated

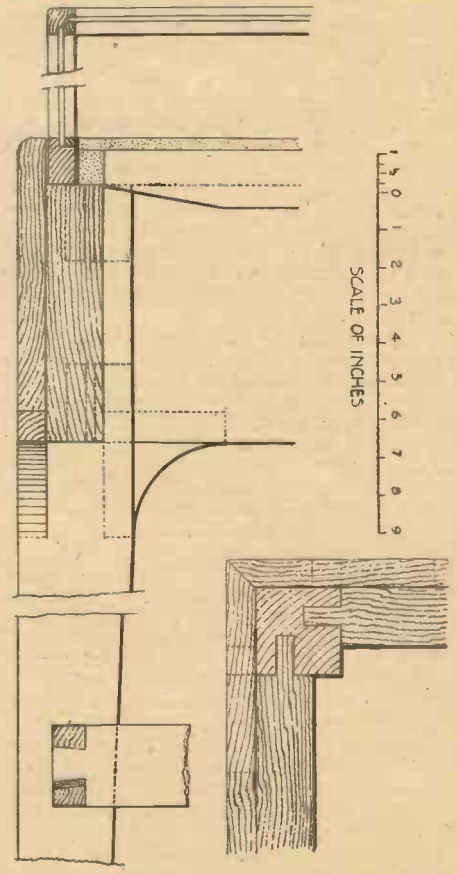


Fig. 5.—Sectional details of the case shown in Fig. 3.

of the case. If a waterline ship is to go into the case a piece of obscured glass, known as "Pattern G," will be used for the water, and the wood strip "B" in Fig. 1 will have to extend right across. The writer has a number of such small cases as this, each with a locomotive in it to a scale of one-tenth of an inch to one foot. A Great Western Railway "Castle" class has a case 6⅞in. long, a G.W.R. broad gauge engine's case is 6in. long, whilst in another, 11½in. long, is a 4-10-4 locomotive. This last has, in addition to the paper, an angle bent from Bristol board with mitred corners, all glued on to the paper. All of the cases are finished in black "eggshell" gloss lacquer, but if the appearance of wood is preferred by the reader the "gumstrip" may be painted with water colour or with waterproof brown ink and then coated with shellac varnish, the wooden base if of walnut or mahogany being polished a natural colour.

Fig. 2 is a section of a larger case, the glass cover of which is 19in. long. In this the glasses are not bevelled, but it has the above-mentioned Bristol board angles laid over the paper. At all junctions of the glasses a very narrow Bristol board angle is glued to the inside of the case for additional strength and the free bottom edges of the sides and ends have paper bindings. In this case "gumstrip" was not used; instead, strong cartridge drawing paper was

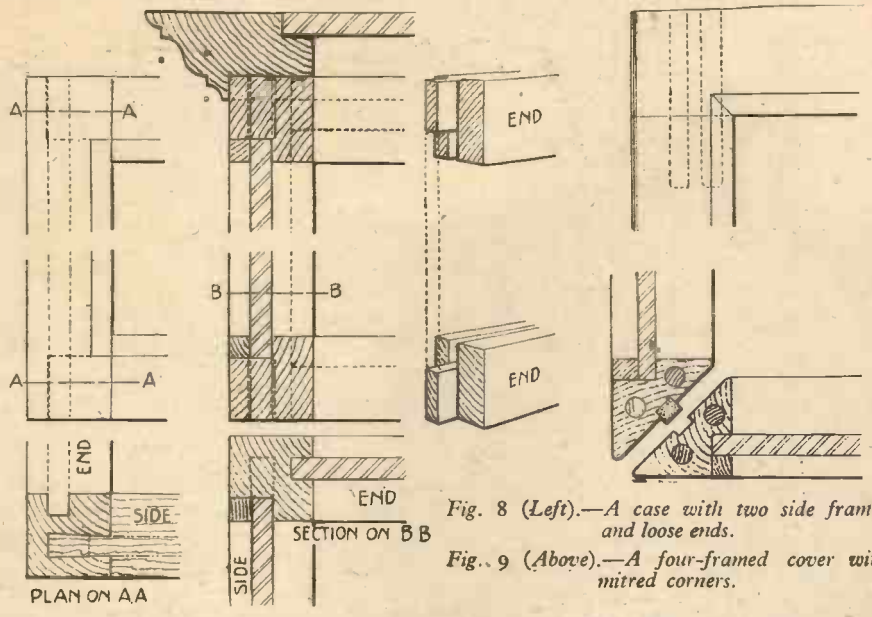


Fig. 8 (Left).—A case with two side frames and loose ends.

Fig. 9 (Above).—A four-framed cover with mitred corners.

by an attempt to imitate the grain, but at the upper parts of the tables there are members covered by stipple: this was done to differentiate between the case and the hypothetical bases of the models. Many models will have bases which may very well take the form shown, for they require, nearly always, to be removable. At the corners they will rest upon the upper ends of the legs and, with a plywood top, will have framing and cross-bearers.

Collapsible Showcases

Fig. 8 shows one method of making a case of detachable parts. The two sides are framed up permanently with dovetailed tenons on the top and bottom rails, and these tenons go into mortises cut in the end uprights. All these side joints are glued At the ends of the case there are only top and bottom rails, and these have tenons which fit into the same channels in the vertical members of the side frames as the end glasses and are not glued to the sides. Both of the side frames, together with the end rails and glasses, are held together by the weight of a completely detachable top frame which fits over the whole as a lid. In this top the glass need not be grooved, but will fit and rest by its own weight on a cushion of cloth or felt glued in a simple rebate in the frame. The colour of the cloth should match the wood. By this arrangement of making the glass to come up flush with the frame there is no angle which can collect dust and the top can be cleaned with facility.

An Alternative Collapsible Design

Another way in which a case can be made collapsible, and this ought to be followed if it is to be much above 4ft. long, especially if it is square, or nearly square, in plan, is to frame up the sides and the ends all alike and let them all mitre at the corners. For details of this see Fig. 9. In this scheme the rebate strips are, for the sake of strength at the corners of the frames, put on the outsides of the glasses; this leaves all the wood next to the mitre available for making the joint. To make these joints it is difficult to devise a form of tongue, tenon or dovetail, which whilst retaining or adding strength on one rail will not weaken the other, and the conclusion which the writer came to long ago was that nothing can be stronger than two dowels as shown. By these we get—measuring on the circumference of the dowels—a much greater area of glued surface than any other form of joint can give, and between the dowels grooves can be cut into which a strip of felt can be fitted and glued in order to seal the mitre against dust. The four frames are held together and the mitres closed up by a top cover frame like that drawn in Fig. 8.

Materials

Of the woods from which showcases are made it is of little use to say much, since, in the first place, most people's thoughts turn instinctively to mahogany, though why this is so is hard to conceive. English walnut is, in the writer's opinion, much more attractive, whilst figured oak has many admirers. For some cases whitewood, cypress, maple and chestnut can be used. These are less costly and when stained black and polished it often has the quiet dignity of a Bechstein piano; but the question of wood and of colour depends largely upon what is the nature of the other furniture with which the model is to be placed.

The quality of the glass and its thickness are important though not so much so as wood. Where cost is a consideration good quality sheet can be used for cases up to about 2ft. 6in. in length, especially if the panes are long and narrow. For anything larger than this $\frac{1}{4}$in. plate glass should be used. Smaller cases can have sheet of the kind known as 31oz. (the title being the weight per square foot). The thinnest sheet is 15oz. which is fit for cases not exceeding 20in. long. Between 15 and 31oz. there are several other weights suitable for intermediate sizes of case. The 31oz. glass has a thickness of about $\frac{1}{8}$in. and if one wants to make a first-class job where this thickness is called for $\frac{1}{8}$in. thick plate should be used. All sheet glass is lacking in flatness and truth and produces a small amount of distortion on looking through it by refraction and a worse distortion of reflected lights. Plate glass does not have this drawback.

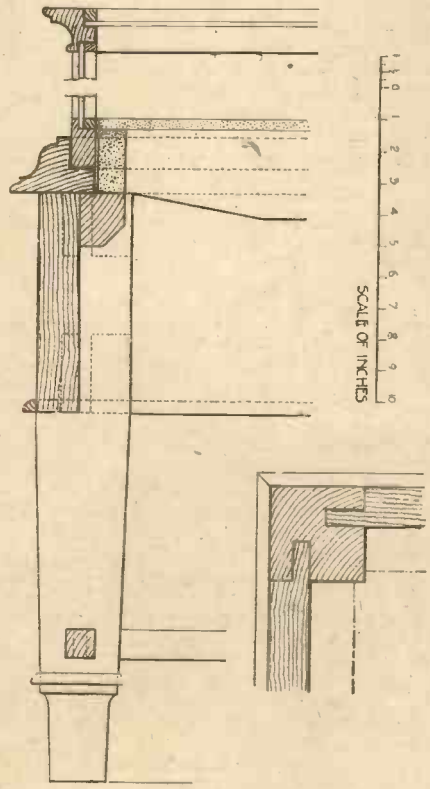


Fig. 7.—Details of construction of the case shown in Fig. 6.

Bristol 173 Twin Helicopter

This twin-engined tandem-rotor helicopter was one of those taking part in the Farnborough Show last year, where the above photograph was taken. It was at one time thought that this machine would be available for civil transport use in city centres, but this is now unlikely, as the Bristol Aeroplane Company has received a large production order from the Services.

WEATHER MECHANICS

3 — THE DEPRESSION

Polar Front Theory of Cyclonic Depressions. Mapping the Weather. A Review of Cloud Forms

By WILLIAM ELLWOOD

LAST month we dealt with the variations of pressure and temperature, as shown on a large scale by means of isobars and isotherms. We now come to an examination of the weather as experienced in a particular area, consequent upon the disposition of apparently isolated centres of low or high pressure.

It must be pointed out that the wind does not blow *directly* from an area of high pressure to a low pressure area, but tends to flow along the isobars. With a low pressure area at the centre (cyclonic depression), the wind edges gradually inwards (Fig. 1) whilst moving in an anti-clockwise direction. In British latitudes this wind speed is generally about 30 m.p.h. but gale-force winds are not uncommon. If there is a centre of high pressure (anti-cyclone), the wind flows round it clockwise, at the same time edging *outwards* across the isobars. The anti-clock and clockwise "internal movements" of cyclonic depressions and anti-cyclones are reversed in the southern hemisphere. The expression "internal movement" or *gradient* wind is introduced to distinguish it from the proper movement of the entire system, which pursues a noticeable though somewhat erratic course over land and sea. Cases do arise, however, where this latter movement is negligible. Often the passage of a cyclonic depression is from west to east, or south-west to north-east; whilst anti-cyclones drift in a southerly direction.

In this brief survey we are chiefly concerned

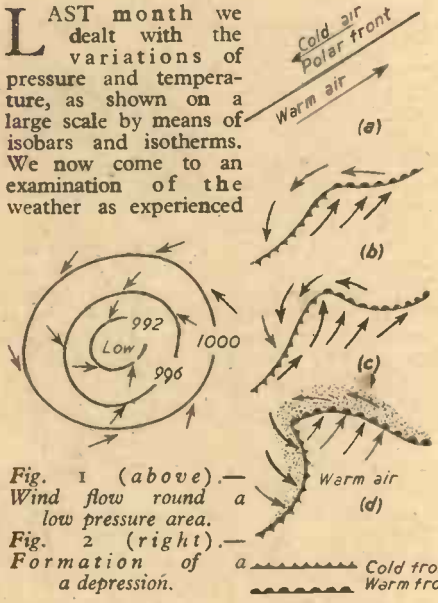


Fig. 1 (above).—Wind flow round a low pressure area.
Fig. 2 (right).—Formation of a depression.

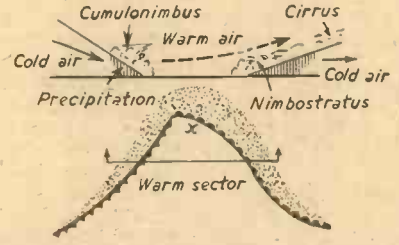


Fig. 3.—Section through a depression.

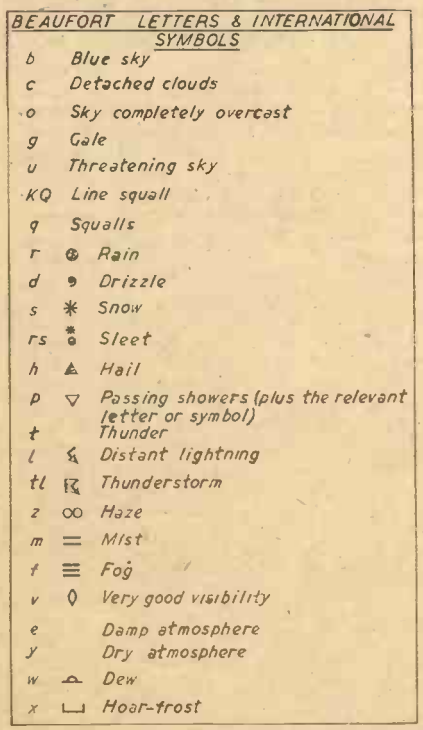


Fig. 6a. (above).—An explanation of symbols used in recording the weather and (right) the Beaufort wind scale.

THE BEAUFORT WIND SCALE

Scale No.	Wind symbol	Wind description	Speed m.p.h.	Observed effects
0	⊙	Calm	0	Smoke rises vertically.
1		Light air ...	2	Smoke drifts, but wind vanes are not affected.
2		Light breeze ...	5	Wind felt on face. Leaves rustle. Vanes respond.
3		Gentle breeze	10	Twigs in motion. Light flags are extended.
4		Moderate breeze	15	Flags flap. Small branches move. Dust is disturbed.
5		Fresh breeze ...	21	Small trees start to sway. Wavelets form on lakes.
6		Strong breeze	28	Telegraph wires whistle. Large branches are moved.
7		Moderate gale	35	Whole trees in motion. Walking becomes unpleasant.
8		Fresh gale ...	42	Twigs break off trees. Progress generally impeded.
9		Strong gale ...	50	Slight damage occurs. Chimney-pots and slates removed.
10		Whole gale ...	59	Trees uprooted. Considerable structural damage occurs.
11		Storm	69	Widespread damage.
12		Hurricane ...	Above 75	Devastation.

with the cyclonic depression (usually just termed a *depression*), the bearer of rains and stormy winds. Anti-cyclones, on the other hand, are the bringers of dry and settled weather in summer, and steady if somewhat foggy weather in winter.

In Fig. 2 some idea is given as to the origin of a depression. A cold air current flows from the north-east and a warm air current advances from the south-west. As there is no gradual change from cold to warm air, between the two masses, they are separated by a surface of discontinuity. This is known as the *polar front* (Fig. 2*a*). It is at this surface where depressions originate. In Fig. 2*b* the cold air begins to thrust southwards and the warm air northwards. Figs. 2*c* and *d* show the formation of a depression.

The air within the bulge is warm, that to the north-east is cold; the air at the warm front, therefore, rises over the cold air. Again the cold front swinging from the north-west drives a wedge under the warm sector. In each instance warm air is lifted. As pressure decreases with height the ascending air expands, which brings about a decrease in its temperature. In most cases the equatorial air of the warm front is moist. The drop in temperature causes the water vapour to condense into minute drops of water which manifest as cloud. As the rising continues the clouds become more dense, until at last the air can no longer maintain the waterdrops, and precipitation occurs.

Fig. 3 shows a section through a depression, looking towards the centre at *x*. It is seen that the surface of separation at the cold front is much steeper than that at the warm front. The former condition brings heavy rain of short duration in contrast to the conditions prevailing at the warm front, where the rain is steady and prolonged.

Along the line *xy* (Fig. 4) all the warm air has been lifted above the cold air. This part of the depression is said to be *occluded*. Rain still occurs but with decreasing intensity. Along this line of occlusion the heavy clearing showers follow immediately after the period of steady rain, as the sultry warm sector has been eliminated at ground level.

Fig. 4 (left).—Occlusion of a depression

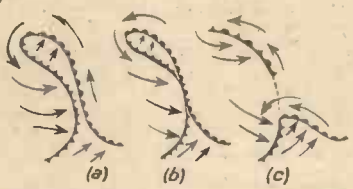


Fig. 5 (below).—Formation of a secondary depression.

Another phenomenon is that of a *secondary depression*, which may develop simultaneously with the occlusion of the initial one. The sequence is illustrated in Fig. 5.

It is not proposed to enter into the technicalities of weather forecasting in this series of articles, but we may take a look at the general procedure.

Initially, the practical weather forecaster forms his opinion of to-morrow's weather by a detailed study of the pressure distribution over a wide area during the past 48 hours. From this study he draws a pattern of what the pressure distribution will most likely be 24 hours hence. This is called a prebaratic chart. Using his exceptional judgment and experience he then endeavours to "clothe" the chart with the winds, temperatures, clouds and rain areas which are usually associated with that particular type of pressure pattern.

A sound knowledge of physics is essential in the difficult art of weather forecasting, but there is little opportunity for the mathematician to excel. Solar activity in the form of sunspots and magnetic storm centres are almost certain to play a part in the production of our weather, but as yet little can be said of these effects with any exactitude.

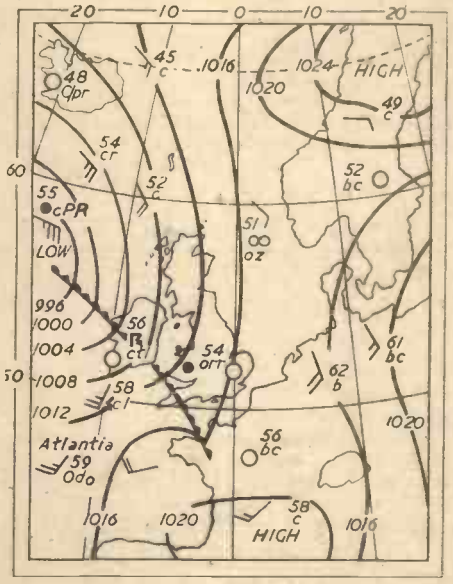


Fig. 6b.—An example of a weather map.

Some time ago Dr. O. G. Sutton, Director of the Meteorological Office, gave an interesting radio talk on weather forecasting. In it he discussed the use of a simple model atmosphere to aid the forecaster in his continuous race against the weather.

The weather, as it occurs, is plotted on a large map called a synoptic chart. On this is recorded the information sent by code (for conciseness) from the network of observation stations at regular intervals. The times of observation are fixed internationally. At the specified time, each observation station reports the wind-force and direction, barometrical pressure, temperature, rainfall, if any, or if snow is falling, also the state of the sky, the amount and type of cloud present, and whether the visibility is good or bad. At the same time, aboard ship, observers prepare and transmit their report on weather conditions, adding their ocean position to the coded message. It is the acknowledged duty of each country to issue by radio, at set times, the prevailing weather conditions within its borders. These reports are called *synoptic messages*. This co-operation is naturally of vital importance, as forecast services are dependent on accurate observation over a very large area.

The published weather map is a simplified

Fig. 7.—Artist's impressions of the weather cloud forms.

version of the large synoptic chart. Fig. 6b shows a typical map on which weather phenomena are indicated by Beaufort letters and international symbols (Fig. 6a). Figures next to the station circle give the temperature in degrees Fahrenheit. The accompanying letters indicate the general condition of the weather, the symbols being used to help in the quick location of the more important phenomena. Wind arrows indicate the wind flow, i.e., they point *down* wind. The "feathers" each arrow possesses give the force of the wind; one short or half feather showing the wind to be very light, whilst five full feathers indicate a gale-force wind. Isobar figures show the pressure in millibars. Considering the Beaufort letters again. If the phenomenon is intense, it is customary to use a capital letter instead of the lower case. Should the phenomenon be weak, the suffix *o* is employed. If it is a persistent weather condition the appropriate letter is repeated, thus *dd* means that the drizzle is continuous.

The 12 illustrations of Fig. 7 are impressions of the better-known cloud forms. It is usual to classify clouds as belonging to one of three main groups; high, medium and low. In the latter class it is quite possible that the summits of quite a number of these low clouds are at great height. The high cloud group consists of cirrus, cirrostratus and cirrocumulus. Their ceiling height is about 8 kms. Cirrus develops many shapes, two of which are shown in Fig. 7*a* and *b*. True cirrocumulus as depicted at *c*, is an uncommon phenomenon. Cirrostratus manifests as a thin veil, imparting to the sky the well known milky appearance. In most clouds of the high cirrus type the sun's outline is still visible and shadows are cast.

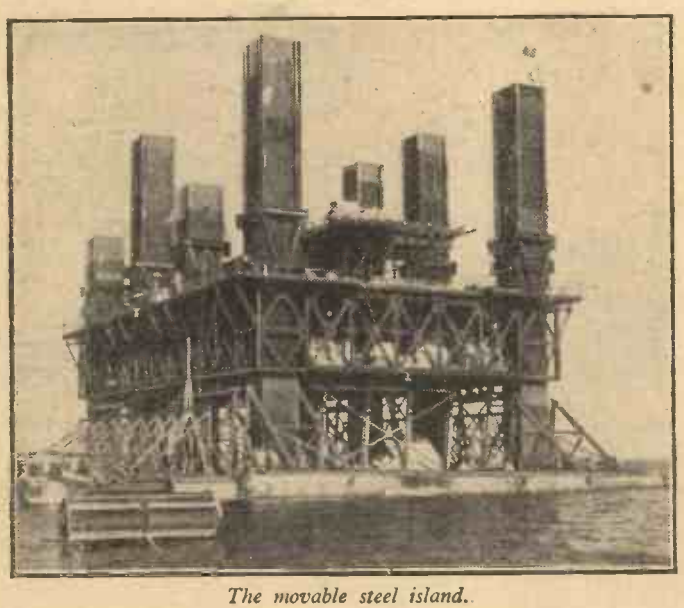
In the medium altitude clouds, altocumulus (Fig. 7*d*) and altostratus are rather like cirrocumulus and cirrostratus in general appearance, but are of a denser nature. Typical altostratus is dull greyish in colour, sometimes of a fibrous structure but often seen as a featureless grey-blue sheet overspreading most of the sky. Through this sheet an occasional gleam of sun or moon may be discerned.

The lower cloud forms may be sub-divided into two sorts—heap clouds and stratified clouds. Stratified clouds often form a sheet of great thickness, covering the whole sky. Stratus is a common sheet-cloud. When it is in broken form it is called fractostratus; or when the disunity is not complete—as at *e*—it is termed irregular stratus. Heap clouds are well represented by the varied and impressive cloud forms known as cumulus. They are thick clouds of vertical development, the upper surface usually being dome-shaped. In strong sunlight these clouds exhibit a striking contrast of light and shade. At *f* and *g* we have two examples of the cumulus family. Stratocumulus may be observed as large globular masses of a soft, grey texture, arranged in groups or lines. During winter the latter formations may be so close together as to cover the whole sky, giving a widespread, corrugated or wavy effect. This cloud formation is sometimes called roll-cumulus (Fig. 7*h*).

There are two cloud forms most closely connected with the precipitation of rain, etc.—nimbostratus which is of sheet or layer formation, and cumulonimbus which is of immense vertical development. Nimbostratus is a low, dark-grey layer of typical rain-cloud. It quite frequently seems to emit, or be illuminated by, a feeble blue light. Often the lower surface possesses trailing precipitation or *virga*. This precipitation does not necessarily reach the ground, but viewed from a distance, it always appears to be particularly "wet." The huge cumulonimbus forms also display virga at the base of the cloud-tower. Two impressions of cumulonimbus are given at *j* and *k*. In the first, the familiar "anvil" is forming at the summit. These clouds are the producers of rain, snow and hail, and are very frequently associated with thunderstorms.

To round off our review of cloud types, we have at *l* and *m* two drawings of the lenticular cloud. This appears to be more of a *form* than a particular species of cloud, as it manifests at many different levels.

Next month, in our final discussion on weather mechanics, we shall examine a tropical revolving storm, usually referred to as a cyclone; also another intense phenomenon worthy of our attention, the tornado—the cyclone's small but violent land-brother.



The movable steel island.

The Search for Underwater Oil

A Unique Movable Steel Island for Underwater Drilling for Oil in the Persian Gulf

A 1,200-TON movable island of steel, with many features unique in the relatively new science of drilling for oil at sea, has been set up in the Persian Gulf, five miles from shore. Built for Shell at a cost of around £500,000 it has been completed in just over nine months.

The steelwork was fabricated in the Netherlands and, after the completion of a mock assembly there, was shipped out to Doha in Qatar where the erection work was done by George Wimpey & Co., Ltd., of London. During the latter phase the heat was so intense that steel had to be dipped into the sea before it could be handled and air-cooling had to be provided in certain enclosed spaces before men could work in them.

Shell's oil concession, acquired from the Ruler of Qatar in 1952, covers a large area of the Persian Gulf beyond the territorial waters of this independent sheikhdom lying on the north eastern coastline of Arabia. Geophysical surveys carried out during the last 18 months have resulted in the selection of the first exploration drilling location, where the drilling platform has now been placed.

The major problem in underwater drilling is to provide a stable platform to carry the weight of the bulky plant and machinery required and at the same time withstand the pressures and stresses of the strongest winds and waves in the area. On many of the wells so far drilled at sea, this has been accomplished by building a steel island supported on piles driven into the sea bed. A serious disadvantage of this method is that, should the well fail to find oil, a large proportion of the steelwork cannot be salvaged economically and much of the expenditure involved becomes a dead loss.

In some areas where weather conditions are favourable, the element of risk can be reduced by constructing only small platforms, the bulk of the machinery being carried on a barge firmly anchored to the platform. In the Persian Gulf, however, storms of gale force are common, necessitating special measures and precautions especially in the more exposed parts of the sea. Based on lessons learned in underwater drilling in the Lake of Maracaibo, in the Gulf of Mexico and in the South China sea off British Borneo, and taking advantage of the relatively hard sea bottom in the Persian Gulf, Shell has developed this movable drilling "island" for its Qatar venture.

Erecting the Platform

The platform was erected in the harbour of Doha on top of two 1,000-ton pontoon barges, and was towed out to the selected drilling location, about 35 miles north of Doha. When on site, eight heavy steel spuds or legs incorporated in the structure were lowered to the sea bed. After this, a system of powerful hydraulic jacks came into operation and lifted the platform itself up on the spuds, thus raising it clear of the supporting steelwork on the pontoons and allowing these to be withdrawn. When in due course the first well is completed, the pontoons will be brought back, the whole operation repeated in reverse and the platform towed away to the next location. Should the well be successful in finding oil a much smaller platform will be constructed around the well site to provide access—and protection—to the well-head fittings.

The main deck of the drilling platform is 140ft. long by 90ft. wide and is about 40ft. above the level of the water. The drilling rig which is to be used on the first well is capable of reaching a depth of 7,000-8,000ft. The high winds and short seas experienced in the Persian Gulf make it impossible to conduct regular relief of drilling personnel, and the platform, therefore, has accommodation for two complete crews including storage, refrigeration, working facilities and air-conditioning. The relief of personnel and the supply of drilling and other materials will be carried out by tugs and barges from Doha, where the main camp is situated.

Making a model of the P.S. WESTWARD-HO

Full Constructional Details of a 4ft. Long Scale Model of a Paddle Steamer Powered by Diagonal Steam Engines

3.—The Paddle Wheels and Boxes, Superstructure and Deck Fittings

By "DESIGNER"

BEFORE leaving the engines there are two points which must be mentioned and a third which will be referred to presently, viz., the ventilation of the burners. The first matter concerns the cylinder lubrication. There are two means available for getting oil to the slide valves and pistons: one is by fitting ordinary single-cock cylinder lubricators with screw-on caps, one on each

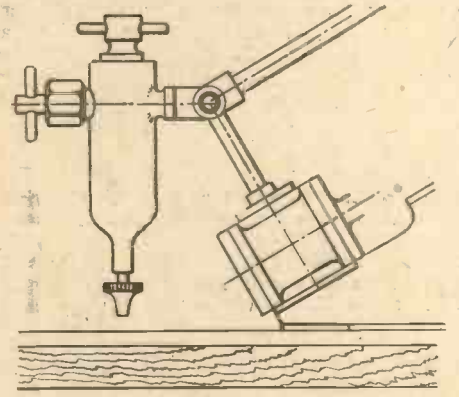


Fig. 11.—The displacement cylinder lubricator and its attachment to the steam pipe.

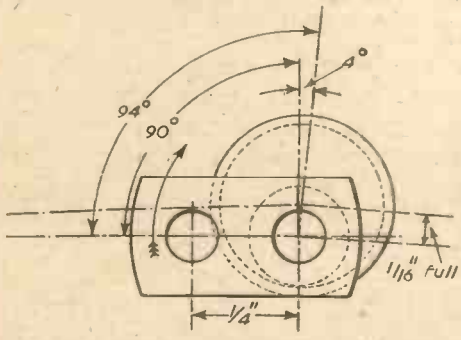


Fig. 12.—Diagram of the setting of the eccentrics in relation to cranks.

valve chest, and the other by a displacement lubricator fixed at some convenient point in the steampipe. Whichever of these is adopted, and one of them must be, they will both be found listed and illustrated in Messrs. Bassett-Lowke's catalogue of engine and ship fittings. The "cylinder lubricators" are the more simple to fit but they have the disadvantage of needing much more frequent filling, and there is no oil flowing when the cocks on them are turned off. If the cocks are left on, the cups will empty at once, so lubrication becomes spasmodic and the engine will only get oil when the "engineer" thinks of it. The displacement lubricator, on the other hand, is automatic, and if carefully adjusted and filled with oil will supply just sufficient lubricant to keep the valves and pistons oiled for a very long time. Moreover, when steam is shut off the flow of oil automatically ceases.

One displacement lubricator is sufficient for the supply of oil to both valve chests and it is recommended that a special tee-piece be made and fitted where shown in Fig. 6, the main single steam pipe branching out on either side to two pipes which turn down to the steam chests. In Fig. 11 is shown the lubricator and the new tee-piece, which is not actually now a tee but a four-way piece.

Setting for Eccentrics

The other of the two points not previously dealt with is the exact setting of the eccentrics on the crankshaft in relation to the cranks. Fig. 12 shows this. From this drawing it will be seen that the centres of the eccentric sheaves are advanced four degrees beyond the right-angle, which position they would occupy were there no valve lap. The lap and the angular advance together enable the valves to cut off steam before the pistons reach the ends of their strokes and thereby utilise the steam's expansive properties, so economising in steam and water.

The Paddle Wheels

Fig. 13 shows one of the paddle wheels, that for the port side. The starboard wheel is exactly similar except for the important fact that it is made for the opposite hand. The differences lie in the attachment of the spokes to the hub plates and the paddles or float plates are soldered to the forward sides of the spokes at the top of the wheel, just as they are in the port wheel. This means that in both wheels, although they are oppositely handed, the reaction of the thrust on the paddles will tend to force them on to the spokes. In both wheels it will be the forward edges of the spokes which will be radially in line with the centre lines of the shafts. The paddle plates will be soldered at three points on each side; to the inner rings, to the outer rings, and to the spokes.

With regard to the fastening of all the parts together, the two hub plates to which all the spokes are attached should be silver soldered to the steel shaft, but as a complicated jig would have to be made to hold spokes in correct positions for silver soldering, I have provided a sufficiently large overlap of the spokes on the hub plates to make a soft-soldered joint sufficiently strong, especially so if an ample amount of solder be applied, so as to fill the spaces between the inner ends on the hubs. Soft soldering will also be strong enough between the spokes and the rings. It is a pity that the wheels have to be dished or made conical on their inner sides, but this has to be done in order to get long, rigid bearings; note that the coned spokes are cranked 9/16in. In the full-size vessel an outer bearing outside of the wheel is provided for each paddle shaft, but it would be most difficult to provide this in the model, besides which the paddle boxes and sponsons would not be rigid enough to take bearings, and paddle boxes had better be removable.

The paddle shaft bearings which are 1⅛in. long must be carefully made of brass tube, silver soldered into brass plates measuring 1¼in. square. They must be carefully made because the tubes must stand dead square and at right-angles in the plates. It will be obvious that the inner flanged collars have to couple up to the engine crankshaft, so the holes

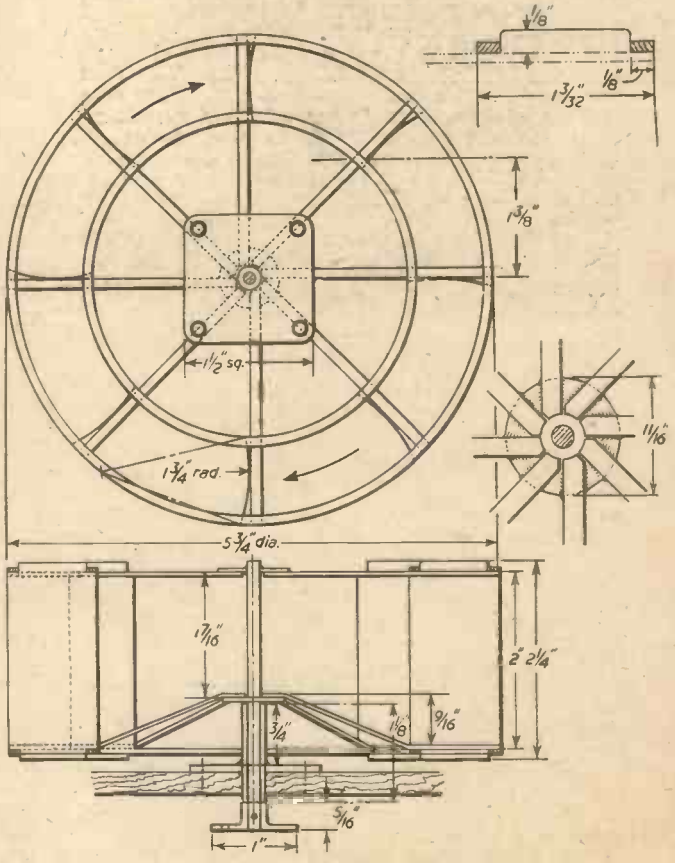


Fig. 13.—The port side paddle wheel.

for the screws or bolts (either can be used) must correspond.

In the previous drawings the square bearing plates were shown secured to the hull, each with four woodscrews. I think now that it will be better to use bolts with nuts and washers on the inside of the hull; this will give a little freedom for position adjustment.

Fig. 14 is a longitudinal section and a part plan of the removable amidship portion of the deck showing all the openings which will have to be cut in it. It will measure overall 16½in., being 10in. forward of the engine and paddle shafts and 6½in. abaft the same. It is made of plywood with a whitewood surface, and its thickness is 3 mm. When this deck is in position it is secured by six simple turnbuttons as shown. These are of threaded brass wire, screwed 1/16in. Whitworth, screwed into the top edges of the hull with about 5/16in. of the upper ends bent over at right-angles. Six rectangular notches are cut out of the edges, three to port and three starboard; these are to clear the turnbuttons when the buttons are laid fore and aft. After the deck is passed over them they are turned inboard, thus preventing the deck from moving.

Burner Ventilation

At the commencement of this present article I referred to the ventilation of the burners, and it is the design of this movable deck which will govern the amount of air which will reach the boiler casing containing the burners. It will be obvious that if an insufficiency of oxygen is taken in the spirit will not burn properly and the flames may even be extinguished. Therefore it is necessary to make use of every opportunity of forming openings through the deck. Under the bridge and supporting the centre of it there is a deck house—a chart room or something of the sort. Now, in our model this is utilised to make a proper and efficient air intake by doing away with the front of it, leaving it open, and in the top and back fitting a curved cardboard deflector which can be painted brown to look like teak. There is another opening over the engine cylinders which in reality is the staircase to the saloon. If these two with the addition of two cowled ventilators of the usual type just forward of the funnel do not provide enough air, it is suggested that an engine-room skylight be fitted over the crankshaft which can be made to open or lift off, and thus provide a third large opening. This is not shown in Fig. 14 since it may not be needed, but if it is required let the rectangular aperture measure about 1⅜in. long by 1⅛in. wide.

Note that the regulator quadrant opening

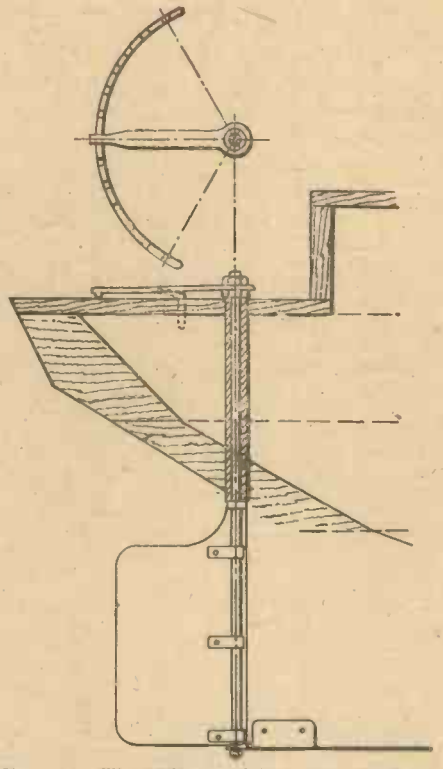


Fig. 15.—The rudder and its setting quadrant.

should have a divided scale on the curved edge. If the handle of the cock is filed to form a pointer to accord with the scale the same amount of steam can be given to the engine each time that steam is turned on and consequently the same speed of the vessel secured. The speed should not be more than two knots or, say, 2¼ miles an hour; this is the maximum permissible and less than this will look more realistic.

The Rudder

Fig. 15 shows the arrangement of the rudder. This can be made from a piece of aluminium plate or of thin plywood. Of the two the aluminium is the better and more durable. It is secured to a vertical shaft of brass wire by three brass plates bent to U-shape which are soldered to the wire and attached to the plate by three tiny rivets. At the upper end of the shaft there is a lever secured by nuts to the shaft, and the shaft works in a brass tube which serves as a bearing in the hull and in the deck. The outer end of the lever is shaped to fit into cross-notches filed in a curved quadrant so that within limits any desired angle can be given to the rudder for steaming on a curved course. The quadrant can be made from a piece of No. 16 s.w.g. brass wire with ends bent down and inserted in the deck.

The Paddle Boxes

In Fig. 16 is shown the paddle boxes. These are, of course, handed: right and left. The general arrangement, Fig. 3, shows the starboard box whilst in Fig. 16 the port is drawn together with parts of the sponson. The two together, box and sponson, give each other mutual support.

The curved cover and back plates of the box can be of tinned steel plate, but the slotted and ornamental outer plates I should prefer to make of thin sheet brass. Both plates for port and starboard boxes should be cut out, tacked together with solder and drilled and filed to outline, including the slots, both plates at one operation. Then they are separated, the wires to represent the beadings soldered on and the two paddle boxes assembled with all the angle brackets by which they are attached to the hull and sponsons soldered on. In the side view in Fig. 16 around three sides of the shaft centre line I have drawn a rectangular dotted line; this is the outline of portions of the inner plates of both boxes which have to be cut away to clear the square plates of the main shaft bearings which are shown in the plan view of the engines and boiler, Fig. 6.

The only remaining items to be referred to are the deck and other fittings and these are too small and too obvious to call for drawings. The davits and boats are, perhaps, the most important but they have been shown in Fig. 3 and their shapes and dimensions can be scaled off from the same. As the boats are carried in chocks the davits will carry no weight and, therefore, there is no need to make metal davits; I should make them of straight-grained birch dowel sticks, ¼in. diameter, tapered towards their upper ends and steamed and bent to the required curve.

There will be eight of them to make and should one break in bending it is not a big job to make another. Steaming should be done at the spout of a kettle of boiling water, the wood being inserted, for several minutes, into the spout. The davits could be of brass or other metal but wood is advocated on the score of weight. As may be seen from the photographs, Figs. 1 and 2, the davits are supported in socket bearings on the sponsons and in brackets projecting at deck level. Also from Figs. 1 and 2, it will be seen that the

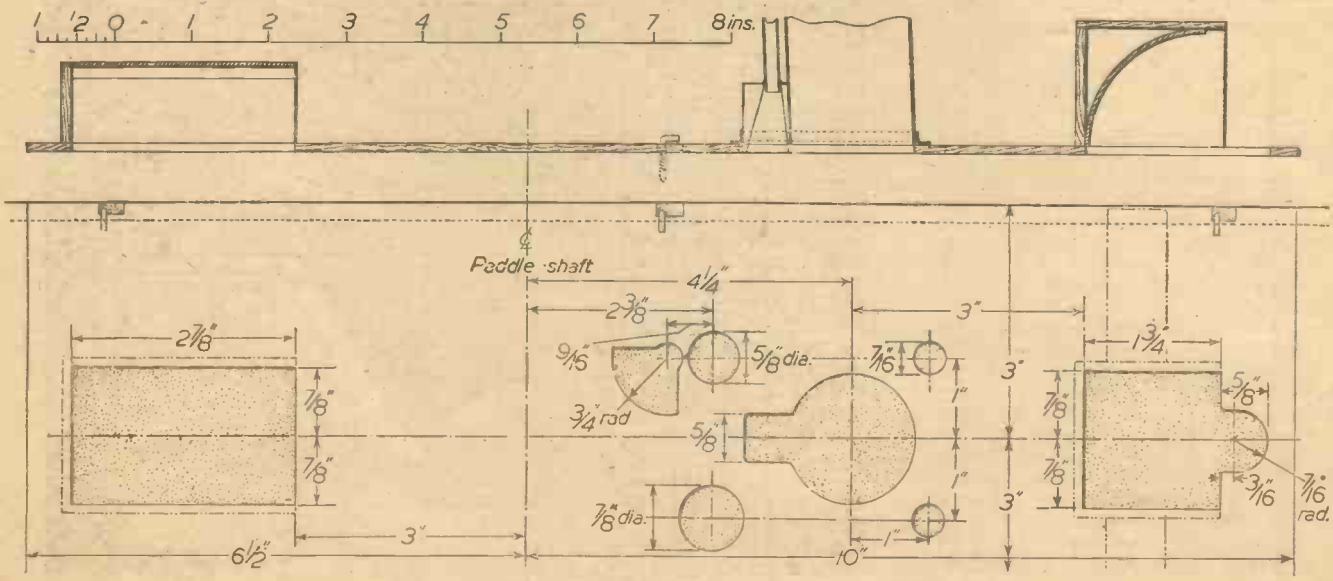


Fig. 14.—The removable central portion of the deck.

boats are carvel built. They can be of soft pine or red deal, shaped on the outside, hollowed within, leaving them as thin as possible and then planked on the outside with strips of bristol board. A bar, or longitudinal partition will be needed to support the canvas covering which, in the model, can be bits of fine cambric cut from an old cotton handkerchief.

The Deck Seats

The longitudinal seats are a prominent feature; they are carried on the fixed portions of the deck only. They are double, that is to say, passengers sit on them back to back. They are not fitted with legs but are supported on watertight boxes so that they float and form life-saving means should the vessel suddenly founder. Cords, arranged in loops, surround the boxes and to these loops people in the water can cling. There are seats forward of the bridge as well as aft of the engines.

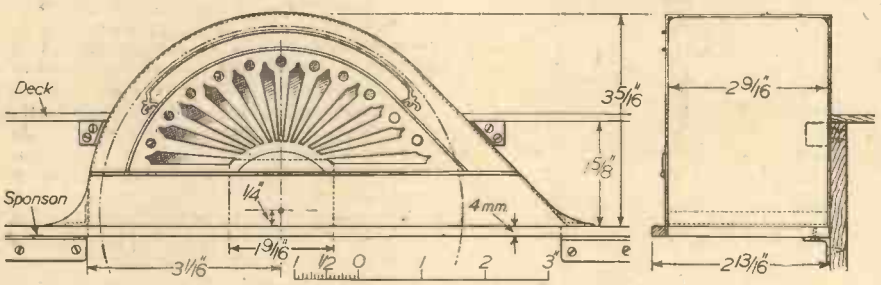


Fig. 16.—The paddle boxes, port side shown.

The outline of the bridge, with the ladder leading up to it, can be seen in the plan view, in Fig. 3. The top of the chart room ventilator, to the right-hand end of Fig. 14, will extend out to the sides of the vessel, as indicated, and thus form the bridge; the fittings on it will be the compass, the wheel and four engine-room telegraphs, two to port and two to starboard. The wheel is a very slender affair and in the prototype it is of brass tubing, polished bright. This wheel in the original vessel controls steam steering gear.

Two Alternative Methods of Making the Rails

The railings may appear to be a rather disheartening problem when it is remembered that they are only ⅛in. high; but they are not so difficult as they may seem. First form the top rails, which in the full size are of teakwood, by using either ⅛in. flat strip brass or half-round brass wire; bend this edgewise to fit the edges of the deck, where they are curved fore and aft; then, using dressmaker's pins for the stanchions, you have two alternative ways of going to work. You can make a gauge to ⅛in. and knock pins into the deck to the depth of the gauge and, when all are in, turn the hull upside down on to the strip or half-round brass and solder every pin head to the top rail, or you can first solder the pins to the strip rail and afterwards knock the rail and pins downward into the deck. By the first method some of the pins may not stand dead vertical so that some may have to be bent a little to get heads on the centre line of the rail; on the other hand by soldering the pin heads independently to the rail you will get them central but the points are likely to be all out of line and it would be more difficult to get them in line and still more difficult to knock them in, therefore, it would seem that the first method is the better way of the two. After the pins, which are the stanchions, are in and the top brass rail is on, the slender horizontal rails are to be put on. These are made from fine florists' tinned iron wire, which can be bought either on a reel or coiled upon a card. There should be two of these fine rails. Hook the end of the wire over the end or first stanchion, at a point one third up its height, pull the tinned wire nicely straight and parallel with the deck and top rail, and solder it at the opposite end. Do the same with the second wire, two thirds up the height of the stanchion. Stretch tightly and then go over both wires and solder to every pin, using a small copper bit, cleanly-tinned, for the purpose.

Details of the Mast

The mast is made from a length of straight-grained birch dowel wood, 5/16in. diameter and planed and glass-papered to a uniform taper. Its diameter at the top is a bare ⅛in. The attachment points for stays can be scaled from Fig. 3. The port and starboard lights and the lampholders can be seen in both plan and elevation on the forward sides of the paddle boxes, actually they may be carried on the rails between the paddle boxes and the boats.

Painting

With regard to the finishing colours; the mast is a medium rich brown and in the original looks as though it were of darkly-varnished spruce. The seats, deckhouses, hatches and rail tops are of teak. The decks, including those of the sponsons are of light-coloured wood like maple. All metal fittings, capstans, bollards, davit brackets, etc., are black. The whole of the funnel is white except the deflector top of the inner funnel which is black. The casing boards of the port and starboard lights are, respectively, vermilion and green. Regarding the hull, the portion in line with the ornamental part—the upper portion—of the paddle boxes, that is to say, all the hull in which the port holes occur, is white; below that line, including the lower part of the paddle boxes, is black down to the waterline. Then we have a fairly deep band of pale green and below that the underwater part of the hull is a deep oxide red. The paddle wheels are also oxide red. The beads in relief on the paddle boxes are gilded and the arched panel in which the name: "Westward Ho" appears, in gold, is painted a bright, royal blue.

The railings are treated with aluminium paint, so that in the model these can be left unpainted.

If tube oil colours are used for painting the model I suggest for the teak wood parts: raw umber. For the green strake on the hull, a mixture of pale chrome yellow and prussian blue with the addition of a very little white. Paddle wheels and the hull below the green, Indian red without any other colour mixed with it. For the black either ivory black or lamp black and for the white, flake white. All the colours must be thinned and mixed with Japan gold size and turpentine.

An Aluminium Boat

THE Albatross Sports Runabout is a 12ft. 8in. high-speed three-seater motor launch built entirely of aluminium alloy, which is proving popular on the Riviera and in other countries for towing water skiers and as a fast tender for yachts.

It is powered by a marine conversion of a Ford 10 h.p. engine and is capable of speeds of 32 m.p.h. Smooth running and quiet, it is highly manœuvrable and luxuriously equipped with waterproof leather upholstery. Aircraft methods of precision construction are used in building the hull.

The firm which manufactures this craft was started by three aircraft engineers, who built their first runabout with their own hands four years ago. Now they have 35 employees and are expanding their boatyard, on the banks of the River Waveney, near Great Yarmouth, to cope with the orders they are receiving. They received one recently from America for 100 boats. They are now the largest producers of high-speed pleasure craft in the country and export 80 per cent. of their output. The address of Albatross Marine Limited is St. Olaves, Great Yarmouth.

Making an Aqualu

How to Construct Your Own

By E.

UNDERWATER swimming is a sport which is fast growing in popularity all over the world. In this country its devotees are limited to about four months sea-swimming in each year, but the enchanting new world that is opened up—even to swimmers of only average ability—makes it a sport that is sure of a large British following. By wearing flippers and goggles alone, it is possible to view marine life clearly and at close quarters, holding the breath to dive in order to inspect anything which attracts the attention. With the simple addition of a snorkel tube one can either lie motionless on the surface of the water or move slowly along, with a gentle movement of the feet, while continuously watching the colourful panorama below.

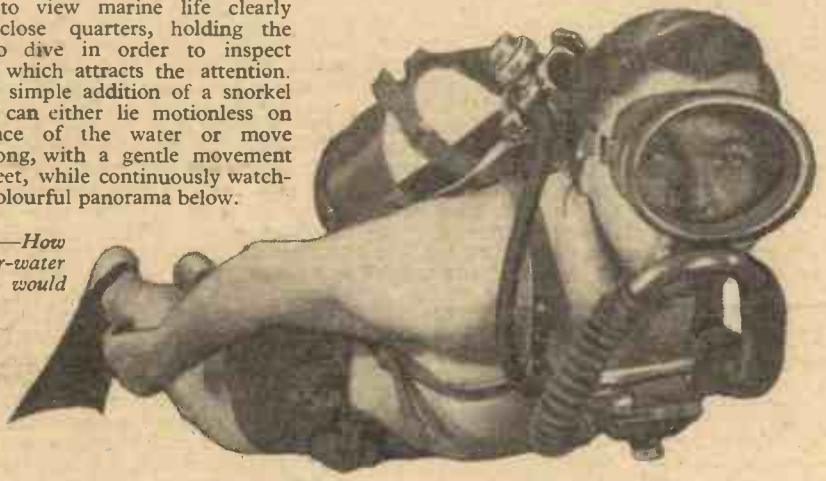


Fig. 14.—How the under-water swimmer would probably appear to the fish.

This sport is known as "skin diving"; but any skin diver will tell you that the final thrill of the sub-aquatic sportsman comes with the possession of an aqualung. "Aqualung" is the name given to the self-contained compressed-air diving apparatus which permits a trained diver to swim down to two or three hundred feet below the surface, or to explore the sea-bed in shallow waters for 40 minutes at a time. While a new aqualung might cost £40 to £70 it is possible to assemble at home a perfectly reliable piece of equipment for approximately £14. The work involved is well within the capability of the average model engineer, as will be seen from the line drawings which illustrate the modifications that have to be carried out on easily obtainable parts.

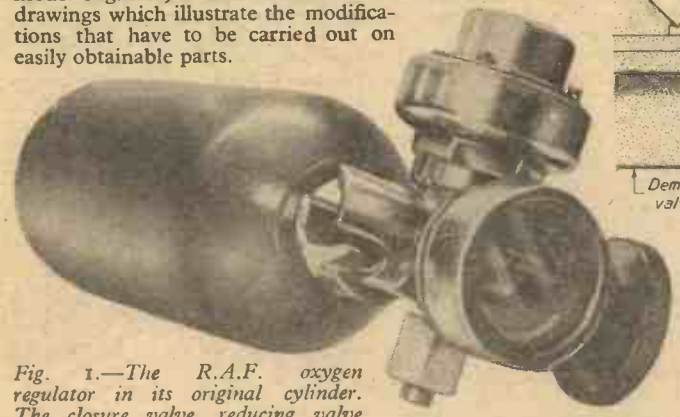


Fig. 1.—The R.A.F. oxygen regulator in its original cylinder. The closure valve, reducing valve and gauge are unscrewed as one unit and fitted into a much larger cylinder, which although capable of holding 40 cu. ft. of air weighs only 14lb.

Warning

Before going on with the details of the home-made aqualung it would be as well to point out that, simple as this equipment is, in the wrong hands, or in inexperienced hands, it could be a source of serious trouble. A cylinder explosion could be quite easily fatal, so there must be no question of using anything but a new, fully-certificated cylinder. Air jets, either at 2,000 or 20lb. per sq. in., can also cause bodily harm; they must be treated with the utmost respect and that simply means that no air must be allowed to escape.

Private pumping to recharge cylinders must not be considered, for it is a specialist's job. Empty cylinders should be sent to a depot of the British Oxygen Company Ltd., who will ensure that they are tested regularly by hydraulic pressure to practically twice the working pressure.

Before finally using the aqualung, take a course of instruction with your nearest branch of the British Sub-aqua Club. The fee will be money well spent, for you will learn not only straightforward diving, but also what to do should an emergency arise. After graduating to sea diving, always stay as close to the surface as you can swim with empty lungs, for you may have to do just that one day. And in any case never dive deeper than 60ft. nor stay there for more than 15 minutes at a time, and you need never fear the "bends."

The aqualung described here has been thoroughly tested and has been used successfully in many dives; it is believed to be a safe and trustworthy piece of equipment. However, neither the editor, author, nor publisher of this journal will be able to accept responsibility for any accidental damage to person or property arising from the use of a similar equipment.

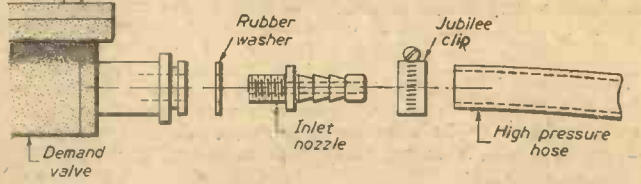


Fig. 2.—Modification to the inlet side of the low-pressure valve.

Principle of the Aqualung

The reason there is a limit to the useful length of a snorkel tube is that water pressure increases at the rate of 15lb. per sq. in. for every 33ft. of depth. It is noticeable when "treading water" with the mouth just above the surface, that breathing requires a slight effort; if the lungs sink 2ft. farther below the surface the pressure of the surrounding water prevents them working at all. In order to counteract this effect, the aqualung is arranged automatically to adjust the pressure of the air it supplies to equal the pressure of the surrounding water. This is done by the "demand" valve, which also conserves the air in the cylinder by closing when the lungs are not taking in air.

The cylinder has a capacity of 0.4 cu.ft., and it contains 40 cu.ft. of air, compressed to a pressure of 2,000lb. per sq.in., when fully charged. This extremely high pressure has first to be reduced by a valve to about 100lb. per sq.in., and the air is then fed to the demand valve, which performs the dual function of equalising the pressure in the inlet tube to that of the surrounding water and supplying air to the lungs as soon as they start to inhale.

Conventional aqualungs terminate the inlet and exhaust tubes correctly close together, but as the complete valve gear is mounted in a single unit on top of the cylinder there is often a difference in pressure between the sensitive demand valve and the diver's mouth. In the normal horizontal swimming position this causes the air to be a little difficult to draw through, but while the diver is swimming on his back the valve is placed well below the level of his face, and causes a leakage of air through his nose and dive mask. The aqualung to be described avoids the worst of this trouble by having separate demand and reducing valves, and the demand valve is worn in the best possible compromise position, high on the diver's chest. The same conditions dictate that the inlet and exhaust tubes should terminate close together at the demand valve; if they were only a few inches apart there would be some positions of the diver in the water where the demand valve would be at a greater depth and pressure than the no-return valve in the exhaust tube, and

Fig. 11.—Front view of a diver wearing the aqualung described.

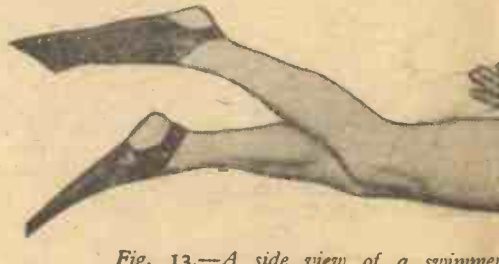


Fig. 13.—A side view of a swimmer

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Underwater Swimming Apparatus

. FEARON

An artist's impression of a standard aqualung in use.

there would be a continuous waste of air.

Cylinder, Closure Valve, Reducing Valve and Gauge

The following descriptions of equipment to be bought and the modifications required will deal in logical order with the high-pressure gear first, then the reducing valve and the low-pressure demand valve, breathing tubes, and exhaust valve. The items to be bought and sources of supply are given on page 166 in the "Parts List."

The high-pressure oxygen regulator, Fig. 1, should first be unscrewed from its small cylinder, and this may prove to be a job for the local garage if the thread is obstinate. Then the complete reducing valve, with its hat-shaped cover, should be unscrewed, revealing the microscopically small oxygen aperture in the valve outlet. This jet should be removed by unscrewing and the aperture soldered up. Care should be taken not to lose the copper washer which seals the jet in place, for both jet and washer will have to be replaced each time the final cylinder is sent away for refill or test. This is necessary because it would be impossible to fill the cylinder if there were a continuous leak through the jet seating. However, when the complete aqualung is assembled the normally closed demand valve prevents this escape of air.

Fig. 12.—Rear view of the aqualung.

The heavy spring against which the metal diaphragm of the reducing valve operates is a steel spring, and therefore liable to rust.

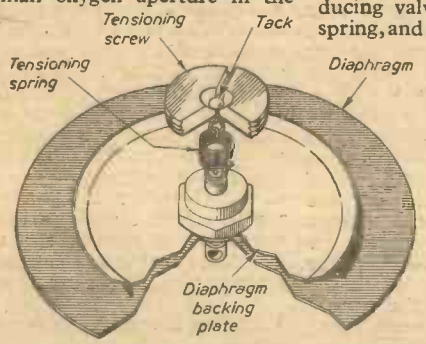

Fig. 3.—Arrangement for tensioning the diaphragm to keep the low-pressure inlet valve normally closed.

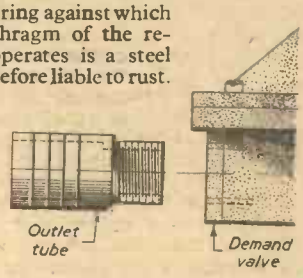

Fig. 4.—Connection for the inlet breathing tube.

wearing the complete aqualung equipment.

It should be removed and either plated with a corrosion-resistant metal, or else well greased and kept well greased. It may be taken out after removing the hat-shaped cover and unscrewing the large hexagon lock-nut and hexagon nut. Alternatively the cover may be waterproofed by soldering a path over the ⅛in. diameter hole and seating the cover on to a rubber washer.

The other components which form an integral part of the high-pressure oxygen regulator are a closure screw-valve, a gauge calibrated 0 to 10 minutes, a female bayonet outlet connection and a refilling connection which is normally closed by a blind ¼in. B.S.P. nipple.

The gauge reads 10 minutes when the cylinder is filled to 1,800lb. per sq. in., so at the maximum permitted filling pressure of 1,980lb. it will read just above this figure, and when the cylinder is only half full it will read just above the five-minute mark. It is important to have this gauge sealed up efficiently with a good adhesive waterproof resin, for it will have to withstand water pressure of pounds per square inch without the slightest leak.

The Cylinder

The regulator head must now be stripped as completely as possible of all its fragile components, and their sealing washers, and the brass body sent away to the suppliers of the large cylinder, who will fit it into the cylinder neck. This is a specialist's job and cannot be attempted by anyone with only normal workshop facilities.

The cylinder, which is by far the most expensive item in the whole assembly, is a specially made lightweight model, 19in. tall and 7in. diameter. Although the wall thickness is only about 1/10in. the cylinder will withstand test pressures of 3,000lb. per sq. in., for it is solid drawn from manganese steel, strongest of the steel alloys.

Reducing Valve—Demand Valve Connector

From the reducing valve, which is carried on the cylinder, air at about 100lb. per sq. in. pressure has to be taken via flexible hose to the demand valve on the diver's chest. The rubber tube which is supplied with the double-ended bayonet connector is not strong enough to withstand this pressure, and the high-pressure hose which is recommended should be used. This hose is tested at 3,000lb. pressure when new, so the factor of safety should be adequate.

In order to fit the push-on nozzle of the male bayonet to the hose it will probably be necessary to dismantle the fitting and turn down the end of the nozzle slightly. Note that the perforated nozzle will not unscrew to allow dismantling until a small phosphor-bronze circlip is removed from the thread. When the high-pressure hose has been pushed well on to its nozzle a Jubilee clip should be screwed on to ensure a thoroughly safe connection.

The female end of the double bayonet connector should be dismantled, and the outer tube put on one side for transformation into a no-return valve. The rounded end of the push-on nozzle should again be turned down so that it can be forced into the high-pressure hose, and its other end should be shaped and threaded ⅛in. B.S.P. as shown in Fig. 2.

Fig. 5.—Photograph of the completely modified low-pressure valve.

The demand valve, which comes next in the sequence, consists of a modified Calor gas low-pressure valve 1946 Type F, and the inlet should be tapped ⅛in. B.S.P. to take the nozzle which has just been threaded. The large hexagon nut should be cut away as it is not required. A thin rubber washer between the nozzle and its screw-in seating completes a good air-tight joint.

The Demand Valve

This valve should now be dismantled, after removal of the eight securing bolts and the

small screw-on cap. The large compression spring and its packing piece are not required, and the fabric diaphragm should be replaced by one of identical size cut out of 1/32in. sheet rubber. Fig. 3 shows the main modifications, which consist of drilling the centre of the brass diaphragm centre, tapping it 4 B.A. and securing to it loosely a double-ended soldering tag, which is required to hold one end of a diaphragm tensioning spring.

The spring was close-wound with a ¼in. former on a power-driven lathe, and was originally a copper-plated steel spring from a motor-cycle carburetter. The wire diameter is 0.035in. and there are 8 turns. The other end of the spring is attached loosely to a tack seated in a central counter-sunk hole in the screw tension-adjusting disc. The pointed end of the tack, which protrudes through the underside of this disc, is looped to hold the spring end. Note that the spring should not be finally connected at both ends until the disc is screwed back into its thread, but after doing this both ends of the spring should be hooked so that they cannot jump off.

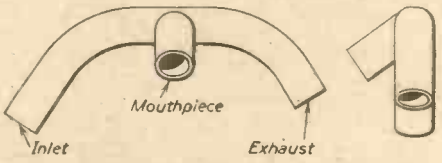

Fig. 6.—Shaping of ¾in. copper tube to form the mouthpiece. The rubber "gag" which fits on to the short arm can be taken from a conventional snorkel tube.

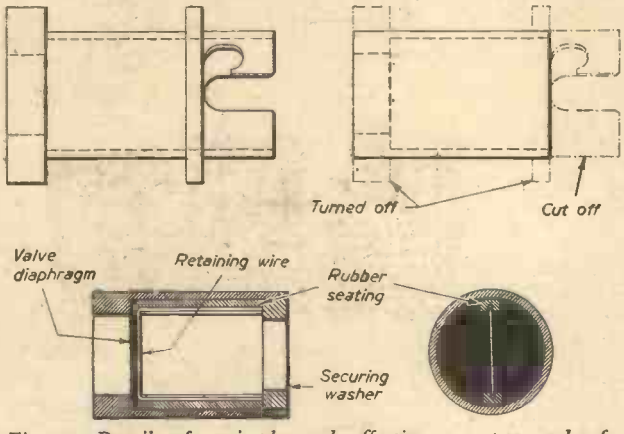

Fig. 7.—Details of a simple and effective no-return valve for the air exhaust tube.

The top cover of the valve should now be drilled with about 24 ¼in. diameter holes, to allow the water to reach the side of the diaphragm remote from the air supply. The single hole that already exists is not sufficient because there is considerable movement on the diaphragm which will tend to displace a cubic inch or so of water at each movement, and any restriction on exit or ingress of water would make the action of the diaphragm sluggish.

The air outlet from the demand valve must be enlarged, but before this is done the lever mechanism will have to be removed from the channel in the base of the valve. It is not easy to remove the lever pivot, but this will not prove to be an obstacle if care is taken in enlarging the hole.

The size of the hole will vary according to the size of outlet tube to be used, but it should be remembered that the bore of this breathing tube section should not at any point be less than ⅜in. The outlet shown in Fig. 4 was made from a piece of aluminium alloy tube found in the scrap box, and as the outer diameter of the thicker section is 1in. it connects well to the respirator tubing which takes the air to the mouth. The narrow section was threaded ¾in., 26 t.p.i., and the body of the valve was tapped accordingly. Before being finally screwed home the threads were smeared with waterproof resin varnish.

It may prove possible to use a short length of the ¾in. copper water pipe which is recommended later for the mouthpiece; if so a small rubber adaptor tube of the type described then will ensure a good fit for the respirator tube. A circular clip held by one of the eight bolts of the demand valve cover is used to secure a short piece of the same ¾in. copper tube, on to which the outlet end of the exhaust tube is pushed. Fig. 5 is a photograph of the completely modified demand valve.

The valve illustrated was mounted on a 4½in. by 3½in. piece of 1/16in. thick fibre sheet, and two edges of the fibre were slotted so that small webbing straps could be secured to it. It was just possible to drill the rear of the valve, at the four corners of the channel, and tap the holes 4 B.A. to screw the fibre to the valve, without risk of the holes breaking through into the air chamber.

Mouthpiece

The inlet respirator tube connects between the outlet of the demand valve and the mouthpiece, which as has already been stated is made from ¾in. copper pipe. Rubber adaptor sleeving with inside and outside diameters of ¾in. and 1in. respectively is used to ensure a tight non-slip fit. In the aqualung shown in the photographs it was decided to bring the high-pressure hose over the right shoulder, although it could equally well have gone over the left, and this positioned the inlet air tube on the left of the wearer, with the exhaust tube on the right. For this reason the left-hand side of the mouthpiece is the longer side. This has been arranged so that both inlet and exhaust tubes will be at similar tensions for any position of the head, and compensates for the fact that the securing fixing for the exhaust tube on the demand valve is slightly above that for the inlet tube.

It must be remembered that the normal position of the head of a submarine swimmer is tilted back as far as it will comfortably go, so that the eyes can look along the line of travel. This dictates the odd-looking angle of the T-piece pipe which is soldered on to the main body of the mouthpiece; when the eyes are looking straight up, the two ends of the pipe should be almost parallel with the chest. Perhaps the importance of this will be lost to readers with no experience of diving masks; those who have used them will know that all models available at present have a very limited field of view. Fig. 6 is a sketch of the mouthpiece tubing.

A second advantage possessed by this aqualung over conventional models may be mentioned here. When the head is thrown back in this way to give good visibility in the direction of travel a demand valve carried on the cylinder head proves to be most uncomfortable to the back of the head; the demand valve worn on the chest solves this problem completely.

One of the cheap snorkel tubes readily available in sports shops will supply the rubber mouth-grip which puts the finishing touch to the mouthpiece, and incidentally it will be a good thing always to take this snorkel along when diving in open water. The aqualung with an exhausted air cylinder soon leads to an aqualung with an exhausted swimmer, for the weight of the lung plus the lead weights worn on the belt keep a surface swimmer very low in the water.

No-return Valve

A no-return valve must be fitted in the exhaust tube, close to its termination on the demand valve, to prevent water being drawn up the tube. The type found in the top of a Services respirator charcoal filter is fairly satisfactory, but many minutes' use may allow a noticeable amount of water to get into the tube.

The design shown in Fig. 7 can be quite easily made, mainly from the outer shell of the female bayonet connector which has already supplied the high-pressure inlet nozzle for the demand valve. The slotted end of the tube is cut off, and both raised shoulders are turned down, leaving a tube with a smooth plain exterior and a slight constriction at one end of the interior. A piece of the thin rubber sheet which was used for the demand valve diaphragm must be cut so that it rests inside the tube on this constriction and yet does not quite touch the inner wall of the tube at any point. A U-shaped piece of phosphor-bronze spring wire is next pushed down the tube to hold the rubber in place, and this is held firmly, in turn, by two square pillars cut from 3/16in. thick rubber. The pillars are nicked along their length to receive the vertical arms of the U-spring. A circular fibre or rubber washer, which must be a tight push-fit in the tube, finally secures the whole assembly. Reference to the accompanying drawing will make the build-up clear.

Webbing Harness

The aqualung is carried on the back of the diver, and its 20lb. or so of weight in air must be supported firmly by sturdy shoulder straps. In water, however, the cylinder is buoyant, and its movement away from the body in any direction must be prevented. In addition it makes the diver buoyant, and he must carry anything from 8lb. to 14lb. of lead weights (depending on his own buoyancy and the density of the water) on the front of

PARTS LIST

Part	From	Cost, including postage
Cylinder to M.O.S. Specification 0.133 ...	Messrs. Pryce, 157, Malden Road, Cheam, Surrey.	£10/5/-
Oxygen Regulator, gauge and double bayonet connector	Watson's Eastern Motors, Aldeburgh, Suffolk.	17/-
High-pressure hose	Belgrave Wire Works, 130, Halkin Street, Leicester.	2/6
Two Service respirators (for tubes)... ...	Sexton & Scragg (Widnes) Ltd., Albert Road, Widnes, Lancs.	5/-
Calor Valve 1946 Type "F"	Calor Gas Ltd., Spares and Service Agents	30/-
Service Webbing belt	Army & Navy Boot Stores, 22, Byrom Street, Liverpool, 3.	5/6
Or Khaki safety belt	Milligans (see below). ...	2/6
Webbing straps: Seven 1ft. 8in. x ¾in., five 3ft. 4in. x 1in., twelve fibre washers (one required for no-return valve)	Milligans, 24, Harford Street, Liverpool, 3.	14/-

his belt to give him neutral buoyancy. This is important, for aqualung divers should be able to swim in all directions in the water with equal ease. Note that as water is virtually incompressible its density does not vary appreciably from surface to bottom, notwithstanding the well-worn tale about drowned people's bodies floating about eternally, each at its own level. In actual fact not even a skeleton has ever been found in wrecks which were more than a few months old.

The harness belt must be strong in order to carry the lead weights, and it must be firmly buckled so that it does not fly open in the water. On the other hand there may come a time when the whole aqualung proves an encumbrance and has to be shed quickly in the water, so the buckle must be capable of quick release. If the Services type of belt suggested in the parts list is used, it will be found possible to hammer the male end of the buckle until it grips securely and yet gives this quick release facility. Time spent in practising opening and closing the buckle by touch many times before entering the water will be time well spent.

Fig. 8 shows the configuration of the webbing harness. When ordering the 2in. straps for the weights and cylinder top, specify brass buckles, for these are used in the harness, and must be corrosion-resistant. The buckles on the 1in. straps are zinc-plated, and so are fairly corrosion-resistant, but they do not give such smooth and easy adjustment at those places where the harness has to be fitted tightly where it is already reasonably taut as the recommended " D " rings. These are 1in. D-shaped rings, sewn into strap ends in twos to make a continuously-adjustable buckle. The method of use is to pass the free end of the strap which is to be joined down through both rings and then down again between them. A tug on the free end of the strap will then be found to tighten the fastening, but there will be no slip back in the other direction.

All joins in the webbing straps and belt should be double-stitched (using two needles) with carpet thread, and the free ends of the thread tied in a firm knot at the end of each rectangular stitching section. Cut ends of strap should be tucked under for about ½in. before stitching is begun, in order to prevent unravelling of the end threads. Unravelling of the small straps used for the weights can be prevented if a waterproof glue is rubbed well into each side of the place it is intended to cut, an hour or two before cutting them to size. One of these spare cut ends is used for half of the cylinder-securing strap near the cylinder head, and two more hold the demand valve high up on the diver's chest. This chest strap must also be quick-release, opening at the side opposite the side from which the high-pressure hose comes. The strap illustrated was fitted with a sturdy press-stud fastener taken from a Services respirator haversack.

The Lead Weights

Six of these were cast, each between 2 and 2¼lb. in weight. Scrap lead was used, and after being scrubbed it was weighed out into batches ready for melting. The melt was kept clear of scum, by skimming and stirring until no more scum was produced, and then poured into the mould shown in Fig. 9. The four walls of the mould were made by tacking together four pieces of 2½in. × ¾in. wood, two of which had metal strips screwed in vertically and centrally to form the strap channels. After the wood had been dried thoroughly in front of a hot fire for some hours it was placed on a trowel, which formed the base of the mould. Fig. 10 is a photograph of a complete set of weights.

Testing

The tension on the demand valve adjusting spring should be adjusted until it is impossible to blow through the inlet tube to the valve, although the valve has just been opened by sucking air through the outlet tube. After assembling the rest of the aqualung, it should be ready for full-pressure testing.

The cylinder should be delivered to a British Oxygen Company air-pumping station, if at all possible, to avoid possible risk of damage to the valve-gear by larger cylinders during transportation from collection depot to pumping station. In any case it is wise to fit some kind of protective cover to the valve-gear at the top of the cylinder. The bayonet connector at the end of the high-pressure hose must, of course, be disconnected, and the soldered-up jet replaced in its position in the reducing valve.

For a few shillings extra charge B.O.C. will paint the cylinder in the regulation fashion, with alternate black and white quadrants at the top third and grey below, with the word " AIR " stencilled on plainly in black. The cost of an air fill is about 4s. for commercial quality, but more than twice this for medically pure air.

If you should be able to join a branch of the British Sub-aqua Club which possesses a transfer pump they will be able to pump your cylinder for you, at a more reasonable cost, from a large B.O.C. cylinder.

With the cylinder fully charged, make sure that the closure screw-valve is turned off (fully clockwise) and then unscrew the reducing valve to remove the blind jet. After replacing the valve and tightening well home, the bayonet connector should be replaced, and the closure valve opened slightly and slowly.

It must be stressed here that sudden build-ups of pressure should be avoided whenever compressed gasses are being used. Temperatures inside the equipment will be produced by careless handling which could easily touch off a diesel explosion if any traces of oil or grease are present. Equally, of course, it is important to keep all apparatus free of even minute smears of oil or grease.

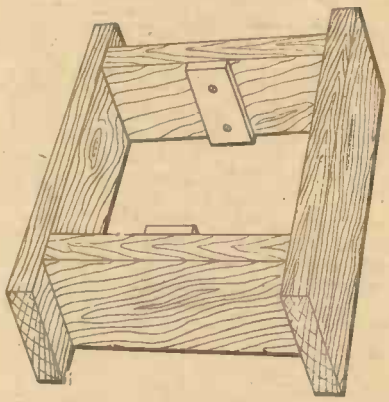

Fig. 9.—Suggested mould shape for casting the lead weights.

Fig. 10.—A set of lead weights, totalling 13½lb.

With the valve open there will probably be a slight escape of air through the demand valve; this should be stopped by increasing the tension on the spring with the adjusting screw-disc. The needle of the pressure gauge should be a little over the 10-minute mark, and when the closure valve is shut the needle should stay where it is. If it does not there must be an air leak somewhere. If the test is satisfactory the valve may be opened again and the operation of the aqualung tested by taking a few breaths from the mouthpiece.

If air comes through freely as required and can be exhaled without effort the equipment is ready for a full-scale water test, and you are well on the way to partaking of the joys of this new and exhilarating sport of submarine exploration. Figs. 11 and 12 give some idea of what you will look like to the fish.

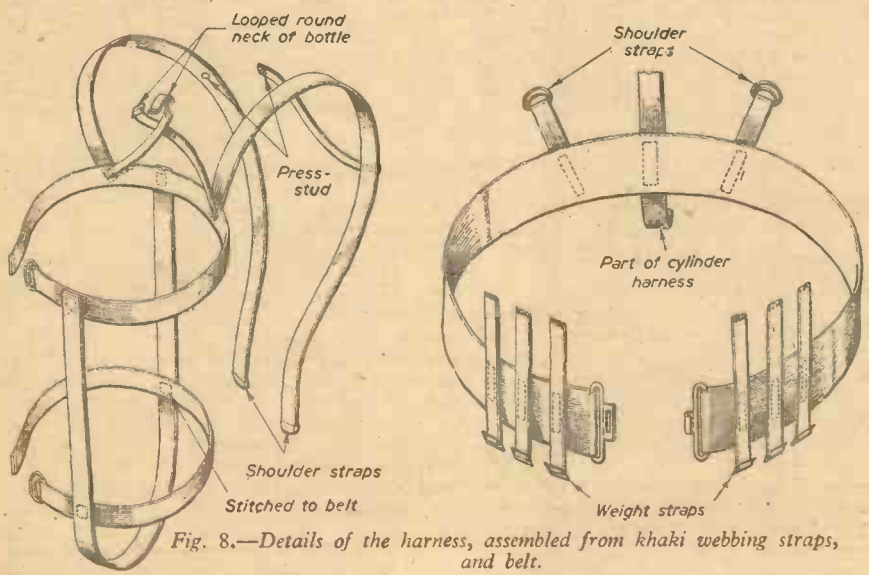

Fig. 8.—Details of the harness, assembled from khaki webbing straps, and belt.

Scientific Timekeeping

Gravity Escapements : Temperature-compensating Pendulums : Electrical Escapement : Crystal Timepieces

By F. G. RAYER

THE accuracy of present-day clocks of the type used for astronomical and other scientific purposes is very high, better than one second per year in some cases, and has been achieved by the systematic elimination of variable factors which may change the timekeeping rate of the mechanism. Many of the principles employed are extremely interesting. Early clocks used a "fly" or air-fan to regulate the rate of unwinding and were poor timekeepers. With the pendulum and balance-wheel as regulators much higher standards of accuracy were possible, but the exact rate of the clock still varied under the influence of variable factors—e.g., temperature (which changes the length of the pendulum rod, and hence its rate of swing), air pressure (which modifies the density of the medium through which the bob swings), and variation in driving force. Such factors have been eliminated one by one, until the present-day scientific clock has reached a remarkable accuracy.

The usual type of clock escapement is shown in Fig. 1, and is to be found in this or similar form in all domestic pendulum clocks. As the pendulum swings, the pallets allow one tooth of the escapement wheel to pass at a time, while the rotation of the wheel imparts impulses to the pallets, crutch and pendulum, so that the latter remains swinging. In clocks of higher grade the pallets may be jewelled to reduce friction and wear. They, and the teeth of the escapement wheel, may also be found in a variety of shapes. All, however, serve the same general purpose.

The length of pendulum in pendulum clocks depends upon the number of teeth on the escapement wheel and gear ratio between escapement wheel and hands. A half-second pendulum requires to be approximately 9¾in. long and a one-second pendulum approximately 39in. long. Longer pendulums are found in some tower clocks, etc. A two-second

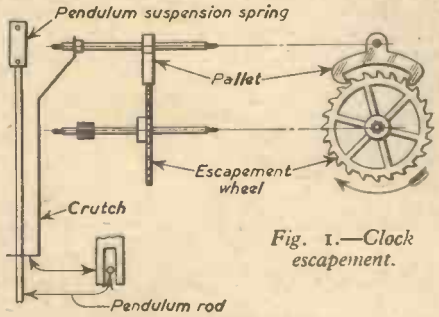

Fig. 1.—Clock escapement.

pendulum would have to be about 156in. long. The exact length depends upon the latitude, and needs to be longer towards the poles.

Though such a clock may keep quite good time, it is useless for scientific purposes because all the variable factors mentioned are at work. If the clock is spring-driven, the worst cause of a fluctuating rate will be the weakening power of the spring as it unwinds. A cheap clock may easily gain when tightly wound and lose badly when almost unwound. Though this can be largely overcome by using a weight as driving power, or employing a fusee and chain to equalise the power of the spring, some variation in driving power is inevitable. The effect of such changes can be overcome by special escapements.

Gravity Escapements

To overcome the variations just described an escapement operating on the principle shown in Fig. 2 is usually employed. The escapement wheel is rotated by spring or weight, through the usual gear train. Its rotation is prevented by the holding catch, until the catch is lifted by the small roller fixed to the pendulum rod. The impulse lever is normally resting upon the point of one of the escapement wheel teeth.

When the holding catch is released by the roller, the escapement wheel turns, allowing the impulse lever to fall. The roller on this lever gives an impulse to the pendulum rod,

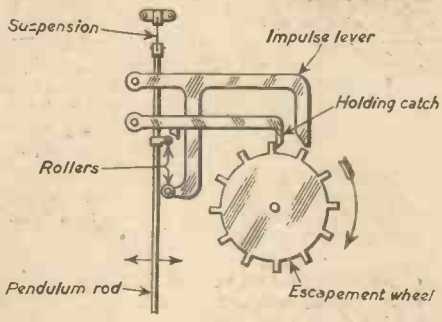

Fig. 2.—Principle of gravity escapement.

pushing it to the left. The escapement wheel then lifts the impulse lever to its original position, the wheel being held until the holding catch is again released by the pendulum swinging to the right.

With this system, the escapement wheel serves only to lift the impulse lever to its original position. The pendulum is kept swinging by the fall of this lever, which depends upon gravity, and is in no way related to the power applied to the escapement wheel. As a result, the clock is freed from any variation arising from changes in spring tension, or any similar cause.

Forms of gravity escapement are employed in almost all high-grade clocks where scientific standards of accuracy are required. Matters may be arranged so that impulses are given to the pendulum in both directions. The exact rate of the pendulum still depends upon its temperature, however, as expansion due to an increase in temperature slows the rate of swinging.

Temperature-compensating Pendulums

The ordinary type of pendulum is shown in Fig. 3a, and the rate of swing is adjusted by moving the bob up and down on the rod. It is lowered to make the clock run slower, and vice versa. With long pendulums subjected to considerable changes in temperature quite large inaccuracies of rate may be caused by expansions and contractions modifying the length of the rod. This can be reduced to some extent by using a material which is not greatly influenced by temperature—a wooden rod is used in some clocks of quite high grade, or a nickel and steel alloy such as Invar, which is little affected by temperature, may be used.

Some modification in length must inevitably arise, however, and an early method of overcoming the results of this is shown at 3b. Here, the pendulum bob is of mercury, the vessel not being wholly full. As the pendulum rod expands downwards, the mercury expands upwards, thus compensating for the change in pendulum length. Such a pendulum can be more accurate than the ordinary type. A scale is often fitted so that the clock can be positioned to provide an equal swing each side the zero, or central hanging point of the pendulum.

A further method is shown in Fig. 3c. Here, the rods "B" support the pendulum bob. These rods are fixed to the upper cross-piece only, to which the outer rods "A" are also fixed. These outer rods are fixed to the lower cross-piece, to which the inner rod "A" is also fixed. If temperature increases, the inner rod "A" and two rods "B" expand in a downwards direction, which would lower the bob. However, the outer rods "A" expand in an *upward* direction, lifting the top sliding cross-piece. If the metals are suitably chosen, this upwards expansion can exactly compensate for the downward expansion of the other rods, so that the bob remains in the same position. This results in a pendulum virtually unaffected by temperature variation.

Even when these methods are employed, however, some variation in the clock's rate arises, largely due to changes in air pressure. With increased air pressure, the pendulum has to swing through a denser medium. Even this difficulty has, however, been overcome in observatory and other scientific clocks, and electrical operation is most usual. Some types of electrical clocks use a high-grade chronometer type movement, the clock being spring-driven and being wound electrically (usually by a magnet and ratchet wheel) at short intervals—e.g., as frequently as 1 minute. This method is not that normally used when the highest grade of accuracy is required, however, when the electrical free-pendulum gravity escapement is used.

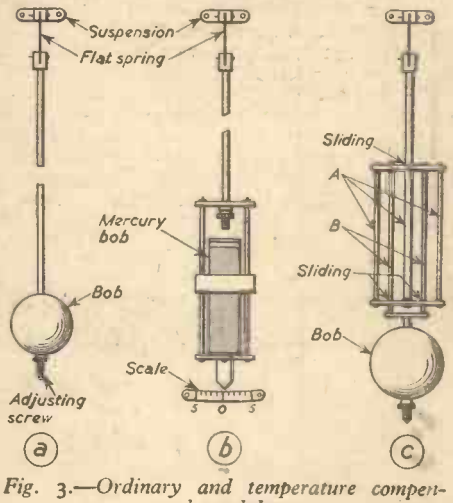

Fig. 3.—Ordinary and temperature compensated pendulums.

Electrical Escapement

One form of this is illustrated in Fig. 4, and it may be assumed that the pendulum will be of a type designed to avoid variations in rate due to changes in temperature. Each time the pendulum swings, the jewelled pawl rotates the toothed wheel one tooth, back motion of the wheel being prevented by a trailing pawl. The impulse lever is normally in its raised position, being held by the

catch. The magnet armature is dropped upon its stop.

When the raised segment of the wheel reaches the pawl, the latter does not drop to its usual extent. As the pendulum swings to the right, the top of the pawl therefore draws the catch aside, and the impulse lever drops. This gives an impulse to the pendulum, the roller moving upon the shaped piece fitted to the pendulum rod. When the impulse lever has reached its lowest position the two contacts meet, energising the magnet. The armature is then drawn sharply upwards, which lifts the impulse lever so that it is again held in the raised position by the catch. As the armature cannot lift quite so far as the impulse lever, the latter continues its upwards movement under momentum, breaking contact with the armature. The armature then falls to rest upon its stop.

With this type of clock the impulse given to the pendulum is not dependent upon the strength of the operating current, which serves merely to lift the impulse lever to its raised position. If the pendulum completes its swing in one second, an impulse will be given to it each 12 seconds. The rotation of the wheel may operate the clock hands through a suitable gear train.

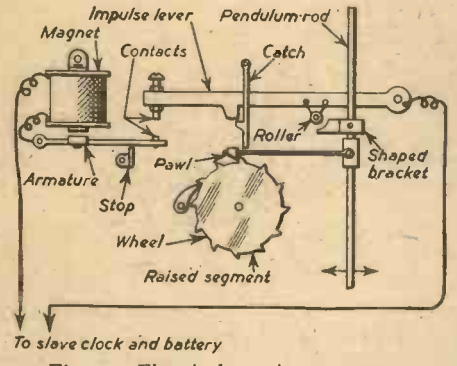

Fig. 4.—Electrical gravity escapement.

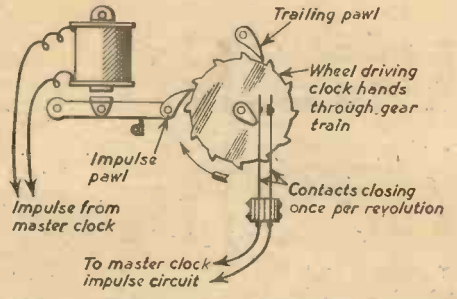

Fig. 5.—Master-slave ; slave-master control.

In order that any possible cause of variation may be removed, a further unit is employed in the free-pendulum clock. This is shown in Fig. 5, and consists of a type of slave clock. With such a slave clock, impulses are received from the master clock pendulum. With each impulse (or completion of the electrical circuit) the pawl turns the wheel one tooth, this rotation being used to operate the clock hands. There is thus no need for the wheel in the master clock to drive the hands, and possible friction from this cause is eliminated. It is also possible for the impulse lever setting circuit to be completed by the slave clock. As the slave clock derives its power from an external current source, variations in which cannot affect its rate of operation, no change in rate is possible in the slave clock. The master clock itself has no work to do, since the clock hands are turned by the slave clock. Its pendulum may, in addition, be enclosed in an air-tight cylinder which is partly exhausted, and this is the form of construction employed in the highest-grade "free pendulum" observatory clocks. Since external influences have been removed to such an extent, the time-keeping abilities of such clocks may be better than one second in 12 months. Final regulation may be by means of adjustment of air pressure within the cylinder. The electrical escapement, with slave clock, means that no moving spindles need project from the cylinder, and the electrical conductors can be sealed in.

Crystal Timepieces

Piezo-electrical crystals are used in radio transmitter circuits because they have the ability to retain a frequency of oscillation within remarkably accurate limits. This principle is employed in crystal-controlled clocks, the method of operation of which is shown in Fig. 6.

The crystal is vacuum sealed under constant mechanical pressure, and maintains its oscillations by means of an oscillatory circuit employing valves or other means. The frequency of oscillation is reduced to a more convenient figure by divider circuits, until the output is of such a frequency that a synchronous motor may be run. Such a motor employs a rotor with a specified number of poles or teeth, and running between fixed pole pieces energised by the field winding. Once set in motion at a suitable speed, the rotor will continue to run in synchronisation with the impulses in the coil. Suitable reduction gearing, by worm or spur gears, reduces the speed to 1 revolution per minute for the clock second hand. Further ratios of 60 : 1 and 12 : 1 (or 24 : 1) operate the other hands. Other clocks may be operated by contacts on the second hand spindle, which will close once each minute, thus energising slave type movements which will all maintain equal accuracy.

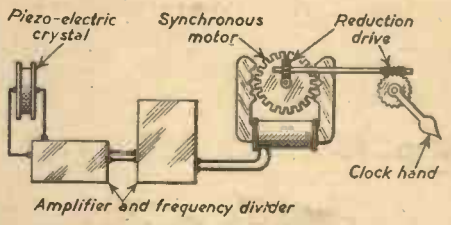

Fig. 6.—Crystal controlled timepiece.

Plastic Stamps

Using Plastic as the Basic Material Instead of Rubber

IN a past issue of PRACTICAL MECHANICS (December, 1953) details were given of rubber stamps manufacture. A more recent development in this field, however, has made this process an easier proposition for the amateur. Instead of using rubber as the basic material, an I.C.I. plastic called "Welvic Paste" has been employed with excellent results.

Plastic has several important advantages over rubber, in that it is easier to process, it is not attacked by the pad ink, and it does not perish with age. Probably the biggest advantage is the simplicity of processing. All that is necessary is to pour it, as you would a metal, into the mould and apply heat. Instead of having to perform the tricky vulcanising process the application of heat at about 150 deg. C. alone is sufficient to cause gelation of the plastic. It is quite possible to make a serviceable stamp by heating to only 110 deg., although the plastic does not attain its full strength at this temperature.

It is not necessary to repeat the methods of preparing plaster of Paris moulds as this is a simple operation within the scope of anyone, but there is a specialised job which this plastic method is particularly suitable for, but which may be tricky from the mould point of view. Many people to-day are interested in producing their own maps or charts, especially schoolteachers, but the problem of getting a rubber roller type of stamp for the rapid production of outline maps is often great when the makers do not have the particular one required in their catalogue Indeed, the cost of producing a non-standard roller is prohibitive. Using the plastic, however, this job becomes simple.

First, obtain a shallow tray, about 1in. deep and line the bottom with a sheet of thin glass. Prepare now a mixture of plaster of Paris (3lb. of plaster to one quart of water). Mix the two by adding the plaster to the water slowly, stirring all the time. Pour the creamy mixture into the tray and allow to set for several hours at least, as the mould must be absolutely dry before using. Remove the mould gently from the tray and turn it over and replace in the tray again. Now the underside will be upwards and if the casting has been done well this surface which has been against the glass will have a very smooth finish.

A positive tracing of the map required should now be made on the plaster surface and, with the aid of a stencil pen or similar tool, the tracing should be engraved into the plaster. This is not such a difficult job as it sounds as the plaster is of a porous nature and can be readily scratched with a sharp implement. The engraving should be carried out to a depth of about 1/16in. When all the figuring required has been done, dust off the removed powdered plaster and pour the plastic over it to a depth of about 3/16in. This thickness is right for a map of approximately 1ft. square. For smaller sizes the thickness can be reduced.

Now heat the whole mould, complete with plastic, to a temperature of 110 to 150 deg. C. As soon as the temperature reaches 110deg. gelation will take place and, if required, the process can be stopped there, but to produce the best the plastic is capable of, complete heating to 150 deg. should be carried out. Do not attempt to remove the plastic from the mould whilst it is still hot as it will probably tear. Allow the whole job to cool down and then gently peel it off from one corner. The result will be a relief map in the negative. After the application of ink this is ready for printing.

Two methods of printing are open to the user : first, using it flat, rolling the ink on to it and then following with the paper or secondly, mounting the plastic map on a wooden roller with a rubber type adhesive and rolling it over the ink pad, and then over the paper. Of the two methods, the second is the better, as it is much quicker and more accurate. Large stamp pads for the purpose can either be bought ready-made or a simple one can be made up.

Obtain a piece of wood a little larger than the map size and cover its upper surface with tinfoil. Now cut about 10 squares of surgical lint and lay them on the surface so that they cover the tinfoil. Cut a square of white cotton material, large enough to cover the pile of lint and also overlap the edges of the wood by about 1in. Using drawing pins secure the edges of the cotton underneath, pulling it tight to clamp the lint firmly in place. The pad can now be placed in a shallow tin and is ready for use

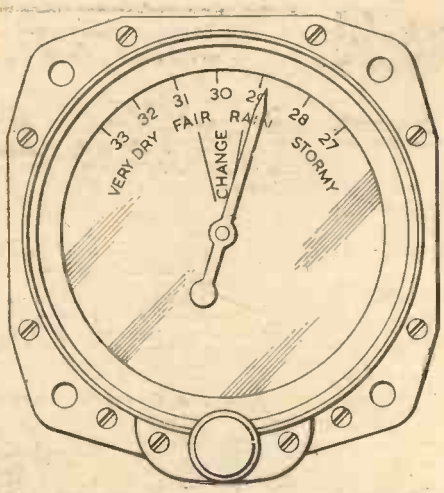

Fig. 1.—The barometer with its new dial.

A Domestic Barometer

Details for Converting a Mark XVIIA Altimeter

By C. W. TINSON

THE Mark XVIIA altimeter is not one of the very sensitive type, but as it is more readily obtainable from stores which sell ex-Government material it is popular among those who wish to make use of it as a barometer. It is quite effective as such and there is no great difficulty in making the transformation, but unless one is familiar with altimeters it is quite easy to do this in such a way that the instrument gives incorrect readings.

This mark of altimeter is constructed on the aneroid principle, with a metallic capsule which expands or contracts according to the atmospheric pressure, the movement being connected to the pointer by means of suitable gearing. The scale on the dial consists of an outer circle of 2¾in. diameter, calibrated in height up to 20,000ft. and inside this is approximately three-quarters of an inner circle. After making one complete revolution up to 20,000ft., the pointer goes on and heights between this and 35,000ft. are indicated on the inner ring.

In Great Britain the atmospheric pressure rarely drops below 28in. of mercury, nor is it often much above 30.5in.; a range of from 27 to 33in. is more than ample to cover barometric requirements. This range corresponds to an altimeter height difference of about 6,000ft. and conveniently covers the top quarter of the dial in a nice symmetrical arrangement. The appearance of this altimeter when provided with a new dial for use as a barometer will be as is shown in Fig. 1. What is required is, firstly the best way of laying out the new scale and, secondly, how to set up the instrument so that the indications it gives will be true ones.

Laying Out a New Scale

As an altimeter, the calibrations are in accordance with the relation between atmospheric pressure and what is known as the "I.C.A.N. Standard Atmosphere," in which, by international agreement, certain "indicated" heights are associated with defined pressures and temperatures, and according to this standard zero height is fixed at a pressure of 29.92in. of mercury and a temperature of 15 deg. C., in which conditions the level is known as "standard sea level." The table which was published on page 531 of the September issue of PRACTICAL MECHANICS, shows this relation and is, therefore, applicable for the purpose of setting out a new dial to give barometric instead of height indications. Using this table, a graph of pressure against height may be plotted to find the particular heights which correspond to the specific pressures in which we are interested, which are from 27 to 33 in. of mercury. These are tabulated below.

Pressure inches of mercury	Corresponding altimeter height, ft.
27	2815
28	1830
29	850
30	—98
31	—1002
32	—1880
33	—2760

In relation to the zero height mark on the dial of the altimeter, the angles which will put these pressures in their correct places on the new dial are shown in Fig. 2. It is as well to cut a small vee-notch in the top of the new dial in the position shown in Fig. 2, or otherwise to mark the new dial in such a way that the line from which all the angles are measured can be made to coincide exactly with the zero height mark on the existing dial during the process of sticking the new one on top of the existing one.

The case of the instrument consists of a bakelite moulding, and the glass is clamped in position by a bakelite bezel secured by eight countersunk screws. Having removed the bezel and the glass, the inexperienced are advised to get a watchmaker to take off the pointer, so that damage to the delicate mechanism may be avoided. The new dial can then be stuck on top of the old one and the pointer, glass and bezel reassembled.

The notch which has been cut at "twelve o'clock" should have ensured that the pressure indications are in their right place relatively, and at first sight the job now seems to be complete, but there is a little more to be done to ensure that correct indications are given by the pointer. Before going into this, a little in the way of explanation of the altimeter is necessary.

The Altimeter Explained

A circular window, with white lines branching out of it, will be noticed in the original dial and the reader, if not familiar with altimeters, may be puzzled about this. The short, white lines are called "lubber marks" and the omission of the window and the lubber marks from the new dial may be queried.

An aircraft has to take-off from aerodromes at various heights and in a variety of atmospheric conditions. In many cases the pilot will want to set the pointer of his altimeter to read zero at the point of departure. If, for example, the aerodrome were at 3,000ft. above sea-level and his instrument were not adjustable, he would have to bear in mind that when it said 3,000 it really meant zero height as far as that aerodrome was concerned. Forgetting this could easily bring trouble if the visibility were poor on his return; he would reckon there was a further 3,000ft. of descent before preparing to land when, in fact, there was nil. So it is more convenient for him to be able to zero his altimeter at take-off. To provide a practical means to do this, the whole mechanism complete with pointer is made to rotate within the case by turning the knob which is fitted at the bottom. On the front plate of the mechanism there is a lubber line, and at a certain point in the rotation of the mechanism this line appears in the window. When this registers with the lubber marks on the dial, the pointer being at zero, the pressure is exactly 29.92in. of mercury, giving a fixed and definite level, i.e., "standard sea level," as opposed to the relative levels shown to the pilot when the knob has been turned.

Setting the Barometer

This facility is not much use as an aid to calibrate the barometer, in fact, it is a nuisance. When the job has been done we do not want to have to wait for a day when the pressure is exactly 29.92 at the seaside—to which we should have to go to set the knob so that the lubber line came in the right position. It is necessary, therefore, to have access to another barometer; consult a mercury barometer, however, as this is a scientific instrument and may be depended upon to give pressures accurately. The knob of our altimeter/barometer conversion may then be turned so that its indication agrees with that shown by the mercury instrument.

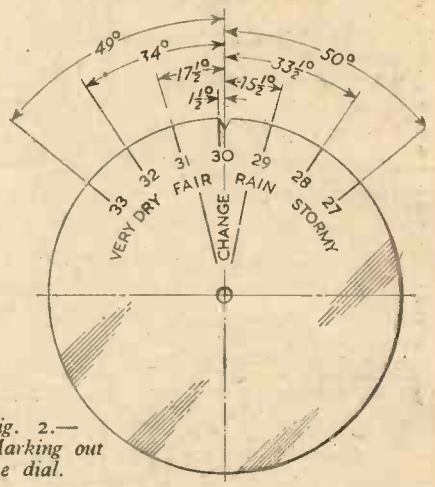

Fig. 2.—Marking out the dial.

Do not make a telephone request for the pressure reading unless the place at which the mercury barometer is situated is known to be at the same level and is not far away; go to the place where it is when you want to set your own. A difference in height of 200ft., for example, makes a difference of about one-fifth of an inch in pressure and this, coupled with the possible difference in the atmospheric conditions at a distant place, may well mean that a telephoned answer would result in an incorrect setting of your job.

Finally, it is desirable to take some action which will prevent anyone interfering with the knob after it has been set, so destroying the accuracy you have taken such trouble to ensure. A light sheet-metal cover can be made to shroud the knob and this can be made to fix to the case of the instrument by means of the two lower screws. If this cover is painted with photographic (matt) black it will blend with the finish on the instrument. In cases where facilities for making a cover are not available, the best way is to paint a dot on the edge of the knob, and another adjacent and in line with it, but on the case, so that subsequent movement of the knob can be detected and the setting returned to its correct position.

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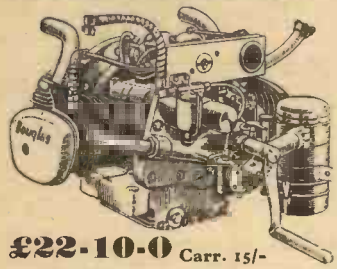

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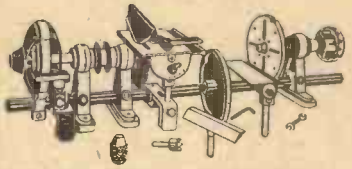

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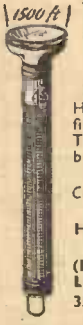

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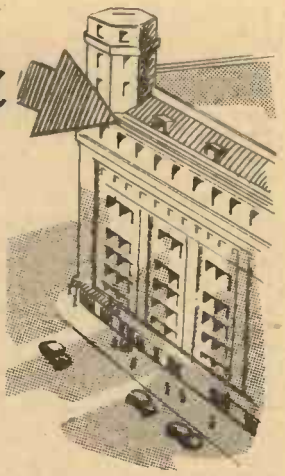


The Editor Does not Necessarily Agree with the Views of his Correspondents

Cosmogony of the Solar System

SIR,—I would like to be permitted to make further comments on Mr. Twining's article and his reply to my letter (November issue).

One very good reason to concentrate on the Andromeda nebula, is that the distance ascribed to it provides the yardstick for the scale of other extra-galactic objects. The nebulae M51, *Canum Venaticorum* and M101, *Ursae Majoris*, are found to be positioned outside the local cluster of galaxies—known as the Local Group—in which we ourselves are situated. Since Hubble's contribution in 1924, all members of the Local Group have been resolved; their Cepheids, novae,, giants, and in several, their satellite globular clusters have been detected. Furthermore, outside this domain, and up to a distance of 10^7 light years, many galaxies have yielded their supergiants.

Mr. Twining's observations in 1901 were seemingly of the Nova Persei. That a nova is a collision between stars, is an archaic hypothesis.

To elucidate further my reference to the spiral structure of our galaxy, a portion of the Milky Way stretching 180° of arc (and opposite to the galactic centre) was resolved into two bands superimposed over each other. These bands, which run approximately parallel to one another, are separated by a distance of several thousand light years; thus Morgan established the existence of spiral arms.

Recent research has granted us new and more accurate distance criteria. As a result, the scale of the universe has been more than doubled; the Andromeda nebula is twice as distant, and its dimensions twice as large. It is of interest that this relieves us of the unique status long attributed to our galaxy.—HAROLD R. ISLIP (St. Albans).

SIR,—I would like to dispute some points raised by E. W. Twining in his article "Astronomy I" (September, 1954), and in his reply to reader H. R. Islip (November, 1954).

Firstly, in his original article, in paragraph two he states that astronomers believe that our own galaxy is one of the largest. This—the Anthropocentric Principle—has always been shunned by cosmologists, and was a drawback until recently, when Walter Baade of Palomar Observatory discovered an error in the "Cepheid method" of determination of extra-galactic distances. Correction of this error led to the doubling of the distances, and consequently the sizes, of all extra-galactic objects. The galaxy in Andromeda and a few other spiral galaxies are now known to be larger than our own galaxy. This error and its correction have been widely publicised in the scientific press ("Times Science Review," Autumn Number: an article by the Astronomer Royal) and should have been considered by your contributor before he published his theory of the cosmogony of the Solar System.

Later in the paragraph, and in his reply to a correspondent in the November issue of PRACTICAL MECHANICS, he asserts that there is no evidence that the spiral galaxies are composed of stars. In 1944 Walter Baade, working at Mt. Wilson, resolved the nucleus of the spiral galaxy in Andromeda into stars by means of a red sensitive photo plate. Since then, this has been repeated with other spiral galaxies.

In his theory E. W. Twining presumes that the extra-galactic nebulae are distributed throughout space along with the stars of a super galaxy which extends in a plane through the observable universe. The stars in the galaxy in Andromeda can be seen on photographic plates and if there were any stars in the neighbourhood of that galaxy it would be possible to detect them and to measure their distances. There is no observational evidence on this point and, therefore, a "super-galaxy" cannot be assumed.

Extra-galactic nebulae could not possibly be confused with globular clusters and other intra-galactic objects for the former have the peculiarity of the "red shift" in their spectra which no other astronomical body has. Here, as before, E. W. Twining has ignored observational evidence which is contrary to his theory.—B. R. POLLARD (Hull).

SIR,—The recent articles on Astronomy by E. W. Twining, and readers' comments, have prompted me to add my own views on the subject of the origin of our Solar System.

I do not think that the system evolved from a near collision of two stars, as many do, but evolved naturally from a condensation of stellar gases.

The chief agency that brings about this condensation of stellar gases is gravity. It draws matter together and compresses it, raising its density. The rise in density is accompanied by a rise in heat, which, besides creating a rotating movement of the whole mass by thermo-electric currents, increases the chance of atomic fusion to create new elements.

There is, however, a limit to this process. It is when the density of the mass rises beyond a critical limit. The mass then breaks up into smaller units, each being of a higher density than before. This is how Nebulae evolve.

The same process is repeated in each Nebula and gives rise to still smaller units of still higher density stars.

The stars will vary in composition depending on their mixing of different elements. Thus some stars composed of light elements will be large, while others composed of heavier elements will be smaller.

It may be that, at first, a star comprises of a mass of elements with the heaviest at its centre and the lighter ones on its surface, i.e., a planetary nebula. Orbital velocities then might separate the lighter and heavier elements into two separate masses, thus giving rise to Binaries.

The condensation process then continues to raise the density of star matter until they, too, exceed the limit and give birth to planets. Thus low density stars give rise to low density planets and high density stars give rise to high density planets.

Gravity is not the only agency for the rise in the density of a mass. The fusion of some elements could release energy which destroys matter or converts it into radiant energy. This process is normal in all stars and is the reason why they can radiate at all. If the radiation exceeds the gravitational attraction of matter, the star shrinks into what we call a dwarf star.

The origin of our Solar System was brought about when the dwarf companion of our sun, formerly a binary, exploded. It broke up completely, forming a group of planets about four or five in number, the planets being enveloped in a dense cloud of gas. As time passed this miniature system (which was to be the inner planets of our system) drew closer to the sun until a large proportion of the gas enveloping the planets was drawn into the sun. The sun, unable to deal with the sudden intake of gas, became unstable and also erupted to give rise to more planets (the outer planets). However, in the case of the sun, the eruption was not catastrophic, i.e., it was not completely destroyed, but acted under Archimedes' Law. The two systems then merged into one, with the sun as centre of gravity.

The break-up of any mass is not haphazard, but follows a definite pattern depending on the relation between the weight, volume and density of the mass. Similarly, the distance from the sun, period of revolution, orbital speed, etc., of a planet is also subject to the relation between gravity and various forces.

In conclusion, I would add that, while my letter is rather sweeping in its content, I have based my conclusions from various facts and data taken from astronomical works. I have had to omit these, together with my own logical deductions derived from them, so as to confine my general views within the limits of a letter.—W. E. HARGREAVES (Rochdale).

SIR,—Has Mr. Twining read Hargreaves' "The Size of the Universe," I wonder? In chapter 8 he cites seemingly irrefutable proofs of the stellar composition of "M31."

Mr. Islip's statement—that "Morgan identified two spiral arms in the Milky Way"—seems lucid. He identified them *as such*—two spiral arms—denoting the spiral conformation of our own Galaxy.

I, too, am a heretic, regarding lunar craters. No meteoric theory can account for the pattern of crater-free areas, nor for the almost universal circularity of them, which would necessitate something close to radial impacts, a totally improbable series of events. Not one or two, but practically every crater would be elliptical, due to angularity of impact, and the "walls" would be higher and thicker at one end. A few stones, flung into mud at a pond edge, will convince anyone of this.—J. D. BROWNSON (Bedford).

SIR,—Mr. Twining has only returned to the Victorian idea of the universe. Works of that period include the spiral nebulæ within our own cosmos! I prefer the modern idea; it fills up those wide open spaces. Where space is there must also be universes!

As they extend through every dimension and for eternity,—let us ignore them! Except perhaps the system in Andromeda and the Magellanic clouds? Our cosy solar system contains worlds moderate in size; some only

a few miles in diameter. It is quite large enough, however, for us to go exploring in.

Mr. Twining's description of Saturn's interior also agrees with an early theory. Far preferable to a modern one, which says that Jupiter and Saturn are encased in ice hundreds of miles thick. Mr. J. Robinson, in his modern work "The Universe," is here in complete agreement with Mr. Twining.

Another old theory—that of Mr. Percival Lowell—is supported by many modern astronomers. They say that after all Lowell was right. It is strange that some others deny the existence of the canals. For it is well known in astronomical circles that the original negatives taken at Flagstaff show many "canals" quite plainly. Anyone can see channel-like features in the reproductions of photographs of Mars in the Astronomer Royal's book "Other Worlds than Ours." There are also pictures of both white and yellow clouds in the Martian atmosphere. How could these exist, and violent dust storms occur, in air layers of extreme tenuity?

I think the polar cap in summer looks too small and solid to be composed of hoar-frost only. I support those astronomers who say that ice over a foot thick covers both poles!

If Australia were crossed by giant canals, with vegetation on either side, the interior would resemble a Martian landscape. The Nile valley is also somewhat similar.

To my mind the extreme negativeness of the modern astronomer in regard to the planets, goes too far! The ideas of Lowell, I think, are likely to be nearer the truth! For Nature is never "restrained" or "sensible," as anyone can see who visits a large modern aquarium.—A. TROWBRIDGE (Staines).

Taking the easiest one first, Mr. Averill's design is simply a cesspool, not a septic tank, and on no account would it be permissible to leave gaps in the covering for ventilation, a most unhygienic procedure. A very nice formula is produced for capacity, but the most important part, the filter, is described as a "suitable filter."

Mr. F. Tudor's design is elaborate, costly and also quite useless. Taking its faults in order:—

No need for a double or such a large primary tank. There is no ventilation—an essential factor demanded by all councils' by-laws.

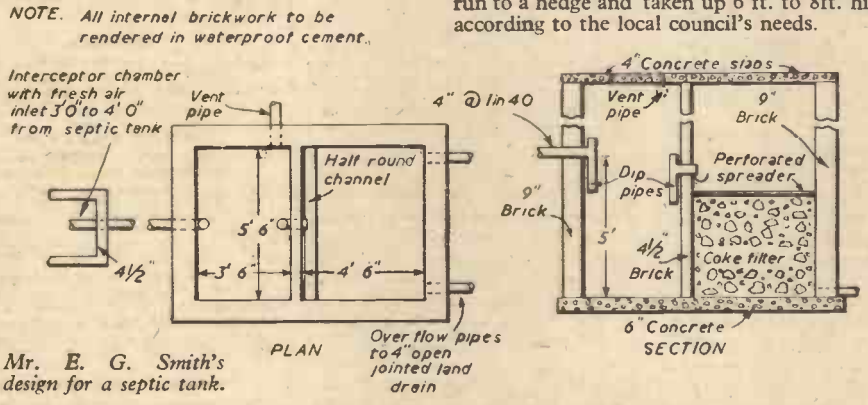
Presuming the filter is underground, which it should be, the channel collecting the effluent from the tank will be filled with earth.

The construction, honeycomb brickwork, makes the collecting channel rather obsolete, as the effluent will drain out through the holes in the brickwork, also the distributor will be covered with earth and will be unable to do its job.

Both designers are correct regarding not piping rainwater in, but both have the filtered effluent piped to a ditch or stream, and this a great many councils will not allow. This effluent should be run into open-jointed 4in. land drains which allow the earth further to filter this effluent.

Neither mention that if possible the tank should be 50ft. from the house, or to the local council's requirements, or that an intercepting chamber approximately 18in. x 24in. should be placed 3ft. or 4ft. from the tank, with a fresh air inlet in same.

The vent pipe for primary tank should be run to a hedge and taken up 6 ft. to 8ft. high according to the local council's needs.



Mr. E. G. Smith's design for a septic tank.

SIR,—Mr. Holwill's well-meant statistical correction of Jupiter's satellites (November issue) is itself erroneous.

In 1951 a twelfth satellite was discovered in the outer group of Jovian moons. Two other amendments to Mr. Twining's table are necessary, viz., Uranus has five satellites and Neptune two, discovered in 1948 and 1949 respectively. Your correspondents seem to be referring to obsolete data!—RICHARD COOK (Herts).

SIR,—May I further correct your correspondent who says that Jupiter possesses 11 satellites? Jupiter does, in fact, have 12 satellites. The twelfth, known as Jupiter XII, was detected on photographic plates taken at Mount Wilson Observatory on September 29th and October 24th, 1951. It has a magnitude of 18.3, and revolves in a nearly circular orbit, highly inclined, at a distance of 13 million miles from Jupiter. It experiences retrograde motion, and was discovered by Nicholson, who also found satellites IX, X and XI.—M. C. METCALFE (York).

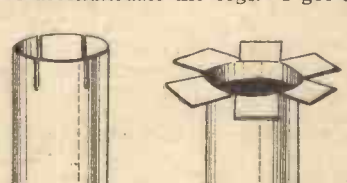
Septic Tank Design

SIR,—I was amazed by the two designs published in answer to Mr. G. W. Ottaway's request.

I enclose a sketch plan of a simple septic tank in general use in this area in the hope that it's not too late for Mr. Ottaway's use.—E. G. SMITH (Hants).

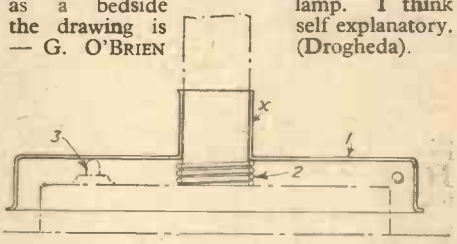
Recording Weathervane Modification: Table Lamp Idea

SIR,—I have just completed a model of the recording weathervane described by Mr. H. A. Robinson in your March, 1953, issue. For the benefit of the neighbours, I made mine with two dials both of which are bolted to a length of 2in. channel girder. As the vertical axle comes down through the centre of the channel I had very little space in which to accommodate the cogs. I got over the difficulty by making a pair of strong and smooth-working gears from a short length of steel tubing. The inside diameter of this being suitable to fit over the vertical axle and spindle. The outside was then marked and cut down with a hacksaw as shown in the sketch. When each piece was bent back and dressed with a file a very serviceable cog resulted.



Method of making gears.

I included below a sketch of part of a table lamp which I have made. It eliminates the nuisance of groping for a switch when used as a bedside lamp. I think the drawing is self explanatory. — G. O'BRIEN (Drogheda).



1. *Base cover (with collar (x) to prevent tilting). A pressure of the finger on any part of this will switch lamp on or off.* 2. *Light compression spring.* 3. *Push-button switch.*

The P.S. "Westward Ho!"

SIR,—I have read with interest "Designer's" article on modelling P.S. *Westward Ho!*

While the information re methods of construction is obviously useful, I feel the choice of the *Westward Ho!* to be most unfortunate. As the article is written in the present tense it is apparent that "Designer" is unaware of the fact that the vessel no longer exists—she was returned to her owners by H.M. Navy in 1946 in such poor condition that she did not merit repair and was scrapped at Newport, Mon., in July of that year.

In consequence, a modeller cannot, at any time, refer to the object of his model. This may be unavoidable in the case of very old ships, but where similar vessels exist, surely it would be best to use one of them.

The matter of the old type of paddle-box appears to have had something to do with this choice, *Britannia* (1896) has a similar type to *Westward Ho!*; *Glen Usk* (1914) and *Glen Gower* (1922) also have original boxes. (These steamers belong to the same owners.)

Contrary to the information in your article, only one steamer, the *Ravenswood* (1893) has been given a new and unornamented box.

Incidentally, I have not yet seen a "Campbell" steamer with completely equi-spaced portholes from bow to midships as in Fig. 3.

I have had an interest and association with these steamers spread over many years and can vouch for the accuracy of the information herein and I trust you will take my remarks as genuine constructive criticism.—J. N. WATSON (Weston-super-Mare).

Author's Comment

IT is rather regrettable that I did not know that "Westward Ho!" had been broken up at Newport, in 1946. I certainly did write as though she were still in existence but I do not see that it matters so very much. A model can very well be made of a vessel which no longer exists or she can be given a different name. But the lovely paddle-boxes, as you rightly surmise, had something to do with the choice of the name "Westward Ho." Other of the Campbell Steamers have been given the new form of paddle-box; there is the "Bristol Queen" and "Cardiff Queen." Most of them now have two funnels and I wanted a single funnel.

I gladly accept your constructive criticism in the spirit in which it is offered and thank you.—"DESIGNER."

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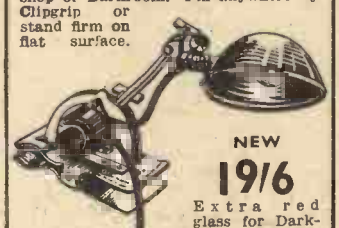

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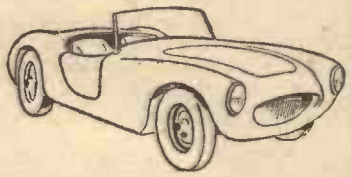

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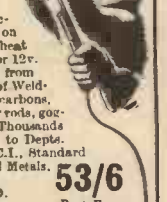

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The B.E.N. Handispray outfit with the IM spray gun.

such as oil paints, distempers, plastic emulsion paints, cellulose and synthetics, as well as spraying creosote, insecticides, etc. Three nozzles are available and will deal with any application problem which may arise. The use of the B.E.N. air chuck enables the unit to be used for tyre inflation purposes. The prices are as follow: Handispray outfit, complete with spray gun and hose, £37 6s. 6d.; Handispray unit only, less spray gun and hose, £29 19s. 6d.; Model IM spray gun with standard fan air cap, £6 6s. 0d.; spare round and 45 deg. angle air caps, 4s. 6d. each; 15ft. length of air hose with unions, £1 1s. 0d.; No. 221 air chuck, 5s. 6d.

Further information may be obtained from B.E.N. Patents, Ltd., P.O. Box No. 10, High Wycombe, Bucks.

Small Kilns for Pottery and Glass Firing

FROM the firm of Webcot, Ltd., Lower Street, Newcastle, Staffs, we have received a comprehensive catalogue, illustrating the supplies, services and help available to hobby potters and small studios. Kilns are available in two ranges, "Series 400" and "Junior." They are all fitted with electric heating elements and range in price from the cheapest of the "Junior" range at £25 to the most expensive "Series 400" model, designed for the professional, at £650. A vast range of kiln furniture, instruments, potters wheels, glazes, stains, etc., is also listed. All requests for information should be sent to the above address.

Scale Model Caravans

A RANGE of 1/12 scale model caravans is available from Cara Models (1952), Old Bank House, Royston, Herts. They are hand-made, true to type and authentic in detail and colouring, prices range from £10 to £25.

Wolf Savings Scheme

WOLF accredited dealers throughout the country are now operating an easy stage savings scheme for the benefit of prospective purchasers of Wolf Cub equipment. The scheme, which already has achieved high popularity, consists of a special savings card issued to each customer, and upon which is entered the amount of money paid in. As equipment is purchased from the funds accumulated the amount withdrawn and balance outstanding can be entered up in columns provided on the card.

The "Fastik" Glue Pen

THIS is a British invention designed on sound mechanical foundations employing a combination of the valve and piston principles. In appearance it is similar to a large ball-point pen, with the piston-end in place of the ball point. The pen is tapped on to the surface of whatever it is desired to stick, and the piston action forces out a dot of glue. As many dots as are necessary may be used and each glass refill contains enough glue for some 5,000 of these.

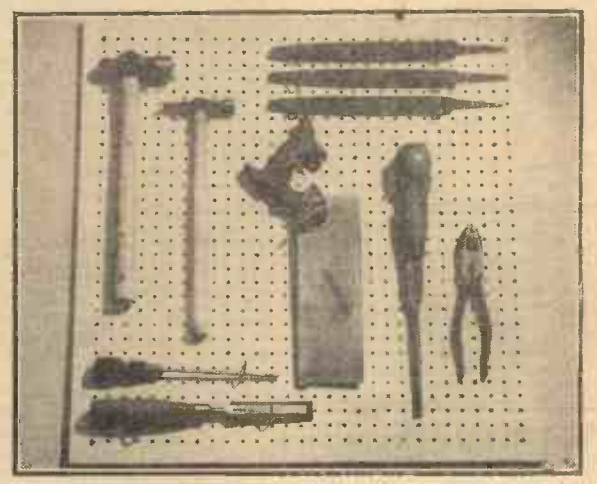
The glue is "Fastik" quick stick glue which is pressure sensitive and sticks immediately. Dry glue on the pen-point peels off easily and glue dots placed in the wrong position can be rubbed off cleanly without smudging or damage to the surface. The pen has a metal head and end cap, the barrel being made of plastic. The price is 6s. 9d., and the pen is made under licence by the Glue Pen Company, 143, Cannon Street, London, E.C.4.

The "Fastik" Glue Pen.

The "Celotex" Peg Board

LATEST inexpensive piece of equipment designed to interest the handyman and the housewife is the Peg Board. It is a perforated board, which is screwed to the wall but stands away from it with the aid of distance pieces. Light and strong, it can be screwed to the wall quite easily. Its hundreds of holes are spaced out at ¾in. intervals. From these perforations hang specially designed rustless and stainless hooks which can be moved about the board so that varying sized articles can be put up.

The board is being made in two sizes, 24in. by 24in. and 30in. by 18in., and in three colours, white, cream and light blue. Its glossy finish can be washed. The Peg Board is sold retail at 13s. 9d., complete with 12 hanging hooks, four chromium headed screws and four distance pieces.



The "Celotex" Peg Board.

In addition to its value as a kitchen and workshop aid, it can be taken out of the utilitarian class and used as a contemporary furnishing in the living rooms.

It is available from stores and shops throughout the country.

BOOKS Received

Elementary Woodwork. By F. H. Harmsworth. 152 pages. Price 5s. net. Published by Percival Marshall and Co., Ltd.

DEALING with the basic essentials, this compact little booklet is intended to be an introduction to the subject for the absolute beginner. It deals briefly with tools and their use, joints, pattern-making, veneering and all the elements of woodwork.

The Amateur's Lathe. By Lawrence H. Sparey. 224 pages. 15s. net. Published by George Newnes, Ltd., Tower House, Southampton Street, London, W.C.2.

AS the title denotes this is a book aimed primarily at the amateur, nevertheless, it should also appeal to the light engineer. The author is a professional engineer with an amateur's outlook and his new approach to the subject has resulted in a book which deals not only with plain turning and screw cutting, but with almost every process which can be accomplished on the small lathe. The chapters go forward in logical sequence from describing parts of the lathe, choice and installation in the early chapters; dealing next with tools and accessories, plain turning, boring, screwcutting, etc., and finally covering milling, shaping, grinding, lapping and honing, metal spinning, spring winding, turning rubber, etc. The final chapter is on the care of the lathe. The appendix contains a number of tables and there is an index. The main form of illustration is photographic, with some line drawings.

Lathe and Shaping Machine Tools. By Duplex. 70 pages. Price 3s. 6d. Published by Percival Marshall and Co., Ltd.

THIS is a booklet which should be of interest to the lathe owner giving, as it does, information on the making of various types of lathe tools. There is also a chapter on shaping and planing machine tools. Illustration is by line drawing and an index is included.

The Johnson Photographic Year Book, 1955. Price 6s. Published by Johnsons of Hendon, Ltd.

THIS annual is again published in two parts. These are the Year Book, containing technical data and exposure calculator, and the separately bound and detachable diary for 1955. It is in the usual pocket size and contains much information useful to photographers, all of which is indexed.

Your Queries Answered

RULES

A stamped, addressed envelope, a sixpenny, crossed postal order, and the query coupon from the current issue, which appears on the inside of back cover, must be enclosed with every letter containing a query. Every query and drawing which is sent must bear the name and address of the reader. Send your queries to the Editor, PRACTICAL MECHANICS, Geo. Newnes, Ltd., Tower House, Southampton Street, Strand, London, W.C.2.

Modelling the Human Face

I WISH to make a plaster model of a human face; could you please advise how to do it?—J. Turner (Gosport).

TAKING casts from a living human face cannot be done at one operation; the subject will have to pose probably six times and the face will have to be prepared each time. It cannot be done at one operation, because the subject would be suffocated by the closing of the nostrils and the mouth with plaster. The face will have to be cast in sections and each section finished and dowels fitted for pinning together before the next section can be cast.

The preparation of the face will consist in greasing it with Vaselene and all hair, including the eyebrows and eyelashes, must be carefully laid down smoothly with a stiff grease. The subject must lie in a recumbent position and there must be a flat, stout cardboard mask fitting around the face to support the liquid plaster. The sections can very well be: (1) the right-hand half of the forehead, extending to the bridge of the nose and enclosing the right eye, finishing in a straight line across the cheek; (2) The left-hand side, again coming half way down and to the centre of the nose; (3) the right cheek and right nostril, coming down to the corners of the mouth; (4) the same for the left side; (5) the chin and the lower lip of the mouth. As each cast is made it must be cut square and true where the next cast to be made has to fit on to it.

When all the casts are made they should be thoroughly dried by baking in a slow oven and then given two coats of shellac varnish. When this is dry the cast is used as a mould and a second cast made. It is this second cast which is a positive; the other was a negative. The positive should be a facsimile of the living face except for the fact that the eyes will be closed.

Repairing Leaded Lights

I WISH to repair some leaded lights. Can you help me? I propose to break joints by heat (at the affected parts), resoldering again after glass is fitted, but as the glass is set in cement I should like to know how to make same.—George E. Lovatt (Stoke-on-Trent).

WHILST it is usual to relead damaged lights, it *is* possible, if the existing leads are unbroken and not too badly distorted, to do as you propose doing: unsolder the joints by heat, i.e., using solder and a soldering iron. Resolder, after the glass is fitted, using a tallow or composite candle as a flux. The cement is composed of whiting, plaster, litharge and boiled linseed oil and has a consistency about equal to thick oil paint; but when only one small job has to be done it is easier to use ordinary putty and work into it a little ordinary black paint. This putty, dark grey in colour, is worked and pressed in under the flanges of the leads with the ball of the thumb, first on one side of the leaded light and then on the other.

All the work should be done with the light laid on a flat table-top.

A Special-purpose Fungicide

I HAVE been engaged in making a series of relative humidity readings here using the wet-and-dry bulb thermometer method, and am having continual trouble with the wick on the wet-bulb one.

I have been told that this district is unusual for the amount of air-borne spores of some sort of algae, but whatever the cause, the wick becomes "slimy" after a very short exposure to a slight draught, even when using distilled water, and when this has happened the instrument is not reliable until a new wick has been fitted.

Is there some kind of fungicide or disinfectant which I could add to the water to prevent this?—R. E. C. Davies (Tenterden).

EACH time the water-containing cell needs refilling, drop in a small crystal of copper sulphate. The equivalent of two or three "pinheads" should suffice. A handier method of doing this is to make up a 2 per cent. solution of copper sulphate in water, store in a conveniently sized bottle and replenish the pan from this supply.

Alternatively, a 1 per cent. solution of phenol in water stored similarly; but we think the copper sulphate would be a better fungicide.

Readers are asked to note that we have discontinued our electrical query service. Replies that appear in these pages from time to time are old ones and are published as being of general interest. Will readers requiring information on other subjects please be as brief as possible with their enquiries.

Gloss Finish on Plaster

I WISH to make plaster models, etc., commercially, but although I have tried out various paints and varnishes I cannot achieve a fine hard gloss. Is this beautiful glaze a trade secret? Can you tell me how it is done and where one can get supplies?—J. Phillips (Bournemouth).

THERE appears to be several methods of getting a high gloss on the surfaces of plaster casts; one which is commonly practised is by immersion in a solution of wax dissolved in turpentine, which, after the turpentine has evaporated, will take a high polish especially if aided by rubbing with white furniture wax.

If an ivory yellow tone is desired the cast can be sprayed with a very weak solution of yellow shellac flakes dissolved in methylated spirits and afterwards wax polished.

In our opinion, however, the best treatment is to spray the casts with a solution of cellulose: celluloid dissolved in amyl acetate. The spraying would have to be done many times in order to get a sufficiently heavy coating to give the desired gloss, but the result would be a hard glaze which would stand up to rough handling and would strengthen the plaster. The celluloid solution can be bought in bulk and is sold as a cellulose lacquer on transparent enamel. We believe the Robbialac people make it, but there are firms who specialise in the production of both clear and coloured varieties. You might try hardware stores, paint dealers and optical instrument makers in order to obtain a sample for experimenting.

Lighting Control Panel

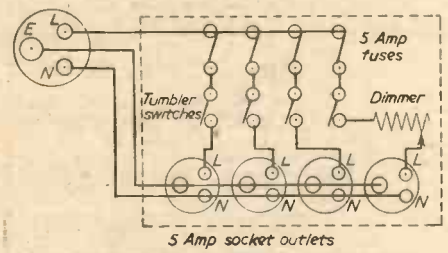
I HAVE been asked by the local drama group to construct a lighting control panel, and although I have some small knowledge of electrical wiring, I should be glad of your assistance. I wish to pick up the current from a 15 amp. plug and lead it to the board, from there it would be led to four 5 amp. plugs on the same board (I suppose these leads would be fused). One of the four plugs would supply current for seven 100-watt lamps for footlights, another plug would feed

(*Continued on page 182*)

the headlights on the stage which would be about the same wattage as the footlights but I would like to incorporate a dimmer in the circuit, the third plug would feed the prompter's small lamp, and the fourth spare.

Would you give me a wiring diagram, and tell me what wire and fittings I should use. An indication of the approximate cost would be a great help.—C. E. Fox (Roxburghshire).

WE suggest that you use three-core, tough rubber sheathed flexible cables. 70/0.0076 could be used between the 15 amp. plug and the socket outlet board, with 23/0.0076 from the 5 amp. plugs to the lights. Three-pin socket outlets and plugs are advised, exposed metalwork on the fittings being connected to earth through the third core of the flexes and the third pins of the plugs. If the neutral point of the supply is efficiently and permanently connected to earth one fuse only need be connected in each "live" pole of the supply to the 5 amp. socket outlets; otherwise one fuse should be connected in each pole. 5 amp. Slydlok fuses (Edward Wilcox and Co., Ltd., Sharston Road, Wythenshawe, Manchester) would be suitable. The fuses and the socket outlets and plugs are about 4s. each.



Suggested circuit for lighting control panel.

Dimmers are obtainable from the following firms, but we regret that we are unable to advise you of present-day costs: H. A. Birch and Co., Ltd., Wilohm Works, Wood Street, Willenhall, Staffs; Cressall Manufacturing Co., Ltd., Eclipse Works, Tower Street, Birmingham, 19; Oliver Pell Control, Ltd., Cambridge Row, Woolwich, London, S.E.18; W. J. Furse and Co., Ltd., 22, Traffic Street, Nottingham.

Making a Barrier Cream

I WONDER whether you could suggest a reasonably economical barrier cream formula for use in our workshop?—J. H. Hoyer (Edmonton, N.9).

DISSOLVE 1lb. of soap flakes in 1 gallon of hot water and add ½ pint of glycerine and 1 pint of medicinal paraffin. Mix thoroughly. Adjust to required consistency by increasing or diminishing water content.

Removing Selotape

I HAVE several pen-and-ink sketches and also foreign stamps that an infant son has covered with Selotape. I wish to remove this without damage to the drawings or stamps. Can you help me?—A. Millais (Sussex).

THERE is no solvent that will deal with the polythene base which carries the adhesive that will not also remove the dye of stamps and inks. However, the Selotape can be removed from the stamps quite simply by immersing briefly in fairly hot water, when it will be found that it comes away quite freely.

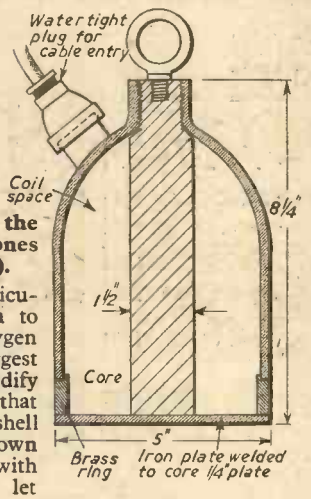
The treatment of the pen-and-ink sketches is more tricky and you will have to risk failure; but we think it is worth trying a hot, damp flannel spread evenly over the back of the sketches and if sufficient time is given for the warmth and the moisture to soak through the paper from the *underside*, you may find that you can peel the Selotape from the face of the sketches.

Another method, which we think may be better for the sketches, would be to direct a steam jet from a kettle to the spout of which is attached a short flexible rubber tube and to play the steam jet directly to the face of the sketches.

Making an Electromagnet

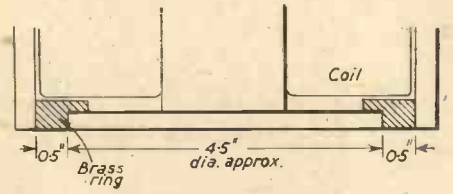
I WISH to construct an electromagnet for retrieving iron articles up to about 50lb. weight from a concrete water tank. It will work from a 12-volt car battery for three to four hours and, using about five to eight amps., I propose to use the top section of an oxygen bottle for the outer carcass and fit an iron core into the thread of the bottle as per sketch.

Please inform me as to the number of turns and gauge of wire required for the coil.—D. Jones (Birkenhead).



Mr. D. Jones' electromagnet design.

IF you particularly wish to use the oxygen bottle we suggest that you modify the design so that the outer shell is continued down to the base, with a brass ring let into the base so that this fills an annular air gap in the base about ½in. across. The coil could be wound with about 1,400 turns of 17 s.w.g.



Suggested modification.

D.S.C. wire. An electromagnet having a coil of diameter about equal to its length would be more efficient, however.

Descaling a Domestic Boiler

I WISH to descale a domestic boiler and would like to know the chemical used and quantities, the method of application, etc.—J. H. Smith (Watford).

WE do not advise you to attempt this job unless you can isolate the boiler from the general water system. If this can be done by disconnecting service pipes, etc., then fill your boiler with a mixture of water and muriatic acid (hydrochloric) in proportion of one part acid to five parts water. Allow to stand for half-an-hour and then flush thoroughly with water. If treatment has been long enough you will find scale sloughing away with the effluent. A considerable amount of scale will have been dissolved. Test final effluent, after flushing, with blue litmus paper to make sure that all acid has been cleared from boiler before finally connecting up system.

Muriatic acid can be purchased from most hardware merchants.

Removing Tin Deposit from Copper

PLEASE tell me how to remove the tin deposit from old copper cooking utensils so that they can be polished for interior decorating purposes.—W. F. Nichols (Isleworth).

TREAT the tinned surface with diluted hydrochloric acid. This must be done with care for the acid attacks both tin and copper, but its reaction with tin is speedier than that with copper.

Checking Window-sill Erosion

THE sandstone mullions of my window are crumbling due to erosion. As I am not prepared to spend a large amount on resurfacing with cement, I am wondering if you can suggest a suitable paint-on solution which would prevent further erosion by sealing the surface.—M. Read (Edinburgh).

WE think a cement water paint might serve the purpose. 50lb. white Portland cement, 5lb. gypsum, 4½lb. calcium chloride, ½lb. hydrated lime. Mix intimately. Stir about 7 to 8lb. of above mixture into 1 gallon of water and paint over wet surface.

Information Sought

Readers are invited to supply the required information to answer the following queries:

Mr. A. T. George, of Rushden, Northants, asks: Can you give me the name of a device for turning the leaves of music while playing the piano? Alternatively, suggestions for turning the leaves of an album while on display, then closing the book and starting again, so giving a continuous cycle; or dropping the leaves one by one from between the covers then returning them together for the action to be continued, would suit my purpose.

Mr. A. Holmes writes as follows: Could you please give me some information on making small glass animals and figures; hand-made not moulded.

The main snag is to make the glass workable. Could you suggest what form of heat I should use, also the title of a book on this sort of work?

Mr. A. T. Thompson asks in his letter: Could you give me an economical method of keeping a shop window free from steaming up and dampness? The goods on show are books and stationery.

All the usual methods have been tried—tubular electric heaters, absorbent paper pads and so on, without success.

The windows are totally enclosed from the shop proper by glass partitions and doors. The size is 12ft. x 9ft. x 5ft. deep.

Mr. P. F. Hayes, of Romford, makes the following request: Could you furnish any details of construction of a small potato peeler suitable for domestic use?

Mr. A. R. Brimer, 24, Stalisfield Bungalows, Gayhurst Crescent, West Derby, Liverpool, 11, writes: Having followed with interest the many articles and features in your paper, on the so-called "Flying Saucers," I would be very much obliged if you, or your readers, could furnish me with any further information on the subject.

I would count it a signal favour if you could pass on any fresh information which (subject to the ever-present security regulations) you can.

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600 **Circular Split Dies,** B.T.D. make 2½" dia., ½", ⅝", ¾", 1" Whit., ½" Gas ; worth 11/- each. Clear 7/6 each, new 2½" die-stock to suit, worth 30/- each, clear 10/- each.

200 **Boxes A to Z Steel Letter Stamps** for marking metal, 5/64" size, 17/6 set : ditto ¼" size, 22/6 set, worth treble this price.

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THE Cyclist
Editor: F. J. CAMM
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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
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COMMENTS OF THE MONTH

By F. J. C.

The Future of the Sport

TWO moves have been made in recent weeks to break the impasse existing concerning the control of sport. The delegation appointed by the British Cycle and Motor Cycle Manufacturers' Union to meet President Joinard of the U.C.I. in Zurich, consisting of Mr. S. C. Cozens, R. V. Davies, and D. D. McLachlan, was received in private audience by the president. This delegation had been appointed by the Union Cycle Road Racing Committee to explore the possibility of a British cycle team being invited for the first time to take part in the Tour de France.

The Union had been advised that the first step towards this must be a settlement of the differences of opinion between various British cycling federations. The delegation asked that the president should give his personal consideration to the problems at present confronting those members of the British industry interested in road racing, and who have reluctantly come to the conclusion that, failing an immediate solution, their interest in the sport must cease.

The president said that he proposed to invite three members of each British federation concerned, as well as the manufacturers' delegates, to meet him in Paris in December so that he could ask them whether they were prepared to accept him as arbitrator. If so, each must sign in advance that he is prepared to accept his decisions when published whatever they may be. If that condition were accepted, all parties must submit their case to the president, who will consider the matter and deliver his judgment on or before January 1st, 1955, this judgment to be binding on all parties concerned.

In view of the tripartite agreement which the N.C.U. signed and has never implemented, there can be no assurance that M. Joinard's findings would be accepted by any particular body who found them unpalatable. Moreover, the selection of M. Joinard as an arbitrator is not a happy one, since he cannot be so impartial as someone entirely dissociated from the sport. What was wanted was a quasi-judicial body. The U.C.I. is vitally interested in this matter. The B.L.R.C. is a comparatively new body, the N.C.U. an old one and the R.T.T.C. has no international recognition.

However, as a result of the further meeting, the date of the Tour of Britain was altered to allow British riders time to prepare for the Tour de France. The delegation received invitations for riders to participate either as a national team or "works" team, as the case may be, in the Tour de France, Tour of Italy, Tour of Switzerland, Tour of Belgium, Tour of Morocco and the Tour of Europe. All these invitations are conditional on the position as at 1st January, 1955.

So much for that. Now comes a letter from J. A. Dennis, of the N.C.U., who has propounded a 1955 racing plan. The letter and the plan have been circulated to every cycle racing club in the country, and also to the R.T.T.C. The plan reviews the classification of the racing cyclists at present. No rider who holds only a B.L.R.C. amateur licence has a full programme of road races in which he can take part. He has no opportunity to complete his cycle racing career by taking part in track races and, unless his club is affiliated to the R.T.T.C., he has very little chance of riding against the watch in competition. The time trialist is catered for by the R.T.T.C. national programme. The holder of an N.C.U. licence can ride as often as he wishes on the track and also in circuit and road races, but his road-racing programme is often restricted owing to the lack of N.C.U. road races. The independent professional rider has, up to now, not had sufficient races to take part in, unless he is prepared for extensive travelling. Mr. Dennis, therefore, propounds the following scheme:

THE 1955 RACING PLAN

1. Primarily, professional and independent riders must be allowed to take part in the existing amateur time trials programme, as laid down under R.T.T.C. regulations.

I have already written to the R.T.T.C. asking that it recommends to promoting clubs that these riders be allowed to take part in any open time trial if the promoting club so desires (professional and independent riders would start at a fixed time after the last amateur has departed).

2. I will be offering a lead by promoting regular track races at Herne Hill for professional and independent riders (I envisage at least 15 occasions for these riders to compete) and track promoters throughout the country will be encouraged to follow suit.

3. Next, all existing B.L.R.C. promoters of road races are asked to make their events open to holders of N.C.U. licences. In this way the traditional "classics" and established B.L.R.C. events will not be interfered with in any way.

4. Additionally, I aim to present a scheme (which you will see in detail further on in this plan) which will interest prospective race sponsors simply because of its hard and fast conditions.

5. N.C.U. affiliated clubs will be encouraged to promote an additional number of road races, to make up any deficiency of events that might occur.

6. This new road racing programme will allow races to be promoted strictly in accordance with U.C.I. Code Sportif conditions under the following classifications, i.e., Professional; Professional/Independent; Independent/Aspirant/Amateur; Aspirant/Amateur and Amateur.

7. A system of guaranteed prize money (and standard allocation of prizes) will be introduced. This will offer the rider guaranteed awards; it will offer invaluable guidance to promoters when allocating prize values, and at the same time present promoters with a fixed scale of standards to use when negotiating with a possible race sponsor.

These standards will also serve another purpose. The amount of money available for a race will decide the classification of rider allowed to compete in the race.

The following scales are laid down as minima:

Total Value of Prize List	Classification of Competitor	Permit Fee for Race (5% of Total Prize Value)
£50	Professional	£2-10-0
£34	Professional/Independent	£1-14-0
£28	Indpt./Aspirant/Amateur	£1-8-0
£19	Aspirant/Amateur	£-19-0
£12	Amateur	£-12-0

Multi-stage races: One stage to count as one race and the general classification prizes to count as separate items.

This scheme will ensure that no "cheap" races are put on at the expense of riders, and that uniformity is observed throughout the country.

To ensure that prizes are guaranteed promoters (or race sponsors) will be required to deposit the full amount of cash, to cover the total prize bill, with the N.C.U. at least one month before the date of the race.

8. In addition to the above, to complete the picture of prize uniformity the following scale of prizes will be laid down as standard minima.

Minimum Prizes to be Allocated as Follows:

Amateurs. Total £12. 1st, £5; 2nd, £3; 3rd, £2; 4th, £1; 5th, 10/-; 6th, 10/-.

Aspirant/Amateurs. Total £19. 1st, £7; 2nd, £5; 3rd, £3; 4th, £2; 5th, £1; 6th, £1.

Amateur/Aspirant/Independent. Total £28. 1st, £10; 2nd, £7; 3rd, £5; 4th, £3; 5th, £2; 6th, £1.

Independent/Professional. Total £34. 1st, £12; 2nd, £9; 3rd, £6; 4th, £3; 5th, £2; 6th, £2.

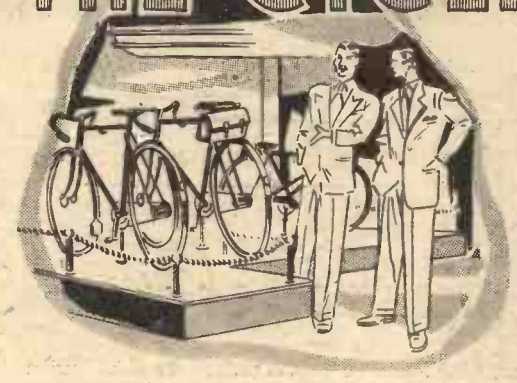
Professional. Total £50. 1st, £15; 2nd, £10; 3rd, £8; 4th, £6; 5th, £5; 6th, £3; 7th, £2; 8th, £1.

AROUND THE CYCLE SHOW

Some of the New Products

Exhibited at the 1954 Show at Earls Court

AS in Cycle Shows of the past, there was this year a bewildering array of cycles of every kind and an even greater array of accessories, but close investigation revealed that the bulk of the exhibits were well-known and well-tried lines, with perhaps some improvement of detail. Some firms, however, have introduced brand new lines.



The Cycle Frame of the Future ?

The most talked-of exhibit was probably the glass bicycle, shown on the Hercules stand. Among the advantages claimed for glass fibre laminates are high tensile strength and great impact-resisting properties, lightness (it is five times lighter than an equivalent section of steel), almost complete resistance to atmospheric corrosion, and permanent colouring. The frame is purely experimental.

The Hercules Glass Bicycle.

New Saddles

On the stand of J. B. Brooks & Co., Ltd., there were shown two new saddles which will be of interest to the clubman and racing man. The first of these was the B17 Competition Standard which has chamfered flaps, a specially shaped back and top and a mud protector underneath. It is available in black for £2 7s. 6d. and chrome for £2 10s. New also was the B15 Flyer, costing £1 13s. 6d. in black or £1 16s. in chrome.

The Wright Featherbed Saddle, a product of the Wright Saddle Co., Ltd., has triple springing to provide extra comfort, and sells at £1 5s. 6d.

Tyres and Accessories

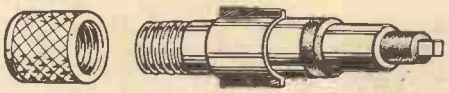
On the stand of Herbert Terry & Sons, Ltd., an intriguing tyre lever was shown, which, it is claimed, will replace a tyre without nipping the inner tube. Made of hardened and tempered steel, it is priced at 2s. 6d.

A new road racing tyre was displayed on the stand of the Palmer Tyre, Limited. The central running surface consists of three continuous smooth ribs, flanked by a zig-zag pattern for obtaining good grip on corners. It is made only in size 27 by 1¼in., the cover costing 16s. 6d. and the tube 5s. 4d.

New on the Dunlop stand was the "White Sprite," which has the well-known tread of the "Silver Sprite," and white walls. Also shown was the latest cycle valve insert, the Dunlop "Easypump," which it is claimed brings easier tyre inflation, accurate pressure checking and greater air retention for roadster cycle tyres. They are sold two in a packet, with dustcaps, for 1s. a pair. Available for use with these valve inserts is the G 20 pressure gauge, price 7s. 6d.

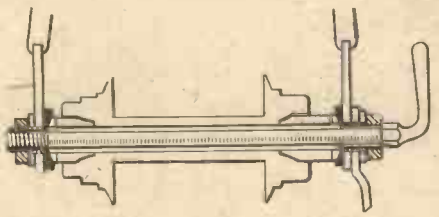
A Multi-speed Gear

The Cyclo Gear Co., Ltd., were showing the new Benelux Tourist Gear. This light-weight derailleur is available in four variations : three-speed (⅛in. only), four-speed (3/32in. and ⅛in.), five-speed (3/32in. only). If used in conjunction with a double chainwheel and the Benelux hand control front chain shifter, six, eight, or ten gears may be obtained. The tourist gear has a 13-tooth to 28-tooth selection and may be used with



The Dunlop Valve insert.

double chainwheel rings with up to 20-tooth difference. The gears are available in three fittings, one to clip on the chain stay, one to



The Constrictor quick wheel release conversion set.

fit the existing fork end and the third which fits a special brazed-on fork-end lug. Prices are ⅛in., three-speed, £2 10s. ; ⅛in. or 3/32in., four-speed, £2 18s. ; and the 3/32in., five-speed, £3 1s. 6d., all complete with the Benelux freewheel.

A New "Constrictor" Line

A new quick wheel release conversion set was the chief item of interest on the stand of the Constrictor Tyre Co., Ltd. This is a modification of a similar device sold by this company in the early days of cycling before the advent of the variable gear. As will be seen from the sketch, the set comprises two carrier slides with nuts and washers, a hollow hub spindle, two domed hexagon lock nuts and a skewer with handle ; the original hubs, cones and spacing washers are used, the existing spindle being removed and replaced by the hollow spindle supplied. The original cones and spacing washers are refitted and locked by the domed nuts. If the spindle protrudes at either end it must be filed off flush, so that the domes can fit into the corresponding recesses in the carrier slides. The whole is locked by pushing the skewer through and screwing it into the slide carrier on the other side. This device will convert any hub into quick release drop out and also provides a positive wheel position. The price is 12s. 6d. per set and the weight 4 oz.

In addition, Constrictor have introduced a lower priced tubular, the Viper, and have redesigned the Viper pedals to give greater ground clearance.

The new Brooks B17 Competition Standard.

The Viking "Family Tandem"

On the Viking stand was being shown the "Family Tandem" which is a lightweight machine with 531 tubing and cutaway lugs. The most interesting feature of this machine is the adjustable rear position of the tandem, which will accommodate either a child or a grown-up. The rear seat tube, which is a short member, is pivoted at its base, as are the seat stays. The top of the seat stays are fixed to a very long saddle tube, which is adjustable in the seat tube. To convert the tandem to suit a child, the saddle pillar is slid right down into the seat tube, which action also causes the saddle to be moved nearer the handlebars by means of the seat tube pivot. The handlebar-to-saddle dimension at the lowest saddle position is 18in. and with the saddle raised to its highest point it is 22in. The rear seat tube telescopes from 23in. to 16in. The chainsets are specially adapted to provide a cross-over drive and the equipment is all high class lightweight.

All the major firms supplying cycle lighting equipment have introduced new lines in rear lamps and reflectors to comply with the Ministry of Transport regulations and some have produced ingenious methods of converting existing lamps. It was noticed that the Miller dynamo is being sold with bracket liners for fixing to pencil stays ; this will be a great boon to the lightweight owner who previously has had to use tape as packing.

Most of the stands were showing some small improvement or other—a sure indication that even though lines stay substantially the same, the opportunity to add refinements is not being lost.

AROUND THE WHEELWORLD

By ICARUS

Sportsman of the Year

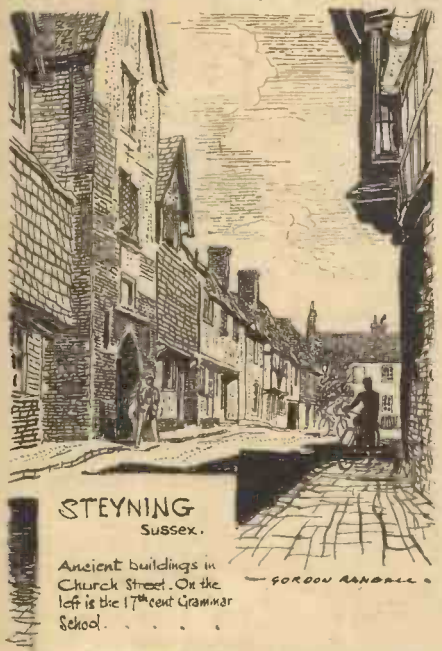
THE *Sporting Record* "Sportsman of the Year" national ballot is now taking place. It is the ninth since the ballot was instituted in 1946, and the public is again asked to choose the sporting personality considered to have done most in 1954 to raise the prestige of British sport. The present holder of the trophy is Gordon Pirie, while the "Sportswoman of the Year" trophy is held by Pat Smythe. Who will hold the coveted title this year? The year 1954 has been a great one for sport and many tremendous achievements have been recorded in the various spheres. Will Roger Bannister and his immortal mile in less than 4 minutes inspire the public to vote for him? Will the tremendous record-breaking victory of Chris Chataway over Vladimir Kutts override Bannister's achievement? In boxing there is Don Cockell and Dai Dower. Cycling supporters will probably support Reg Harris, who regained his world championship and has been sportsman of the year on two previous occasions, or Cyril Peacock, world amateur sprint champion.

Then there is Geoff Duke, once more a world motor cycling champion, and Stirling Moss in motor racing. Everyone is entitled to vote and all votes should be sent to the *Sporting Record*.

Open Letter

I HAVE received the following letter from Mr. J. Taylor, President of the Nottingham Wheelers Cycling Club, and which has also been circulated to other cycling journals as well as to the B.L.R.C., R.T.T.C. and N.C.U.:

"As an old established club affiliated to all three cycling organisations we feel that the recent action taken by the N.C.U. and



R.T.T.C. in withdrawing from the agreement is a retrograde step and not in the true interest of the sport.

"This club considers that the only way to unity in the sport is for an overall body to be formed as quickly as possible. The three organisations have proved by actions in the past that they have not the true interest of the game at heart but are more concerned in maintaining the so called ideals of their obsolete separate entities.

"Unless definite action is taken to this end within the next few months, we consider it is our duty, as a progressive club, to appeal to all other cycling clubs in the country for support in the formation of one controlling authority.

An unusual scene of two cyclists depicted in a stained glass window in All Saints Church, Lincs.

"We shall welcome correspondence from other clubs who wish to make known their opinions on this matter."

It was this journal which first suggested the formation of an overall body. It is obvious that the three bodies cannot continue on present lines, and that two of them are redundant. The R.T.T.C. as an unrecognised body so far as international sport is concerned is the one whose identity is bound to be submerged should an overall body be formed.

It is certain the Ministry of Transport will not allow three bodies to mess road sport about for ever, and "messing about" is the right term to use so far as two of the organisations are concerned.

Voltage Control

APROPOS the article in the December issue commenting on the Cycle Show, Messrs. Joseph Lucas, Ltd., point out that Lucas Cycle Dynamos have always been fitted with voltage control. The present model CD33 is rated at 6 v., 3 watt, at 4,200 r.p.m., which is equivalent to a road speed of 10 miles per hour. At 7,500 r.p.m. the voltage rises to 7.5 bulb rating allowing for a wider margin than this for such short periods as will be run at 18 miles per hour at night time. The voltage regulation is effected by the design and flux density of the magnet and also the design and location of the pole shoes.

The N.C.U. Plan

THE N.C.U., true to form, has propounded yet another plan for 1955 cycle sport. It suggests that all road races next year should be promoted under one set of rules, that there should be a standard list of prize values for events throughout the country and suggests that professionals should be entitled to ride in existing amateur time trials.

Clubs, however, will look askance at this suggestion. The N.C.U. under such a scheme would establish a complete autonomy because of lack of the competition of the other bodies. The N.C.U., in my view, by its past history, has demonstrated itself to be unqualified to act as a controlling body in which all cycling sport interest should be reposed. The scheme therefore, in my view, is doomed to failure.

C.T.C. Subscriptions

THE Northumberland and Durham District Association of the C.T.C. opposes the suggestion of the Finance Committee of the C.T.C. that subscriptions should be increased. It believes that this would result in loss of members, and therefore a worsening of the present financial troubles. Instead, it says that the position should be remedied by a policy of expansion and recruitment and it would support such a plan. But recruiting plans have been tried by the C.T.C. in the past and they have seldom been successful. I have felt for very many years that there is not room for two national bodies. I know that it has been suggested many times that the two bodies should amalgamate. Their membership is largely overlapping, neither of them is doing well, and the moment seems opportune for the suggested amalgamation to be reconsidered. If the present financial position of both bodies is allowed to continue they must eventually go out of existence. Whether that would be a good or a bad thing I do not know. It might result in a new body being formed from different personnel, who would carry the confidence of the cycling public to a greater extent than is the case at present.

The new Lucas cycle Reflex reflector, made to comply with the new M.O.T. regulations.

Over 21 m.p.h.

IN the figures for the best all rounders of 1954 no fewer than 375 riders beat an average speed of 21 m.p.h. At the top of the list is V. Gibbons (Brentwood R.C.) with 23.811 m.p.h.; R. Booty, C. Horton, C. Morris, B. Balneaves, E. Britton, J. Blunsdon and K. Price all beat 23 m.p.h., while no fewer than 79 beat 22 m.p.h. Gibbons, of course, scored the best at 12 hours with 264.39, whilst the lowest in the list is over 236. The women set new records too. M. Dawson (Teeside R.C.) averaged over 22 m.p.h., and so did J. Sutherland and I. Hoult. Sixty-eight women altogether beat 20 m.p.h., and of these 30 beat 21 m.p.h.

Built for the defence of the North, the castle towers 150 ft. above the cliffs and ranks one of the most impressive in England.

Wayside Thoughts

By F. J. URRY, M.B.E.

Comparisons

OCTOBER was the best cycling month of the year as far as I was concerned, for though it was windy and stormy at times, it was mellow enough to invite a rest and smoke by the wayside, and today I rather welcome that indulgence. In the old days we used to say October was a fine month for touring, for accommodation was easy, and seven to eight hours' riding found us quite content to anchor at the old country pubs and yarn away the dark hours until bedtime. But the old country pubs have gone or almost gone, and the "amenity" hostels do not seem to have retained that ancient warm air of hospitality associated with them. The quick passage of the car has brought the town so near to the country that the old feeling of remoteness has departed and taken with it that atmosphere of hospitality which the country inn-keeper with his home-cured ham and his home-brewed ale diffused.

Though I welcome the Summer Time Act of clock discipline, when the return to sun time falls in early October days, it seems to draw the curtain on the summer—even a bad summer—so definitely, that the idea of touring does not receive the attention it deserves. But I have enjoyed some fine riding in the tenth month and some well-remembered tours when, as I say, the old pubs were always at work and ready to welcome you with fire and food. Now, and I am sorry the old order has departed, the halls of the road house seem deserted and their loneliness lies on the mind. I suppose this development is natural, for increased traffic must have increased accommodation provided to house it, yet I sometimes wonder if all the extensions, all the desire to make the old country inn a reflection of the city hotels has not helped to destroy one of the kindly characteristics of our delightful land. But some folk never knew the old English inn, and I'm sorry they have missed a romantic touch to our native history that has almost disappeared.

Those Old Divisions

ALL through the month the forest trees have been holding out against the gales and still wave their green flags, albeit a little tattered, in the gale. It needed a touch of frost to strip their foliage, and that did not come until later; the wet summer kept the leafage remarkably green and fresh. In the middle of the month we enjoyed a warm spell with beautiful sunshine that lit a hope that English weather can still work its miracles of loveliness. On one of those days I was along the ridge of the Cotswolds and burned incense to the marvellous vision of the Severn valley where the hill escarpment descends to the levels and gives the watcher on the heights a panorama of the wide brown river, where on the opposite shore it swills almost to the foot of the Forest of Dean.

I spent a long while there, as long as a well-loaded pipe lasts, for I'd never seen this great vision more colourful and lovely under the mellow October light. And as I rested there how easy it was to understand that the river's division of the land bred two races, one on either shore, so distinct in feature and characteristic that even now the eastern and western Severn-sider can be recognised, despite all the modern traffic movements. I suppose when the projected Severn Bridge is built well below Gloucester—and heaven knows it is needed to carry the south-west traffic—in a few decades the old divisions and differences of the folk of the English and Welsh banks will finally disappear, and another feature of our population falls into the common mixture. We improve one thing and destroy another, and it is only when the destruction is complete we are apt to regret that preservation of the ancient is merely folded away between the covers of forgotten tomes.

Another Aspect

ONE of those Sunday mornings in October I wandered through the warm, bright air along a lonely lane and saw a covey of partridges dusting themselves on the verge of the road, and they saw me and moved quietly into a stubble field alongside a big wood. A gate, jutting out from a green bank, was as good a place as any for a smoke, so I quietly lit a cigarette and, sitting on the saddle with one foot on the bank, watched the little brown birds run along the stubble aisles all hunched up and scarcely seeable, until they thought they were a safe distance from the watcher. Then up came their heads and they kept an eye on me for five minutes, after which they evidently came to the conclusion I was not to be feared.

I was about to move on when I heard a gate click and out of the wood came a farmer, and as he rose over the crest of the stubble, my feathered interests folded themselves up again, moved just about twenty yards from his path, had a look at him and went on with their feeding. Such is the impact of familiarity. But the man disturbed half a dozen rabbits on his route to my gate, and I had not seen those fellows for they were just over the little rise until they shot, ears flat and bellies to the ground, into the wood. As the farmer came up we exchanged greetings and I asked him if he had any rabbit disease on his ground, and he said no, and then told him about the little covey of partridge. "Yes," he said, "they are usually on the stubble about this time of the morning, and as I came through the other gate half a dozen pheasants, heads down, wriggled into the wood, which is proof there is a little game about, despite the poor season. I like to see a sprinkling of it around—it makes the place more homely and countrified." I agreed; after which we talked of crops and cows and coddlings, hunting men and shooting men, keepers and Inland Revenue officials, and again agreed that up to that time October had been the best month of the year. All of which was nothing to do with a bicycle except being part of its magic. As I turned to ramble on he said, "You're an old 'un to be at that game"; and as a final parting shot, "But you're wiser than most I know." Such simple little things make my cycling a romance still.

The Country Call

I WAS out for a ride of five mile or so when I saw a young motor-cyclist wearing an L plate was standing by the verges contemplating his machine as if he wondered what was the matter. I asked him if anything was wrong. "No," he said, "I was just in love with the thing and thinking how much it would mean to me when I have holidays." And he became quite expansive, explaining that he had always wanted to see the countryside, but until then has never been able to meet the cost. "Even now," he said, "it will take the best part of two years before the machine becomes mine, but I don't mind that because I've a decent job, don't smoke or drink, and have no entanglements with girl friends."

He was so full of the excitement and enchantment of the moment, I hadn't the heart to even suggest my greater love for cycling, and silence may have filled his desire. Nor even to observe that a lot of things can happen to people in a couple of years, and especially at his age. He left me after enquiring the way to Tanworth; left me with a little ache from remembering what it meant to be young and how varied life could be and how good it was even when running actively mid-way between seventies and eighties.

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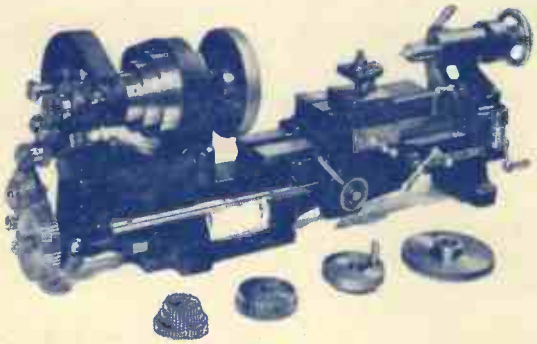

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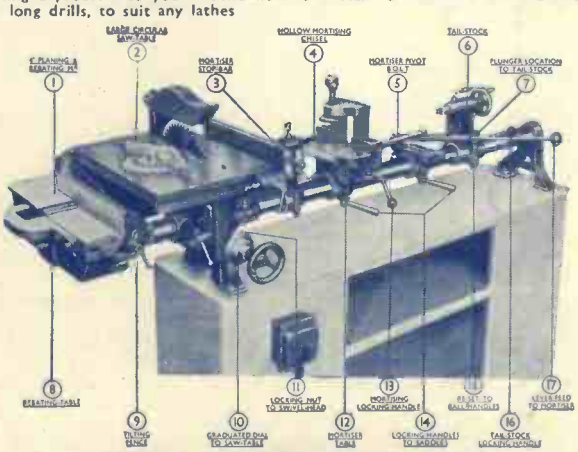

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