MAKING AN ELECTRIC OVEN

NEWNES

PRACTICAL MECHANICS

9D.

EDITOR : F. J. CAMM

MAY 1950

PRINCIPAL CONTENTS

This pocket EXPOSURE CALCULATOR will help you to get really good bright photographs.

A quick, simple and remarkably accurate exposure calculator. Works equally well in summer or winter. By 'dialling' the time of day, subject, weather and film speed the exact exposure for any lens aperture is instantly indicated. Strongly made in white ivorine with clear black and red figures. Provision is made for filters.

Photographic Dealers everywhere sell these Johnson Calculators.

PRICE **2/6**

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

THE 'ZYTO' $3\frac{3}{8}$ in. LATHE

BACK GEARED : SCREWCUTTING : SLIDING : SURFACING GAP BED : SET-OVER TAILSTOCK : COMPOUND SLIDE REST : ETC.

$12\frac{1}{2}$ in. *BETWEEN CENTRES* **BRITAIN'S FINEST LATHE VALUE**

£6/10/0 FIRST PAYMENT AND TWELVE PAYMENTS OF 35/10

CASH PRICE £25/10/0

BRIEF SPECIFICATIONS :
HEIGHT OF CENTRES $3\frac{3}{8}$in. DISTANCE BETWEEN CENTRES $12\frac{1}{2}$in.
HEADSTOCK MANDREL ADMITS $\frac{3}{8}$in. TAILSTOCK BARREL ADMITS $\frac{1}{4}$in.
HEIGHT FROM SADDLE 2in. HEIGHT FROM GAP $4\frac{1}{4}$in.

BIF 1950
MAY 8-19
CASTLE BROMWICH
BIRMINGHAM
SEE OUR EXHIBIT
STAND No. B.714

BOOK YOUR LATHE NOW

MOTORISED MODEL
(complete on Stand)
FIRST PAYMENT £11/10/0
TWELVE PAYMENTS OF 62/4
Cash Price £45/10/0

Illustrated Leaflet and full details free on request.

S. TYZACK & SON LTD.

WOODWORKING & METALWORKING TOOLS & MACHINERY MANUFACTURERS

341, 343 & 345, OLD STREET, LONDON, E.C.1

Telephone : CLERKENWELL 8301 (10 lines) *Telegrams :* TYZGAR AVE. LONDON

Sensitised Materials for PHOTO COPYING and BLUE PRINTS

As actual manufacturers of all types of sensitised photo materials, Haldens are in a unique position as print room suppliers. Materials for Blue Prints, Dyeline Prints, Gas Developed Prints, Sepia Prints, "Ferazo" Blue Prints, Ferro Gallic Prints, etc.

The brand names "Dyalyn," "Neutralyn," "Vaporax," "Cyano," "Ferazo" are your guarantee of complete satisfaction.

Illustrated is the "Ferazo" Developing Machine. Write for fully descriptive leaflet.

Haldens **OF MANCHESTER**

J. HALDEN & CO., LTD., 8, ALBERT SQUARE, MANCHESTER 2.
Branches at London, Newcastle-on-Tyne, Birmingham, Glasgow, Leeds and Bristol.

PAINT SPRAYING

"COMPTON"

PORTABLE OUTFITS FOR FLAT OR GLOSSY PAINTS ENAMELS, DISTEMPERS, etc.

Type D.P.F.

COMPLETE—As illustrated with A.C. Motor. Ready for use with spray gun, hose, cable. Universal or D.C. Motors, £4 extra. **£31**

COMPTON GFA SPRAY GUN. Suitable for use with Cellulose ; Synthetic ; Oil Paints ; Water Paints.

Will produce a fine finish at a high speed.

$\frac{1}{2}$ pint Aluminium Material Cup.

Can be arranged for pipe line material supply. Price : **£6 5s.**

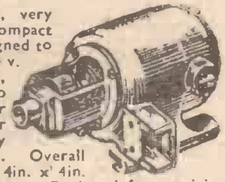
May we send you further particulars of our products ?

DAWSON, McDONALD & DAWSON
COMPTON WORKS, ASHBOURNE, ENGLAND
Trade Enquiries invited.

TABLE FANS

By G.E.C. brand new, 200 to 240 volts A.C. 0.125 amps., with guard. Weight 16lb., 12in. sweep, overall diameter 14in. Complete in all respects, including speed control. Worth £7 each. (Carriage and packing 2/6) **70/-**

ELECTRIC MOTOR 24 v.



Brand new, very powerful compact motor designed to run from 24 v. D.C. supply, but will also run on other voltages or supply. Very heavy duty. Overall size 4in. x 4in. x 4in. Shaft 2in. long. Designed for precision work on Air Ministry cameras and ideal for driving power tools, models, drill, pumps, etc. Flywheel incorporated, brushes easily accessible. Finest value in electric motors we have ever offered. At our price well worth the trouble of getting 24 v. D.C. current. Special offer for limited period. Post and packing 1/-. **10/6** only.

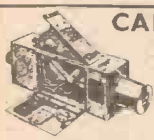
DRAWING INSTRUMENTS

British made by Harling. Ex-Army, used but complete. Includes three spring bows, small and large compass, small and large dividers, pens, etc. Complete in fitted polished wooden case. Worth over £10 new. **£5-15-0** Registered post and packing 1/6.

FLEX DRIVE

For the above 24 v. Electric Motor with thrust-type ball-bearing bayonet socket connector at each end, 3ft. 6in. long, heavy brass construction, (Postage and packing 6d.) **9/6**

CAMERA GUN (G.45)



Consisting of body, lens and 16mm. magazine. The standard Air Ministry, G.45 camera, with beautiful variable speed 12 v. motor, reduction gearing and gate mechanism. Can be used as a cine-camera by adding a sight and dry batteries, or adapted for hand operation. Also as a basis of a 16 mm. projector, 2" f/3.5 lens, (Post and packing 1/6.) **65/-**

NON-SENS. ALTIMETER

Reading to 20,000 ft. An accurate British instrument by Smith, Kelvin, etc. Diameter 3½ in. Depth 2¾ in. Convertible to barometer, pressure switch, etc. Made to top R.A.F. standard: **5/6** Post and packing 6d.

PRESSURE GAUGES

Large stocks available of standard A.M. instruments, all with 2¼in. square flange and 2¼in. diameter dial, clearly marked and designed for oil, air, fuel, gas, etc. They can be used for any pressures (but not recommended for steam) and many ranges are available, all with full scale. By Smiths, Negretti, Short and Mason, and other leading instrument makers. Strongly recommended for superchargers 0 to 5 p.s.i.—7 to +8 p.s.i. —7 to —16 p.s.i. —7 to —20 p.s.i. —7 to +25 p.s.i. —0 to 500 p.s.i., 0 to 2,000 p.s.i., 0 to 3,000 p.s.i., **5/3** each. Post free.

Send 3d. Stamps for List 210.

AERO-SPARES CO. (Dept. 79), 71 HIGH HOLBORN LONDON, W.C.1

HIGH FIDELITY REPRODUCTION

TYPE 'K'

S. G. BROWN, Type 'K'

Moving Coil Headphones supply that High Fidelity Reproduction demanded for DX work, monitoring and laboratory purposes, etc.

OUTSTANDING CHARACTERISTICS

D.C. RESISTANCE 47 Ohms.

IMPEDANCE 52 Ohms at 1,000 c.p.s.

SENSITIVITY, 1.2 x 10—12 watts at 1 kc. .0002 Dyne/cm².

PRICE **£5.5.0** PER PAIR

Descriptive Literature on request.

Your local dealer can supply.

★ *For details of other S. G. Brown Headphones (prices from 30/- to 77/6) write for illustrated Brochure "P.M."*

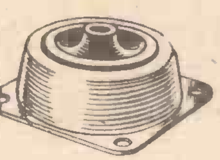
Telephone: Watford 7241

S.G.Brown, Ltd.

SHAKESPEARE STREET, WATFORD, HERTS

ANTI-VIBRATION MOUNTINGS

Rubber Metal - bonded



A useful mounting that will be found invaluable in the installation of machines, equipment, instruments, electrical apparatus, motors, etc., and wherever complete elimination of vibration is essential.

Can be mounted to take an 8lb. load in any position.

Gives flexibility in all directions.

Box of 10 Mountings

2/6 *Post Free*

(Dept. P.M.)

WIRELESS INSTRUMENTS (LEEDS) LTD

54-56, The Headrow, Leeds

Tel: 22262

LIVE STEAMERS

REEVESCO locomotive castings are fully approved by "L.B.S.C.," the eminent designer of small steam loco's, and enjoy a world-wide reputation for their free machining qualities, accuracy and attention to detail. Send a 6d. stamp *now* to Dept. G.N. for a copy of our comprehensive illustrated catalogue, with details of blueprints, castings, materials and fittings for 35 "L.B.S.C." designed small steam loco's; workshop equipment, etc.

MYFORD 3½in. heavy duty lathes, type M.L.7. Bench models, £39/17/6. Deposit **£9/19/6** and 12 monthly payments of **£2/16/6.** DELIVERED FREE. Accessories, chucks and motors. Illustrated literature gladly sent.

HALIFAX 524. 5in. S.S. & S.C. lathes, motorised £74/10/-. Deposit **£18/13/9** and 12 monthly payments of **£5.** Carriage extra. Illustrated literature on request.

A. J. REEVES & CO.,

ENGINEERS—MACHINERY AND TOOLS.

416 MOSELEY ROAD, BIRMINGHAM 12.

Grams: *Reevesco Birmingham.* *Phone:* *CALthorpe* 2554.

"THE CHOICE OF EXPERIENCE"

YOU can become a first-class RADIO ENGINEER

We are specialists in Home-Study Courses in Radio Engineering, Servicing, Transmission, Television, Mathematics and Radio Calculations.

Post coupon now for free booklet and learn how you can qualify for well-paid employment or profitable spare-time work.

(Post coupon in unsealed envelope —1d. Postage.)

T. & C. RADIO COLLEGE

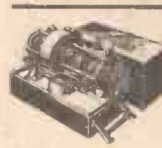
To: R. Heath Bradley, T.C.R.C.,
50, Harland Road,
Southbourne, Bournemouth.

Name ....

Address ....

M.59

UNUSED Ex-WD BARGAINS.



POWER UNITS T87, input 24 v. D.C., output 250 v. 50 m/A and 6.5 v. 2.5 amps. Size 8¼in. x 6½in. x 4½in. Complete with output smoothing equipment in base, 30/- incl.

CHARTBOARDS, 17in. square with Perspex Rule and Protractor on parallel arms, etc., 15/-, post 1/-.

ROTARY TRANSFORMERS T31. Input 18 v. D.C. 12 amps.; output 220 v. .11 amps; and 7.2 v. 13 amps. or converts to good Mains Motor for A.C. or D.C., 25/- incl.

HYDROMETERS, unbreakable glass, complete, 3/6 incl.

ROTARY CONVERTORS. Input 24 v. D.C., output 230 v. A.C. 50 cycles 100 watts, 70/- incl.

OIL PRESSURE GAUGES. 0-150 lbs. sq. in. complete with union and 20ft. capillary, 12/6 incl.

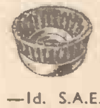
AMMETERS, 0/20 amps., 2½in. dial, 6/- incl.

MILLIAMMETERS, 0/350 m/A, 2in. dial, 5/- incl.

RELAYS (cut-outs), 24 v. mounted and in metal case 4in. sq. x 2¼in., 5/- incl. Ditto 12 v., 6/- incl.

TRANSFORMERS, input 230 v. 50 cycles, output 6.75-0-6.75 v. 19 amps., 40/- incl.

Ditto **AUTO,** input 230 v. 50 cycles, output 57.5 v. and taps every 11.5 v. up to 228 v., £5 incl.

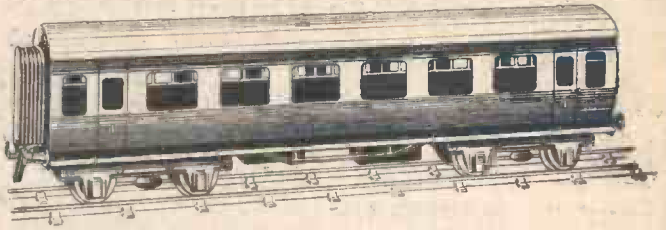


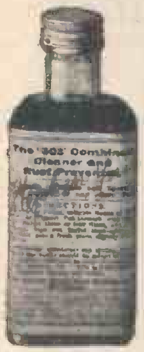
ROTARY CUP BRUSHES. Coarse steel wire, 5in. diam., ⅜in. shaft fitting, 15/- post 1/-.

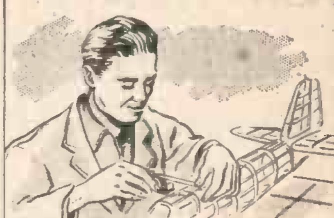
—1d. S.A.E. FOR RADIO/ELEC. LISTS—

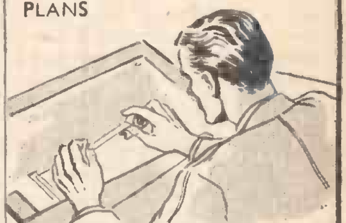
AUTO COLLECTIONS LTD.

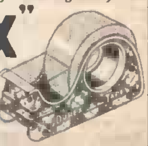
15, LAWRENCE STREET, NORTHAMPTON.



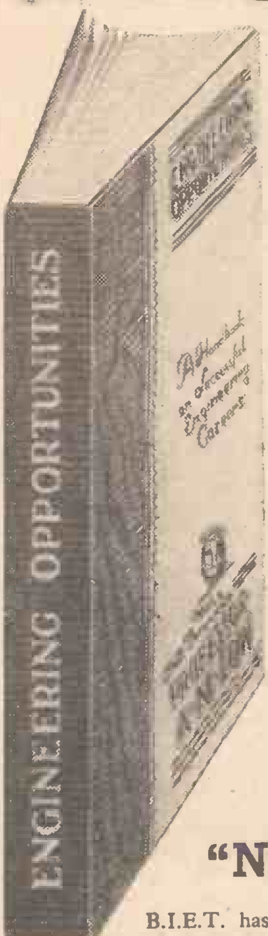








FREE! TO AMBITIOUS ENGINEERS



This enlarged and entirely new edition of the valuable Handbook "ENGINEERING OPPORTUNITIES"

For 21 years this unique book has been a guiding light to Engineers all over the world. More than 1,000,000 copies have been distributed . . . there have been 104 editions. Still the demand continues! After months of research, we have been able to produce a better and even bigger "ENGINEERING OPPORTUNITIES" packed from cover to cover with vital, up-to-the-minute information that every engineer requires—information *you* must have if you want rapid promotion, higher pay, and one of the many worth-while appointments open to technically trained men.

176 PAGES OF PRACTICAL GUIDANCE

"ENGINEERING OPPORTUNITIES" explains the modern, quick way of preparing in your spare time for recognised engineering examinations, outlines hundreds of examination and non-examination courses in all branches of Engineering, describes the benefits of our Employment Dept., and enables you to visualise a secure, better paid and more important position for yourself.

We definitely Guarantee

"NO PASS—NO FEE"

B.I.E.T. has helped thousands of ambitious men. We can and will help you. It will cost you no more than a stamp to inquire, and in any case "ENGINEERING OPPORTUNITIES" is well worth having. It will reveal many opportunities you are now missing and, if you are earning less than £10 a week, will be of special interest to you. Make sure of your FREE copy by posting the coupon now.

WHICH IS YOUR SUBJECT?

Mechanical Engineering
A.M.I.Mech.E.—CITY & GUILDS—General Mechanical Eng.—Maintenance Eng.—Diesel Eng.—Sheet Metal Work—Welding—Metallurgy—Machine Drawing & Design—Refrigeration, etc.

Electrical Engineering
CITY & GUILDS—General Electrical Eng. — Installations — Illuminating Eng.—Electrical Science—Electricity Supply—Meters & Measuring Instruments—Mains Eng., etc.

Radio & Television
A.M.Brit.I.R.E. — SERVICING CERTIFICATE—C. & G. Telecommunications—General Radio Eng.—Radio Servicing—Television Servicing—Sound Film Projection—Electronic Eng., etc.

Production Engineering
A.M.I.P.E.—Works Management—Foremanship—Staff Supervision—Planning Eng.—Costing, etc.

Automobile Engineering
A.M.I.M.I. — CITY & GUILDS — General Automobile Eng. — Automobile Repairs — High Speed Diesels—Garage Management, etc.

Building & Civil Engineering
A.M.I.C.E. — F.R.I.C.S. — L.I.O.B. — General Building — Architectural Drawing—Sanitary Eng.—General Civil Eng.—Surveying—Specifications & Quantities—Heating & Ventilating—Painting & Decorating — Plumbing — Carpentry & Joinery—Timber Technology, etc.

PLASTICS — DRAUGHTSMANSHIP—AERONAUTICAL ENG.—FORESTRY

SOME LETTERS AFTER YOUR NAME
A.M.I.Mech.E. A.M.I.E.E. A.M.I.C.E.
F.R.I.C.S. A.M.I.Struct.E. L.I.O.B.
A.M.Brit.I.R.E. A.F.R.Ae.S. A.M.I.P.E.

HUNDREDS OF OTHER COURSES
(Tell us what interests you)

POST THIS COUPON TODAY!

(Write if you prefer not to cut page)

Please send me FREE and entirely without obligation a copy of the new and enlarged edition of "ENGINEERING OPPORTUNITIES."

NAME..

ADDRESS ....

....

....

I am interested in...

(State subject, exam., or type of appointment that appeals to you.)

BRITISH INSTITUTE OF ENGINEERING TECHNOLOGY
410A Shakespeare House, 17-19 Stratford Place, London, W.1

BIET

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

PRACTICAL MECHANICS

EDITOR F. J. CAMM

MAY, 1950
VOL. XVII. No. 199

Owing to the paper shortage "The Cyclist," "Practical Motorist," and "Home Movies" are temporarily incorporated.

FAIR COMMENT

By THE EDITOR

VICTORIAN CRAFTSMANSHIP

IT was one of the laments of the late G. K. Chesterton that modern craftsmanship was inferior to Victorian craftsmanship. He stressed the importance of the amateur. His contemporaries, he often said, had given up doing a great many things for no other reason than that they could be done better by experts; and he instanced the crowds who attend professional football matches, instead of playing the game themselves, and the obsolescence of the family concert party because professional singers put the amateur to shame. I do not altogether agree with his reasons. The family concert parties went out not because professional singers outclassed amateurs but simply because the introduction of the bicycle, the motor cycle, the motor car and the cinema provided people with distractions or *divertissements* which hitherto they could not obtain. In the days of horse-drawn carriages a visit to a theatre was an event which took considerable organising, and unless people lived on top of the theatre it was a rare occasion. Train services were less frequent than they are to-day, and people were very much tied to their homes, and left to their own devices in the matter of amusement. Their world was bounded by the Parish pump. As soon as travel took people beyond those limits, they were bound to desert the old ways for the new. Public taste is an ever-changing thing. The womenfolk in those days plied their needles and their brushes in the decorative crafts. Cloison work, barbola, basket making, samplers, crochet, etc., were their hobbies. The menfolk made woodwork their hobby, for machine tools for amateurs were then unknown. As new sciences developed it was inevitable that the men would turn from inanimate articles of wood to devices of metal which worked. They like to see the wheels go round, and, of course, the women do not now waste their time on those silly, frilly things and absurd decorative work for which no one has use to-day. Machinery can now produce far better results at but a tithe of the cost.

In the fifty years of this century which have passed we have seen enormous progress in many directions—wireless, telegraphy and telephony, the aeroplane and airships, television, nuclear energy, plastics, new metals, the motor car, road transport and the annihilation of distance and, therefore, the gradual shrinking of the world by fast travel.

I venture to suggest that if G. K. Chesterton had compared the work of amateurs to-day with the amateurs of the 'nineties his views would have changed. There were few exhibitions in those days to afford opportunities of public viewing of private work. Some of the work which is executed to-day far surpasses the work of the expert, and no doubt in the year 2000 some one will be comparing the work of the amateurs of that year with those of 1950. It is a national habit to say that things are not as good as they were. In the words of Mr. Punch, they never were. For myself I am glad that the amateur crafts of the Victorian era, which, looked at through modern eyes, amounted to the making of useless dust-collecting gew-gaws, are things of the past. The Albert Memorial is symptomatic of that era and, by common consent, it is the ugliest of the world's statues in stone.

In those days, too, there were very few periodicals to instruct amateurs. Such as existed were dull affairs illustrated with woodcuts, for the line and half-tone process, made possible by Lumière, was in its infancy. There were no blueprints and large scale drawings. Fretwork was in its heyday. There were no such hobbies as model railways, model boats, model aeroplanes and model engineering. There were no radio amateurs. The modern generation is vastly superior in intellect to the Victorian. Travel has broadened their vision and science has enhanced their knowledge. G. K. was a master of rodomontade so perhaps when he made this invidious comparison he was being as facetious as when he said that the rolling English drunkard made the rolling English road!

OUR MODEL COMPETITION

I REGRET that the task of judging the entries in the competition set in our January issue has not been completed in time to include the result in this issue. It will, however, be given in our next. Some interesting examples of readers' work have been submitted, and I hope to be able to include illustrations as well as the names and addresses of the prize-winners in the next issue.

"PRACTICAL TELEVISION"

THE first issue of our new journal *Practical Television* was entirely sold out on the day of publication and a re-print was rapidly absorbed. I fear that many would-be readers were disappointed because they had failed to take the precaution of ordering from their newsagents. It is illegal to-day for journals to be on sale or return, and newsagents therefore only order such copies as they require to satisfy those orders received from their customers. If you desire to become a reader of *Practical Television*, which deals with every aspect of the new science, including the building of television receivers, you should place a regular order for its delivery with your newsagent. Do not rely upon chance copies.

SUBSCRIPTION RATES
including postage for one year

Inland - - -	10s. 6d. per annum.
Abroad - - -	10s. 6d. per annum.
Canada - - -	10s. per annum.

Editorial and Advertisement Office: "Practical Mechanics," George Newnes, Ltd.
Tower House, Southampton Street, Strand, W.C.2
'Phone: Temple Bar 4363
Telegrams: Newnes, Rand, London.
Registered at the G.P.O. for transmission by Canadian Magazine Post.

READERS QUERIES

SOME readers are submitting queries which are outside the ambit of this journal. Far too many readers are asking us for formulæ relating to cosmetics, gardening, and even medical queries. These we do not undertake to answer. Readers should confine their queries to those of a practical or a mechanical nature. We cannot undertake chemical analyses, nor can we disclose the chemical composition of commercial products. We do not undertake to prepare special designs for readers. I mention these points because some letters contain as many as twenty queries on different subjects and to answer them adequately would mean the preparation of an illustrated text-book. Moreover, readers are continuing to send electrical queries, which we have discontinued for the time being. Those which appear in our query pages are a selection made from past replies because they are of general interest. Some readers, too, are omitting the coupon, the stamped addressed envelope and the three penny stamps. We cheerfully go to an enormous amount of trouble to help our readers, and we merely ask them to be reasonable in their demands, and to ask themselves before writing whether the information they require is really the subject of a query or an illustrated article.

THE TURBINE CAR

ELSEWHERE in this issue we deal with the technical details of the Rover Turbine car which was recently demonstrated before technical journalists. It must not be thought, however, that piston engines are likely to go out of fashion within the next few years. The turbine engine as applied to motor-cars has a long way to go. Its main snag at present is its somewhat heavy fuel consumption, which somewhat outweighs the advantages. But it is a possibility of the future which cannot be overlooked. The piston, crank and poppet valve engine, which has held the field so far as internal combustion engines are concerned for more than fifty years, is a complicated and wasteful method of employing the heat units liberated by combustion. The average petrol engine as a fact only puts about 15 per cent. of those units to work. The Rover test, however, has demonstrated that a small compact and easily manufactured unit can propel a car and give a performance superior to the piston engine; but it must be remembered the efficiency must also take into consideration fuel consumption.

Experiments are going on with jet-propelled cars, but they have not reached a stage of development comparable to the turbine.

The internal combustion engine used to-day was due almost entirely to the work of Gottlieb Daimler and Otto with detail improvement by the late Dr. Frederick William Lanchester, who was responsible for more improvements to the motor-car than any other man. There has been, in fact, little improvement in the motor-car beyond the work of Lanchester.

The Rover turbine car during a recent demonstration.

The First Gas Turbine Car

Outcome of Ten Years of Research

THE story of the Rover Company's latest contribution to British engineering prestige by the development of the gas turbine engine—now proved for the first time as a practical means of propulsion for a motor-car—begins early in 1940. At that time the company became acquainted with Air Commodore Whittle and his small band of pioneers, who were working with prodigious faith and energy to develop the "Whittle jet engine" for use in aircraft.

Until 1943 Rover engineers and technicians assisted materially from the development and production angle, and, in fact, the Rover Company built some of the very first of that type of engine. Work on gas turbine development was started at the company's plant in Coventry, and after that was bombed a move was made to two converted cotton mills—one at Clitheroe, Lancashire, where development was centred, and the other at Barnoldswick, Yorkshire, where emphasis was on production.

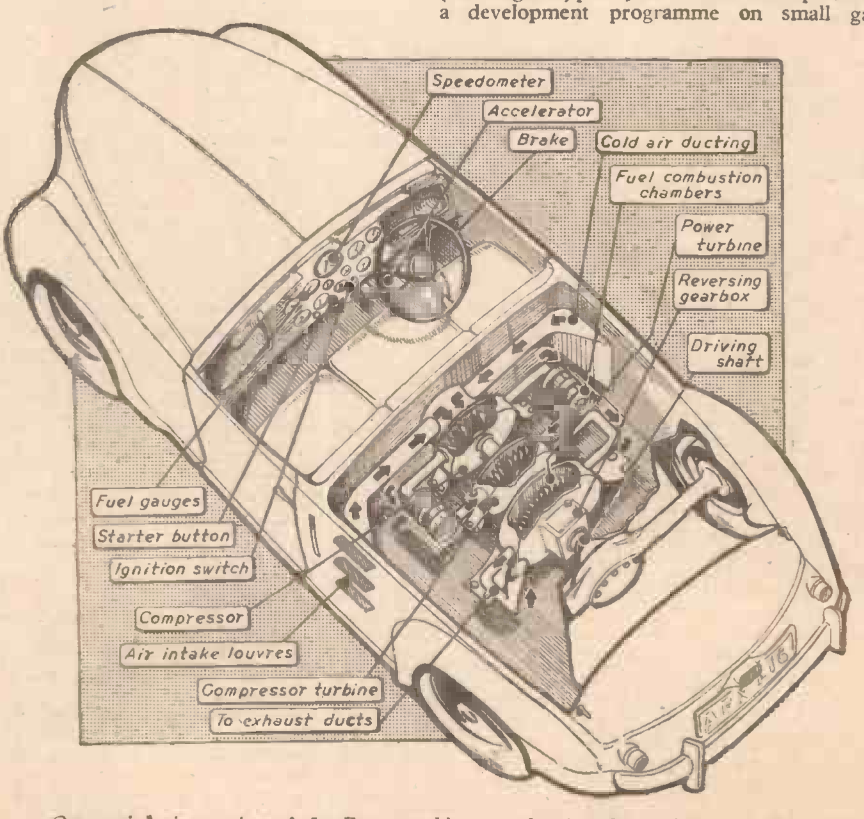
At an early stage, the Rover Company sought and obtained permission to sub-contract fuel and combustion development and manufacture to Messrs. Joseph Lucas, Ltd., who, through their vigorous pursuit of this project, with its many problems, have come to supply fuel and combustion systems for most of Britain's successful aero gas turbines.

The happy association between Rover and Lucas has continued and Lucas engineers have helped materially in the development of fuel and combustion systems for the small car engine.

The Engine

The original Whittle design was for an engine with "reversed flow," the air taken in being made to double back upon itself within the engine before expulsion. As a result of Rover experiments and developments at Clitheroe, however, a "straight through" version of the engine was developed. By early 1943 the engine had reached the stage where it was ready to be put into quantity production, and with the emphasis now shifted to production in quantity the project was handed over to Rolls-Royce. The now famous Rolls-Royce Nene and Derwent engines derive directly from the straight through version of the Whittle engine developed and produced by the Rover Company.

For the remainder of the war period the Rover Company was concerned primarily with the production of piston engines for tanks. When the firm's post-war manufacturing and development programme was considered it was felt that the pool of highly specialised knowledge gained during the work on gas turbines was too valuable to be allowed to remain stagnant. Consequently, when civilian activities were resumed at the Solihull (Birmingham) plant, there came into operation a development programme on small gas



Our artist's impression of the Rover turbine car showing the various controls.

turbines with the object of trying to find practicable methods of using them for car propulsion and various other applications.

That programme has been pursued steadily, and during the past few years there has been considerable speculation as to results and the nature of the work. During the whole of this period of patient work, of trial and error, fewer than twenty men have been directly engaged, under the leadership of Mr. Maurice C. Wilks, the company's chief engineer.

Problems Involved

Of the problems involved, Mr. Maurice Wilks told a correspondent: "When we went into this job we had no illusions—we did not start off with the idea that we would be able to make satisfactory car gas turbine engines in a year or so's time. We knew that it would take a long time, but we felt that as we were one of the few motor-car manufacturing firms in the medium quantity production class with this very valuable 'know-how' on gas turbine engines it was most desirable to continue our work."

Mr. Maurice Wilks emphasised, "This is, in fact, what might be called a practical interim report on the progress of our work. We know we still have a long way to go before the gas turbine car becomes a marketable proposition, but this will show that we have gone some way on the journey and that the gas turbine car has some very attractive features.

"The present engine is really a piece of test-bed apparatus and, in consequence, does not bear much resemblance to what the company has ultimately in mind for a motor-car, either in power output, dimensions or weight. It would be a mistake to regard this particular engine as representing anything approaching finality—in any case, in any future 'production' car we would certainly not put the engine where one expects to find the back seat. That has been done purely for convenience in this case, and because the vehicle is, literally, a mobile test bed.

"This car does, however, demonstrate that many of the major problems have been solved, and that it is possible to build a vehicle with only two-pedal control—accelerator and brake.

"It is obviously the Rover Company's intention to produce a gas turbine engine car as a marketable proposition if and when that becomes practicable, in which case it will certainly be as good as—most probably better than—existing piston engine cars in respect of performance and weight. Probably, though, it will not be quite so good in respect of fuel consumption, but to balance that the performance will be superb."

Nimonic Turbine Blade

The part played in the development of gas turbine engines by the Birmingham firm of Henry Wiggin & Co., Ltd., was pointed out by Mr. Maurice Wilks. He said, "When we put the first Whittle engines on the bench we could seldom run for more than a few minutes owing to the fact that the special blade metals now in use had not been developed. Then came the now famous Nimonic turbine blade material produced by Henry Wiggin & Co., Ltd., and as this new material became more readily available, endurance running of turbine engines came to be measured in hundreds of hours instead of tens of minutes.

"The present small engine, like its predecessors and most current British gas turbines, owes its freedom from brake failures under the most arduous temperature conditions to the use of Nimonic turbine blade material."

The present engine was designed to include a heat exchanger, but as the design of this is one of the most difficult problems involved, its development is for the most part being done away from the engine, the initial engines being run without heat exchangers—in which condition their fuel consumption is more than twice what it would be in a good piston engine of equivalent power. With a heat exchanger, however, the gas turbine's fuel consumption comes down to within measurable distance of that of the conventional piston engine. Fuel may be petrol, paraffin or diesel oil.

For a road vehicle the gas turbine offers two pedal controls, as there is no need for a clutch or manual gear change in the accepted sense. With a piston engine the problem is one of fit and wear; with the gas turbine there are few close fits and there is very little wear, but balance is a big problem, as it must be nearly perfect.

Technical Details

The following leading particulars apply to the car: wheelbase, 9ft. 3in.; track, 4ft. 4in.; type of body, open; number of seats, 2-3.

The general design of the car, apart from the power unit and transmission, is on conventional lines, and its external appearance normal.

The power plant, which is mounted immediately ahead of the rear axle, consists of a centrifugal compressor, with dual combustion chambers, having a single-stage compressor turbine and an independent power turbine. The latter is positively coupled through gearing, incorporating a reverse gear, and drives a conventional rear axle. The fuel used is kerosene.

The method of starting is by a normal car-type electric starter, with push button on the instrument panel.

The time taken to start the power unit and to run up to idling speed is 13 1/5 seconds, and the car moves forward in a further 3 2/5 seconds.

Control is simple from standstill to maximum speed, and is solely by means of the accelerator pedal, the only other driving control being the brake pedal.

The reverse gear is operated by a lever which functioned normally.

Under test the car was driven for five laps on a circuit of the Proving Ground measuring 2.75 miles per lap, during which the Royal Automobile Club observers travelled alternately as drivers and passengers.

No attempt was made to attain maximum speed, but during the course of the test a speed exceeding 85 m.p.h. was readily attained, at which speed the compressor-turbine revolution counter indicated 35,000 r.p.m.

In a test of acceleration from a standstill, the car smoothly attained 60 m.p.h. in 14 seconds.

Although no provision for silencing the exhaust was observable, the volume of noise was not excessive or unpleasant, but was naturally accentuated during acceleration.

Two-way Radio Communication in Industry

MAXIMUM efficiency in the use of transport vehicles and material-handling equipment can be extremely difficult to attain where plant operations cover a considerable area, and where a variety of mobile handling units is required. Many hours of working time, both for men and machinery, may be lost through inability exactly to locate, and direct to the required site, specific equipment.

Such plants as shipyards, steelworks, docks and railway yards, where a vast amount of material is regularly handled, require a wide diversity of trucks, trailers, road and track cranes, locomotives and tugs and lighters, all of which may be utilised over an area of several hundreds of acres, and to ensure an even, steady flow of materials it is essential that each of these be used to maximum capacity without overlapping or idle time.

Two-way F.M. System

It is in this respect that the system of two-way Frequency-modulated V.H.F. radio communication, recently introduced by the Plessey Company, Limited, and embodying the wide experience of the Bendix Corporation in this field, can play such an important part in cutting costs and increasing production. Originally developed for use on railways, and recently experimentally installed by courtesy of the Railway Executive in a busy marshalling yard in London, this method of control has a wide field of application in industry. All components have been specially designed to withstand the arduous conditions likely to be encountered in railway engine and heavy vehicle installations.

Under this system, designed to operate in the 156-184 Mc/s band, each vehicle is equipped with a crystal-controlled transmitter with output rating of 100 watts, a crystal-controlled receiver and a power unit, all housed within a robust, weather-proof container. In the above installation this was mounted on the roof of a diesel shunting engine, with aerial adjacent. A central control station incorporates a crystal-controlled transmitter and receiver and a power supply within a single metal cabinet. The main control may be up to 50 feet from this cabinet and incorporates a loudspeaker serving also as a "talk-back" microphone.

The driver in the cab of a shunting locomotive receiving instructions by the new radio-communication system.

Where required, a remote control point, with all the facilities of the master control, may be several miles distant, connection being by twin telephone line.

Selective Calling Device

When employing this form of control it is frequently adivsable to be able to converse with individual drivers rather than to broadcast a message to all. With the Plessey system, an optional addition is a selective calling device whereby, at the turn of a dial, the control point operator may speak to any one of up to ninety units, each of one or more vehicles, the remainder being "locked out." Completely undisturbed conversation is thus assured.

Making an Electric Oven

A Thermostatically Controlled Appliance for the Experimenter

By E. N. J. MARGUERIT

THE purpose of the oven described in this article is to provide a means of constant temperature for the writer who is interested in chemistry, such as drying precipitates and keeping glassware dry.

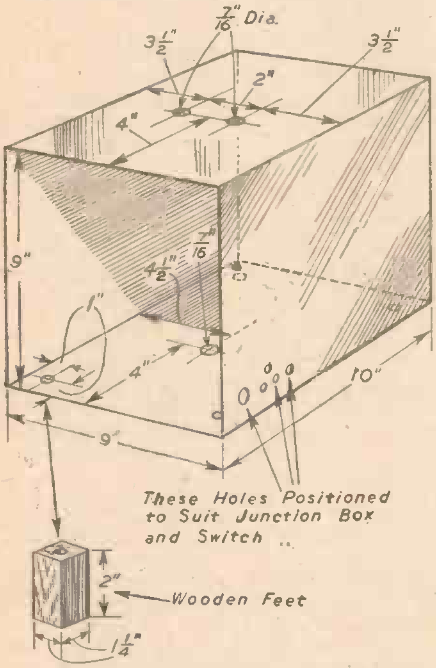


Fig. 1.—Details of the outer tin casing.

The oven can, of course, have many other uses whenever a source of constant temperature is required. Temperatures between 20° and 120° centigrade are obtainable with an accuracy of plus or minus 2 per cent. at 120° C. The desired temperature being attained merely by turning a small bolt on the thermostat. The oven is provided with a red pilot lamp which is automatically switched on when the thermostat puts the element out of circuit.

Cost

Before proceeding with the details of construction the writer would like to stress the fact that the complete oven did not cost more than 10s.; whereas a commercial article would cost at least 40 times that price.

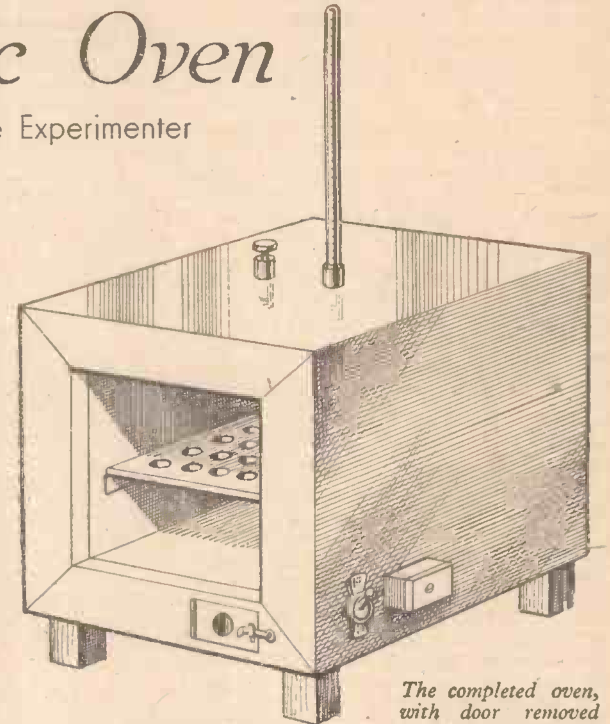
The thermostat is a bi-metallic type and is entirely satisfactory. It can be obtained from Messrs. Thermolectrics, of Hampton-on-Thames, Middlesex, for 3s. 9d.

Construction

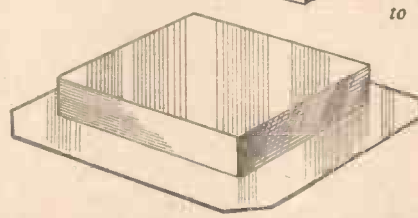
The oven is made out of two tin boxes, one smaller than the other, the small tin being fixed inside the larger one, and the space between the two is lagged with asbestos slag acting as a heat insulator. The whole is shut by an asbestos lagged door.

The large tin measures 9in. x 9in. x 10in.; if the lid is soldered to it, it should be removed with a tin opener and the rough edges hammered down with a mallet. It is then drilled according to the measurements given in Fig. 1.

The legs, consisting of four blocks of wood, 2in. x 1¼in. x 1¼in., drilled lengthwise, are screwed on the bottom of the tin with four 2½in.-long bolts and nuts. Similarly, the smaller tin, 6in. x 6in. x 8in., is freed of its lid and the rough edge smoothed out. Three 7/16in. diameter holes, two on the top and one at the bottom, are drilled, following the dimensions given in Fig. 2 (a). Three lengths of copper pipe, each 2in. long and 7/16in. diameter, are then soldered in those holes with 1¾in. length of pipe protruding on the outside. Two additional ⅛in. diameter holes are drilled on the right-hand side, spaced 1in. apart. Each is fitted with a 1in. bolt, insulated from the tin by fibre washers. The terminals of the thermostat are then soldered to the free ends of the bolts (Fig. 2 (b)). The tin is then covered with two layers of asbestos paper held in position by means of two lengths of No. 16 S.W.G. enamelled copper wire with their ends twisted together and cleaned with emery paper.



The completed oven, with door removed to show the interior.



These two ends serve as terminals for the electrical element, which consists of five yards of No. 41 nickel-chrome resistance wire. The beginning of the wire is twisted and soldered on the first copper wire, then evenly distributed over the whole length of the tin on the asbestos paper, the other end being similarly soldered on the second copper wire. A flying insulated wire is also soldered to each end of the element for further connections (Fig. 3). The element is protected with a sheet of asbestos paper.

The large tin is fitted with an on/off switch and a small ex-R.A.F. junction box on the right-hand side. The back of the tin is packed with a 2in. deep layer of asbestos slag, the top of which is covered with a

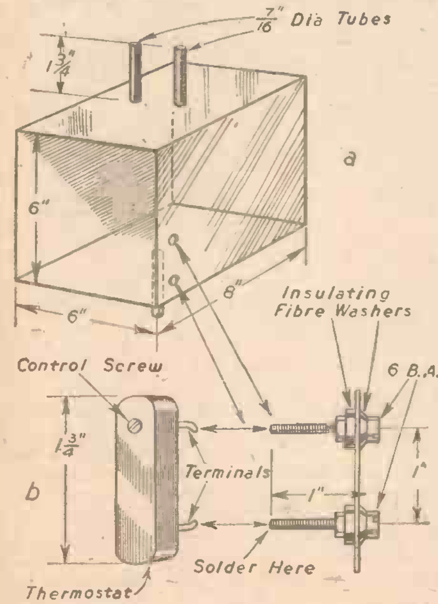


Fig. 2.—Inner tin lining and details of thermostat.

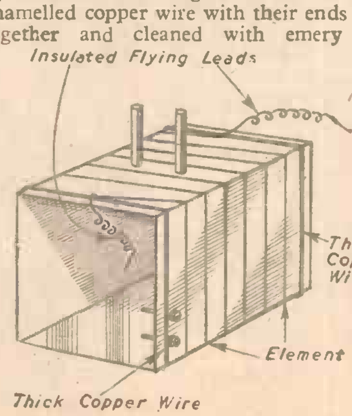


Fig. 3.—The heating element.

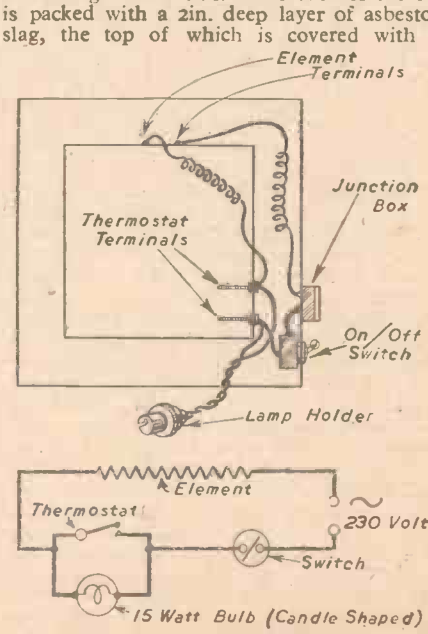


Fig. 4.—Wiring diagram and theoretical circuit.

sheet of asbestos paper. The small tin is then fixed inside the large one and the three pipes are made to fit in the holes of the large tin and then soldered in place.

Connections

At this stage the connections are made and are as follows: One flying wire from the element goes to the junction box, the other is soldered to one of the thermostat's terminals. The second terminal of the thermostat is connected to the junction box via the on-off switch.

A lampholder is then connected by means of a 1ft. length of twisted insulated flex across the thermostat's terminal (Fig. 4).

The length of the flex allows the lamp and its holder to be removed from the oven through a special door for replacement. The spaces between the two tins are now filled with asbestos slag, about 9 lb. being required for that purpose. When filling the spaces, a cavity about 2in. x 2in. x 6in. should be left free of asbestos slag so as to allow for the free withdrawal of the lamp and its holder. Four pieces of tin are cut and bent to the dimensions given in Fig 5, and a 1in. diameter hole is cut in one of them. A small piece of tin, 2in. x 1¼in., is hinged opposite the hole and has itself a ½in. hole cut in the centre with a piece of red celluloid glued on the back. It is also provided with a catch. This small door enables the removal of the 15-watt candle-shaped indicator lamp for replacement. These trapesium-shaped

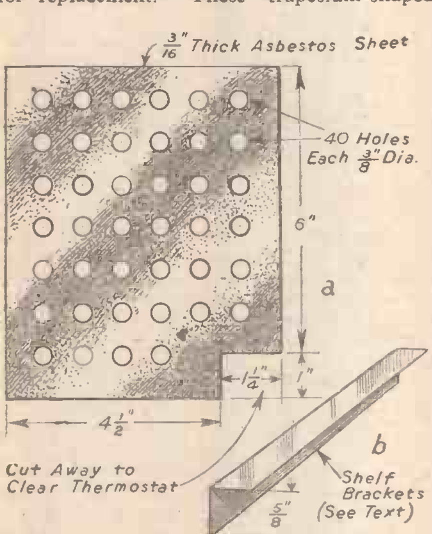


Fig. 7.—The perforated shelf.

pieces are then soldered so as to cover the spaces between the two tins (Fig. 6).

Fixing the Shelf

The next step is fixing a shelf in the oven. This is made out of an asbestos board, 3/16in. thick, 7in. by 5¾in. cut as shown in (Fig. 7 (a)). Forty evenly-spaced holes are then bored with a cork-borer ⅜in. in diameter.

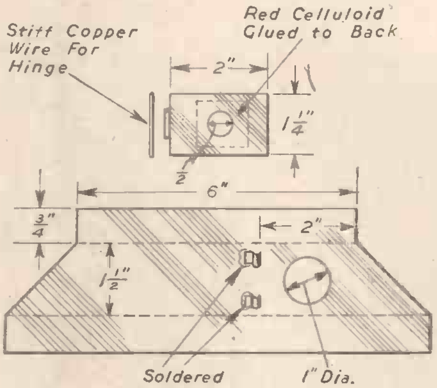
Three right-angle tin brackets, 7in. 6in. and 5in. long and ⅝in. wide, are soldered inside the tin to act as a shelf support (Fig. 7 (b)).

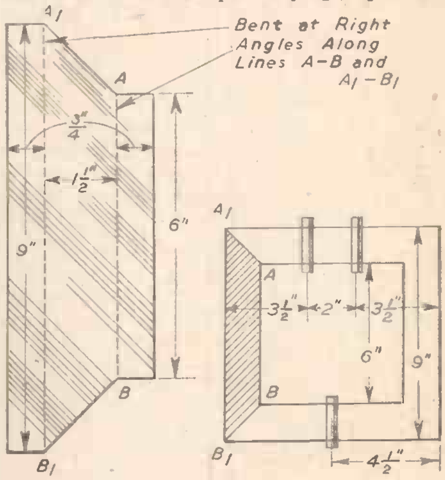
The door is made of a strip of tin, 26in. long and 1in. wide. This strip is given the shape of the open end of the inner tin and held in this position by a temporary fixture (e.g., two pieces of tin soldered in a cross so as to keep the strip in position).

A piece of tin slightly smaller than 6in. x 6in. is cut, and this is soldered on to the band, the soldering being made from the inside. The cavity is packed with asbestos slag and a piece of tin 8in. x 7¼in. is soldered on the outside (Fig. 8).

A plastic handle (obtainable at most cheap stores) is fixed on the front of the door before soldering the latter to the band. The door, if proper care has been taken during its construction, should fit perfectly in the tin and no catching should occur.

A hinged door, if preferred, could easily be fitted instead of the type described.





Figs. 5 and 6.—Details of the parts for forming the front of the oven.

It will have been noticed that there are three pipes connecting the outside air with the inside of the oven. One of the pipes on the top serves to carry a thermometer; a mercury one for high temperatures, but an alcohol type can be inserted if the oven is used for low temperatures (e.g. as an incubator).

The underneath pipe draws cold air from

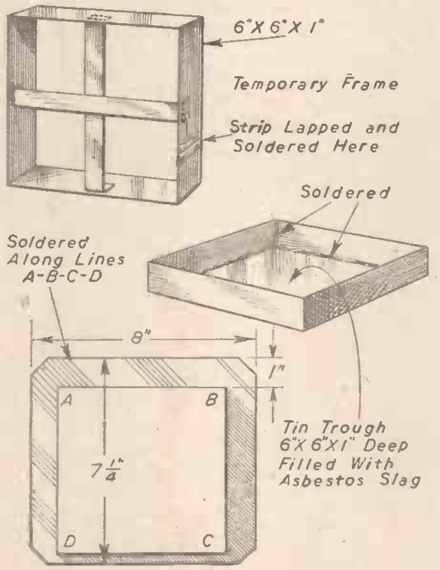


Fig. 8.—Details of door construction.

the outside, and this air is warmed inside and escapes into the atmosphere from the top pipe. These pipes can be fully closed or opened at will by the device shown in Fig. 9. In the case of a very moist substance it is advisable to open both pipes so as to allow the moisture to escape.

When the oven is complete, give the outside two coats of good paint or enamel of any desired colour.

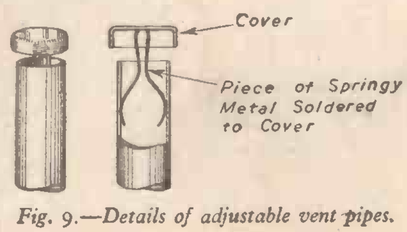


Fig. 9.—Details of adjustable vent pipes.

Operation

Connect a length of twisted flex to the junction box on the right-hand side and plug the other end to a power plug; put the switch on the "on" position and adjust the thermostat. Place the thermometer in the vacant pipe by means of a piece of rubber tubing, and close the door.

The oven warms up and at a certain moment the red light goes on. At this stage the air inside the oven has reached the temperature recorded by the thermometer. Suppose it is 60°C. the red light should stay until the thermometer reads 59°C., at this moment the red light goes off which means that the element has been switched on again, and so on until the oven is not required, when the switch is put on the "off" position.

The writer has found that it takes 25 minutes to reach a temperature of 100°C. (212°F.) and that at that temperature the element is "off" three minutes and "on" one minute. The variations being from 99°-101°C. This accuracy being due to the great care taken in lagging the oven.

The criterion of good lagging is that the outside of the oven should remain absolutely cold when the inside temperature is 120°C.

The desired temperature is found by the method of trial and error in manipulating the bolt on the thermostat.

Britain's Oil Supply

An Up-to-date Review of the Position

By "TECHNICUS"

THIS is not the first time that I have dwelt on the supply position of oil for Britain, but since the subject was last discussed the position has altered. Indeed, it continues to change, and there should be no illusion about this country's dependence on petroleum. Any changes, therefore, must be watched no less vigilantly than our coal situation. In the past thirty years industry and communications have grown more than ever dependent on oil in all its forms. As a fuel for transport and aircraft it is essential, but alongside these demands have grown those for oil as a boiler fuel, for lubricants and other applications.

Our dependence on crude oil, or "oil," as it is often called, is well illustrated by a list of products obtained from it. It is the former which emerges from the ground, to be processed at the refinery into so many essential petroleum products, and these include the following: —

Petroleum ether (for solvents).
Petrol (engine fuel).
White spirit (for paints and rubber).
Paraffin (for illuminants and heating).
Gas oil (for diesel engines).
Lubricating oils (for machinery and transport).
Greases (for machinery and heavy plant).
Fuel oils (for boilers).
Asphalt (for road making).

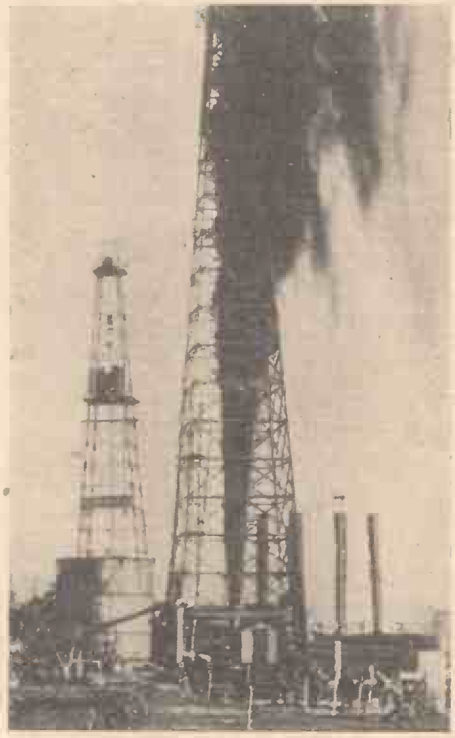
The crude oil resembles a thin tar, and is distilled to yield the above products. Petrol and paraffin are, clearly, among the important fractions, with gas oil becoming increasingly so as diesel road transport is developed. The jet engine for aircraft has produced a big demand for paraffin or kerosene, but in this the refiner has, as it were, been caught in a cleft stick.

Cracking

The main object of a refinery is to produce as much petrol as possible from a given quantity of crude oil. Straight distillation gives a limited yield, which can, however, be increased by what is called "cracking." The hot petroleum vapours obtained by heating crude oil are passed through long lengths of hot tubes, which serve to break up the heavy molecules of the oil vapour into smaller molecules. It is these latter which give petrol, so that the more an oil can be cracked the higher the yield of petrol. Since 1940 a further improvement called "catalytic cracking" has pushed up the yield of petrol even further, but 1940 marked also the development, in earnest, of the jet engine, for which the fuel is kerosene. It so happens that catalytic cracking raises the output of petrol at the expense of kerosene, which produces a relative scarcity in the latter just when it is most needed. The world, in consequence, finds that the jet engine is in direct competition with the petrol engine for fuel supplies. This has introduced serious difficulties, and the matter is receiving the attention of experts in all countries, especially in Britain and the United States

Strategic Position

Behind the technical questions of the supply of oil lie political issues of major importance. The supply position up to 1948 brings out this point clearly, when it is revealed that, not only is Britain dependent on the Middle East, but that American supplies are becoming tighter, so throwing the Middle East into yet greater prominence. It has been estimated that America, the largest producer of crude oil, is living on its reserves at the rate of 10 per cent. per year. The Middle East, on the other hand, is using only 1.5 per cent. of its reserves annually. Against that better position must be set the



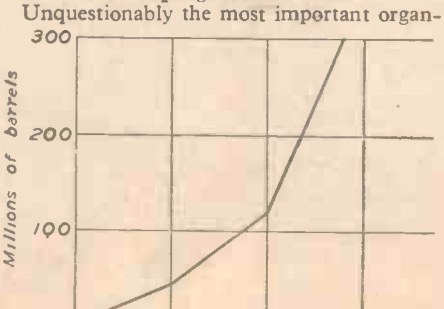
A gusher liberating black oil in a pressure stream into the air.

geographical and political situation of the Middle East.

The steep rise in the world production of petroleum is illustrated in the accompanying graph, and it now stands at about 3,200,000,000 barrels a year. Estimates show that the demand in 1951 will be about 3,900,000,000 barrels. It is already known that the U.S.A. cannot supply Britain with petroleum on the scale to which we have been accustomed during the past ten or twenty years, and the position is expected to deteriorate as time goes on. Indeed, America is worried about her ability to supply her own expanding demand, and is actively developing the Middle East oilfields, in co-operation with Britain.

Who is Developing Middle East ?

Unquestionably the most important organisation in the Middle East oilfields, which cover Iran, Iraq and Arabia, is the Anglo-Iranian Oil Company. With oil concessions which have another forty years to run, this big undertaking is carrying the load of oil supplies to Britain. The Government of this country holds about one-half of the shares, the rest being in private hands, so that one might say that it is a semi-official body. In some respects it is unique, being privately run but financially under the control of the British Government, and, judging from results yielded over the past years, one is tempted to say that the combination is a successful one.



Graph showing rise in petroleum production.

The huge refineries at Abadan, on the shores of the Persian Golf, receive the crude oil by pipeline from the fields some miles inland. From Abadan both crude and finished, or semi-finished products, are shipped to Britain and elsewhere. For this a large fleet of tankers is required, and these have to pass through the Red Sea and Suez Canal.

During the past ten years American interests have grown, and to-day there are various subsidiaries of the Standard Oil Company in the Middle East fields. The Arabian American Oil Company, for example, contains the holdings of Standard of New Jersey and Socony Vacuum, in association with the Shell Group and Anglo-Iranian, not forgetting an equal share with the two latter held by the French part - Government - owned C.I.E. Francaise des Petroles.

The Future

Whether we like it or not, Britain's petroleum supplies of the future are tied up with political developments in the Middle East. It is recognised that there is no economic substitute for natural petroleum, which is cheap and gives many valuable secondary products, but our dependence on political factors makes one consider seriously whether our natural coal supplies should not be tapped for oil, even though the ultimate cost per ton of the finished product is higher than for petroleum. Having inspected the German synthetic oil plants, which rely upon coal as the raw material, I am impressed with the possibility in that direction for a country so rich in coal. And now one reads of synthetic oil plants being built in the United States where oil is comparatively abundant. Given a process for coal analogous to the catalytic cracking of petroleum, we could rid ourselves of outside dependence on liquid fuels, which, unfortunately, have become as essential to our industrial economy as coal itself.

Sufficient is known technically about the problem to need little further investigations of ways and means of turning coal into oil. That it can be done on a large scale and with reasonable economy has also been demonstrated, but more important than technical considerations is the confidence in such a project. Millions of tons of low-grade coal are burnt in this country annually, with a wastage of efficiency that would make the most extravagant synthetic oil project seem economical. It is true that coal-cleaning methods will gradually reduce this gigantic loss of efficiency, but it is unreasonable to expect that some millions of tons of coal will not be mined each year which could better be turned at the coalfield into fuel oils. The question is: how long is Britain to wait before the present perilous position with oil supplies is relieved ?

Model Internal Combustion Engines–3

A Review of British Commercial Model Engines

By C. E. BOWDEN, A.M.I.Mech.E.

(Concluded from page 168, February issue)

MILLS BROS. (Model Engineers), Ltd., 143, Goldsworth Road, Woking, Surrey, were the first to enter the British market with large-scale production of the diesel, and they have always held a most enviable reputation for very high-grade engines, having an excellent finish as well as performance. I have used many of their engines in my models, invariably without a complaint.

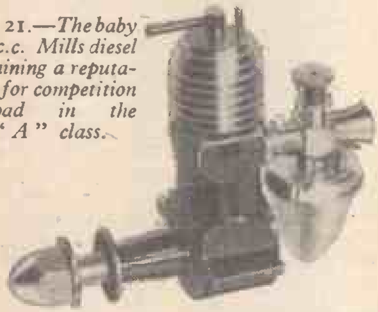


Fig. 21.—The baby .75 c.c. Mills diesel is gaining a reputation for competition abroad in the "A" class.

Fig. 22.—(Right) The famous 1.3 c.c. Mills Mark II diesel has powered very many models to success. Noted for its excellent finish and performance.

The firm provide a good range of capacities in their motors, which therefore cover a wide field of model activities. There is the baby Mills of only .75 c.c. (.045 c. in.) which is much sought after in America for the small A class competition aircraft. I gave an American friend, with competition leanings, one of these engines and he immediately asked me for another, so successful did he find it, and he tells me that they are most popular in his country.

The next size is the famous Mark II 1.3 c.c. Mills, which was the original capacity chosen by the firm. The engine has been much improved in appearance and performance over its years of development, until it is hard to conceive any possible increase in output. At 3½oz. it is claimed to be the lightest engine of similar power. Mills engines are provided with airleak cut-offs which a timer can operate. They make excellent boat and car engines besides being most popular for aircraft.

The last of the range is the 2.4 c.c. diesel, in which the maximum horse-power is developed at about 10,000 r.p.m., but owing to its flexibility this engine will operate at very near peak efficiency at speeds well below this optimum speed. This flexibility is a useful asset for car or boat, and also stunt control-line flying. The larger Mills has a disc inlet valve situated at the rear of the crankcase. I use one of these engines in a twin-float seaplane.

Fig. 23.—The largest of the Mills' range is the 2.4 c.c. diesel specially designed for high speed and stunt work. This engine is fitted with a disc inlet valve at rear of the engine.

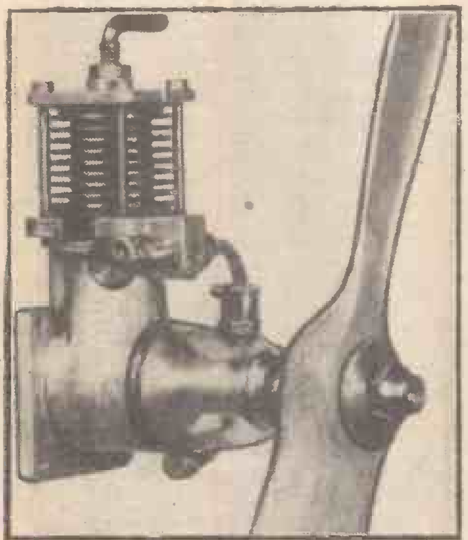


Fig. 24.—The M.S. 1.24 c.c. diesel is an exceptionally light motor, having the unusual feature of a fuel tank located around the main-bearing housing, with the advantage of neatness and even flow.

Mills .75 c.c. Diesel

Bore .33in., stroke .52in., speed 7,000 to 7,500 r.p.m., 8in. by 4in. pitch prop. Thrust 10oz., weight 2oz., height 2½in., length 2¼in. Control-line prop. 7in. by 6in. or 8in. according to model. Fuel, Mills Blue Label.

Mills Mark II Diesel

Capacity 1.3 c.c., weight 3½oz., power ⅛ h.p., speed 8,000 r.p.m. Thrust 20oz. Propellers. Free flight, 9in. by 4in. pitch, or lower climb 6in. pitch. Control-line flying—from 8in. diam. by 8in. pitch to 8in. diam. by 10in. pitch. Flywheel, 1¾in. diam., ½in. wide, weight 5oz. Mills Blue Label fuel to be used.

Mills 2.4 c.c. Diesel

Bore ½in., stroke ¾in., speed 8,500 r.p.m. (10in. by 5in. prop.). Thrust 32oz., power .18 h.p.; maximum power at 9,500 to 10,000 r.p.m. Props. Free flight, 10in. by 5in. pitch. Control line, 9in. by 8in. or 8in. by 12in.—pitch according to model. Flywheel diam. 2in., 5½ to 6oz. Fuel, Mills Blue Label recommended. Separate tank used, suitable for stunt work.

The M.S. 1.24 c.c. Diesel

The Model Shop, 3, Ridley Place, Northumberland Street, Newcastle-upon-Tyne, 1, are responsible for an exceedingly light 1.24 c.c. diesel called the M.S. This interesting little motor has a radial mounting, with the unusual British feature of a transparent fuel tank located in front of the crankcase and encircling the main bearing housing, where it is neatly out of the way (see Fig. 24). This tank is immediately adjustable for upright or inverted running. The makers claim that the engine is "the lightest engine made of its kind suitable for model aircraft, race cars, speedboats, etc." The weight is only 2.8oz. which is good going for 1.24 c.c. The engine is suitable for model aircraft up to 28oz., from 30in. to 54in. wing-span.

Bore 11 mm., stroke 13 mm., r.p.m. 3,000 to 7,000. Fuel tank to run engine for 60 to 70 secs. Recommended fuel, Redex 10 per cent., anæsthetic ether 40 per cent., paraffin 20 per cent., castor oil 10 per cent., double Shell oil 20 per cent.

"K" Diesels

The K Model Engineering Co., Ltd., Darnley Street, Gravesend, Kent, market a range of four sizes in diesel with similar design characteristics. The smallest of the range is probably the smallest commercial diesel in Britain. In Fig. 25 is shown this little engine of only 0.2 c.c. which I have run a considerable amount, and which starts by hand quite easily in spite of its minute size once one has mastered the technique. The illustration shows the original type which has since been cleaned up, having been made even smaller, lighter, and with a radial mounting. The propeller is only 4in. diameter! The engine runs like an angry insect at very high revolutions and is altogether a delightful little unit.

The other engines of the K range are

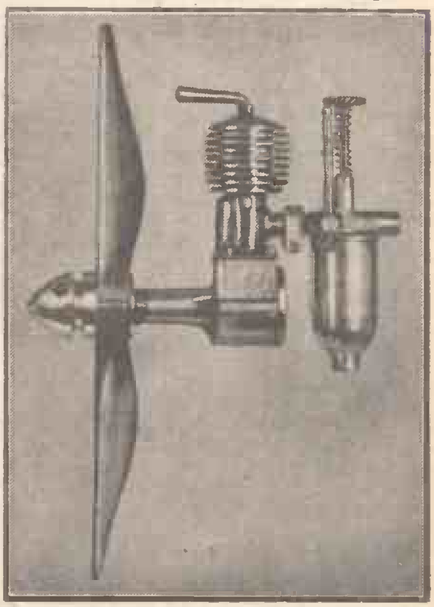


Fig. 25.—Surely one of the smallest commercial engines in Britain, the minute 0.2 c.c. K diesel is a practical little diesel with a 4in. propeller and an exhaust note like the angry buzz of an attacking insect.

Fig. 26.—The Masco Buzzard 2.8 c.c. diesel is available as a very complete set of castings with drawings and instructions.

the large 5 c.c. Vulture, a very powerful and high-speed engine at a low price, and the 2 c.c. Falcon. Both have crankshaft rotary inlet valves and a ring of exhaust ports around the cylinder. A glow-plug head can be fitted, and an 8oz. flywheel is obtainable for boat or car. There is a 1 c.c. Eagle diesel, which can be bought in kit form with all parts fully machined ready to assemble, at a very low price.

K. Vulture 5 c.c. Diesel

Weight $7\frac{1}{2}$oz. R.P.M. with flywheel, 15,000. With 10in. by 6in. airscrew, 10,000; or 10in. by 8in. prop. 8,000. An extended crankshaft and spinner can be fitted to this engine as an extra. Suitable for radio control 'planes. Bore $\frac{3}{4}$in., stroke 11/16in., height $3\frac{5}{8}$in.

K. Falcon 2 c.c. Diesel

Weight 4oz. Bore 9/16in., stroke 9/16in., height 3in. R.P.M. with flywheel, 18,000. With 8in. by 6in. prop., 9,000 plus.

Fuel recommended for K diesels. Lubricating oil 20 per cent., paraffin oil 35 per cent., castor oil 10 per cent., ether 35 per cent.

The Foursome 1.2 c.c. Diesel

Arthur Mullett, 16, Meeting House Lane, North Street, Brighton, 1, provides the Foursome 1.2 c.c. diesel, which has a reputation for good power output and reliability, together with sound, rugged simplicity of design. This firm is also responsible for the very small 0.3 c.c. Kalper diesel, which is only a shade larger than the tiny 0.2 c.c. K diesel which we have discussed already. Although this is one of the very few engines that I have not personally had the good fortune to test it has been independently stated by a tester other than the firm that this tiny engine can be started by hand without the aid of a cord. Like all very small diesels, the r.p.m. is higher than the larger capacity motors.

Kalper 0.3 c.c. Diesel

Running on 1 part Mills fuel and 1 part ether plus 10 per cent. medium engine oil, the engine did 10,250 r.p.m. under load. The makers, however, specify ether 6 parts, petrol 5 parts and castor oil 4 parts, or Mills fuel and ether equal parts.

Bore .2510in., stroke .402in., weight 410 grains.

R.P.M., 6,000 to 8,000. Weight with fuel and propeller 5oz., height overall $3\frac{3}{4}$in., prop. 11in. diam. Fuel recommended: ether meth 6 parts, petrol 5 parts, heavy mineral oil 4 parts.

The Conquerer 10 c.c. Engine for Racing

Ten-Sixty-Six Products Ltd., 26, Battenhall Road, Worcester, are well known for racing car accessories of all kinds and have produced a racing engine of 10 c.c. which is normally of the spark ignition type but is also provided with glow plug when desired. The shaft is tapered and takes a flywheel for car and boat racing, or an adaptor for aeroplane work. The motor is reminiscent of the leading American design features for racing engines, and has very large porting, two Wellworthy piston rings with a rotary disc inlet valve, the main bearing being ball races.

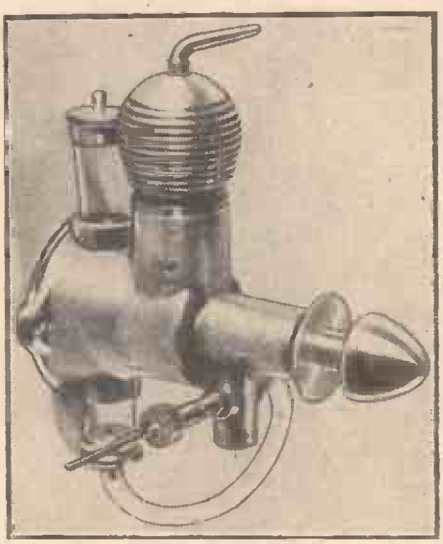


Fig. 27.—The 1.8 c.c. Elfin diesel has a truly outstanding performance most suitable for stunt and speed control line events.

Bore 15/16in., stroke $\frac{7}{8}$in., overall height $4\frac{5}{8}$in. Compression ratio, 13 to 1. Weight $14\frac{1}{4}$oz., fuel 85 per cent. refined methanol, 15 per cent. Castrol R. Claimed r.p.m. when run in, 23,000 running light.

A Home Construction Diesel Set

Model Accessories Supply Co., The Aerodrome, Billington Road, Leighton Buzzard, Beds, produce a set of castings and parts with very full machining and fitting directions and a drawing, for those who enjoy the thrill of making their own engine. The castings and parts which I have before me as I write, appear to be complete and well turned out.

M.E.C. Engines

M.E.C., 33, Cazenove Road, London, E.17, produce a small diesel of 1.2 c.c. weighing only $1\frac{1}{2}$oz. This extremely light little motor can be used to power sailplanes. A 7ft. span sailplane has been flown by one of these engines.

The firm has under development a 2.5 c.c. and a 4 c.c. diesel cum glow-plug engine. Also, a tiny 0.25 c.c. diesel and an 8 c.c. glow-plug and petrol spark ignition engine is on the stocks. A 10in. long pulse jet engine is also under development. The firm will therefore have a very useful range of engines to cater for all types of modellers.

The M.E.C. Mark IV Diesel 1.2 c.c.

Bore .450in., stroke .460in., height $1\frac{7}{8}$in., length $3\frac{3}{8}$in., width $\frac{3}{4}$in., diameter of bulkhead fixing flange $1\frac{1}{4}$in. Power 12oz. thrust. Recommended revs. under load of 8in. to 9in. diam, airscrew with 6in. pitch is 6,000. All engines are made from solid bar materials. The makers claim lightness for this method. Engines are run up light at 16,000 r.p.m. for 15 minutes.

Competition Engines

Mercury Model Aircraft Supplies, Ltd., 308, Holloway Road, London, N.7, have a wide range of engines and supporting accessories for free flight and control-line flying, including the Mercury Cossor radio control set. I consider that radio control is so vital for the future popularity and development of model aircraft and boats that it should be mentioned with this review of model engines. I am trying each of the present British radio sets, namely, the E.D., Mercury Cossor and E.C.C. sets, in models of my own design, and later I hope to be able to give an unbiased description of the practicability of radio control for the average modeller.

Besides this set, Mercury Model Aircraft Supplies are sole suppliers to the trade of three interesting makes of engine which have a particular appeal to the man who wants a really "hot" diesel for competition work. These are the Elfin, the Allbon and the Amco. I have had personal experience of these three engines in the past, and know their very outstanding performance. One may say with justifica-

Fig. 28.—(Left) The new 3.5 c.c. Amco diesel has all the design features for racing performance. Note the radial ring of exhaust ports and the rotary inlet port in the crankshaft.

Fig. 29.—(Right) The Juggernaut has a detachable head of light alloy with a "flutter-valve" at the rear. The latest engine has a variable fuel metering jet which enables thrust to be reduced to 50 per cent. of maximum when desired,

tion that the Elfin has made a great name for itself in the small-sized stunt and speed control-line world. This firm are now producing a larger engine 2.5 c.c. as well, and are following up their little diesel with a really "hot" 3.5 c.c. diesel which is a size badly wanted. It has all the design features of a very high performance engine.

Allbon Diesel Mark II 2.8 c.c.

A competition diesel, having a bore of 9/16in., stroke 11/16in., weight 6oz., height 3$\frac{3}{4}$in., width 2in. An exclusive feature is the main bearing bushes of high duty metal pressed into the end cover. There is adequate space between the bushes for crankshaft lubrication.

Elfin 1.8 c.c. Diesel

Weight 3oz., with rotary crankshaft inlet valve and exhaust ports encircling the cylinder. Radial mounting. 10,000 r.p.m. under load. Propellers, 9in. by 4in. or 8in. by 10in. pitch are suitable according to the task, free flight or control-line, stunt or speed. A free-flight plane of 45in. wingspan, or a control-line plane for stunt work of 150 sq. in. to 200 sq. in. wing area are suitable for competition work for which this engine is specially designed. The Elfin is a particularly fierce little motor capable of doing every stunt in the book when the plane weighs 7oz. to 10oz. A wing area of 50 sq. in. to 70 sq. in. is suitable for an Elfin-powered speed model.

The 2.5 c.c. Elfin Diesel

I have just tested one of the new larger capacity Elfin engines. Those who have experience of the very exceptionally high power output for capacity of the smaller Elfin diesel, which so deeply impressed the control-line world when it first came out, will not be surprised that this new larger engine has all the same high performance attributes with the extra punch of larger capacity.

At first sight the engine looks the same, except that the old and rather ungainly cylindrical fuel tank seen in the illustration of the smaller engine has now gone. This results in a shorter engine. On measuring up the two engines I find the smaller capacity engine has a length of 2 1/16in. from rear of crankcase to propeller backplate, whereas the larger engine is only 2in. The new motor is therefore even more compact. The height is 2$\frac{5}{8}$in. against 2$\frac{1}{2}$in. of the old motor. The bore has been increased, thus making a nearly "square engine," which is the modern tendency for high r.p.m.

One may sum up by saying, we "have something here" in this engine for those who are seeking ultra-high performance from a medium-size diesel. The finish of the engine, besides being neat and compact in outline, is very smooth and pleasant to look at.

Bore 0.555in., stroke 0.620in., weight 3$\frac{1}{2}$oz. approx. Revs. under load, 12,000.

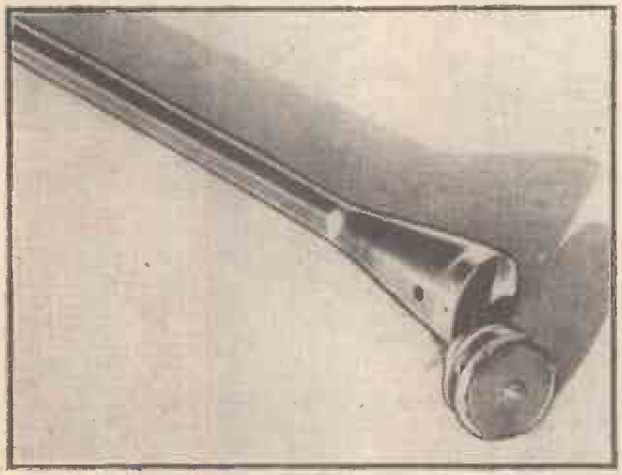


Fig. 30.—The Decojet is noted for its exceptionally easy starting. This is assisted by the long tail pipe. A special feature is the detachable shroud to protect the "flutter-valve" when the engine is being run on a slow model or for long periods at rest. This disc can be seen in the photograph attached to the head, which is shown detached in front of its combustion chamber.

Amco 3.5 c.c. Diesel

Described as "virtually designed on the flying field," this engine has medium capacity, light weight, correct jet positioning for special stunt tank location, beam and radial mounting, no fuel fussiness, and maintains its power output from 9,000 to 13,000 r.p.m. under propeller load. Prop. 10in. diam. by 8in. pitch, bore .6875in., stroke .5626in. weight 3.75oz. Piston with specially developed contour at top, of steel alloy, and heat treated. Three lengths of propeller drivers are available to facilitate realistic cowling according to the length of the model's nose. The engine may be converted to glow plug. A special exhaust manifold is also available for cowled models.

Mercury models also provide a very complete range of fuels, including a very effective etherless diesel fuel, Mercury No. 6, which cuts out the bother of mixing ether with the fuel. Starting is just as good as with an ether fuel so far as my engines are concerned, and I find that not having to close the fuel can top is a great boon, for there is no ether to evaporate.

Fig. 32.—This photograph shows the Jetex motor in its box with a simple clip next to it which is attached to the model and enables the motor to be detached in a moment for re-loading. In the next compartment, and outside the box, can be seen the solid fuel pellets which are placed in the motor's combustion chamber and ignited by one of the wicks seen in the metal container below the box.

Fig. 31.—The Jetex jet motor is a safe, simple method of power, having no torque reaction, for boys' models in the aeroplane field, or for baby car or hydroplane racing. This photograph shows the jet nozzle facing the camera.

Juggernaut Jet Engine

Juggernauts, rear of 113, Leigh Road, Leigh-on-Sea, Essex, introduced the first "flutter-valve" pulse jet engine to appear on the British market. This motor was on the well-tried general lines of the American jet engines. It has recently undergone improvements and the latest model is known as the Juggernaut Red Head jet engine. A new type of fuel injector (variable) has replaced the fixed jet, and the weight has been reduced and the power increased.

Specification

Weight 12$\frac{1}{2}$oz., max. static thrust 4$\frac{3}{4}$lb., magnesium machined head, valve chest machined from duralumin and shrunk into head. Tail pipe, welded heat resistant steel, chromium plated for protection from corrosion. Valve, high-grade Swedish spring steel, hardened and tempered. Frequency of pulsation is 280 to 320 per second. Fuel consumption 2.7lb. per 1lb. thrust/hour. Fuel ordinary car petrol. Starting by hand pump. The variable fuel injector enables thrust to be varied by approximately 50 per cent. max.

Jetex Motors

Wilmot Mansour and Company, Ltd., Salisbury Road, Totton, Hants, introduced a novel form of small jet motor suitable for "rubber sized" model aircraft, little hydroplanes and baby cars. These engines burn a solid fuel which has a constant thrust and which is quite safe for boys to handle. Should excess pressure build up in the combustion chamber due to the jet orifice becoming blocked there is provision for the safety

(*Continued on page 273*)

Our Lathe Competition

J. H. Halford's Design for a 3½in.-centre Lathe which was Awarded Fourth Prize

THE leading dimensions for this lathe are as follow:—

Height of centres, 3½in.; lead screw pitch, 8 T.P.I.; distance between centres, 16in.; headstock mandrel admits, ½in.; height from gap, 5½in.; tailstock barrel admits, ½in.; height from saddle, 1⅞in.; faceplate diameter, 6in.; overall length of lathe, 34½in.

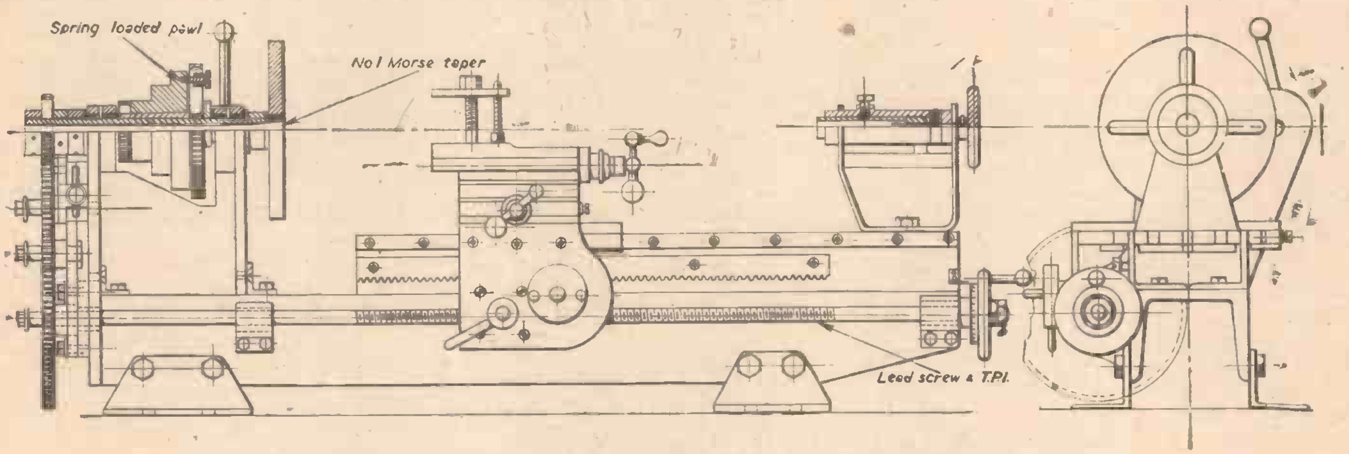
The Saddle

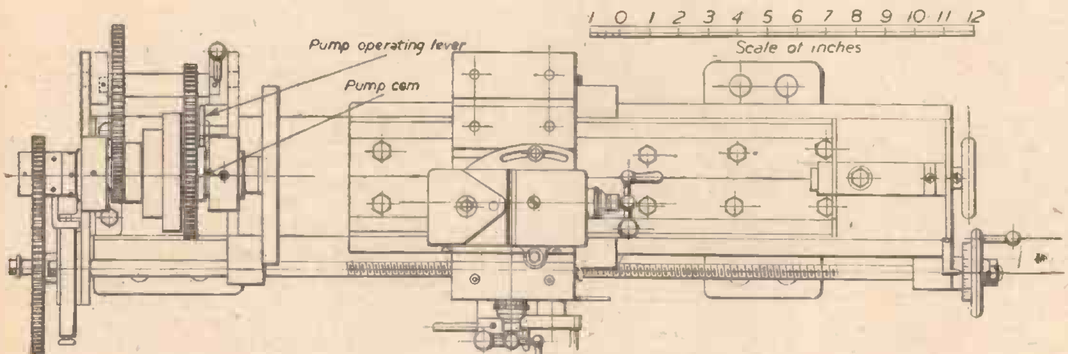
This has square section guides which have proved satisfactory on the machine already produced, adjustment being taken up by means of a gib strip. The nut is of the split type and is actuated by a cam plate operating two pins, one in each half of the clasp nut, the nut halves are held in position by means of a bracket at each end, to which is fitted ¼in. square strips, these run in slots cut in each end of the nut halves, thus preventing any tendency of the nut to tilt.

The Lead Screw

Is of eight threads per inch and is supported by three bearings, thrust being taken by a collar at the gear train end and adjustment by a nut at the handwheel end. The handwheel is graduated in thousandths of an inch.

These are of 20 D.P., a reverse and neutral tumbler is also fitted and both screw cutting gears and back gears, are enclosed by a sheet metal guard.





Side and end elevations and plan of a 3½in. centre screwcutting lathe designed by J. H. Halford. Note the channel-section bed and fabricated construction of the headstock and tailstock.

The Mandrel

This is hollow to allow of a draw spindle collet to be used, it runs in bronze bearings and end play is adjusted by means of two nuts on gear end, drilled to suit a "C" spanner. The three-step pulley and small back gear are mounted on a bronze sleeve which rotates on the mandrel when back gear is engaged.

The Headstock

This is of fabricated construction, the centre web being a light fit into the square cut in the end plates; after assembly these are brazed up. Steel blanks are pinned and brazed to these end plates to carry the bronze bearings. The blank which carries the end lead screw bearing and the change wheel bracket is also held in a likewise manner.

The Bed

This consists of 3in. x 4in. channel to which the headstock is held by three bolts; thus alignment of the headstock can be carried out. The saddle guides are dowelled and held in position on the strips of 2in. angle by means of "Allen Screws," the angle being bolted by 5/16in. bolts to the channel iron bed. The guide strips are scraped in after fitting and checked with a dial indicator.

The Compound Slide

The cross and top slides are of built-up construction and adjustment is made by gib strips. Both slides have adjustable indices, which can quickly be reset to zero, the friction drive for these indices being by means of two spring loaded balls. The top slide can be adjusted to 18° either side of the zero position.

The Tailstock

This like the headstock is of frabricated construction, the barrel and rib being brazed to the end plates and the handwheel and spindle is prevented by end movement by means of the collar held in position by a set screw.

The Coolant Pump

This is of the plunger type actuated by a cam on the mandrel and connected by a right angle lever whose pivot is fixed to the front headstock plate, the pump is fitted to a bracket bolted to the bed and draws the coolant through a gauze, from a sump let into the chip tray.

Book Received

Modern Motor-cycle Maintenance. By Bernal Osborne. Published by Temple Press Ltd. 210 pages. Price 5s. net.

THIS handy book, written by a well-known *Motor Cycling* staff writer, explains to the motor-cyclist all he wants to know about the job of maintaining his machine in top-notch condition. Such subjects as Setting up a Workshop; the Use of Cutting Tools; Preparing for an Overhaul; Concerning the Crankcase; Brakes, Rims and Tyres, and Dynamo Overhaul, are fully dealt with. At the end of the book there are several pages of useful data, including specifications of several well-known makes of motor-cycle. Line drawings and "exploded" engine illustrations give added interest to this practical work.

The Elements of Mechanics and Mechanisms—31

Gear Tooth-forms (contd.)

THE angles P and Q are the "pitch angles" of the bevel gears. More precisely they should be called the "pitch angles of engagement" of the gears. The pitch angles

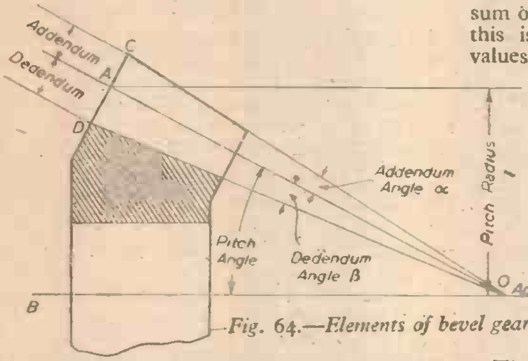


Fig. 64.—Elements of bevel gears.

of generation are usually, but not essentially, the same as the pitch angles of engagement.

Pitch of Bevel Gears

As the elements of a bevel gear tooth taper towards the apex, the teeth cannot strictly be said to have any particular pitch, addendum or depth. When any of these dimensions is mentioned without qualification, it is taken to refer to the outer end of the teeth, that is, where the dimensions are largest.

The distance measured along the pitch cone to the outer limit of face width is called the "cone distance." If the numbers of teeth in the gears are T and t, the cone distance is C and the shaft angle S, then the pitch is given by:

$$p=\frac{2\pi C\sin S}{\sqrt{(T^2+t^2+2\,Tt\cos S)}}$$

If S=90°, this becomes

$$p=\frac{2\pi C}{\sqrt{(T^2+t^2)}}$$

Virtual Number of Teeth

In Fig. 60, the virtual radius AD of the pinion is greater than the actual radius, AF in the ratio of sec $\hat{AOD}$ to 1. From this it can be shown that:

Virtual number of teeth in pinion:

$$\frac{\sqrt{(T^2+t^2+2Tt\cos S)}}{\frac{T}{t}+\cos S}$$

If S=90° this reduces to $t\sqrt{(1+\left(\frac{T}{t}\right)^2)}$

Similarly the virtual number of teeth in wheel is:

$$\frac{\sqrt{(T^2+t^2+2Tt\cos S)}}{\frac{t}{T}+\cos S}$$

and when S=90°, this reduces to

$$T\sqrt{\left[1+\left(\frac{T}{t}\right)^2\right]}$$

On the British Standard system, addenda of bevel gear teeth are determined by the formulae used for spur and helical gear teeth except that the virtual number of teeth (tv and Tv) are used instead of the actual numbers.

Thus Addendum of pinion:

$$a=\frac{p}{\pi}(1.4-0.4\frac{tv}{Tv})$$

Thus Addendum of wheel:

$$A=\frac{p}{\pi}\left[(0.6+0.4\frac{tv}{Tv})\right]$$

The working depth is always equal to the sum of the addenda of wheel and pinion, and this is always $2p/\pi=0.6366p$ whatever the values of t and T.

In every case the dedendum is equal to 0.7162p minus the addendum.

From Fig. 64, it will be seen that the addendum angle is given by:

$$\tan\alpha=\frac{CA}{AO}=\frac{\text{Addendum}}{\text{Cone distance}}$$

and the dedendum angle B is given by:

$$\tan\beta=\frac{DA}{AO}=\frac{\text{Dedendum}}{\text{Cone distance}}$$

The face angle BOC is equal to the sum of the pitch angle and the addendum angle. The root angle $\hat{BOD}$ is the pitch angle minus the dedendum angle.

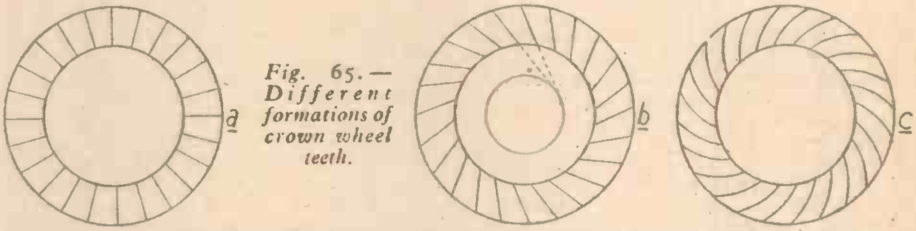


Fig. 65.—Different formations of crown wheel teeth.

The dimensions of the tooth of the basic crown wheel are determined from the pitch in the same way as those of the basic rack tooth form for spur and helical gears are determined from the pitch.

The tooth form of the gear in the plane DAC may be determined from the basic crown wheel tooth form by the method of "rolling" as already described for spur and helical gears using, however, the virtual number of teeth and not the actual number when fixing the size of the rolling circle.

Spiral Bevel Gear Teeth

In the simplest crown wheel, the tooth flanks cut the pitch plane in straight lines, which all pass through the centre of the plane (see Fig. 65a). This is not essential, however, for the lines may be tangents to a circle (see Fig. 65b), when the crown wheel is the "helical bevel" type; furthermore, it is not essential that the lines should be straight.

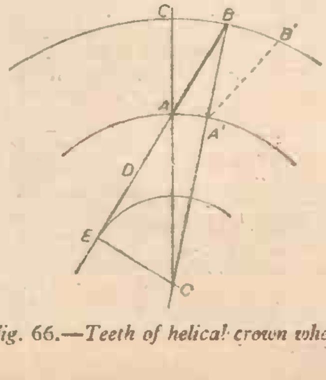


Fig. 66.—Teeth of helical crown wheel.

They may be arcs of circles (see Fig. 65c), as is the case in the Gleason spiral bevel gear. There is no theoretical reason why the curves should be circular arcs, in preference to any other curve, but the circle is the easiest to produce.

Although from the theoretical standpoint the terms "helical bevel" and "spiral bevel" might equally well be applied to either of the tooth forms, shown in Figs. 65b and 65c, in the following the former will be referred to as the "helical bevel tooth" and the latter as a "spiral bevel tooth."

In considering the angles of helical bevel and spiral bevel gears, it is simpler to think of the imaginary crown wheel rather than of the gears themselves. This is because at any specified radius the crown wheel has the same spiral angle and pressure angle at all points in its depth, whereas the tooth of any other spiral bevel gear has different spiral angles and pressure angles at different depths. So far as pressure angle is concerned, this comparison corresponds to that which can be made between a helical rack and a helical pinion.

The crown wheel, is, however, less simple than the rack, because the spiral angle at any point usually varies with the distance of the point from the centre line of gear.

(A spiral bevel gear might be made with the same spiral angle at all points in its face width, but there would be considerable practical difficulties and no practical advantage.)

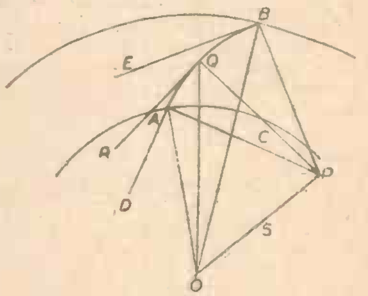


Fig. 67.—Teeth of spiral crown wheel.

Helical Bevel Teeth

For example, Fig. 66 shows a helical bevel tooth of a crown wheel. The spiral angle at A is the angle OAD and the spiral angle at B is OBD. Euclidean geometry shows that:

$$\hat{OAD}=\hat{OBD}+\hat{AOB}$$

so that the difference between the spiral angles at A and B is the angle AOB.

If the gear is designed so as just to give "overlap" the next tooth is A′ B′ and the angle AOB is, therefore, the angle between adjacent teeth, that is, 360 degrees divided by the number of the teeth in the gear. The quickest way to determine the spiral angle on this basis is to draw arcs of the circles representing the inner and outer limits of the face width of the crown wheel, as in Fig. 66, to draw two radii separated by the angle corresponding to the pitch, and to draw a straight line (AB in Fig. 66) from the outer end of one radius to the inner end of the other. The line OE is drawn perpendicular to BA (extended) and OE is then the radius of the circle to which all tooth spirals are tangential.

The spiral angle σ at any point distant r from the centre may be calculated from the fact that—

$$\sin \sigma = \frac{OE}{r}$$

Gleason (Circular Arc) Spiral Bevel Gear Tooth

In the Gleason spiral bevel gear, the crown wheel tooth is in the form of a circular arc struck from a centre P (Fig. 67). The radius of the arc corresponds to that of a 'standard cutter,' and the position of P is selected so as just to give "overlap." This again is a process which is more conveniently effected graphically than by calculation.

A spiral angle OBE at B is greater than the spiral angle OAD at A. Owing to the curvature of the tooth the difference is greater than in the case of a helical bevel tooth (Fig. 66). The spiral angle OQR at any point Q distant r from O is determined from the triangle OPQ. In this:

$$\cos O\hat{Q}P = \frac{OQ^2+QP^2-OP^2}{2OQ\ QP}$$

QP is the radius of the cutter. Let it be denoted by c. OP is the distance of the centre of the cutter from the centre of the crown wheel. Let it be denoted by s.

Then $\cos O\hat{Q}P = \frac{r^2+c^2-s^2}{2\ rc}$

Also $O\hat{Q}R = 90\ \text{deg.} - O\hat{Q}P$.

Therefore, $\sin \sigma = \cos O\hat{Q}P = \frac{r^2+c^2-s^2}{2\ rc}$

Determination of Helical Bevel or Spiral Bevel Gear Tooth Form

Let it be required to determine the form of a bevel gear tooth in any plane perpendicular to the pitch cone such as, for example, the plane represented by AB in Fig. 68.

It is first of all necessary to know the normal tooth form of the generating cutter which corresponds to the basis crown wheel. At such a section as AB only part of the depth of this cutter is used. This is the length CD=h between tip cone and root cone of the gear, measured upwards from the tip of the cutter.

In Fig. 69 AB represents the profile of the normal section of one flank of the crown wheel tooth. The form CD represents the section of the same flank in the plane AB (Fig. 68). In Fig. 69 form CD is derived from AB by dividing the height h into any convenient number of parts (say 10) and drawing horizontal lines at that spacing. From any convenient vertical line CF a length is marked off on each horizontal line equal to the corresponding distance of AB from AE multiplied by the secant of the spiral angle at the plane AB (Fig. 68). For example, on the third line from the top $P^1 Q^1$ is made equal to PQ sec σ where σ is the spiral angle. The formulae for the spiral angles of helical bevel and spiral bevel gears have already been given.

If any part of the profile AB is straight it needs only two horizontal lines to define the corresponding part of CD. It is only for curved parts of the profile that more than two lines are required.

Now the position of the profile of the next tooth in relation to CD is determined by the pitch of the teeth on the circle represented by E in Fig. 68. The radius of this circle is EF, and therefore the pitch—

$$p = \frac{6.283 \times EF}{\text{Number of teeth in gear}}$$

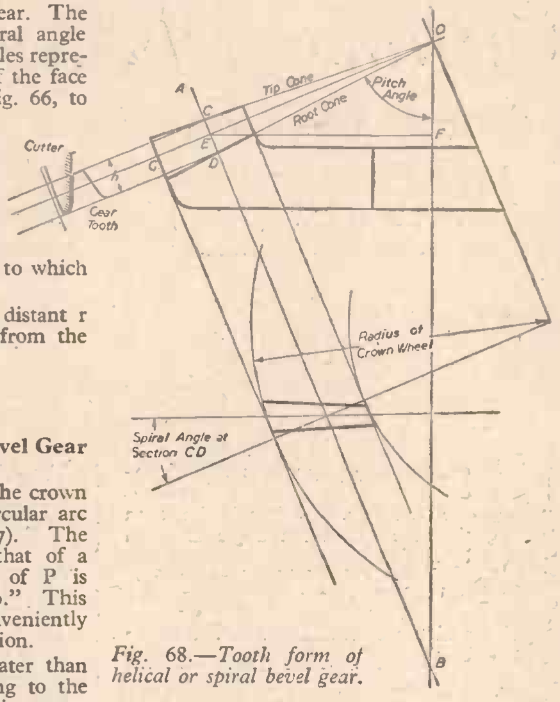


Fig. 68.—Tooth form of helical or spiral bevel gear.

In Fig. 69, therefore, the point D^1 is marked on the top line at a distance p from D and the profile D^1C^1 is made exactly like DC.

The position of the other flank C^1G^1 in relation to C^1D^1 depends on the nature of the cutter. If it has two blades (or two series of blades) not fixed to each other, the distance between the flanks C^1D^1 and C^1G^1 diminishes as the centre of the crown wheel is approached. If, on the other hand, one blade (or a pair of blades fixed in relation to each other) finishes both flanks at once, the distance between the flanks remains constant. (This is usual in cutting spiral bevel wheels by the Gleason process.)

In the former case GD^1 is equal to (Space width at tip of normal section of—

$$\text{tooth at large end}) \times \frac{OE}{OG}$$

from Fig. 68.

In the latter case GD^1 is equal to the space width of the fixed normal section of the crown wheel tooth form at a distance h above the root.

Thus the crown wheel tooth form is obtained and the height of its pitch line above the root is b, which is equal to ED in Fig. 68.

The bevel tooth form corresponding to this in the plane represented by AB in Fig. 68, is derived by the "rolling" method already described. The radius of the virtual pitch circle is EB, which is OE multiplied by the tangent of the pitch angle GOB.

If the effective part of the crown wheel tooth form is straight, the generated gear tooth form will, of course, be involute. From what has previously been said, it will be understood that the simple "rolling" method is only an approximation; the error involved is, however, very slight.

The effective part of the profile of the mating gear on the corresponding section is derived from the crown wheel tooth form (Fig. 69) by rolling its "counterpart" on a circle whose radius is the virtual radius of the mating gear on the section concerned. For this purpose the "counterpart" may be taken as the same tooth form inverted. In other words, the rolling motion is carried out with the centre of the rolling circle on the same side of the crown wheel pitch line DGD^1.

It may be mentioned here that to effect that result in practice the two sets of tooth flanks of the mating gear have to be cut with separate settings of the machine.

It is rare in practice that it is found necessary to draw the tooth form of spiral bevel gears. A standard generating cutter form corresponding to the basic crown wheel tooth form is used, and this is almost invariably straight-sided except for the root fillet.

The Gleason Process

The teeth of the wheel are completely generated in a straightforward manner, and by the Gleason process both tooth flanks are finish generated at the same time. The two sets of tooth flanks of the pinion have, however, to be cut separately, this being necessary because the tooth form of a spiral bevel crown wheel cannot be symmetrical about its pitch line at all points across the facewidth. The reason is that whilst the cutter tooth thickness at the pitch line of the normal section remains constant, the pitch of the teeth diminishes as the centre of the gear is approached. Consequently the space width may be less than half the pitch at the large end of the tooth and greater than half the pitch at the smaller end of the tooth. This difficulty does not arise in the case of spur or helical gears, and consequently in those cases the same cutter can be used to generate the teeth of both pinion and wheel without difficulty.

In the case of spiral bevel gears, the exact settings of the machine to produce a pinion tooth form which meshes satisfactorily with the gear wheel has to be determined by trial, the test for correct contact being the distribution of contact marking on the pinion after being run with the wheel whose teeth have been lightly coated with red lead or other "marking" substance.

Even when this has been done to the very best advantage, it is impossible to obtain a contact marking spreading over the whole face-width of the teeth of Gleason spiral bevel gears, unless specially dimensioned cutters are used for pinion and wheel.

When the same cutter is used for both, as is the common practice, the concave flanks of the teeth of one gear are cut by the outermost edges of the cutter blades, whilst the convex flanks of the teeth on the mating gear are cut by the innermost edges of the cutter blades. The radius of curvature of the former flanks is, therefore, greater than that of the latter, and so full contact across the whole face-width is impossible.

(To be continued)

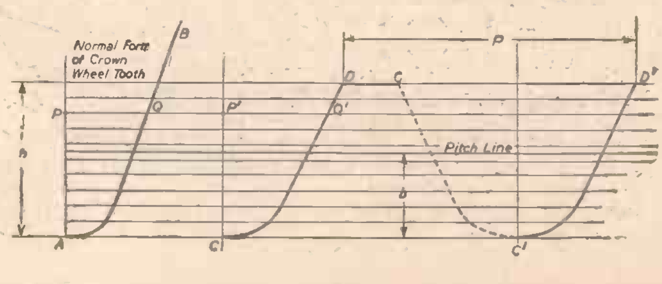


Fig. 69.—Determination of oblique section of crown wheel tooth form from normal section.

Natural Colour Photography

Particulars of a New and Simple Process, and a New Camera Technique

By THE MARQUIS OF DONEGALL

DURING the latter part of the 19th century our pioneers were struggling with the problem of producing photographs in natural colours.

Varying degrees of success were achieved and, to-day, anyone who goes to the cinema can enjoy the results of their years of labour and heartbreak in a disbelieving world.

Those who can afford it can also obtain from the photographer a real colour photograph of the family or, from the local chemist, they can buy a colour transparency film for the camera, take snaps and have the film processed to give a colour rendering of the pictures which is very lifelike.

If you have the good fortune to possess your own cine-camera and home projector there is the additional joy of seeing your moving pictures projected in colour.

But the processing by the makers of the films is still a costly business, as only trained craftsmen can bring to a successful conclusion the result of our exposures. They require the same expert handling as do the shots of the film studios, or the colour portrait taken by the local photographer.

The accumulation of results obtained by these years of intense research have given us to-day all these good things in colour photography: everything in fact except a simple way for the amateur to take his pictures and get colour prints back from the developing house, instead of the usual black-and-white ones.

Obviously, it would be nice to have a simple method by which we could give a projector show of colour pictures of a holiday, of the method in which we produce our goods or, indeed, for a surgeon, showing how he performs a particular operation!

Even more ambitious, a simple way of producing at once the cinema newsreel or feature pictures in true natural colours at little more than the cost of the black-and-white film.

The New Process

What I believe to be a new process is designed to give three colour-separated negatives on one plane and in one shot and, from a black-and-white positive, to project directly into natural colours.

It covers almost every phase of photography, in that it can be used for ordinary studio work where colour-work is practised; for Press photography, because of the simplicity of producing immediate negatives for colour-printing blocks, and also for the amateur for colour-snaps in countries where a triple-coated emulsion paper is produced such as in America and Canada. This will eventually come, of course, also in this country.

No expert registration of the three separated negatives is necessary—the three images automatically merge into one picture.

The process is really additive, whereby a red filter is used to pass red and any part of a colour made up thereof.

Blue to admit all blues in the same way and green to follow the same course.

But, generally speaking, the procedure hitherto adopted has been that the same filters should be used to project the colour obtained.

With this process the projecting filters are different. Blue is used where green was used for taking, yellow through the blue taking filter and red through its own receiver, and, from this combination of projecting filters, real greens, whites, blacks, etc., are obtained—hence the description of the process as "Natural Colour Photography."

No dyes are used at any time.

System of Filters

The reason for this result is that, instead of relying on the taking filters only to obtain the final result, a further system of filters is brought into use; these are arranged in the fashion of a "lens hood," and they have the effect of throwing a non-receptive colour upon the facets of the "beam-splitting unit" in such a way that, instead of a shadow being caused as would be the case with an opaque hood, no obscurity on the viewing screen occurs, or, of course, upon the negative. The general effect is that the main receiving filters really are changed in value.

Colour Prints by Return

It can be more simply put by the following example, thus:

If you have two receiving facets placed at an angle of 45 degrees to each other, you can, by having the forward facing facet in line with the objective, throw the actual image as far to the left or right as you wish, but although the forward facing facet receives a frontal view, it nevertheless collects light from the left and right in the same way that an ordinary lens would do: but more so because of its angle, and so, if you shade this unwanted light with a colour, such as red, which is reflected upon the receiving facet, and the facet is intended to pass an image through a green filter, then, of course, the image is accordingly recorded, correctly colour-separated, without the red reflection being transmitted; thus you have full lighting without interference, although, of course, this additional flush of colour reflection has really changed the colour value of the resultant negative.

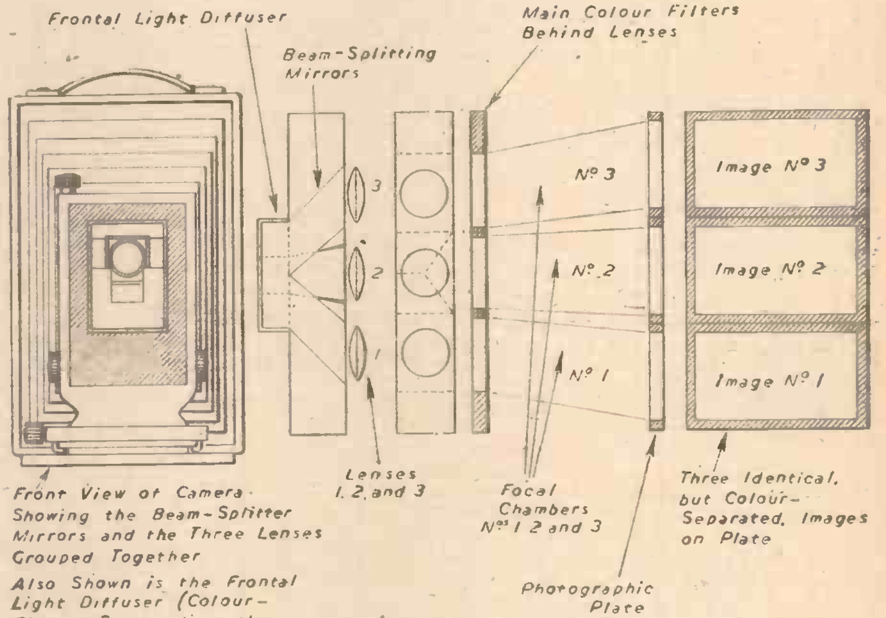
The cost and method of processing is the same as for ordinary black-and-white photography, inasmuch as three proportionately smaller images appear instead of one image, on the same-sized plate or film.

No special study is needed for making exposures; such factors as filters, lighting, etc. The amateur should take it in his stride, the process being very simple in ease and speed of operation, and the colours produced are very faithful to life.

New Type of Camera

Although referred to as a "process," the results are really obtained by a new type of camera, very simple in construction, yet smoothing out difficulties previously encountered in presenting an all-purpose colour-producing camera to the public.

The same camera can also be used with minor modifications as a projector and, as such, will project, in colour, the resultant pictures taken.



Details of the camera, mirrors and colour filters for natural colour photography.

The inventors seem to have found a method of creating a beam-splitting optical system for separating the light reflected from the object to be photographed into two or more paths, each containing appropriate colour-separating filters, as indicated in the accompanying illustration. Each path of light is directed, through filter and lens, to its own place on the plate or film, producing three separate negatives in one, each being correctly colour-balanced of the one image.

Thus, by contact-printing a positive from the triple-negative thereby obtained, and placing the positive in the projector with the three complementary colour filters between the light and the positive, the picture is thrown on the screen in its natural colours.

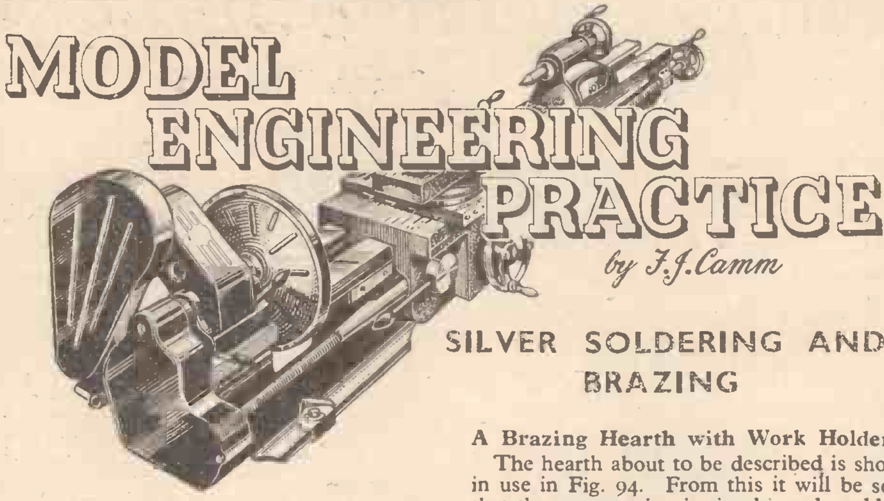
Remembering that three images project automatically into the one picture, it will be easily seen that an ordinary black-and-white bromide print may also be produced.

To achieve these results, the inventors spent 20 years on research work and, naturally, considerable sums of money. But for the war years, the work has been carried on almost without a break.

11th Article of a New Series

MODEL ENGINEERING PRACTICE

by F. J. Camm



SILVER SOLDERING AND BRAZING

THE process of silver soldering is employed in cases where soft soldering would be unsatisfactory on account of the joint having to be subjected to great heat in use, or being insufficiently strong for the purpose. As with a sweated joint the parts are joined by a film of soft solder, so in silver, or hard, soldering they are joined with an alloy containing silver. The chief difference in the operation, however, is that while one is carried out at a temperature of about 400 deg. F., which varies, of course, according to the tin content in the solder, the other requires a red heat.

Heating the Work

For this reason, some means of heating the work to a corresponding temperature is necessary. A gas blowpipe and bellows are the most convenient heating agency, although for small work a self-blowing or Bunsen type of gas blowpipe is suitable. Failing gas, a good paraffin blowlamp will do the job. With certain classes of work these may be dispensed with, but such conditions will be dealt with later on. With most jobs it is necessary, in order to obtain sufficient heat, to lay the work on a bed of coke, more particularly so for brazing. The following details are given for making a small hearth for this purpose.

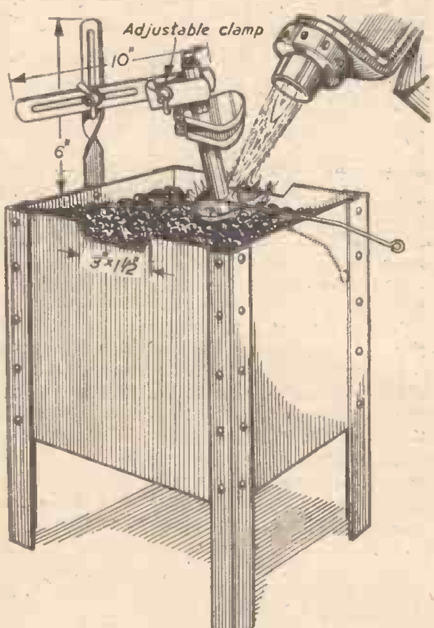


Fig. 94.—The finished brazing hearth in use.

A Brazing Hearth with Work Holder

The hearth about to be described is shown in use in Fig. 94. From this it will be seen that the construction is simple and could be carried out in a few hours. Provision in the form of an adjustable clamp attached to one side has been made for holding small or awkward work.

The sheet-metal box is 9in. square by 8in. deep. These proportions may seem unusual, but the extra depth is to allow for longish jobs that have to be worked upon at the ends. As an example, to silver solder an end cap into a boiler, the job must be stood on end, and to obtain and conserve the necessary heat it is surrounded by coke. Thus, it is more certain to build and retain the coke round the job than doing the same job by heaping the coke round it on a shallow hearth.

Mark out and cut the sides and bottom from 18 s.w.g. sheet iron. These are cut in

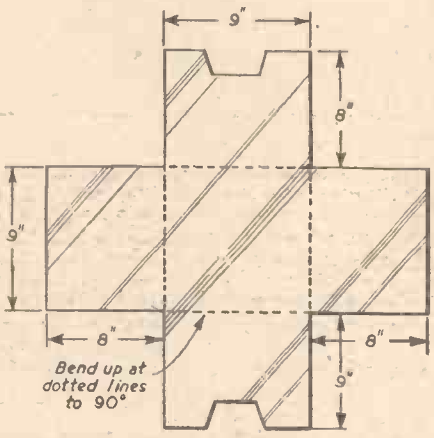


Fig. 95.—Details of the sides and bottom of the hearth.

one piece, dimensions being given in Fig. 95; the 3in. by 1½in. sections cut out on the opposite sides are to allow long rods or tubing to lie in the coke when necessary. The four sides are bent up at right angles. Angle iron, 1in. by 1in. by ⅛in. section, is used to join the corners and also to form short legs. These pieces are 12in. in length, and are riveted or bolted on. Black mild steel, 1in. by ¼in. section, is the material for the clamping arrangement. The vertical slotted bar is attached to the sheet metal with a bolt and wing nut on the outside so that it may be quickly removed at any time. A ¼in. cup-head coach bolt and wing nut through the slotted portions form the means of adjusting the work-holding bar. On the end of this a simple clamp is formed by bending the end of a short piece of the flat material to form a heel. This has a square hole in the centre to suit a ¼in. coach bolt, and a round hole is drilled to correspond in the end of the bar. The bolt is then fitted with a wing nut and washer. After filling the box with small clean "nut coke," the hearth is ready for use. Should the coke be dirty—clogged with dust—riddle in a sieve, cleanse in a bucket of water, and allow to drain well before using. For small jobs asbestos blocks sold by weight are sometimes used. Where such are employed it is not a bad plan to make a small shallow tray from sheet iron, provided with clips to hook over the sides of the hearth. This can then be lifted off when the full depth of the hearth has to be utilised.

Preparation of Work

All parts to be silver soldered or brazed must be thoroughly cleaned by scratch brushing (forged parts by filing) to remove any scale such as is likely to be present on the surface of blank-finished steel. The surfaces to be joined should be neatly fitted, and cylindrical parts are made a good sliding fit into respective holes. Driving fits may prevent the solder from penetrating as desired, whereas a sloppy one allows it to run through without filling. Before assembling

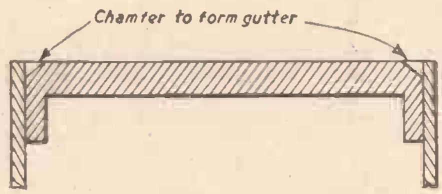


Fig. 96.—By slightly chamfering the end cap of a boiler the silver solder, when melted, will flow where it is wanted.

paint the surfaces with flux made up to a creamy paste with water. This may be either borax or boracic powder or one of the special brazing fluxes such as "Boron." After assembling, the parts, where practicable, are drilled and pinned, treating the pins with flux before inserting. Where the nature of the work prohibits pinning, iron wire is used for binding. Tinned or galvanised wire must not be employed for the purpose.

With certain jobs, such as the boiler end shown in Fig. 96, a gutter formed by slightly chamfering the end cap ensures that the silver solder when melted will flow where it is wanted.

The Choice of Brazing Wire

For general use on small work, silver solder is obtainable in sheet and wire form. This is suitable for all articles likely to be handled by the reader, of steel, brass, bronze or gun-metal. Silver solder is an alloy, and contains copper, zinc and silver in proportions governed by the required melting-point. The correct grade for most model engineering requirements is supplied by dealers in model-making requisites.

On larger work, brazing wire composed of copper and zinc is more economical. The most common grade, containing roughly two-thirds copper, is used for steel work. For brass articles it is natural that the wire must have a lower melting-point than the job, and thus a special brazing material is called for. In this the copper content is about one-third; owing to its brittle nature, the material is supplied in short strips cut from sheet.

Brazing

Having prepared the work, lay it on the hearth, holding in the clamp if necessary, and build the coke round it, but leaving the portion that it is intended to work upon exposed. Play the flame on to the exposed portion until the part attains the desired heat—a very dull red for brass or bright red for steel—

and apply the brazing medium. For the sake of economy silver solder is cut into small pieces and applied with fine tongs, but, whatever the medium employed, avoid applying a surplus, so as to reduce the work entailed in cleaning up. Should the metal be disinclined to flow, that is, remain in a small lump or ball, heat the end of a piece of ¼in. iron wire, flattened as shown in Fig. 97, and dip into dry flux. Place this on the work and lightly scrape the surface with it, and, as the flux dissolves, so will the metal flow where required. If the work has been properly prepared and heated, inspection after allowing to cool should reveal perfect penetration of the brazing.

Fig. 97.—The spatula for aiding the flow of silver solder.

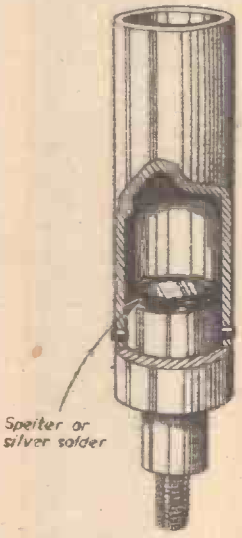


Fig. 98.—Another method of hard soldering.

Cleaning Up

Owing to the nature of the process, a certain amount of cleaning up is necessary. When cool the flux sets hard like glass, and can be cleanly removed by chipping with the edge of a file, when any surplus silver solder or brass is neatly filed off. This scale is readily removable from small or delicate articles by immersion in an acid and pickling bath.

Other Methods of Brazing

As stated previously, there are other methods of brazing which may be employed for work such as is shown in Fig. 98. This is prepared as previously stated, and granulated brass (spelter) and a little dry flux are placed inside the tube. An end is then placed inside the tube, and inserted upright in a fire or forge until the brass melts.

Small articles can be brazed by covering round the joints with clay or fire cement, leaving an exposed portion at the top surrounded by the clay to form a cup. Granulated brass is put into the cup or cups and heated by placing in a forge in a short length of steam barrel laid horizontally in the fire. The whole job is then heated uniformly, the brass running into the joints. Several joints may be made at once by this method. Owing to the difficulty of controlling the heat with an open fire, these methods, without exception, should be adopted for steel work only.

Soldering Aluminium

Success in soldering aluminium depends on the effective removal from the metal of the microscopically thin film of oxide always present on the surface. When measures are taken to deal with this film, the main difficulty of soldering is removed. Three different types of soldering are employed, which may be distinguished by the terms hard soldering, soft soldering and reaction soldering.

Hard Soldering

In this process the solder consists of an alloy of aluminium having a melting point between 500 deg. and 600 deg. C. Many such alloys exist, but the silicon alloy, containing 10 to 13 per cent. of silicon, is undoubtedly the best. The oxide is removed by means of alkaline halide flux, such as is used for aluminium welding. At the temperature at which the soldering is carried out, the flux is melted and rapidly attacks the oxide, permitting the melted solder to come into contact with clean aluminium and to alloy with the surface. In carrying out the process, a gas blowpipe is used as heating medium, but, apart from this and the higher temperature required, the process does not differ from the ordinary soldering of brass. The flux is melted up and flows readily, sweating the parts together. Certain manufacturers supply silicon-alloy solder in the form of a tube, with flux contained inside.

Hard soldering with a silicon-alloy solder is thoroughly to be recommended as regards the ease of application, strength and permanence. Unlike soft soldering, the joint is capable of withstanding the action of boiling water or steam without protection.

Soft Soldering

In this process the solder melts at a comparatively low temperature, and it is this type of work which has given rise to the widespread view that aluminium is difficult to solder. The reason is that no satisfactory flux is available which will attack the oxide at the low temperature of working, so that the oxide must be removed by mechanical means. After a preliminary cleaning, the metal is heated until the solder melts upon it. The molten solder will not adhere, but it can be made to do so by scraping through it with an old hacksaw blade or other form of scraper to break up the oxide film. Once the film is broken the oxide cannot re-form under the solder, and alloying takes place. When the surface is fairly well covered with molten solder the adhesion is improved by rubbing with a wire scratch brush while the solder is still molten, thus breaking up the remaining traces of oxide. After such "tinning," the parts can be re-sweated together in the ordinary way. Fluxes are sometimes supplied with these solders, but these consist largely of stearin or resin, and are of little assistance. The composition of the solders is not of great importance. They usually consist of zinc and tin with or without small additions of other ingredients.

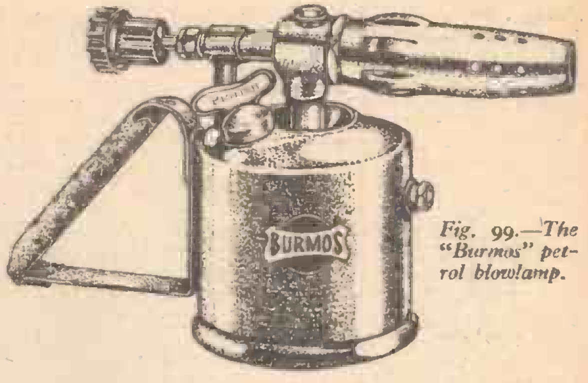


Fig. 99.—The "Burmos" petrol blowlamp.

Reaction Soldering

This is a newly developed process which is particularly interesting. The solder is a chemical mixture, which is spread on the parts to be joined and heated by a blowpipe to about 200 deg. C. A chemical reaction takes place, which results in the deposition of pure zinc in a molten condition of the aluminium surfaces to be joined. The zinc flows readily between the edges, and alloys readily with the aluminium, forming an excellent joint. Such joints are much more permanent than joints made by the ordinary soft-soldering process.

(To be continued)

Items of Interest

Newnes' Motorists' Touring Maps and Gazetteer

THIS book specially produced for the motorist has now been revised. It comprises 96 skilfully coloured maps covering the whole of the British Isles. Every road classified by the Ministry of Transport is clearly shown. Every main road is marked with its signpost number. It also shows the railways, level crossings, stations, churches, contours, etc.

The scale is 4 miles to the inch, except in the outlying parts of Scotland, where the scale is smaller.

In addition to the 96 road maps, this handy size edition contains a gazetteer index to places—64 additional pages giving place-name, county, mileage from nearest big centre, population, and map reference so that the place, whether it be city, town, hamlet or even railway station, may be found in an instant.

The book costs 17s. 6d., and is obtainable from George Newnes, Ltd., Tower House, Southampton Street, Strand, W.C.2.

New Domestic Electrical Appliances

A NEW and attractive hair-dryer has been produced by the General Electric Company. Air flow is axial throughout, the inlet being directly above the switch and well away from the outlet so that there is no danger of long hair being drawn into the fan. The casing is of cream-coloured plastic. Great care has been taken in perfecting the insulation. A stand enables the user to place the dryer on a table and thus have both hands free to manipulate the hair.

A new domestic water heater of the circulator type makes small quantities of hot water available very soon after switching on. Withdrawable cartridge-type elements are used with the thermostatic control.

Model Internal Combustion Engines—

(Continued from page 267)

escape of gas due to spring retention of the filler top. Recently a very small and cheaper model of these engines has been introduced, which enables tiny models to be jet propelled. This is known as the Jetex 50. There are three other sizes in the range, details of which are given below. A tiny hydroplane about 7in. long, a small aeroplane 18in. span, and a very modern-looking racing car of minute proportions were shown at the B.I.F. exhibition last year.

Range of Jetex Motors

No. 1.—Jetex 50. Suitable for aeroplane models up to 20in. span.

No. 2.—Jetex 100. Weight 10 drams, plus ¼oz. for charge. Length 2¼in. Thrust 1oz.

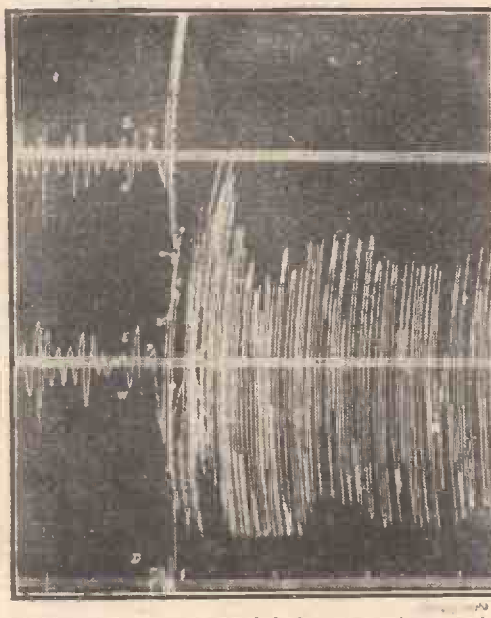
No. 3.—Jetex 200. Weight 18 drams, plus ¼oz. for charge. Length 2⅞in. Thrust 2oz. Duration 20 to 40 seconds.

No. 4.—Jetex 350. Weight 2½oz., plus 1oz. for charge. Length 4½in. Thrust 3oz. to 4oz.

Enigma of the Earth's Interior

Modern Conjectures on this Fascinating Subject

By J. F. STIRLING



Earthquake waves recorded by the seismograph. By their speed of travel it is possible to estimate the condition of the world's inner regions through which they pass.

IT is unlikely in these modern times that you will ever become a multi-millionaire, but should you at some future period prove yourself to be a prodigy of fortune in this respect, one of the many excellent scientific purposes to which you could put a portion of your wealth would be that of organising the digging of a hole in the ground. Not an ordinary hole, of course; not even a complete coal-mine. The hole in this case must be at least twenty miles deep, and it would be much better if, whilst you are interested in the job, you could make it a round thirty or even forty miles deep.

The project is not altogether an impossible one in spite of the fact that the deepest hole made so far does not reach even three miles downwards. You would get ample excitement and interest for your money, and although you would be unlikely to hit upon anything startling in the way of rare minerals and precious metals, you would stand a good chance of making an artificial volcano and changing the face of the surrounding countryside.

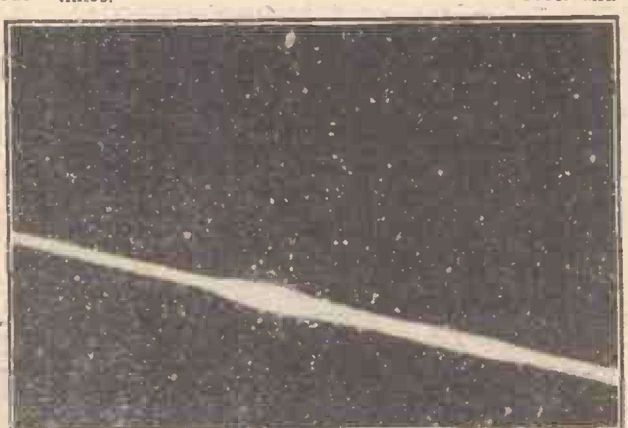
From the earliest times, interested and thinking people have speculated on what may possibly exist deep down in the earth, hundreds and even thousands of miles below our feet, our country lanes and city pavements. Curiously enough, the early philosophers all came to the conclusion, although without a scrap of evidence, that the earth's central regions are terrifically hot. Some, indeed, more practically minded perhaps than others, found the earth's centre a convenient spot for the physical location of Hades, the abode of evil spirits and for the world of physical darkness and perpetual gloom. Others, however, averred that the earth is solid through and through, that deep down there is gold in abundance and that, in reality, far from being a region of problematical evil, the earth's interior presents a veritable mine of wealth for the individual who is first able to rifle its treasures. Well, there are good folks who hold all these opinions still. There are people who, relying on the evidence of volcanic action, picture the region miles below our feet as being one of perpetual lurid sulphurous flame in which nothing is substantial and which is patiently awaiting its opportunity to break out of its age-old prison and to consume the world and everything on it.

It is all very well to dub all theories of the earth's centre fantastic, particularly when the holders of them are able to point to some shred of evidence, however slender it may be, because amid a welter of speculation on this subject very little of a definite character is known.

What Science Says

Modern science has approached the whole question from many different angles, as a result of which present-day conjectures, unlike those of a former age, are, at the least, well-reasoned ones, and ones which, in many instances, are directly based on experimentally established facts.

The earth, as we all had drummed into us during our schooldays, is not a sphere. It is orange-shaped, with a bulging equator and flattened poles. In round figures the distance via the earth's centre from pole to pole is a matter of 7,900 miles, so that the earth's radius, that is the distance from any sea-level point on the surface of our globe to its centre, will be one-half of the diameter, that is 3,950 miles approximately. Let us, however, be content with saying that a vertical shaft drilled from the earth's surface to its centre would have to traverse a distance of 4,000 miles.



The trail of a "shooting star" photographically recorded. It is by the chemical study of such meteorites that definite conclusions regarding the earth's inner regions have been formulated.

High mountains are probably like teeth. They have roots, or fangs, which penetrate deep into the sub-layer of the earth's surface.

The earth has a crust, and on this crust is laid a carpet. It is not a particularly good carpet, for it is full of holes in places, and, owing to its age, it has gathered a lot of dust and debris. Indeed, it has become mouldy with damp, and, among the mould growths there have come into being strange species of mites, four-legged ones and two-legged creatures, the latter being the most formidable and interesting of all in consequence of their being endowed with the transcendental power of reasoning. Well, therefore, may we call them the "mighty mites."

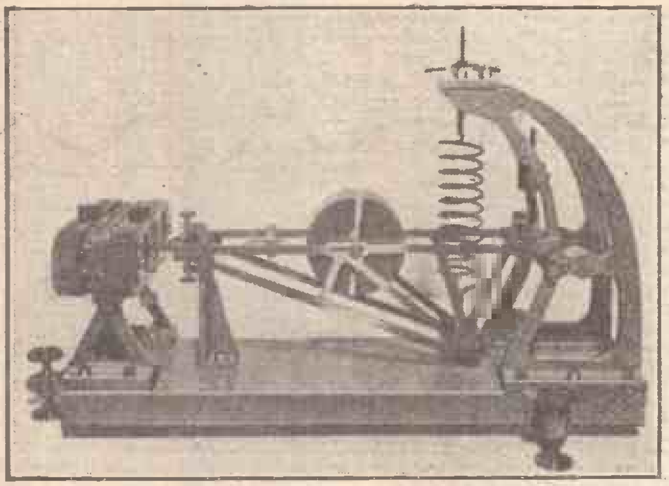
The earth's carpet consists of rocks of various kinds. It is a carpet which extends even under the oceans. The dust on the carpet is, of course, the soil, grits, sands and other débris on which the mould or the vegetation, as we prefer to call it, extends its roots and has its being. In certain areas, however, the carpet of soil is hardly existent, and even the ordinary rocks are not to be seen; there is only one universal rock in such areas, and that rock is granite.

The Earth's "Floor"

Now, granite, the stone material which is made up of countless interlocking grains, and which, on account of its durability, serves a useful purpose for building work and monument making, has a very great significance. It is found all over the world, the more so in those areas in which there are "holes in the carpet." Dig deep down anywhere you like, and you will invariably come to granite. So far as we know there is absolutely no exception to this universality of granite in the underlying layers of the earth's crust.

Does this infer, you will be thinking, that the granite floor of our seas and continents perhaps persists right down to the earth's centre? By no means. On the contrary, the granite "floor" may be only some twenty miles in thickness, and, although it is hard and solid in its upper layers, it probably changes not only physically but, also, in chemical composition as it gets deeper and deeper.

It is a well-known fact that the deeper we go into the earth's crust the higher the temperature becomes. On an average it is found that the temperature increases about 44 degrees Centigrade (or 111 degrees Fahrenheit) for every miles that we go downwards. Reasoning on the assumption that this temperature-increase is maintained at greater



The seismograph, or earthquake detector, which has been brought into service in the investigation of the earth's inner regions.

depths below the earth's surface, we can well see that at a depth of, say, 50 miles, the normally solid granite (or whatever else may take its place) must be raised in temperature above its melting-point. It should, indeed, be something akin to the molten, plastic lava which is hurled out of the tops of volcanoes.

Under the Granite

Granite is a rock which is really a mixture of three minerals, felspar, quartz and mica. There is, however, an even more fundamental rock, something akin to granite, but which contains more lime, iron and magnesium than granite does. This is the black, flinty-looking material which we call basalt.

Most volcanoes eject basaltic lava in preference to granitic lava and, partially because of this, it is now considered that the granite "floor" of the earth's surface is only a relatively thin one and that, underlying the granite, there is a much thicker understructure of basalt from which the volcanic lava is derived.

The basalt support of the granite "floor" of the earth's surface may, and probably does, go down for a hundred miles or more, but we have evidence that there is a rock material which exists at still greater depths than the basalt layer. This rock is known as olivine. It is found near the surface in the "pipes" or vertical shafts of long-extinct volcanoes, the olivine having apparently solidified and blocked the volcanic vent sufficiently well to suppress all further activity of the volcano.

Chemically, olivine is a silicate of iron and magnesia, and, in this connection, it is important to note the increasing prevalence of iron as we proceed downwards to the earth's centre. Granite has little iron. Basalt contains a considerable proportion of iron, whilst olivine rock has more iron still.

It is almost certain that these rock materials, basalt and its underlying olivine, are far from existing in the solid condition in which we know them. The temperature within the earth must be such that, under normal conditions, the materials would exist in the liquid state, being almost as fluid as water.

However, there are two facts which tell us this is not the case. In the first place, if, deep in the earth, there were underground oceans of liquid basalt and olivine, internal tides would be set up by the influence of the moon just in the same manner as surface tides are created in the oceans of the world. No one has ever been able to detect any semblance of tides within the earth. Indeed, any such tides would considerably diminish the essential stability of our globe.

Influence of Pressure

Again, there is the factor of pressure. When you compress a liquid it must necessarily become thicker or more viscous for the reason that you are forcing a given quantity of matter into a smaller space. All liquids, of course, resist compression in a very high degree, but there are pressure limits above which even liquids must cease their constitutional resistance to compaction. At a depth of 50 miles within the earth, the pressure per square inch must be of the order of approximately 300,000 lb. This, clearly, is a gigantic pressure which we cannot hope to imitate on the earth's surface, so that under the opposing influences of high temperature and ultra-high pressure, the rock material in those deep-lying and mysterious under-earth regions must be in a dough-like state.

The Meaning of Magma

The earth's internal temperature will tend not only to liquefy but even to vaporise the underlying rock materials, but, against this, we have to reckon with the colossal pressures prevailing in such deep-lying regions which will tend to solidify even gases and vapours. Consequently, an effective compromise must be attained, this compromise taking the form of vast areas of a dough-like, plastic material, to which the Greek word *magma* (meaning a soft, viscous (mass) is now technically applied.

A piece of the earth's floor — granite — the rock material which lies universally below the earth's surface.

The lava of volcanoes is, on this theory, nothing more than portions of the earth's underlying magma which, at times, are ejected under great pressure. As soon as the magma comes up to the surface, it solidifies, and, for this reason, it continually tends to choke the volcanic vent and, therefore, to extinguish the volcano's action.

It is probable that the state of magma begins at the lower extremity of the upper "floor" of granite, and that the whole of the underlying basaltic and olivine layers are in that condition. Whether the magma becomes thicker or thinner at greater and greater depths is impossible to tell. Conjecturally, however, it possibly becomes much thinner, the influence of heat as the earth's centre is neared gaining ascendance over the pressure influence.

It would seem that the earth's magma, being, in its upper reaches, semi-solid and probably very viscous, serves a useful and, indeed, an entirely essential purpose as a cushioning or shock-absorbing layer, serving to prevent any pressure changes occurring in the central core of our globe from exerting disastrous effects on the surface crust.

Floating Continents

It seems certain, however, that the earth's continents and even the underlying granite of the ocean beds actually float in the semi-liquid magma at still deeper levels just like a ball of iron will float in a vessel of mercury. It has been calculated that the average continent is about 20 to 25 miles deep, consisting of masses of granite of this depth or thickness which, by equilibrium of forces, "sit" securely in an underlying sea of plastic basalt magma much in the same manner as a heavy-weighted ship "sits" in the supporting waters.

Not, of course, that lands and continents are considered to project downwards into the magma to one universal depth and thus to present flat bottoms, as it were, to the supporting ocean of magma. On the contrary, projections above the land surface are counterbalanced by projections downwards into the magma. Thus, high mountains on the earth's surface appear as so many teeth which have corresponding roots, or fangs, thrust deeply into the magma. Just as an iceberg rides into the ocean with its greater bulk below the water-level, so, also, are our lands and continents considered to lie in the magma with by far their greater mass below the magma surface.

Considerations of the earth's magma, or semi-plastic zone, do not, however, lead us to any information on the subject of what

A roll of black bitumen left to itself on a white slab on a laboratory workbench.

conditions at or near the earth's centre may be like. The olivine layer of the magma is supposed to go down for something between one and two thousand miles. Possibly, the the one-thousand limit is the more accurate figure of the two.

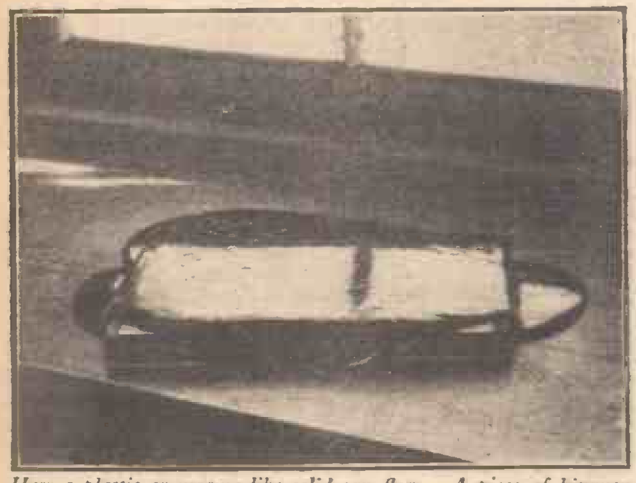
Then what underlies the magma, the basaltic and olivine layers deep under the earth? The question must seem a puzzling one and, indeed, a truly insoluble one, but fortunately there are several roundabout ways of gleaning information about the earth's deep inner core. Here are some of them:

Granite, basalt and olivine are approximately 2.5, 3 and 3.5 times as heavy as water, but the density of the earth, which can be determined with considerable accuracy, comes out as 5.5 times that of water. This fact can only mean that the material around the earth's core must comprise something exceptionally heavy. Such material must be at least half a dozen times as heavy as water. It is this heavy matter around the earth's centre which attracts a plumb line vertically downwards towards itself.

The Evidence of Earthquakes

Again, there is the evidence of earthquake waves. There are two kinds of these waves—those which travel around the earth at its surface and those which proceed in straight lines through the deeper layers of the earth. The surface waves travel at a constant rate of about 2½ miles per second, but those which travel through the deeper layers of the earth proceed at different rates according to the positions of the stations at which they are recorded.

These "deep" waves must necessarily pass at considerable depths under the earth's surface, and it has been found possible to calculate their approximate speed of travel



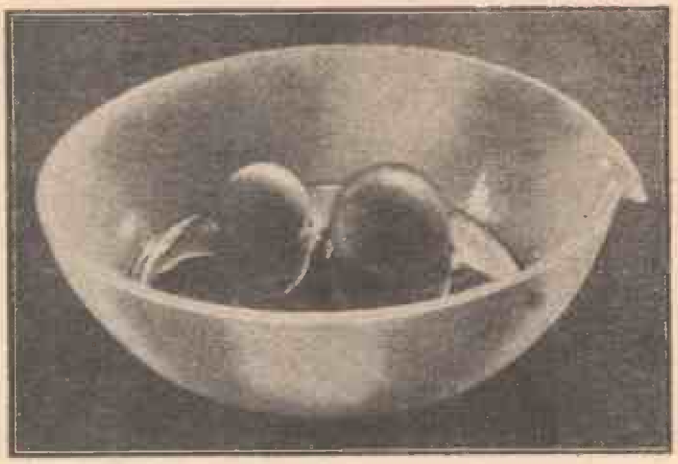
How a plastic or magma-like solid can flow. A piece of bitumen after two days' exposure to the atmosphere. The solid has behaved as a liquid and has completely flowed away from its original position. (See similar illustration on preceding page.)

and, from the results, to reach conclusions as to the state of the underlying medium through which they pass.

The evidence thus obtained points to the first 20 miles of the earth's crust being composed of rocks of varying characters. After this comes a zone which is entirely homogeneous and through which the earthquake waves travel at a speed which increases with increase of depth. This would seem to indicate that the density of the earth increases with increase of depth from its surface.

What Meteorites Reveal

Then there is the rather unexpected evidence which can be obtained from a study of meteorite compositions. These, the so-called "shooting stars," are merely rock fragments which enter our atmosphere at enormous speeds and which are raised to incandescence by friction with the earth's atmosphere.

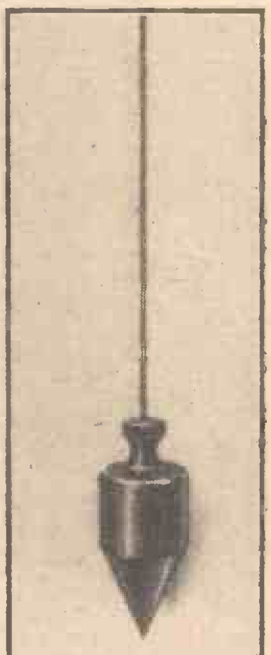


Heavy iron balls floating in a dish of mercury. In a somewhat similar manner the great land areas and continents of the world are conjectured to float in equilibrium in a medium of heavy plastic and viscous magma.

There are, in general, two kinds of meteorites, "metallic" and "rock" meteorites. Metallic meteorites are mainly lumps of nickel-iron ore, containing about 10 per cent. of nickel, together with traces of other heavy metals, such as copper and cobalt. The "rock" meteorites, on the other hand, are composed mainly of basalt and olivine with, perhaps, some grains of metallic iron here and there.

No meteorite containing granite has ever been found; and this is a very significant fact since it is believed that all these extra-terrestrial fragments are the age-old débris of past planets which, by explosion of some other internal cataclysm, have literally exploded and blown themselves into countless millions of small fragments.

Astronomical study indicates that the basic compositions of the sun and planets are all the same. No elements have been found to be present in the planets which are not available on earth. No new element has ever been discovered in a meteorite. So, working on these lines, it is conjectured that what we know as meteorites are, in reality, fragments of the core of some exploded planet which had, it would seem, an inner central zone of metal and an outer shell of rocky material similar to our basalt and olivine.



The plumb line. When freely suspended it must point directly towards the earth's ultra-dense and compacted core.

Iron in the Middle

This, of course, is pure supposition, and it must lead to an analogy which is, at present, without proof. Yet after every scrap of evidence, practical and theoretical, has been weighed, the inescapable indication is that the earth's central core consists for the most part of metallic iron and nickel, with, no doubt, a proportion of other metallic materials at a considerable distance from the centre.

Iron, it must be remembered, is one of the most plentiful elements in the sun. It would seem, therefore, that as the earth cooled down from its original semi-liquid, plastic condition and formed for itself an outer, solid crust, most of its iron was drawn downwards to its centre through the agency of some natural mechanism of which we are not aware.

It is estimated that, in consequence of the earth as a whole having a density of 5.5, the metallic core of our globe must have a radius of 2,000 miles. Above this radius there will be a transitional concentric shell consisting of mixed iron and silicates (olivine), merging upwards into the true olivine rock at a distance of 1,000 miles from the earth's surface.

Above the olivine layer is the comparatively thin zone of basaltic rock which supports above it the granite "floor" and its thin, worn carpet of heterogeneous rock materials, with its accumulated "dust" of soil, its vegetable "moulds" and its "mites" of man, animals and other living things, to say nothing of the little puddles of condensed moisture which constitute its oceans.

Metal Gas

In conclusion, a word must be said about the iron or the iron-nickel core at the earth's centre and existing for some two thousand miles around it.

This core can hardly be a solid core. It is doubtful, too, whether it can be a liquid one. Under ordinary pressures, metallic iron melts at a temperature of 1,530 deg. C. and boils at 2,450 deg., nickel melting at 1,435 deg., but, like iron, boiling at 2,450 deg.

The temperature of the earth's central region must be enormous, far higher, indeed, than the normal boiling point of iron and nickel. Hence these metals must be continually under the opposing influences of ultra-high temperatures and ultra-high pressures.

But it is thought that the temperature influence in the earth's central regions must outweigh the pressure influence, colossal though the latter undoubtedly is. If there is any truth in this conjecture, then it is impossible to escape the conclusion that the iron-nickel core of our earth must exist, not, of course, in the form of a solid, not even in liquid, doughy or "magma" state, but in the form of a gas—iron and nickel gas—which must be in a highly compressed state, a condition of which we have very little means of conceiving. So great must be the metal gas pressure that the gas must be heavier than the solid metal!

If the upper concentric shells of silicate material—the olivine and basaltic regions—were less enduring, or, on the other hand, if the inner "core-temperature" of our globe were for some reason to increase, then the consequent gas expansion would eventually overcome all obstacles to its release and, like a bursting steel boiler, our earth and everything on and in it would suddenly shatter into formless dust and into a myriad of fragments, making, no doubt, in subsequent time, an excellent display of meteorites for some other planet.

Such a thing seems to have happened before. It might happen again!

The Harwell Cyclotron

Successful Operation on the First Trial

THE successful start-up of the Harwell cyclotron was recently announced by the Ministry of Supply. The following details have been provided by the Atomic Energy Research Establishment at Harwell.

The cyclotron at this establishment was put into operation for the first time on the night of Friday, December 2nd, 1949.

Constructional work on the complex buildings and equipment occupied just under three years, but the experimental work involved in the final tests and adjustments took only a few weeks, and the machine operated on the first full trial.

The cyclotron is a particle accelerator for research in nuclear physics, and it produces streams of light atomic nuclei moving at very high speeds. The particles are accelerated in a great number of successive steps, each of a few thousand volts, between the poles of a large electro-magnet. They are produced by a low-voltage arc discharge in a gas-filled chamber placed at the centre of the magnet gap.

Process of Acceleration

The magnet causes the particles to move in circular paths, and since the diameter of their paths increases as their speed increases, they travel in a spiral, which makes it possible to get a very long path in a comparatively small space. The speed is increased by applying, twice per revolution, an accelerating voltage from a short-wave radio oscillator.

This gradual process of acceleration makes it possible to achieve much higher speeds than those obtainable in a single acceleration. The acceleration takes place inside a vacuum chamber, otherwise the particles would be scattered and slowed down by atoms of oxygen and nitrogen in the air.

At present, the Harwell machine is producing a total accelerating voltage of about 160 million volts. When final adjustments have been carried out, this will be increased to 180 million volts or more. The particles now being accelerated are protons, the atomic nuclei of hydrogen. During acceleration they circulate about 50,000 times and travel about 100 miles in a total time of a few thousandths of a second, to complete a spiral path from the middle to the edge of the magnet gap.

Particle energies are expressed in "electron volts" by nuclear physicists, so that the present proton energy is 160 million electron volts (Mev.). Protons of this energy travel at over half the speed of light, or about 95,000 miles per second. Other accelerators, such as the linear accelerator and the synchrotron, are producing electrons travelling at very nearly the speed of light, but protons are about 2,000 times heavier than electrons, and are much more potent in producing nuclear disintegrations, at energies so far obtained.

The Harwell cyclotron is thus the most powerful "atom-splitting" machine at present operating in this country.

Magnet of 700 Tons

The magnet contains 700 tons of steel, and its oil-cooled energising windings contain 80 tons of copper and consume over 300 kilowatts of electrical power. Its circular poles are 110 inches in diameter and are 12 inches apart.

The oscillator which produces the accelerating voltage is similar to a 15-metre radio transmitter, and can give a maximum power of 150 kilowatts. Large vacuum pumps operate day and night to maintain a high vacuum in the accelerating system, which has a volume of about 500 cubic feet. The main parts of the cyclotron are cooled by circulating purified water.

The cyclotron is installed in an underground room 100 feet long, 45 feet wide and 12 feet high, with a 6 feet thickness of reinforced concrete overhead, and it is remotely controlled by a system incorporating elaborate safety circuits.

This is done to protect those working on the machine from harmful effects of neutrons, which are produced in large numbers when the fast protons disintegrate atomic nuclei of materials in the cyclotron. These neutrons are much more penetrating than those produced in an atomic pile, since they are released at higher speeds.

(Neutrons, together with protons, are the constituents of atomic nuclei, and are more difficult to stop than are protons, since they carry no electric charge.)

The fast protons and neutrons produced by this machine are capable of causing many kinds of nuclear disintegrations and of producing new species of atomic nuclei, when they strike target materials placed in their path. At the higher energy, soon to be reached, there will be a possibility of creating mesons, the particles which form the "cement" which binds neutrons and protons together in atomic nuclei.

Detailed study of these phenomena will enlarge our knowledge of the nature of matter, and in particular, of the nuclear binding forces.

The cyclotron is thus a research tool. It is not capable of producing useful atomic energy, but it can be used for experiments which cannot be performed in a pile, since it produces much faster particles.

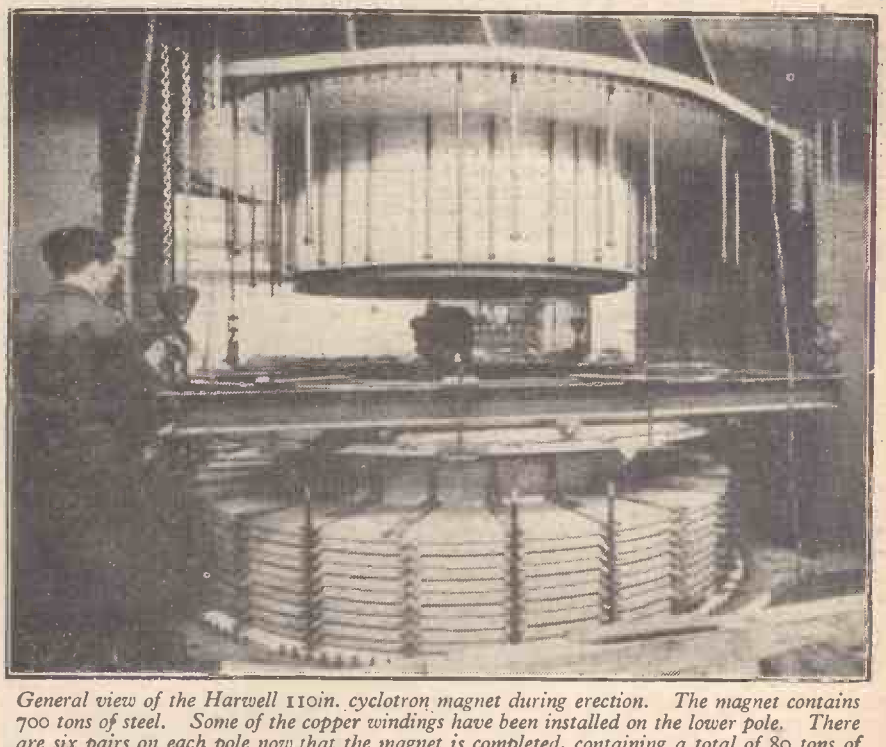
Cyclotrons, first built by Professor E. O. Lawrence, in California, have been in use for about 15 years, and there are three others in this country. The early machines were, however, limited to particle speeds about one-tenth that of light. The Harwell machine is of a new type, known as the freqeuncy-modulated cyclotron or synchro-cyclotron, and was based on a similar large machine installed in Professor Lawrence's laboratory.

Largest Cyclotron in Europe

The Harwell cyclotron is, at present, the largest in Europe, although there are several larger ones in use or being built in the U.S.A., where they have already produced valuable results in nuclear research.

The cyclotron was designed, and its construction supervised, by a scientific group at Harwell. The magnet was built by Messrs. C. A. Parsons, and this was the biggest single industrial contribution. Electrical equipment was made by British Thomson-Houston and G.E.C., the vacuum plant by Metropolitan-Vickers, and smaller contributions by other British industrial firms. The larger firms installed their own equipment.

Most of the cyclotron, other than the magnet, was made by the engineering division at Harwell. All building work, civil engineering and electric wiring were carried out under the supervision of the Ministry of Works by their contractors.



General view of the Harwell 110in. cyclotron magnet during erection. The magnet contains 700 tons of steel. Some of the copper windings have been installed on the lower pole. There are six pairs on each pole now that the magnet is completed, containing a total of 80 tons of copper. At maximum power a current of 600 amps at 500 volts is passed through the coils.

NEW SERIES

Wood Turning—8

Fancy Turning

By FREDERICK JACE

THE turning of knobs, decorative plinths, finials, etc., is a subject from which hard and fast rules cannot be laid down. Where numbers of them are required they should be turned as a series in one operation, and then separated by sawing with a tenon saw. This would be the case when, say, a number of ornamental feet are required. Such

Fig. 68.—Acorn finial.

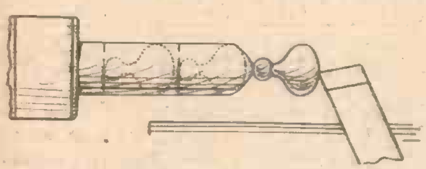


Fig. 69.—Chucking and turning the finial.

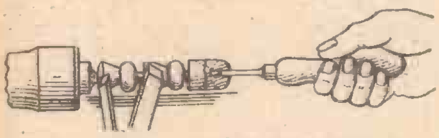


Fig. 70.—Turning a thistle-head finial.

Fig. 71.—Small ornamental finial.

pieces lend themselves to a display of individuality in the shapes, the most pleasing results being obtained by a combination of the ogee, ovulo, cycloid, etc.

Fig. 68 shows a small knob somewhat resembling an acorn, and Fig. 69 shows how it would be turned. Such knobs must be made of boxwood or some similar hardwood. The piece of material with which they are to be turned should be mounted in the cup chuck, the first operation being effected with the gouge to turn to the correct diameter and the rounding effected with a chisel. It may then be bored with a bradawl, as shown in Fig. 70. The finishing chisel cuts are taken in rotation and Fig. 70 shows the two manipulations. The end knobs are, of course, glasspapered and cut off in rotation. Fig. 69 illustrates the chucking of knobs of similar type.

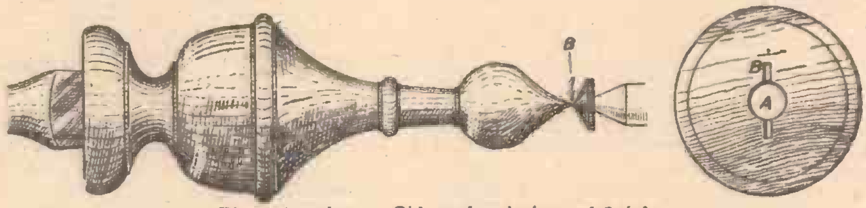
Finials

Provided that the finials are not required to be more than 3in. in length they may be chucked in the cup check, using a piece of material of sufficient length to cut two of them. They are turned as shown in Fig. 71, with the pin projecting away from the chuck, although that is a matter of personal choice. In Fig. 72 is shown an example of the method of turning small feet. In this case it is better to turn them with the dowelled feet projecting upwards, as this enables them to be turned to suit the holes in which they are to fit. The holes can be used as a gauge. The left-hand part of Fig. 72 shows how to turn flat feet with a radius periphery.

Such pieces having secured dowels need a turning gauge so that all the dowels can be made of the same size, and such a gauge is shown in Fig. 73.

Ornamental Pillars

In Fig. 74 is shown an ornamental pillar such as might be used for the stem of a wooden candlestick, a standard reading lamp, etc. It will be seen that a tenon is turned on the material nearest to the strut and a hole is bored at the other. Any number of such pieces may therefore be fastened to-



Figs. 76 and 77.—Side and end views of finial.

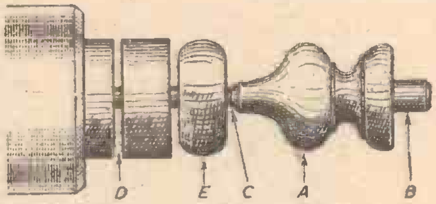


Fig. 72.—Turning small feet.

gether to provide an ornamental pillar of any length. In fact, most long pillars are built in this way. Fig. 75 shows an example of the use of the cup chuck where the work is bored right through and the various pieces of ornamental turning assembled on a straight through dowel. Figs. 76 and 77 illustrate an ornamental finial which is turned between the prong chuck and the tailstock centre. In this case the hole is bored in the bottom end of the finial to suit the pin on the pillar.

Fig. 73.—Pin gauge.

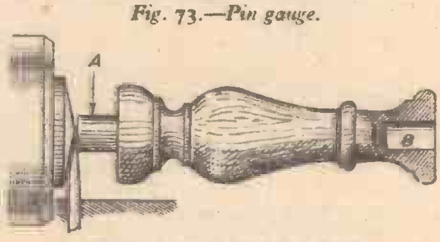


Fig. 74.—Ornamental pillar.

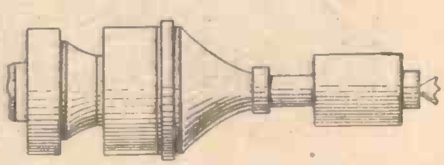


Fig. 78.—Cutting the finial down to lengths and diameters.

The wood is first chucked between the prong and the tailstock, forcing it deeply on to the prong so that the indentation so made will serve for rechucking purposes. It is then rough turned as formerly explained for chucking in the cup chuck, but in this case it is cup chucked by the tailstock end of the rod and the prong end cut down squarely and smoothly.

Fig. 78 indicates blocking out for finishing the finial by cutting in the different

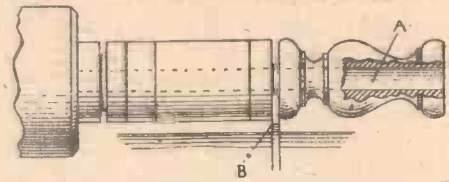
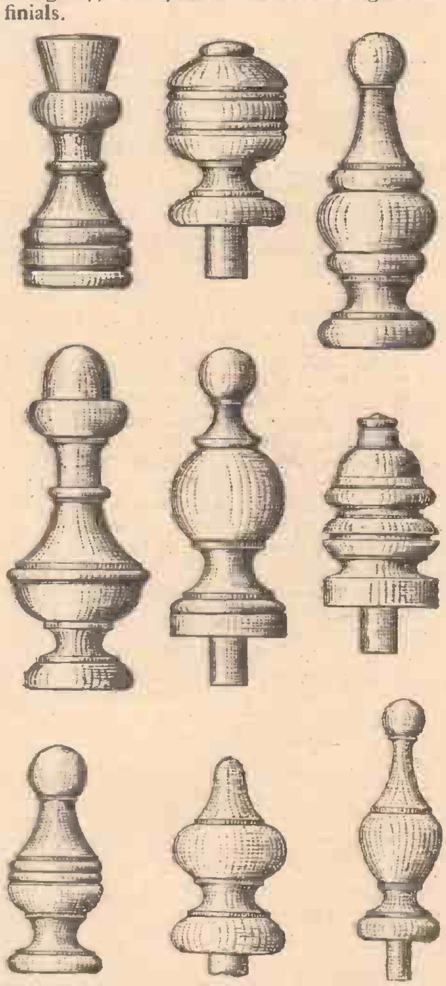


Fig. 75.—Pillars bored right through.

members to length and diameter and then rounding over the beadings, working from the bottom end towards the top. The small point must not be turned to so small a diameter as to risk breakage.

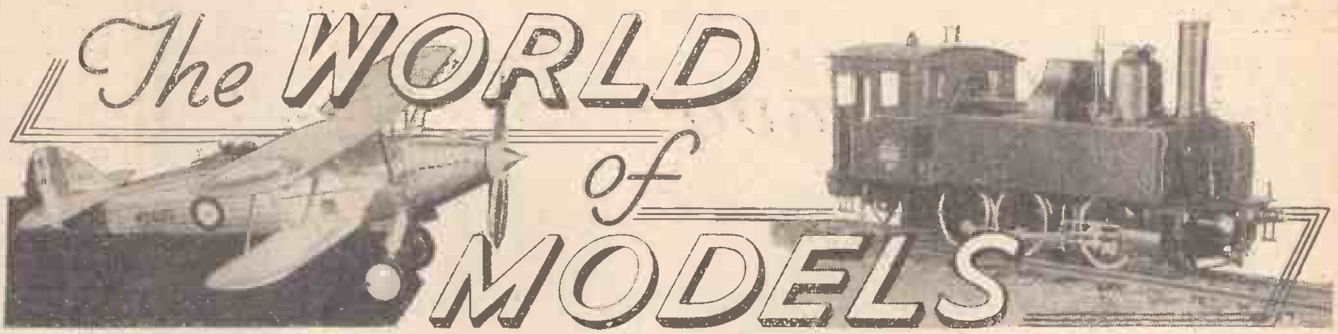
Figs. 79 to 87 show various designs for finials.



Figs. 79 to 87.—Various designs for finials.

(To be continued.)

The WORLD of MODELS



Training School for Student Apprentices : Waterline Model Ships : Gauge 00 Rolling Stock

By "MOTILUS"

MANY engineering firms in this country nowadays run training schools attached to their works, in order that boys leaving school may become student apprentices to the trade and thus provide skilled operatives for the company, familiar with their own methods. Messrs. Joseph Sankey & Sons, of Bilston, Staffs., who specialise in the manufacture of laminations for the electrical trade, have a centre of this kind, the Bankfield Training School, which was started in 1936 by Mr. E. W. Richmond, director and general manager, who has since retired after more than twenty years' service with the company.

At Bankfield the training course lasts approximately three years and is followed by two years' practical experience in the tool room. During the training period, students are paid standard Union rates and for good conduct and progress they qualify for a bonus of tools and books. Training consists of lectures and practical work, including cylindrical and surface grinding, press tool making and setting, lathe work, milling, slotting, setting, and the school is well equipped with the latest types of machine tools for all operations taught.

In order to encourage students to co-operate with one another and create interest in their training, it is the practice for them to build models of outstanding examples of engineering.

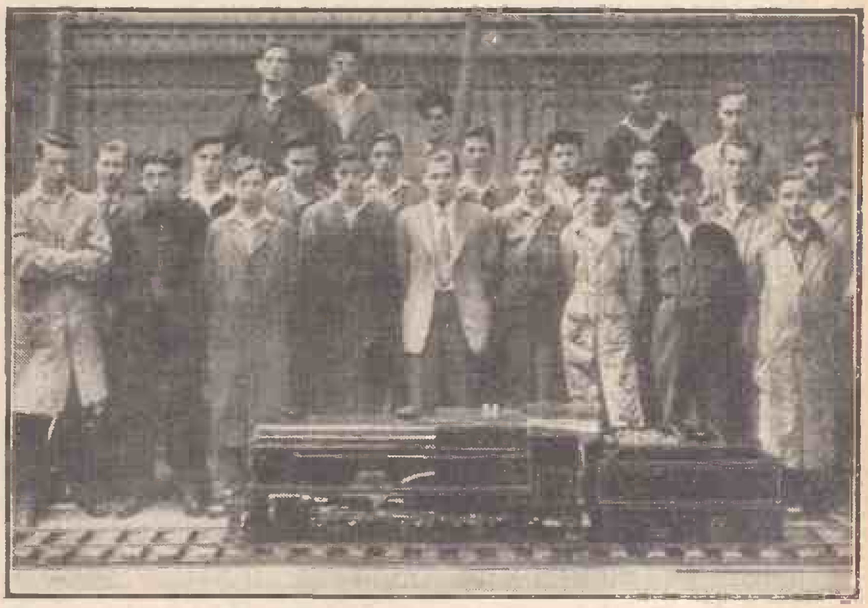


Fig. 1.—The finished 7¼in. gauge, 1½in. scale model of the "Royal Scot" and the apprentices who made the model at the Bankfield Training School, of Messrs. Joseph Sankey & Sons, Bilston, Staffs.

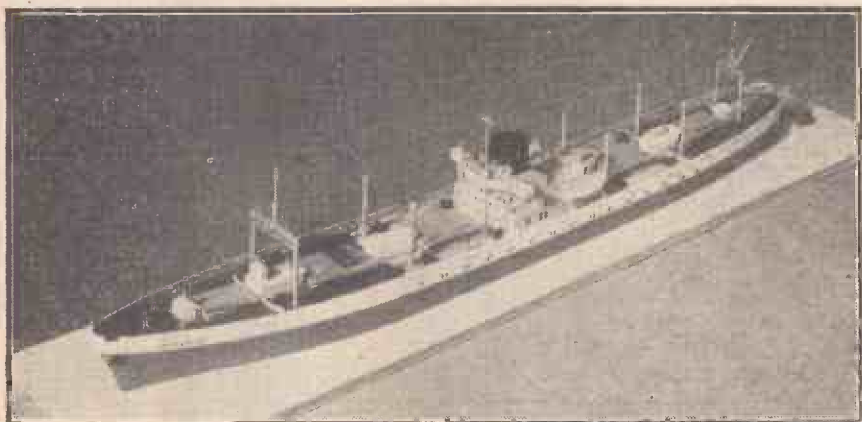


Fig. 2.—Waterline model of a large modern cargo ship, the "Wanstead." The model is 14½in. long and to a scale of 32ft. to 1in., or 1/384 actual size. Model made to the order of Wm. Harvie & Co., Birmingham, makers of ships' navigation lights.

7¼ in. Gauge "Royal Scot" Locomotive

Thus, in 1945, the Training School Manager, Mr. R. A. Williams, obtained from Bassett-Lowke, Ltd., working drawings of a 7¼in. gauge "Royal Scot" locomotive, in order that the apprentices might build such a model. At that time it was not possible to obtain castings for these large models, owing to Ministry of Supply restrictions, so that all the parts that could have been cast had to be machined from the solid. The boiler was of welded construction and tested to 200lb. per sq. in., without a sign of a leak anywhere, since when it has been under steam. The accompanying illustration, Fig. 1, shows the finished model surrounded by the apprentices who were responsible for the work.

Fig. 3.—Waterline model of the turbo-electric oil tanker, "San Silvestre." The model is 16½in. long and made to a scale of 32ft. to 1in., or 1/384 actual size, to the order of Wm. Harvie & Co., of Birmingham.

The locomotive has been shown at various industrial exhibitions, as part of the Apprentices' Training Scheme. During such exhibitions the model is geared up for electric drive to show it in operation, and it is always a centre of interest.

Such is the success of this model-making that it is the intention of Messrs. Sankey & Sons to have their students build a further "Royal Scot" locomotive of the same gauge, the last one having proved such an excellent training medium, bringing out the best abilities for all phases of workshop practice, as well as being a fine incentive for the students. This time it is intended to use a copper boiler and as castings are now available they will be used in this instance.

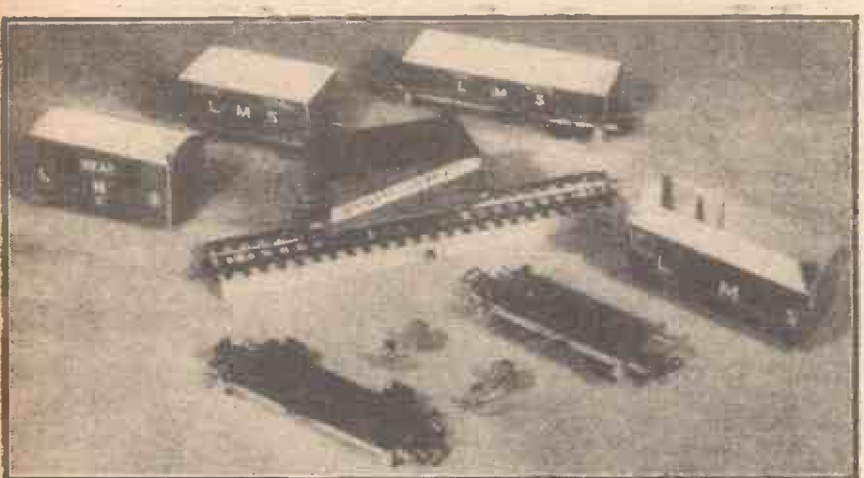


Fig. 4.—Examples of Gauge 00 goods rolling stock under construction in English design by Mr. W. Richter, of Leipzig.

Waterline Model Ships Display

Many visitors to shipping or model exhibitions will have seen a display of the magnificent collection of waterline ship models exhibited by Messrs. Wm. Harvie & Co., of Birmingham. These models have been specially made, under the direction and supervision of Mr. Leslie T. George, a director of the firm, as a unique method of drawing attention to their company, who have been famous since 1856 for the production of navigation lights.

The original display consisted of over three hundred waterline models, all specially built for the company by Bassett-Lowke, Ltd., to a scale of 50ft. to 1in. or 1/600th actual size. It includes many types of both British and foreign vessels for which Messrs. Harvie & Co. have supplied navigation signal lanterns, etc. They represent examples of over 23,000 vessels that have been equipped by this company. In addition to this, they are a special attraction for exhibition visitors, as they show the progress that has been made in the size and design of ships over almost a century of ocean travel.

So great is the appeal of these models that Mr. George is continually adding to the collection. Latterly he has had the scale changed to 32ft. to 1in., which gives an opportunity of including finer details in the models. The illustrations, Figs. 2 and 3, show two of the most recent models that have been made for the collection, to this scale.

These two models are of very interesting, modern ships. One is of the latest cargo motor-ship, *Wanstead*, which represents a new interpretation of the average modern cargo liner. She is the first of three of the same type being built, the other two being the *Wendover* and the *Woodford*. The *Wanstead* was built by the Caledon Shipbuilding and Engineering Co., Ltd., Dundee, to the order of the British Steamship Co., Ltd. All three ships are for the same general cargo service between the ports of the east coast of Canada and ports in north-western Europe. In view of their having to navigate the icy waters the vessels have been reinforced to enable them to travel in safety. In accordance with modern practice, the final form of the ships' lines was decided following model experiments carried out at the Ship Division of the National Physical Laboratory at Teddington.

The $14\frac{1}{2}$in. long model represents an overall length of 486ft. on the actual ship, which has a gross tonnage of 5,664 and a service speed of 15 knots. The propelling machinery is amidships and deep tanks for fuel, oil and water ballast are between the engine room and forward cargo decks. The propelling unit consists of a Scott-Doxford two-stroke cycle, direct reversible, 5-cylinder, opposed piston, oil engine, made by Scotts' Shipbuilding & Engineering Co., Ltd., of Greenock, who are also providing the machinery for the other two ships in the group. The plant develops 5,500 b.h.p.

Mention should be made of the excellent accommodation provided for the officers and crew. The architect responsible for the innovations in this layout is Mr. Howard Robertson, A.R.A., F.R.I.B.A., and it is felt that his design may be followed in many future ships of this kind, as it gives the crew so many improvements in the furnishing and decoration of their apartments. Each member of the crew has a room to himself and the apprentices are three in a room. An interesting innovation is the provision of a cafeteria service for the crew.

The ship's colours are faithfully reproduced on the small model: light grey hull with white topping, maroon decks fore and aft, with planking amidships and the plain, black funnel.

The second model is of the turbo-electric oil tanker, *San Silvestre*. This ship is being built by the Furness Shipbuilding Co., Ltd., for the Eagle Oil and Shipping Co., London, and is, like the *Wanstead*, the first of three sister ships. She is the first turbo-electric ship to be built on Tees-side.

Her turbo-electric propelling machinery has been designed and built by the General Electric Co., Ltd., London, to the specific requirements of Mr. W. L. Nelson, O.B.E., superintendent engineer of the Eagle Oil and Shipping Co. All the propelling equipment is in the stern of the ship, the bridge

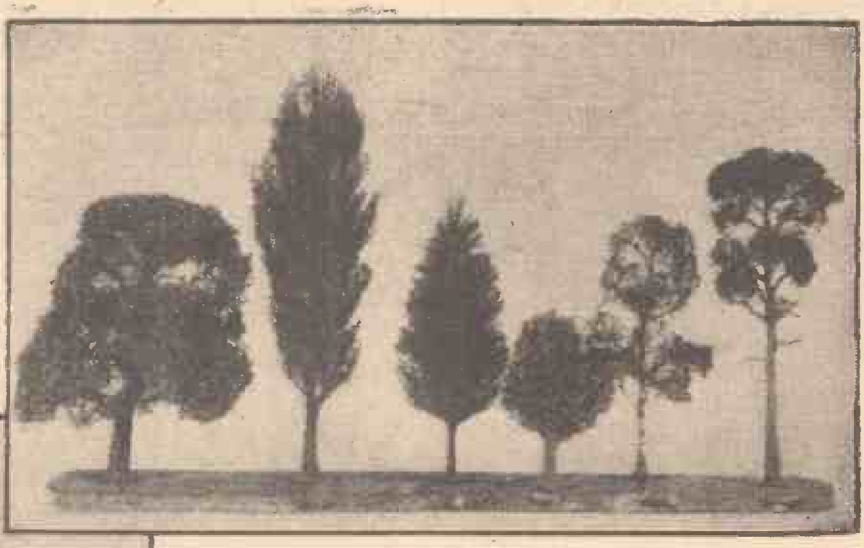


Fig. 6.—The fulfilment of a long-standing need: scale model trees with realism for your model railway, in 00 or 0 gauges. An untouched photograph of models of some typical English trees; oak, Lombardy poplar, cypress, birch, pollarded willow and Scots pine. All handmade by a model tree expert.

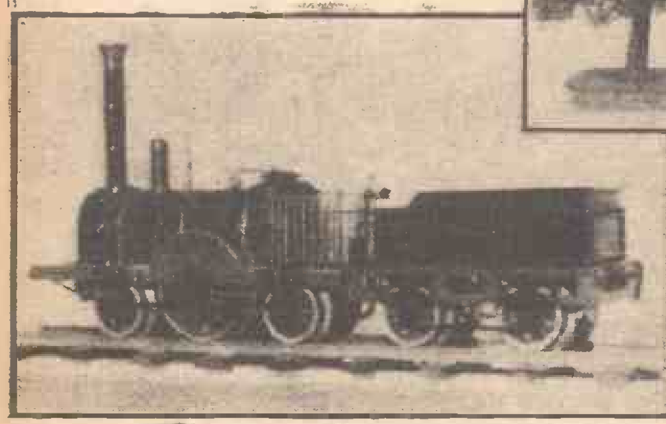


Fig. 5.—A working model of an early German steam locomotive of 1835; "Der Adler," built for passenger traffic between Fuerth and Nuremberg.

and captain's quarters being amidships.

The *San Silvestre's* hull is all black and she also bears a black funnel with white and yellow bands and the company's symbol, an "O" surmounted by an eagle. Her overall length of 537ft. is represented by 16¼in. on the miniature model.

Gauge oo Rolling Stock

I have received further news from my German correspondent, Mr. W. Richter, of Leipzig, who is such a keen student of English railway practice and of English-type model railways. He has sent me a photograph (Fig. 4) showing some of his oo gauge English wagons, which he builds himself, in course of construction. The wagon bodies are of card, with bases and wheels of metal. I notice that Mr. Richter still adheres to the individual companies' liveries of pre-nationalisation days, preferring, as he does, variety in his rolling-stock. All the same, I am wondering whether I will soon be receiving photographs from him showing he has been converted to using British Railways stock!

Model German Locomotive

Mr. Richter also sent me a photograph (Fig. 5) of a gauge o model of an early German steam locomotive, *Der Adler* ("The Eagle"). This was the first locomotive to run between Nuremberg and Fuerth in December, 1835, and the model was produced for the Centenary of the German Railways some years ago, when a large railway exhibition was held in Nuremberg to show the progress of the German State Railways.

Scenic Effects

In model-making there is always difficulty in obtaining realistic trees and hedging for scenic effects. Many model-makers who are good craftsmen in metal or woodwork fail to develop an ability for making model trees with any degree of success. When I called at the London branch of a well-known firm of model-makers recently I found they have a very fine selection of models of some of the trees common in this country. They include oak, Lombardy poplar, cypress, silver birch, pollarded willow, Scots pine, elm, larch, beech, yew and lengths of typical hedging. These can all be obtained in two scales: 4 mm. to 1ft., suitable for oo gauge model railways and 7 mm. to 1ft., suitable for o gauge. Prices for the oo gauge trees range from 7s. 6d. to 12s. 6d., according to the type of tree and, for o gauge, prices are approximately 50 per cent. extra.

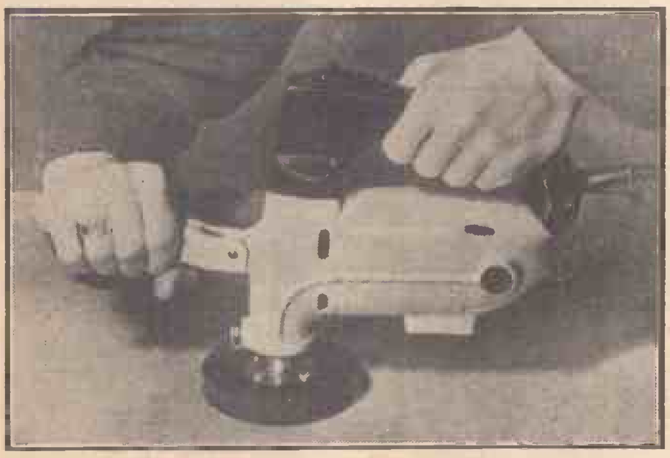
These models are all carefully hand-made and, as readers will see from Fig. 6, the form and details of the respective kinds of tree have been faithfully reproduced with great accuracy. In addition to several kinds of trees in full leaf, models of trees in winter, with bare branches, can be supplied to order.

Trade Notes

The Vatric "Multipol"

CALLED the "Multipol," the latest household electric aid is a combined polisher, food mixer, pot scourer and bench tool. Manufactured by Vactric, Ltd., it has an amazing variety of uses. While domestically it has wide appeal for housewives as a labour-saving device, it is also very useful for the handyman.

Although no larger and weighing no more than a flat iron, with no complicated gadgets to worry about, this handy little unit can be quickly transformed from one household job to another.



The Vactric Multipol combined polisher, food mixer, pot scourer and bench tool illustrated here sanding a wooden surface.

As a polisher it will keep tables, sideboards and other furniture bright, and by its use the polishing of household surrounds becomes no longer a back-breaking job; and the putting of a glossy finish to glazed tiling of hearths and bathrooms and kitchen walls is done with ease.

The unit, fitted to its stand, can be efficiently used as a cutlery cleaner and metal polisher. It will also quickly scour pots and pans.

Employing the quickly fitted accessories, the Vactric Multipol becomes a cook's aid in a little over a minute. It will mix, beat and do several cookery jobs usually calling for plenty of elbow grease.

For men's work about the house, garage or tool shed, the new unit with its stand is an adaptable power unit which can be used for many kinds of wood and metal work. For example, it is ideal for buffing, tool sharpening, light grinding and drilling. Used as shown in the illustration, sanding can be done with ease.

Shoe polishing is a quick and effortless job with the Multipol.

Taking it to the garage, or outdoors with a flex extension, motorists can make a professional job of wax polishing their cars with the minimum of effort.

The Multipol is manufactured in the Newhouse, Motherwell, factory of Vatric, Ltd., and further particulars can be obtained from Paul Brewster, 188, Strand, London, W.C.2.

Greenwood's Handicraft Materials

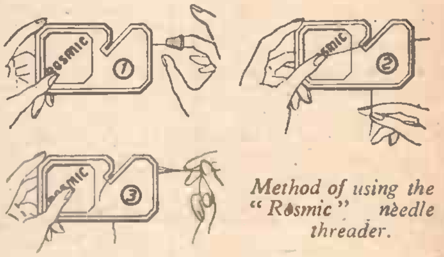
A VERY comprehensive catalogue of handicraft materials has recently been introduced by Messrs. Greenwoods, 12, Queen Street, Huddersfield. A very complete range is listed for arts and crafts of all kinds, including needlework and wools. The materials and tools for such crafts as lampshade making, leathercraft, stool seating, shellcraft, imitation jewellery, plastics, transfer work, toy making, rug making, weaving and needlework. Copies of this useful and well-illustrated catalogue are obtainable, price 1s. 6d., from the above address.

"Rosmic" Needle Threader

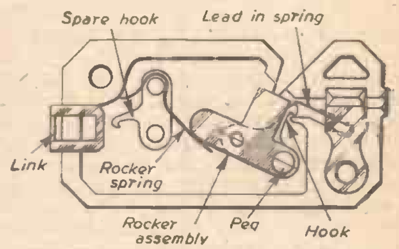
W. J. MYATT & CO., LTD., of Graham Street, Birmingham, 1, announce the introduction of a unique and patented device for threading sewing needles. No larger than a domino, the "Rosmic" automatic needle threader was primarily designed to assist the blind and the aged, and, unlike most other forms of needle threaders, has no complicated gadgets or levers, etc., with which to perform the threading operations.

The subsequent simplicity is such that, even without the aid of eyesight, it is possible to thread a needle in three simple movements, all in the space of approximately six seconds' time.

Apart from the obvious advantage this threader gives to those suffering from defective eyesight and the everyday requirements of the housewife, there are many directions in which "Rosmic" can be used as a time-saver and a safeguard against eye-strain. For example, dressmakers, milliners, tailors,



Method of using the "Rosmic" needle threader.



Showing the internal construction of the "Rosmic" needle threader.

burlers and menders (as employed in the textile trade), manufacturing jewellers and even the medical profession.

A threader can be used with sewing needles sizes 5 to 9 with cottons, silks and other threads, from the maximum coarseness, No. 36, to the finest.

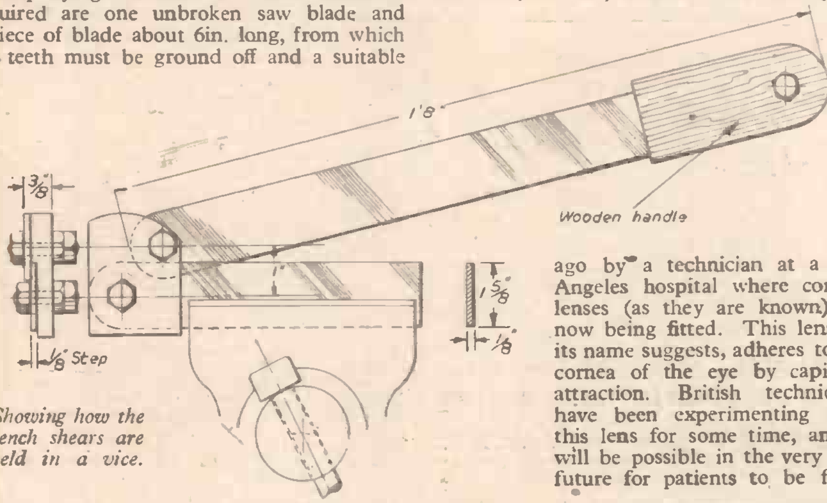
Every threader is individually tested before leaving the factory and is wrapped in cellophane, together with an explanatory leaflet, in counter-display cartons containing one dozen.

A spare hook is provided inside the threader in case of accident, and it is quite simple to dismantle the threader and exchange the hook if it should prove necessary.

In order that the interior mechanism shall at all times function, the case is moulded in special plastic material, which can be relied upon not to warp or distort, no matter what the climatic conditions may be.

Bench Shears

SIR,—The following particulars of the bench shears which I have made from worn-out and broken machine-saw blades may be of interest to other readers. It is quite a practical tool, as I know from use, and will cut 1/16in. brass sheet or 1/32in. iron without undue effort. It is quite simple to make, as will be understood from the accompanying illustration. The materials required are one unbroken saw blade and a piece of blade about 6in. long, from which the teeth must be ground off and a suitable edge for shearing produced at the same time.



Showing how the bench shears are held in a vice.

The coupling strap is ⅛in x 1½in., with a step on one side to accommodate the lower blade and rounded over the upper hole for the cut sheet to clear as it is pushed forward. The upper hole is brought forward to allow the upper blade to clear the lower bolt head. A wooden handle can be made by cutting a groove in a suitably shaped piece of wood and a recessed hole to take a small bolt passing through the existing hole in the blade. If the blades are ground on both edges they can be reversed when worn. When in use the lower blade is firmly held in the vice.—G. W. HARGRAVE (Bristol).

Contact Lens

SIR,—I welcome the opportunity of replying to your correspondent, P. Watkins, of Wolverhampton. As he rightly states, the wearing time with an orthodox contact lens is approximately three to four hours when first worn. This time does gradually increase with regular use and builds up on average to about five to eight hours' continuous wear—the time varying with each patient. The corona to which he refers is not experienced as much with the modern form of contact lens, which employs a capillary layer of tears instead of the former fluid lens. This corona may occur at any time and is, perhaps, more noticeable at night, due to the relative brightness of artificial lights. Most practitioners to-day employ an all-plastic contact lens, which is very much lighter in weight than the glass lens and is, of course, unbreakable.

Mr. Watkins' suggestion that it might be possible " . . . to fix the lens centre to the lens of the human eye without the cap to affix under the eyelid . . . " is very interesting and most creditable to a layman. His idea was, in fact, realised some two years ago by a technician at a Los Angeles hospital where corneal lenses (as they are known) are now being fitted. This lens, as its name suggests, adheres to the cornea of the eye by capillary attraction. British technicians have been experimenting with this lens for some time, and it will be possible in the very near future for patients to be fitted with these lenses.—E. STEEL (London, W.).

Ex-aircraft Generators

SIR,—I was interested in Mr. Wadeson's letter concerning the conversion of surplus motor-generators for use on A.C. mains.

I have had a fair amount of experience in experimental work on the type he mentions (Type 29). The method I used gave much better results than any other that I have come across.

The 230-volt mains was connected across the H.T. armature in parallel with the field and the L.T. armature was shorted out, as he shows.

When running, there is a considerable current flowing in this short-circuit which must obviously decrease the efficiency of the machine.

This short-circuit current circulates in the L.T. armature, causing a retarding effect in the armature and also a considerable loss due to heating. The alternating field induces an alternating e.m.f. in the L.T. armature, which causes an alternating current to flow through this armature via the short-circuit.

If the L.T. brushes, still shorted out, are now turned through about 90° to a position on the commutator where the e.m.f. in the armature coil is just passing through a zero value, the short-circuit current will decrease to a very small value, and consequently the power and speed will rise, the latter to about 2,800 r.p.m. I have not measured the power of the machine thus connected, but it would be about 1/6 h.p.

The motor should run for four or five hours on a small load with no appreciable rise in temperature.

The reason why the above connections are made is not fully understood, although it seems very likely that the motor is running as a synchronous motor, the no-load speed being approximately synchronous speed.—J. G. HARLOW (Southampton).

Club Reports

Hastings and District Society of Model and Experimental Engineers

PLANS are being made for the above club's forthcoming exhibition, to be held on August 28th to September 2nd, at the New Pavilion, Falaise Road, Hastings. This year it is being planned on a greater scale than in previous years, and there will be competitive sections open to everyone in nearly all branches of model engineering. Final details will be announced later.

Members are keenly interested in the construction of the club loco "Ajax," which is now taking shape, frames, wheels, boiler and several small fittings are well under way. The enthusiasts of the power boat section have devoted the dark evenings to building new craft, hydroplanes, prototype ships and launches, and with spring here we are hoping to hold our meetings on the pond in Alexandria Park on Sunday mornings.

Race car meetings are held every Friday evening in the New Pavilion, Falaise Road, and are well attended by members and the general public. General meetings are held every 2nd and 4th Tuesday evening in each month at the Congregational Church Hall, London Road, and members of other clubs are cordially invited.—Hon. Sec., P. KELLER, 3, Portland Terrace, Hastings.

Aylesbury and District Society of Model Engineers

THE meeting was held as usual on the third Wednesday of the month at Hampden Buildings, Temple Square, Aylesbury.

A talk was given by Mr. C. Horwood, one of our members, about the daily life of a signalman. Mr. Horwood is at present employed on British Railways, Eastern Region, and is fully conversant with his subject, as was shown by his answers to a steady stream of questions which followed.

Mr. Umbers, our honorary member, also opened his stall for the first time, and did a brisk trade among the members present, a proportion of his sales going to the club funds.—Hon. Secretary, N. F. SOUTHERTON, "Astracot," Bucklands Wharf, Aston Clinton, Bucks.

Radio Controlled Models Society

THE Radio Controlled Models Society is seriously perturbed at the number of radio-controlled models taking part in field events at which no official frequency monitoring is arranged. At these events, over which the society has no jurisdiction, models have been observed operating outside the frequency bands allotted by the Postmaster-General for that purpose. It is of vital importance that these concessions are not abused otherwise they may be withdrawn, and radio-control enthusiasts may find themselves forced to operate under the more stringent conditions imposed in other countries.

Monitoring equipment of a simple type is cheap to construct and operate and, in the view of the Radio Controlled Models Society, is essential in any radio-controlled demonstration.—J. HEATHCOTE, Hon. Gen. Sec., Radio Controlled Models Society.

Get extra M.P.G. by fitting a new set of Plugs.
Standard Sparking Plugs—14 and 18mm.—made by Siemens-Bosch for the German Army. New and Boxed, 4 for 7/-, 6 for 10/-. Short Reach.

200/250v. A.C. or D.C. Motors, about ½ h.p., fitted with 2½in. x ½in. High-grade Grindstones, Medium or Fine, made by Nortons. 20/- each.

New Brown's Moving Reed Headphones. Best in the world. 6/6.

Moving Coil Microphones. 3in. diameter, with Pressel Switch, 5/6. Matched Transformer, 5/-.

New Carbon Microphones. U.S. made for the Type 58 Walkie-Talkie, 3/-.

Powerful Small Motors, 24v. A.C./D.C. with geared spindle. 3½in. x 2½in. x 2½in. 8/6.

Headphones with Breast Plate Microphones. Packed in wooden boxes. Operate with 4½v. Battery. 10/- a set.

Meters. 4½in. 0-200 Microammeters. First Grade. 42/9 each. 2in. 0-500 Microammeters, 8/-. 2in. 0-300v. M/c., 10/-. 0-40v. M/c., 7/6.

Miniature Slow Motion Dials. 100-1 worm geared. 2½in. x 2in. Beautifully made. 4/- each.

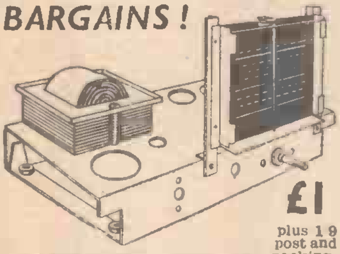
24v. A.C./D.C. Motors, 5in. x 3in. Fitted with powerful blower fan. 14/- each.

250 watt Double Wound Transformers, 240-110v. Made by G.E.C. With Steel Shroud. New. £2 7s. 6d. each.

All Carriage Paid. Money Back Guarantee from :

THE RADIO & ELECTRICAL MART.
253B Portobello Rd., London, W.11.
Park 6026.

NO RADIO CONSTRUCTOR
can afford to miss these
BARGAINS !



£1
plus 1/9 post and packing.

CONSTRUCTOR'S PARCEL (A)
As illustrated, comprising heavy gauge metal chassis cut out for a 5 valve superhet, overall size 14in. x 6in. x 2in., with mains transformer (250-0-250 v. at 60 m.a. 6.3 v. at 3 amps. 5 v. at 2 amps.) and L.M. & S. scale size 7in. x 5in., and back plate complete with supporting brackets and pulleys, drive drum, pointer and 2-speed spindle, all complete with instructions showing, among other things, how the string fits round pulleys and pointer.

★ **CONSTRUCTOR'S PARCEL (B)**
As above but with 4v. type transformer, same price.

★ **CONSTRUCTOR'S PARCEL (C)**
As above but without mains transformer. 6/6 plus 1/6 post and packing.

★ SPECIAL OFFER !
This is a beautifully made 10in. P.M. Speaker, a real precision product made by a very famous firm you will recognise immediately. It is undoubtedly a 10in. speaker with a 12in. quality reproduction, and has these special features ; (A) a solid diecast frame, (B) a dustproof speech coil arrangement, and (C) a patented speech coil suspension which gives wider frequency response. Speech coil is normal 2.3 ohm impedance. The correct retail price of this speaker is 35/-, but we are able to offer them, while stocks last, for 16/6 each, plus 2/6 carriage and insurance.

MAIL ORDER ONLY.

THE INSTRUMENT CO.,
11, Gunnersbury Lane, Acton, W.3.

500 YARDS BEAM!
This extraordinary American-type **FOCUSING TORCH** has not been seen on the home market for many years. Fitted with **FIVE U2** batteries, it is of solid brass, nickel-plated construction, with spare bulb container in base. Overall length 15in. Illustration shows torch compared with one of the batteries used. Adjustable Ring Focusing Head with pull-out carrying loop in base. Ideal for farmer and smallholder, pest destruction, motorists and cyclists, etc. Night watchmen will welcome its additional feature of being heavy enough for protective purposes.
Spare bulbs available.

ONLY **22/6** Post free

A.C./D.C. 1/16h.p. MOTORS
Easily converted from one of our Power Units 35A. Full wiring diagram given. Brand new in steel case with full smoothing and starter relay. Approx. 4,000 r.p.m.
20/- each. Carriage and packing 5/-

THIS MONTH'S SNIP
Brand new and guaranteed
P.M. SPEAKERS
3½in. dia. **8/-** each. *Postage 9d. extra.*

D.C. BATTERY CHARGERS
Motor generator, suitable for D.C. charging, in steel case and complete with full smoothing system including carbon pile voltage regulator. Input 24 v. D.C. Outputs 300 v. 260 mA ; 150 v. 10 mA ; 14 v. 5 amps. By application of D.C. mains to 300 v. output 12 v. batteries may be charged at several amps from the 14 v. output.
ONLY **20/-** Carriage and packing 5/-.

VISION WITHOUT VEXATION !
HEAD LAMP SET. Fits round the head like a miner's lamp, with long lead and battery box to clip on belt or slip into pocket, leaving hands free. Works off 4.5 v. battery. Complete with bulb, clips, headband, etc.
NEW and UNUSED **5/11** Post free
or with battery ready for use **7/11**

W.B. JEWEL EXTENSION SPEAKERS
In handsome cream cabinet, comprising 5in. P.M. speaker with multi-ratio output transformer and volume control.
BRAND NEW **36/-** Post and packing 2/-.

Have you seen the
M.O.S. NEWSLETTER
in its new format?
Now in magazine style.
Brings you the news and goods of the world.
SEND 6d. FOR SPECIMEN COPY.

M·O·S MAIL ORDER SUPPLY CO., The Radio Centre, 33, Tottenham Court Rd., London, W.1. MUS. 6667-8-9

ANOTHER WINNER FROM WALTONS
Once again we have been fortunate to secure another unit which represents amazing value to-day. These are the Transmitter portion of the Type 58 Walkie Talkie. To conform to Post Office regulations these have been partly stripped by the Ministry of Supply before release, but this only consists of removal of parts, and remaining components are in every way as new. These compact chassis are ideal for Short Wave Receivers, Battery Receivers, etc., but they are actually sold by us for the parts contained therein, which include :—
1 .0002 air spaced variable condenser on ball bearing fitted with slow motion drive and dial.
1 .0025 ditto.
1 midget microphone transformer to suit carbon microphone.
1 single pole 8-way rotary wafer switch complete with knob.
1 2 pole 6-way ditto.
1 double pole change over push switch.
3 postage stamp trimmer condensers.
1 Westinghouse W.1 Westector.
1 500 micro-amp. meter rectifier.
2 octal valve holders.
2 20 ohm volume controls (ideal for speaker control).
2 standard jack sockets.
Several tag strips.
OUR SPECIAL PRICE is 10/6 per unit, or 2 units for 17/6.
Send S.A.E. to-day for latest lists.
WALTON'S WIRELESS STORES,
203, Staveley Road, Wolverhampton

QUICKER CLEANER — CHEAPER
A Perfect Finish with all **PAINTS, DISTEMPERS, CELLULOSE,** etc. Any Liquid that flows.
FITS ANY VACUUM CLEANER
Approved by Electricity Board.

With 2 jets and instructions **19/6**
Extra jar, 1/8.
Connection for Bag Type, 2/-.

● Press Button Control.
● Saves Brushing. ● Can't go wrong.
● Simple to use. ● Makes better job.

WRITE
UNICO WHOLESALE
(Dept. P.M.),
51, THE MALL, W.5.
Trade enquiries invited.

MODEL ENGINEERS
FOR THE TURNER :
Lathes from 1⅝in. to 5in. Bench Millers. Drilling Machines. Hand Bench Shaping Machines.

FOR THE WOODWORKER :
Wood Turning Lathes 3½in.—5½in. centre height. 4½in., 7in. and 10½in. Ball Bearing Planers at competitive prices. 6in. and 12in. Saw Benches, Sanders, Grinders, Jigsaws.

Perspex, Catalin and Acetate Sheets always in stock.

NUTTALL'S (LATHES) LIMITED,
MANSFIELD, NOTTS.

GALPINS
ELECTRICAL STORES
408, HIGH STREET, LEWISHAM, LONDON, S.E.13.
Tel : Lee Green 0309. Nr. Lewisham Hospital.

TERMS : CASH WITH ORDER. NO C.O.D.
THURSDAY EARLY CLOSING.

MAINS TRANSFORMERS. 230v., 50 cys., 1 phase input, 700/0/700v., 70 mA., 4v., 2 amps., 12v. 1 amp. output, 25/- each, post 1/6. Another Auto wound "Booster" Transformer tapped 0, 200, 215, 235, 250 and 265v. at 1.25 amps., 10/6 each, carriage 1/-.

PREPAYMENT 1/- SLOT ELECTRIC LIGHT CHECK METERS. All electrically guaranteed. 200-250v. 50 cys., 1 ph., A.C. input, 2½ amp. load, 27/6 each ; 5 amp. load 35/- each ; 10 amp. load 42/6 each ; 20 amp. load, 50/- each ; carriage 2/- extra, in quantities of 1 dozen or more a special discount of 10 per cent.

MAINS TRANSFORMERS. 200-250v. 50-1 ph. in steps of 10v. output 500-0-500v. 300 mA. 6.3v. 8a., 6.3v. 8a., 6.3v. 4a., 5v. 4a., 4v. 4a. at 67/6 each, another same input, outputs, 450-0-450v. 300 mA. 6.3v. 8a., 6.3v. 8a., 4v. 4a., 5v. 4a. at 62/6 each.

ELECTRIC LIGHT CHECK METERS. Quarterly type, for sub-letting garages, apartments, etc., all fully guaranteed electrically, for 200-250v. A.C. mains, 50 cys. 1 phase, 5 amp. load, 17/6 each ; 10 amp. load, 20/- ; 20 amp. load, 25/- each ; 50 amp. load, 37/6 each ; 100 amp. load, 45/- each. Carriage 2/- extra on each. Special discount of 10 per cent. on quantities of 1 dozen or more.

EX-R.A.F. ROTARY CONVERTERS, D.C. to A.C., 110v. D.C. input, 230v. A.C. 50 cycles at 250 watts output at £7/10/- each, carriage 7/6. Another 24v. D.C. input 50v. 50 cycles at 450 watts output at £4/10/- each, carriage 7/6. Another 24v. D.C. input 230v. 50 cys. at 100 watts output at £3/5/- each, carriage paid. Another 24v. D.C. input 50-100v. 500 cycles 1 phase at 300 watts output at 82/6 each, C/p. All these converters are by well-known makers, condition as new.

RESISTANCE (DIMMERS). 700-750 watts, worm wheel control, as new, 27/6 each, carriage 2/-, total resistance 60 ohms.

MAINS TRANSFORMERS INPUT 200/250 VOLTS. 50-1 in steps of 10v. output tapped 0, 12 at 24v. at 10-12 amps, 47/- each, ditto as above, but at 25/30 amps. output, 68/6 each.

MAINS TRANSFORMERS INPUT. 200-250v. in steps of 10v. output 350-0-350v., 300 mA. 4v. 8a., 4v. 4a., 6.3v. 6a., 6.3v. 2a., tapped at 2v. (Electronic) at 57/6 each ; another same input as above, output 500-350-0-350-500v. 250 mA. 5v. tapped at 4v. 4 amps twice 6.3 v. tapped at 2v. 2 amps., 67/6 each.

MAINS TRANSFORMERS. 200-250v. input in steps of 10v. output 350-0-350v. 300 mA. 4v. 4a., 5v. 4a., 6.3v. 8a., 6.3v. 8a., 62/6 each. Smoothing chokes 10 henry 100 mA. 200 ohms D.C. Resistance, 5/- each.

EX-GOVERNMENT AUTO-WOUND TRANSFORMERS (as new), 1,000 watts output, 115-230v. or vice versa, £4/10/- each, carriage 5/-. Another 1,000 watts from 5 to 230v. with 32 various tappings inclusive of 110, 150, 60, 90, etc., etc., all tapping at 1,000 watts, £5/10/- each carriage paid.

EX-R.A.F. MICROPHONE TESTERS, these contain a 2½in. scale 0 to 450 Microamp Meter shunted to 1 mA. calibrated 0 to 10v. Moving Coil, complete with 1 mA. Rectifier, "Mike Transformer," etc., all contained in polished wood box, as new, 17/6 each.

EX-NAVAL SOUND POWER TELEPHONE. Hand-sets comprising earphone and microphone, no batteries required, complete with wall brackets, as new, 15/- per pair, 1/6 post.

MAINS TRANSFORMERS, 230v. A.C. 50 cys. input, 17½v. 50 amps output, 52/6 each, carriage 5/-. Another auto wound, 14 and 17v. output at 30 amps. 35/- each, carriage 3/6 Another, with 2/4v. 20 amp windings. 25/- each. P/f.

A.C. ALTERNATORS by well-known makers, condition as new, output 80 volts 60/70 cycles at 2½ amps. separately excited 2,300 R.P.M., £4/10/- each, carriage 10/-.

D.C. GENERATOR OR MOTOR by well-known makers, as new (Generator), 110 volts, 10 amps, 2,300 R.P.M., shunt wound, 4 pole, £7/10/- each, carriage 10/-. As above as Motor 1½ h.p.

EX-R.A.F. D.C. TO D.C. MOTOR GENERATORS, 24-28 volts input, 1,200 volts at 72 mA. output, as new, 10/- each, post 1/-.

EXTENSION P.M. SPEAKERS by well-known makers (new boxed), 3½ in. will handle 1½ watts, 7/6 each, post 9d.

It Pays to Purchase
ELECTRADIX BARGAINS

THE FAMOUS CHOREHORSE lighting plant for small house or bungalow, 300 watt, 12/15 volt, 20 amp., complete with switchboard and fuel tank. 1 h.p. single-cylinder four-stroke engine, air-cooled, in first-class condition, £17.

MOTOR PUMPS. 230 volt A.C., for garden fountain, etc., compact unit by Stuart Turner, £5/15/- (foot valve and strainer, 16/-). 12 volt for caravan or boat, lift 2ft., throw 10ft., 100 g.p.h., £5/10/-.

PUMPS. Rotary Suds Pumps, lift 8ft. head 35ft., capacity 60 g.p.h., with pulley, £4.

DYNAMOS for battery charging on boats, etc., for use ashore or afloat. 24 volts 30 amps 4 pole 1,000/1,200 r.p.m., shunt wound, fan cooled, £17 each. 24 volts 18 amps 1,000 r.p.m., shunt, fan cooled, £15. 24 volts 18 amps 1,200 r.p.m., encl. ven., shunt wound, £12/10/-. Carriage extra.

MOTORS. A.C. 50 cycle 230 volts ½ h.p. new 1,425 r.p.m., £5/10/-. 1/3rd h.p. 230 volts 50 cycles A.C. capacitor start 1,425 r.p.m., new £8/10/-. Reconditioned motors, G.E.C. 230 volts A.C. ½ h.p. 1,425 r.p.m., £4. 3-phase 50 cycles ½ h.p. 440 volts 1,425 r.p.m., £7.

MOTORS, D.C. ¼ h.p., 110 volts 1,400 r.p.m. A.E.C., 30/-.

IRONCLAD SWITCHGEAR. We have a large stock of ironclad fuses and switchfuses, new condition, by leading makers, 15-30-60 amps. Write for special leaflet, "P.M."

LIQUID LEVEL INDICATORS with ball float geared to watch dial panel gauge for 9in. rise and fall, 7/6. Level indicators with ball float, less meter, 3/6.

METERS.—D.C. moving coil voltmeters, 2in. panel type, 0-30 volts, 4/-. Ammeters, 50-0-50 amps, with shunt, 5/-. Ammeters, 0-20, 4/- each. Voltmeters, 2½in. flush panel, 100-0-100 volts, 6/-.

TRANSFORMERS for soil warming. Foster 100 watt size, 50 volts 2 amps output, 230 volts input, double wound, 15/-; postage 2/-. B.T.H. 200/230/250 volts to 2 volts 20 amps and 75 volts 6 amps with 15 taps, 45/-; carriage 5/-. Auto Transformers, 230/110 volts 85 watts, 25/-; 150 watts, 35/-; 1 kW., £7/10/-. We can supply transformers for all purposes—send us your enquiries.

RESISTANCES, variable wire wound, laminated brushgear, 3 ohms 10 amps, 12/6. 1.2 ohms 15 amps, 10/-. 6 ohms 6 amps, 15/-. 300 ohms ½ amp, 15/-. 290 ohms .45 amp, 15/-. Isenthal Geared Resistances for lab. work, 60 ohms 2.8 amps, 25/-.

DIMMING RESISTANCES, 100 ohms ¼ amp, 2/-, post 6d. Stage Dimmers, all sizes to 5,000 watts; send for prices.

THE DEM. CONTINUITY TESTER, a self-contained circuit tester in wood box with battery and single 'phone, 7/6, post 1/-.

TELEPHONES. Ex-G.P.O. wall-type set of Constructors parts for office or garage use, comprising Bracket Mike, Mag. Bell, Transformer and condenser, Switch-hook and Receiver, connection strip in polished box 8in. x 6in. x 3½in. Hand Mag. Generator and wiring diagram, 35/-, carriage 5/- extra.

MORSE KEY AND BUZZER for practice. A.M. Key perfect balance, with insulated knob and high-note buzzer in metal case, 4/6, post free. Townsend high-note buzzer with plat. contacts, 5/-. G.P.O. twin coil test buzzer, 2/6.

HEADPHONES. Single L.R. 'phone with headband and cord, 2/-; double headphone suitable for crystal set reception, with headband and cord, 5/-, postage 9d. Moving coil, single 'phone units, 45 ohms resistance, ¾in. coil, 5/-.

MAGNETO BELLS, in polished box, 9in. x 6in. x 3½in., with condenser, connection strip, switch-hook and contacts, 5/-. G.P.O. Candlestick Mike with switch-hook and cords, 7/6. Postage 1/6.

ELECTRO MAGNETS. D.C., 6 volts, weight 10oz., lift 4lb. on 6 volts, 3lb. on 4 volts and 1½lb. on 2 volts, 5/- each, post 6d.

MAGNETS. Swift Levick S.L.S.36 Instrument type circular horseshoe, 1¾in. dia., ⅜in. thick, with ⅛in. polar gap, drilled poles, weight 2oz., lift 3lb., 2/6 each; six for 12/6.

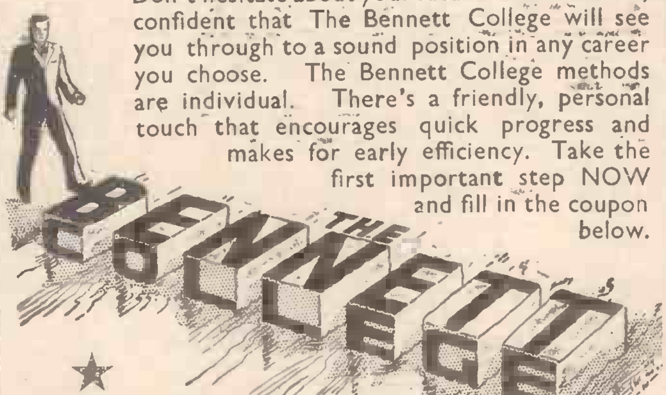
THE ALNI DISC MAGNET, ⅝in. dia., ⅜in. thick, 3/16in. centre hole, a powerful midget in pot with keeper, 3/6. Permanent flat bar magnets, 2¼in. x 1⅛in. x ⅛in., 2/- pair.

TRENCH TRANSMITTERS in canvas-covered box, a bargain for break-up, 12in. x 9in. x 8½in., with ebonite panel fitted 10-way Rotary Stud Switch with laminated brushgear, litz wound variometer coil, coupling, valve holder, folding Morse key, etc., 3/6, carriage 2/6. Carriage to N. Ireland, 5/-.

ELECTRADIX RADIOS
214, Queenstown Road, Battersea, London, S.W.8
Telephone: MACaulay 2159

The STEPPING STONES TO SUCCESS!

Don't hesitate about your future! Go forward, confident that The Bennett College will see you through to a sound position in any career you choose. The Bennett College methods are individual. There's a friendly, personal touch that encourages quick progress and makes for early efficiency. Take the first important step NOW and fill in the coupon below.



★ ***CHOOSE YOUR CAREER***

- Accountancy Examinations
- Agriculture
- A.M.I. Fire E. Examination
- Applied Mechanics
- Auctioneers and Estate Agents
- Aviation (Engineering and Wireless)
- Blue Prints
- Boilers
- Book-keeping, Accountancy and Modern Business Methods
- Builders' Quantities
- Building, Architecture and Clerk of Works (A.R.I.B.A. Exams.)
- Cambridge Senior School Certificate
- Carpentry and Joinery
- Chemistry
- Civil Engineering
- Civil Service
- All Commercial Subjects
- Commercial Art
- Common Prelim. E.J.E.B.
- Concrete and Structural Engineering
- Draughtsmanship, all Branches
- Engineering, all Branches, Subjects and Examinations
- General Education
- G.P.O. Eng. Dept.
- Heating and Ventilating
- Institute of Housing
- Institute of Municipal Engineers
- Journalism
- Languages
- Mathematics
- Matriculation
- Metallurgy
- Mining, all Subjects
- Mining, Electrical Engineering
- Motor Engineering
- Naval Architecture
- Novel Writing
- Plastics
- Play Writing
- Plumbing
- Police, Special Course
- Preceptors, College of
- Press Tool Work
- Pumps and Pumping Machinery
- Quantity Surveying—Institute of Quantity Surveyors Exams.
- Radio Service Engineering
- Radio (Short Wave)
- Road Making and Maintenance
- Salesmanship
- Sanitation
- School Attendance Officer
- Secretarial Examinations
- Sheet Metal Work
- Shipbuilding
- Shorthand (Pitman's)
- Short Story Writing
- Social Welfare
- Structural Engineering
- Surveying (R.I.C.S. Exams.)
- Teachers of Handicrafts
- Telecommunications (City and Guilds)
- Television
- Transport Inst. Examinations
- Viewers, Gaugers, Inspectors
- Weights and Measures Inspectors
- Wireless Telegraphy and Telephony
- Works Managers

If you do not see your own requirements above, write to us on any subject. Full particulars free.

COUPON. CUT THIS OUT

IF YOU ATTEND TO THIS NOW IT MAY MAKE A WONDERFUL DIFFERENCE TO YOUR FUTURE

To DEPT. 76, THE BENNETT COLLEGE LTD. SHEFFIELD, ENGLAND

Please send me (free of charge) particulars of...

Your private advice about...

(Cross out line which does not apply)

PLEASE WRITE IN BLOCK LETTERS

NAME...

ADDRESS...

(1.5.50) ....

THE
BURGESS vibro-tool

*** *Writes on STEEL, GLASS WOOD or PLASTICS***

The Vibro-Tool enables you to write on Steel, Glass, Wood or Plastics as easily as writing with a pencil.

Operates off 220-250 volt, 50 cycle A.C. Supply. Just connect to any electric light socket or plug point.

Sole distributors for Scotland: H. A. Dawson-Bowman, 8/10, Beech Avenue, Glasgow, S.1.

Complete with standard engraving point. 52/6
De Luxe Kit 97/6

BURGESS PRODUCTS COMPANY, LTD.,
Vibro-Tool Dept., Hinckley, Leicester

Meters. 10v., 2½in. Rectifier (a.c.), in wooden carrying case, 14/6; 15v., 2½in., m/c., 9/6; 150v., 2in., m/c., 10/-; 3,500v., 3½in., m/c., 20/-; 6,000v., 3½in., m/c., 57/6; 15/600v., 2in., m/c. double reading, 8/-; 100 m/a., 2in., m/c., 7/6; 3.5 amp. 2in., T.C., 5/-; 4 amp., 2½in., T.C. in case with switch, 7/6; Meter Movements, 2in. size with magnet and case (500 microamp), 2/6. All meters post extra.

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 8/-, post 6d. BELLS for use with either the above or batteries, 6/-, post 6d. BUZZERS 3/-, or Heavy Duty 4/6, post 5d.

Ex-R.A.F. 2-valve (2-volt) **Microphone Amplifiers** as used in 'plane inter-com., in self-contained metal case; can be used to make up a deaf aid outfit, intercommnication system, or with crystal set, complete with valves, 20/-, post 1/6. Useful wooden box with partitions to hold amplifier, 2/- extra. Ditto, less valves, 10/-. One valve amplifier, complete with valve, 9/6, post 1/-.

Hand Microphones, with switch in handle, and lead, 4/-. Similar instrument, moving coil, 7/6, post 6d.

Mike Buttons (carbon), 2/- **Moving Coil,** 4/6; **Transformers,** 5/-. All post 4d. each.

Sparking Plug Neon Testers, with vest-pocket clip, 3/3, and with gauge, 3/6, post 3d.

Soldering Irons.—Our new streamlined Iron is supplied with two interchangeable bits, one each straight and curved; 200/250 v. 50 watts, 9/-, **Standard Iron** with adjustable bit, 200/250 v., 60 watts, 9/6. **Heavy Duty Iron,** 150 watts, 12/6, all post 6d.

Crystal Sets. Our latest Model is a real radio receiver, fitted with a permanent crystal detector. Have a set in your own room. 9/6, post 6d. De Luxe Receiver in polished oak cabinet, 18/6, post 1/-. 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., 15/-, 23/-, and super-sensitive, 30/- a pair, post 8d.

New Headphones, 10/- a pair. Balanced armature type (very sensitive), 12/6 a pair. Both post 6d. New **Single Earpieces,** 3/6. Bal. armature type, 4/6; ex-R.A.F. earpiece, 2/-, post 4d. **Headphones,** in good order, 4/6 and 5/6 (better quality, 7/6), all post 6d. **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.)**

Money refunded if not completely satisfied.

HIGHSTONE UTILITIES
58, New Wanstead, London, E.11.

New illustrated List sent on request with 1d. stamp and S.A.E. Letters only

QUERIES and ENQUIRIES

A stamped, addressed envelope, three penny stamps, and the query coupon from the current issue, which appears on page 64 (THE CYCLIST), 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.

Dyeing a Tapestry Carpet

I WISH to dye a tapestry carpet. Can you please suggest an effective method?—C. Hackney (Doncaster).

THE only effective method of dyeing a carpet is by immersion. The carpet must be immersed in a 5 or 6 per cent. solution of the dye. The dyebath is then gradually brought to boiling-point during one hour, maintained at that temperature for 10 minutes and then allowed to cool. The carpet is then taken out and well rinsed. In works practice, carpets are put on a "jig" and passed slowly backwards and forwards through the dyebath.

There are proprietary dye materials which claim to be able to dye carpets by simple brushing or dabbing on of the hot solution. These are notoriously unreliable, and many good carpets have been ruined by their use. It is true that such preparations stain the material of the carpet satisfactorily, but the trouble is that such stain is not fixed in the fibre. It easily comes off, "runs" and "bleeds," as the terms are, so much so, indeed, that the dye may even come off on to the soles of shoes which have trodden on the carpet.

There is no way of permanently dyeing a carpet other than the one above-mentioned, and this is really a task which is beyound the resources of the average household.

Removing Paint from Stonework

CAN you inform me of any good economical method of removing paint from sandstone garden walls and gateposts? Also, how can the stone be kept clean after removing the paint?—R. E. Jackson (Preston).

A COMMERCIAL paint-remover would be too expensive for your purpose and, because of the rough surface of the stonework, we doubt whether it would be very efficient. You could get the paint off the stone and the gatepost by use of a paraffin blowlamp, but this process would leave "burn" marks behind.

On the whole, we think that you would be advised to use caustic soda for the job. Dissolve 1 part of caustic soda in 5 parts of water. Do not make up this solution in an ordinary galvanised bucket, for the solution will dissolve the zinc coating of the bucket. Use an iron pan for the purpose, or a glass or earthenware vessel, but *not* an enamelled vessel.

By means of an old brush, dab the solution (preferably hot) on to the stonework. Then, with another old brush, vigorously work away the softened paint. Finish up by swilling the surface with plenty of water. The process can be repeated, if necessary.

After you have removed all the paint in this manner, do not omit to use plenty of water in swilling the stonework. The idea here is to get rid of any of the caustic solution which the stone surface may have absorbed. If the caustic is not all removed, it may cause the stone surface to flake and crumble. Use only plain water for swilling.

There is no special preparation which you can apply to the bare stone in order to keep it clean; usually the rain sees to that.

"Blooming" Optical Surfaces

IS there a formula for a "dope" which can be painted on lenses for cameras and other instruments to imitate the new "blooming" process for the purpose of increasing light admission?

What firms would undertake the work of "blooming" plain lenses?—C. Bailey (Belfast).

LENSES and other optical surfaces are "bloomed" by placing them in a high vacuum and by subjecting them to a fluoride vapour, whereby a very thin and invisible film of a metallic fluoride is deposited permanently on the glass surface. There is no "dope" or any similar material which could be applied to the glass surfaces either by brush, or by spray.

A number of London firms are now able to undertake the "blooming" of lenses, etc., at moderate charges. You should send your inquiry to any of the following:—Messrs. C. Baker, 244, High Holborn, London, W.C.1. Messrs. R. J. Beck, Ltd., 69, Mortimer Street, London, W.1. The Cambridge Instrument Co., Ltd., 13, Grosvenor Place, London, S.W.1. Messrs. Wallace Heaton, Ltd., New Bond Street, London, W.1.

Leather Cuttings for Barrelling

I HAVE a large number of stamped tinplate articles which have to be barrelled to remove the rough edges, as they are too numerous to handle individually.

Up to now I have used plain sawdust in the barrel but the articles come out badly scratched. Can you give me the name of any chemical to mix with the sawdust, to give a polish, or a substitute for the sawdust, which must be non-poisonous?—A. R. Beasley (Ferndown).

YOU have probably been using a mixed sawdust, so that particles of the harder woods have been responsible for the scratching of the metal surface. You can obtain soft barrelling sawdust from Messrs. Wm. Canning & Co., Ltd., Great Hampden Street, Birmingham, but this is relatively expensive. We think that you would do better with a mixture of leather cuttings and dry lime. Tripoli powder, powdered pumice and powdered rotten-stone are all excellent abrasives, the pumice being the most vigorous. These can all be obtained from the above address.

The actual conditions of barrelling have some effect on the condition of the articles so treated because if the barrel is rotated too quickly, the articles cling together as one mass and are taken round with the barrel. An average barrelling speed is from 30 to 60 r.p.m.

All the abrasive materials above mentioned are entirely non-poisonous. Leather cuttings and leather powders are particularly useful because they separate the articles and prevent the edge of one article scraping against the surface of another article and thus scratching it severely.

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.

Colouring Balloon Fabric

CAN I stain, or dye, the silver surface of some balloon fabric, still keeping the metallic appearance; if so, what with? Also, where can I obtain a small quantity of coloured, transparent, lacquer, red and green, for colouring lamp glasses?—R. K. Hall (Tottenham).

YOU cannot stain or dye the surface of your balloon fabric, because this is of the "aluminised" type. That means that the fabric itself has been coated with fine aluminium flakes which, lying close together and in close contact, obscure the fabric and, in effect, give it a coating of metallic aluminium which a dye solution would be unable to penetrate. On the other hand, if you attempted to colour the fabric by means of painting, the applied paint would lie on the aluminium coating and would thus completely obscure the latter.

The only way of getting round your problem would be to paint the existing fabric with a blue metallic paint mixed with clear cellulose solution. You can obtain metallic powders of this nature from Messrs. Johnson & Bloy, Ltd., Metana House, Hind Court, Fleet Street, E.C.4, but you would find them rather expensive.

Many large paint shops supply stained cellulose lacquer. You can make this for yourself if only a few small lamp glasses have to be coated. Dissolve half a tube of a cellulose cement (of the "Duofix" type) in an equal bulk of amyl acetate and add to the solution about one-quarter of its bulk of a strong solution of dye in methylated spirit. Then paint the coloured solution resulting on to the lamp-glass, or, preferably flow the solution on to the lamp-glass so that it presents a perfectly clear and smooth surface. Then set the glass away to dry for a few hours in a dust-free place.

When working with such glasses, see that they do not get too hot.

Removing Waterglass Stains

CAN you assist me with the following problems? I have a rectangular glass tank 16in. x 11in. x 10in. deep which has contained waterglass for egg preservation, and although it has not been used for some time, I now wish to use it for another purpose. The difficulty is that the waterglass has adhered to the container even though it has been stored empty.

Can you suggest a solution which will remove the waterglass stains? Soaking in water, and the use of various scouring powders has had no effect.—A. J. Slatter (Worcester).

WATERGLASS (sodium silicate), on exposure to the air, slowly becomes insoluble. It also exerts a sort of etching or corrosive action on ordinary glass, so that if you do succeed in removing the adhering waterglass from the glass container, the glass walls will, probably, be found to have been permanently "matted" or rendered opaque, as if they were covered with a whitish film. This is due to the attack of the waterglass on the actual glass itself, and there is no method of removing the opaque film.

If the waterglass had dried and hardened on the sides of the glass, we suggest a gentle scraping to remove it. If this fails, try softening it with a strong solution of caustic soda (1 part caustic soda—3 parts of water). A paste of lime and soda may help, also, but, apart from caustic soda treatment, we suggest manual scraping.

The hard, white material which you wish to remove is silica (silicon dioxide, SiO_2). Since it is insoluble in water, it cannot be dissolved away.

Picture Restoration

I HAVE an old Dutch oil painting on a copper ground. Small round blisters have appeared leaving small specks of copper exposed.

Would you please suggest a suitable treatment to prevent further deterioration?—J. Rodber (Bridport).

YOURS is a very difficult problem, calling for great skill and the utmost patience. It is not easy, either, for us to advise you because we have not seen the painting in question and because we are uncertain whether it has been varnished or otherwise, and whether the varnish has dried, become brittle, and pulled the paint layer off the copper support. All these little details, trivial as they may seem, have to be considered before deciding on a mode of treatment and restoration. In the absence of these details, we can only give you *approximate* advice without guaranteeing its result.

Assuming that your painting has been varnished with a hard varnish, begin by removing the varnish very carefully by rubbing the picture surface with a cloth charged with butyl alcohol. A quicker alternative, is to wipe the surface down with pure turpentine. This will soften the varnish. The blisters and their immediately surrounding areas are painted over with turpentine and left for a week or more, when on being pressed with a needle they give an indication of being more flexible. They are then very carefully punctured with a needle. The needle is withdrawn, and a small drop of cellulose cement ("Durofix" cement—sold in tubes) is introduced on the end of another needle into the cavity within the blister. The latter is immediately pressed downwards and flattened in contact with the cement within it. Every blister requires to be treated in this manner, and each manipulation is as delicate as a surgical brain operation.

The blisters are caused (assuming that the painting has been well executed) by hanging the picture in too warm and dry a position, or by allowing it to become overheated by the rays of the sun.

Depositing Copper on Glass

IS it possible to deposit copper on to glass by a chemical process (similar to silver), by using copper sulphate or copper chloride?

Also, I understand that silver is copper backed by the electroplating method. Is it possible to deposit copper to silver by the same chemical process (not electroplating); that is, copper to glass; copper to silvered glass?—A. Carter (London, N.).

WE presume that you wish to deposit metallic copper in mirror form on to glass. This is quite possible, but the process is more difficult than the analogous one of depositing silver in mirror form. The procedure is as follows: Make up a solution (strength immaterial) of copper sulphate in water. Add caustic soda solution (1 in 6) to this until the precipitation is complete. Let the precipitate settle. Wash it with water several times, pouring away the washing water, but being careful not to lose any of the precipitate. This precipitate consists of copper hydroxide. Take this precipitate and dissolve it in strong ammonia, adding as much of the precipitate as the ammonia will dissolve, so that a saturated solution is obtained.

Now dissolve 1 part of phenylhydrazine in 2 parts of water. Heat gently until a clear solution is obtained. To this solution add one-half of its volume of the warm saturated solution of copper hydroxide in ammonia, prepared as above. Finally, dissolve 10 parts of caustic potash in 90 parts of water, and add this solution hot to the phenylhydrazine mixture with continuous stirring, until a slight permanent precipitate of copper hydroxide is formed. This is the "coppering" liquid. It should be colourless or pale yellow. It must be used at once.

The glass surface to be coppered should have been washed with hot soap solution, treated with dilute nitric acid (1 in 6) and then with a 10 per cent. caustic soda or potash solution. The copper solution is flowed on to the glass, and the latter is heated above a steam bath for about an hour. Tarry matter is formed and bubbles of nitrogen are evolved. The copper mirror is deposited during this time. Finally, the coppering liquid is poured off, the surface is gently rinsed with water, allowed to dry of itself, and finally lacquered.

Silver mirrors *can* be copper-backed by electroplating, but this process is not usual. It would be possible to deposit metallic copper on to silver by the above process, but it would be a rather difficult, not to say a wasteful task.

To deposit fine copper on to silver, the electrolytical method would be by far the best, using an acidified solution of copper sulphate, or, for the very finest results, a solution of copper cyanide in potassium cyanide. For particulars of such processes, you should refer to any textbook on electroplating, as, for example, S. Field and A. D. Weill: "Electro-Plating" (Pitman).

Painting Wire Frames

I HAVE a number of wire frames which I desire to paint or enamel a dead white, and not the normal yellow or creamy white so often seen. I have tried dipping the frames in a bath of brushing cellulose, but the tendency of the cellulose is to blob in certain places. Is there any special paint which would prevent this blobbing?

A number of these frames are too large to conveniently dip in cellulose, and I should be pleased if you could suggest any method of coating these with some rustproof preparation which will be pleasant to the eye. Again, white would be the preferable colour.

The frames in question are soldered and during the soldering, resin tends to run at the joints. I find this resin extremely difficult to remove. Could you suggest any preparation which would quickly do this?—A. Godfrey (Halifax).

THE "blobbing" trouble about which you complain is entirely due to your practice of actually dipping the wire frames into the paint or lacquer. The frames take up an excess of paint, which subsequently drains away from them and thus forms "blobs." Any paint or lacquer of normal paint viscosity would have this effect.

You must apply the paint by simply brushing, or, better still, by spraying. This will cure the trouble.

If you want a perfectly dead white paint, use a clear cellulose lacquer (or oil varnish) in which has been worked a quantity of fine-ground titanium oxide, which is an entirely non-yellowing white pigment. It should be obtainable locally from any paint and colour supplier. If otherwise, apply to British Titian Products, Ltd., Billingham-on-Tees, Co. Durham.

A mere trace of ultramarine blue mixed with the white oxide will intensify the dead whiteness, but do not overdo the blue, otherwise the purity of the white will be destroyed.

Mixed as above, you will obtain a gloss paint. If you wish to make a flat "white" paint, dilute the mixed paint with an equal bulk of thinner.

If you can fill a shallow tray with hot paraffin oil and immerse a frame in the oil, the surplus resin from the joints will quickly be dissolved away. If this cannot conveniently be done, you will have to wipe the soldered joints with a cloth saturated with paraffin or benzine. Note the latter solvent is especially inflammable, for which reason it is advisable not to warm it, although, of course, any warm or hot solvent has a more rapid dissolving action than a cold one.

Episcope Queries

I AM endeavouring to build an episcope, to be used with the normal room lighting reduced as little as possible. To keep the light intensity at maximum I wish to use a short range, short focus (say 5in.), wide-angle lens, with as large an aperture as possible. Can you advise me of such a lens, giving definition suitable for episcope work? Can I use an 8in. "Pentac" that I have, with a supplementary lens, and still retain sharp definition?

For lighting I am considering two 500 watt or 1,000 watt tungsten lamps, but wonder whether high efficiency mercury-vapour lamps could be used instead. Does the thickness or quality of the glass, against which the picture is pressed, matter?—S. T. Stow (Harpenden).

THE most suitable type of lens to use with any given episcope depends entirely on the design and dimensions of the instrument itself. Usually, a lens of 8in. focal length is the best. This should preferably be of the anastigmatic type because it gives critical definition over its whole field. The lens should have the widest aperture possible in order to give a more brilliant image. We quite agree that a shorter focus lens (5in. or 6in. focus) will give a more brilliant image for a given light intensity because it will enable the instrument to be moved nearer the screen.

If your existing "Pentac" lens is in good condition, the use of a supplementary lens which will cut down its focal length should be quite possible without very appreciably diminishing its definition, but you must remember that when you introduce a supplementary lens into the system you invariably add two more reflecting surfaces so that a little of the fine definition and brilliancy is nearly always sacrificed.

Mercury-vapour lamps would not do for the episcope illuminant. You will be much more satisfied in keeping to the usual tungsten projection lamps. These give a whiter and a more concentrated light.

The thickness of the glass sheet against which the picture is pressed in the episcope is quite immaterial. What does matter is the surface condition of the glass and its optical quality. That is why the glass should be "optically worked" to give a reasonable degree of flatness or else should be of good ordinary plate glass quality. You will, we think, be quite satisfied by using plate glass. Ordinary glass is seldom surface-flat. Hence, it distorts images, as you will often observe by looking out of a household window. Provided that the glass, therefore, is free from a pronounced green colour and imperfection, its actual thickness does not matter. Its surface flatness, however, is a very important consideration. The flatter the surface the better the definition.

Testing Earth Connections of Motor

I WISH to test the effectiveness of the earth connections of a motor. This is earthed by means of a copper plate sunk in the ground. The resistance of this should only be 1 ohm as far as I can ascertain. Could you please furnish me with the necessary information to enable me to carry out this test?

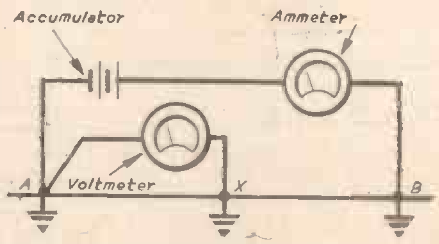


Diagram showing method of testing the earth connections of a motor.

Also, if possible, could I have a diagram of the connections for the above test?—Sergt. Corcoran (Corps of Engineers).

FOR efficient tests, A.C. at power frequency (obtained from the mains through a double-wound transformer) or else a special continuity tester incorporating a hand-driven generator are advised. If the above equipment is not available we suggest you use a 4-volt accumulator together with an ammeter and voltmeter, as shown in the accompanying diagram. First prepare an earth connection B at such a distance from the earth electrode A to be tested that the resistance areas of the two earth connections or electrodes do not overlap, say, about 40 yards away. Connect the ammeter and accumulator between the electrodes and measure the current C passed through the earth between the electrodes. Drive a connecting spike X in the ground about midway between A and B; the connection X need not be of very low resistance. Connect the voltmeter so as to measure the volt drop between A and X. Then the resistance of A is equal to the volt drop between A and X divided by the current C passed between A and B. In order to ensure the resistance area of A and B do not overlap two more readings should be made; one with B 20ft. nearer to A, and the other with B 20ft. farther from A. If the results are substantially the same the mean of the results may be taken as the resistance of A. If not, the tests should be repeated with B much farther from A.

The resistance of the earth electrode A should be kept as low as possible, and it should be remembered that the resistance may vary with weather conditions. The total resistance to earth, which includes the earth electrode and the earthing conductor to the remotest point of the circuit, should not exceed 2 ohms, and should not exceed the value E/C, where E is the voltage above earth of the system, and C is the setting of the overload trips or the melting current of the fuses protecting the circuit.

Removing Iron Moulds

PLEASE let me know the procedure and/or substances used to remove fresh iron moulds on linen, etc. I believe there is a certain substance that may be purchased at the chemist's, or perhaps there is a commercial remover of which I am unaware.—W. H. Secker (Ramsgate).

AN effective liquid for removing iron mould from fabrics is a solution of oxalic acid of strength above 1 part of oxalic acid dissolved in 4 parts of water. Oxalic acid is a poison, but its use is quite safe and it will be supplied to you by any pharmacist who knows you personally and understands the purpose for which you require it.

The advantage of this oxalic acid process is that the acid does not harm the cloth in any way at all, so that the cloth can remain in the acid solution for any length of time without injury to it. When the acid solution is used hot, the iron mould very quickly disappears, After this, the cloth is merely washed well in warm water and allowed to dry in the usual way.

An alternative and more powerful process is to make a thin paste of chloride of lime and water. Then stir 1 part of the paste into about 8 parts of COLD water. Immerse the fabric in this solution for a few minutes Then, after lightly wringing out, immerse it in a solution made by diluting 1 part of acetic acid with 6 parts of water. This will eradicate the iron mark, but it will bleach the cloth. Hence, the method is not applicable to coloured or printed fabrics unless it is previously known that the dyes will resist the bleaching action. This treatment can be applied several times, but it should be borne in mind that, quite apart from the bleaching action on the cloth, the bleach solutions tend to "tender" the material and to deteriorate it. This however, should not occur as a result of one or two treatments, but in all cases, the treated material MUST be thoroughly washed with abundant water in order to get rid of every trace of the bleach. If this is not done the material will slowly but surely deteriorate afterwards as a result of the continuing action of traces of the bleach, particularly if it is subsequently exposed to sunlight.

All things considered, the oxalic acid treatment is the safer of the two, but it is slower and less energetic.

Liquid for Spirit Levels

WHAT is the nature of the liquid used in filling spirit level tubes? I am aware that there are a number of different mixtures in general use for this purpose, but I am concerned only with the particular greenish-coloured liquid used in the type known popularly as the "Cats Eye" level. In the event of the liquid being a mixture, I should be glad to have the formula.—J. S. Walden (Leeds).

THE yellowish solution used in spirit levels is generally a solution of fluorescein in industrial alcohol. Since you will not be able to obtain this spirit as a private individual, you will have to use rectified spirit, which is decidedly expensive owing to the excise duty which is levied on it. However, a single fluid ounce of rectified spirit should be ample for your purpose. In this liquid dissolve sufficient fluorescein dye to give the intensity of colour and shade which you require. Of course, you need not use fluorescein if you prefer any other colour. It is merely necessary to use a dye which is soluble in alcohol. You will be able to obtain such dyes (and also rectified spirit) from Messrs. Reynolds & Branson, Ltd., of Leeds, or Vicsons Ltd., 148, Pinner Road, Harrow, Middlesex.

Heat-resisting Cement: Painting on Wax Candles

CAN you please tell me how to make putty fire-cement that can be used for modelling? Also, what can I use for painting designs on ordinary wax candles?—M. L. Stephens (Southall).

THE following is a good heat-resisting cement: powdered pumice (9 parts, by vol.), asbestos powder (1 part).

The above mixture is slaked with waterglass (sodium silicate) to putty consistency. It dries a creamy-white. If you want to make a slow-drying putty, use less waterglass, and work in some raw linseed oil. But if it is to be used exclusively for fire-resisting purposes, do not use the linseed oil, since this is combustible.

For painting designs on ordinary wax candles the most convenient medium to use is artists' oil paint. That is to say, the ordinary tube oil colours which are sold at all dealers in artists' materials. Apply the paint thinly and undiluted. It will take about a week to dry. If the colour dries too dull for your liking, give it a thin coating of any type of spirit varnish.

Another way is to dissolve scrap celluloid in a mixture of equal amounts of acetone and amyl acetate until you have a thickish solution. Then grind dry powder colour into this so that you obtain a medium of paint consistency. Such paint will dry rapidly, but it is rather messy to make. You could, perhaps, get the same effect by grinding small portions of dry colour into portions of cellulose cement, as sold in tubes.

ATOM BOMBS

may have you worried, but you can forget them if you possess a copy of the new, revised "HOME CONSTRUCTOR'S HANDBOOK" (now in its seventh edition !). This justly famous book is crammed full of many good things for ALL radio beginners, servicemen, dealers, experimenters, hobbyists, etc.

- Eleven tested and guaranteed circuits, with full descriptions and parts lists.
- Feeder Units, Tuning Units and Superhets.
- Quality Amplifiers.
- Test Gear.
- Servicing and Constructional Hints and Tips.
- Resistance Colour Code, Charts, etc.
- Simple Formulae, etc.
- And many other interesting items.

We are proud to offer this most useful book to "P.M." readers for **1/6 ONLY.** Send NOW for **your** copy of the new issue and catalogue.

DO YOU FIND RADIO HARD WORK?

To do anything really well involves hard work, but that is where we come in. Our technicians have developed really special radio coils and assembled them into units, together with all switching, trimmers, padders, iron-dust cores, etc. All YOU do is to wire the remainder of your circuit. These coil-packs are 3-wave superhet., with or without RF stage. See how really easy and cheap radio construction can be. Space here doesn't allow details, but you'll also be amazed at our parts prices—much less than you normally pay !
Earn easy money in your spare time !
—All the 'gen' in our new issue !

RODING LABORATORIES
(MAIL ORDER DEPT. M),
70, LORD AVENUE, ILFORD, ESSEX.

CLYDESDALE

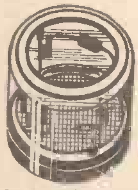
Bargains in Ex-Services Electronic Equipment

Ex-ROYAL NAVY SOUND POWERED TELEPHONE

NO batteries required, gives long service without attention. Complete with warning indicator lamp and generator giving a high-pitched note, which can be heard through any noise; where a number of units are used the lamp would indicate which one is being called. Diam.: 7¾ x 9 x 7¼ins. overall; for wall mounting. Designed for Ships' use, but suitable for the Home, Office and Factory.
CLYDESDALE'S PRICE ONLY **27/6** each CARRIAGE PAID

INFRA-RED IMAGE CONVERTER CELL

Sniperscope. Snooperscope. The famous war-time "Catseye" tube used in "Tabby" for night sniping and observation.

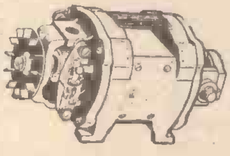


Provides a Silver Caesium Oxide Screen for the conversion of Infra-Red rays to visible rays, using an Infra-Red light source. Data provided. Dimensions overall: diam. 2in. x 1¾in. Screen diam., 1¼ins.
CLYDESDALE'S PRICE ONLY **12/6** each POST PAID

Brand New in Maker's Carton

A UNIVERSAL MOTOR

By simple external wiring. Full data supplied, for 220-250 volts, A.C. or D.C. mains. New method gives better than 1/6 h.p. Ideal for light bench work; when the fan is removed a 1in. spindle is available for driving. Motor Generator type 29. Size 11 x 5¼ x 5¼ins., input 24 v. 16 a. Output 1,200 v. 200 ma.



CLYDESDALE'S PRICE ONLY **25/-** CARRIAGE PAID

Ex-R.A.F. Motor Blower

E961. Input 12 or 24 volts D.C. Cast Aluminium blower housing, diam. 5in. overall, depth 2in., inlet diam. 1¼in. Outlet diam. 1¼in. Motor, overall length, 3¼in., diam. 3in.
Unit, overall length 6in. 5-hole mtg. base. Unused, stripped from equipment by the B.O.T.
CLYDESDALE'S PRICE ONLY **15/-** POST PAID

CAMERA CONTROL ELECTRICAL

Type 35, No. 26, Ref. 14A/2208.
Input 24 volts, D.C.
Time interval selection switch, 2-51 seconds. One pulse per revolution. Exposure counter.
Ideally suitable as the basis of an enlarger timer; data and circuit supplied. Also many other timing uses. In metal case, 8 x 3¼ x 4ins. overall, inc. controls. Supplied in padded wood transit box, 8¾ x 4¾ x 5¾ ins.
CLYDESDALE'S PRICE ONLY **27/6** each POST PAID

Order direct from: 'Phone: SOUTH 2706/9
CLYDESDALE SUPPLY CO. LTD. 2, Bridge Street, Glasgow, C.5.
Visit Our Branches in Scotland, England and Northern Ireland

Special Offer of 40 only:—

Ex-Govt. U.S.A. Manufacture

ROLLS PACKARD INSTALLATION ACCESSORIES

Contains 9 various Romec, Heywood, I.A.E., and Dowty Pumps, Air Compressors and Vacuum Pumps. Together with a quantity of spares and fittings incidental to above; consisting of Right Angle Geared Drives, Splined Shafts, Separators, Regulators, Adaptors, Gaskets, Seals, Tubing, Collars, Nipples, Nuts and Bolts, etc., etc.

All very high grade manufacture, individually packed and boxed, contained in a sealed case, weight 160lbs., condition, brand new perfect, as when manufactured. Originally cost 2,000 dollars, as shown on packing slip.

Our price, a tremendous bargain, £6/5/0, carriage 15/-. Order early to avoid disappointment. Also hundreds of other interesting Radio, Electronic and Mechanical items, send s.a.e. for current lists.

MIDLAND INSTRUMENT CO.
MOORPOOL CIRCLE
BIRMINGHAM 17.
Tel. HARborne 1308 or 2664

You Can Become a

HANDICRAFTS INSTRUCTOR

EXPERIENCE NOT ESSENTIAL

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

We definitely guarantee "NO PASS — NO FEE"

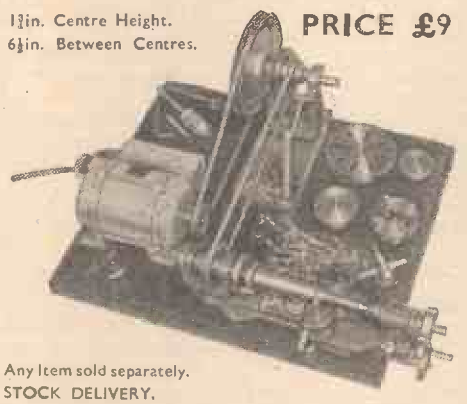
If you would like to know about our unique method of preparing you for one of these excellent appointments, write *today*, and we will send you an informative 176-page Handbook—**FREE** and without obligation. Mark your letter "Handicrafts Instructor."

British Institute of Engineering Technology
591, Shakespeare House, 17/19, Stratford Pl., London, W.1 **BIET**

The "WIZARD" Lathe

1⅞in. Centre Height.
6½in. Between Centres.

PRICE £9 4 9 (Carriage extra—Average 3/6)



COUNTERSHAFT (less large pulley), £2/0/0.
DRILL CHUCK, "O" Shank, 7/6.
ELECTRIC MOTOR, 1 Ph. 230/25 V. ¼ h.p. —Constant Speed, £3/10/0. Carr. Extra.

Neat Portable Home Workshop built from "WIZARD" components.

Photo shows "WIZARD" lathe reducing ⅝in. mild steel bar down to ⅛in. IN ONE CUT. GENUINE REPEATABLE PERFORMANCE.

2¼in. x 4 Jaw Indep. Chuck, 35/-.

Any Item sold separately.
STOCK DELIVERY.

C. LANE & SON, Dairy Lane, Houghton-le-Spring, Co. Durham

BUILD YOURSELF a RADIO SET, a RADIOGRAM, an AUDIO AMPLIFIER or RADIO FEEDER UNIT and save £££'s

Full Constructional details comprising set of Blueprints and Point to Point Wiring Instructions how to build first class, professional instruments as follows:
"Vanguard 4" 3-valve plus rectifier L. and M.-wave Radio Set in attractive plastic cabinet (brown or ivory shade), 2/6. A.C. or A.C./D.C. model.
"Overseas 5" 5-valve All-wave Superhet, a powerful receiver with wonderful tone in beautifully figured walnut cabinet, 4/6. A.C. or A.C./D.C. model.
"No. 1 4-watt Amplifier," volume, tone and negative feedback controls. A.C. only, 2/6.
"No. 2 12-watt Amplifier," two inputs, 3-impedance output, ideal large house or hall. 4/6.
"No. 1 Tuner"—L. and M.-wave T.R.F. with infinite impedance detector, highest quality output. 3/6.
"No. 2 Tuner"—Allwave Superhet, beautiful, elaborate, full-vision scale, special quality output. 4/6.
Absolutely complete Kits of Parts available to build all above instruments at knock-out prices. Also available ready-built and tested. All fully guaranteed. Any constructor in difficulties fully advised and helped. Our Technical Dept. at your disposal—let us have your enquiries.
All Record Players and Autochangers previously advertised still available. Full Bargain Catalogue 2½d.

Northern Radio Services, 16, Kings College Rd., London, N.W.3.

Jubilee
PATENTED WORM DRIVE
CLIP

Absolutely leakproof joints on Air, Water, and Oil lines, are swiftly and easily made by using "Jubilee" Worm Drive Clips. They stand up to any pressure.

RP/12. THE FINEST CLIP IN THE WORLD.

L. ROBINSON & CO. (GILLINGHAM) LTD.
Gillingham Kent

TELEPHONE SETS, comprising 2 G.P.O. hand-phones, 2 bells, 2 pushes and 80ft. twin wire. Price 48/6, post free. Makes an excellent inter-office, works or domestic installation. Really professional instruments. Brand new, not rubbish. Single instrument, 11/6.
BATTERY CHARGERS for A.C. mains. For charging 2-volt accumulators at ½ amp. Parts with diagram, 15/-. Complete, 21/6. Postage 10d.
FOR TRICKLE CHARGING CAR CELLS, parts with diagram. Output 1½ amps. for 6v. cells, 26/6 set. For 12v. cells, 28/6 set. Post 10d.
PHOTO-ELECTRIC CELLS.—For all sound films, high fidelity production, speech and music. Small tube size, 2in. x ⅞in. dia., 26/6. Midget tube, 1in. x ⅜in., 22/6.
COMPLETE OPTICAL SYSTEM for 35 or 16 mm. sound film, 2in. long, ⅜in. diam., projects 0.0005in. light. Price £2 2s.

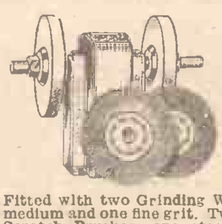
ECONOMIC ELECTRIC CO.,
64, London Road, Twickenham.

PRINTING

WE OFFER a reliable, quick and inexpensive Service for your Printing requirements — Invoices, Letter Headings, Price Lists, Catalogues, Cards, Programmes, Circulars, etc., write or phone to

THE FORREST PRESS LTD.
240, Holloway Rd., London, N.7
Telephone - - - NORth 2004

AN INEXPENSIVE TWIN GRINDER



35/- Carr. Paid

Fitted with two Grinding Wheels, one medium and one fine grit. Two 4in. dia. Scratch Brushes, one steel and one brass. Dual Driving Pulley for "V" or round belt drive. An efficient little machine at a reasonable price from :—
MORTONS, 13, CAMDEN ROAD, WALTHAMSTOW, LONDON, E.17

THE Cyclist
Editor: F. J. CAMM

VOL. XVIII MAY, 1950 No. 338

All letters should be addressed to the Editor, "THE CYCLIST," George Newnes, Ltd., Tower House, Southampton Street, Strand, London, W.C.2.

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

Comments of the Month

By F. J. C.

Road Control Clause Withdrawn

THE Wolverhampton Corporation has wisely agreed to withdraw the contentious, even tendentious, clause No. 128 of its Private Bill which has been opposed by the cycling organisations because it endeavoured to set aside Section 85 of the Highways Act of 1888 and which is popularly regarded as the cyclist's Magna Carta. This act makes it clear that all enactments affecting cyclists, as well as other carriages which use the highway, must be national and thus the power to make by-laws in contra-distinction to an act of Parliament was rightly taken away from local authorities.

Before this Act a cyclist passing through different towns and counties could not help breaking the law. He would be complying with law in one town or county, but breaking the law in another. The Wolverhampton Corporation must have been wrongly advised because it was quite clear that such a clause in its Private Bill would be elided. The 1888 Act had been completely overlooked.

The main opposition came in the House of Commons as a result of which a second reading of the Bill was delayed. The main opponent had been the Cyclists' Touring Club and it may seem curious to many that an organisation which does not in any way represent the class of cyclists affected by the Bill, mainly racing cyclists, should have interested themselves in the matter. By inference the N.C.U. and the R.T.T.C. were prepared to let the clause go through by default. The C.T.C. attitude is that it opposed the offending clause on the grounds that it interfered with (hackneyed phrase!) the "cyclist's rights." However, the means of obtaining a withdrawal of the clause does not matter. It is sufficient that it has been withdrawn. Had it not been other corporations would have undoubtedly followed suit and numerous prosecutions would have been brought. It would then have been left to individual defendants to raise the question of the illegality of the prosecution or to take the matter to appeal, a costly business in which it is doubtful whether costs against the police would be allowed.

We hope that this incident will be a lesson to other authorities who wish to interfere with a sport which has been well conducted for over fifty years with only a minor number of accidents during that time in which hundreds of thousands of races have been held on the open roads. The time has come when we must not be afraid to use the word race instead of time trial. The latter term was introduced as a covert means of avoiding any reference to a race which was considered a heinous offence fifty years ago. Let the hole-in-corner atmosphere be purged from cycling.

Red Reflectors

THE National Clarion Cycling Club, London Union, unanimously passed a motion that "this meeting of cyclists demands that the law compelling the carrying of red reflectors and white patches in addition to red rear lights on cycles be rescinded." This was at a meeting of protest which the Union organised at Hatfield and a deputation was appointed to carry the protest to the Minister of Transport. The motion, however, is unhappily worded. The main opposition is against rear lights. The red reflector was a compromise many years ago when the threat of rear lights was first raised. It was the late F. T. Bidlake who suggested the reflector. The white patch did not come until many years later. Cyclists would not object to the reflector and white patch. The motion rather suggests that if the law regarding red reflectors and white patches is removed cyclists would be quite happy to continue with red rear lights!

Road Accidents

IN the road accident statistics for January it is shown that nine child cyclists were killed and three hundred and ninety-nine injured. The total of 408 is 95, or 30 per cent., more than in January, 1949. Accidents to children are expected to increase up to the beginning of June.

Accidents to pedestrians were fewer than in the same month of 1949, but there was a big increase in the number of casualties among child cyclists.

The numbers of killed and injured in all accidents totalled 12,294, or 99 fewer than January, 1949. Deaths numbered 361, a decrease of 41.

The decrease in pedestrian casualties, though slight, maintained the improvement noted in recent months. Altogether 200 pedestrians were killed, 28 fewer than in January, 1949, and 3,854 injured, a decrease of 214.

Among the pedestrian casualties were 1,447 children, 49 of whom were killed. Three out of four of those killed were under seven years of age.

Statistics are not yet available showing the effect of the Children's Safety Week, which has received so much publicity in the Press. We do not agree with the opinion expressed by a contemporary that the emphasis should have been aimed at the "killers and maimers." We strongly object to those terms. Nor do we believe that "the victim of a road accident is more often than not the innocent party." This is a loose statement, entirely without foundation and it cannot be supported by statistics. It is seldom that the police or anyone else witnesses an accident and the evidence is compiled from statements made by the survivors. The motorist or cyclist or even the pedestrian who is involved in an accident and survives is hardly likely to attach the blame to himself. The only person who could offer rebutting evidence is in the mortuary. It is known, however, from observation that the majority of accidents are due to carelessness, and pedestrians and cyclists are not guiltless in that respect.

An aspect of the case which is often overlooked is that but for the care taken by the majority of road users, the accident statistics, appallingly high, would be even higher. It must not be forgotten that many a pedestrian and many a cyclist have caused accidents in which they themselves have not been personally involved. We think that the cycling Press are doing a disservice to cyclists in presuming that the motorist is always wrong. The Government departments concerned know the facts and they are not likely to be impressed with the opinions of cycling representatives on other matters when their opinions on the causes of road accidents are so unsound. That we have quoted, is a loose statement expressed without recourse to the facts and is an evident straining after effect.

We have the advantage of many years of road usage on all sorts of vehicles and on foot and our opinion is that cyclists are no more careful than any other type of road-user. Pedestrians are the most careless of all. The plain fact is that no one has been able to deduce the causes from the effects and to evolve preventive measures. Successive Ministers of Transport have added to our legislation in an attempt to reduce the toll of the roads. Accident statistics continue to rise. We have one-way streets, divided carriage ways, pedestrian crossings, which are observed more by misuse than use, warning signs, poster campaigns, broadcasts, articles in the Press, lessons on road safety in the schools and comment in the House of Commons, yet accidents continue on a rising scale.

Lancaster
The Gateway.
This has been called the greatest of English gateways. It dates from the 15th century, and bears the arms of Henry V as Prince of Wales on a shield above the archway.

Ye Olde Six Bells, Billingshurst, Sussex.
A fine half timbered inn dating from the 12 cent. The interior contains many rooms & corners of old world charm.

Paragrams

Plenty of Enthusiasm

IT was revealed at the annual general meeting of Doncaster Wheelers on January 15th that during the past year the club membership had been increased to a record figure of 163. At the meeting a further 11 new members were enrolled. A comprehensive programme of racing events and time trials has been drawn up for the coming season.

Another Twenty Years!

"I SHALL go on working until I am 100," says 80-years-old Mr. W. Underwood, of Kettering, who is still at work as a gardener; which job he took when he retired after 52 years in the boot and shoe industry. He has been a keen cyclist for a great number of years and, although he became deaf as the result of an accident while racing in 1898, he says emphatically that he will never walk anywhere so long as he can ride his cycle. He neither smokes nor drinks and he thinks this abstention may have something to do with his now having enough wind to keep on cycling!

Race of the Aged!

MR. FRED QUIRE, of Ponder's End, Middlesex, who will never see his 91st birthday again, has issued a challenge to any other man turned 90 to ride in a cycle race over a distance of 10 or 20 miles. The time taken over the course will not be taken into consideration!

Food for Argument

THERE were three different schools of thought regarding rear lights at the January meeting of the Leicester and County Accident Prevention Council. The Chief Constable suggested that all vehicles should have a bright light with a small glass; the Deputy Chief Constable said he would like to see all rear lights standardised at two inches diameter, while a third speaker wanted all rear lights to be abolished altogether. He said we ought to go back to the old law that a person overtaking was solely responsible if he collided with anything in front of him and travelling in his direction.

"Fatality Flash"

THE "Fatality Flash" lights on the roof of Leicester City Police headquarters, which show red following a fatal road accident and green for all clear, may have their flashing time shortened following suggestions that the lights may cause accidents. Cyclists and motorists make a habit of peering up at the lights to see whether they are red or green, and so make themselves liable to collide with something. The lights, which first shone red for the death of a cyclist, may have their flashing time shortened to give two-second intervals between the flashes. The idea of the lights has, on the whole, met with a considerable amount of approval.

Not Interested

COMPLAINTS have been made by members of Brigg (Lincs) Road Safety Committee regarding the committee's approach to Lindsey County Council about the formation in the town of a Safe Cycling League for school-children. The committee was considering the provision of badges for the children to promote an interest in road safety and care of their cycles. It is felt, however, that as the county council could obtain a 50 per cent. grant towards the cost of the badges it would not be fair for the committee to bear the cost, merely because the council are not particularly interested.

Cycling Costs Them More

MEMBERS of the Norwich, Lowestoft and Yarmouth Hospital Management Committee, who live some distance from the offices where the meetings are held, are complaining that if they use a taxi to get to the meetings they can receive repayment at the rate of a shilling a mile, while those who prefer to cycle can claim no allowance at all. They have suggested an allowance of twopence a mile for cyclists and, although the Regional Hospital Board has rejected their first claim, they do not intend to let the matter drop.

Speed Man's Mount

A FINE impression of speed is given by the lines of a new type of racing cycle invented by a Frenchman, Pierre Bourguignon. It is longer than the normal machine and of quite unorthodox design. The frame consists of a thick curved member from the front wheel to the rear wheel and on this are two curved body supports to hold the rider in position. The rider lies at full length with his body supported at stomach and chest, and the pedals are immediately above the rear wheel with the usual chain drive. The handlebars are short and only a few inches above the front wheel and carry the hand levers for the brakes. At top speed, the rider would appear to get the feeling of being in a dive-bomber.

Bicycle Thieves

AN Italian film company have produced a film about cycle thieves. It is called, rather naturally, "Bicycle Thieves," and has recently made its first appearance at a West End cinema. The action of the film is in Rome and depicts the adventure of a father and son when they search for the father's cycle which has been stolen by some cycle thieves. The father, a bill-poster, must have his cycle to do his work, and although the plot is just a trifle thin the film has plenty of what Hollywood calls "human interest."

Keeping the Wheels Turning

AT 94 years old, Mr. Thomas Cooper, of Little London, near Keelby, in North Lincolnshire, still continues to be a cyclist. He has been riding for years and he regularly rides each week to the post office at Stallingborough to collect his pension—a journey of three miles each way—and every Sunday he cycles the two miles to the old Wesleyan Chapel at Keelby. He and his 91-year-old wife have just celebrated their 70th wedding anniversary, and although they both see eye to eye in most things, Mrs. Cooper refuses to accompany her husband on his cycle rides.

Leicester's Speedway Boom

ALTHOUGH cycle speedway racing only started to become popular in Leicester last June, there are now some 22 teams in existence with about 250 boys actively interested in the sport. Inter-city challenge matches have taken place between Leicester riders and those from other towns and rules are being drawn up to cover doubtful points. Mr. Fred W. Samwell, chairman of Leicester Speedway Supporters' Club, has had much to do with the development of the sport in Leicester and he has obtained permission from the City Surveyor for riders to use a plot of land at Aylestone for a new track. The track is to be laid out by the members themselves and it is hoped that it will be permanently available for all the teams in the city.

Warm Weather Machine

NUMBERED among the 14,000,000 or so cycles ridden in the United States is a strange machine which appears to be a cross between an aeroplane and a bicycle. Mounted on the handlebars is a 27in. aluminium propeller which is driven by a chain connected to the pedals. The pedals also drive the rear wheel in the usual way, but an increased speed of anything up to 45 m.p.h. is claimed with the propeller turning at full speed.

Loughborough Club Planned

PLANS are on foot for the formation of a new cycling club at Loughborough, Leics., to be known as the Town Cycling Club. Touring riders and speed men—and everyone else in between—will all be catered for and made welcome. A preliminary meeting to discuss ways and means has been held and the club should be in full swing for the coming season.

Signposts You Can Read

NORTHAMPTONSHIRE County Council are experimenting with cast metal letters screwed to signposts, instead of having the direction signs painted as has been done in the past. Some mentalities seem to delight in defacing signposts and many complaints have been received by the Council of delays caused by hooligans having defaced the signs. The wife of an Oxford don wrote to say that she spent much time and petrol in trying to find Rushton, after someone had altered the painted sign to read "Push On." Probably the next move in the game will see the nit-wits going about armed with screwdrivers, until the metal letters get really corroded into position.

Around the Wheelworld

By ICARUS

Harris Awarded Trophy

THE "Sportsman of the Year" Trophy was awarded to Reg. Harris by Aneurin Bevan, Minister of Health, at the Savoy Hotel on March 29th. This trophy is awarded each year by means of a country-wide ballot to elect the Sportsman of the Year. The first of these ballots took place in 1946 when the public were invited to vote for the sportsman or sportswoman, amateur or professional, considered to have done most during the year to raise the prestige of British sport. The first ballot produced Bruce Woodcock with Sydney Wooderson as runner up. In 1947 the issue lay between Denis Compton and Reg. Harris, and in the final result Compton headed the poll by a majority of over seven thousand votes. In 1948 the battle was between Compton and Freddie Mills, and the result was that Compton was elected for the second time with a majority of over five thousand votes. Reg. Harris, the famous cyclist, gained the award for 1949, with Billy Liddell as runner up. Harris has well deserved the award, for he has raised the prestige of British cycling more than any other cyclist. He has won over one hundred international races, and is the only cyclist to win two second places in the Olympic Games. He began his cycle-racing career at the age of sixteen. In 1939 he was selected to ride in the World Championships in Milan. During the war years he was in the Royal Armoured Corps, and in North Africa was badly burned in tank action. In 1944 and 1945 he won three English track championships, and in 1946 he again won the British Sprint Championship, as well as twenty international sprint races, including the classic Grand Prix of Paris. He was world amateur sprint champion in 1947, the first Briton to win this event for twenty-five years. He turned professional in October, 1948, and at the beginning of 1949 won his first major success, the Winter Grand Prix of Paris. He raced on over sixty occasions in 1949, winning the World Professional Sprint Championship, the first Englishman to win the title, as well as the Grand Prix of Copenhagen. He has every British unpaced track record to his credit as well as the 1,000 metres world record. I add my congratulations to the many he has received.

Resolution Withdrawn

A FULLY-ATTENDED meeting of the North D.C. of the R.T.T.C. was held last month in Preston. National Committeemen F. Slemen, H. F. Rogers and T. Anderton attended and took part in the discussion. During the three or three-and-a-half hours' session they were subjected to a barrage of questions, and the upshot was that the North D.C's original resolution which contained the words "reserves the right to act as it thinks fit in the best interests of the sport," was withdrawn. A new resolution, worded as follows, was carried unanimously, and is to be further circulated to the district councils: "That this District Council considers the National Council was out of order in making decisions on highly controversial issues without Standing Order 14 having been complied with. This Council, therefore, reserves the right to carry out its 1950 programme in accordance with the Rules, Regulations and Standing Orders as printed in the 1949 Handbook, until such time as Standing Order 14 has been complied with, club, district and National Council delegates fully instructed, and the decisions taken at the National Council meeting held on January 8th, 1950, confirmed or amended accordingly." The decision to work under the 1949 rules, etc., had previously been taken by the North D.C., but had not been made clear when the original dissenting resolution was circulated.

N.C.U. A.G.M.

WHENEVER cyclists foregather in an annual general meeting they consider that the affairs of Europe are rocking in the balance. They will descant for hours on trifling topics, and so it turned out at the A.G.M. of the Nobodies' Chatterbox Union. For one minute short of seven and a half hours they expatiated on libra, soldi and denarii, interspersed with the dangling of the usual red herrings. The surprise was when the Leicester Centre put its motion that the N.C.U. ask the members for a mandate to allow the Union to become the controlling body of all cycling sport in the country. The motion was defeated after eight minutes' discussion. No one countered this with another motion that in view of the vote of no confidence which the defeat of this motion implied, the N.C.U. should disband! Such a motion ought certainly to be put the next time, for the fact is that the majority of sporting cyclists are without confidence in the Union. Wherever the Union is discussed it is criticised. This has been the state of affairs for about fifty years.

Penalisation of Road Transport

THE Economic Survey for 1950 demonstrates that the Government does not yet appreciate the indispensable service given by the roads and road transport of this country.

Totally inadequate funds are made available for roadwork. Arrears of road maintenance work already total over £200,000,000, due to the enforced neglect of the past ten years. The amount of £48,500,000, to be spent in 1950 on all roadwork, is a reduction of more than £2,000,000 on last year's figures. It represents a decrease of 27 per cent. in money on immediate pre-war years. The enormously increased cost of labour and materials is not taken into consideration.

The Government's intention is to reduce the annual supply of goods vehicles to the home market to a figure less than 65 per cent. of that for 1949.

Efficient road transport is inseparable from a healthy national economy. So long as it is treated as a Cinderella by the Government, there is no hope of a full response to official exhortations for maximum efficiency.

Unrest in R.T.T.C.

ALL is not well within the ranks of the Road Time Trials Council, for recently two district councils have expressed their dissatisfaction with it "reserving the right to act as they think fit in the best interests of the sport." The North D.C. did rescind this after a visit from three National committeemen, but the same district council then proceeded to vote unanimously to run its sport under 1949 rules, so the position is in *statu quo ante bellum.*

The West District Council takes the same view, and at a meeting of its affiliated clubs, which was properly constituted, an overwhelming vote of no confidence in the National Committee was passed, and it decided to act as it considered in the best interests of the sport. The two district councils represent more than two thousand riders and fifty clubs.

This causes a dilemma, because other district councils are wondering whether their riders will be suspended if they ride in the North or West D.C. events.

"Every Cyclist's Handbook"

"EVERY Cyclist's Handbook," which was issued simultaneously with the first issue of *The Cyclist* when it was published weekly, has been out of print for many years, but the demand for it continues. The Editor tells me that he has been at work on a pocket-sized edition of this book, considerably amplified and including place-to-place road routes of England, Scotland and Wales. It contains practical information on wheel building, gears, frames, camping, foreign touring, map reading, overhauling, etc. etc., and will be published probably towards the end of June.

A corner of the saloon of the "Six Bells," Billingshurst.

The great fireplace with its inglenook and its old flagged floor. A unique feature is the iron grave head, forming the back to the fireplace. It bears the following quaint inscription :

HER LIETH ANE FOREST R DAVGHTER AND HEYR TO THOMAS GAYNSFORD ESQVIER DECEASED XVIII : OF JANVARI 1521 LEAVYNG BEHIND HER II SONES AND V DAVGHTERS.

Wayside Thoughts

By F. J. URRY

The picturesque old stone bridge that spans the East Dart at Dartmeet—so well known to all West Country tourists.

That's That !

THE cycle trade is so busy it does not want a show this year, and since it rules the roost, no show will be held at Earls Court. Personally I do not think it matters much, but the younger element in the cycling game will be disappointed and, no doubt, many little gadgets which may or may not be helpful to the rider, will be kept on the shelf and possibly never lifted off. The industry is overwhelmed with orders for export, and from the business angle the best policy is concentration on production to earn exchange and, in the home trade, to make more and more people cycle-minded. You who read may think the British public know all about bicycles and their equipment. If you could glance through a cross-section of my correspondence you would be amazed at the ignorance of the man in the street when the moment of purchase arrives. Difference of opinion on bicycles and cycling I can understand, that is right and natural ; but some of the questions asked me are truly wonderful. One thing I am glad to see emerging from the modern fashion of upright frame angles is the series of warnings issued by the technical Press against this indulgence, which was first designed for the purpose of the trackman and mainly for use on small circuits. The steep-angled frame is a difficult machine to steer over the give and take roads of the land, can be very tiring and, in certain circumstances, really dangerous. My preference is for 68° frame angles, and 70° is my limit in comfort ; anything steeper is a mistake for the tourist and, I think, for the time trialist.

The Truth of It

A FEW weeks ago the Ministry of Supply asked me to attend a meeting of Colonial and foreign correspondents with the idea of telling them what a bicycle can mean to its owner in the way of health and enjoyment, physical and spiritual. These gentlemen of the pen (or typewriter) had been visiting various cycle factories in the Midlands to give their readers overseas a notion of the specialisation to which the trade of cycle manufacture has advanced, and some bright mind imagined I could be helpful in suggesting that cycling is far more than a convenience of travel ; that it is a game that can be played in every stage of active life, and possesses a wider variety of interests than any other pastime. I do not know if the people were impressed ; probably not as individuals, for the car habit has been ingrained in men of their type ; but the remarks may have been a relief to the dust-dry statistical figures. It is a fine thing to know the British bicycle is a wanted product by so many inhabitants of the world, and that our manufacturers are making so excellent a vehicle, but I think it is finer still if we can all be brought nearer to the realisation that cycling contains for its advocates the magic of health and freedom, and that sometimes rare possession "individuality." We are so apt to follow the crowd on buses and trams, trains and motor coaches, or, if we are lucky in this matter of travel, imagine our car-owning status is the last word in desire ; but in these things we have lost our individuality by losing our individual activity : we have surrendered ourselves to mobile immobility, and have forgotten to be human beings in active enjoyment of a fine body. Often enough the body finally objects to being so neglected and we invent all kinds of exercises in our endeavour to put it right, but if you will ride a bicycle regularly with wisdom wedded to your years, then you will know what I mean when I mention health, freedom and individuality. It may need an effort to break down the little ostentations that imperceptibly capture one's mentality in these modern times, but once that initial and purely mental objection is overcome, then the satisfaction of cycling will enter into your soul and you will begin to live wholly and completely. A big claim, you will say, but I have found the truth in its simplicity.

There's no Proof

I NEVER go out for a real ride without the magic of it all entering into my being. Here I am able to gallop along at a speed that would outwear any horse in a distance of thirty miles, and by the time those leagues are covered I'm ready for a feed, a smoke, and many more miles to follow. The change and chances of scene and weather have been with me all the time ; with the brisk breeze that will help me home, the delicate tree filigree just beginning to feel the urge of spring, the blue curl of smoke against the empurpled wood, the line of the hills ever beckoning me on, over which the light clouds swing shafts of sunshine, and perhaps above all the gaiety of feeling fit, ready to face to-morrow and remember yesterday. That is what I mean when I say there is a spiritualism about cycling that is inexplicable, those precious moods that fall and pass, that ebb and flow like the play of light over a fair scene, occur and recur, and at the end of the day count up to an immense satisfaction. I think it is the tempo of the game, it gives you time to think and absorb, to feel the tang of the day and the hour and unconsciously make a holiday of it. I heard a man say he was tired of riding over the same old roads but I find many roads to the same place, and all of them are never the same, but changeable as the day and the season, and most of them warm with the welcome of a resting place.

The Luck of Punctures

A FRIEND of mine with whom I do a fair amount of riding, recently had the curious experience of five tyre perforations in five days, just one a day to remind him that even new covers are not immune. The source of the trouble was traced to steel swarf scattered on the road from a badly-laden lorry, and to round off the little trouble in an appropriate manner, the swarf came from a cycle factory. A complaint was lodged there, and for the time being the road is clear ; but, generally speaking, you cannot account for punctures. Some four months ago I put a new tube into a sound front cover, a tube presented to me as an example of air-tightness by the Dunlop firm who told me I should not need to blow it up more than once in six months. I didn't believe it, so carried the tube as a spare during my summer touring, then fitted it in the early autumn because the replaced one had stretched. I inflated it and within half an hour it was flat, with a great hob-nail advertising the damage. After the repair, I blew it hard, since when no pump has operated on that tube. I still find it difficult to believe, for every time I use that bicycle I thumb the front tyre in the expectation that it will need attention. That is now nearly four months ago, and I am still thumbing. This tube is not yet on the market, I understand, but it is coming soon, and what a fine thing it will be for those of us who dislike the pump, and use it only under protest and in order to save our precious tyres from quick disintegration. When it is obtainable at the depôts I shall have my tyre upholstery made more or less permanent, and so save hard and disagreeable work with the pump.

Those Little Stories

THE persistence with which some people denounce a rainy day is one of the curiosities of the human outlook. Let us admit that a real drencher can be uncomfortable when the temperature is low and the wind against the traveller, but that is really a rare occurrence, and I know, because I ride every day ; yet without such downpours where should we be ? They are as necessary as the sunshine, and really should be welcomed in a similar manner, but they are not. These spring showers that go sweeping over in a gossamer cloud are really delightful to me, though they frequently seem to irritate my friends who object to donning and shedding a cape every few miles. Usually these sudden little storms give you notice of their intention, and as a rule I seek shelter, smoke and watch the sombre air overcast the brittle lightness of a few minutes ago, knowing the sparkling condition will return anon. Out on the moors, or over the mountain roads it is not always easy to find shelter, but personally I have no objection in carrying a cycle cape on the bars, secured with a piece of string, the shelter from which can be brought into instant service. Naturally, I prefer fine conditions, but why complain if the sunshine is a trifle vagrant ? As a fact, some of the finest views hang their loveliness before your eyes after a sudden spring shower framed in the arch of a rainbow. If you feel cross with the weather you cannot enjoy your riding to the full, and such a temperament reduces cycling to an unfortunate exercise, the sooner over, the better. The real wayfarer takes the road and the weather as they come, and, without hurrying to keep a schedule, just enjoys touring and laughs at the impatient and perturbed.

CYCLORAMA

By H. W. ELEY

Learning to Ride

IT occurred to me the other day that it was ages since I had seen anyone "learning" to ride a bicycle. In the old days, it was no uncommon thing to see, in some quiet suburban by-road, an awkward "pupil," holding on to handle-bars like grim death, and supported by some kindly "teacher"—giving advice as to steering, keeping one's eyes on the road ahead . . . etc., etc. . . . Do children now get born with an already-provided sense of balance? Do they ride a bike as naturally as they walk at the appropriate age? It is a rather interesting question, and when the thought occurred to me, I discussed the matter with several friends. Not one of them had seen, for years, the once-familiar spectacle of an adult "holding up" a wobbling machine, and imploring the pupil to "keep making the pedals go round." Of course, I am all for a world in which children are born with the ability to cycle without teaching. But . . . even if a child can jump on to a cycle and ride it away, there is a lot to learn about the *correct* way of riding. It is not every cyclist who is "part of his machine"—unfortunately. . . .

Maytime Customs

I AM old enough to recall the merry celebrations which used to herald the coming of May Day. How good were those old colourful processions, with children carrying posies of spring flowers, and how pleasing those Maypole dances on a village green. The Maypoles were, I remember, works of art . . . garlanded with ribbons and flowers, made from the old-fashioned children's hoops, fastened on to broom-sticks. The children sang old-time songs, some of them quite ancient in origin . . . telling of the re-birth of Nature, and the "time of the singing birds." There was a spontaneous gladness about these old customs; folk greeted the returning sunshine with obvious joy . . . and in many an English village and country town, May Day was looked forward to as eagerly as Christmas. One of the most famous May-Day celebrations was held at Knutsford, in Cheshire . . . and I believe that it still flourishes, even in these unromantic days.

I Meet a Tricyclist

THE lane was narrow, with big oaks and elms rising from its banks; some of the gnarled tree-trunks were covered with ivy, and the lichen on fragments of wall made from good Derbyshire stone was a vivid green. One of my favourite lanes . . . taking me, with many a twist and turn, to a village I love. And it was along this lane that I met an old gentleman on a tricycle. A fine old gentleman too . . . bearded like a patriarch, smoking a great curved pipe, and evidently enjoying every moment of the sunny April day. He dismounted by the old stone well and I chatted with him . . . about his tricycle, about the weather, about the chaffinches and yellow-hammers which twittered from the hedgerow. The "trike," I was informed, was purchased in the year 1913 . . . "before world wars were fashionable" as the old gentleman said. It was in perfect condition, and I gathered that it conveyed its proud owner many miles a week, and enabled him to indulge with ease in his favourite hobby of wild-flower study. Before we parted in that lane, where we both leaned against a gate-post and smoked our pipes, I learned that the old gentleman was seventy-four years of age, that he had commenced work at the age of thirteen, and that he was "Derbyshire born and Derbyshire bred . . ." but he certainly did not fulfil the conditions of the rest of the old couplet, for he was by no means "thick i' th' head"!

A Tip from the Harness Room

TO the older generation of riders it is always a tremendous pleasure to meet with young cyclists, and chat with them about their mounts, their touring experiences, their views about different English scenes . . . and often it is possible to pass on a useful tip about riding. The other week I talked with some good "Youth Hostel" folk, whom I met in a wayside tea-room; and we got on to the subject of saddles and saddle comfort. I admit I was surprised that some of these young riders, with their fine gleaming machines, and their knowledge of cycling equipment, did not apparently know of the "sovereign remedy" for saddle soreness. A new saddle can, as we know, bring quite an irritating amount of saddle soreness . . . before it is broken in . . . and I found that one of my young friends had this trouble. He looked surprised when I told him I would give him a "tip from the harness room" . . . and recommended him to purchase a tin of good, old-fashioned saddle soap, such as the ostler of old time used for the saddle of the Squire's hack or hunter. I explained how the soap, spread on the under-side of the leather, penetrates when the warmth of the body opens the pores in the leather. A few "dressings"—and if my own experience is anything—the soreness soon vanishes.

Arm-chair Touring

THE day's work done . . . slippers on . . . pipe well alight . . . a cheerful fire . . . and dreams of tours to come. I am very fond of this peaceful and inexpensive pastime. From the cosy depths of an arm-chair I have, in spirit, toured many counties of England . . . and browsed in many old towns, lingered in many scented lanes, and beheld many entrancing vistas of hill and dale, copse and common, silvery rivers, and wind-swept heaths. Where shall we tour? Memories of past rides help a lot and maybe we shall start our imaginary tour from some pleasant place like Warwick, that lovable, medieval old town where the ghosts of Dudleys and Grevilles stalk through the little streets by the great Castle, and one views the placid Avon, gliding through the very meadows where perchance Shakespeare himself once wandered. A tour through Shakespeare land . . . visiting the villages of fair Warwickshire where the poet must have walked and mused. Or, our pipe-dreams may take us awheeling in broad Yorkshire, to some picturesque village of the dales; to some wild moorland area, where the curlews cry mournfully overhead, and some shallow, boulder-strewn river winds its way to a cascading waterfall, lonely and musical, far from the haunts of man. Sometimes my dreams have taken me to the flat, pleasant land of the Fens; sometimes to the sweet thatched villages of Wiltshire, where the immemorial downs whisper of the dim origins of the first races in our land, and ancient stone circles bring thoughts of grim human sacrifices amid the groves. Yes, arm-chair touring is cheap and good. And, when the summer comes, those dream-rides can be translated into reality, and all the imaginary towns and villages come to life. . . .

Tyres . . . and Oil

I CALLED, the other morning, on a friend who keeps his cycle in an old coach-house, where a motor-cycle is also housed. The bike stood . . . in a great patch of oil. Now, rubber tyres and oil do not mix well . . . oil is an enemy, so I remonstrated with my friend, and asked him why he should, through carelessness, shorten the potential life of his tyres. We did a bit of cleaning up, and I felt that I had done my "good deed for the day."

My Point of View

By "WAYFARER"

Ye Olde Six Bells, Billingshurst. Looking towards the staircase, showing the massive timber work of the upper floor of this lovely Sussex inn.

In Decline

IT was my privilege, on a mid-January Saturday, to give a lantern talk on Ireland to a company of cyclists and their friends gathered, suitably enough, at the village of Parkgate, in the Wirral Peninsula. I say "suitably enough" because of the past history of the village in question. Early in the last century it was a place of some importance, having its own Custom House and staff of officials, and from there there were regular sailings—several times a week—of packets to Ireland. But the River Dee gradually silted up and the sailings ceased about 140 years ago. A picturesque place is Parkgate, consisting mainly of a line of buildings along the river-front—hence the local saying: "All on one side like Parkgate"—and I was sorry to hear that the silting-up process has continued to such an extent that probably, within the next five years, sunset will have come to Parkgate, the river then being conspicuous by its complete absence. It is sad to see one of our old seaports in decline, but nothing can now be done about it. The village retains all its old picturesqueness. It looks over miles of golden sands to the hills of Wales and still has its quota of visitors of the summer, whilst it is a favourite place of call for Liverpool and Cheshire cyclists.

Testimony

RECENTLY I received a letter from a regular correspondent — a doctor — in south-west Ireland. Amongst other things, he said: "I have just finished my evening round on the bicycle which you were kind enough to design for me many years ago. It is as good as ever and brought me home in fine style with a following wind." Price for price, what better bargain is there than a quality bicycle ? Regardless of price, what better investment is there than a quality bicycle ? So far as I am concerned, none. The bicycle—especially one of good breed—is one of the greatest and most beneficient inventions the world has ever seen. It is also one of the grandest of investments, and the benefits it bestows on its owner are infinite. Yet even now it is not fully recognised what the bicycle has achieved and what it can still achieve, if properly used.

Which reminds me that, when I was paddling about the Black Country the other day, I "had words" with a cycling postwoman. She was enthusiastic about her job, which, at its lowest, was "better than being in a factory." Of course, there were "roughs" as well as "smooths;" but she was prepared to take them all in her stride, and she realised how much her health had been enriched by the outdoor life she was leading. She had forgotten what it was to have a cold. Think it over, my friends, and, if you are not getting your proper ration of fresh air and exercise (and of the other blessings which cycling provides), do something about it.

Proud Possession

DURING a journey home from Mid-Wales a few weeks ago, I happened across one of my old cronies of the Anfield Bicycle Club, and it transpired that he had just about come to the end of his active cycling career. (The last time I saw him he was toiling painfully up a hill—making "heavy weather" of it—and I was not altogether surprised or sorry to hear that he had "packed.") We had a yarn about the good old days, and I found that he was quite philosophical concerning the ringing-down of the curtain on his activities as a cyclist. He had had a jolly good time and had seen much of his native land. "We have our memories," he ejaculated, voicing a thought to which I was about to give expression. Yes: those memories are our proud possession when the time comes for us to retire from the open road and take our place in the chimney corner, there to fight our battles over again. And herein lies but another advantage of cycling, superimposed on all the benefits which have accrued to us from active participation in the best of games; and "while memory holds its seat" we can continue to enjoy the pleasures of the game of games; we can see in our mind's eye the places we have visited, and reminisce about experiences enjoyed in days gone by.

"Travelling Light."

THERE was an interesting leading article under this heading in *The Times* a few months ago, wherein it was stated that "the lesson of travelling light remains one that most of us are unable to assimilate." A subsequent statement is more debatable. After dealing with the various objects which we are tempted to include in our impedimenta —for instance, an old pair of flannels, a pack of cards, or a book of verse—we find on our return that the emergency with which such were designed to cope has not occurred, and *The Times* adds that "the hiker, setting out on a walking tour with the knowledge that every item will make itself felt, alone escapes criticism in this respect." "Alone"? What about the pioneer of light-weight travellers—the cyclist ? He, like the hiker, realises who has to provide the propelling power for his luggage, and he, if he is wise, cuts down the weight (and bulk) as severely as possible. The cyclist has been indulging in this process of elimination for years, and long before the "hiker" was thought of he was reducing his luggage to an absolute minimum. Certainly in the case of the hiker, who carries his impedimenta on his back, there is every reason why as little as possible should be taken, but the cyclist, too, has to "push the freight," by, it is true, an easier method than that of necessity adopted by the foot-slogger, and the wise pedal-propeller makes a point of doing without some of the things deemed essential in his everyday life. (By the way, what *do* hikers carry in their loaded ruck-sacks when they go out for a day's—or a half-day's—jaunt ? Judging by the size and bulk of their packs, the possibility of being marooned on an uninhabited island for a few months is not so very remote!)

In the Picture Again

OUR canine friends are in the picture again. In the Staffordshire town of Wednesbury last year there were 163 road accidents, of which 43 were caused by straying dogs. In the Worcestershire towns of Kidderminster, Stourport and Bewdley there were 97 accidents during December, 26 of them being caused by dogs. Each month about 20 dogs are killed in West Bromwich road accidents. Many of these are said to be children's pets and, to induce the youngsters to take a greater interest in their canine friends, the local Junior Accident Prevention Council is organising an obedience test for dogs. All very interesting—but I would like to know how many cyclists have sustained accidents through colliding with these straying pests. (And when I say "pests," I mean "pests"—not "pets"!) I write as a lover of dogs, always at a loss to understand the type of affection which permits our canine friends to run wild in the traffic-laden streets of our towns and cities. I, at least, would not thus express my regard for dogs.

"Practical Mechanics" Advice Bureau COUPON
This coupon is available until May 31st, 1950, and must be attached to all letters containing queries, together with 3 penny stamps. *A stamped, addressed envelope must also be enclosed.*
Practical Mechanics May, 1950

Published about the 30th of each month by GEORGE NEWNES, LIMITED, Tower House, Southampton Street, Strand, London, W.C.2, and Printed in England by W. Speaight & Sons, Ltd., Exmoor Street, London, W.10. Sole Agents for Australia and New Zealand—Gordon & Gotch (A/sia), Ltd. Sole Agents for South Africa—Central News Agency, Ltd. Subscription Rate (including postage) : For one year, Inland and Abroad, 10s. 6d. (Canada 10s.). Registered at the G.P.O. for transmission by Canadian Magazine Post.

THE LATEST TYPE FIXED CRYSTAL DETECTOR
THE CRYSTAL VALVE
as used in radar receivers.

Overall size ⅝in. x ¼in.

AMAZING RESULTS

3/6 each, postage 2½d.

Protective Tube and Fixing Brackets, 3d. extra.

Wiring instructions for a cheap, simple but high quality Crystal Set included with each Detector.

These Crystal Valves or Diodes are not Government Surplus but brand new goods manufactured by one of the largest and most famous Radar Equipment Manufacturers in the country. They can be used in any Crystal Set circuit and are fully guaranteed.

CRYSTAL SET
INCORPORATING THE LATEST
CRYSTAL VALVE

Adjustable Iron Cored Coil

RECEPTION GUARANTEED

Polished wood cabinet, 15/- post 9d. A satisfied customer writes—"I should like to thank you for the headphones received 24-12-49, which combined with your crystal set really do give amazing results."

Send S.A.E. for lists of copper wires, screws, nuts, paxolin tubes, ebonite, tufnol rod and panels, etc. Copper wires, 14 s.w.g.-48 s.w.g., in stock.

POST RADIO SUPPLIES
33 Bourne Gardens, London, E.4

DUNLOPILLO UPHOLSTERY
Seat type, used, 3½in. thick at front, heavy gauge: 34in. x 15in., 12/-; approx. 17in. x 15in., 6/6 carr. paid. Cash with order.
USED PLYWOOD, 5/32in. thick, approx. 36in. x 17in., 3/- each; 4 for 9/-. Write for Bargain List.
B & M SALES
16, Hamm Moor Lane, Weybridge, Surrey. Tele.: Weybridge 3311.

REWINDS AND REPAIRS to vacuum-cleaners, portable electric tools and all types of electric motors. Trade invited.—Omega Electrical Rewinding Co., 318, High Road, Willesden, London, N.W.10. WILlesden 0769.

SAILOR SAM'S SECRET
How to Make
SHIPS IN BOTTLES
Kits, 5/6 and 6/-
OLD TIME GALLEONS
Kits 6in. to 22in. From 6/- to 27/6
Stocked by Model, Sports and Toy Stores
Please write for details
COOPER - CRAFT, LTD.
The BRIDEWELL, NORWICH

PHOTO-ELECTRIC METER COMPONENTS

Selenium Light Cell ..	6s. 6d.
Microamp Meter Movement	10s. 6d.
Moulded Perspex Case ..	9s. 0d.
Assembly Instructions ..	2s. 6d.

All standard Photo-Cells in Stock.

G. R. PRODUCTS,
78, REPTON ROAD, BRISTOL, 4.

BOMB SIGHT SIGHTING HEADS
Gears : Lenses

Carr. paid **7/6** ea., to clear.

H. BROWN, 102, CLEVELAND ST., DONCASTER.

Instrument Wire, Insulation Materials, Leatheroid, Mica, Fibre, Varnish, etc., 1/3 h.p. Capacitor Motors Single Phase £4/15/- each New. Packing & Carriage 10/- extra. Rev. Counters 3/6, postage 4d. Many other Radio, Electrical and Mechanical bargains. Send S.A.E. for list.
L. C. NORTHALL, 16, Holly Road, Quinton, Birmingham, 32.
Tel.: WOO 3166.

NO MAN CAN KNOW TOO MUCH OF HIS PRODUCT

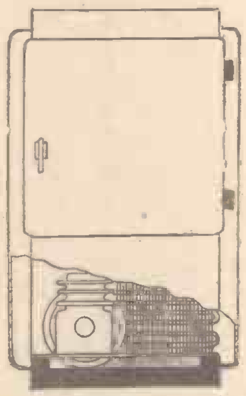
For the close scrutiny of every conceivable object, metals, tools, fabrics, fibres, minerals, precious stones, paint, print, manuscripts, biological and botanical specimens, cutting edges, fractured surfaces, raw materials, powders, granules, and innumerable other purposes, the ULTRA LENS is invaluable, and presents in many instances hitherto unsuspected data which can be used to advantage.

The Ultra Lens is a revealing eye of six actual diametrical magnifications, which brings out points of strength or weakness, and enables the most minute measurements to be gauged accurately. Whether you are engaged in manufacturing, buying or selling, it is an ally of real value. No instrument you can buy will more quickly justify and pay for itself.

Full particulars on request.

PRICE £4 15s. 0d., complete in case with spare bulb, battery and transparent measuring scale.

THE ULTRA LENS COMPANY,
75, Finsbury Court, Finsbury Pavement, London, E.C.2.



Make your own—

DOMESTIC REFRIGERATOR

from comprehensive working drawings, including cabinet, and full details of construction now available at the low price of 10/6, post free.

You can make a 6 to 8 cub. ft. Refrigerator at low cost. We will send plans per C.O.D. upon receipt of your order posted to our registered London address :—

BCM/TECHNIPRINTS
LONDON, W.C.1.

Price £7 10s. 0d. Carr. Extra.

The 'Adept' Bench Hand Shaper
Length of stroke of ram, 3½ins.
No. 2B.H. Shaper, 6¼in. stroke.
Price, £13 13s. 0d.
"Ask your dealer." Manufactured by:

Machine Vice 21/-

The SUPER 'ADEPT' LATHE
1¾ in. centres, 6 in. between centres.
Price £4 10s. Postage and Packing, 2/-.
The "Adept" 2¼ in. 4-Jaw Independent Chuck. Reversible Jaws, 32/-. A Good Range of Accessories is Available.

F. W. PORTASS,
ADEPT WORKS, SELLERS STREET, SHEFFIELD, 8

BOOKS :

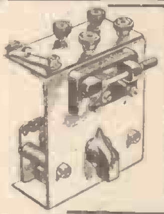
"Two Rail 00 Handbook" ...	...	1/3
"Railway Modellers Handbook" ...		2/6
"British Passenger Locos" ...	...	3/-
"Freight & Mixed Traffic Locos" ...		3/-
"Model Railway Signals" ...	...	3/-

Assorted Coloured B. Rly. Postcards. Set of 12, 3/-

USEFUL PARTS	00	0
Level Crossing S./Line for Dublo ...	6/6	—
Island Platform, 24in. ...	7/6	—
Ex-R.A.F. 16 S.W. Blocks ...	5/6	5/6
20 v. Lamps for Hornby ...	—	1/2½
Bakelite Wagons ...	2/11	10/6
Bakelite Vans ...	3/6	12/6

Postage extra. "00" or "0" Parts List 3d. per post.

TYLDESLEY & HOLBROOK (M.E.T.A.).
109, DEANSGATE, MANCHESTER, 3.



RADIO is interesting. With a D5 Coil you can build this crystal set, or 1, 2, and 3 valve sets. The most comprehensive radio coil for simple circuits. With full blueprint and circuits, 5/-.

HILLFIELDS RADIO.
Dept. M, 8, Burnham Rd., Whitley, Coventry.

THOMPSONS TRANSFORMERS
In steady demand for Home Cines, Trains, Motors, Chargers, Ground Heating, Clocks, etc.
In any odd voltage to order :-

12 volts	2 amps.,	26/-.
12 volts	5 amps.,	32/-.
20 volts	2 amps.,	26/-.
25 volts	6 amps.,	42/-.

Made in many other sizes : List 2½d. stamp.
T. W. THOMPSON & CO., 176, Greenwich High Road, Greenwich, S.E.10

The "THAMES VALLEY"
BATTERY CHARGER
2 - 6 - 12 VOLTS 1 AMP.
with AMMETER
for 200-250 volts 50 cycle mains
for **47/6** post free
Thames Valley Products (P),
28, Camden Ave., Feltham, Middx.

RATCHET & REVOLUTION COUNTERS

Ask for Leaflet No. 18/6
Speed up to 6,000 r.p.m.
B. & F. CARTER & Co., Ltd., Bolton 5
Members of B.E.S.T.E.C. Organisation.

Everything for Shooting

Fully illustrated and descriptive Catalogue of Arms and Shooting Accessories.

Price 5/- copy. Post Free.

PARKER-HALE LTD.,
Bisley Works, Birmingham, 4.

The watch material famine. 20 Geneva watch movements. Take 25/- the 20. Ten English lever movements £2 the 10. Ten Swiss lever movements £2 the 10. Ten wristlet watch movements 30/- the 10. **Merkels, Jewellers, Pilgrim Street, Newcastle-on-Tyne.**

WEBLEY AIR PISTOLS

Marvellously accurate for target practice.

No licence required to purchase.

Senior Mark I
Junior Webley Air Rifle

Write for List. WEBLEY & SCOTT LTD., 106, Weaman Street, Birmingham, Eng.

SPARKS' DATA SHEETS

Now recognised as the Safest, the Simplest and the Finest Constructional Sheets obtainable. The Full-size Plans and Detailed Descriptive matter, plus Component List with all Values and Prices, and the fact that all the Designs are Fully Tested and Guaranteed, make these Sheets Second to None. While discriminating Constructors in the Five Continents use and praise them, the veriest beginner, without any knowledge of Radio, can use and follow them with complete confidence.

ALL-DRY BATTERY DESIGNS

The "POCKET PAK" One-valve Portable. Med. waves. Frame aerial and batteries self-contained. Fine 'phone signals. Carry it in your pocket. 2/9

The "ONE-VALVE PORTABLE." Slightly larger than the above but covers medium and long waves. 2/6

The "TINY TWO" Portable. Med. waves. Self-contained frame aerial, batteries and 2½in. Speaker. For "local" station "Individual Listening." 2/6

The "THREE-VALVE PORTABLE." This model is 9 x 6 x 4 ins. and has a 3½in. Speaker. Covers medium and long waves. Good speaker results on the "locals." 2/6

The "FOUR-VALVE PORTABLE." Slightly larger than the above. Med. waves. 5in. Speaker. T.R.F. Circuit. Has greater range than the 3-Valve model. 2/6

The "CORVETTE." A 4-Valve Superhet covering S., M. and Long waves. Midget valves. Chassis approx. 5¼ x 5¼ x 2 ins. Ideal for Portable or House model. Fine range in any area. 3/-

The "CRUISER." A 3-Valve T.R.F. circuit designed for use with a short aerial. Very efficient in any area. 2/6

The above are only a few of the 40 designs available.

SEND STAMP FOR COMPLETE LIST.

PLEASE NOTE NEW ADDRESS.

L. ORMOND SPARKS (M)
48A, HIGH STREET, SWANAGE, DORSET.

MATRIC.

WHY needlessly handicap yourself and watch other people winning success and security? Whatever your age, you can now prepare for the all important Matriculation Examination at home on "NO PASS—NO FEE" terms. Write now for our valuable "**GUIDE TO MATRICULATION**" which explains the easiest and quickest way to matriculate—FREE and without obligation.

BRITISH TUTORIAL INSTITUTE (Dept. 160), 356, Oxford Street, LONDON, W.1.

"NO PASS—NO FEE"

WALKY TALKY, 65/-
Complete transmitter and receiver, 5 Mazda valves, battery operated, 3 volts and 120 volts, weight 3lbs.

COLLARO CHANGERS, 9 gns.
Two only brand new and boxed, takes records mixed any order.

VALVES 3/- Each
EF50, EA50, EF39, EBC33, EL32, 954, 955, EB34, 6H6, QP21.

A.C./D.C. PUSH-PULL AMPLIFIERS, 85/-
Special offer of brand new 7-watt amplifiers in miniature cabinet. Limited quantity available.

VALVES 5/- Each
KT33C, PEN383, 6AG5, 6C4, EK32, 6K8, 6SL6, 14J7, 14H7, MHLD6, VP13B, VP13C, TDD13C, 6R7, 210HL, 220P, FC2A

COLLINS RADIO,
24, Lillyville Road, London, S.W.6
RENown 4178

ADANA PRINTING MACHINES

Print in the odd hours with an Adana—still the most absorbing of crafts. **No. 1 H/S Machine £4.10.0 No. 2 H/S Machine £9.15.0.** Will quickly pay for itself. *Send for illustrated folder to Dept. P.M. 34*
ADANA (Printing Machines) LTD., 15-18, Church St., Twickenham, Middx.