A POWER-DRIVEN GLIDER

Palin

NEWNES

PRACTICAL MECHANICS

9D

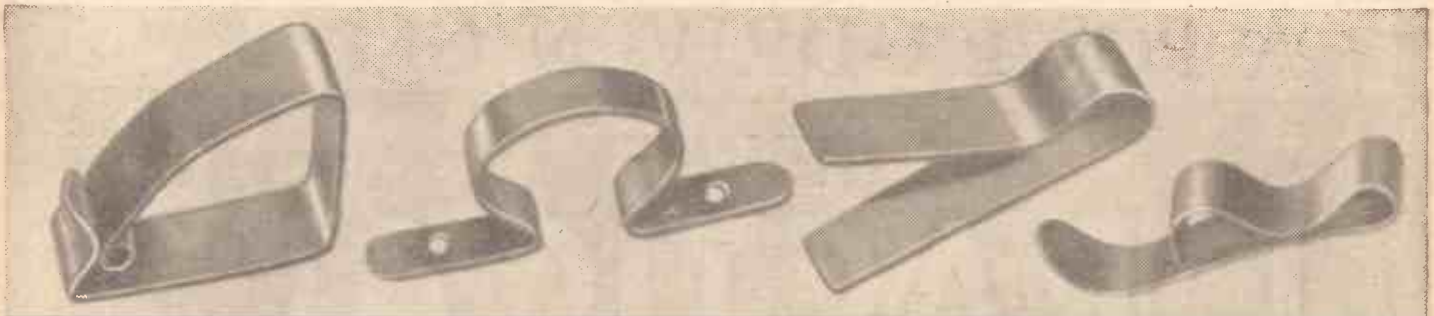
EDITOR: F. J. CAMM

AUGUST 1950

MOTOR-ASSISTED BICYCLES Reviewed

(See page 368)

PRINCIPAL CONTENTS



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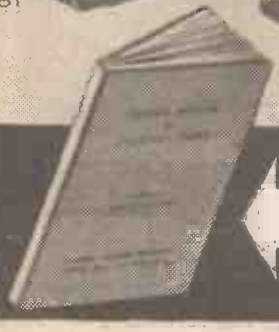

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PRACTICAL MECHANICS

EDITOR F. J. CAMM

AUGUST, 1950
VOL. XVII. No. 202

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

FAIR COMMENT

By The Editor

GUILD REVIVAL

THE craftmen's guilds which were formed in the 16th and 17th centuries, and continued in this country until the time of the industrial revolution, were not trades unions. They existed for the purpose of encouraging the love of craftsmanship, and they performed great service to this country in spreading the knowledge of skilled trades, through the apprenticeship system of those times. Most young men in those days were apprenticed to one trade or another, and it was a serious business. The indentures were drawn up by a lawyer, and the apprentice had to place his thumb upon the seal and declare it to be his act and deed. That document laid down his duties and also those of his master. It stated the premium which had to be paid by his parents for the privilege of learning the craft, and it specified his wages—usually 4s. a week for the first year, 6s. a week for the second year, and so on by 2s. yearly increments up to the full period of seven years, when he would receive 16s. a week. From that point he could remain on as an improver or become a journeyman, taking jobs in various parts of the country to augment his experience. The guilds went out of existence in the latter half of the 18th century.

Freemasonry in this country owes its origin to the guilds. Indeed, Freemasonry, contrary to popular belief, is of English origin. It arose in the 18th century on the foundation of the corporations of architects and builders that had existed in various parts of Europe from the 7th century. The order includes three degrees, those of the apprentice, the craftsman and the master mason. From these three degrees the guild origin will easily be seen.

The later apprenticeship system which replaced the guilds system fell into desuetude about 30 years ago, and this probably more than any other factor is responsible for the lack of skilled craftsmen from which we are suffering to-day.

I am glad, therefore, to see that an energetic attempt is being made to revive the guilds. The formation, about four years ago, of the Institution of Mechanics, which at present has a membership of about 1,000, is a move in the right direction. Membership is confined to those in engineering, either in the skilled or semi-skilled grades, and a selection committee decides whether applicants have the right qualifications for membership, which is intended to be a hallmark of a man's experience, recognised by employers and other craftsmen.

The guild hopes to provide the pool from which employers will draw their skilled men for the various branches of engineering in the not too distant future.

I should like to see this idea copied in other industries, such as the building trade. The guild is not a trade union in any sense. It exists for the interchange of knowledge, and the raising of the standard of skill. Various sections have been formed throughout the country and others are in process of formation. Those of my readers in the engineering industry would do well to investigate the desirability of joining it.

THE WORLD ENGINEERING CONFERENCE

THE World Engineering Conference, formed in Paris in 1946, was the outcome of the First International Technical Congress at which 1,200 engineers and technicians were present representing 35 nations.

PUBLISHER'S ANNOUNCEMENT

OWING to the withdrawal of overtime working which has been imposed by a section of the printing industry in London and the lateness of publication caused thereby, we have been reluctantly compelled, in order to make up lost time, to produce our next issue as a combined September-October number, which will be published on September 22nd.

We express our regrets to readers that no other course is open to us. Whilst the dispute continues delays in publishing may continue.

These felt that the co-operation of engineers and technicians of the allied and many of the over-run nations, which had been born of the world war, should be placed on a permanent basis, and in a form which could be most readily used by the agencies of the United Nations.

The parent body is located in Paris with national committees in each country. These national committees are supported by their own institutions and societies from the engineering profession, as well as by individual members. The institutions and societies remain fully autonomous, the World Engineering Conference acting as the connecting link between the national committees and the U.N. agencies, as for example the Economic and Social Council U.N. and U.N.E.S.C.O., both of which have granted W.E.C. "Consultative Status" and with which it is in constant touch. This recognition ensures W.E.C. being invited to send representatives to technical committees and conferences organised by these agencies.

The British committee is a member of the International Executive Bureau and has been represented at all meetings of the Bureau, and at the congresses organised by W.E.C. The most recent, held in Cairo in March, 1949, was attended by 600 engineers and technicians from twenty-five nations, and by delegates from the Economic and Social Council U.N., U.N.E.S.C.O. and several international specialist organisations.

When the British section was being formed in 1946, invitations were sent to all engineering and technical institutions and societies in this country. As a result a small number of these, together with some individual engineers, formed the British section. Many of the engineering institutions, however, took the view that they would give their support if the three major institutions did so. Unfortunately the three senior Institutions of Civil, Mechanical and Electrical Engineers have refused to co-operate with the W.E.C., maintaining that the liaisons already existing between themselves and the "Professional Engineering Institutions" throughout the world were of a sufficiently comprehensive nature to meet present needs.

In 1948 the three senior institutions, possibly stimulated to action because of the support given to the W.E.C. in other parts of the world, convened a conference of the "Professional Engineering Institutions" of Western Europe and the U.S.A. from which the "London Conference" has emerged. This form of limited co-operation between a few selected institutions from a few countries is distinct from the all-embracing organisation aimed at by the World Engineering Conference.

The following comment has been published by the "London Conference" in regard to this matter: "The Conference has been informed that U.N.E.S.C.O. is proposing to undertake the formation of an organisation to act in an advisory capacity in connection with International Specialist Congresses, to assist in preventing clashing of dates and overlapping of programmes and to advise U.N.E.S.C.O. in respect of any grants of money. In view, however, of the constitution of this Conference and of a similar Conference of the Engineering Societies of the British Commonwealth, and of the possible formation of a Conference of Engineering Societies of the Western Hemisphere, it is the opinion of this Conference that it is not necessary for U.N.E.S.C.O. at this time to concern itself with the affairs of the National Engineering Societies and their relations with each other."

My own comment is that I feel the attitude of our three senior institutions is the correct one. International agreements mean so little nowadays, and it would be dangerous for us to hand over our technical knowledge at the present time. We have nothing to gain, and a great deal to lose.—F. J. C.

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The Latest

A Review of Some Recent Editorial Comment on the

THE earliest motor cycles were bicycles with auxiliary engines attached. Some early examples were the Werner, Quadrant, Rex-Acme, Humber and Singer. Figs. 1 and 2 show the first Werner machine with front-wheel drive and the Singer Motor Wheel in which the engine was mounted between the spokes of the rear wheel. As

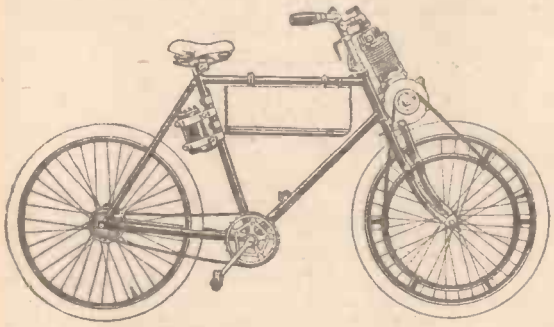


Fig. 1.—The first Werner machine with front-wheel drive.

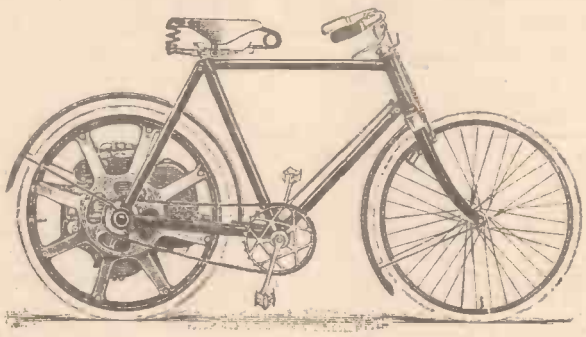


Fig. 2.—The Singer Motor Wheel in which the motor was mounted in the back wheel.

motor cycles developed the idea of attaching an engine to a standard machine was abandoned in favour of a designed job where the engine was located in the bottom bracket position, the front forks were sprung, and the frame was specially constructed to carry the additional loads.

The first motor-assisted bicycles were unsatisfactory because they were too powerful for so light a structure, the ignition system (usually by trembler coil and accumulator) was erratic, frame breakages were frequent, and the engines were by no means reliable. No engine under about 1½h.p. was considered satisfactory; indeed, it was thought to be impracticable to make an engine of smaller than 100 c.c. capacity.

Cylinder castings were of poor cast-iron, as were the pistons, lubricating systems were of the hand-plunger type (automatic pump lubrication then being unknown) and seizures were frequent. In the past 50 years, however, special alloys for pistons and cylinders have been produced enabling the production of tinier engines producing the same power because of their higher crankshaft speed.

Fig. 3.—The VeloSolex with the engine mounted over the front wheel. The machine is designed for the engine and is sold complete.

Model petrol and diesel engines of less than 1 c.c. capacity, and running at about 8,000 r.p.m. are quite common.

However, the motor-assisted bicycles went out of existence for about 20 years and were revived again in this country just after the 1914-18 war by the introduction of two American auxiliary bicycle attachments—the Wall Auto-wheel, and the Johnson motor unit. The former consisted of a small auxiliary road wheel carrying the engine and tank which was coupled to the rear of the nearside of the bicycle converting it virtually into a tricycle, although the motor wheel was fixed quite close to the rear wheel of the bicycle. The bicycle thus had two tracks instead of one.

The wheel was sprung and it suffered a considerable amount of bucketing, especially when travelling over rough roads which made efficient carburisation impossible. The Johnson motor unit was a horizontally opposed, two-cylinder, two-stroke engine of 1½h.p. capacity with flywheel magneto and a double throw crankshaft. Both pistons were, therefore, on compression stroke at the same time, and the plugs fired together. The engine was mounted above the mudguard of the rear wheel and drove by means of a chain.

Fig. 4.—The Cymota which is also a front-wheel drive. It can be fitted to any type of bicycle.

One or two other motor units were produced with varying forms of drive such as belt, friction pulleys operating on the tyre, and chains. Some of them drove the front wheel, and some the back wheel.

This attempt to revive interest in motor-assisted cycling was no more successful than the first. During the past five years, however, there has been a vast development in Italy, France, Switzerland, Germany and the Netherlands in motor-assisted cycling, and a large number of units have been produced in this country.

The necessity in Europe for strict economy from the point of view of finance as well as in the use of petrol forced their development. The position to-day on the Continent is that motor-assisted cycles have become a vast new industry.

Rights to manufacture some of the more successful of these Continental engines have been granted to English companies, and about eight firms are at present marketing units in Great Britain to-day.

The wheel has certainly turned full-circle in the space of 50 years in the case of one of the latest units because the Cyclemaster illustrated on the cover and also in this article is built into the rear wheel in a manner similar to the early Singer shown above.

The capacities of the engines vary between 25 to 50 c.c. which, taking the Treasury rating of 100 c.c. to one horsepower, means that they vary between ¼ to ½ h.p.

Immediately the unit is fixed the bicycle becomes a mechanically propelled vehicle

Fig. 5.—The Mini-Motor which is a friction drive on the back wheel. This engine can also be fitted to any cycle.

Motor-assisted Bicycles

Models and Some Facts About Their Early Development. For C.T.C. Attitude, see page 81 of "The Cyclist" Supplement

By F. J. CAMM

Fig. 7.—The motor-assisted bicycle is ideal for tradesmen and public servants. Here it is being used to speed up the collection of letters.

subject to the Special Road Fund Tax of 17s. 6d. per annum. If the user has never held a driving licence before he must fix "L" plates, hold a provisional driving licence, and pass the driving test. The vehicle is subject to the same laws as for cars and motor cycles. Most of these motor-assisted bicycles run about 300 miles on one gallon of petrol, and the tanks are of about one quart capacity, enough for about 75 miles of riding.

Fig. 6.—Showing the compact arrangement of the Cyclemaster. It is a complete back wheel which can be fitted to any machine.

Lubrication is by the petroil system, the filler cap to the petrol tank being the measure of the quantity of oil required for one tankful of petrol.

Regarding the driving licence payment of a fee of 5s. enables one to obtain a provisional driving licence. Before a Road Fund Licence will be granted a certificate of insurance must be obtained. Some of the companies handling this type of insurance have not taken kindly to motor-assisted bicycles and are demanding insurance rates more appropriate to a motor cycle proper. One or two companies, however, charge reasonable rates. One, for example, provides a comprehensive cover (subject to the insured bearing the first £1 of each and every claim) for £1 2s. 6d., a third party fire and theft policy for 17s. 6d., and a third party only policy for 13s.

The engines are mostly of the two-stroke variety, although at least one uses a four-stroke engine and a two-speed gearbox. The others are direct-driven to one or other of the road wheels. The average speed is from 25 to 30 miles an hour.

It is regrettable that the Cyclists Touring Club, with supercilious snobbery, has set its hand against motor-assisted bicycles. Regarding this, read the editorial comments in The Cyclist Supplement of this issue.

The following are specifications of some of the units:—

The VeloSolex

This machine is designed as a complete entity. The bicycle frame is specially built and designed to carry the motor, and the motor is not available as a seperate unit for attachment to other types of bicycle frame.

The sole model has the same frame for use by either men or women and is of special Solex design with a very open swan neck of thick and rigid build. The sitting position is, in consequence, the easiest possible for the rider, while the road-holding capacity of the machine is excellent. Moreover, the frame is built in four separate sections so that repairs and part replacements are easily and quickly carried out. Cables and wires are concealed inside the frame.

The rim-mounted brakes are both powerful and easily adjustable and the brake levers are particularly handy to ensure perfect control. The luggage carrier allows for a bulky load in addition to which a bag can be hung from either side, apart from the metal toolbox, which is standard equipment. All accessories are of the best quality, and the total weight of the VeloSolex is 55lb.

Ignition is by flywheel magneto fitted beside the crankcase, on the left side of the engine. The engine is a single-cylinder, two-stroke, three-port, with a cylinder capacity of 45 c.c., bore 38 mm. and stroke 40 mm. It is air-cooled.

When at rest, before starting, put the engine in contact with the tyre. To do this, the engine itself (which is on a hinged bracket) is pushed forward by means of the top of the carburettor after lifting the disengagement locking nut. Then, taking hold of the handlebars, press the decompressor lever fully over with the thumb. Holding it there, start pedalling the machine. On releasing the lever, the engine will start up. In cold weather, the engine will start more quickly by closing the choke before starting. To close the choke, move the special red lever to the left. After a few yards of running, move the lever back to the normal running position. When reducing speed or when stopping, press on the decompressor lever, and brake as on a push bicycle. When going

Fig. 8.—Another view of the VeloSolex showing the complete assembly.

uphill, if the speed is less than nine or 10 m.p.h., the rider may help the engine by pedalling.

Specification of the Velosolex

Bore: 38 mm.
Stroke: 40 mm.
Cubic Capacity: 45.
Carburettor: Solex type 7Li.
Fuel Tank Capacity: 1¾ pints.
Fuel: Solexine will give the best results and longest period before decarbonising becomes necessary. In default of Solexine it is possible to use standard petrol with 6 per cent. oil added—½ pint to a gallon.
Plug: 14 mm.
Gap: .016in. to .020in.
Bulbs: Headlamp: 6v. 1 amp. Tail Light: 6v. .15 amp. Parking Light: 3.5 or 3.8 v. .15 amp.
Makers: Solex (Cycles), Ltd., Solex Works, 223-231, Marylebone Road, N.W.1.
Price: £38 (plus £10 5s. 2d. purchase tax).

The Cucciolo "Micro-Motor"

Manufactured by the Italian Ducati concern, the Cucciolo "Micro-Motor" is of revolutionary design and construction. A 48 c.c. four-stroke unit, it incorporates a two-speed, pre-selector gearbox and many other refinements. The motor can be fitted to ordinary pedal cycles, and power is transmitted to the back wheel by the actual cycle chain. The drive is, therefore, absolutely positive. The 48 c.c. precision-built engine incorporates every desirable feature of the bigger engines: detachable head, light-alloy piston, single cam traction pulled overhead valves, standard 14 mm. spark plug, highly efficient finning of the piston head and crank case for perfect cooling, two-jet automatic carburettor for easy starting and smooth running, metal plates oil-immersed clutch, two-speed gears with automatic pre-selection and neutral position, sump lubrication. No oil has to be mixed with the petrol.

Fig. 9.—The Cucciolo "Micro-Motor" It is a four-stroke unit and is a chain drive on the rear wheel. It incorporates a two-speed pre-selector gearbox.

To start the engine make sure that the gears are in the neutral position, that is, rod is half way in. This can also be controlled by moving the cycle backwards as this will free the motor if either gear is "in." The motor being in neutral position there will be no difference from an ordinary bicycle and pedalling will be as usual. When a speed of about three to four miles per hour has been reached with the aid of the pedals, stop with your right pedal in a horizontal forward position (pre-selection of high gear).

Bring the valve lifter/throttle control into full forward position. Simultaneously pull fully in the clutch control lever and release; this movement will automatically engage the top gear and the release will start rotation of the engine immediately, the exhaust valve being open and the cylinder, therefore, decompressed.

Rotation of the engine is thus obtained by the momentum gained while pedalling. As soon as the engine is rotating bring back the valve lifter and throttle control slightly over the central notch, that is not more than quarter throttle. The motor will start immediately.

If the engine should start jerkily (due to insufficient riding speed or a dirty spark plug or carburettor), or should the motor give irregular firing or be slow to start, you can help it with a few pedal strokes, but without touching the clutch lever, as this would throw the gears into neutral, then low gear, neutral, top gear, etc., position on every quarter revolution of the pedal crank. Eventually, use valve lifter again while pedalling for a few seconds and then throttle halfway back-and-forth two or three times until the motor starts. Obviously if the road is on a gradient you will start facing down hill, then as soon as the motor is started brake and turn back up hill in high or low gear.

When the engine has "warmed up," even in cold weather, and always in warm weather, "momentum" starting is obtainable just by operating the clutch lever, that is without acting on the "valve-lifter" control.

Specification of the Cucciolo "Micro-Motor"

Bore: 39 mm.
Stroke: 40 mm.
Compression Ratio: 6.24: 1.
Cubic Capacity: 48.
Spark Plug Points: .018in. to .020in.
Sump Capacity: 1 pint approx.
Petrol Tank Capacity: ½ gallon.
Lubrication: Separate, ample and positive, with about a pint of oil carried in the bottom of the crankcase.
Fuel: Petrol.
Plug: 14 mm.
Agents: Britax (London), Ltd., 115-129, Carlton Vale, N.W.6.
Price: £40 (free of purchase tax).

The Mini-Motor

This sturdy 1.3 h.p. unit can be fitted to any bicycle or tandem, is simple to operate and easy to maintain. The motor has no gears to wear out, and there is only one revolving unit—a crankshaft assembly mounted on ball- and roller-bearings. It is a two-stroke running on petrol and oil. A drive lever, for engaging and disengaging the engine, and a throttle lever are fitted to the handlebars. To ride, close the throttle, release the ratchet on the drive lever and the Mini-Motor comes to life. Close the throttle, release the ratchet on the drive lever and the motor will stop, enabling you to save petrol by coasting down hills or pedalling along the flat, if you so desire.

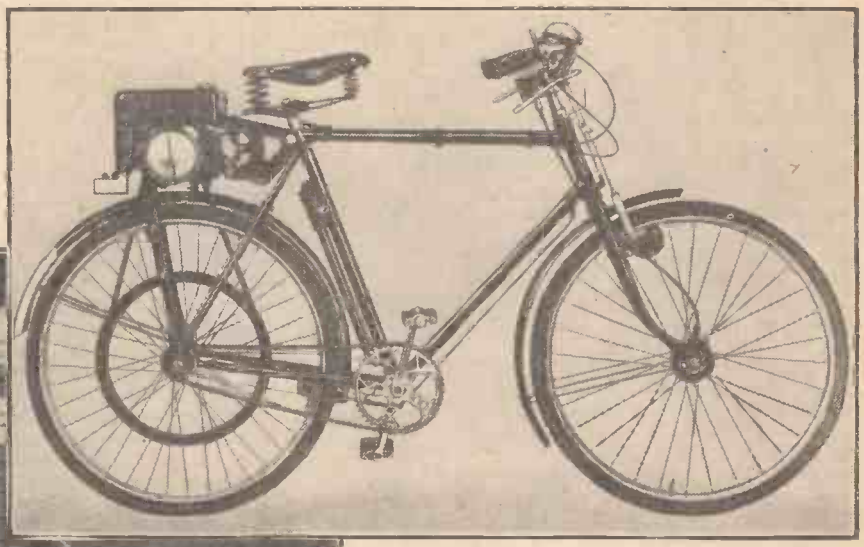


Fig. 10.—The Cyclaid which is also a back-wheel drive.

The drive is taken by the rear wheel, and providing the tyres are kept well inflated there should be no undue wear.

Mini-Motor Specification

Bore: 38 mm.
Stroke: 44 mm.
Cubic Capacity: 49.9.
Tank Capacity: ¾ gallon.
Fuel: Petroil mixture.
Carburettor: 9 mm. Dellorto.
Manufacturers: Mini-Motor (Gt. Britain), Ltd., Trojan Way, Croydon, Surrey.
Price: £21 complete.

The Cymota

The Cymota is based on well-proved Continental practice and consists of a two-stroke motor within a protective and attractive bonnet which fits over the front wheel of the bicycle. It has only one control—the accelerator—fitted within comfortable reach on the handlebars. The Cymota is a 45 c.c., two-stroke engine utilising a deflection type piston.

To ride, close the choke on the carburettor by rotating the small lever on the trumpet-shaped air-filter which protrudes through the backplate. See that the petrol is turned on at the tap on the left-hand side of the backplate (the "on" position is when the lever of the tap is parallel to the body of the tap).

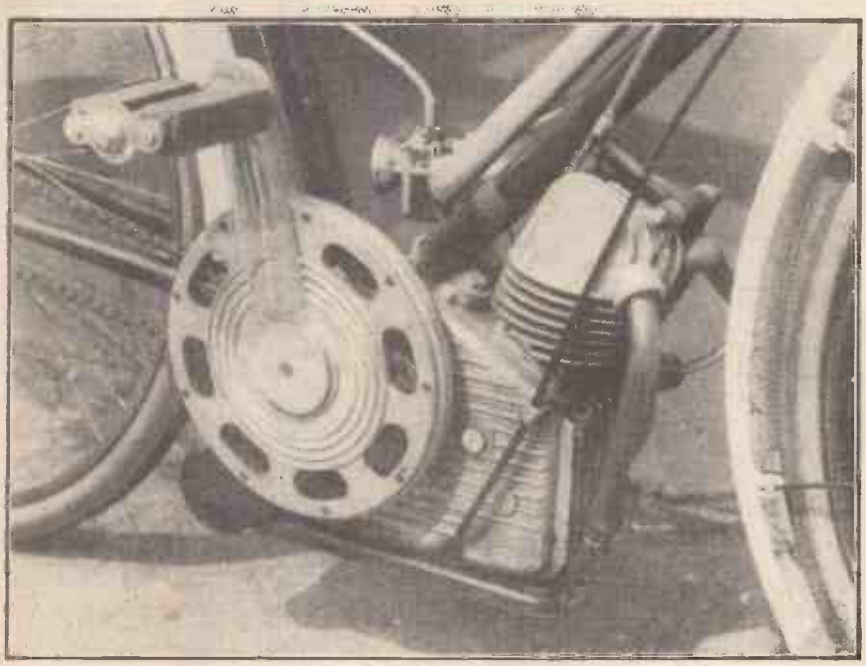


Fig. 11.—A close-up of the Cucciolo "Micro-Motor."

Mount the bicycle, push the control lever on the handlebar over to the right as far as it will go; this opens a valve in the cylinder head, releasing the compression and making it easy to pedal the machine. The motor will not start with the decompressor valve open, and it is inadvisable to run for an excessive distance this way, for the plug will tend to oil up. Begin pedalling, and when you have reached a speed of 5-10 m.p.h. move the control lever right over to the left and the motor should then start. After about a minute's run (dependent on the temperature) commence to open the choke. As the motor attains running temperature the choke can be fully opened. If you wish to stop, use your brakes and push the controller over to the right.

If on a steep hill you find the revolutions of the engine dropping, close the throttle slightly and turn the pedals round two or three times every 10-15 yards. It is advisable to keep the motor turning at full revolutions, and this assistance will ensure that. A freewheel should be fitted to all bicycles with a Cymota. It has a petrol consumption of 200-250 m.p.g.

Specification of Cymota

Bore:	38 mm.
Stroke:	40 mm.
Cubic Capacity:	45.
Carburettor:	Amal type 308.
Main Jet:	25.
Mixture Control Needle:	In centre slot.
Fuel Tank Capacity:	3 pints.
Fuel:	Petroil mixture in the proportion of 1 : 20 (1 fluid oz. oil per pint of petrol). The measure attached to filler cap holds the correct amount of oil for 1 quart of petrol.
Lubrication:	The following grades are recommended for summer and winter: Singleshell, Wakefield, Castrolite, Mobiloil, Arctic, Essolube 20 (all grades to SAE 20).
Plug:	Champion L.10.
Gap:	.018in.
Ignition and Lighting:	Flywheel magneto.
Bulbs:	Headlamp: 8 v. .5 amp. Parking Light: 4.5 v. .3 amp. Tail Light: 6 v. .5 amp.
Battery;	Twin Cell: Exide type C.60 or Ever-Ready type .800.
Contact Breaker Gap:	.012in. to .015in.
Ignition Timing:	.015in. before T.D.C.
Agents:	Blue Star Garages, Ltd., 364, Kensington High St., W.14.
Price:	£18 18s. 0d. (free of purchase tax).

The Cyclemaster

Known as the "Cyclemaster," it is a complete back wheel, embodying a small but highly efficient two-stroke engine. The wheel spokes are fixed to a drum, which revolves around the engine. A clutch is provided so that the engine can be kept ticking over in traffic.

The "Cyclemaster" power unit can be fitted to any pedal bicycle in 20 minutes in place of the existing rear wheel and removed when necessary—a puncture, for instance—in ten minutes. No reinforcing of the cycle is required, thereby keeping additional weight down to a minimum.

It is practically noiseless in action and, therefore, inconspicuous (a strong point for those rightly conscious of their dignity!), whilst the high horse-power developed enables a cruising speed of 20 m.p.h. on the level, easy ascent of 1 in 14 gradients without pedalling, steeper hills with slight assistance. Where even powerful cars are daunted, the Cyclemaster will tow its owner up on foot! It does 300 miles to the gallon.

The engine itself requires a minimum of maintenance owing to its sound yet very simple construction. If petrol runs out and the cycle has to revert temporarily to its original function, the overall additional weight is only 20lb.

Altogether it is a most fascinating piece of engineering. Behind it are two very well-known figures in the British motor industry, and the wheel is being made by E.M.I. Factories, Ltd., in their great factories at Hayes.

Specification of the Cyclemaster

Engine:	Two-stroke
Bore:	32 mm.
Stroke:	32 mm.
Cubic Capacity:	25.7.
Developed b.h.p.:	0.6 (approx.).
Engine Speed:	4,000 r.p.m. at 20-25 m.p.h.
Fuel Mixture:	"Petroil" (1 in 25).
Fuel Tank Capacity:	2½ pints (approx.).
gnition:	Flywheel magneto.
Carburettor:	Amal.
Fuel Consumption:	300 m.p.g. (approx.).
Clutch:	Single plate, operating in sealed oil bath.
Maximum speed:	20-25 mp.h. at 4,000 r.p.m.
Ratio Engine-clutch:	3.2 : 1.
Ratio Clutch-wheel:	5.6 : 1.
Ratio Overall:	18 : 1.
Transmission:	Chains.
Climbing Capacity (without pedalling):	6-7 per cent. approx.
Additional weight of Cyclemaster Wheel:	20 lb. (approx.).
Agents:	Cyclemaster, Ltd., 26, Old Brompton Road, S.W.7.
Price:	£25.

The Cyclaid

This is a modern single-cylinder two-stroke engine of advanced design, with detachable cylinder head for simple maintenance, and inserted metal liner for easy and inexpensive replacement. Its dependable Amal carburettor and special rotating ignition will be appreciated by all those of an enginering turn of mind. The engine can be easily fitted to either men's or ladies' machines, and the positive belt drive ensures that there is no slipping, even in wet conditions.

Specification of the Cyclaid

Stroke: 32 mm.
Bore; 35 mm.
Piston displacement: 31 c.c.
Ignition: Special rotating magnet with sparking plug.
Advance Ignition: 2.6 mm.
Carburettor: Amal.
Fuel Tank: 3 pints (approx.).
Fuel: Normal oil-petrol two-stroke mixture. One part oil to 30 parts petrol.
Makers: British Salmson Aero Engines, Ltd. Raynes Park, S.W.20.
Price: £20 (free of purchase tax).

Fig. 12.—Another view of the Cymota showing the streamlined cowling of the engine.

A Power-driven Glider

Particulars of the Construction and Performance of a Machine Powered by a 3½-h.p. Engine

By R. SWINN

SINCE flying began it has been the dream of interested persons to possess a plane that is cheap to run and within the reach of their pockets, in fact, something of an aerial motor-cycle. Simple though this requirement is, achieving it presents a large variety of problems. The

The completed power-driven glider, with the author in the cockpit.

advent of the Flying Flea seemed to have bridged the gap, but owing to its unstable qualities its useful life was of short duration, and by the time the designer had found a solution to its misbehaviour, so much damage had been done that the Government had banned the machine. I was able to operate my Flying Flea some considerable time after the ban as I was fortunate enough to be in Egypt where the broad-minded outlook of the Egyptian Air Ministry waived red tape. In fact, I flew the machine twice per week from Cairo to Port Suez via the Desert Road and found that I did something like 240 miles per week, which was quite an achievement, particularly when one remembers that it had only a 3½-h.p. Douglas twin engine to propel it.

It was amusing to see the cars (which were constantly overtaking me) slow down and give me a wave, and finally go on ahead, leaving me to my 35 m.p.h. and 50ft. of height.

Being interested in gliding I thought that possibly the cheapest way of flying was to fit a glider with an engine, and to this end I bought an old 3.49 c.c. Villiers two-stroke engine, sent it off to the makers for reconditioning, and sat down to work out the details. My first plan was to design an auxiliary unit which could be fitted to the average glider, above the wings, and which did not necessitate any alteration to the glider itself. My propeller on this occasion proved to be of too coarse a pitch, and as a result the unit was under-powered for the work it had to perform.

In June, 1949, I purchased a glider and had many happy hours soaring in it. The thought came to me one day when the wind was unfavourable for soaring, why not fit an engine into my machine and attain a height where I could soar on thermals and so be independent of unfavourable surface winds. I sent for and altered my power unit which I fitted into my machine, and provided it with retracting gear. The idea being to retract the unit in flight when sufficient height had been gained to enable soaring to be carried out.

I designed another propeller in the light of the shortcomings of the last one, and had it built by Airscrew, Ltd., of Weybridge.

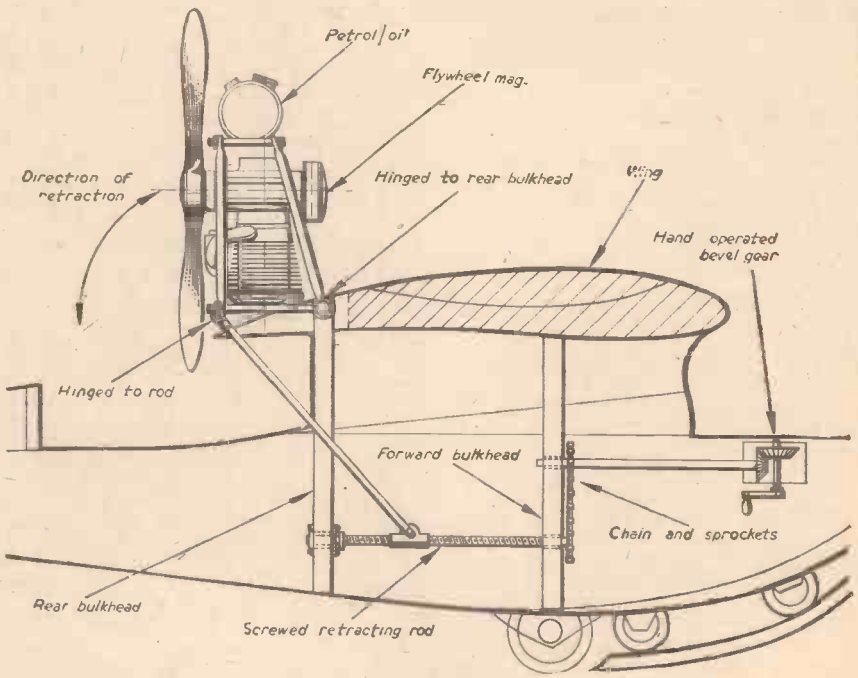
Engine Unit

My engine unit consisted of a cylindrical tank, divided to form compartments for the oil and petrol and this tank was situated above the engine. Petrol was fed to the engine by gravity, oil being fed by compressed air (4lb. to the square inch), which was obtained from the crankcase compression. The engine itself was mounted in an inverted position to give the maximum height to the propeller. The inversion of the engine raised the question of adequate lubrication of all parts. I accomplished this by blocking the piston lubrication hole and feeding the lubricant direct to the main bearing and big end. The surplus oil running down the cylinder walls was ample for the lubrication of the piston.

Considerable difficulty was experienced in starting the engine, due to the plug becoming wet, it being now situated at the lowest point of the cylinder head. This difficulty was overcome by recessing the plug hole and fitting an aviation plug which had a long reach body, thus standing above the inner edge of the cylinder head. My engine was now ready, but I still had a lot of vibration to eliminate, so a few more days were spent with the engine on a stand trying to overcome this problem. Eventually I was able to start the engine and, with little loss of time, pass the low revving danger point and reach a speed at which the engine ran quite smoothly.

Trial Run

The day came for the machine's trial, and I took it to a nearby wartime aerodrome, assembled it, and filled up with oil and petrol. I started up the motor and made myself comfortable in the cockpit of the machine, opened up the motor and slowly gathered speed. At first, I found the machine hopping off the ground and then being blown sideways by the cross wind to alight with a judder on the ground again. I concentrated on the controls to increase the engine speed, and the side kicks I had been experiencing died away and I found I was some feet above the ground. Now it was only a matter of keeping the machine straight, and flying on, but then I found that the power output was not enough to keep me airborne, and I was being slowly but surely forced down into a ploughed field. Then my juggling of the controls had some effect,



Sketch showing the arrangement of gearing for retracting the engine and propeller.

and up I went to fifty feet only to lose it in the next mile or so through further juggling. This time I was forced to land. I had in effect flown a very wide circuit and a quarter of an hour later I was back at the starting point ready for another attempt. This I am pleased to say was less eventful and was followed by another immediately afterwards. The machine was a success, and I returned to the club with a distinct feeling of elation.

Engine Details

The engine used was a 3.49 Villiers two-stroke with lubrication pressure fed by compressed air tapped from the crankcase and fed to the oil tank. The air forced oil up a tube reaching to the base of the tank, past a sight feed on top of the tank, and thence on to the side of the cylinder wall, where suitable channels in the block lead the oil to the bearings. The fuel used was ordinary car petrol. The overall width of the engine is 8in.

Propeller

The propeller had a diameter of 3ft. 6in. and was professionally made with a pitch of 1.24ft. with leading edges brass bound. This is most essential as all sorts of things are picked up and sucked into the propeller; in my case mainly small brads. Propeller thrust was taken by an ordinary thrust race mounted between the propeller boss (which was the flywheel of the engine suitably cut down) and the crankcase side.

Retraction

First, I attempted to achieve this by compressed air, then by hydraulic, and finally I decided to fit a screwed rod, which ran along the fuselage for about 2ft. immediately behind my back. Between the two wings, along this rod, was mounted a bar which was moved up and down the screwed rod and was free to pivot and to follow the curved path taken by the motor unit in its extension and retraction. The unit was hinged to the top of the rear bulkhead with two bolts, a third bolt attaching it to the retracting bar. The screwed rod which effected the retraction was operated from the cockpit of the machine by means of a sprocket at its end which was coupled by a chain to another sprocket situated at the side of the fuselage. This brought the drive to a position where it could be carried to a more convenient place for the pilot, and this was done by means of a long rod. Finally, the drive was turned from along the fuselage to an angle of 45 degrees by two bevel wheels in a case with the winding handle attached.

Close-up rear view of the engine.

A side view of the glider.

Further Details

Wing span, 45ft.
Length of machine, 21ft.
Weight of the machine, 360lb.
Weight of engine, 70lb.
Weight of pilot, 14½ stone.

Landing gear, one wheel beneath pilot's position and an ash skid to finally bring the machine to a stop.

Maximum height reached, 5,200ft. This was done with engine retracted and using thermals—I had at this height reached cloud base and was worried about being taken into cloud without suitable instruments.

Flying speed of machine, 30 m.p.h.

During the whole of my tests I was never able to get more than ¾-throttle. I am now attempting to rectify this.

Model Engineering Exhibition

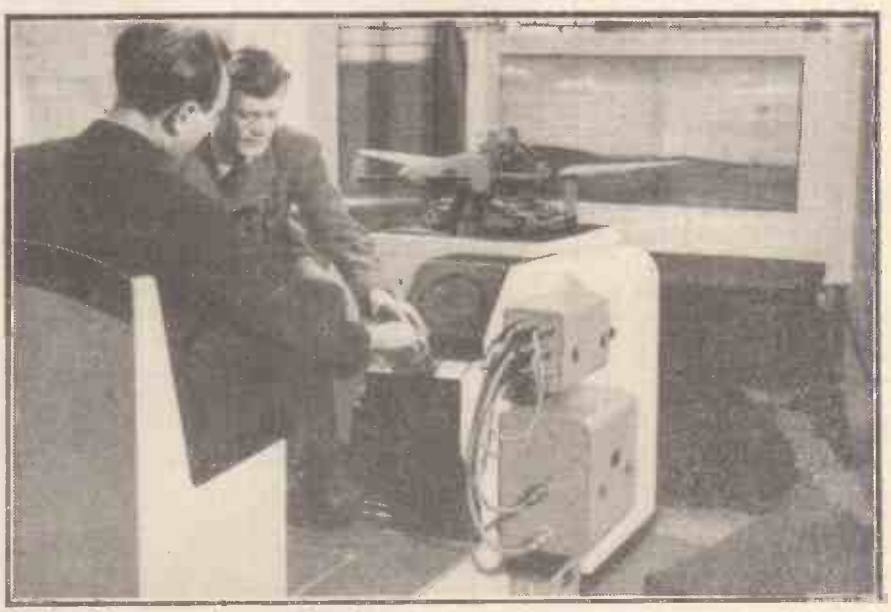
THE Model Engineering Exhibition will celebrate its jubilee at the New Horticultural Hall, Westminster, from August 9th to August 19th.

The exhibition will maintain all its well-known features, to which many new ideas will be added. Demonstrations will be given to help those wishing to take up Britain's premier hobby of model making, and exhibits will be on view showing the important part played by model making in industry.

Imperial Pound and Yard Test Report

The report on the comparisons of the Imperial Standard Yard and the Imperial Pound and the Parliamentary Copies by the National Physical Laboratory is available on June 7th, from H.M. Stationery Office, price 1s.

These comparisons have to take place every 10 years and should have been held during the war years. Among the conclusions reached by the National Physical Laboratory in their report is that the Imperial Standard Yard has been shortening at a fairly uniform rate throughout the last 52 years. It is recommended that new arrangements for defining the Yard and Pound more scientifically are much overdue.



An electrical automatic pilot, shown at the recent Annual Exhibition of the Physical Society. The response of this automatic pilot is considerably quicker than the hydraulic type of apparatus, and is now in use in the R.A.F. Changes of course, climb and dive may be effected without disengaging the auto-pilot by means of an automatic controller.

Glass Fibre and its Uses

A Modern Product Having Many Uses in the Engineering, Technical and Industrial Worlds

GLASS has at least one very decided advantage in our modern rather precarious civilisation. It is relatively cheap, easy to produce and in good supply. What is more, its basic materials are abundant.

Glass in fibre form can be flimsy, almost transparent material, yet it has great strength.

Ordinary glass, as we know it, however, has the enormous drawback of fragility. That is why for a very long time various attempts have been made to develop manufacturing methods of producing glass fibres which could be used for spinning and weaving purposes and which, in this manner, might present glass in an entirely new form, deprived of its "shatterability" and enhanced with many new and valuable properties which, in its ordinary guise, it is entirely denied.

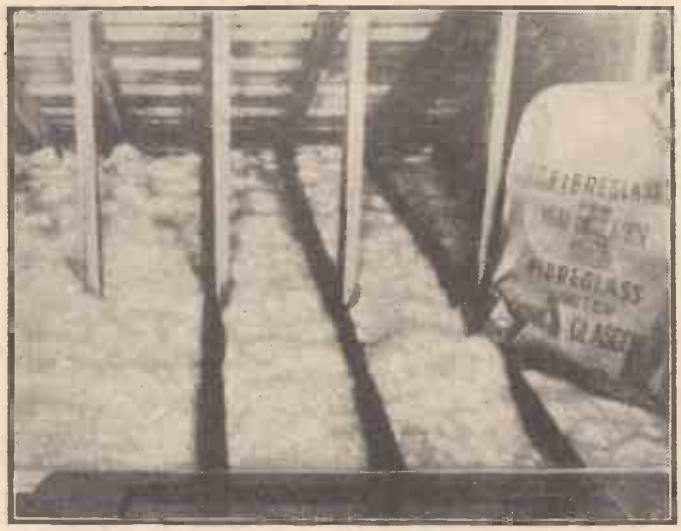
The first glass fibres in comparatively modern times were produced in England about a century and a quarter ago. They were made by drawing out thin glass rods, and it was proposed to employ them in the making of lamp wicks. However, the project fell through, and it was not until World War No. 1 was well under way that the Germans managed to develop a local manufacture of glass fibre which was used as a substitute for their then much-needed asbestos sheeting, the whole of which supply had been cut off by the British Navy's blockade.

When the need for this asbestos substitute passed, so also did the German trials in glass-fibre production. In fact, the entire subject was dropped, so far as industrial production was concerned, until it was again taken up by a few American scientists about ten or a dozen years ago. These people were interested in the possibilities of artificial fibres, and, besides dwelling on the probability of utilising new synthetic resins for fibre production, they were struck by the many unique advantages held out by glass if it could be reliably manufactured in fibre form.

Many Advantages

Glass in the form of fibre has many advantages over all other types of fibrous materials, natural or artificial. It is, in the first place, thermally insulative. It has a high resistance to many kinds of chemical attack. Particularly, it can withstand strong, boiling acids (except hydrofluoric acid), although it is not so resistant to alkaline influences. Additionally, glass is quite incombustible. Hence, like asbestos, a glass fibre material is quite fireproof.

The fibre is electrically insulative and it has quite a considerable tensile strength. Its abrasion-resistance is of a high order. It is non-absorbent, cleanly hygienic, and it does not harbour bacteria and other putrefactive organisms. It can be coloured by the incorporation of various metallic oxides in the glass itself, but more conveniently still, methods of actually dyeing glass fibres when woven up into yarns have been successfully devised. Consequently, the surface dyeing of glass material now presents almost as little difficulty as does the dyeing of cotton, wool, silk or rayon fabrics.



Close-up view of the rafters of a building, showing thermal insulation by means of a glass-wool layer.

The story of the manner in which the modern glass fibre crept into industrial use is a long and intricate one, and it cannot very well be detailed here. Beginning, however, with the production of relatively coarse glass fibres the fibre glass industry arose in Britain, particularly around Glasgow, and so developed itself that within a few years it was producing glass threads of all useful commercial and technical diameters.

Flexible Fibres

The laboratory student who has made short glass fibres for himself by drawing out a few inches of glass rod in a hot flame and has noted the characteristic brittleness of such products may, perhaps, be somewhat sceptical of the possibilities inherent in the commercially manufactured fibres. But, strangely enough, the flexibility of any given glass fibre varies *inversely* as the square of its diameter. That means that the thinner the thread the relatively more flexible it becomes. The thin glass fibres and threads which are being produced nowadays are surprisingly flexible, although, of course, unlike the natural vegetable fibres, there is a maximum radius to which these glass filaments can be bent.

That is an admitted disadvantage of the modern glass fibre, a drawback which it is hoped to eliminate, or, at least, to lessen very considerably in the future; but as things are at present, the "knot-strength" of glass fibre is low, and it is not a practicable matter to tie two glass threads together, as, for instance, in the knotting of broken yarns. This present difficulty, however, is overcome by cementing the threads together, using for the purpose a specially quick-drying plasticised cellulose acetate adhesive which gives neat yarn joints with tensile strength even exceeding that of the glass fibre itself.

The modern method of producing glass fibres on a commercial scale and in various accurately-controlled diameters (which, normally, range from 0.00020in. to 0.00023in.) is of great interest. Although ordinary glass could be used for the purpose, such material is never employed, since fibre glass of much higher insulation, di-electric strength and general durability can be produced from special alkali-free glasses in which the oxides of the alkali-producing metals, such as sodium and potassium, are reduced to very low proportions or eliminated altogether.

There is, also, another type of "chemical" glass which is now used for fibre-glass production. This is employed for the production of glass fibre which is to be used for resisting chemical attack from acids. Although glass is ordinarily not very resistant to alkalis, it is reported that a newly-developed type of fibre-glass material

Weaving glass fibre. A worker engaged in the production of "woven glass" fabric.

has given very good results when tested against prolonged alkali attack.

Marvellous Marbles

The selected glass for manufacture into fibrous form is cast into marbles. These are like the clear glass marbles of our juvenile days. They are automatically fed into a little platinum crucible-furnace, which is heated and kept at a well-defined temperature by means of a heavy current (high amperage) at a low voltage.

The individual marbles are all of uniform size, and before they are fed into the furnace they are carefully inspected. Those which have striæ and bubbles within them are rejected and sent back to the melting pot to be re-cast.

Each platinum crucible has upwards of 100 very fine orifices in its base, and as the marble melts, the liquid glass emerges in minute drips at the underside of each orifice. Each globule of glass is touched with a metal "picker" and drawn down, being gathered together with the others at a sort of V-shaped pad which is furnished with a continuous oil-emulsion supply to act as a lubricant. From thence the fibre is wound at high speed on a revolving spindle, the resulting drawing speed of the glass being as high as 10,000ft. of thread per minute and the filament diameter being about 0.00023in. With any given type of glass, the filament diameter depends on three factors, viz., drawing speed, temperature of the molten glass and diameter of the drawing aperture.

It should be noted that the continuous filament thus produced is, in reality, a combined thread, being made up of a hundred or more separate filaments of glass. This comprises the continuous filament which is being so much used for electrical insulative purposes and allied uses.

Steam-blown Threads

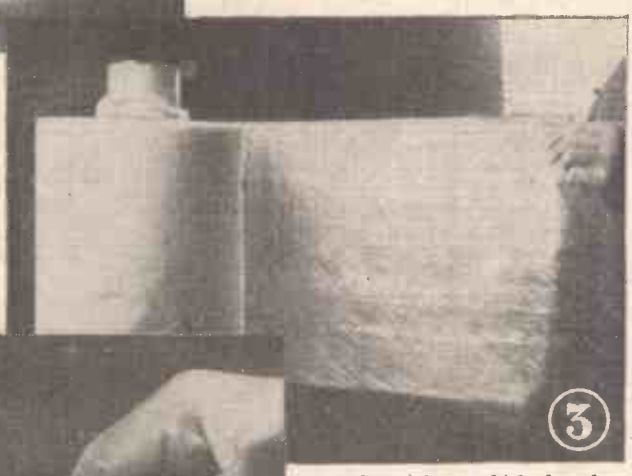
There is, however, another basic variety of fibre-glass material. This is the "staple" fibre which is used for chemical and absorptive purposes. Here, the mechanical high-speed drawing is replaced by a process of fibre drawing by means of a steam or air blast. In this case, the platinum melting-crucible contains only 28 jets, and the molten glass, as it drips through the separate orifices or nozzles, is at once caught up in high-velocity steam or air jets (usually the former) which have the effect of attenuating the then plastic material and of throwing the resulting fibres on to a revolving drum. This produces a sort of wad or "sliver" of glass fibres, not unlike, in appearance, a "sliver" of raw cotton. From the drum the sliver is withdrawn on to a small revolving drum.

In order to give greater inter-fibre adherence, the glass fibres, during their forcible steam or air drawing, are sprayed with an oil emulsion preparation.

If desired, the resulting sliver of fibre glass may be processed-up into "matted" form, or it may be used for spinning in

1.—As a laboratory aid to filtering glass fibres have long been known.

2.—Showing the "warp" or "up-and-down" threads being secured on a glass weaving loom.



3.—Glass fibre which has been woven into a roll of incombustible fabric.

4.—Ordinary glass marbles such as any diminutive schoolboy would have in his pocket; yet more than 100 miles of glass thread may be drawn from each one.

5.—A continuous "silver" or mat of glass fibre material being manufactured for sound-insulating purposes.

6.—Glass fibre spinning. A frame of "cops" on which the finished glass thread has been wound.

much the same way as ordinary wool or cotton fibre.

It is interesting to note that, according to accurate assessments, each individual marble of specially-made alkali-free glass is capable of producing more than a hundred miles of glass fibre, an amount which certainly emphasises the economy, utility and overall efficiency of the process.

The reason for using special glasses for fibre production may be appreciated from the fact that, although any type of glass in its "ordinary" form is relatively insensitive to adverse influences, this is not the case when the same glass is so enormously attenuated as it is when made into fibre. For example, the average glass marble used in the drawing process above described has a surface area of approximately 1.7 sq. in. In fibre form, however, the same bulk of material can have a surface area of as much as 4,000 sq. in., in which condition the glass material becomes highly sensitive to atmospheric and other influences. If the glass in fibre form contained appreciable amounts of alkali, any film of atmospheric moisture deposited on the fibre material would dissolve the surface alkali, giving rise to an alkaline solution which would slowly attack the constituent silicates in the glass and thereby set up a vicious circle which would proceed gradually and which would end up only with the entire disintegration of the fibres. The same influence would also decrease the weathering resistance of the fibrous material, together with its electrical resistance. Hence, for these reasons also, it is very necessary that only "alkali-free" glass should be used in the manufacture of fibre glass.

Glass fibre may be woven into an all-glass fabric in much the same way as the various natural and synthetic fibres are treated. Usually, the winding and weaving speeds are lower in the case of glass fibre, and there are various details of procedure which require special practice when dealing with this material.

However, in this woven glass fibre which, as we have already noted, is quite capable of being dyed, we have at last a textile fabric which is inherently and quite permanently fireproof. For stage and cinema hangings, for drapings among inflammable surroundings, and for many another similar usage, this woven material is likely to replace all others.

In the electrical industry, glass fibre material has been well received. It has been found possible to wind motors and generators with a glass-fibre insulated wire and, by so doing, to reduce the size and weight of the machines. Because one glass fibre has a certain frictional influence on another, fibre material for all such usages is invariably varnished. This eliminates the mutual abrasive action of the fibres and practically completes their normal indestructability and resistance to corrosion.

A Mystery Unsolved

When drawn out into fibre form, not only does the flexibility of the glass increase, but its tensile strength also becomes greater. Under ordinary conditions, it is quite possible to produce thin, glass-fibre material, having an average tensile strength of 150,000lb. per square inch, whilst laboratory workers have made such threads stand up to loads approximating to a million pounds per square inch. Yet, an unsolved mystery still remains in this connection, for theoretical calculations based on considerations of the molecular structure of the glasses used for fibre formation suggest that tensile strengths up to a maximum of 10 million tons per square inch are within the bounds of possibility!

Similar observations have, in recent years, been forthcoming in various fields of metallurgical research. It would appear, indeed, that the way is being paved for an original discovery of far-reaching importance connected with the subject of material strengths, by virtue of which it will become possible to increase the tensile strengths of carefully-produced materials, metallurgical and otherwise, to heights which are altogether unattainable at the present time. Whether such a revolutionary principle in physics will come through research into glass fibres or through some other channel of scientific investigation it is, of course, utterly impossible to predict.

Mention has previously been made of the use of glass fibre as a thermal insulator. This is the case when the loose glass wool is employed, the material occupying about one cubic foot for every 8lb. of weight. But, curiously enough, when the same material is highly compacted, that is to say when about 80lb. of the same glass wool are compacted into one cubic foot of space, it becomes an excellent heat conductor!

Just as cotton, paper, wool and other fibrous materials can pick up atmospheric moisture, so, also, can glass-fibre material; but, in the latter instance, the moisture pick-up is very much smaller, amounting to only about 5 per cent. of that of cotton under similar conditions.

To list the various uses of the new glass fibre material would be out of the question here. Threads, fabrics, wools, felts, sound-insulating media, air filters, acid-proof felts in submarine and other high-duty accumulator cells, chemical filtering beds, acoustic silencing devices, rot-proof sealing tapes, packing material for specialised products—these are but a few ways in which the new material has been used.

Penicillin Manufacture

In the highly specialised industries, too, glass fibre is used. For example, in penicillin manufacture, glass-fibre material is used as a material in which the necessary mould may be grown, and, also, in which air-borne bacteria may be trapped. The glass material is readily sterilised without undergoing injury, and so, very conveniently, it can be used over and over again.

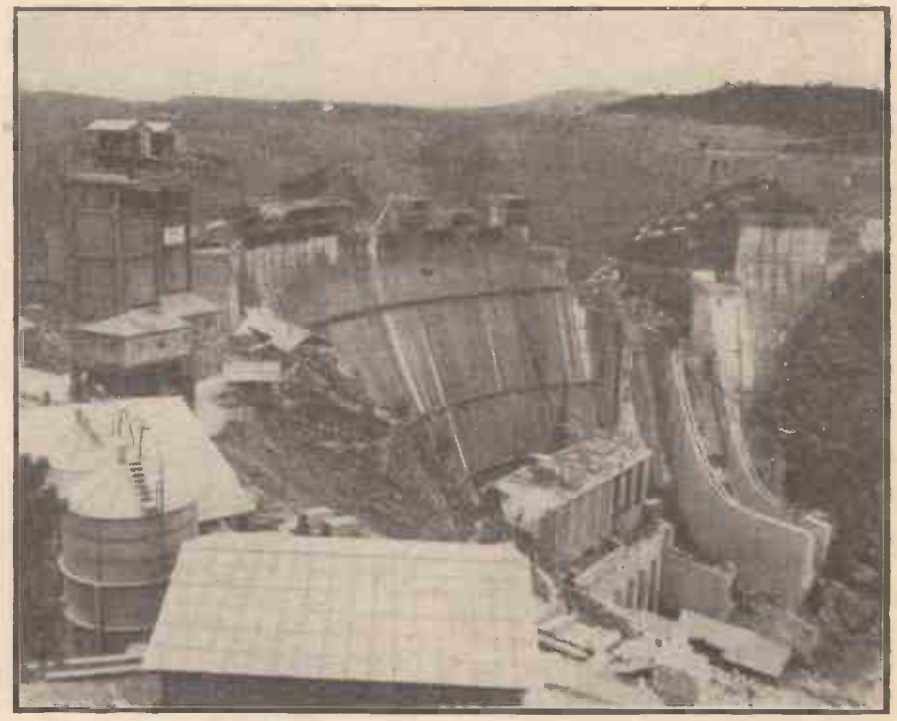
Even glass-fibre bootlaces have come into being, and in wartime a special type of black-dyed, glass-fibre fabric was regularly used to provide flare shades in parachute flares. Such shades directed the intense flare illumination downwards and so diminished the exceedingly great dazzle to which the aircraft observer would have been subjected without their use.

Given a process for rendering glass fibre still more flexible, "knottable" and "stitchable," we may still, perhaps, encounter glass fabric garments made, not for protective purpose but for ordinary utilitarian everyday wear. To-day glass in fibre form is mainly a structural, engineering, chemical and industrial material. To-morrow, however, it may be a new arbitrator of fashion and the gleam of the glass fibre may appear universally in all our wearing apparel.

You never can tell in these matters of technical science.

(For permission to include the accompanying illustrations of glass fibre processing, we are indebted to the courtesy of Fibreglass, Ltd., Glasgow.)

New Hydro-electric Scheme



A view of the Zezere Dam, which is being built at Castelo do Bode, about 90 miles north of Lisbon, in connection with a hydro-electric scheme to develop the water power of the River Zezere. All the equipment for the dam and the generating plant is being supplied by British manufacturers.

ELEMENTS OF MECHANICS AND MECHANISMS—34

Power Transmission Methods

THE curious-looking devices shown in Fig. 100 are mechanisms used for converting constant speed rotary motion into variable speed motion. The device shown at D is the familiar Geneva movement used in motion-picture apparatus. The right-hand wheel is revolved in a series of jerks by the spindle tool on the other wheel. Between the jerks each picture is retained in front of the lens for the brief space of time which it takes for the left-hand wheel to make a complete revolution—that is, during the time it takes for the single tool to come round again.

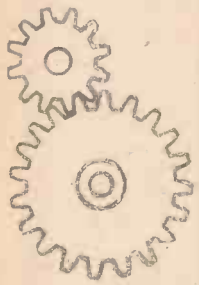


Fig. 96.—Spur gear wheel and pinion giving a ratio of 1 : 2.

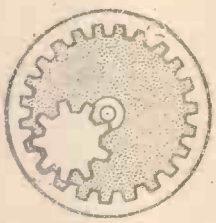


Fig. 97.—Internal toothed-gear wheel and pinion which maintains the direction of rotation.

Gearing and the Law of Work

The power developed by an engine is usually dependent to a large measure on the speed at which it runs. This is particularly so with internal-combustion engines and electric motors, where the maximum power is only developed at high revolutions. However, it may not be convenient or possible to use the power in this form, and the final shaft, wheel or other device performing the work may be required to revolve at a much slower speed. On the other hand, the speed of the final shaft may, in certain instances, need to be higher than that of the engine or prime mover. This necessitates the use of some form of gearing to carry out the conversion.

It will be readily appreciated that a difference in the size of a driving and a driven pulley or sprocket, or in the size of two intermeshing spur wheels, will also mean a difference between their relative speeds. For instance, in Fig. 96 the circumference of the small wheel or pinion is only one-half of that of the large gear wheel, so that for one revolution of the large wheel, the small one will revolve twice. Obviously, if the pinion were mounted on the shaft of a high-revving engine and the drive to the work taken from the spindle of the gear wheel there would be a step down in speed between the engine and the driven appliance of 2 to 1.

Now, although there is a reduction in the speed of the gear wheel compared with that of the pinion, there is no loss in the power transmitted (except the small fractional losses, etc., incidental to any form of transmission), for what is lost in speed is gained in force. Thus the turning force of the gear wheel spindle is proportionately greater than that of the engine shaft carrying the pinion. This relationship between the speed and the force is known as the Law of Work, and is the law under which all forms of gearing operate.

A simple gear and pinion as in Fig. 96 is employed for small ratios, but it is more usual to employ a train of gears, as in Fig. 98, for large ratios. In the example shown it is quite obvious that the ratio between A and D is 12 to 1. There is also the question of the direction of rotation, and sometimes three wheels are used instead of two, merely to retain the same direction of rotation. Alternatively, where the shafts are close together an internal toothed-gear wheel and pinion as in Fig. 97 may be used.

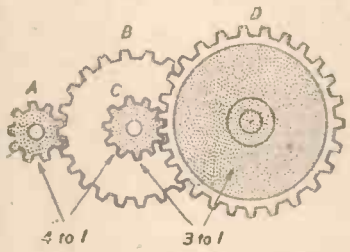


Fig. 98.—A train of spur wheels.

Another type of high ratio device, but with the driven shaft at right angles to the driving shaft, is the worm and worm wheel. When skilfully designed, ratios as high as 70 to 1 can be employed. Above this, however, the efficiency drops off rapidly. Great accuracy in construction and fitting of the worm and wheel are necessary for efficiency and silent running.

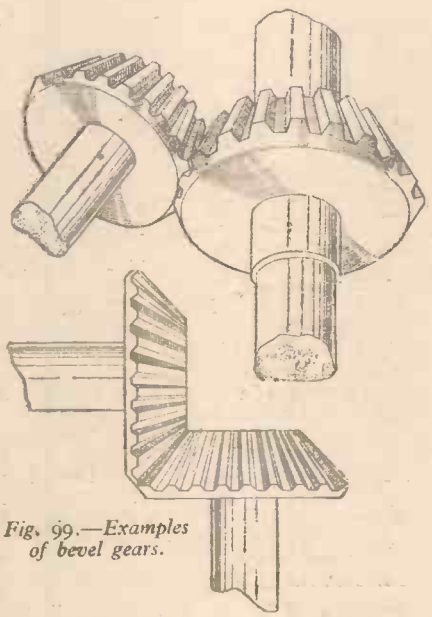


Fig. 99.—Examples of bevel gears.

Although electric motors, petrol engines, turbines, etc., revolve at very high speeds and usually require gearing down to the work, there are other prime movers which have to be geared up to obtain the necessary speed. Many devices operated by human energy, such as treadle lathes, sewing machines, bicycles, etc., are geared up.

It is not always realised that the length of the crank affects the gearing of crank-operated mechanisms. Thus, increasing the length of the cranks of a bicycle has a similar effect to lowering the gear, for, owing to the extra leverage obtained, long cranks require less force to push them round than short ones. The reduction in the force is accompanied, however, by an increase in leg speed, since the cyclist's feet sweep out a longer path for each turn of the long cranks than they do with short cranks. The same thing applies to internal-combustion engines using pistons and cranks. For example, a motor-cycle employing a "long stroke" engine will pull a higher gear than one with a "short stroke" engine of the same cubic capacity. (The "stroke" is the total movement of the piston from one end of the cylinder to the other, and is, of course, dependent on the throw of the crank.)

Variable Gears

An understanding of the law of work will make clear the reason for variable gears as applied to motor-cars, bicycles and many other mechanisms. As already stated, most prime movers develop their full power at maximum speeds. Now, a car is so geared that when the engine is developing most power it will propel the car at the maximum speed on the level. In climbing a hill, greater force is required to turn the road wheels owing to the effect of gravity. To obtain this extra turning force it is necessary to lower the gear ratio. This will, of course, produce a slower turning of the road wheels, but owing to the law of work, a greater turning force will be imparted to them.

Clearly the ideal arrangement would be an infinitely variable gear which would work automatically and so adjust the gear ratio to suit the load under all conditions. Various attempts have been made from time to time to produce such a device, but without much success.

Step-by-step Gears

The type of variable gear most frequently used, not only in cars and bicycles, but in engineering workshop and factory power transmission, is the step-by-step type. In a typical example there are three pairs of pulleys giving three distinct ratios mounted on the two shafts. The gear is changed by slipping the belt from one set of pulleys to another, the diameter of the pulleys being such that one belt is suitable for each set of gears.

(To be continued.)

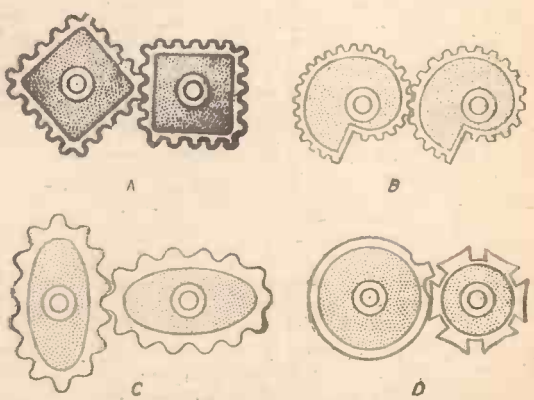


Fig. 100.—Various mechanisms for converting constant speed rotary motion into variable speed motion.

Our Mechanical Pencil Competition

Constructional Details of the Four Prize-winning Entries

THE pencil described by Mr. L. W. Killeen, the first prizewinner, is of original design, and is provided with a propelling, repelling and expelling action. It will use leads up to two, or a number of short pieces, and will use them up to less than ½in. The entire mechanism is easily detachable.

The accompanying illustration, Fig. 1, is a sectional view of the pen showing the various parts. The procedure for stripping the mechanism is as follows :—

Unscrew the pencil in centre, R.H. thread, and wind lead forward a few turns, R.H. thread. Next, unscrew the knurled collar above clip, R.H. thread, and wind out the plungers with blade, R.H. thread; then pull the lead tube from the plunger.

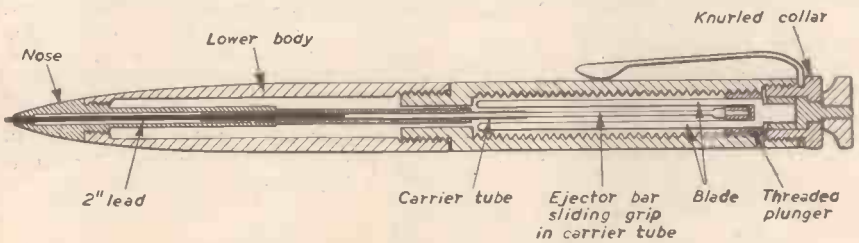


Fig. 1.—Mr. L. W. Killeen's design.

These operations take about 20 seconds.

The nose which is also detachable, has a 2 B.A., R.H. thread. The spare lead container is in the bottom half.

To load the pencil push the lead down the large end of the tube flush with end, and place on the plunger.

The construction of the prototype pencil did not present any difficulties. It is a little long, but that is caused by the container for the spare 2in. leads. It would be better to have a container to take, say, 1in. lead, which would bring the length 1in. shorter. It is also on the heavy side, that is, of course, on account of the materials used (the only ones to hand). The lead tube was made out of a .004 feeler gauge.

Mr. C. Williams' Design

The design sent in by Mr. Williams, which gained second prize, is for a very robust pencil, the construction of which is shown in Fig. 2. A feature of this pencil is the screw feed. The casing and nose is of light alloy, but these parts can also be made of vulcanite or plastic material.

To dismantle the pencil, the nose and top are unscrewed and the scroll withdrawn. The guide is pushed downwards, using the nose.

To re-assemble, the feed-rod is pushed into the guide tube and inserted into the body from the nose end, a slot allowing the feed rod to pass. Screw on the nose and insert the scroll, turning it anti-clockwise to engage the pin. Finally, screw down the cap.

Mr. B. C. Cuffley's Design

The specification of the third prizewinning design is as follows :—

The pencil consists of a moulded plastic body G (Fig. 3), ⅜in. O.D. and threaded internally for 2in. with a ½in. 20 T.P.I. 3-start thread C. The top end of the body is threaded 5/16in. 40 T.P.I. at T. The bottom end of the body is threaded 9/32in. 40 T.P.I. at B. A brass point, A, is recessed to take F, O and D. The extreme tip is bored .048in. and split by a very thin slot for 3/16in. The tip is made long and is split to support the lead. Standard .049in. leads N are used in preference to thin leads which break very easily. The propelling mechanism consists of a tube D ⅛in. I.D. × 3/16in. O.D. with a cross-section as in Fig. 4, having a 1/16in. slot for all of its length. Inside this tube is a small tube O.048in. I.D. × 5/64in. O.D. split to grip the lead and fitted with a guide ring F soldered to it. A slot is cut down one side to accommodate the "pip" E "pinched" on the 18 S.W.G. brass wire P so that the travel of P is limited. A spring, which clears thread Q, between F and H, keeps O at the outer limit of its travel on P. A portion of an 8 B.A. screw Q is soldered to P and screws into H, which is shaped as in Fig. 5 with the "pip" at I to fit the thread C. The end of tube D is plugged by R and a larger tube X 3/16in. I.D. × 7/32in. O.D. is soldered to D. This forms the lead carrier. The tube X has fitted to it two plain rings J and S 9/32in. O.D. to centralise, support and locate the tube X. The whole mechanism is held in place by a brass bush U threaded 5/16in. 40 T.P.I. and carrying the clip K, which is pressed from sheet metal shaped as in Fig. 6, the two lugs being wrapped around the bush U in the recess provided. This method of fixing is adopted to facilitate adjustment of the clip. The cap M of moulded plastic has a metal tube insert L with dimples to grip the top of X. An evaser clip V and erase W are provided. The overall length of the pencil is 5¼in.

To dismantle, unscrew K, turn tube X anti-clockwise until H leaves the thread C; withdraw tube X. Slide H and F from D; unscrew H. P can now be slid in O but not removed. The whole can be cleaned easily.

Using 2in. leads, the first 1/16in. projects with the mechanism full "in." All internal metal parts are nickel plated, and all external metal parts are gilt.

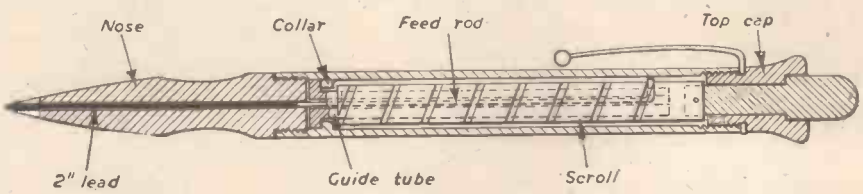


Fig. 2.—Mr. C. Williams' Design.

Pencil Design by Mr. H. B. Munro

Novel features of this pencil are the sliding weight for propelling the lead and the speed with which the pencil can be taken out of the pocket for instant note-taking, and continuous uninterrupted writing. Another feature is the transparent case, enabling the amount of lead available to be readily visible.

The pencil, details of which are given in Fig. 7, is designed to be carried point upwards in the waistcoat pocket (the lead pushes in flush for safety). So carried it is ready for instant note-taking. It can be "whipped" out of the pocket—between thumb and forefinger—swung round into writing position—a couple of shakes, whilst the eyes locate the paper—and the pencil is well away and writing. No fumbling or change of finger grip is necessary.

The pencil is also particularly convenient for continuous writing. The couple of shakes, occasionally given, being all that is required to continuously feed the lead forward. It is to be noted that it is never necessary to move the finger grip to propel the lead. It can be said, moreover, that the couple of shakes required for propulsion come "natural" to the hand and do not interrupt writing. The transparent case completes the simplification of the pencil, as it eliminates the necessity for carrying emergency leads.

Method of Using

When a lead is used up—and this can easily be seen by the sliding weight being at the lower end of the pencil barrel—the barrel is unscrewed and removed.

The central lead ejector is then pushed

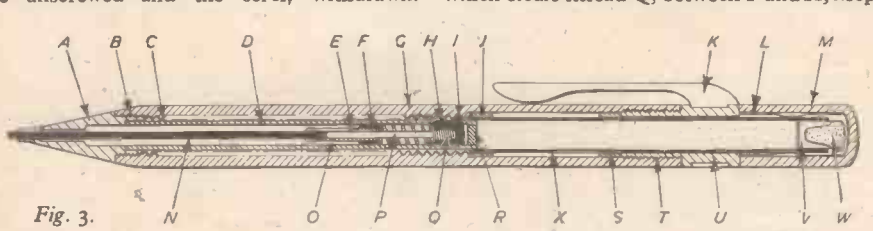


Fig. 3.

Section and details of Mr. B. C. Cuffley's design for a propelling pencil.

Fig. 4.

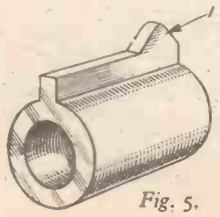


Fig. 5.

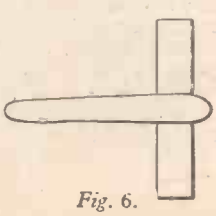


Fig. 6.

down and ejects the small piece of unused lead.

The new lead is inserted into the nose end of the pencil and pushed firmly into the spring grip of the carrier tube.

Pull back the carrier tube itself and draw the lead up into the pencil. Stop when the lead is flush with the pencil point.

Now take the barrel—containing the sliding weight—and screw the pencil together again.

To advance or feed the lead forward for writing, give a couple of shakes to the pencil whilst holding it in a writing position.

After writing, push the point of the pencil against a hard surface—this pushes in the lead flush with the point of the pencil and it can then be safely carried point upwards in the waistcoat pocket.

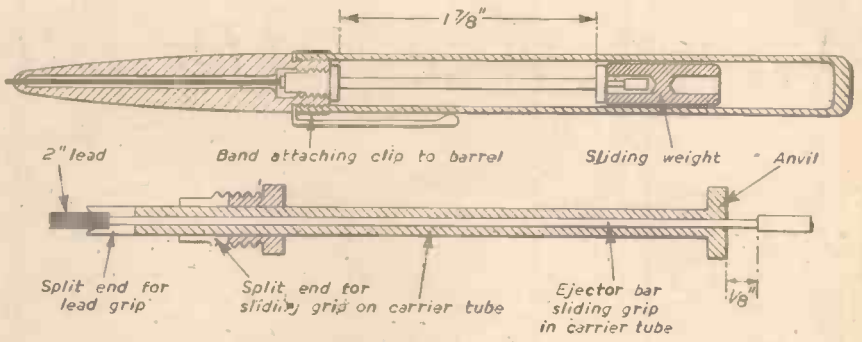


Fig. 7. Sectional details of the pencil designed by Mr. H. B. Munro.

The Law About Patents

7.–Obtaining Your Patent

By W. J. WESTON

YOUR invention is worth patenting. The process of obtaining the patent may seem to be exasperatingly slow and, in this country, is unduly costly. The slowness—it takes at least 21 months between the lodging of a patent application and the sealing of the patent—cannot well be avoided if thorough examination is to precede the granting; and protection of the patentee is (assuming that the patent is in fact ultimately given) afforded from the date at which a complete specification is lodged at the Patent Office. Such lodging is the publication that justifies the grant of monopoly.

An Argument for Cheapness

The cost could and, in the interests of industrial progress, should be avoided. The total fees of about £132 in this country, as compared with the total fees of about £12 in the United States, would appear beyond reason. Need to find the fees in order to obtain protection may prompt an inventor to reap such reward as he can by working his invention in secret or by selling it to one whose interest lies in stifling the invention. To the extent that exorbitant fees have this effect they must, from the point of view of a country's progress in industry, be counted ill-advised.

Hire-purchase

Here you get your patent on a kind of hire-purchase system. You pay so much a year over the full sixteen years of your monopoly. After the preliminary fees—£1 per application, £4 for complete specification and the rest—the yearly fees begin with a payment of £5 for the fifth year, £6 for the sixth year, and so on. This method may be of advantage to the patentee with little capital at his command; he can avoid the fees by foregoing the monopoly. Thus *The Official Journal* (*Patents*), dated Saturday, December 31, 1949, lists 240 "Patents Ceased through Non-Payment of Renewal Fees."

Official Examination

Your application being filed it is allotted to an examiner. He has to ascertain whether the invention is entitled to the patent privilege. If you have made a provisional specification before submitting the complete specification, he compares the two to find out whether they refer to what is substantially the same invention. His essential function, however, is to make search through all the specifications published within the fifty years preceding the date of application. Has the invention been anticipated? After eighteen months the application, if in order, is accepted.

Unofficial Examination

This official examination is not all. Here, different in this matter from most other countries, there is in effect an unofficial examination. Each week *The Official Journal* gives the titles of "Complete Specifications open to Public Inspection," and photographic copies are available at a stipulated cost. And, under the Patents and Designs Act, 1949 (which came into operation on the 1st January, 1950) any person may, within three months of the date of publication of the complete specification, give notice of opposition to the grant of a Patent. This co-operation of unofficial examiners is not thought necessary in the United States. There the official examination suffices. No hiatus occurs to allow of objections by persons interested.

Procedure by Post

If you care to do so, you may yourself carry through the business of obtaining a Patent; and you can do this by post. You get from the Patent Office the necessary forms for each step in the procedure; for, dealing as you are with a Department of State, you cannot avoid the filling in of forms. You make prepayment of the stamps necessary on the forms; by giving a week's notice at any Money Order Office, you save the trouble of writing to London. The address for all your communications concerning the patent is The Comptroller, The Patents Office, 25, Southampton Buildings, Chancery Lane, London, W.C.2.

Patent Agents

You will realise that the value of a patent when ultimately granted hangs a good deal upon the way in which the specification is drawn up and the claims made. You may, therefore, very well be diffident about carrying through the procedure yourself. If so you should get the services of a Patent Agent. A list of Registered Patent Agents, who alone are recognised by the Patents Comptroller, is obtainable from The Secretary, Chartered Institute of Patent Agents, Staple Inn Buildings, London, W.C.1.

A Problem in Mathematics

Banish the Absurd

"THIS baffles me; would you please explain?" So asks a reader, and he presents a "proof" wherein is a breach of the mathematician's eleventh commandment: "Thou shalt not divide by zero." Here it is:

If $a=b$
Then $a^2=ab$
and $a^2-b^2=ab-b^2$
and $(a+b)(a-b)=b(a-b)$ Nothing wrong so far; but now and $(a+b)=b$.

You see, since $a=b$ then $(a-b)$ must be 0: when you multiplied by $(a-b)$ you turned both identities into 0; and you then proceeded to divide 0 by 0. Now, you cannot extract $(a+b)$ from 0 any more than you can extract the price of a pint from Falstaff's denuded purse. That a million multiplied by 0 is equal to one multiplied by 0, does not justify the conclusion that a million equals one.

The mathematician will have nothing to do with what leads to absurdity. Faced with a puzzling statement he first casts about for what will make the statement intelligible. He deals thus with the old Greek paradox "I am lying," says one: if his statement is true, he lies, and his statement is untrue; if his statement is untrue, he lies, and his statement is true. The mathematician assumes a preceding statement to which "I am lying" applies; and trouble goes.

When, however, nothing can remove the absurdity, the mathematician discards it from his system. He does this with division by 0. "Increasing and diminishing by zero I know" he says, "they leave the total unaffected. Multiplying by zero I know, too: it wipes out the total. Dividing by zero I know not, and I reject it." "*Divide 6 by 2*," can be put in this way: "*What number multiplied by 2 will give 6?*" Now, if we said, "*What number multiplied by 0 would give 6?*" we are at a stay: there is no number at all. Therefore, don't divide by zero.

Look for example, at this—at first view quite plausible—reasoning, whereby we "prove" that 1 and 2 and 3 and all other positive numbers equal one another. You have the identity.

$$\frac{a-1}{a-1}=1$$

You also have:

$$\frac{a^2-1}{a-1}=a+1$$ (for you have multiplied each side by $(a+1)$.

You also have:

$$\frac{a^3-1}{a-1}=a^2+a+1$$

and so on as far as you care to go.

Suppose that in all these identities $a=1$. Then the right hand side of the identities will be 1, 2, 3 (for a^2 also $=1$), 4, and so on. And all the right-hand sides are $\frac{0}{0}$. You reach a quite untenable conclusion; and you reach it because you have admitted the possibility of dividing by zero.

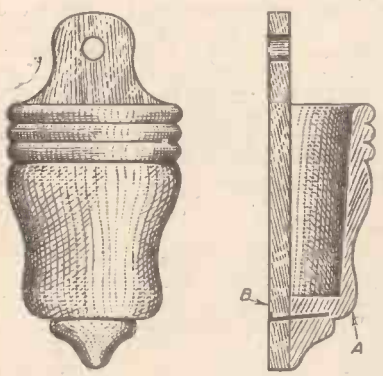
Wood Turning—11

Box Making : Stools : Spiral and Jacobean Turning

By FREDERICK JACE

BOXES, both useful and ornamental are a ready selling line. String boxes, powder boxes, trinket boxes, etc., are frequently made in one of the fancy woods, but in view of the shortness of the grain one of the tougher woods such as box wood or lance wood should be used. It is often possible to pick up pieces of the latter from coach builders, since it is the wood which is used for the shafts of carts.

It is usual practice to make these boxes in pairs, sawing them apart afterwards.



Figs. 115 and 116.—Half boxes for wall mounting. This is an example of a box turned in one operation to provide two half boxes.

Spill holders and similar brackets are made by turning a complete box and sawing it in half, mounting it to a backboard as shown in Figs. 115 and 116, whilst Fig. 117 shows how to use the side tool in making the taper bore.

Fig. 118 shows how, after turning the inside, the piece is driven on to a wooden mandrel so that the outside can be turned to the fancy shape required. The mandrel should, for preference, be turned from soft wood.

Stools

Fig. 119 shows the first operation in turning a circular seat for a stool. The square blank is mounted on the screw chuck. A circle is first scribed for the desired diameter, the blank is then removed and the corners sawn off, or they may be parted off with the parting tool in the lathe. Fig. 120 shows the spreaders for the leg and Fig. 121 shows how the seat is mounted for boring the hole at the required angle to splay the legs. It will be seen that the angle piece is mounted to a block which fits on the lathe bed or shears, the angle piece itself being continued down through the shears and locked underneath. The seat itself, is, of course, held by the hand, the position for the holes being marked out first.

The hole in the legs should be drilled by a similar set-up. The assembled stool is shown by Fig. 122.

Fig. 123.—Example of Jacobean or spiral turning.

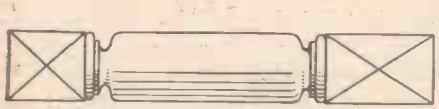


Fig. 124.—First operation in turning Fig. 123.

Spiral and Jacobean Turning

The imitation Jacobean furniture now on the market is entirely produced by automatic machines, but it is possible for the woodworker to produce it at home, although the process is more laborious. Take for example the leg shown in Fig. 123. It would be turned in the first place as shown in Fig. 124, observing that the root diameter of the centre part is also that which the root diameter of the spiral is required to be.

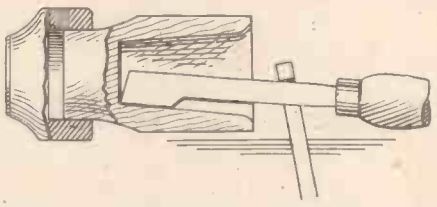


Fig. 117.—Turning the bore by means of a hook tool.

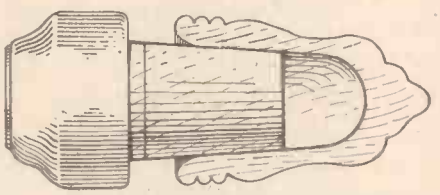


Fig. 118.—Mounting the box on a wooden peg or mandrel so that the outside can be turned.

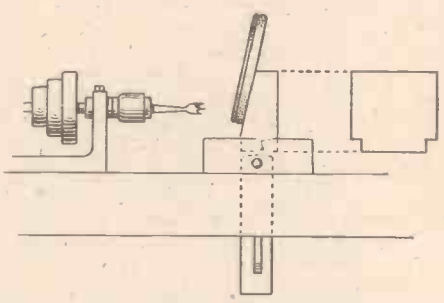


Fig. 121.—Set up for boring the holes for the legs in the stool seat.

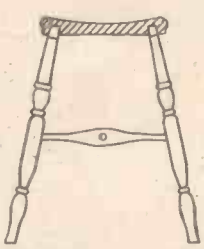


Fig. 122.—Completed stool, showing seating in section and the spreaders for the legs.

Notice also, that the spiral starts on one side of the blank and finishes on the opposite side. To mark this out sub-divide the circumference of the cylindrical portion into four by means of scribed lines. Next multiply the number of "threads" required by four remembering that in order to make the twists end up on opposite sides a half must be added to the number. Thus if four "threads" are required the figure would be four and a half, and multiplying that by four produces eighteen. Make pencil marks along the cylindrical portion, each space being equivalent to one eighteenth of the length as shown in Fig. 125 and strike off the diagonals as shown. This may be conveniently done by means of a flexible steel plate wrapped spirally round the cylinder to coincide with every fourth line or by means of a stiff piece of adhesive tape paper using the edge of either to run the pencil along. The spirals are then carved by means of the gouge in the ordinary way. A tenon saw is used with a depth gauge attached as shown in Fig. 126 for setting in the twist to the required depth.

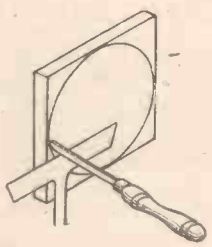


Fig. 119.—Turning a chair seat.

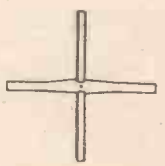


Fig 120. — The spreaders for the legs of the stool.

For very fine spiral turning a special chisel may be filed up for the beading at the top and the bottom. Sandpapering is, of course, done in the lathe. A burnishing tool should then be used to close the grain prior to French polishing.

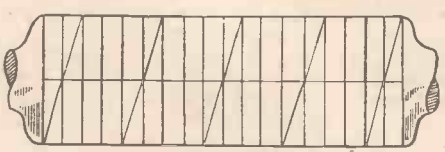


Fig. 125.—How to mark out for spiral turning.

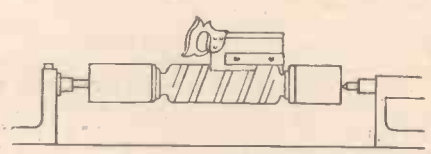


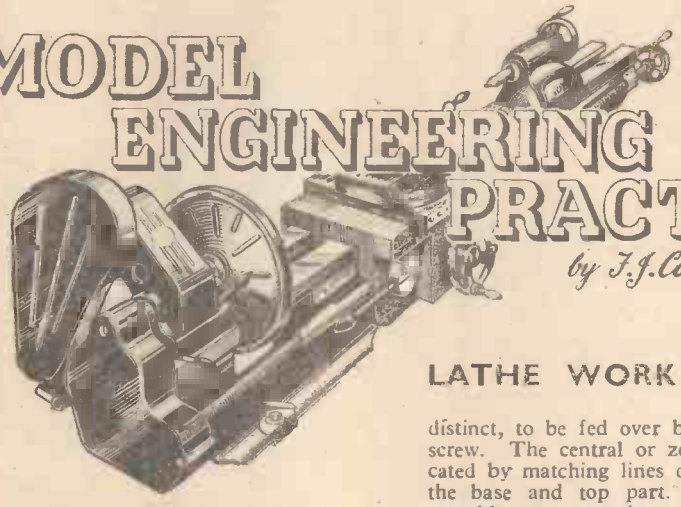
Fig. 126.—Using the tenon saw, with depth gauge attached in the first operation for spiral turning.

(To be continued.)

14th Article of a New Series

MODEL ENGINEERING PRACTICE

by J. J. Camm



LATHE WORK (*Continued*)

Height Adjustment

THIS is effected in various ways. The swivel shoe of the regular American post has the disadvantage of altering the cutting and clearance angles of a tool, consequently some have a screwed-gland device for direct vertical movement, or a ring with steps at various heights. The British holders require packing under the tool to elevate it, but the separate tool-holders clamped on them embody height regulations without such necessity. The Norway design, fitted to some small 3½in. lathes, consists of a rectangular block, taking the tool in a square hole and clamped by two set screws. The block fits in a round hole on a stout vertical stem, and is held by a split and contracting bolt. Therefore the height up the stem can be altered and the block be slewed to any position around it.

In a lathe not intended to be used for boring work held on the saddle there is no special provision in the way of T-slots, but most of the small lathes bought for light work in small shops possess ample bolting facilities on the saddle, or else the cross-slide is extra large in area, taking several T-slots, so that quite bulky pieces may be accommodated when the tool-holder is taken away. Sometimes a large boring table is substituted for the ordinary cross-slide for the same purpose. In exceptional circumstances a specially long table is employed, the outer end supporting the extremity of a lengthy job such as a connecting-rod.

Three main features about the loose head or tailstock are: (1) the system of preserving the alignment; (2) supporting the barrel; (3) providing for taper turning. The first requirement is met by giving a particular guiding edge, as mentioned in connection with bed sections, otherwise the tailstock may lie askew and prevent parallel turning being accomplished. The foot should always pull down or against a surface which is not subject to wear from the saddle. Condition (2) is specially important in small lathes for varied service, because so much drilling is done, and if the barrel is inadequately supported it soon wears untrue. Many makers have reverted to what was common in the earlier days of lathe construction, namely a solid barrel extending right through the head, and operated by a hand wheel controlling the square thread along the tail end. This affords full support at all parts of the travel.

Short tapers may be turned by swivelling the compound rest, but for long ones the tailstock must embody a set-over action. This is obtained by making the top portion distinct, to be fed over by slideways and a screw. The central or zero setting is indicated by matching lines on the end face of the base and top part. By means of a movable centre attachment an ordinary rigid head can be adapted for taper work, the fitting being clamped on a barrel, and holding a centre which may be set over by a screw and slide.

Attachments constitute very important adjuncts to any small lathe of the kind we are considering. Some are used without any extra details, but an overhead drive must be included in certain cases, so it is well to have this when purchasing the lathe, or at least, buy one which can have the drive added subsequently. From the pulleys on it grinding, milling and gear-cutting attachments are driven. By inclusion of a division plate at the headstock drilling and gear-cutting are carried out, running a spindle in an attachment on the slide-rest. External and internal grinding spindles can be revolved from the overhead, or self-contained motor-driven designs are sold to go on the rest.

Rest or saddle attachments comprise a saw-table with one or two guide fences, and a universal milling-slide, bolted to the saddle, and having a T-slotted table fed vertically or angularly by screw and handle. All kinds of surfacing, slotting, keyway cutting, grooving and drilling are thus possible by the compound movements obtained.

Before practical work can be done on the lathe it is necessary, first, to have some means of driving it; secondly, a series of devices for holding the work in the lathe; and thirdly, a series of tools of various shapes and cutting angles for operation of work of varying form and material. The engineer has the choice of drives mentioned earlier.

Holding Devices

Under this head are included split chucks or collets which are coned to fit the coned recess in the lathe spindle and are intended to grip round work. The split collet is made to grip the work by means of a draw spindle which passes through the lathe mandrel. Such collets are available in all sizes to suit standard round stock, and if the operator is likely to do much turning from rod he is advised to purchase a set of them varying in sizes from ⅛in. diameter hole up to about ½in. diameter hole.

Other chucks are the self-centring and three-jaw, the four-jaw independent chuck, the face-plate, the angle-plate, the bell chuck; the carrier and catchpin are driving devices.

Turning Between Centres

For turning between centres it is necessary to have a carrier which will grip the work in the manner shown in Fig. 6 (see last month's issue). The tail of this carrier contacts with a catchpin attached to a small circular plate, which screws on to the lathe mandrel and is usually supplied with it.

Before round work can be turned it is necessary first of all to make sure that the rod is reasonably straight—otherwise it will be impossible to turn a true cylinder. Fig. 7 indicates the effect of endeavouring to turn a rod which is bent. It is also necessary to make sure that the ends of the rod are true. It may be necessary to take a preliminary facing cut by chucking the rod in a split collet or three-jaw chuck. If the end of the rod is left irregular, as shown in Fig. 9, the work will tend to revolve unevenly, and the centre hole will rapidly wear, causing the tool to dig in and the work to chatter.

Centring the Work

There are many methods of finding the centre of a rod or bar. Some of them are illustrated in Fig. 8 and Figs. 10 to 16. In the first method illustrated a pair of odd-legs or jennies are used. They are opened out rather greater than the radius of the bar to be centred, and an arc is struck from four points of the rod as shown. It will be obvious that the centre of the rod will be in the centre of the various points of intersection. Another method is by means of a bell centre punch, as shown in Fig. 11, whilst Fig. 10 shows a centre square also used for the purpose. In Fig. 12 the bar is rested on two vee-blocks themselves, in the manner shown. Having located the centre, the next operation is to cut a cone hole with clearance at the bottom so that the lathe centre fits nicely. The clearance enables the point to clear the work and also provides a small reservoir for oil.

In Fig. 13 you see one of the special centre drills sold for this purpose held in a chuck, whilst the back centre is used to force the work on to it. In Fig. 14 a drill chuck is fixed in the tailstock and a centre drill is locked in its jaws. The work to be centred is gripped in another chuck fixed to the lathe spindle, and the tailstock is then fed into the work. Older methods of performing this operation were by means of the square centre and the half-centre, illustrated in Fig. 17. In using these, a small hole was first drilled in the approximate centre of the rod, which was then run on these centres.

Correct tool grinding is important in all lathe operations. The object in roughing is to remove the surplus material in the minimum amount of time. Finish is dependent on the tool itself; tool angles vary for different materials. Next month we shall explain the best range of tool shapes for general use, together with grinding angles for different materials. Many of the tools may be ground or filed up from bar material.

Where solid tools are used it is better to use a steel of deep section. Rectangular steel tools are more rigid. The rectangular steels are obtainable in many sections in both carbon and high-speed. High-speed tools are the most advantageous. The cheapest way to use high-speed steel is in "tool-bit" form in a special holder, or to use "tipped tools."

A tool cannot function correctly if improperly set. With a "rocker-bar" type tool-post the effect of rising or dipping the nose of the tool is to alter the front clearance and top-rake angles. If the base of the tool is rising towards the front, the front clearance angle is decreased and the top-rake increased, and vice versa.

(To be continued)

High Vacua

What it is, How it is Obtained, and its Uses

By F. W. COUSINS, A.M.I.E.E.

TO the lay mind the term vacuum conjures up no great enthusiasm for study or enquiry, the term being generally associated with the idea of a complete void. It will be shown, however, that the realisation of a perfect vacuum is unknown, and that the production of a very low pressure in an enclosure necessitates the use of ingenious pumping machinery, the evolution of which has accrued from a detailed understanding of the structure of matter.

In 1643 Torricelli, who had studied under Galileo, produced a partial vacuum in the space above the mercury column in a simple barometric tube; this is known scientifically as a "Torricellian vacuum" in honour of his achievement. Such a vacuum contains traces of water vapour and air mixed with mercury vapour at a pressure of a millionth part of an atmosphere or more.

Otto von Guericke produced a mechanical air pump in 1654, and this was capable of producing a reduction in gaseous pressure within an enclosure, but the reduction was seriously limited by the weight of the valves, and the leakage around the piston of the pump.

Early Investigations

Although these early pumps were refined by many workers, the study of vacua was sadly neglected, interest in vacua *per se* commencing with the arrival of the carbon filament lamp and investigations into electrical phenomena in gases at low pressure. The classical researches of Crookes, J. J. Thomson, Richardson and Roentgen not only resulted in a great increase in our knowledge of the constituents of matter and the mechanism of electrical conduction in gases at low pressure, but it resulted also in a focusing of great minds upon the methods of obtaining high vacuum. It soon became clear that since the production of any vacuum necessitates the continuous decrement of gaseous pressure within the enclosure to be evacuated, the study of the methods of obtaining such a continuous decrement must be associated with a study of the transportation of the gas molecule at atmospheric and low pressure, coupled with an appreciation of the gas laws; all this is now treated in what is termed the "Kinetic Theory of Gases."

Fig. 3.—Centrifugal freeze drier. Edwards and Co. Model No. 3.

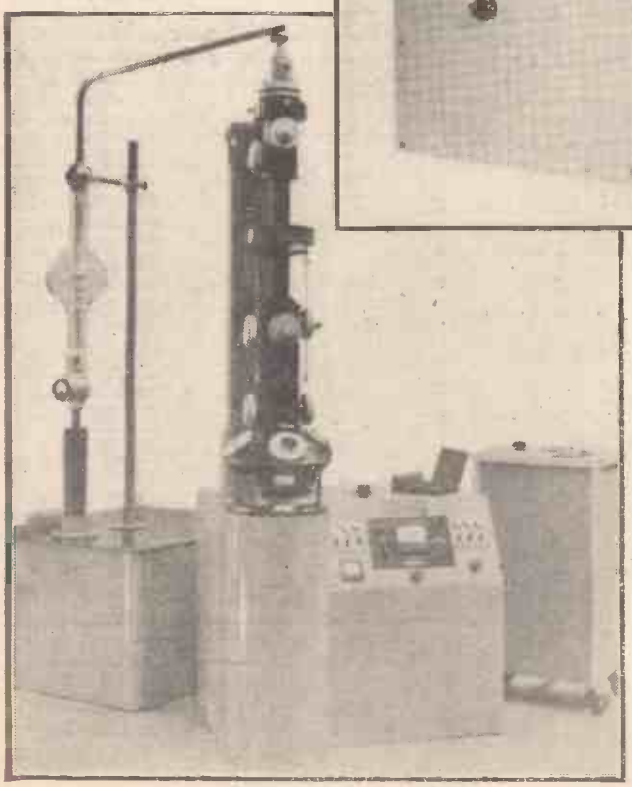


Fig. 2.—Electron diffraction camera.

To-day, the demand for high vacua is greater than ever before; the atomic energy projects have called for high vacuum systems on a scale never before attempted, so that the electromagnetic and gaseous diffusion methods of isotope separation might be successfully employed. In the metallurgical industry thermal reduction under high vacuum is applicable to certain of the lower melting point metals, while optical lenses and mirrors are surface-plated by the evaporation of metals and metallic salts under high vacuum conditions. Uses are also found for such conditions in commercial medical chemistry, typified by the production drying of blood plasma, penicillin and other biologicals through sublimation. Vacuum distillation is used in the manufacture of vitamin oils and aromatics, and accelerated drying under high vacuum has resulted in dehydrated foods in which the taste is equal to that of fresh foods. In the lamp industry, and the ever-increasing field of electronics, the evacuation of enclosures is a major undertaking, while certain large pieces of apparatus such as mercury arc rectifiers, and the electron microscope are provided with integral vacuum pumps and gauges. Representative of the aforementioned techniques and pieces of apparatus used in their employment are the combined sputtering and evaporating plant (Fig. 1), the electron diffraction camera (Fig. 2), and the centrifugal freeze drier (Fig. 3), a centrifuge head and bearing assembly loaded with ampoules being shown at Fig. 4.

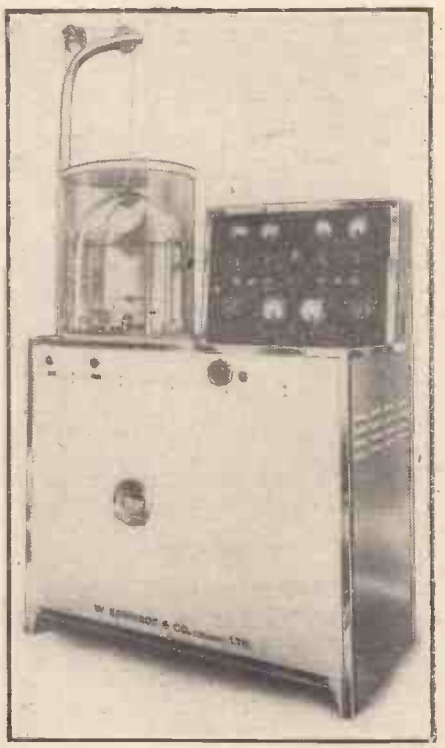


Fig. 1.—Combined sputtering and evaporating plant.

As an introduction to a more academic approach to the study of high vacua let us commence with a definition of the term "high vacuum" and lay down the conventional units employed in the measurement thereof.

Definition of High Vacuum

High vacuum is defined as the state of any space or enclosure from which air or gas is evacuated to a pressure of not more than 1 dyne per square centimetre, which would be sufficient to support a mercury column 0.00075 mm. high; this is due to Jnanananda[1].

Another definition based upon a consideration of electrical discharge phenomena in gases and due to I. Langmuir[2] is that, high vacua is that state of any enclosure from which gas and vapour is exhausted to such an extent that the remaining molecules of gas or vapour do not retard "space charge." To make this

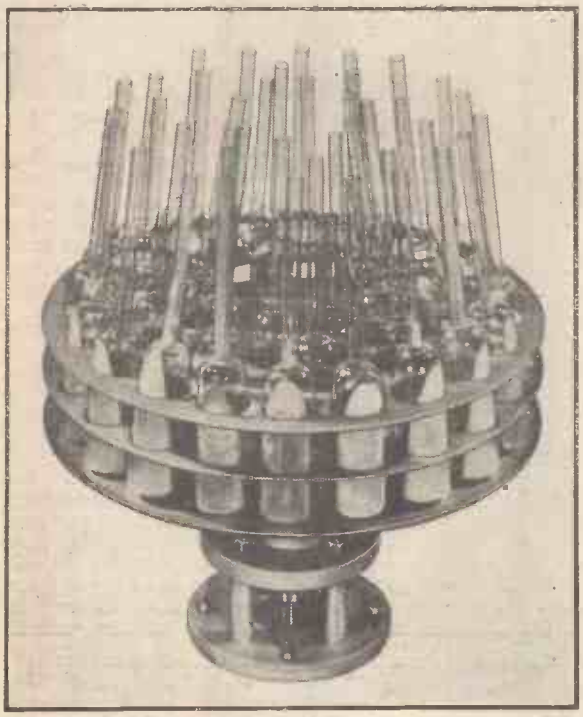


Fig. 4.—Centrifuge head and bearing assembly loaded with ampoules showing frozen wedges of material.

definition clear to readers who are unfamiliar with the phenomena associated with electrical discharge in vacua it should be pointed out that it has been shown by Child and Langmuir [2], [3], simultaneously that for the case of a

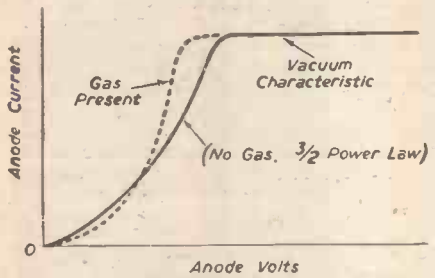


Fig. 5.—Effect of gas on space charge.

discharge occurring between two parallel plane electrodes in a high vacuum the following equation for the maximum current flow would be :—

$$i = \frac{\sqrt{2}}{9\pi}\sqrt{\frac{e}{m}}\frac{V^{3/2}}{x^2} \qquad (1)$$

where i is the current flow between the electrodes per sq. cm. of surface; e is the charge on the ion; m is the mass of the ion; V is the difference of potential between the anode and cathode; and x is the distance between the electrodes.

From equation (1), it is seen that the maximum current is inversely proportional to the square of the distance between the electrodes and directly proportional to the 3/2 power of the voltage; this is the well known 3/2 power law.

It was further established that the 3/2 power law was only followed in a discharge where the carriers were all of one sign, i.e., all electrons or all + ions; and it served as a sensitive test of the degree of vacuum in an enclosure. Any deviation from the 3/2 power law, consequently, indicates the presence of + ions and, therefore, gas. Now + ions in the discharge tend to neutralise the space charge, that is to say the "sheath" of electrons forming in the interelectrode space which tend to drive the emitted electrons back into the cathode, thereby permitting a greater flow of current than would obtain under the same conditions in complete vacuum with pure electron discharge, this is shown graphically in Fig. 5.

Units of Measurement

It is usual to measure high vacua by the height of the mercury column it will sustain; just as atmospheric pressure is recorded as the height of the mercury column supported by the pressure at any given instant.

Meteorologists measure atmospheric pressure in terms of the "bar" which is equivalent to 75.007 cm. of mercury at 60deg. C. in latitude 45 deg. For high vacua the standard unit is 1 mm. of mercury; hereinafter termed 1 mm. Hg.; and this may be converted to microns of mercury for extreme low pressure, it being remembered that 1 micron = 10^{-3}mm.

The Kinetic Theory of Gases and its Application to High Vacua

The kinetic theory of matter proposes that matter is discontinuous, that is to say it consists of atoms and molecules. The state of matter in which we are here interested is the gaseous state wherein a substance completely fills the region containing it and the kinetic theory of gases is taken to imply that the gas molecules are elastic spheres, the bombardment of which with the container walls, owing

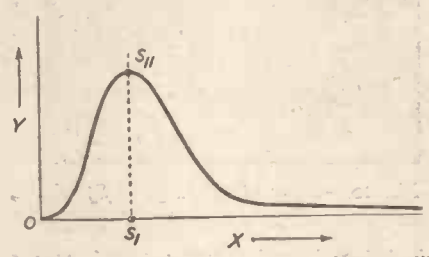


Fig. 6.—Graphical representation of Maxwell's Law.

to the thermal agitation, causes the pressure exerted thereupon by the gas. The theory, further, gives a simple explanation of the gas laws, and it has yielded valuable results concerning gaseous viscosity and molecular dimensions.

The Gas Laws

I. Dalton's Law.—The pressure of a mixture of gases is the sum of the pressures which would be exerted separately by the several constituents if each alone were present.

II. Avogadro's Law.—Different gases at the same temperature and pressure contain equal numbers of molecules per unit volume. (The number of molecules in 1 cu. cm. of gas at temperature 0 deg. C., at pressure of 760 mm. Hg., is 2.705×10^{19}.)

III. Boyle's and Charles' Law.—When the temperature of a gas is kept constant the pressure varies inversely as the volume, and when the volume is kept constant the pressure varies as the temperature.

The main gas laws may be summarised mathematically by the expression :

$$Pv = nRt \qquad (2)$$

where "P" is pressure at absolute temp "t" of a mass of gas having volume V; n is a number equal to the mass in gms. divided by the molecular weight and R is a constant.

Maxwell's Law of the Distribution of Molecular Velocities

Maxwell has shown that the distribution of the velocities of the molecules of a gas at any temperature may be calculated by an application of the laws of probability. It will be readily appreciated that owing to the collisions of the molecules within the gas, a non-uniform distribution of molecular velocities would obtain, even if the molecular velocities were the same *ab initio*. The Maxwellian distribution curve is shown at Fig. 6 and it will be seen that the most probable speed comes at the highest point of the curve between the origin and the asymptotic decline to the abscissa, denoted by the ordinate s_I, s_{II}. The equation to the curve is $Y = \frac{4}{\sqrt{\pi}} x^2 e^{-x^2}$ where "Y" denotes the probability of a velocity whose magnitude is x, the most probable velocity being unity. Dushman[4] has prepared Table 1 which elucidates the above noted curve and this is reproduced, $\triangle x$ is the range of velocities and

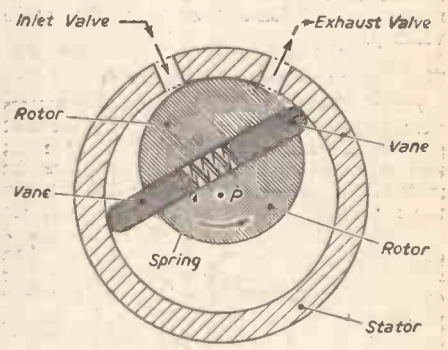


Fig. 7.—Gaede backing pump.

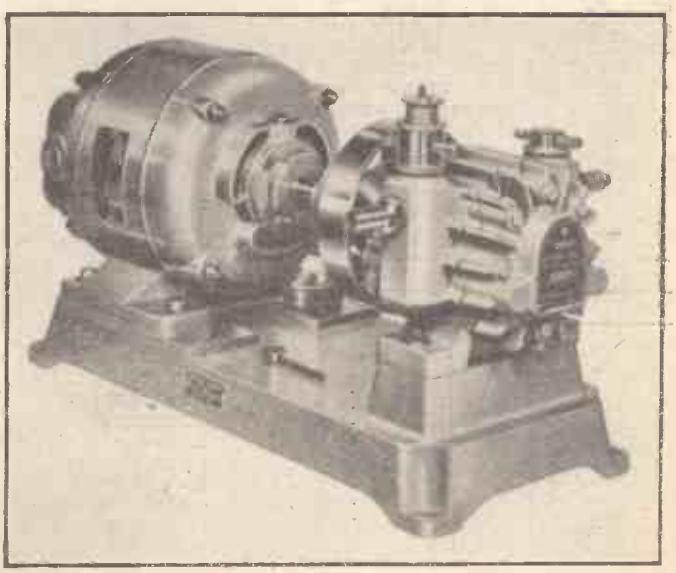


Fig. 9.—Type IV compressor and vacuum pump, by Edwards and Co.

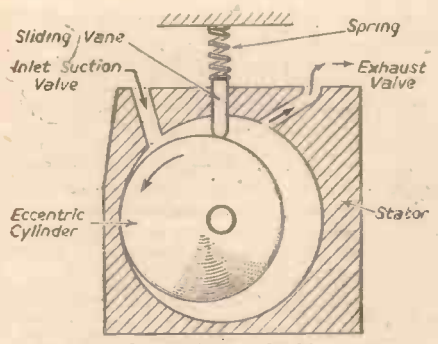


Fig. 8.—Cenco-Hyvac backing pump.

Δy the fraction of the total number of molecules which have the velocities corresponding to the range. As an example, 68.4% of the molecules have velocities ranging between 0.5 and 1.5 times the most probable velocity.

Avogadro's Constant

Avogadro's constant refers to the number of molecules in a gram molecule and according to Millikan it is 6.062×10^{23}, this often being accepted as 6.1×10^{23}.

The Molecular Bombardment of a Surface

As already explained, gaseous pressure is thought to be produced by the random and chaotic bombardment of the surfaces of an enclosure or envelope by the molecules. It has been shown by Meyer[5] and others that for an enclosed gas in equilibrium the molecules that strike a given unit area of surface in 1 second is equal to $\frac{1}{4}nv_m$ where "n" is molecules/cm.^{3} and "v_m" is the mean velocity.

The Phenomenon of Free Path

Although the molecules in a gas may possess very high velocities, it is well known that gaseous diffusion occurs at a slow rate; this is explained by the fact that since the molecules have a finite size collisions between the molecules occur and the molecules are prevented from pursuing a course in a direct straight line over a distance other than a strictly limited one. The idea of molecular collisions introduces the idea of a "free path" and since this is intimately related to the velocities of the individual molecules we usually talk of "mean free path" which is defined as the mean distance traversed by a molecule of gas between successive collisions.

The mean free path is a most important concept, it is related to the molecular diameter, and is proportional to the coefficient of heat conduction, viscosity and diffusion in a gas.

The relationship between molecular diameter d_m and the mean free path L has been given by Clausius for spherical molecules having the same velocity as:

$$L = \frac{3}{4\pi d_m^2 n} \qquad (3)$$

Table I
Range of Molecular Velocities

11.0	11.0
Δx	Δy
0—0.1	0.001
0.1—0.3	.021
0.3—0.5	.063
0.5—0.7	.112
0.7—0.9	.149
0.9—1.1	.161
1.1—1.3	.150
0.5—1.5	.684
1.3—1.5	.112
1.5—1.7	.078
1.7—1.9	.058
1.9—2.1	.034
2.1—2.5	.030
2.5—3.0	.008
0—2.5	.969

If consideration is given to the Maxwellian law of distributed molecular velocities then the equation becomes:

$$L = \frac{1}{\sqrt{2}\,\pi d_m^2 n} \qquad (4)$$

where "n" is the number of molecules per unit volume. This equation has been corrected by Jeans to allow for the persistence of velocities after molecular collision and becomes:—

$$L = \frac{1.319}{\sqrt{2}\,\pi d_m^2 n} \qquad (5)$$

A further correction to allow for intermolecular attractive forces due to Sutherland[6] makes

$$L = \frac{1.402}{\sqrt{2}\,\pi n\, d_m^2 \left(1 + \frac{C}{T}\right)} \qquad (6)$$

where "C" is Sutherland's constant for each gas and "T" is the absolute temperature.

Equations (3), (4), (5) and (6) may be used to give molecular diameters if values of "L" are known, and these are usually derived from the coefficient of viscosity of the gas, this being dependent upon transference of momentum from one layer of gas to another; or, alternatively, the coefficient of heat conduction may be used which is dependent upon the transference of increased kinetic energy of the molecules. Each of these coefficients are proportional to the collisons in the molecular structure and, therefore, the length of free path.

Table II is a record of molecular radii to show the comparative dimensions obtained by the alternative methods discussed briefly above.

It will be understood that the mean free path in a gas at low pressure is very long when compared with the mean free path at atmospheric pressure.

For example, in oxygen at 20 deg. C. and at a pressure of one atmosphere the mean free path L is approximately 0.0000099 cm. and at a pressure of 0.0076 mm. Hg. L is approximately 0.00001 cm., while at 0.00076 mm. Hg. L is approx. 10 cm., which, in this latter case, is of such an order that the mean free path is similar to the dimensions of the diameters of typical enclosures used in the vacuum physics art, thus the molecules travel in straight lines in such enclosures until the walls of the enclosure are contacted. This has an unimportant bearing upon "molecular flow" and Knudsen has used this term to designate that condition of gas flow where *inter alia* collisions between the molecules are rare as compared with the collisions of the said molecules with the walls of the enclosure.

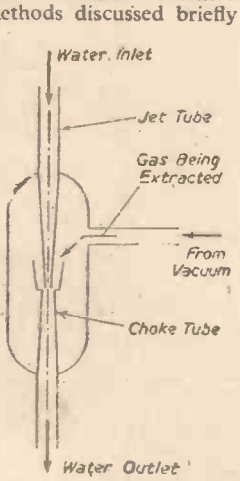


Fig. 11.—Water jet pump.

Brownian Movement

Before leaving this short survey of the Kinetic Theory of Gases it is of great interest to refer to the Brownian Movement the only visible phenomenon in support of the theory. Brownian movement is the random never ceasing, self-maintained motion* of fine particles in fluid suspension, especially colloid solutions and is thought to be caused by the unbalanced impacts of the fine particles with the surrounding molecules, the fine particles behaving as large molecules, their agitation being promoted by the kinetic energy imparted to them when in collision with the invisible molecular constituents of the medium. In this way the fine particles are governed by the same laws as those postulated for the Kinetic Theory of Gases; this was suggested and proved by Einstein in 1905. Brownian Movement may be used to provide data upon which the Avogadro Number may be calculated.

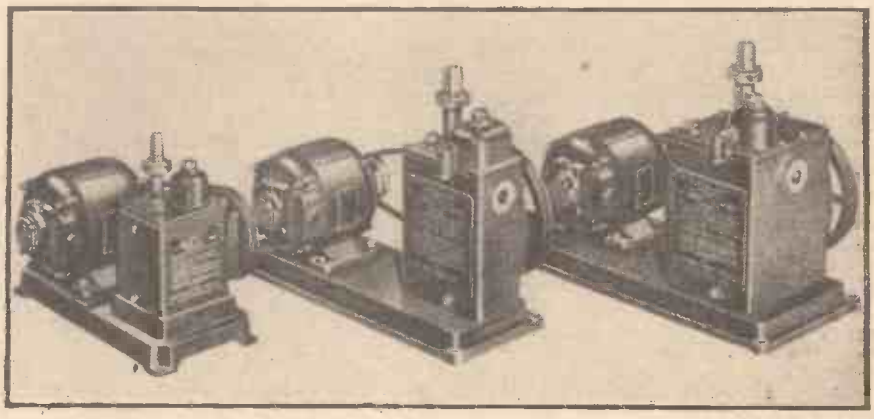


Fig. 10.—Three of the range of Speedivac rotary oil-sealed high-vacuum pumps (Edwards and Co.).

Pumps Used to Obtain High Vacua

The classification of vacuum pumps may be conveniently arranged under two main headings:—

1. Pumps operating with an exhaust at atmospheric pressure (often termed "rough" or "backing" pumps).
2. Pumps which require a fore-vacuum obtained by a backing pump, thereby exhausting into a container at a pressure lower than atmosphere.

Pumps under heading No. 1 are not generally capable of producing pressures

Table II
Molecular Radii Calculated from Kinetic Theory of Gases

Gas	From derivations from Boyle's Law	From coeff of viscosity	From coeff of conduction of heat	From coeff of diffusion
	cms.	cms.	cms.	cms.
Hydrogen	1.27×10^{-8}	1.36×10^{-8}	1.36×10^{-8}	1.36×10^{-8}
Air ..	1.66×10^{-8}	1.87×10^{-8}	1.87×10^{-8}	1.87×10^{-8}
Oxygen ..	—	1.81×10^{-8}	1.81×10^{-8}	1.82×10^{-8}

* Brownian movement is known to exist in liquid occlusions in amber which have been sealed for centuries.

lower than 10^{-3} mm. Hg when used by themselves as there is considerable leakage through the pump.

Pumps which are classed under heading No. 2 are capable of producing high vacua, that is to say, pressures of the order of 10^{-6} mm. Hg when operating with one or more backing pumps of the type under heading No. 1.

Types of Backing Pumps in General Use

Two types of rotary vacuum pumps are in general use, one being termed the Gaede Backing Pump, Fig. 7, and the other the Cenco-Hyvac rotary oil pump, Fig. 8. Other rotary pumps having refinements and varying in certain structural details are manufactured by specialists in the vacuum art, such as W. Edwards & Co., a range of their rotary vacuum pumps being shown in Figs. 9 and 10.

Referring to Fig. 7, it will be noted that the Gaede pump comprises a rotor having sliding vanes, suitably sprung—urged in an outward direction by a helical spring located within the rotor. The rotor and the sliding vanes rotate within the stator about the axis, P, which is offset with respect to the centre of the stator. It will readily be appreciated that air or gas entering by the inlet valve will be highly compressed as the rotor and the vanes rotate, the gas being pumped to atmosphere via the exhaust valve, while a new quantity of air or gas will be admitted through the inlet valve into the suction chamber for subsequent compression and exhaustion. No rubbing contact between the vanes and the stator occurs as the inner wall of the stator is lubricated and the clearance is sealed by the attendant oil film.

The other type shown in Fig. 8 is usually oil submerged to seal all clearances and one sliding vane only is employed, which is spring loaded into contact with the eccentrically mounted cylinder, the axis of which is coincident with the centre of the stator.

The oil normally used in such pumps is a special oil such as "Shell-Mex Pump Oil." This is an oil having approximately a vapour pressure of 10^{-3} mm. Hg at room temperature; and a suitable viscosity providing a satisfactory lubrication of the pump mechanism.

The Water Jet Pump or Aspirator

This is not as popular as the rotary pumps referred to, but it belongs to a class of pump termed a liquid piston pump, and although of ancient design it finds a use in the pumping of vapours which may contaminate the oil of the rotary oil-sealed pumps. Referring to Fig. 11, it will be noted that such a pump comprises essentially a jet tube and a choke tube enclosed in a container having an orifice capable of connection to the vessel to be evacuated.

Water flowing through the jet tube and entering the choke tube entrains air or gas molecules and removes them from the container to the waste tank and the atmosphere. The limiting pressures of such a pump may be lowered by providing a silica gel or phosphorus pentoxide drying trap intermediate of the aspirator and the vessel to be evacuated; this permits the limiting vacuum to go below the saturation pressure of water (about 12 mm. Hg at room temperature), and by this means a pressure as low as 7 mm. Hg may be attained.

(To be continued)

Mathematics as a Pastime

A Detective's Device

HIERO, King of Syracuse, wondered. Had the goldsmith tricked him and mingled silver with the gold when making the crown? To melt the crown and weigh the resultant metal against the same volume of pure gold would be one way of finding out. But what a waste of fine craftsmanship! Archimedes, the mathematician, would find a better way. And Archimedes, pondering the problem even in his bath, noted how the water buoyed him up, and he cried aloud, "Eureka! I have it." He thought it out: the weight of a thing wholly immersed in water must be less than the weight of that thing in air by the weight of the water displaced.

Very well: gold loses one-twentieth of its weight, silver loses one-tenth. (The comparative weights of equal volumes, the specific gravity, that is, are in fact: water 1, gold 19.3, silver 10.5.) Weigh the crown in air; weigh the crown in water; calculate the fraction lost. Unless that fraction is very near one-twentieth there has been admixture. The method, you see, depends upon the fact that the two metals in question differ in their specific gravity: if the goldsmith had base metal like gold in its specific gravity, he could have evaded detection.

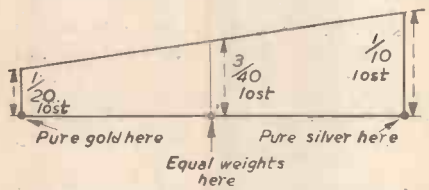


Fig. 1.—Diagram representing specific gravities of gold and silver.

Yes; and the device would reveal, too, the amount of the baser metal. For this is an instance where direct proportion is really applicable: the less the loss the nearer to gold; the greater the loss the nearer to silver. (Fig. 1.)

Ascertaining Specific Gravities

With a little ingenuity you could make your own apparatus for ascertaining specific gravities: only a little calculation is involved. Work this, for instance: "A uniform bar 12in. long and mass 0.5lb. is pivoted 9in. from one end (Fig. 2). When a piece of glass is suspended from the end of the long arm and a 2lb. mass from the end of the short arm, the lever is horizontal. When the glass is immersed in water the 2lb. mass must be moved 0.9in. to restore the lever to horizontal. What specific gravity has the glass?

The effect of the mass of the bar is summed up at the centre of gravity, 3in. from the fulcrum. Then you have the equations, first with the glass in air, second with the glass in water: put x for the weight of the glass in air, y for its weight in water. Thus:

(1) $2 \times 3 = .5 \times 3 + 9x$
$6 - 1.5 = 9x$
$\therefore x = .5$

(2) $2 \times 2.1 = .5 \times 3 + 9y$
$4.2 - 1.5 = 9y$
$\therefore y = .3$

The loss is 2 out of 5 or 1 out of 2.5. The specific gravity of the glass is therefore 2.5.

Here is a little corollary for your consideration: what will be the distance of the 2lb. mass from the fulcrum to make the beam horizontal when the water is replaced by a liquid of specific gravity 0.8?

Immersion in the lighter liquid will cause less loss: instead of .2 the loss will be $.2 \times .8$, or .16. Well,

$2 \times d = .5 \times 3 + (.5 - .16) \times 9$
$= 1.5 + 3.06 = 4.56$
$\therefore d = 2.28$ inches.

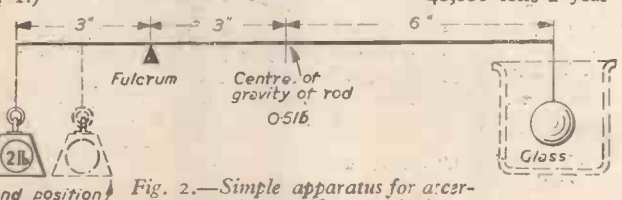


Fig. 2.—Simple apparatus for ascertaining specific gravities.

LATEX FOAM CUSHIONING

THE world output of latex foam cushioning is estimated at 40,000 tons a year with an approximate value of at least £16,000,000, according to an official of Dunlop's factory at Walton, Liverpool. The whole industry has grown in twenty-two years from an experiment at Fort Dunlop, in a cake-mixing machine holding ten quarts of rubber latex. Last year in Liverpool they had made three times their pre-war volume of the cushioning and with their new extension this year they hoped to increase it to five times. Their pre-war export had been multiplied by nine, spread over ninety-nine different markets. It was not only their own factories which were being extended; in America a number of the leading rubber manufacturers were now licensed by Dunlop to produce latex foam, and all round the world every firm who was making it was planning an extension of factories. During the next few years the annual output of £16,000,000 would be considerably extended.

Early experiments on latex foam were made with this simple machine in the Fort Dunlop Laboratories.

The WORLD of MODELS

Toronto Model Engineering Society : German Model Locomotives : Model Electrolytic Tinning Plant

By "MOTILUS"

IT is not often that I receive news of amateur model-making from Canada, so I was most interested to receive a short while ago particulars of a model of a "Pacific" type locomotive built by Mr. R. J. Nixon, marine engineer, of Waterloo, Ontario. Mr. Nixon is a native of Belfast, and in his letter to me he recalled that he used to watch the trains coming and going to and from the station there. When he decided to go to Canada he took with him a well-known book on model locomotive building.

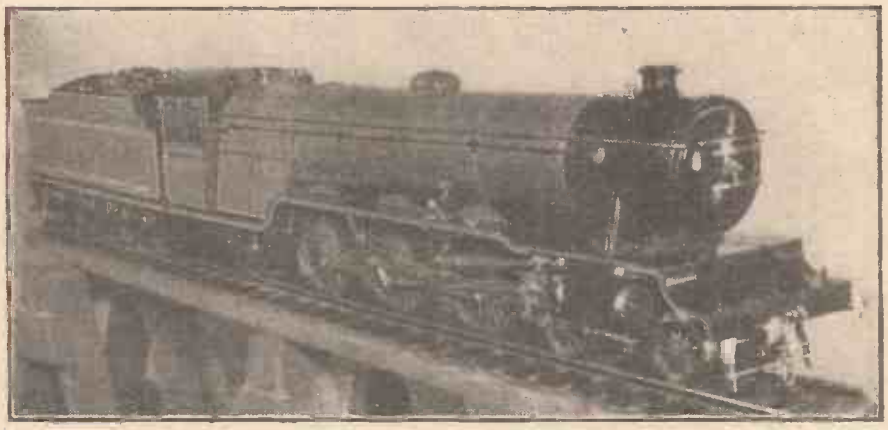


Fig. 1.—Photograph of the "Pacific" type locomotive built by Mr. R. J. Nixon, of Ontario, to a scale of 1in. to 1ft. Both workmanship and detail finish are a credit to the builder.

It was some time, however, before Mr. Nixon really started model engineering as his hobby; in fact, not until 1929. He had been given some illustrations of British locomotives and thought the "Flying Scotsman" a most attractive proposition, so proceeded to make his own drawings for a model to a scale of 1in. to 1ft. This he accomplished by reference to the model locomotive book, and by taking measurements from the picture of the "Flying Scotsman." Mr. Nixon then made patterns and had castings prepared, which he machined himself, being able to do the work on the machinery in the factory where he was employed then, by permission of the firm, Canada Illinois Tools, Ltd. The model-maker's enthusiasm at that time is best described in his own words:

"There were several nights I would work from 5 o'clock until 12 or 1 o'clock. Then I would throw the stuff in my car and drive home (seven miles) through the city like a fire engine, run down to the basement and start fitting some of the parts I had just made. I would get to bed about 3 o'clock and get up again about 7.30, and start all over again."

The completion of the locomotive, from its first conception, was spread over a period of nineteen years, representing about four or five years' of spare-time work. During the war years the model, finished except for painting, was put in storage, as Mr. Nixon was engaged on work elsewhere. It was brought out, however, for loan to the Toronto Model Engineering Society for exhibition purposes.

After the war the Toronto Society returned the locomotive to Mr. Nixon, and he commenced work on a tender for it. As his model was only based on the "Flying Scotsman" locomotive, and not exactly to prototype in its detail, he allowed himself freedom in designing the tender, while keeping fairly close to that of a "Flying Scotsman."

A few technical particulars may be of interest to readers as follows: The boiler is made of 3/32in. copper, riveted and brazed. The firebox is properly stayed and has two fire tubes of ⅜in. diameter. The boiler is insulated with Rockwool insulation and lagged with 1/32in. sheet steel; it is tested to a pressure of 250lb. per sq. in. All boiler fittings were provided by a well-known English firm of model engineers. The tender is of 1/16in. sheet steel, riveted and soldered. The feed pump is fitted between the frames, working from the rear driving axle. In the tender are an injector (also from the English firm), and an emergency hand-feed pump. There are superheater coils in the smokebox, two oil pumps in the box above the valve gear for cylinder oiling, and 100lb. steam pressure can be raised in approximately 15 minutes from cold water.

Fig. 2.—Members of the Toronto Model Engineering Society and some of the model locomotives. Mr. Nixon, builder of the "Pacific" type locomotive, is on the extreme right of the picture, with his model.

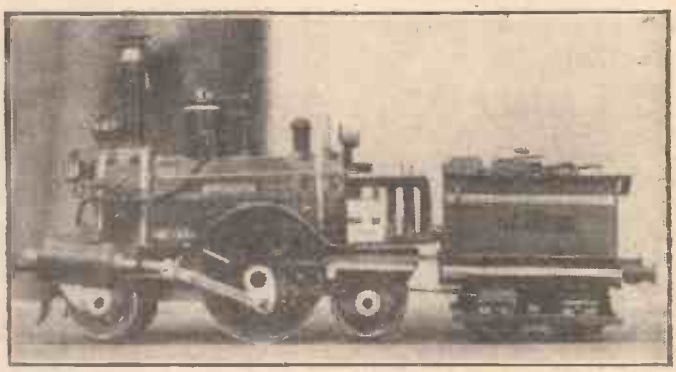


Fig. 3.—"Model of a museum piece"—a non-working model made by Dr. V. Ackermann, of Esslingen, Germany. Built to Gauge 1 scale, this model represents an 1844 locomotive of the Bavarian State Railway.

The cylinders are 1⅛in. bore and 2½in. stroke. There is a Walschaerts type valve gear, 6½in. diameter driving wheels, a heating surface of 750 sq. in., a grate area of 38 sq. in. and the overall length is 6ft. 9in. Gauge of the track for the locomotive is 4 13/16in.

The illustration, Fig. 1, gives an idea of the excellent finish on this model, which was

painted with a spray gun, the lining, lettering and numbers being applied with artist's oil paints. In the illustration, Fig. 2, three members of the Toronto Engineering Society are seen with some of the model locomotives.

German Model Locomotives

There are some interesting photographs this month from Esslingen-Obertal, in Germany, sent by Mr. F. Spielhoff, a member of the Model Railway Club there. The quaint model locomotive, "Bavaria," with tender (Fig. 3), is a non-working model, made entirely of cardboard, except for metal wheels. It is a gauge 1 model, and represents a locomotive built in 1844 by the Bavarian firm of Maffei, at Munich, for the Bavarian State Railway, Munich-Augsburg district. The builder of the model is Dr. V. Ackermann, of Esslingen.

Dipl. Ing. W. Henning, also of Esslingen, is an expert in building gauge oo railway models. Illustrated in Fig. 4 are a locomotive and two coaches built by him, in metal. The locomotive, representing an old type that used to run on the Prussian State Railway, is fitted with a worm gear and uses a Maerklin motor.

Another German-made model was built by apprentices of the Esslingen railway works and represents a locomotive of the former Wurttemberg State Railway, class AD type, which hauled fast trains from Stuttgart to Ulm and from Stuttgart to Heilbronn. This model (Fig. 5) is to a scale of one-tenth and although it is non-working, all parts are movable.

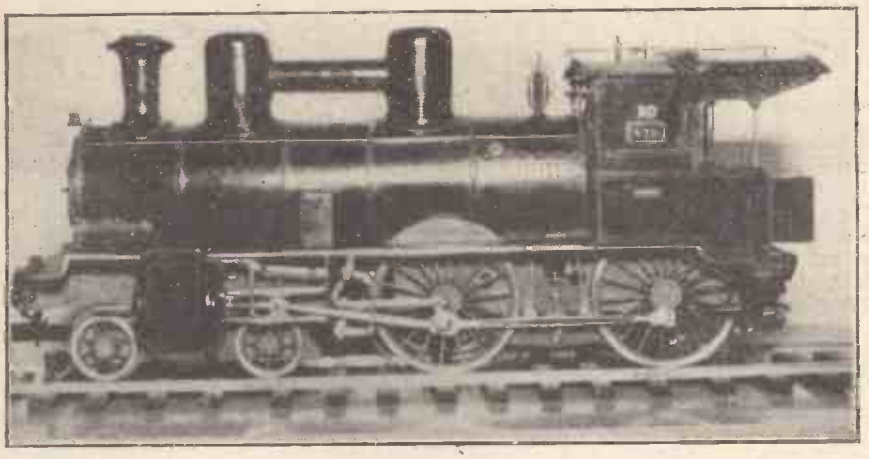


Fig. 5.—This exhibition model, to a scale of one-tenth, was built by apprentices of the Esslingen railway works. It is modelled on a locomotive of the former Wurttemberg State Railway, class AD type.

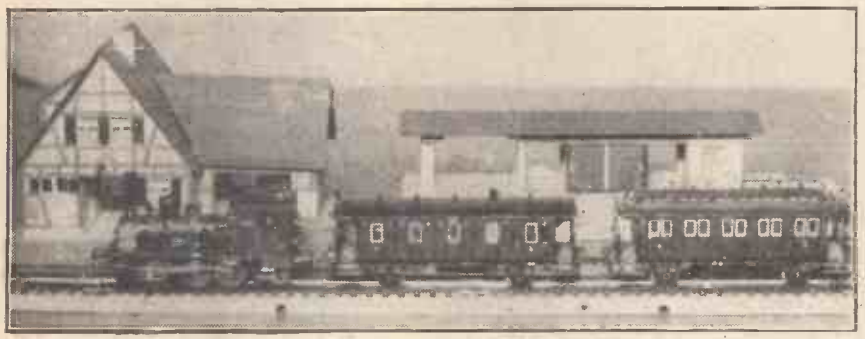


Fig. 4.—Another model of an old German locomotive, but this time for gauge oo, and with coaches in addition. These models were all built in metal by Dipl. Ing. W. Henning, of Esslingen and the locomotive represents a prototype that used to run on the Prussian State Railway.

Model Electrolytic Tinning Plant

An unusual commercial model was displayed at the British Industries Fair, Birmingham, this year, by Messrs. Richard Thomas & Baldwins, Ltd., showing their electrolytic tinning plant at Ebbw Vale, the only plant of this kind in operation in Europe at the present time. Electrolytic tinning has only been introduced into tinplate manufacture during the past ten years. Its adoption was hastened by events in the Far East in recent years, and now the method is widely used in the U.S.A.

The model is built to a scale of 1in. to 1ft., and was constructed by Messrs. Bassett-Lowke, Ltd., of Northampton. It shows the complete plant, with all the units through which steel strip passes, having previously been trimmed at the sides to the length of tinplate required. Each fresh coil of steel strip is joined to the end of the last coil, in order that operation may be absolutely continuous. To allow for the seam-welding of the beginning of a new coil to the end of a coil already passing through, this section of the plant can be independently stopped, while the later operations carry on. The feed of strip steel is maintained by a double loop of coil in a 50ft. looping pit, which allows the strip to continue for 20 seconds. When the new coil is ready and starts moving through the pinch rolls, the loops reform, their length being automatically controlled by photo-electric cells.

As tin will not adhere to the strip unless it is absolutely clean, the grease and oxide scale that has accumulated during earlier operations must be removed and immersions in a hot alkaline degreasing solution and then in diluted sulphuric acid follow. These, after washing, leave the strip clean and ready for the actual tinning process. The plating unit consists of four tanks, in which the strip passes through the electrolyte, which is an acid solution of tin sulphate. Direct electric current transfers tin from suspended tin bars on to the strip, the amount of tin deposit being determined by the current passing and the time of immersion. As the electrolyte is expensive, all surplus is mechanically removed for further use, when the strip leaves the tinplating unit.

A process known as flow-melting then follows, in order that the finished tinplate strip may have a smooth, shiny surface. For this, an electric current heats the strip as it passes through a vertical muffle furnace. Instant immersion in water afterwards prevents oxidation. Precaution must also be taken against discoloration through long storage or stoving processes, and this is effected by spraying with a weak chromic acid solution in a vertical tower. After spraying again with water to remove surplus acid, the strip is dried. Even then it is not quite finished, as the dry surface has proved to give rise to difficulties in later handling, so a further spraying follows, with an emulsion of cottonseed oil in water. When dried after this process the tinplate strip is ready for cutting. The cutting by a rotary flying shear and then the classification of the tinplate sheets, complete the whole operation.

On the model shown at the British Industries Fair, a diagram fitted to the base of the model indicated the flow of the steel strip through the whole line.

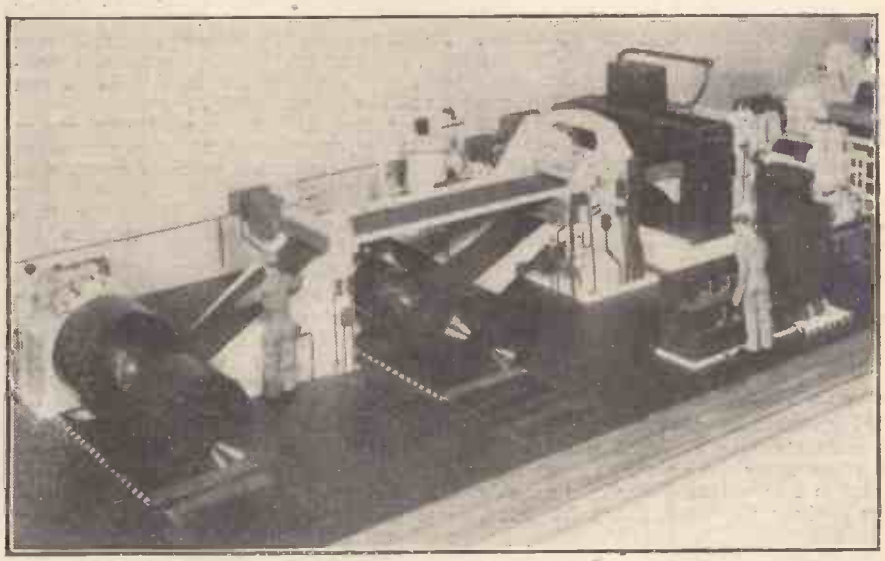


Fig. 6.—Portion of the model electrolytic tinning plant built for Richard Thomas & Baldwins, Ltd., to a scale of 1in. to 1ft. This shows the beginning of the line, with the steel strip coil being fed into the machine.

Trade Notes

A Review of the Latest Appliances, Tools and Accessories

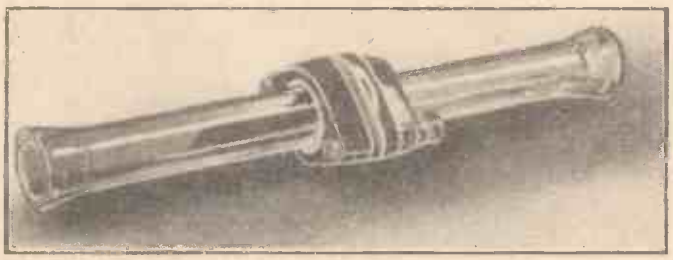
Pyrex Glass Pipe Lines

IN response to a demand for a smaller bore Pyrex brand pipe line, a complete range of ¾in. bore equipment has been developed and produced by Griffin and Tatlock, Ltd., Kemble Street, Kingsway, London, W.C.2.

The design has been based on the successful performance of this firm's larger diameter pipe lines, and provision has been made to connect to these larger sizes.

The joint is similar to that used in the standard equipment using two-bolt fixing instead of three. The coupling flanges are made from "shock-proof" plastic material. A gasket suitable for the fluid under conveyance is incorporated.

Because of their small diameter and robust construction these pipe lines are suitable for installation where severe service conditions are met.



Part of a Pyrex brand pipe line showing the "shockproof" flanges made of plastic material.

The well-known heat and chemical resistance of Pyrex brand borosilicate glass, from which these pipe lines are made, ensures that corrosion and contamination is eliminated.

These glass lines can be flushed with steam or detergents, and, due to their transparency, cleanliness can be visually checked.

The mechanical strength of these lines is such that they will operate satisfactorily at pressures up to 50lb. per sq. in.

New Products of the British Distributing Co.

THE British Distributing Co., 66, High Street, London, N.8, have recently released three new products, as follows:

Nylon Drive Cord. A perfect grip is claimed for this non-stretch, glass-cored drive cord, which can be obtained in 50ft. lengths (carded). Retail price, 4s. 6d. This material is now available to manufacturers and large users on reels of a few gross yards at a lower price.

Radio Cement. This useful adhesive, which is cellulose cement based, is specially intended for all radio and workshop uses. The retail price is 1s. 6d.

Switch and Contact Cleaner. Suitable for use on all electrical and radio contacts, this cleaner is a very efficient dirt and verdigris remover. Retail price, 3s. The above products are all subject to the usual trade and wholesale discounts.

Electronic Flash Photography

THE outstanding advances which have been made in the field of electronic flash photography during recent years were revealed in a special exhibition held recently at the Holborn Gallery of Ilford Ltd., 101, High Holborn, W.C.1.

This exhibition was organised by Ilford Ltd. in collaboration with Mullard Electronic Products Ltd., of Shaftesbury Avenue, London, W.C.2.

Of particular interest among the exhibits was a large selection of photographs illustrating the manner in which electronic flash tubes are now being used in various branches of science, medicine and industry. Their use in Press, studio, theatre and commercial photography was also illustrated by means of a large selection of fascinating action pictures covering subjects ranging from the penetration of a dart into a rubber balloon to the refuelling of an aircraft at midnight over the middle of the Atlantic.

A representative selection of the latest Mullard electronic flash tubes was also displayed. These included the well-known LSD3 100-joule tube extensively used by Press photographers; the LSD2 tube providing light flashes of approximately one microsecond duration; and a complete range of line source tubes specially developed to meet the demands from workers in nuclear research, air flow and schlieren photography. A stroboscopic tube, LSD8, was displayed which will dissipate 30 watts at repetition frequencies up to 500 c/s with perfectly free air ventilation. This tube is being used for such applications as the analysis of motion in production processes and the study of high-speed phenomena in the aircraft industry. An illustration of its use in the textile industry for investigating the breakage of threads and sources of weakness was given in a series of pictures showing the progress of a high-speed shuttle in a loom.

Very important contributions to nuclear research have also been made by flash photography in the investigation of the nature and properties of atomic radiation, and some interesting pictures were to be seen showing the tracks and showers of electrically charged particles created in Wilson cloud chambers.

A group of pictures of mosquitoes in flight, some magnificent photographs of marine life, and some excellent examples of ophthalmic photography illustrated the rapidly expanding use of electronic flash tubes in biological and medical research.

Insulating Oils

A VERY comprehensive handbook on Insulating Oils for Transformers and Switchgear has been issued by the Shell Petroleum Co., Ltd., St. Helen's Court, Gt. St. Helen's, London, E.C.3. Information on insulating oils is scattered in various technical books little read by engineers, and some have not been made generally available. Consequently, it is not easy for the electrical engineer to obtain a comprehensive understanding of the subject, and the need exists for literature that presents concisely and in an accessible form the information required by those concerned with insulating oil applications. This book has been prepared to help to meet that need. There are various chapters covering such subjects as transformer oil, transformer design in relation to oil, switchgear oil, insulating oil specifications, installation and operation of transformers in relation to the oil. The book runs to 102 pages and is illustrated with half tones and line diagrams.

Aerocem Cement-spraying Process

A VERY ingenious technique of construction has been recently invented in England by a firm of manufacturers of cement-spraying apparatus. The technique virtually provides for the erection of houses and factories from hessian and wire netting covered in foamed concrete. The technique is so simple and economical and at the same time is sound, that it is being rapidly adopted in many parts of the world.

The inventors, Messrs. Aerocem Limited, of Chelsea, London, are manufacturers of the Aerocem cellular cement-spraying apparatus—a simple and inexpensive device for aeroplacement of cellular or foamed concrete, which is a special form of lightweight concrete.

The technique originally intended for waterproof coatings and insulation of ordinary type of buildings, has, by this invention, been extended to construction itself.

Aerocem structures consist of a slender frame of metal, timber or reinforced concrete. This frame is then covered with hessian or any other available fabric. If extra strength is required this is provided by wire netting placed in front of the hessian and firmly attached to the frame. The whole—that is the substructure, the hessian and the wire netting—is then sprayed with foamed or cellular concrete. The whole structure thus becomes a monolith cellular concrete structure—the original framework of hessian and wire netting acting as a mere reinforcement.

The Aerocem structures are therefore very light yet very strong. They are completely weatherproof and provide for a high degree of thermal insulation. For example, a wall constructed of 1in. of cellular concrete is equal in thermal insulation properties to 12in. of ordinary concrete. The thermal insulation properties of a structure consisting of two 1in. Aerocem walls with 2in. cavity in between, is equal to 2½ feet of solid concrete.

The technique has further advantages in the fact that it is exceedingly economical in use of labour and material, and in the fact that abroad natives can be easily trained to handle the equipment. The technique, therefore, has unique advantages in the lesser developed areas where difficulties of transport, combined with the absence of skilled executives, make orthodox construction methods prohibitive.

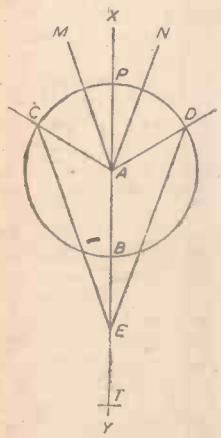
In a world crying out for living accommodation, this new building invention has a task almost amounting to a mission.

Further particulars of this process, including illustrated leaflets, can be obtained from Aerocem Ltd., Rolands Wharf, 71, Lots Road, Chelsea, London, S.W.10.

Trisecting an Angle

SIR,—While in France recently I was shown a method of trisecting an angle.

The method, which I pass on to any readers interested, was discovered by an employee of the S.N.C.F. (the French Railways), and I am assured that it is perfectly accurate for all angles, though I have not yet proved it correct by recognised geometrical means.



A novel method of trisecting an angle.

Construction

Suppose any angle CAD is to be trisected.

Construct the bisector of CAD, XY. Describe the circle, centre A, any radius. Suppose circle cuts AC at C; cuts AD at D; XY at P and B, such that P is opposite to the angle CAD.

With radius BC, centre B, draw an arc to cut XY in T, such that T is outside the circle CBD.

Bisect BT in E.

Join EC, ED.

Through A, draw AN parallel to ED; through A draw AM parallel to EC; then the angle CAD is trisected by AM, AN.—W. DUNCAN NEEDHAM (Chelmsford).

Relative Motion and the Propagation of Light

SIR,—With reference to Mr. D. K. D. Rees' letter on "Relative Motion and the Propagation of Light," there is one fact which seems to have escaped his notice, and which should, I think, solve his problem. This is that the velocity of light in any particular medium is constant, whether the source of the light be moving or not. An impulse, or series of waves, generated even from a moving beacon, would travel radially outwards, each successive wave from the spot at which it was initiated, and so C would not receive his answering signal until after A had received his. If the beam travelled in one direction only not more than one observer could get an answer.

Let the time taken for the beam to reach mirror D from A be t seconds, and let the direction which the beam must take to do this make an angle θ with the direction taken by C.

Then distance travelled by light

$$= \frac{3 \times 10^5}{\text{Sin } \theta} \text{ Km.}$$

$$= 3 \times 10^5 \text{ t}$$

Distance travelled by C $= \frac{3 \times 10^5}{\text{Tan } \theta}$ Km.

$$= 5 \times 10^4 \text{ t}$$

From which Cos $\theta = \frac{5}{30} = 0.1667$.

Sin $\theta = 0.9860$.

Thus the time taken for C to receive his answer

$$2t = 2 \text{ Cosec } \theta$$

$$= 2.028 \text{ Seconds.}$$

If C has simple harmonic motion the problem becomes a little more complex, but could be solved in a similar manner.—B. J. NEWTON (Worcester Park).

SIR,—In answer to the first part of D. K. D. Rees' problem on relative motion lies in his condition: "If the beacon is flashed when A and C are at the same position (instantaneously) and it had been focused by A to give a parallel beam along AB only." Naturally A, and only A, will receive a reflected signal (Fig. 2 of Mr. Rees' letter). For C to receive a signal it would be necessary either for A to divert his beam in the direction AD, i.e., to where D will be in just over one second, or for C to be carrying the beacon and to direct it in the direction AB. In the latter case, light, having mass, will be carried in the AC dimension at 50,000 Km sec. The point being that although A, C and the beacon meet at the point A, C has a motion of 50,000 Km./sec. relative to A *and the beacon* and A *and the beacon* have a motion of the same speed, but in the opposite sense relative to C.

Thus, although A's report is still the same, C's report should read: A beam was sent by A towards *B* two seconds ago and has, of course, been reflected back to A.

Mr. Rees' second problem is more interesting and would appear to furnish a means of testing the concepts of absolute rest and motion. I personally am unable to decide who will receive a reflected signal without postulating that A or C is at absolute rest. Can our problem be solved along the following lines: that when we boldly demand "Let C move with simple harmonic motion," we must remember that we must be dealing with accelerations and decelerations and must therefore consider the force producing them and thus its effects on the details of our problem? Or that possibly there is no instantaneous pause, i.e., one instant motion from left to right, the next instant the opposite motion.

We are all familiar with the concepts of the atomicity of matter and energy; some even with the possible atomicity of space—the volume of an electron. Can there be such an entity as an atom of time?—M. P. DANDRIDGE (West Wickham).

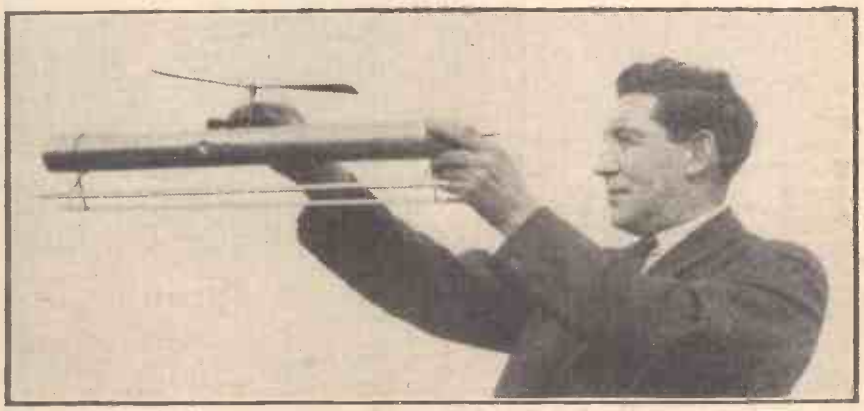
A Flying Model Helicopter

SIR,—I was very interested in the article in the June, 1950, issue on "Helicopters and Their Development."

I enclose a photograph of an actual flying model, made by myself about 1935. The blades were driven by compressed air ejected from the tip of the blades; unfortunately, I had not the means to test the speed. The pressure used was 100 to 110 lb. per sq. in. (not without a few burst tanks).

Naturally, there was no torque reaction. Later I found it possible to obtain a direct lift without an airscrew; further experiments were cut short by the war, when I rejoined the R.A.F. Since the war I have not had the opportunity to experiment further.

I might add that no one was interested in either jet propulsion or direct lift at the time I made this model.—"OLD TIMER" (Clapham).



"Old Timer's" early flying model helicopter.

A Mains-driven Pendulum Clock

SIR,—With reference to the master battery clock in the June issue of PRACTICAL MECHANICS, you may be interested in the photographs of a clock incorporating the Hipp pendulum movement which I constructed about seven months ago. The construction is similar in most respects, with the exception of the power supply, mine being run off the mains instead of batteries. The magnet core and armature were made out of ½in. hoop iron, softened in the fire and allowed to cool, the coils being wound with 1,200 turns each of 36-gauge enamelled wire, forming a U-magnet. The weight of the lead pendulum bob is 9 lb., while the length of the pendulum rod is 39.14in. from where the suspension spring leaves its bracket to the centre of the bob. The rod is made of mahogany to counteract the expansion and contraction due to changes of temperature. The trailer is about an inch of an old ⅛in. twist drill, and the block was fashioned from the tang of an old file, the groove being 1/32in. deep, both block and trailer being afterwards hardened. With the pendulum at rest, the trailer hangs about 3/16in. to the left of the groove and ⅛in. below it, the contact gap being ⅛in. The movement is taken from an old alarm clock (with seconds wheel) which was removed to enlarge the arbor to carry the count or ratchet-wheel, which has 30 teeth, the pawl pulling one tooth every two swings of the pendulum. I also fixed a seconds finger, which lies close to the centre of the face, and, of course, moves

only once in two seconds. I find the clock foolproof, free from attention, and very accurate, being spot on with the B.B.C.'s six pips signal.

I have also provided a scale, with a pointer on the pendulum bob, showing the strength of the "pull." The impulse takes place every half minute, thus lessening the risk of the pawl missing a tooth when the pendulum is slowing down, and gathering two teeth directly after an impulse. The current consumption is negligible. By putting 945 turns of wire on the coils, instead of 1,200, the clock will run about eight months off a cycle battery.

In the event of a power cut there is a danger of the clock stopping with the trailer in the groove damaging the coils (in the mains version, of course). To safeguard against this, a 40-watt lamp is included in series with the coils, so that when power is restored the lamp simply lights and no harm is done. The lamp is also a resistance, more wire than the 1,200 turns on each coil being necessary if run without it.—H. FARRAN (Irlam).

Mr. H. Farran's mains-driven pendulum clock.

A Mathematical Puzzle

SIR,—I think the following solution will satisfy the mathematical paradox submitted by A. Delfont (Redditch) in your July, 1950, issue.

$$\frac{7}{6}\times 7=\frac{7}{6}+7$$

$$=\frac{n}{n-1}\times n=\frac{n}{n-1}+n$$

Taking the first expression

$$\frac{n}{n-1}\times n=n\left(1+\frac{1}{n-1}\right)$$

$$=n+\frac{n}{n-1} \text{ or } \frac{n}{n-1}+n$$

It is very simple really, though at first it appears puzzling.—W. H. F. COPPIN (Croydon).

SIR,—I was much interested in the mathematical problem sent in by Mr. A. Delfont (Redditch), in the July issue. Consequently, I submit the follow two proofs of the general formula:

$$\frac{n}{n-1}\times n=n\frac{n}{n-1}+n$$

(1) $n=n$

Add $\frac{n}{n-1}$ to both sides.

Then $\frac{n}{n-1}+n$

$$=n+\frac{n}{n-1}$$

$$=\frac{n(n-1)+n}{n-1}$$

$$=\frac{n^2-n+n}{n-1}$$

$$=\frac{n^2}{n-1}$$

$$=\frac{n}{n-1}\times n$$

(2) If $\frac{n}{n-1}\times n$

$$=\frac{n}{n-1}+n$$

Divide each side by $\frac{n}{n-1}$

$$\therefore 1\times n$$

$$=1+\left(n\div\frac{n}{n-1}\right)$$

$$\therefore n$$

$$=1+\left(n\times\frac{n-1}{n}\right)$$

$$=1+(n-1)$$

$$=n$$

$$\therefore \frac{n}{n-1}\times n$$

$$=\frac{n}{n-1}+n \quad \text{Q.E.D.}$$

Thus any number substituted for **n** in

$$\frac{n}{n-1}\times n$$

$$=\frac{n}{n-1}+n$$

produces an equality.

—M. N. COURT (Taunton).

Club Reports

Harrow and Wembley Society of Model Engineers

MEMBERS are notified that there will be no society meetings at Heathfield School during the month of August.

Section meetings will be held as follows:

Locomotive Section.—Every Wednesday evening at 7.30 p.m., with the exception of the first Wednesday in the month, at the Track, L.M. Region Sports Ground, Headstone Lane, Harrow.

Marine Section.—Thursday evenings at 6, Birchmead Avenue, Pinner.

A number of outings have been arranged by the Marine Section, to which all members are invited. Details of these will be announced at section meetings.

All members are reminded that help, of any description, will be most welcome in the erection of the new track at Headstone Lane.—J. H. SUMMERS, hon. sec.

Shrewsbury and District Society of Model and Experimental Engineers

THE above society will be holding its annual exhibition on Friday, 10th November and Saturday, 11th November, in the Walker Hall of the Technical College. Hours of opening will be 7-9 p.m. on the Friday, 2.30-9 p.m. on the Saturday.

The exhibition, as usual, will be non-competitive, and support from "lone hands" would be very welcome. As in previous years, the Oswestry Society will collaborate. The club loco, an 0-6-0 5in. gauge job, is progressing surely, if somewhat slowly. An air compressor, motor and storage tank have been purchased and fitted up by members. We now have an ample supply of compressed air at up to 45lb. p.s.i. for testing and running engines, locos, etc., and also a supply for our spraying equipment.—W. T. HOWARD, hon. sec., Technical College, Shrewsbury.

Hastings and District Society of Model and Experimental Engineers

A FINE show of models was given by the club in a model exhibition held during "Hastings Carnival Week" in the White Rock Pavilion, in the aid of local charities. The club is now looking forward to its own exhibition commencing on August 28th-September 2nd. This year we have gone a step further and have a competition section. Entry forms are obtainable from the hon. sec. together with full particulars.

An interesting series of talks and films have been planned for the summer season together with several outings including one to Ashford loco sheds and works.

There are always plenty of spectators and thrills at the power-boat meetings in Alexandra Park on Sunday mornings, and the track nights of the race-car section on Friday evenings at the New Pavilion, Falaise Road. Members of other clubs visiting Hastings are invited to bring their cars and boats to our meetings; they will be given all the usual facilities.—Hon. sec., P. KELLER, 3, Portland Terrace, Hastings.

Aylesbury and District Society of Model Engineers

THE service van belonging to the British Oxygen Company arrived outside Hampden Buildings, Aylesbury, on the second Wednesday of June for a demonstration to the society.

Mr. Warner, the B.O.C. representative gave a most interesting talk on acetylene welding as applied to model making. Although Mr. Warner only dealt with brass and copper, the information he imparted on these two metals was of great benefit to all members present.

After his demonstration, several members were converted to the idea that acetylene welding was definitely the thing for the model engineer, although quite a few snags with the acetylene are met with by amateurs. Hon. sec., N. F. Southerton, Astracot, Bucklands Wharf, Aston Clinton, Bucks.

QUERIES and ENQUIRIES

A stamped, addressed envelope, three penny stamps, and the query coupon from the current issue, which appears on page 88 (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.

Anti-dimming Compound

CAN you inform me of the composition of the anti-dimming compound such as is used to obtain clear vision in respirators?

Can it be made of such consistency as to impregnate fabric, and if so, how?—W. R. Berry (Sleaford).

THE anti-dimming compounds to which you refer are merely thick solutions of soap containing a little glycerine. The soap is best dissolved in methylated spirit. The solution is then concentrated, a little glycerine added, and finally it is again concentrated until it becomes semi-solid.

If this material is dissolved in water, the resulting solution can be used to impregnate fabric.

For such latter purposes only, a better compound is made according to the following formula:—

Sodium oleate	1 oz.
Glycerine	1 oz.
Water	1 gallon.

If sodium oleate cannot be obtained, use shredded hard soap or soap powder in its place. The cloth to be impregnated is gently simmered in the above solution for five minutes. Afterwards, it is hung up to dry.

Evaporative Method of Refrigeration

CAN you inform me how to obtain a modest degree of refrigeration for milk, butter and meat without the high expense of a commercial refrigerator?—L. Butterfield (London, S.W.).

THE ice-box is one solution to the problem, but this solution is not by any means an ideal one since it involves the trouble and expense of purchasing regular supplies of ice, a task which, in many districts, is virtually impossible.

The evaporative method of cooling is quite good provided that really low temperatures are not ordinarily expected.

To operate this system, you need a metal, say a zinc, "shell" or case in which the articles to be cooled are placed. This should be wrapped round with a good quality absorbent asbestos sheeting,—not one of the asbestos-cement type, which is rigid, but one which is made of pure asbestos "wool" or fibre. The asbestos covering should be tied on with asbestos string. These materials can be obtained from either Dick's Asbestos Co., Ltd., Cory Buildings, Fenchurch Street, E.C.3, or Asbestos and Engineering Products, Ltd., Winchester House, Old Broad Street, E.C.2.

The cabinet should rest at opposite lower sides on one or two clean bricks so as to give an air space all round. Arrangement should be made for a continual spray or drip of water to impinge on the asbestos covering so that the latter is saturated with the water. The evaporation of the water will induce some degree of cooling within the cabinet, and the greater the evaporation speed the greater the cooling. Hence, if you can arrange for one or more electric fans to be working so as to bring an air current to bear on the asbestos covering, the water-evaporation will be speeded-up and the degree of cooling within the cabinet will be increased accordingly.

So far as we are aware, this device has never been commercialised, presumably on account of its need for a continuous water drip and also because its results cannot compare with the very efficient degree of cooling effected by the mechanical refrigerators.

Paint Removers

CAN you give me a formula for making up a good paint remover, and also one for removing oilbound distemper?—G. Briggs (Sutton).

MODERN paint-removers generally consist of organic liquids which have the property of softening and/or actually dissolving the paint layer. Because such liquids are usually very volatile, they contain in them dissolved wax, which forms a film over the paint layer and thus prevents the paint-removing liquids from evaporating away too quickly.

A good paint-remover has the following composition:

Acetone	1 part (by measure).
Benzene	2 "
Methylated spirit	½ "
Butyl alcohol	½ "
Methylene chloride or Tetrahydronaphthalene	½ "

In the above mixture, about one-quarter part of wax is dissolved. Any type of wax may be used, but paraffin wax or ceresin is, perhaps, the best and the cleanest.

The above liquid preparation softens paint almost instantly. It is non-staining and does not raise the grain of the wood. Unfortunately, it is rather expensive.

An alternative paint-remover is:

Benzene	5 parts (by measure).
Ethyl acetate	3 "
Paraffin wax	2 "

The following is a simpler and less expensive material, but it contains alkali, and is likely to raise the grain of the wood:

Flour	5 parts (by weight).
Water	50 "
Caustic soda	10 "
Whiting	15 "
Carbon Tetrachloride	20 "

Any ordinary paint remover will also deal with an oilbound distemper. Usually, however, it is far cheaper and more convenient to deal with large distempered areas to brush over them an alkaline liquid such as a solution containing 3 parts of caustic soda and 2 parts of ammonia in 95 parts of water. The alkali softens the oil "film" and, also, the film of lime (casein) which is sometimes present in these old distempers, and thus renders removal of the distemper by scraping quite a simple job.

The wall (particularly if it is an absorbent plaster wall) should be scrubbed down with soap and hot water afterwards in order to get rid of the alkali.

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.

Electrolyte for Nickel-Cadmium Cells

CAN caustic soda be used as an electrolyte for Nife Nickel-Cadmium cells, and if so, what is the preparation? Potassium hydroxide seems difficult to obtain.—J. W. J. Arnold (Darlaston).

POTASSIUM hydroxide is not difficult to obtain. You can procure it from Messrs. Vicson's, Ltd., 148, Pinner Road, Harrow, Middx, or from Messrs. W. & J. George & Becker, Ltd., 157, Great Hampton Street, Birmingham 3, price about 7/- per lb. Sodium hydroxide (caustic soda) of the same purity would cost about 6/- per lb.

Sodium hydroxide (caustic soda), in the pure form can be used in the majority of nickel-cadmium cells, and at about the same strength as the caustic potash (potassium hydroxide). It is advisable, however, to keep to the potassium hydroxide. On no account, however, should the commercial grade of caustic soda be used, since this contains many impurities.

Removing Cemented-in Tiles

CAN you inform me what will soften cement, so that some very good tiles can be removed safely to another part of the house to be re-laid? They are beautifully glazed, so I do not want anything that will ruin the surface of the tiles.—E. Hancox (Stromness).

THERE is nothing which will soften a well-compounded cement. Sometimes, strong hydrochloric acid can be used to dissolve the cement away, but this acid is equally liable to attack the back of the tile, as well as the cement.

We take it that you wish to remove wall tiles which have been cemented in position. To do this without injuring the tiles is not quite as difficult a job as you may think, although it is a task which calls for much patience. You will require merely a small stone chisel and a few hacksaw blades. Begin by carefully chiselling away the cement at the edges of the tile. Sometimes you will be able to saw through masses of cement, and, when doing this, keep the cement well wetted with water.

There is no other way of removing the tiles without injury. It is a matter of careful scraping, chiselling and sawing until you have entirely dislodged each individual tile. When the tiles have been separated and detached, the adhering fragments of cement will have to be carefully scraped away in just the same way.

Bonding Agent for Firebricks

I WISH to make some refractory blocks (firebricks) of various materials, using sodium silicate (waterglass) as a bonding liquid.

Would you kindly advise me how I can use sodium silicate for this purpose, and if I can get variable setting times?—F. G. Elliott (Leatherhead).

SODIUM SILICATE can be used as a bonding agent for various refractories, but it has a long setting time, and this time, also, is dependent on the concentration of the silicate and the composition of the product. Acidic ingredients decrease the setting time. Alkaline ingredients tend to increase it.

The use of sodium silicate in these compositions is simple enough. The ingredients are thoroughly mixed in the dry state. The sodium silicate (strong or diluted) is then stirred into the dry mixture until a plastic mortar-consistency mass is produced. This is then allowed to set in contact with the air. In many instances, the blocks are hydraulically compressed before being placed aside to set. For the sodium silicate, you can use the ordinary "waterglass" employed for egg preserving, although it would be better to use one of the grades of sodium silicate specially prepared for technical work by Messrs. J. Crosfield & Sons, Ltd., Warrington, Lancs. Their "Pyramid" brand of sodium silicate, No. P.84, which is used for concrete sealing, would probably show the most rapid setting time for your specialised work.

Composition for Printing-machine Rollers

WOULD you please advise me about the procedure for re-casting small printing-machine inking rollers? I understand this can be done but I have not been able to melt the gelatine.

I have tried to melt this composition in a glue-pot and also directly over a hotplate without success.

Would you also give the composition of this material? Can it be prepared at home?—E. B. Wright (Burton-on-Trent).

THE rollers to which you refer consist essentially of a stiff mixture of glue or gelatine, china clay or whiting and glycerine.

The reason why you have experienced trouble is that you have tried to melt the glue or gelatine without water. Glue and gelatine will, under ordinary circumstances, not melt without decomposition. There must be sufficient water to soften the glue or gelatine and for these materials to dissolve.

The following is a formula for printer's roller composition:

Glue	100 parts (by weight)
Water	30 "
Glycerine	100 "
Old rollers	200 "

This mixture is well stirred up in the hot state and afterwards cast in a cylindrical mould.

The following composition should be used for surfacing the roller:

Gelatine	70 parts (by weight)
Whiting	50 "
Beeswax	12 "
Glycerine	70 "
Water	Sufficient quantity.

Dissolve the gelatine in just sufficient hot water to form a solution. Add the glycerine. Stir in the whiting. Melt the beeswax and add it drop by drop with rapid stirring. If the composition is too thick, add a little more hot water. The composition should be placed in a tray over a hot-water vessel so that it is kept hot. The roller is then rotated in the composition so that the roller surface is evenly covered. The precise water content of the composition is a matter

for experiment, since the more water it contains the softer it will be.

Polishing Carbon Granules

WILL you please inform me of the method employed in the polishing of carbon granules?

I am making a telephone, and would like to polish the granules myself.—J. Jennings (Swindon).

FOR the polishing of dense carbon granules, the latter are usually rotated slowly in a tumbling barrel, wherein they are jostled together and thus brought to a state of surface polish by attrition. You might imitate this method on a small scale by placing the granules in a cylindrical "tin" or container and by rotating it on a lathe or by some other mechanical means. The rotation speed should be slow enough to ensure that the granules are not carried round in one mass each time the cylindrical vessel rotates.

Electrolytic Bath for Cleaning Metal Articles

I UNDERSTAND there is an electrical process for cleaning old brass articles.

Can you tell me the composition of the bath, voltage used, and the theory of the process?—J. W. Bee (Ruddington).

THE electrolytical cleaning of metallic articles is a method which has come to the fore in recent years. The process is simple enough. The article to be cleaned is suspended as a *cathode* in a suitable liquid, an iron or steel plate being the anode. A heavy current is then sent through the cell. Large volumes of hydrogen are evolved at the anode, and grease, dirt and scale are quickly removed therefrom.

A solution of sodium carbonate (one in six) or of trisodium phosphate (one in four) is suitable for the above purpose. Normal sodium phosphate may also be used for the purpose.

The cleaning action is due to the following causes: (a) The mechanical dislodgment of insoluble particles from the anode by the scouring action of the evolved gas.

(b) The production of caustic soda in the solution by electrolytic action, this being a powerful cleaner.

(c) The scouring action of the fine solids which are loosen from the anode and which become suspended in the solution.

(d) The saponifying of grease by the caustic soda present.

An E.M.F. of six volts is ample for the purpose, but the amperage should be as high as possible. Direct current must be used. From time to time the current should be reversed in direction through the cell.

Great care should be observed when cleaning articles of zinc, aluminium, lead, tin and magnesium by this method, because these metals are susceptible to caustic soda influence, zinc, lead and aluminium being particularly soluble in strong caustic solutions.

Removing Whitewash from Brickwork

WHAT is the best way to remove lime wash (whitewash) from hard, smooth red perforated bricks which form the door and window surrounds of a dwelling-house?—T. T. Rea (Ballymena).

BY "red perforated brick," we assume that you refer to the hard brick made with a roughcast or pitted surface.

If you wish to remove one or more coats of whitewash from this, go over the surface first of all with a wire brush. Afterwards, thoroughly wet the surface with water (preferably hot water) and scrub it vigorously with an ordinary hard bristle brush. With patience, this treatment will remove all the surface whitewash.

Finally, in order to get at the whitewash within the hollows of the brick surface, you will have to use strong hydrochloric acid ("spirits of salt"). Use the commercial variety of this, and scrub it into the brick hollows with a bristle brush. Afterwards, swill it away with plenty of water.

Foam-type Carpet Cleaner

CAN you supply me with any formulas for a foam-type of fabric cleaner such as is used on carpets and furniture; also the method of use?—J. B. Fellows (Exeter).

FOAM-TYPE cleaners for carpets and rugs have usually a complicated formula. A suitable type is as follows:

Oleic acid ..	..	107 parts (by weight).
Butyl cellulose	..	27 " " "
Naphtha ..	..	25 " " "
Triethanolamine	..	19.7 " " "
Potassium hydroxide		8.3 " " "
Water ..	..	13.5 " " "

Mix the oleic acid, butyl cellulose and naphtha. Heat to about 140 deg. F. Dissolve the potassium hydroxide separately in the water. Heat to the same temperature. Then stir the latter solution into the former. Stir well and continually for about 30 minutes.

A simpler formula is:

Oleic acid ..	..	6-10 parts (by volume)
Triethamolamine	..	3-4 " " "
Carbon tetrachloride		18-17 " " "
Naphtha ..	..	73-69 " " "

Mix the oleic acid and the triethanolamine. Warm the mixture. Then add the carbon tetrachloride and the naphtha.

The above are excellent dry cleaners, but they do not foam. To make the liquid foam, add to them about five parts of an extract of soap bark in methylated spirit. This extract can be made by placing in a bottle two parts of powdered soap bark and two parts (by vol.) of methylated spirit. The bottle is corked and the contents shaken up at frequent intervals for three days. The extract is then filtered and is ready for use. The foam, however, does not affect the cleaning powers of the preparations, and, for practical purposes, it is quite unnecessary to use it.

For ordinary work on carpets, a solution of shredded or powdered soap in warm methylated spirits plus a little benzine or carbon tetrachloride constitutes a simple preparation (non-foaming), which will give very good results.

"Antique Silver" Finish on Wrought Iron

I WISH to make a pair of electric wall-brackets with soft iron strip, as in the accompanying sketch. Could you please inform me how I can produce a finish on the iron which looks like "antique silver" (black and grey silver patches)?

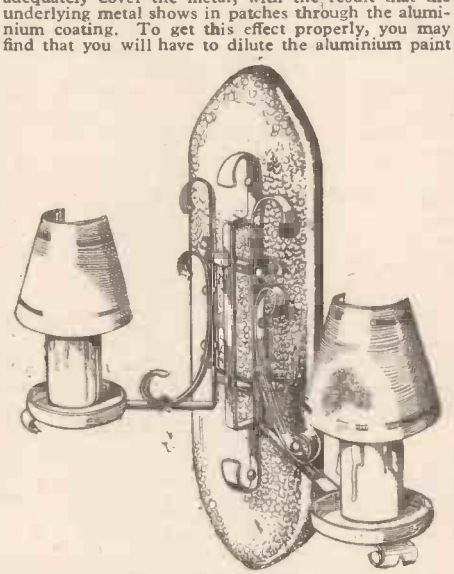
What metal other than soft iron could be used to obtain the same finish as "antique silver"?

Also, is it possible to give the soft iron strip a copper finish?

Where can I obtain the necessary materials? Is it possible to obtain any books with small designs for metal work such as shown in the sketch?—L. K. Meeres (Middlesbrough).

YOU can only get an antique silver effect on ordinary wrought iron by a process of painting or lacquering. You cannot obtain the effect by any chemical treatment.

All you need to do is to clean and degrease the metal thoroughly and then to apply a very sparse coating of a good aluminium paint, so that the paint does not adequately cover the metal, with the result that the underlying metal shows in patches through the aluminium coating. To get this effect properly, you may find that you will have to dilute the aluminium paint



A bent-iron electric wall-bracket (L. K. Meeres).

with some thinning medium. The precise thinning medium to use will depend on the composition of the paint, but usually, you will find that benzene will be effective in this respect.

Other metals which you could use for the metal articles are aluminium (or its alloys) and zinc. The latter metal might have too dark a surface colour for your liking, but it could be touched-up with thinned aluminium paint. Aluminium, of course, would merely require a little touching-up with a thinned black lacquer, or with a trace of a lead grey priming paint.

It is quite possible to give iron strip a copper finish. You can do this very simply by giving it a coating of a copper lacquer. You can obtain bronze powder (in a "copper" shade) from Messrs. John & Bloy, Ltd., Metana House, Hind Court, Fleet Street, London, E.C.4, price about 10s. 1b. This dry powder is worked into a quantity of clear cellulose lacquer and it produces the quick-drying paint which you need.

Alternatively, you can copperplate the material, using the following copperplating bath:

Copper sulphate	2lb.
Sulphuric acid	4 oz.
Water	1 gal.

Dissolve the copper sulphate in the water. Then add the sulphuric acid. This bath requires an E.M.F. of about 4 volts D.C. An accumulator will be found to be a good source of current. A copper sheet must be made the anode or positive electrode and the iron to be plated will comprise the cathode or negative electrode.

Materials for this process should be obtainable from any local pharmacist. If not, apply to Messrs. Reynolds & Branson, Ltd., Leeds.

There are several books on art metalwork which should be of interest and use to you. We append a few titles. You will be able to obtain these books new (and possibly secondhand) from any good bookseller, such as Messrs. W. & G. Foyle, Ltd., Charing Cross Road, London, W.C.2, or Messrs. Wm. Bryce, Ltd., 54, Lothian Street, Edinburgh.

H. M. Adam & J. H. Evans: Metalwork.
B. Cunnor: First Book of Metalwork.
P. W. Davidson: Educational Metalwork.
G. M. Hart and G. Keeley: Metalwork for Craftsmen.
C. G. Leland: Elementary Metalwork.
J. Kay: Simple Art Metalwork.
A. J. Shirley: Elementary Craftwork in Metal.
F. J. C. Jordan: Metalwork for Beginners.

You should be able to consult many of these volumes in your local Reference Library. They should also be obtainable on loan from your County Library.

Note also that Dryad, Ltd., St. Nicholas Street, Leicester, issue a series of inexpensive booklets on various art crafts, including metalwork.

Pearl Ash: Gum Tragacanth

WHAT are the uses of Pearl Ash, and where can I purchase some?

Also where can I purchase 3lb. or 4lb. of white petroleum jelly, salicylic acid powder and gum tragacanth?—J. Roberts (Wallasey).

PEARL ASH is an impure form of potassium carbonate, K_2CO_3. It is an alkali, although not a caustic alkali, like caustic potash. It can be used for any purpose for which a mild alkali is needed, e.g., in soap-making, in pharmacy, in photography, etc. It is sometimes used as a fertiliser, as an ingredient of electroplating solutions, in chemical synthesis, and for various other miscellaneous purposes. It is readily obtainable from chemical wholesalers, price about 2s. 6d. per lb. If you cannot obtain it locally, try Messrs. Vicsons, Ltd., 148, Pinner Road, Harrow, Middx.

The following are approximate present prices of the other materials which you list:

White Petroleum Jelly ("White Vaseline") 1s. 4½d. lb. (in 7lb. lots).

Salicylic acid. Pure (Powder), 3s. 10d. lb.

Gum Tragacanth. Pure (Powder), 12s. 6d. lb.

If you only want these materials in small quantities, it would be best for you to obtain them from a local chemical wholesaler, or from the above-mentioned firm. For large quantities, of course, you would obtain them from the actual manufacturers.

Colour Filters

I WISH to make some colour filters for stage lighting. I believe these can be made with gelatine to which is added a chemical which has the effect of preventing the gelatine from softening with the heat of the lamp. Could you inform me if this is so, and the name of the chemical? Also, are there any books which might help me?—P. Stocker (Edmonton).

DISSOLVE 10 parts of gelatine in 90 parts of hot water. To the solution, add a little water-soluble dye until it is approximately coloured the shade you require.

Flow the coloured hot gelatine solution on to a number of sheets of glass supported horizontally. The gelatine will set on the glass, forming a coloured film. It may then be stripped away from the glass and sandwiched between sheets of clear glass, or, alternatively, the glass sheets on which the gelatine solution has been flowed can be used as light filters directly.

To harden the gelatine film, immerse the glass sheets in a cold bath made up by diluting one part of formalin with five or six parts of water. After five minutes' immersion, followed by drying, the gelatine will be quite hard, and it will be insoluble even in boiling water.

There are no special books on this subject, but the making of gelatine filters is sometimes referred to in various books on practical photography and photographic processes.

Anti-fouling Compound

CAN you supply me with details of the composition of an anti-fouling and preservative compound suitable for use on a sea and river cabin cruiser, clinker built? I should prefer a compound based on tar or bitumen and one that can be applied cold, and which will set in the water.—J. Shuckburgh (Bristol).

YOU do not say whether the anti-fouling composition is intended to be applied to a wooden or a metal bottom. In the case of a wooden ship's bottom, dissolve 25 parts copper naphthenate in 75 parts of hot naphtha. In an iron pan gently melt a quantity of a medium-hard bitumen, such as can be made by blending together about 70 parts of "65 penetration" petroleum bitumen with 30 parts of Gilsonite or Raphaelite bitumen.

When molten, the medium-hard bitumen is slowly thinned out to a liquid of paint consistency with the copper naphthenate solution prepared as above.

This solution has excellent preservative and anti-fouling properties. It is fungicidal, and it adheres well to woodwork. It should be applied in two coats. To render it quicker setting, white spirit should be used in place of naphtha for the preparation of the copper naphthenate solution.

For use on metal bottoms, melt a quantity of the medium-hard bitumen and then stir into it about 15 per cent. of its weight of a mixture of equal parts of zinc oxide, red oxide of iron and red lead. Then, by means of the above copper naphthenate solution, thin the mixture down to paint consistency. This preparation has stronger fungicidal properties than the above. It has also a very powerful corrosion-inhibiting action when applied to metalwork. As before, the paint should preferably be applied in two coats.

To be of maximum value, these anti-fouling compositions should be allowed to dry out properly before being allowed to make contact with water. The compositions are, of course, applied cold. In case of need they can actually be applied under the water, but they will not adhere to the same extent as they will do when applied to a perfectly dry wood or metal surface.

A medium-hard tar may be used in place of bitumen.

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THE Cyclist
Editor: F. J. CAMM

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Comments of the Month

By F. J. C.

The C.T.C. and Motor-assisted Bicycles

THE Cyclists Touring Club is a body which purports to represent the views of cyclists. In point of fact, it is a body which advances the views of its own council, quite often without reference of any sort to its own members. From its statements some may think it exists to foster a hatred of motorists.

Presuming that there are ten million cyclists in this country, and the membership of the C.T.C. to be about fifty thousand, the position is rather like that of a very lean tail trying to wag a very fat dog. This blundering body, with its council of so-called cycling "legislators" has injected into the cycling movement a heritage of hate of all forms of road users but pedal cyclists. Its secretary recently visited the Alliance Internationale de Tourisme in Paris armed with a report on motorised bicycles, interlarded with what the secretary called the C.T.C. point of view, which is that it will continue to *interest itself entirely in cycle touring* and that cycle touring cannot in any of its forms cover the use of a petrol engine. The burden of this amusing document, which seems to be straining for effect, and only succeeded in making the C.T.C. look stupid, is that cycles with motors of any size should be regarded as motor-cycles. It shows how little the C.T.C. is in touch with current trends and current thought, when we inform our readers that his proposal was rejected by an overwhelming majority; the representative of the Dutch Touring Club, speaking for the majority when he expressed the eminently sensible view that the A.I.T. should accept motor-assisted bicycles as ordinary cycles, and also that the Cycling Touring Commission should endeavour to obtain for users of motor-assisted bicycles the same concessions and freedom as it had already achieved for ordinary bicycles. It would be almost true to say that the proposals to excommunicate motor-assisted bicycles were howled down with contumely. It should be a lesson to its sponsors to confine their attention to what they admit to be the only object of the club, namely, *cycle touring*, and not to become peripatetic delegates on subjects which do not come within their purview or experience. It cannot be too clearly stated that the C.T.C., as one of the Three Tailors of Tooley Street, *does not* represent the views of British cyclists, and it would be difficult for it to prove that it expressed even the views of its comparatively small membership.

It is of no concern of the users of motor-assisted bicycles nor to the manufacturers that the C.T.C. will have nothing to do with them. It is to their advantage and a C.T.C. loss. What they will do as the movement grows is to form their own association and make their own rules free from the blind hatred of everything mechanical on the roads which suffuses the attitude and the statements of the C.T.C.

Instead of having a measure of gratitude that the motoring fraternity drew away from cyclists the attentions of the police and virtually gave them unfettered use of the highway, they pump out their venom year by year against motorists.

For example, at the A.I.T. meeting to which we have referred, the secretary of the Automobile Association vigorously protested against a statement by the secretary of the C.T.C. (who is also secretary of the Cycle Touring Commission) that some British magistrates were unduly lenient towards motorists, and consequently prejudiced against cyclists when their interests came into conflict. This is such utter balderdash that we are astonished that it should have been made by an accredited British representative at an international meeting of this sort, thereby giving foreigners a totally false impression of our standards of British justice.

Whilst this campaign of hatred against motorists continues to be fomented by the C.T.C. it can hardly be expected that motorists will turn the other cheek. Is it not high time that the C.T.C. Council got together and purged its ranks of this bitterness—cleansed the Augean stables? Its attitude is well known in Government quarters and the force of its arguments when it meets the Ministry of Transport and other national bodies is considerably stultified by it.

As we have pointed out before, there may be a measure of sour grapes about its attitude to motoring, because in 1906 a High Court action was brought to negative a move which was then being made to open the ranks of the C.T.C. to motorists!

There is an inconsistency even in its stated objects. In the current issue of its club journal the C.T.C expresses pride that throughout its existence it has remained true to its original purpose. "The chief object of the club is not to promote touring but to protect cyclists." Compare this with the other statement in its report on motorised bicycles that it will *continue to interest itself solely and whole-heartedly in cycle touring.*

Of the ten million or so cyclists in this country at least nine and a half millions are utility cyclists using their machines for business purposes or for riding to and from work. They are outside the ranks of all cycling organisations as membership statistics prove, and it might have been thought that the C.T.C. would have been anxious not to offend the pool from which they hope to draw further members. There may be some alarm in the C.T.C. camp that if the motor-assisted movement grew their membership, especially of family members who may wish to attach small engines to their tandems, would decline. Perhaps this accounts for this effort to stifle motorised cycling at birth.

Motorised cycling, as is pointed out in an article on the subject elsewhere in this issue, is nothing new. The early motor-cycles were bicycles with engines attached. Several attempts have been made in the last forty years to revive them. This latest attempt looks as if it will be successful. On the Continent some dozen makers are producing first-class units and selling them in thousands. Eight manufacturers in this country are manufacturing under licence, from Continental designs, and they are selling in large quantities.

The apathy of C.T.C. membership is well known, and it is that apathy which makes it possible for the C.T.C. to advance views in the name of its membership which are really the views of the council. The latter body should bring its ideas up to date and not endeavour to rule modern times by the tenets of outworn creeds. The C.T.C inferiority complex has become a persecution complex.

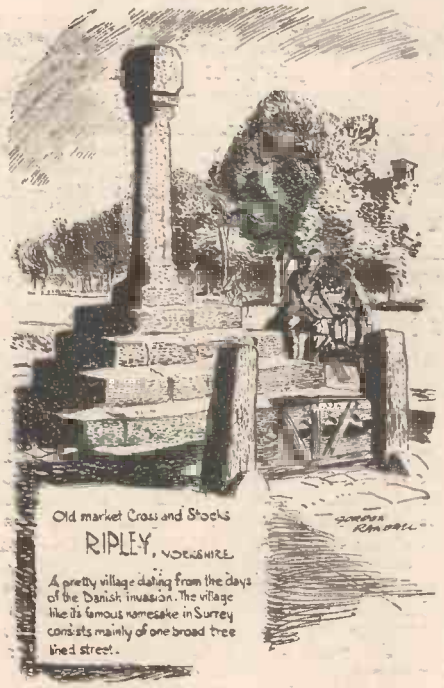
In a further splenetic statement to the Press the C.T.C. announces that it has withdrawn its association with the Royal Society for the Prevention of Accidents because it feels that body is sympathetic towards motorists, and is not sufficient pro-cyclist. This body is thoroughly impartial, and we have yet to discern that it has discriminated in its judgment in favour of motorists. The C.T.C. thinks that its announcements are addressed against cyclists, and that the victims of accidents are always blamed for them. We understand that the vote to withdraw from the R.S.P.A. succeeded by only one vote; twelve being in favour of withdrawal and eleven against. The N.C.U. is naturally annoyed and dismayed at this move. The time has arrived when a period should be put to this dangerous C.T.C. policy which is divorced from fact.

We challenge the statement by the C.T.C. secretary in a contemporary that: "It is not merely sense but the law of the land that the protection of cyclists cannot be combined with an interest in the welfare of motorists." What law?

The B.L.R.C. and the Press

LAST month we criticised the B.L.R.C. rule banning the Press from its meetings. Since the B.L.R.C. have had considerable publicity in the daily Press as well as the periodical Press, we sent a copy of our comments to the Institute of Journalists and to the National Union of Journalists. The latter body is considering the matter, whilst the former body, through its general secretary, makes the following comment:

"*I should like to congratulate you on your outspoken criticism of a rule which, quite unjustifiably in my opinion, excludes representatives of the Press from all business meetings of the League. You have indeed rendered a considerable service both to the Press and the sporting world by exposing this rule and I can only say that, if similar publicity were given to all other restrictive practices of this kind, journalists would be greatly assisted in their primary task, which is to provide the public with the information that the public has a right to receive.*"



Paragrams.

" Zebras " for Safety

AFTER carrying out investigations over a period of some seven months, the Road Research Laboratory has decided that the " zebra " pedestrian crossings, with their foot-wide black-and-white stripes, do make road users and pedestrians take care. During a period of observation more pedestrians were seen to use the " zebra " crossings than used the ordinary pedestrian crossings, and more road users took care when approaching them than the ordinary type.

Road or Allotment ?

DURING a discussion at the monthly meeting of Market Harborough Trades Council a member complained that there were cracks in the surface of Northampton Road large enough to grow potatoes in. Mr. B. Foster, racing cyclist, said he regularly had to make a detour to avoid this road on his way to racing events, for fear he got a puncture or damaged his machine. The matter is to be taken up with the local council.

How to Win Races

MR. CYRIL HOLMES, veteran Dowsby (Lincs) racing cyclist, some 40 years ago, used to ride 600 miles a week to keep himself fit for racing events and carried out his training on a touring machine. He advises would-be record breakers to train on a normal machine so that when they get on the track on a racing machine they immediately get away at speed. The training, not the racing, was the hard work during his racing career and, in addition to his road work, he used to skip for hours at a time. He does not advise any cyclist to take up racing until he is 18 years old, and he says that at least 10,000 miles should be ridden on the road before a cyclist starts racing. Many present-day cyclists, he says, ride badly, and few have the proper ankle movement which enables them to go fast and far without undue strain.

Up in a Balloon !

CHARLES K. PAUL, who is with the U.S. Navy and has been watching with interest naval experiments with small airships for spotting purposes, has built himself a pedal-driven gasbag. To a small balloon capable of lifting one man he attached a framework of light tubing, complete with seat and pedals. The pedals drive a propeller through chain and sprockets, and with a favourable wind and plenty of muscle power Charles can work up an airspeed of something like 10 miles an hour. With a headwind, however, his speed slackens.

Doesn't Like " Crocodiles "

BRIGADIER J. N. CHENEY, Chief Constable of the East Riding of Yorkshire, criticised the " club crocodile " in his monthly road accident report for March, and complains that it does not make for safety in traffic. " We see anything up to a hundred cyclists riding along the road in an unbroken line, sometimes over a hundred yards long," he says. Motorists cannot overtake because of the length of the string of cyclists, he complains, and suggests that riders should travel in groups of 10, leaving a space of 50 yards between each group. He ends by saying that the cyclist enjoys an almost complete immunity from road traffic Acts and regulations that make him the envy of all road users and should not take undue advantage of his position.

On His Conscience

THE most difficult part of a murder is, according to crime experts, the disposal of the body. Angus McIntyre, of Dundee, did not commit a murder, but he stole a bicycle and found it almost as difficult to get rid of as a body. In fact, it worried him so much that he gave himself up to the Gainsborough (Lincs) Police. McIntyre stole the cycle from a bus driver near Scunthorpe, and at Scunthorpe Magistrates' Court he was later sentenced to three months' imprisonment.

Less Punctures ?

A MECHANICAL street sweeper, working on the vacuum cleaner principle, has been brought out and, maybe, if it comes into general use, we may not collect so many punctures at awkward moments. A revolving brush loosens the dust and rubbish and a fan sucks everything, from nails and bits of broken glass to bottles and half-bricks, into a refuse cart. After the machine has passed by, for a few minutes at any rate, the road is said to look like the floor of a well-tended home.

Defective Cycles

DURING March, in connection with the Children's Road Safety Week, the police in the Isle of Ely inspected 998 cycles belonging to schoolchildren in the county, and of this number they found 799 to be defective to a greater or lesser degree. The police gave the children notes of the defects, to be handed to their parents in the hope that the parents might do something about the matter.

Junior on Tow !

WHEN Junior grew old enough to sample the fun of the open road, Mr. Frederick Warner, 32-year-old Leicester draughtsman, and his wife, both cycling enthusiasts, wondered how they would carry him. However, Mr. Warner set to work and sketched out a light-weight trailer to be towed behind his machine, and now, at a cost of round about £1, he has a comfortable trailer. Using the bodywork of an old cycle sidecar, he mounted this on an angle-iron chassis running on two cycle wheels, fitted mudguards and a towing bar made out of steel tubing bent to shape, and there was the trailer. Mr. and Mrs. Warner are this year planning a cycling summer holiday—complete with trailer.

For Calm Weather Only

A BODYWORK of oilcloth over a light frame has been designed by a French inventor to fit over a bicycle and rider to give protection from the weather. There are windows all round to give a good view and the rider gets on his bicycle after opening a swing door. There is some attempt at streamlining, but with a head wind a good engine would seem to be necessary to help the riders' legs, while with a side wind he might just as well pack up and go home.

In the Wholesale Business !

WHEN a man was charged at Canterbury Magistrates' Court with stealing two cycles, he told the court that he wished 138 similar cases to be taken into consideration. The value of the 140 cycles which he stole was estimated at £2,024. He was sentenced to 12 months' imprisonment.

Ancient Planning

AS the result of extensive research, Mr. Victor Ashby, a keen archæologist, of Towcester, Northants, holds the theory that some 3,000 years ago roads were planned to a " Master Plan " to cover the whole country and that with the exception of a few modern roads the roads of Britain still follow this Master Plan. He suggests that possibly the priests prepared this Master Plan, which also, he says, determines the parish and county boundaries and the positions of every town and village. For more than 30 years Mr. Ashby has been travelling all over the country, checking his theories and digging to find the sites of roads now disused. A network of good stone roads, laid out according to the Master Plan, once covered the whole of the country, according to Mr. Ashby, and instead of the Romans building new roads they simply improved the existing roads.

Kettering Club Expands

FOUNDED in 1945, primarily for young riders who merely wished to get around the countryside in their own time and without undue haste, Kettering Friendly Cycling Club has produced a number of promising racing riders and the emphasis is now to be on hard-riding. A Touring Section has been formed for those riders who prefer to potter. At the foot of the circular giving details of the Touring Section is a reassuring note for beginners. It reads: " Our pace will be that of the slowest member and no one need be in fear of being left behind. When one stops we all stop."

Years Give Speed !

RIDING his tricycle in Peterborough Cycling Club's Beardsall Memorial Cup " 30," Bill Beeby, veteran rider and club secretary, put up a time of 1hr. 36min. 9sec., which was 16 minutes faster than his time for the event in 1939 when he claimed the club record. As Bill is soon celebrating his 50th birthday, it looks as if his speed is increasing with his years.

Around the Wheelworld

By ICARUS

The Passing of Goss Green

THE most famous unpaced rider in the history of cycling, Harry Green, or Goss Green to his friends, has passed from this mortal coil. He died at the age of 74, having between 1889 and 1901 set up eight records, and altogether he held no fewer than 15 R.R.A. records. Most of these were records which he broke, only a few being "made" records. In some of them he used the Bricknell handgear which was worked by rocking the handlebars which operated a gear secured to the front wheel. Thus the gear was always in motion, and the original front wheel with the gear attached is possessed by Mr. W. J. Robin, Carshalton Road, Sutton, Surrey, who accompanied Harry Green on many of his rides after he resumed the racing game in 1908. Many of his records stood for many years before they were beaten by later riders such as Rossiter, Leon Meredith and Frank Southall. One of his favourite machines was the Dursley-Pedersen which had a hammock type of saddle and was, of course, fitted with the Bricknell handgear.

Special Carriage for Bicycles

AN experimental van equipped to carry bicycles by passenger train was shown in June at Victoria Station to the National Committee on Cycling, a body which represents all the organised cyclists of Great Britain (its president is Sir Harold Bowden, Bart.).

It was on the suggestion of the National Committee that the van has been constructed; and after they had secured official acceptance of a figure of 2,000,000 bicycles as the number carried yearly by passenger trains in Great Britain.

The experimental van, taking 47 bicycles, has been tried out on the Continental route to Newhaven and, should it prove as satisfactory as it seems, it may be generally adopted.

Imperial Wheelers Rally

I LEARN from the hon. secretary of the Imperial Wheelers that the date of their rally upon which I commented last month has been put forward to September 16th. The rally will start at 10.30 a.m., and there will be over £200 worth of prizes; the cycling events will include grass track and roller contests.

Road Transport Lighting (Cycles) Act, 1945

APROPOS the comments on the present position of the cycle lighting law, I would point out that the above act which is still in force makes it compulsory for a red rear lamp to be carried by cycles, and section 2 provides that all pedal cycles and pedal tricycles shall, as from such day as the Minister shall by order appoint, exhibit to the rear a red reflector and white surface in addition to a red light.

Biography of Reg. Harris

GEORGE PEARSON has written a most interesting biography of Reg. Harris, Britain's world champion. It contains 88 pages, and costs 3s. 6d. from Temple Press, Ltd., Bowling Green Lane, London, E.C.1. It is illustrated by interesting photographs of Harris in action in some of his most famous events.

No Segregation

MR. G. H. B. WILSON, managing director of Raleigh Industries and president of the Pickwick Bicycle Club (the only bicycle club which is not a bicycle club!) said in a speech at the annual luncheon when Lord Llewellin, President of the Royal Society for the Prevention of Accidents was the principal guest: "We must never see cyclists segregated to any road of their own." Fortunately, there seems little possibility of this happening.

Massed Start

THE N.C.U. Birmingham Centre had two propositions on its recent agenda relating to mass start races. The first suggested that there should be two massed start races on the open roads during the present season. The rules of the N.C.U. clearly show that it is against this form of racing which goes to show that N.C.U. policy is out of touch with the feelings of its members. The second proposition made the interesting suggestion that entries for massed start races should be picked according to the merit of the individual, without taking into consideration the formation of teams. That would take a lot of kick out of the present form of massed start racing where each member of the team can take turns at giving a bit of back wheel assistance.

Accidents—Monday the Worst Day

IF cyclists were superstitious like sailors who in years gone by refused to go to sea on a Friday, they would not cycle on Mondays, because according to an accident analysis issued by Scotland Yard for the year 1949, Monday is the worst day for cyclists. According to this analysis 565 people were killed and 32,319 injured on the roads of the Metropolitan area, fatalities thus being up by 38 over the figures for 1948. Cyclists seriously injured increased by 37 per cent. for the same period. Saturday is shown to be the most risky day of the week for all classes of road users.

Tyre Prices Up

TYRE prices, both covers and tubes, were increased by 12½ per cent. during June. Even at the increased price, however, they are one of the cheapest of our necessary commodities.

End-to-end Tricycle Record

HERBERT PARKES, of the Mersey Roads Club and Tricycle Association, regained his Lands End-John o' Groats' R.R.A. Tricycle Record with a time of 3 days 38 minutes for the 872 mile journey. It will be remembered that J. K. Letts in July 1949, beat the record from Parkes by no less than 8 hours 49 minutes. The End to End record is the most fascinating of all those in the R.R.A. list, and it will continue to attract aspirants to road record honours whilst the cycling game lasts. Who will be the first to beat three days for the tricycle record, and when will the record be put on the shelf for all time as unbeatable? For a figure must be reached which can only be equalled but not beaten. Only 20 years ago it was thought that some of the records had reached this point, yet they continue to be broken. To lop off 8 hours 49 minutes on the End to End with gears of 52, 57.2, 63.5, and 71.5 is no mean achievement. As Parkes is only 38 minutes outside the three days, it should be possible to get within three days, although I cannot envisage that the record will ever be very much below it.

Another C.T.C. Outburst

THE sub-editor on the *Evening Standard* who published the fulmination from the C.T.C., giving reasons why they have withdrawn from the Royal Society for the Prevention of Accidents, must have been a bit of a wag, because in the adjacent column appeared the following: "Peter Holt, radio engineer, of Gyles Park, Stanmore, was said at Hendon to-day to have hit a coach so hard with his bicycle that two seats in it were broken. He was fined a total of £4."

Incidentally, the secretary of the C.T.C., in a letter couched in the usual C.T.C. style, states: "*It is not merely common sense, but the law of the land that the protection of cyclists cannot be combined with an interest in the welfare of motorists.*" I should very much like to know the law which states this. I am surprised that our contemporary printed this letter, for the attitude it discloses is not helping the cause of cycling.

Wayside Thoughts

By F. J. URRY

The Way to Look At It

THE quality of resolution varies widely in all of us, and never so much as on the wet day at home and the wet day on tour. I think most tourists would scorn the notion of wasting a day of their holiday time in a hotel lounge unless the weather was impossible with storm and flood. I know I should. But, given similar climatic conditions at home, it is difficult for some people to accept them with the same degree of philosophy, notwithstanding the fact that obviously choice of protective raiment is much wider. We dilly and dally and say is it worth it? I know I do, and expect other folk are similarly affected. Yet go out, and in nine cases out of ten you are glad you did because it is the only form of exercise left for your indulgence, and nearly always the day has a habit of "taking up" so that you end the journey with satisfaction. A little time back we had some of that type of weather, and twice I spent most of the day going to see the floods, the little streams in riot and the weirs in fury. These sights only come infrequently, and quite apart from the riding are a vivid interest in themselves for the power of angry waters is fascinating. Often enough on such days I would love to be within reach of a coast where the great rollers come ashore and shake the earth; to see Chesil Beach in the fury of a south-wester or the great waters pound the iron rocks of Pembroke. All I have within call of home are the usual placid valleys of the Trent and Avon and the tributaries, but even they can be awesome under extended storm conditions. Another thing about such days as these is that the roads are almost free of traffic and the question of accommodation is easy; indeed, there is a welcome for the lone wanderer.

When Speech Doesn't Matter

PEOPLE who do not know think the cyclist riding through the hours of a wet day must be most unhappy and uncomfortable. Well, if he is it is his own fault, for good macks will keep out the wet and only the condensation will dampen the ordinary garment. But many riders do not pay much attention to the protective garments, apparently in the vain hope they will never be needed, and that is a mistake. Personally, I keep a couple of capes, one in regular service for my daily riding and short trips and the other for real touring, the latter, of course, being the latest acquisition. Leggings I hate, but on a really wet day they are needful if a fellow is to keep reasonably dry; but when I don them I deliberately slow down, and this refusal to hurry under any circumstances certainly adds to the comfort of wet weather riding. The younger people who rush about in such conditions often get wet and warm, the latter from too great a speed, necessitating undue effort, and the former reason from giving the bicycle its head on long, descending slopes. That, indeed, is the mistake we make if we desire to keep reasonably dry, for there is nothing that will dampen the rider more quickly than a long descent at full speed. I remember once riding from Pitlochrie to Forfar on a day of storm in the company of a man who rather dreaded the journey and wanted to stay in the Perthshire town to see the storm out. When we got to our destination, never have I seen an individual so pleased with his little performance; a change of stockings was the only needful replacement, other than a pair of slippers, and yet it had rained solidly for twelve hours. The macks were new, as was the rider to such a journey; both of them played up to the day, and the human was a happy mortal who will never funk a wet day along the road again. So in the rain it is gently that does it, and you can enjoy the journey better than most people enjoy such conditions.

Towards Better Appreciation

NATURALLY I would rather have the fine weather, and especially after rain, when the visions are crystal clear and everything gleams with the beauty of light; even the bird song seems to have been washed. But as we cannot do without rain, surely it is best to make such days more enjoyable than they will be if spent in disappointed idleness; at least, I think so. This handy vehicle, this bicycle which I shall shortly ride home, is the slender marvel that can meet nearly every weather condition, and most of the road conditions, and come through to the other side of the pass or the worst of the weather without protest, and at the end of it need little more than a drop of oil to replenish its qualities. We have not fully appreciated it yet, but I think that time is coming, for I find more and more people—even among those who do not and never will ride—realising there is something here that has been relegated—not forgotten—but definitely relegated—to the common ruck of everyday articles. It is all that in its utility sphere, but how much more than that is still to be understood by a very big public, and I think the comparatively modern incidence of the lightweight touring bicycle will have its effect. For the game of cycling is a great game, whether you play it for sport or pleasure, mix it with club life or individual roaming, or use it for work and those odd evening hours of the present summer, that will create for you a little holiday free from the daily whirl of work and worry. To me, a simple working man near the end of his term, it has been as a gift from the gods, an ever-present refreshment as I cock my leg over the saddle and quietly wend my way.

The Temperate Outlook

THE adventures will not be quite the same as in the golden days of my youth, the fire has died down, the dash for hill-tops and the desire for miles; but the glance now lingers lovingly over the scene and the interest in new roads is as keen as ever. Quietly, yet how enjoyably, you change the shires, the hills for the plains, the valleys for the moors; and, maybe, in the evening of one day come to the sea at a lonely cove where an old-fashioned inn has escaped the chromium urge of modernity. To sit on a bicycle saddle, machine and man equipped for a journey, is to sit on top of the world and survey paradise in series; or that is how I feel when those happy moments arrive. There is then in me the thrill of being self-contained in speed power and personality, and the route, the distance, the time, and those precious moments of contemplative appreciation are just mine to share with a friend, or absorbing them individually, desiring a friend's company. That in epitome is my cycling to-day when I go seeking the further shires, and it is very good. But that is not all; there are the dawns when the roads are busy with the energy of youth, chasing time; the quiet evening when work is over and I revisit the old haunts of my boyhood when first I possessed a bicycle; and last but by no means least, the daily journey to work that keeps me fit and trim to enjoy all the rest and make life whole. So you see cycling occupies a large part of my activity, and to it I verily believe is due the pleasure of that activity, a very precious possession which I find missing in far too many people of my years. I would not aver cycling would have kept them virile and happier people—but I believe it!

The Making of Friends

ON my evening jaunts I get great interest from conversation with my country friends. A man cannot roam round an area for over half a century without making numerous acquaintances, who by the process of time develop into friends, who in turn give you confidences and information which the average townsman seldom gathers. For the countryman is still a little shy of the owner of the big car, and whether he be farmer or gamekeeper, or that skilful individual, the farm worker, he preserves to himself a reticence that quietly but completely subdues the importunate and the inquisitive. No, you must be "well in" with the countryman over a long period before he attempts to teach you the reasons, and some of the mystery of his many crafts. But once that stage is past a new chapter of country lore is opened, and every phrase of it is intensely interesting, even though you can only know the rudiments. Every countryman is something of a naturalist, a botanist and a biologist; they are part of his daily life, and an hour or so in such company always adds a sum of little knowledge to your make-up and widens the sense of living. It is not given to all of us to make friends easily, but I tell you that friendship of country people is a delight as well as an education. The chance has been mine, and I'm glad I have taken it.

CYCLORAMA

By H. W. ELEY

Car Cleaning—and Cycle Cleaning

A SEASONED old rider said to me recently that it would be a good thing if the average cyclist had the same "passion" for cleaning his bike as the average motorist has for cleaning his car. We all know the motorist who seems to love strolling out on to that concrete drive in front of "Ivydene" or "Elmleigh"—complete with oily rags, dusters, polishing cloths, and his tin of Karpol—and then spending hours on cleaning up the "old bus." Well, he gets a good deal of satisfaction out of the job, and it does seem that many cyclists could, with advantage, emulate his example. How many bikes cry out for a clean! How much sweeter they would run if there was a bit more cleaning done! Maybe for once it is good advice to the cyclist to suggest that he takes a leaf out of the book of the motorist. . . .

The Potential Market

OFTEN I have referred to the figures which are published from time to time, purporting to give the total number of cyclists in this country. The figures are invariably challenged and queried . . . and it is difficult to arrive at a figure which is really accurate. I mention the matter again because in conversation with a man in the cycle manufacturing business, I was asked what I considered the potential market to be. Have we reached "saturation point"? Is there a great body of citizens who, not cyclists now, could be converted to riding bikes? It is an interesting point, and of much concern to those in the manufacturing business. It has always been my firm belief that "group propaganda" by cycle makers could do a lot to extend the market, and increase the body of riders. In fact, many advertising schemes have been prepared with this end in view, but somehow they never "got over." One of the "snags" is that whenever an industry contemplates "group" publicity, there is invariably dissension as to the equitable share of expenditure to be borne by each contributing manufacturer . . . at least, that was my own experience when in the advertising world.

In Search of Solitude

HE was a likeable and friendly sort of fellow . . . that solitary cyclist I met in a remote Derbyshire village, leaning against a gate, smoking his pipe, and contemplating the wide fields where a farm worker was "ridging" preparatory to sowing kale. I fell to chatting to him, and found that he was one of those somewhat rare men who love solitude . . . who crave to be alone . . . who do not need the companionship of the crowd, and can find their own pleasure and inward satisfaction by riding, on their own, into the "waste lands." He came from East London; he had worked in Dockland, in a meat market, in a printer's warehouse, and had done some "soldiering" with the Desert Rats. And here he was . . . leaning over a gate, admiring the scudding clouds, liking the look of the good reddish earth, and feeling that it was good to be alive . . . and alone. Well, not really alone, because his bike was his "pal." I enjoyed that talk with the man who loved solitude, and I suspect that there are far more men than we imagine who, if they could, would ride away from it all . . . and find peace in the heart of the countryside, and companionship in the fields and hills.

"Push" . . . and "Pedal"

I AM not the only cyclist who hates to see cycles referred to as "PUSH bikes." The phrase is so often used by the lordly rider who gets from here to there in an incredibly short space of time on a high-powered motorcycle. For my part, he can have his monster . . . and I am well content to pedal along the high-road, up the Hills, and down the dales. Push! There is no "pushing" about the skilful riding of the modern machine, and whenever I hear the appellation, I always join issue, and defend the ease and economy of the pedal cycle. I hope other riders do likewise!

Wiltshire Ways

I HAD an inquiry recently from a man who is toying with the idea of a cycle tour, and who wanted information and advice about Wiltshire. Was it a "pretty" county? Could I recommend it for his tour? Well, as for being "pretty," I never like that term . . . to many, a place is only "pretty" if there are roses around the cottage doors, and some "sweet" thatched cottages in winding lanes. All very well in their way . . . but there is, I feel, greater charm in the sweeping uplands, in the vista over rolling downland, in some grey northern hamlet where stone walls divide the fields, and the scene is as rugged as the folk. Wiltshire! I wrote to my correspondent, and tried to picture some of the glories of that county . . . where Stonehenge defies the hand of time, and baffles the antiquary, and conjures up visions of grim sacrifices on immemorial stones, and of altars in ancient groves, and mystic rites and ceremonies. I told of the charm of ancient Devizes, and of the grace and glory of Salisbury cathedral. I referred to the call of Salisbury Plain . . . and threw in some of those thatched cottages, because fair Wiltshire abounds in them. Oh yes! one should certainly tour in Wiltshire . . . and learn that it has glories besides bacon . . . however succulent a Wiltshire rasher may be. . . .

Selling British Cycles in U.S.A.

THERE has been considerable comment in the Press during recent months about the fine efforts of British manufacturers to sell cycles in the United States. I am told that the home product has "caught on" to a very pleasing extent. This is great news . . . but after all, there never has been a cycle as good as the British made article! I noticed that my good friend D. D. MacLachlan, of Hercules, took credit to his bosom for being thoughtful enough to use American spelling in his literature sent over there to foster sales. "Tires" instead of "Tyres" for instance; and a general Yankee flavour to the "copy." Well, I suppose it was right . . . but I do not love those American phrases! However, if those guys have gotten keen on our bikes, and will part with good dollars for them, gee, its just swell. . . .

A "Staffordshire Knot"

FOR as long as I can remember, there has been good-natured controversy about the pronunciation of the name of "Uttoxeter" . . . that pleasant market-town in Staffordshire. Some insist that it should be called "Uttcheter"; others favour "Uxeter" . . . whilst other pedants maintain that the straightforward Uttoxeter, as spelt, is correct . . . and that it is sheer affectation to call the place anything else. The matter interests me, as I am living not very far from the place itself . . and sometimes amuse myself by cycling there, and browsing around the market; I like the sight of good cattle, of pigs, of good Midland farmers, of brightly painted harrows, and rakes, and lime-spreaders. And I find that the natives of the town are content to pronounce its name in the ordinary way . . . as Uttoxeter. There!—for me, the matter ends, and I shall follow local practice!

My Point of View

By "WAYFARER"

The March of Time. Two old landmarks of the Bath Road, at Sipson, which are to be pulled down. Work on demolishing this old barn built with tarred weatherboards and roofed with red tiles has commenced. The "Three Magpies" Inn is to follow later in the year.

Concerning Maps

SO far as I am aware, nobody has ever explained why the makers of those maps to which many of us refer affectionately as "Barts." took it upon themselves, a few years ago, to alter the cut-up of these islands, so that the old boundaries have disappeared, and the purchaser of a replacement map finds himself—mildly—in queer street as regards fitting in with adjacent sheets. Superficially, it seems to me to have been a rather arbitrary action on the part of our friends and benefactors at Duncan Street, Edinburgh, though possibly there is quite a plausible explanation of what they did. It may be that the step was taken to increase sales, but I am sure that such explanation, if made seriously, would be deemed an unworthy one. In my case, it has had just the reverse effect, and I have deliberately refrained from buying new maps, preferring to use the old lot until they were long past pensionable age.

Recently, however, the sheet on which I live (so to speak) cried aloud for replacement, and I took the plunge—carefully refraining, however, from any consequential purchases! And I must confess that I studied the new sheet with very considerable interest, ignoring the effect of the surgical operation which made the map a misfit when used in conjunction with the existing "neighbours." What particularly intrigued me was the development and alteration of certain roads since last I traversed them. I was due shortly to make the journey from Birmingham through Northampton to Bedford, and I felt sure that a couple of very awkward jerks in the road between the two last-named places had been ironed-out since last I went that way. When I lived in Northampton, during the first decade of this century, one of my regular cycle jaunts was to Turvey, whither I went week by week in order to have tea at one of the two pubs which has the numeral "three" in its title. How well I recalled the manner in which the road jerked from its course in order to traverse Denton; how well I remembered the much bigger detour which permitted the cyclist, willy nilly, to see the sights of Yardley Hastings! As I expected, the hand of Progress has been at work in the interim, and the new map revealed to me that the straightening-out process had been effected—how long ago I am not able to suggest, nor is the point material. This alteration, at least, may be viewed as an improvement (that cannot always be said with truth!) because there was no need to complicate life in the two places named by carrying all the through traffic into them.

Be it noted that, in regard to the point mentioned, the comparison had to be made between the new map (now called "Warwickshire," as against its former name of "Birmingham") and a map of the old series ("Huntingdon, Cambridge, etc."), this transfer of territory being the result of the surgical operation mildly condemned in my opening paragraph. Incidentally, the new sheet (formerly No. 18) has appropriated the number of the old map (19), thus adding to the general confusion.

In the Groove

THE reference, above, to my frequent visits to Turvey, has set in motion a new train of thought, and I remember that all through my cycling career I have made a feature of going regularly to one or two particular spots. In the days of my youth, while living in Birkenhead, the two villages of Shotwick and Puddington were my regular resorts. They stand less than a mile apart (taking the field-path), and it was a case of ding-dong—Shotwick on Saturday, and Puddington on Sunday, or vice-versa. On moving to Birmingham I found a nice little cottage on the Stonebridge-Kenilworth Road, which I haunted. From Northampton, as already stated, Turvey was my frequent objective. Hunmanby saw me very often when I lived in the East Yorkshire village of Hornsea. Residence in Salisbury placed the glories of the New Forest on my doorstep, and I went with great regularity to the late Mrs. Gardner's, at Bartley, afterwards at Ashurst. I climbed out of my groove in order to put on a suit of khaki in the 1914/18 war—and a certain happening in France nearly ended my cycling career (and my life!). Returning to my native town (Birkenhead), I joined the Anfield Bicycle Club, and participated in many of their weekly runs, as well as in a great number of week-end jaunts, which, in combination, put paid to my "groove" habits. These, however, were resumed nearly 30 years ago when I returned to Birmingham. How long it is since I commenced having my Sunday lunch at Henley-in-Arden, and my Sunday tea at Hanbury I cannot remember.

"Ringing the Changes"

This "groove" business is not of necessity to be deprecated. It is nice to ring the changes on lunch and tea places, but there is something to be said, especially in these still difficult catering days, for an intense loyalty to certain establishments. "Grooving" does not necessarily "cramp your style" as regards explorations, because one can often go "round the earth" to reach one's chosen destination. Week by week, particularly within recent years, I have rung the changes in my routes to those two spots which have seen so much of me. The little cottage which is less than 20 miles from your home can readily be placed 50 or 60 miles away, with a little ingenuity.

No Famine in Pumps

DURING a recent visit to the very pleasant town of Bedford I made a superficial study of the cyclists who form so large a proportion of the traffic—Bedford is indeed a cycling town—and it was dismaying to note the general mal-treatment of tyres. This deplorable state of affairs is, of course, by no means peculiar to Bedford. On the other hand, it is very widespread, though I fancy it flowers to perfection in those places where the bicycle is so largely used for purely utilitarian purposes. And yet there is no famine in pumps! One extreme case of under-inflation was presented by a woman who clanged past me with noise almost sufficient to waken a graven image. The clamour—and the discomfort—apparently meant nothing to her, though I have no doubt that she would be peeved by the early demise of her tyres, the cause of which would be attributed, by any self-respecting Coroner's jury, to "Brutal Neglect." I saw—and heard—the woman later in the day, and it was evident that flatness in her tyres was a quite normal state of affairs. Here, possibly, was an extreme case of neglect, and, indeed, abuse, but I noticed scores of other instances of flabbiness.

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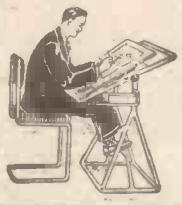

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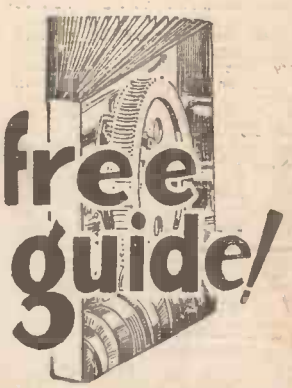

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