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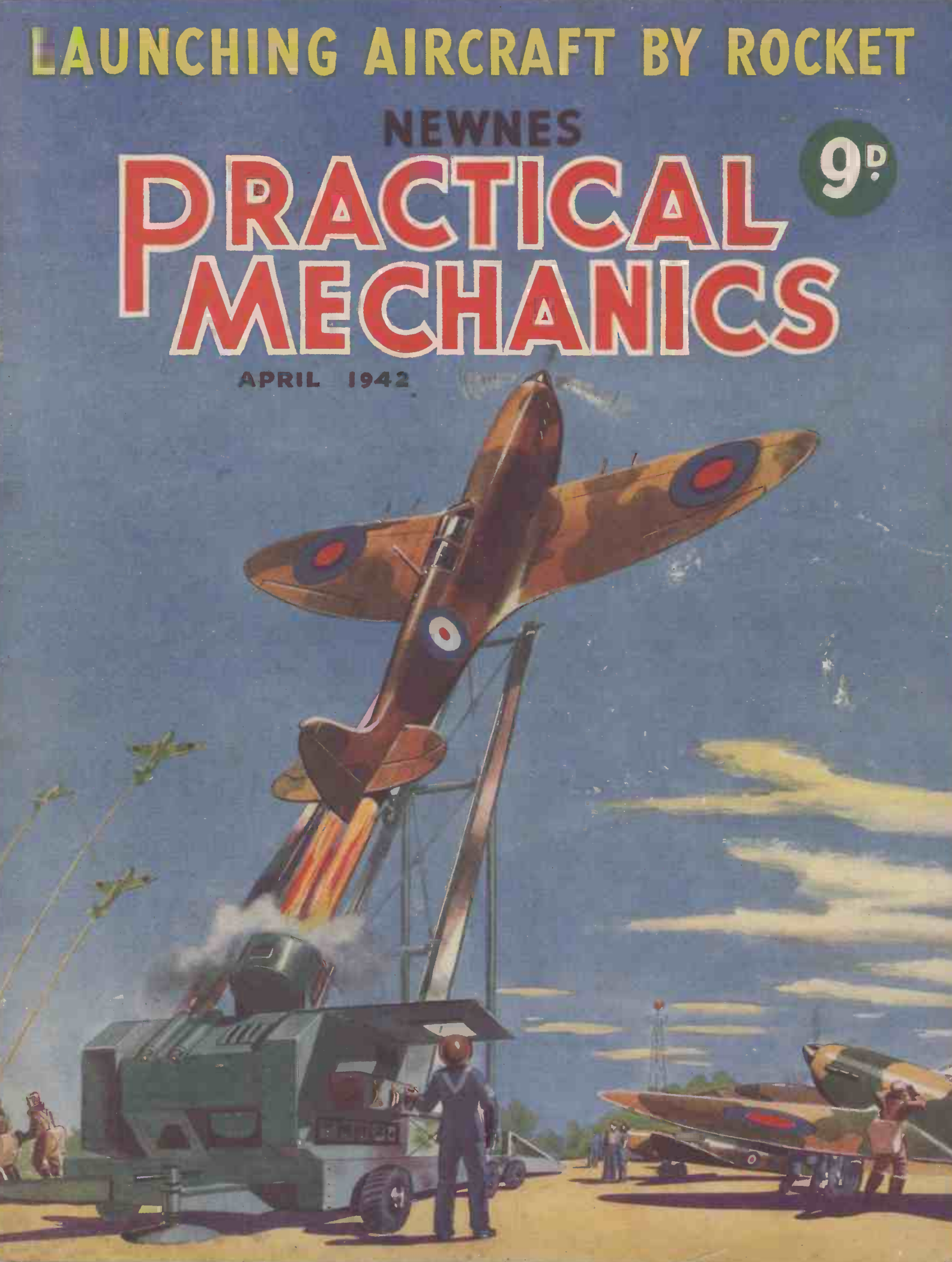
NEWNES

PRACTICAL MECHANICS

9D.

APRIL 1942



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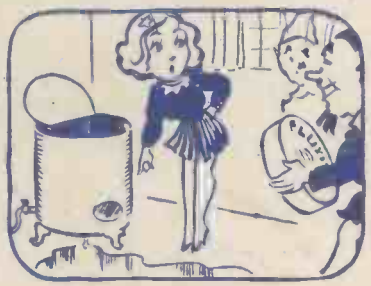

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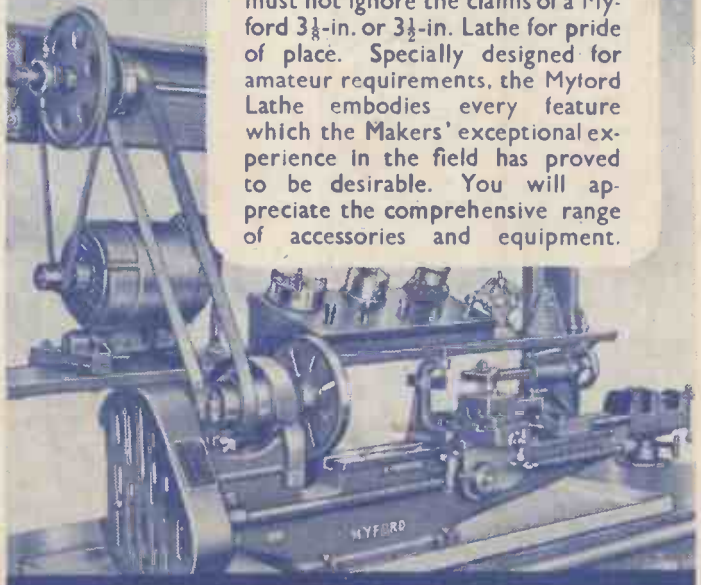

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PRACTICAL MECHANICS

Owing to the paper shortage "The Cyclist" and "Home Movies" are temporarily incorporated

Editor: F. J. CAMM

VOL. IX. APRIL, 1942 No. 103

FAIR COMMENT — BY THE EDITOR

Launching Aircraft by Rocket

OUR cover subject this month does not represent some fantastic and untried idea. Rockets and jet propulsion are practical ideas, and only the stress of war prevents further experiments upon them. We must concentrate upon aircraft and systems which are already in production, but scientists all over the world continue to experiment with jet and rocket propulsion. The great advantage of launching aircraft by what is sometimes erroneously called the reaction principle is that the necessary climbing velocity in order to quickly reach a high altitude can be attained in but a fraction of the time taken in the ordinary way. An aeroplane once the engine is started has to taxi over the ground for some distance before it can lift, and once it is off, it takes some further time for it to obtain its maximum climbing speed. The method of launching aircraft shown on the cover has been successfully demonstrated, and if the war prophets prove unfortunately to be right, and that the war will be a long one, there can be no doubt that before it is over, rocket launching will be rather more than an idea whose practicability has been demonstrated. We are not, of course, able to deal in greater detail with the system, but our cover does give a general idea of the method. When details are released we shall follow our usual practice of giving detailed drawings and a full description.

Making Cosmetics at Home

WE recently published an article on the making of Cosmetics and Toilet preparations at home. We did this to help those who are finding a difficulty in purchasing the usual commercial preparations. Readers will understand, however, that it is illegal to manufacture and offer for sale toilet preparations unless the person concerned has for a considerable time been engaged in so doing. It is a serious offence to manufacture cosmetics unless you comply with the law. Some readers have asked us to give them the formulae for commercial preparations, but this we must decline to do. Nor can we undertake the analysis of samples submitted.

Queries

READERS are continuing to send in queries without the Query Coupon, and sometimes without a stamped and addressed envelope. We cannot deal with them. Every question must be accompanied by the current coupon, three penny stamps, and a stamped and addressed envelope. The query service is intended for those who purchase the paper and by none other. We have not a responsibility to answer questions addressed to us by those who have never purchased the paper, but who turn to us when they are in difficulty. It sometimes happens that a reader wishes to ask two sets of questions in a month. He has sent the coupon with his first batch of queries, and is therefore without a coupon when he sends in the next. In such a case the reader should quote the date of his previous letter. Our Advice Bureau cheerfully and promptly deals with all letters from its readers. Another point. We cannot undertake to answer letters dealing with articles that have appeared in other journals. Such letters must be addressed to the Editors of the journals concerned.

Issues Out of Print

WE are receiving many applications for issues of this journal which are out of print, and which contain articles which continue to be topical. In certain cases we are prepared to re-print the information, and we now invite our readers to address a postcard to us listing those articles which they would like so re-printed. The order of selection will be the order of popularity decided by the cards. One issue which has been in particular demand in recent months is that in which we described how to make a Battery Electric Clock. This article has been reprinted twice. It is pointed out that whilst the blueprint gives sufficient information without further description, to those with technical knowledge, it is insufficient for others. Accordingly, we have prepared a second blueprint showing the construction in perspective and in greater detail. In future, therefore, two sheets of blueprints will be issued in connection with the electric clock, costing 2s. inclusive. Those who already have the first sheet may obtain the second for 1s.

The Engineer's Vest Pocket Book

WE now have supplies of the Engineer's Vest Pocket Book at 7s. 6d. or by post 8s., from The Publisher, George Newnes, Ltd., Tower House, Southampton Street, Strand, W.C.2. It measures 5 in. by 3¼ in. by ¾ in., is neatly bound in dark blue close-grained leatherette with gold lettering, gilt edges, and round corners. It consists of 600 pages of valuable facts, formulae, and memoranda of the greatest use to engineers, draughtsmen, fitters, turners, planning and progress men, etc. There is a great deal of the contents which has never been published before. The book is fully indexed and contains also a Buyer's Guide.

Indexes

The index for Volume 8 is now ready, and can be obtained for 9d. post paid, from the Publisher, address as above. Difficulty may now be experienced in getting the issues bound by those who usually undertook this work. We can still supply the binding cases at 4s., including index and title page, and no doubt local bookbinders will undertake the work. Now that paper is scarce, readers should take care to preserve their copies, for back issues in most cases are not obtainable.

The Electric Bicycle

APROPOS the article on the Electrically propelled Bicycle, which we gave in our issue dated March 1942, readers should note this is a mechanically propelled vehicle and as such is subject to the Road Fund Tax. It must, therefore, carry Number Plates, and on the rear side handlebar a Licence Holder with the current licence. Applications should be made for the necessary forms to the County Council of the District in which the reader resides.

B.B.C. Records

THE B.B.C. normally uses three methods of recording—the M.S.S.-Watts Disc System (for Studio and Mobile Car Recording); this employs metal-based blanks with a coating of nitro-cellulose (referred to as cellulose acetate) which after cutting can be played back immediately up to about 25 times without marked loss of quality. This is in contrast to the wax master method used in ordinary gramophone recording, which requires electrolytic processing and pressings made for reproduction purposes. Re-recorded copies and solid stock pressings can be made from the M.S.S.-Watts Disc.

Another system used by the B.B.C. is the Marconi-Stille magnetised steel tape method which is a development of the original Blattnerphone invented by Ludwig Blattner. This system is almost confined to recording rehearsals and programmes shortly after their event, but which are not of permanent interest. The novel feature of this method is that the recording can be washed out or obliterated from the tape which can thus be used over and over again.

The third system is the Phillips-Miller in which the recording medium is an opaque coating on a film strip or tape. This is cut by a sapphire stylus so that a transparent track of variable area is produced. This is reproduced photo-electrically. The record is compact and permanent with a normal playing time of about 15 mins. per spool, and this system is used for high quality recording. No doubt sooner or later this latter system will be used to replace the present gramophone discs.

Eyes and Television

The Peculiarities of the Human Eye, and Modern Television

By Prof. A. M. LOW

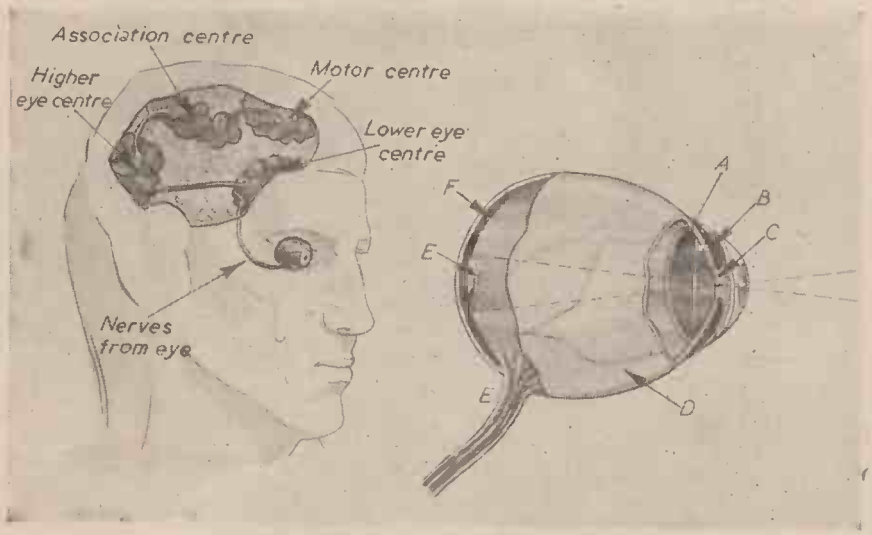


Fig. 2. Pictorial diagrams explaining how the human eye is planned

I HAVE often observed the unfriendliness of many people towards the things which serve them best. To me, there is something vain and almost rude in this attitude of patronage towards scientific achievement. I object most strongly to the ship's passenger who refers casually to the engineers as if they were underlings; while maintaining the strictest courtesy and awe for the "dear captain."

We take telephones for granted, we think of a polished cabinet in imitation oak when asked to look at a radio receiver, and we never dream of saying "thank you" to the engine-driver after a perfect run of two hundred miles. Yet, it is engineers who have built our world. Engineers give us comfort that would have been luxury to a King two hundred years ago; they give us clothes, knives, forks, permanent waves, vacuum cleaners, and a nice hot bath. Our lives and our land can now only be defended by their aid.

In a short time television will again be popular. Surely it will be one of the after-the-war luxuries that everybody will buy at the cost of a simple radiogram. The public will not long be satisfied with sound alone any more than a silent cinema would again be popular. An appeal to more senses than one is essential.

Television is not a mystery. It is a simple thing; like radio. it depends upon the transmission of electric currents rather than the sound or sight itself. We see a mechanised picture which depends entirely upon that very wonderful and very badly made instrument, the human eye.

Peculiarities of the Eyes

Eyes have many peculiarities. They have developed from the earliest days when starfish had a hollow containing water so that damage might be prevented to the sensitive skin which was nature's eye. They are miracles of perfection in the result that eyes achieve; they are hopelessly bad from the point of view of any maker of optical instruments.

What would we think of a camera fitted with lenses which were not achromatic and which were not even round? Spherical aberration is almost a hobby of the human eye, indeed this is one reason why a star seems to have points radiating from its rim. It should appear as a mere point of light.

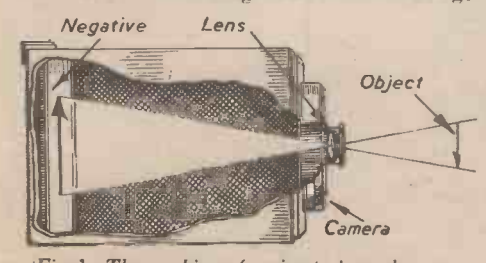


Fig. 1 The working of a simple lens, showing how the image is reversed

Fig. 3. A common optical illusion

What would we all think of a microscope lens which retained an impression so long that we had to wait for one picture to fade away before another could be viewed? Yet it is this very "fault" which makes television possible. It is because a lighted cigarette, twirled round in the hand, looks to the eye like a circle of fire that we are able to enjoy the cinematograph.

Remember your eyes for a moment. There are two—we all know that. But it is because there are two that we can see in perspective. Our eyes are like an anti-aircraft rangefinder in this respect. where the angle turned by each eye is judged by the brain so that distance may be estimated. In an instant we can realise the almost insuperable difficulty of the stereoscopic cinema. To see alternate pictures is not enough. The right-hand picture must only be seen by one eye, so that unless the other eye is covered, no stereoscopic effect is obtained.

Retentivity

Hence the old idea of a film which is dyed red or green on alternate pictures. The audience wear glasses in which one side is red and the other green, so that each picture is alternately visible to each eye, but only one eye at a time sees its own picture which was taken at the proper angle. Remember that a picture remains on the retina long after it has ceased to be there. Retentivity is a strange thing. The time of "dwell" depends upon the individual, but it is never more than a fraction of a second, and it appears to depend upon the construction of the retina—the photographic plate of the eye.

The eye, of course, is astonishingly like a camera, and still more like a television apparatus, for the main part of the human eye consists essentially, as the patent specifications say, of a sensitive plate and a series of lenses.

I often wonder who first thought of a lens, for it must have been made by nature in every drop of water since the early stages of the world. A lens "bends" light, either opening the rays or closing them to a smaller spread than that in which they entered. The bending of light is a very familiar thing. One sees the effect when a stick is put into water; it seems to be bent. Fishermen know this when they stand well back from the bank, and over every fire can be seen a haze as the result

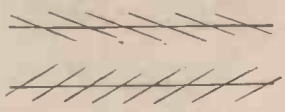
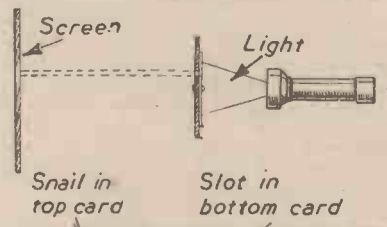


Fig. 4. Another simple optical illusion

These lines ARE parallel



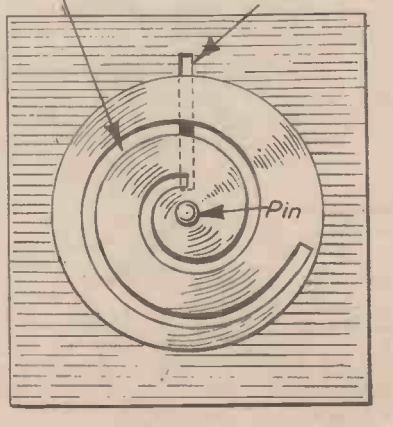


Fig. 5. A form of optical illusion of interest to the engineer

of light bending as it passes from one medium to another which is more dense or more light.

The working of a simple lens system such as that of the human eye is shown in Fig. 1. It will be observed that the image is reversed. The human brain again reverses the image so that we are not alarmed by seeing our friends walking down the garden path on their heads.

In any good instrument the lens is corrected for chromatic aberration because various colours are bent to a different extent as they pass through a lens; thus the red end of the spectrum cannot be focussed by a simple lens with the same focussing as that which is needed for the blue.

Human eyes take no account of this any more than a cheap pair of binoculars which show colour edges on the image. So there is more work for the brain to do in telling us that all we see is not true. No one, for example, would imagine that the green we see as the result of "fatigue" after looking at a red spot, was really present.

The Human Eye

A general idea of how an eye is planned is given by Fig. 2. The round main lens D is filled with a liquid like any other liquid lens. A contains a more viscous liquid, and C, the cornea, is a tougher covering over the eye where it is chiefly exposed. At B is the iris—a shutter which opens or closes like that of a camera to pass the right amount of light which can be accommodated. At the back of the eye from E to F is the retina—in the centre of this sensitive part is another still more sensitive area called the fovea. At E the optic nerve passes into the eye through an opening which forms the eye's "blind spot."

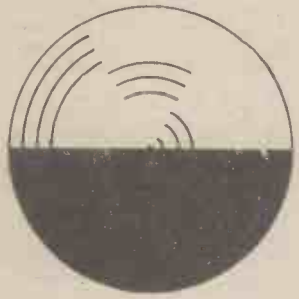


Fig. 6. A strange device which deceives the eye.

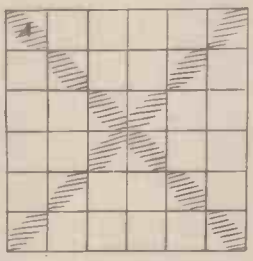


Fig. 8. Illustrating how a television image is built up.

This nerve is really a bundle of nerves, like a "very-multi" electric cable. Each of these telephone wires is connected to one minute spot on the retina which is itself constructed of thousands of rods and cones like a mosaic. Of these sensitive nerve ends some see colour and some shape. There are more shape-seeing units round the sides of the eye which explains why objects can best be seen in the twilight if one looks "not quite at them."

With so wonderful a system, we might believe almost anything of the eye. It is not hard to guess that there must be many optical illusions in which the judgment of the eye is misled, because of the false standards it often assumes. Thus, a top hat is assumed to be "high," and few would believe that it is as broad as it is long. An ordinary "topper" is 6 in. high. Most people guess about 10 in. or more (Fig. 3), while the lines shown in Fig. 4 look anything but parallel.

More Optical Illusions

Two other illusions are most interesting to the engineer. If a card is made as in Fig. 5, so that a spot of light can be thrown on to a screen, the moveable card can be turned round and the patch of light made to climb slowly up the screen. When it is stopped it will often appear to travel in the reverse direction, because the eye has become used to one kind of motion and assumes this as its proper standard.

Even more strange is the device shown in Fig. 6, for if this is revolved at between 50 to 200 r.p.m.—in a bright light—it will glow with all the colours of the rainbow. So irritated do the "shape-seers" become that they agitate the "colour-seers" into action.

It is easy to understand that with an eye so simple to deceive, motion can be suggested where no motion exists, and this is just what is done in the case of the cinema. About half the time we spend in the "movies" is spent in the dark. We do not always realise it, for the series of pictures, each showing, for example, the movement of a hand, is thrown so quickly on the screen that the image does not have time to die away.

Basis of Television

This eye "fault" is also the basis of all television, which is best appreciated by understanding how stationary pictures are sent by wire or radio. In Fig. 7, L is a light which shines through a negative N on to, let us say, a selenium cell S, which has the property of changing its electrical resistance in accordance with the amount of light falling upon it. Imagine that the beam of light shines on an opaque part of the picture—none would pass—no light shines upon the cell S, and no signal is sent by the radio transmitter T, for it will not be switched on by the action of light on the cell.

Now look at the receiving end. If no signal is sent the light from L cannot get through to mark the negative N, because no signal is received, and the magnet M cannot pull open the window W through which the beam is trying to pass. So both transmitting and receiving ends record a black spot. But if N is moved until the light can pass through a transparent part, the selenium cell is activated, a signal is sent and the magnet M pulls open the window allowing the beam of light to mark the new negative N1. As for the receiver R, it may be of any kind—instead of its amplified current working a loud speaker it operates the light shutter—and that is really all.

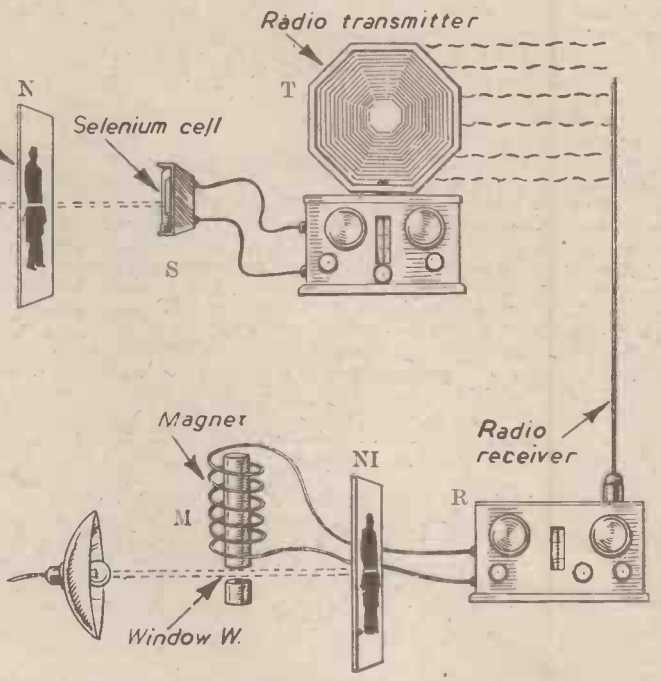


Fig. 7. Diagrams illustrating the basic principles of television.

Transmitter and Receiver

Naturally, the transmitter and receiver are in phase, and move together, so that a rotating drum is usually employed. In modern outfits, a photo-electric cell replaces the selenium as a current control, while the light is shut off or opened at one end by a "prism" which is affected electrically instead of the relatively crude window. But the principle remains the same, and if we are sending a huge X, we merely transmit all the spots on Fig. 8 until the picture is built up.

This process takes perhaps 10 minutes for an ordinary picture, and if you have remembered the phenomenon of retentivity, the rest will be very clear in so far as television is concerned. It is only necessary to transmit the whole picture so quickly that every spot is sent within the limits of this impressed image for television to be achieved. If I send A on Fig. 8 once again, after covering the whole picture before it has time to die away, the image can be moved as a whole, and will become cinematographic.

Mechanically, this is difficult, because a vast number of spots are needed if it is not to be too coarse in grain when thrown on a large screen. Also, the picture must move "in tune" at transmitting and receiving ends, or the photograph will be a mere jumble of spots. This explains the meaning of, for example, "80 line" television—there would be 80 lines of spots.

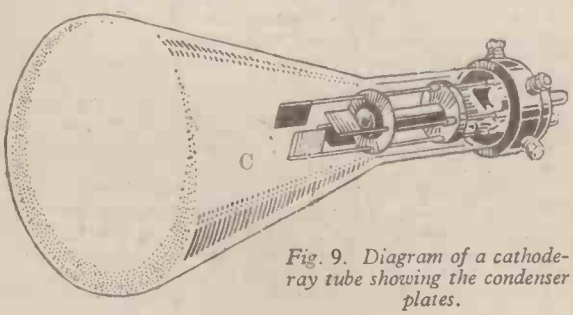


Fig. 9. Diagram of a cathode-ray tube showing the condenser plates.

"Scanning"

In modern practice the principle remains exactly as it was when demonstrated in 1914, but the difficulty of "scanning," that is, tracing the spot of light over the picture, is avoided by employing a cathode-ray tube. In effect, this is a vacuum tube in which a stream of electric particles is turned in any re-

quired direction by means of condensers around the path of the rays . . . Like a hosepipe which can be squirted at any part of a picture.

The picture is thrown upon a mosaic background of cells, as in 1914, strangely enough, and finally the electric " hosepipe " is directed at each right spot in turn by controlling its direction so that this synchronises with movement at the transmitting end.

Fig. 9 is a diagram of the cathode-ray tube. C shows how condensers are fitted in pairs so that the beam can be controlled: right, left, or up and down—looking at the picture in plan. The end of the tube on which the electrical " hosepipe spray " falls is coated with a material which fluoresces when struck by these electric particles. In short, it glows at each spot or remains dark in exact accordance with the lightness or darkness of the corresponding spot at the transmitting end.

Future of Television

What must first strike anyone who familiarises himself with television principles is that none of the apparatus is costly—*or need be costly*. Therein lies much satisfaction, for television may be destined to play a great part in removing fear of travel, and in bringing about distant friendships. No one would fear to leave home so much if they could see and talk to their own people. Nations of the world would have many more opportunities for intercourse if they could bring more than one sense at a time into their meetings. Think how the cinematograph has advanced our knowledge, as distinct from the old " stills " of the magic lantern !

It is sad if television should be applied to war when it has so many basic or peacetime uses. Perhaps if the sounds and sights of battle could be broadcast into every home, a little of the greed that brings war would seem less necessary. It is in this respect that I always feel the engineer could score. For it is his part, not only to build up a new world, but to make sure that the ultimate possibilities of science are made clear—quite distinct from the mere construction of apparatus over which he has no control. It is for the engineer to see that the public appreciate discovery, and in this way learn also of the benefits it can give. " Television for all " will surely be more than a slogan before many years have passed.

An Emergency Water Still

Particulars of an Invaluable Apparatus for Shipwrecked Sailors

By H. J. ANDREW

WATER fit to drink is one of the first essentials of life, being second only to air.

When you have lost your ship, and have been a few days in a ship's lifeboat, or on a raft at sea, you begin to realise the importance of drinking water. " Water, water everywhere, but not a drop to drink " would automatically run through your mind as you gazed at the vast expanse of sea water.

And yet, all the water we drink has come from the sea, having been absorbed by the warm air in contact with the sea water and conveyed to the upper atmosphere, by a process known as convection, to fall later as rain when the air gets chilled.

It is not necessary for the air to be hot, as even slightly warm air is greedy for moisture.

Of course, the hotter the air, the quicker the process works, which is an advantage in hot climates where man's need of water is greater because of the evaporation of the moisture from the surface of his body.

A man's need of drinking water, therefore, varies according to the climate and may be as little as one or two spoonsful per day.

Life Saving Value

The convection water still here illustrated, works on the above principles, and needs no fuel or chemicals. The only ingredients required are sea water and daylight.

One must not expect an output of pints per hour, but, if one gets only just sufficient to maintain life, surely it should prove worth while.

The idea is protected, but the writer is more concerned with its life-saving value, and hereby gives the details of the apparatus for the public benefit. Anyone can make the apparatus, free of royalty, until September 1st, 1942, after which date it is hoped to manufacture on a large scale which would reduce the purchase price to a reasonable sum for the benefit of all those who go to sea.

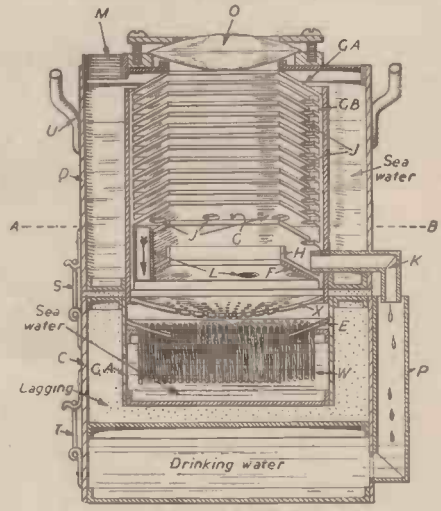
Referring to the illustration, it will be noted that the apparatus consists of three main parts, the upper portion (D) being a condenser, the middle (C) the heating chamber, and the lowest one is for collecting and storing the water until required for consumption.

These three parts are held together by spring clips (S and T), and the two handles (U) serve for attaching a strap by which it could be slung from the shoulders.

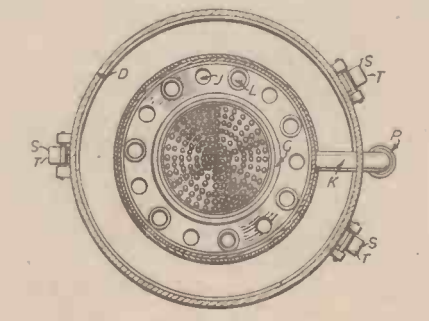
The water jacket round the upper portion is for the purpose of maintaining the tinned conical copper fins (G) at a low temperature.

A number of small holes (J) are provided around the outer edges to allow the condensed moisture to drip to the collecting disc (H), whence it passes by way of the tubes (K and P) to the bottom chamber.

The exterior of the middle portion (C) is lagged to conserve heat, the interior is a watertight container (CA) containing the sea water which is to be evaporated.



Sectional elevation



Plan at A-B

Sectional elevation and plan of the convection water still.

Cotton Wicks

A large number of cotton wicks (W) are suspended from the concave grid (E) into this sea water so that the upper portions of these wicks are always moist.

Just above these wicks, a concave tinned copper disc (X) is fixed, which forms the heating element and is perforated with a large number of very small holes.

The rays of light from the lens (O) are focussed on this heating element and thus the air in the vicinity is warmed up.

The warm air absorbs moisture which rises into the upper chamber where the cool fins condense the moisture and the cold air returns to the heating chamber via the tubes (L), and the action is repeated continuously.

BOOKS RECEIVED

Radio Simply Explained. By John Clarricoats. Published by Sir Isaac Pitman & Sons, Ltd. 44 pages. Price 6d. net.

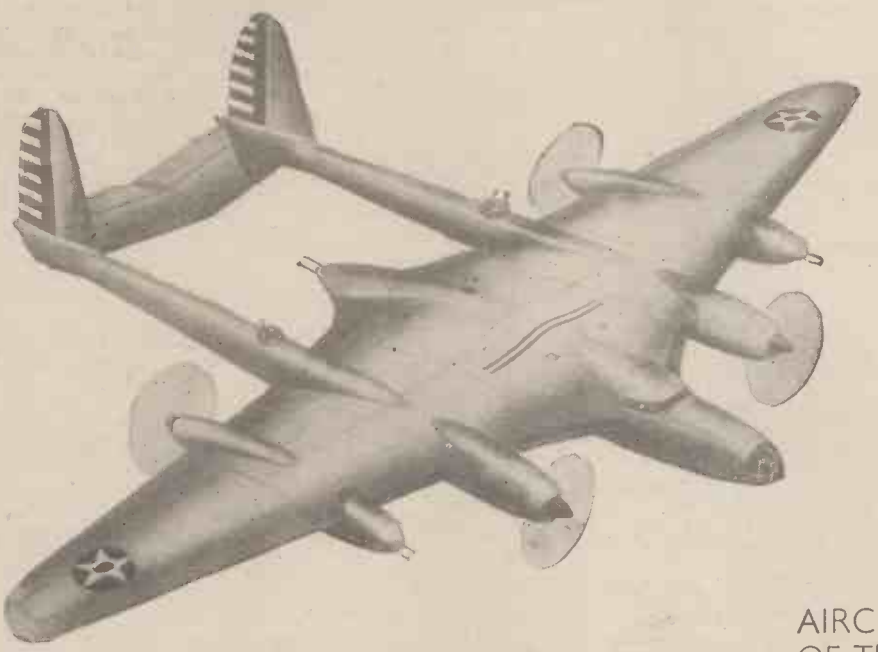
THIS useful handbook is intended as a brief introduction to radio, and will appeal to readers having little previous knowledge of the subject. The elements of radio are told in simple language that anyone can understand, and much of the text is illustrated by diagrams. As a " first-step " book for prospective radio mechanics, wireless operators in the services, and all who wish to gain an elementary knowledge of radio, this little work admirably achieves its object.

Practical Sound Conversion for Amateurs. By F. G. Benson. Published by BCM/VALU. 30 pages. Price 5s. 6d. net.

THIS book is written especially for those home cinematograph enthusiasts who would like to convert their silent machines for sound. For the amateur, the price of professionally made equipment is, of course, prohibitive, and in this book an endeavour has been made to explain how enthusiasts can show sound films by suitably adapting their existing apparatus. In order that the apparatus described may be applied to any gauge of film, dimensions have been omitted. The book is illustrated with several line drawings.

The World of Aviation

New Merlin Aero Engine: Futuristic Aircraft Design: Shocks for Nazis: New German Aircraft: 600 m.p.h. Power Dive: World's Fastest Plane



A four-engined bomber with its motors arranged for obtaining advantageous fire power. Two of the propellers are of the pusher and two of the tractor type.

The New Merlin Aero Engine

ONE of the most popular aero engines used in aviation to-day is the Rolls-Royce Merlin which is fitted to Hurricane and Spitfire day fighters, the Defiant and some Beaufighter night fighters, the Fleet Air Arm Fulmar fighter, the Whitley, Wellington, Manchester and Halifax bombers and the Battle and Master trainers. Now, the Merlin XX is going into full-scale production. It is a 12-cylinder liquid-cooled engine fitted with a two-speed charger. The 12 cylinders are arranged in two banks of six, mounted on the crankcase in V formation. This mark has a considerably better performance than its predecessors. The engine is built up from 11,000 separate parts weighing in all 1,450 lb. The materials used are steel (12 different classes), 47 per cent., aluminium 43.6 per cent., brass and bronze 2.5 per cent., and other materials including plastics and rubber, 6.9 per cent.

Futuristic Aircraft Design

IN these pages are shown three of the futuristic aircraft designs that engineers of the United States Army Air Corps are now experimenting with at Wright Field, near Dayton, Ohio. One is a very revolutionary design for a "sky fighter," named the "Canard." As will be seen from the illustration, it is a pusher type with the tail first and the propeller at the extreme rear, giving the advantage of elimination of rough air over the aeroplane. Vision characteristics are excellent. Next is shown a four-engined bomber with its motors arranged for obtaining advantageous defensive fire power. Two of the propellers are of the pusher and two of the tractor type. Note the double tail assemblies and the huge wing and gun mounts. Finally, we show a single-engined aeroplane with the engine submerged and with the advantages of an enlarged section wing,

AIRCRAFT OF THE FUTURE

A revolutionary type of fighter which has been named the "Canard." It is a pusher type plane with the tail first and the propeller in the rear. Vision characteristics are excellent.

but with relatively thin percentage characteristics. The U.S. Army is studying such designs to add to the effectiveness of the planes of the future and models of these machines have already been experimented with by both commercial and Army plane makers.

American Aircraft

BELOW is a list of American aircraft of which much is likely to be heard frequently in the near future. The British name is given in parenthesis. P39 (Aircobra), P40 (Tomahawk), F2A2 (Buffalo), P36A (Mohawk), A20A or DB7 (Boston when used as a bomber and Havoc when used as a fighter), F4F-3 (Martlett), P38 (Lightning), P51 Apache (Mustang), Flying Fortress (Fortress), B24 (Liberator), Martin 167 (Maryland), and PBY5 (Catalina).

Shocks for Nazis

LIEUT.-COL. J. T. C. MOORE-BRABAZON, in his last speech as Minister of Aircraft Production, announced that development of the four-engined bomber would play an important part now that the war had spread over "astronomical distances." He said that Britain has many surprises for Germany in the air. Work is in hand on engine types which will provide warplanes to astound the Nazis. He disclosed that while the American Fortress and Liberator aircraft have been most valuable acquisitions to the R.A.F., British heavy machines carry a bigger bomb load. Also, Whitley and Hampdens to some extent have gone out of production, but the well-tried Wellington remains with a big share in our bombing strength.

World's Heaviest Aeroplane

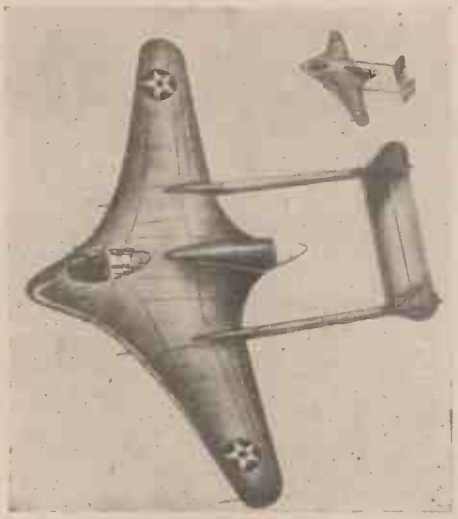
WHEN the giant four-engined American Douglas B-19 bomber took off with a gross weight of 62½ tons, it lived up to its reputation as being the heaviest aeroplane ever to leave the ground. This monster of the air has a wing span of 212 ft. and weighs over 32 tons. Its cargo consisted of fuel, military equipment, crew and a dummy bomb load of 11½ tons. It was recently announced that the British Stirling bomber has a bomb load of 8 tons. Aeroplane experts, it is reported, were astonished to find that the monster aeroplane needed only a few seconds more than the normal take-off for a heavily laden bomber, and it rose into the air after a run of about 3,500 ft. Each of its four engines generates 2,000 h.p., and have been designed to give a range under normal conditions of over 7,000 miles.

A New Heinkel

IT is learned from a reliable source that the Germans are testing a new twin-engined Heinkel fighter in which the pilot and observer lie prone in the wing, instead of sitting up in the fuselage. The chief advantage is extra speed as the fuselage can be reduced in frontal area with better streamlining. The speed claimed is 450 m.p.h.—much faster than any other twin-engined aircraft and most single-seat fighters. The German invasion gliders are being built on the same principle.

New German Bomber

ANOTHER German aircraft to make its debut is a new type of Junkers bomber, said to be much superior to any previously used by the Luftwaffe. The Junkers factory,



A single-engined aeroplane with the engine submerged and with the advantages of an enlarged section wing.

who have made this announcement, state that the machine is to enter action soon. They say that these machines are to be fitted with 1,000 h.p. engines, and entirely new armament. Features of the bomber are manoeuvrability and faster speed.

600 m.p.h. Power Dive

AN American Baltimore twin-engined bomber has set up a new world's record power dive for bombers in U.S. by reaching a speed of nearly 600 m.p.h. A dive from 23,000 ft. showed 400 m.p.h. on the air speed meter at 17,000 ft., and nearly 600 m.p.h. just before the pilot flattened out.

The Baltimore is an improved version of the famous Martin Maryland, which has done such fine service in the Libyan campaign. A mid-wing high cantilever monoplane, it is known in the U.S. as the Martin 187, and is claimed to be the fastest and longest-range medium-type bomber. Apart from being fitted with American-built power gun turrets, some of its defence and offensive armament is considered to be unorthodox.

Invasion Gliders

GERMANY are at present producing seven different types of glider. Some are rather large, and it has been found that increased stability has been given by the tail-less type. The Junkers Company think that towed gliders is one way of solving the transport by air of tanks, armoured cars and field guns. Another method of transport suggested is by means of the modified Ju. 52-3M transport plane. In its modified form it has a hinged fuselage which folds back, enabling whippet tanks and 10 cm. and 15 cm. guns to be driven in without the need for dismantling them.

An Australian Bomber

PLANS are nearly complete for the mass production in Australia of a new bomber designed by a famous Australian airman. It is believed to be twin-engined and very fast. A number of factories are being set up which will use almost entirely Australian-produced materials for the new aircraft.

Secret Canadian Fighter

THE Canadian Munitions Supply Department stated recently that a new secret type of fighter, for the production of which special facilities are being made available, is confidently expected to be "sensationally effective." Its specifications are among the most closely guarded information the Canadian Government possesses.

Wooden Trainer Plane

A WOODEN two-seater aeroplane which is comparable in most respects to present-day fighters, has been designed by Mr. F. G. Miles, Although not as fast as the most modern fighters, it is claimed to be the fastest wooden machine ever built. Known as the Miles Master 111, it is being used as an advanced trainer for which a high degree of safety is demanded. Wood was used to reduce competition with urgent Service needs for metal. A portion of the hooding, however, between the cockpits is specially constructed of metal to form protection for the crew should the plane turn over on the ground.

World's Fastest Plane

THE Hawker Typhoon is now being delivered to fighter stations, which means that the fastest plane in the world will shortly be in action. Powered by a 2,400 h.p. Sabre engine designed by Major Frank Halford, it has a speed of over 400 m.p.h. The designer of the Typhoon, Mr. Sydney Camm, said recently: "The Typhoon represents a great advance in aeroplane design, though its great-grandfather was the old Schneider Trophy plane. I have no doubt it will make circles round any machine the Germans have. No other country has yet produced a motor that will compare with the Sabre engine." The first man to fly the Typhoon, Flt. Lt. Lucas, Hawkers chief test pilot, said: "It climbs like a rocket, turns easily, and responds immeditely to the slightest touch of the controls. Any pilot, though he has only just left his flying training school, could easily fly the Typhoon."

Improved Gun Turrets

IMPROVED Defiant turrets are now being installed in the American-built Hudson used by Coastal Command, and in the Halifax heavy bomber. Other bombers are expected to be equipped with them shortly.

The Thunderbolt Fighter

THE Thunderbolt, an American designed fighter, is now being manufactured on a big scale and is already being delivered to squadrons of the United States Army Air Force. Officially designated the Republic X.P. 47B, the Thunderbolt is said to be one of the fastest single-seater fighters in the world. It is powered by a Pratt and Whitney 18 cylinder air-cooled radial engine which develops 2,000 h.p., and this drives a four-bladed airscrew that has been specially developed to harness such immense power to a comparatively small machine. Its speed is said to exceed 400 m.p.h., and it is fitted with a turbo-supercharger to enable it to fly in the sub-stratosphere. The development of the 2,000 h.p. engine with which this new fighter is fitted is one of the main factors that have made it so successful. Its light weight, compactness, and comparative simplicity are special features of the air-cooled motor, which is a type that has been in favour in America for several years for both military and civil aircraft.

Happy Landing by "George"

"GEORGE," the automatic pilot, brought off a 100 to one chance by landing an empty aeroplane successfully after the crew had baled out. The crew of the aircraft had done a good job of work and were making for home in darkness and foul weather. Everything that could have given them guidance was hidden in mist. The wireless was faulty. They became lost. To attempt a landing would have meant almost certain disaster. Petrol was running short, and while the last drops remained in the tanks, the pilot set "George" to take the aircraft in the direction of the sea so that it would not fall on a town. Then he and the crew baled out over land. The aircraft was heard by the Observer Corps, who told the aerodrome, which was nearer than the pilot had supposed. Soon the aerodrome staff heard it approaching. They sent off rockets and flares but, to their consternation, the aircraft paid no attention and passed on towards the coast. Later, someone 'phoned up in great excitement to say that the aircraft had made an almost perfect landing on the beach—empty!

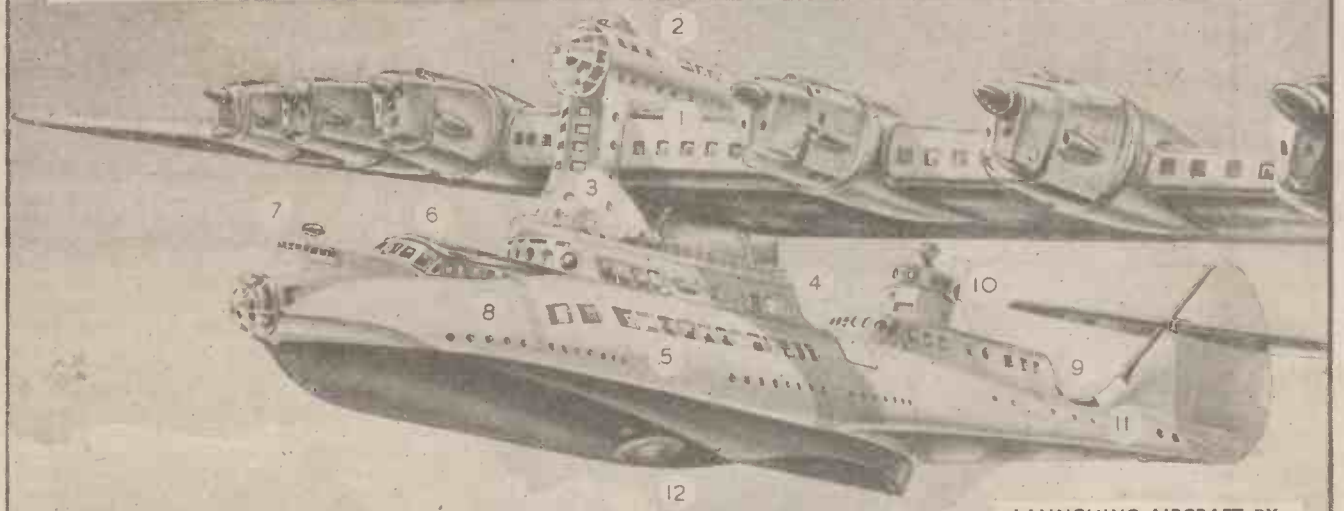
London's river barrage balloon units are now issued with properly fitted-up barges, for living quarters, which are tied alongside the operational barge. This picture, taken with one of these units, shows the activities of the R.A.F. personnel aboard the barge. It shows how a small balloon is transferred from the operational barge to a destroyer by means of an R.A.F. speed boat.

LOOKING AHEAD IN AIRCRAFT DESIGN

THREE AIRCRAFT DEVELOPMENTS

Our Artist's impression of the giant aircraft which American builders are planning. It is a three-deck, passenger carrying craft with a total capacity for 300 passengers. The key numbers indicate the main features which could be incorporated in this pioneer of post-war transatlantic liners. The operating crew, consisting of pilots, navigators and engine maintenance mechanics are located, when on duty, in the upper works of the aircraft, leaving all cabin space in the hull available for passenger services.

1. A Gallery giving access to each of the six heavy diesel-type engines.
2. The Main control cabin housing navigators and pilots. A look-out is shown on top of this cabin.
3. Internal stairway and lift from flight deck to control cabin.
4. Main flight deck and lounge. When travelling at low speed on the water, passengers may walk on the railed deck outside.
5. Lower deck, containing dining rooms and recreational facilities.
6. Forward smoking room and bar.
7. Passengers' observation cabin.
8. Passengers' sleeping quarters.
9. Rear passengers' lounge.
10. Wireless room.
11. Crew's sleeping quarters.
12. Retractable wheels for carrying craft down the runways from land to sea.

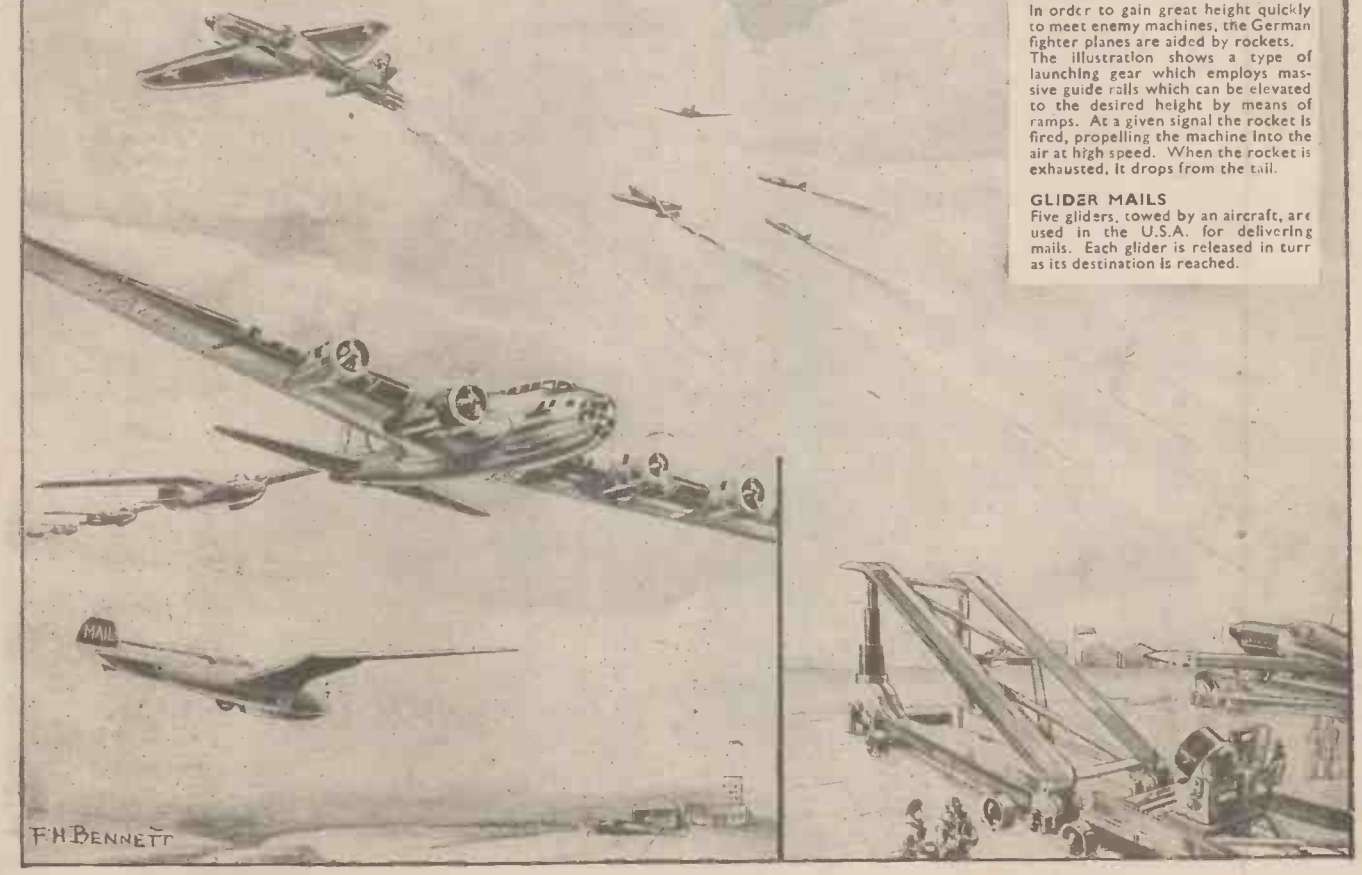


LAUNCHING AIRCRAFT BY ROCKET

In order to gain great height quickly to meet enemy machines, the German fighter planes are aided by rockets. The illustration shows a type of launching gear which employs massive guide rails which can be elevated to the desired height by means of ramps. At a given signal the rocket is fired, propelling the machine into the air at high speed. When the rocket is exhausted, it drops from the tail.

GLIDER MAILS

Five gliders, towed by an aircraft, are used in the U.S.A. for delivering mails. Each glider is released in turn as its destination is reached.



Magnetic Crack Detection

A Speedy and Efficient Method of Locating Minute Flaws in Highly Stressed Components for Aircraft and Automobiles.

Testing high-speed cutting tools between clamps on the detector.

THE danger of the formation of cracks in vital or highly stressed parts has, of course, been appreciated since the earliest days of engineering. In the case of highly stressed automobile and aircraft parts in particular, a very critical standard is now maintained. Early methods of crack detection were necessarily simple, but sufficiently effective in most cases when employed by a skilled inspector. The ringing test, for instance, by which the note emitted by a part when tapped with a hammer gives an indication of its condition, is still employed during routine checking of the wheels of railway rolling stock. Similarly, if a steel component is suspended and tapped it should give out a true note if in sound condition, whereas the note will sound "dead" if the part is cracked.

Again, visual detection of cracks can be carried out if the parts have a reasonably highly finished surface; on public transport vehicles and on many racing cars one frequently sees vital parts, such as steering arms and front axle heads, highly polished to facilitate regular inspection of the parts for cracks. This principle was also used until fairly recently in aircraft production, an inspector often spending an hour or more examining a highly stressed engine component with a magnifying glass. Fine cracks, which may occur during grinding operations, may not ordinarily be visible, but can be detected on sample parts by etching the surface with acid.

Yet another widely used method of crack detection is to clean the suspected component thoroughly, and then to wipe it over with a rag soaked in paraffin or hot oil. The part is then cleaned off and painted with whitewash. As this dries, any oil or paraffin trapped in a crack will seep through and discolour the surface. This practice is still fairly widely followed when checking aircraft parts, such as undercarriage axles for cracks during the examination of dismantled components for renewal of the certificate of airworthiness.

Time-saving Methods

The effectiveness of the foregoing methods, however, will necessarily depend on a certain degree of skill on the part of the inspector, besides taking a considerable time if they are carried out efficiently. Consequently, the magnetic method of crack detection is now being widely adopted; with the aid of suitable apparatus it is possible to inspect a component such as an automobile or aircraft crankshaft minutely for surface cracks or slag inclusions in a matter of five minutes, with the further assurance that the smallest cracks, which could not be detected by a powerful pocket magnifying glass, will immediately be revealed.

There are two methods of applying electro-magnetic principles to crack detection. The first consists of placing the component across the poles of an electro-magnet. No great strength of magnetic field is required, a magnetising field of about 20 ampere turns per inch usually being adequate for a closed magnetic circuit, while residual magnetism is frequently sufficient.

After removing the part from the magnetiser, it is painted with or immersed in a detecting ink, which carries finely divided particles of iron in suspension. If a crack is present, magnetic poles will be formed on each side, and the iron particles will line up and reveal the defect clearly. It therefore follows that it is important to place the component on the magnetiser so that the path of the magnetic flux is at right-angles to the suspected crack. With larger components, such as crankshafts or camshafts, the detecting fluid is often poured on while the part is still between the poles of the magnetiser.

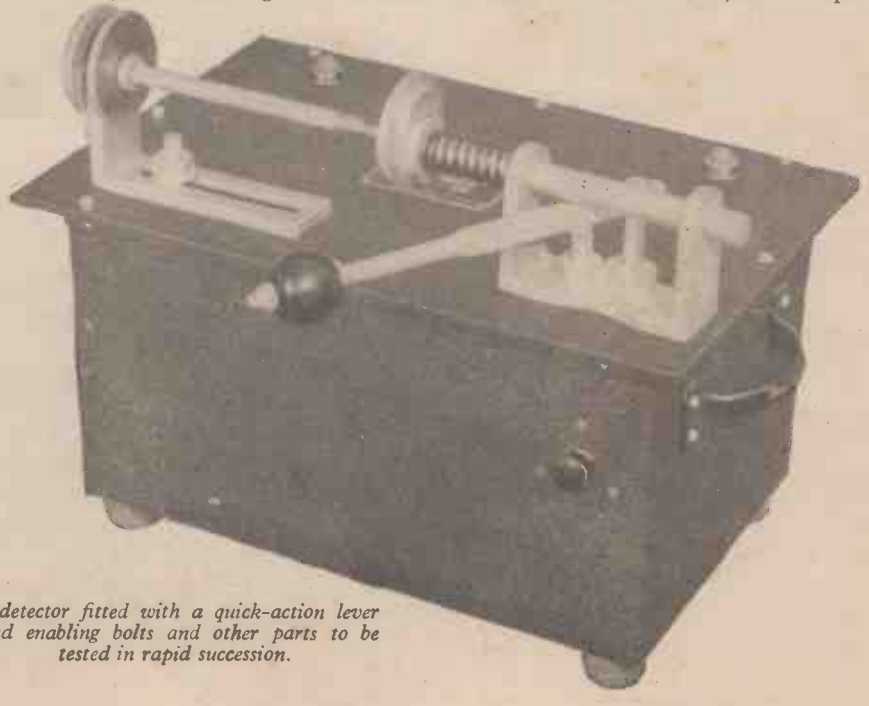
De-magnetising Test Pieces

Since it is undesirable that any residual magnetism should remain in the part after inspection, a de-magnetiser must be employed before the part is put into service. This can be of the platen or aperture design according to the nature of the component, and is, of course, of the type already familiar to users of magnetic chucks.

The alternative method of magnetic crack detection is to produce the magnetic field in the part itself instead of employing an external field. A heavy alternating current is passed through the part, generally in the form of an impulse of very high current for a short duration, rather than a sustained current flow. This method of testing is particularly valuable in the case of long bars, although it will only show up longitudinal cracks. De-magnetising, on the other hand, is unnecessary, since the only magnetism present is that which forms along a crack.

A Typical Detector

An ingenious crack detector which combines both these principles, is the Johnson-Fel detector, manufactured by Fel-Electric, Ltd., of Sheffield. This detector, which is portable



A detector fitted with a quick-action lever head enabling bolts and other parts to be tested in rapid succession.

and can be used in any part of the factory or workshop where there is a suitable A.C. current supply, is now used by a large number of prominent manufacturers, and has been supplied to the Air Ministry. In the first method the electric current is passed through the actual test piece. In the case of bars or tubes, cables of ⅜ to ½ sq. in. in area are fitted with suitable copper clamps to make contact with the ends of the test piece. For intricate or heavy parts, such as crankshafts, it is possible to support the component on cast iron V-blocks lined with brass or copper gauze, the V-blocks being connected to the machine by flexible cables.

When dealing with bars or tubes the clamps can be gradually moved along the bar until the whole length has been tested, while end faces of large-diameter bars can be examined by

Crazy cracks caused by drastic grinding of a hardened material.

making contact at diametrically opposite points on the circumference. The length or diameter of the bar which can be dealt with at one operation depends on its composition and material. The harder the steel and the higher its carbon content, the greater the length or section that can be examined.

Testing Alloys

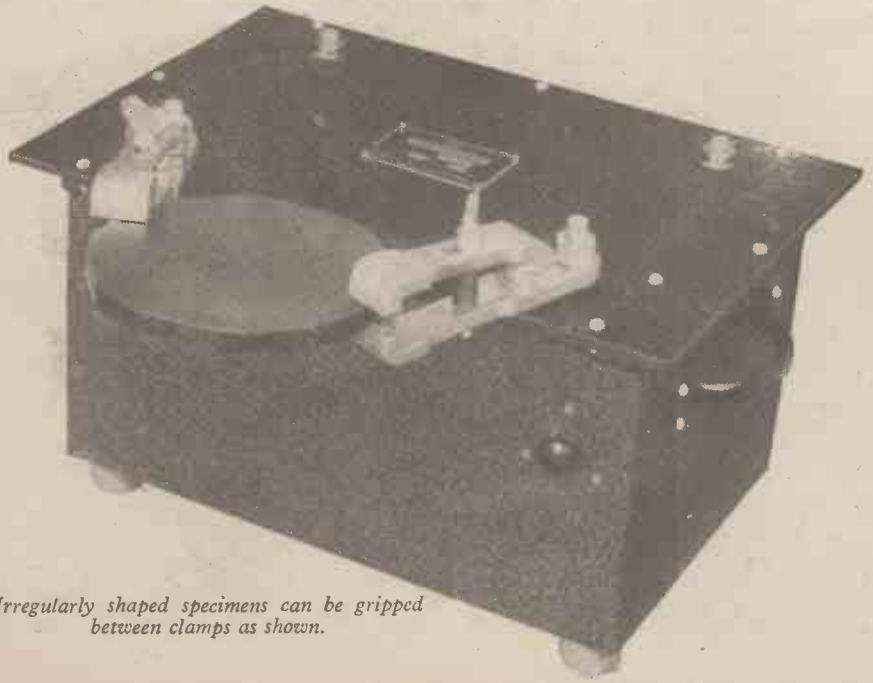
The composition of the metal also affects the period during which the magnetic effect lasts. In the case of high-carbon steels, alloy steels and hard steels, the effect may last three months or more, whereas with a very low carbon content the magnetising effect may last only six hours. Parts magnetised on the Johnson-Fel machine do not show any external field, however, unless a crack is present; when tested for residual magnetism sound parts, therefore, appear non-magnetic.

Smaller parts can be placed across the actual contacts of the machine, which are adjustable to deal with components of different shapes and size. Clamps can be used for irregularly shaped specimens, or high-speed machine tools, while a lever head can be adopted to enable bolts or other repetition parts to be tested in quick succession. In order to ensure that satisfactory contact is made, a pilot lamp will glow only when the correct current is being passed, while a second pilot lamp indicates that the machine is correctly connected to the main supply.

The alternative application of the machine is obtained by passing the current through a copper or brass bar which is threaded through the actual test piece. This provides the only really effective method of checking rings, gear wheels, pinions, ball races, gudgeon pins, or any other component with a hole through it, enabling examination for defects in all directions to be carried out in one operation. The part is simply threaded on to the bar of the jig, the switch is pressed, and the part removed for dipping, pouring, or spraying with detecting ink.

Fatigue and Grinding Cracks

When parts which have already seen service are examined in a machine of this type, fatigue cracks may be detected, usually developing in the plane of maximum stress, and originating from a definite starting point, such as a badly formed radius, a sharp edge, or a tool mark. In practice, however, an efficient magnetic crack detector will often show up cracks formed during the original grinding or hardening process, which must obviously have been present before the part was assembled into the engine or put into use. This has led to an increasing tendency to test parts—particularly those used in aero engines—before passing them to the stores or the assembly



Irregularly shaped specimens can be gripped between clamps as shown.

A Johnson-Fel "R" type machine showing the ring jig in use. The rapid-action lever head is also fitted.

lines.

Grinding cracks are shown up by the magnetic detector in cluster or network form; they seldom penetrate very deeply into the outer skin of the material, but nevertheless may prove dangerous when the part is put into service. Naturally, it is usually necessary to judge each case on its merits. Cracks on gear teeth which run from the roots to the tips of the teeth, and which are not too close to the edge, may be passed, provided that the part is returned for further inspection after the engine has been assembled and tested. If the cracks run along the length of a tooth parallel to the root or tip, on the other hand, the pinion is rejected owing to the risk of the cracks extending under load.

It is seldom satisfactory to remove grinding cracks (which are usually caused by drastic grinding of a hardened material) by light stoning; in the case of gears the stoning operation is almost certain to alter the tooth form, while the fact that the surface appears perfect after stoning does not indicate that the internal stresses which originally caused the cracks have been normalised.

Heat Treatment Cracks

Hardening cracks are of a different nature from those caused by grinding, generally being isolated and penetrating to a much greater depth. They constitute a definite danger signal, since they often indicate the presence of small slag inclusions in the metal. In view of this, and the fact that they are almost certain to extend in use, the presence of hardening cracks results in the rejection of the part for aircraft work.

It will be obvious that a magnetic crack detector can prove extremely valuable in rejecting faulty components at a comparatively early stage in their manufacture, probably saving a considerable amount of expensive machining which would otherwise represent wasted time. Crack detectors are also being employed in modern factories to control the standard of bar material, stampings and forgings coming into the works. In one aero engine factory, in which magnetic crack detection is applied to raw materials and parts during the early machining processes, the number of parts subsequently rejected before or after engine test has been reduced by 25 per cent.

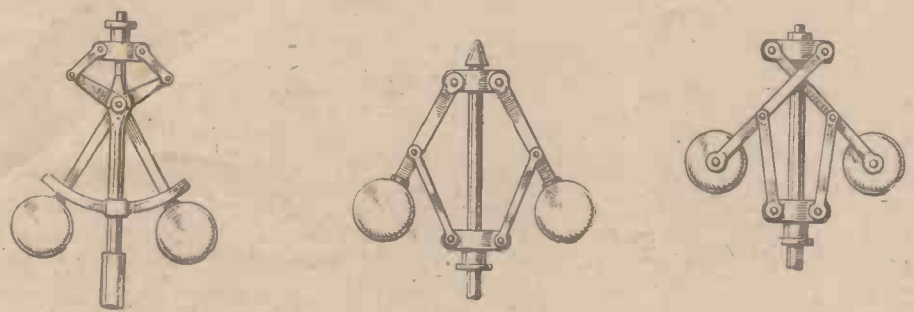
Steam-Engine Governors

A Brief Description of Their General Types and Mode of Action.

THE function of a governor is to regulate the average speed of a prime mover or a machine, which regulation, in the case of a steam engine, is brought about by the alteration in the supply of steam to the cylinder, this being effected by changes in the rotation speed of the governor.

Other factors being equal, the efficiency of a governor is dependent upon its sensitiveness, but, in some circumstances, it is possible for a governor to become over-sensitive, in which condition the device is practically useless. Within a wide range of sensitiveness, however, an increase in the efficiency of the governor in this direction results in a smaller variation of the engine from an average speed of running.

The principle of the steam engine governor is an extremely simple one, being based on the tendency of two revolving balls or weights to fly apart or away from a vertical spindle under the influence of centrifugal force. In addition to this force, a governor is controlled by centripetal force, or by the tendency of the balls or weights to hang downwards under the influence of gravity.



Figs. 1 to 3.—(Left) Simple type of conical pendulum governor. (Centre) Another common type of governor. (Right) Crossed-arms governor.

Centrifugal Force

With any type of governor it is possible to calculate the centrifugal force acting upon it in terms of the weight of the balls by multiplying the square of the number of revolutions per minute of the vertical shaft of the governor by the radius of the circle described by the balls in inches, and by dividing the result by the constant number 35,226.

Similarly, to find the centrifugal force acting upon the governor in terms of the weight of the balls, divide the horizontal distance of the balls from the centre of the vertical spindle (or from the centre of their point of suspension) by the vertical height of the latter above the centre plane of the balls.

One of the simplest types of governor is the conical pendulum governor shown in Fig. 1. The vertical spindle of this is driven by the engine which the governor is intended to control, and the arms of the governor are joined together and to the vertical spindle. Limbs connect the arms to a movable sleeve which is thereby enabled to rise and fall along the spindle with the motion of the balls. The sleeve has a groove formed in it and this receives the end of a lever which communicates with the throttle valve of the engine (either directly or by means of a system of levers), the supply of steam to the engine being controlled by this simple means. In the conical pendulum type of governor, the arms are made to work in a curved slot secured to the spindle centrally.

A more common form of engine governor is the one shown in Fig. 2. Here the sleeve travels up the driving spindle as the weights extend outwards under the influence of centrifugal force.

The crossed-arm governor, of which there are many varying patterns, is shown in Fig. 3. This type of governor is more sensitive than the former one, being somewhat steadier running.

Centre of Suspension

In all types of simple governors, the centre of suspension of the weighted arms should always be situated in the centre of the vertical spindle unless it is located beyond it, as in the case of the crossed-arms type of governor, Fig. 3. The reason for this ruling is to be seen in the fact that a governor should at all times operate with as little speed variation as possible, and the locating of the centre of suspension of the arms away from the centre of the spindle results in an increased variation in velocity of the revolving weights. The variation in the rotational speed of the weights becomes greater as the distance between the centre of the spindle and the centre of the arms-suspension pin of the governor is increased.

No governor operates without at least some degree of frictional resistance in its various joints, but, naturally enough, the smaller these resistances can be made, the more efficient the governor becomes, since the combined frictional forces of the governor tend to act together in a direction opposite to that of its motion.

In order to improve the performance of a governor and particularly to enable it more readily to overcome its own frictional resistance, what are known as the "loaded" types of governors have been introduced.

The Loaded Governor

The principle of the loaded governor comprises the addition of a central weight to the governor. This increases the downwards pull on the revolving governor balls and thus tends to overcome frictional drag in the sliding parts or in the joints.

A simple type of loaded governor is shown at Fig. 4. Here the centre weight takes the form of a heavy metal disc which, in effect, corresponds with the central sleeve of an unloaded governor. The governor "balls" or weights in this case are actually rollers, and it is upon these that the centre disc rests, slots being provided in the disc to permit of the passage of the governor arms through it.

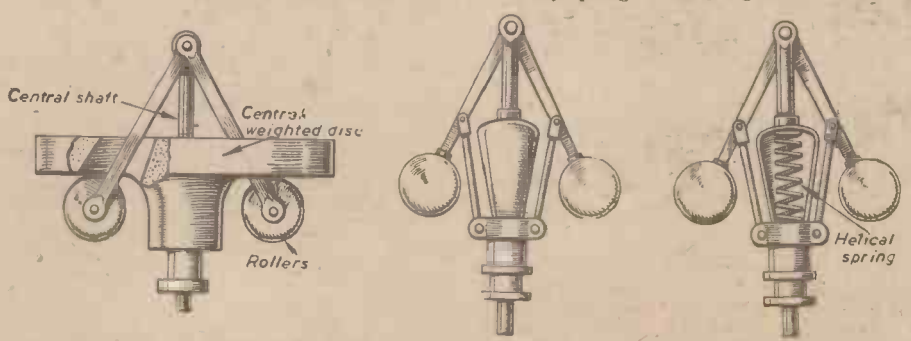
A commoner form of loaded governor is the Porter governor, so styled after the name of its inventor. The Porter governor is illustrated at Fig. 5. In this variety of governor it will be seen that the centre weight takes the form of a much enlarged and heavy sleeve-riding over the central revolving spindle.

All such types of centre-weighted governors require to be operated at relatively high speeds in order that the gravitational attraction of the centre weight may be overcome by the centrifugal force of the balls. Given this essential condition, the weighted type of governor has the decided advantage of high sensitiveness, enabling uniformity of speed to be preserved under varying engine loads. Furthermore, in consequence of the augmented power of this type of governor, the actual dimensions of the governor can, in practice, be reduced very appreciably, a consideration which is of much importance in the design of some of the present-day compact types of steam power units.

Spring Loader Governors

Some modern types of governors are spring-loaded, a helical spring being slipped over the central spindle so as to cause a downwards thrust on the collar of the sleeve (Fig. 6). In such types of governors the centrifugal force of the rotating balls is exerted against the thrust of the spring, which is in a state of compression. A more powerful governor is obtained in this manner, one which can deal with maximum amounts of power as supplied by heavy prime movers.

Spring-loaded governors are usually equipped with a sort of auxiliary spring which is connected to the link mechanism between the sleeve of the governor and the valve of the engine in such a way as to augment the load on the sleeve. It is also usually possible to alter the tension on this auxiliary or supplementary spring whilst the governor is running.



Figs. 4 to 6.—(Left) A simple type of loaded governor utilising a centre-disc weight. (Centre) The Porter governor. (Right) A common type of spring-loaded governor.

This alteration results in a change of the speed at which the governor is in equilibrium in any one position, its centrifugal force being balanced by the forces tending in the opposite direction.

What is known as the "stability" of a governor may be defined in this way: if a governor is running uniformly at a steady speed, the radius of the circular path of the revolving balls will increase with increase of speed of the governor when the latter is in the *stable* condition. In other words, the governor responds progressively in radius of the circular path traced out by its flying weights for every increment of speed increase. This condition of stability is coincident with freedom of the sleeve and of the linkage work of the governor and it would not obtain were any of these parts defective in operation.

An Isochronous Governor

An *isochronous* governor is not infrequently referred to in engineering papers. In straightforward language, it may be said that any governor is *isochronous* or is in *isochronous* operation when for any given speed of rotation the balls or weights will attain and remain in any given position within their normal range. With such a governor, a very slight change in rotational velocity will result in the balls taking up an extreme position, a small decrease in speed resulting in the balls falling to their inner limit and any minor increase in speed causing them at once to assume a position near their outward limit.

It is obvious that a governor in this condition is of little practical use, for it is far too sensitive and, in practice, it would continuously alternate between its two extreme positions, thereby cutting off the steam and giving full steam to the cylinder in rapid sequence.

Governors not infrequently tend to get into an over-sensitive condition, due frequently to their being run with engines for which they were not designed. Such governors give trouble by falling into a state of oscillation known as *hunting*. The *hunting* of a governor may be due to a number of causes but it is usually to be looked for in the lightness of the governor.

Governors are sometimes referred to as being more or less powerful than a standard or a given type of governor. In this sense the term "power" is rather loosely employed. Strictly speaking, the *power* of a governor represents the quantity of work which it does at its sleeve in consequence of a stated fractional increase of speed, and by what is sometimes termed the *effort* of a governor is meant the force which it exerts at the sleeve for a given change of speed.

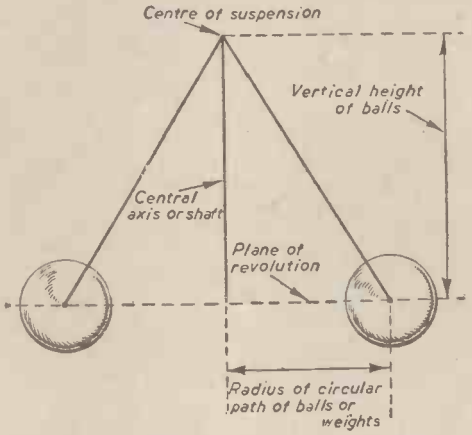


Fig. 7.—A simple type of engine governor in diagram form, showing the various theoretical elements of its design.

Power of the Governor

A simple calculation enables the power of a governor to be determined. Merely multiply the weight of the balls in lbs. by the vertical height to which they are lifted for any given speed of rotation.

A good method of finding the vertical height of the governor balls between their plane of revolution and their upper point of suspension is to divide the constant number 187.5 by the number of revolutions of the governor per minute and then to square the product. This will give the required vertical height in inches.

In the design of any type of governor it is obvious that the combined weight of the balls must be sufficient to overcome the resistance of the steam valve which the governor operates, and that of the linkage work between the two. It is common practice to make the diameter of the balls equal to one-half the vertical distance between their point of suspension and their centre when at rest, this measurement being taken in inches.

An approximation to the actual speed of a revolving governor of the simple unloaded type may be made by dividing the constant number 187.5 by the square root of the vertical height (in inches) between the centre of suspension of the balls and their plane of revolution (see Fig. 7). The quotient will represent the number of revolutions per minute of the governor shaft which is required to keep the governor balls at that constant height.

Construction

In general, all engine governors must necessarily be strongly made articles. They are usually made of steel and brass, the steel balls being of the most perfect spheroidal shape obtainable. The central weighted portions of governors are also of steel, since this high tensile strength metal can withstand high centrifugal forces without bursting asunder.

At one time, the majority of governors were belt-driven—a method which is nearly always inefficient and sometimes dangerous. This mode of governor driving by means of belt and pulley is now fast becoming obsolescent. It is being replaced by the much more efficient and completely positive type of geared drive, of which there are many varying patterns.

The "P.M." Master Battery Clock

ANOTHER reader, R. Bonney, of Preston, who has constructed this clock, writes as follows:—

"I finished the construction of my P.M. Battery Clock at the end of 1938. At the time I had no lathe, but have since obtained one, and have now fitted a 30-tooth wheel which is more exact in detail than the hand-made one. With three Leclanche cells, this clock has gone for three years without any replacement of the zinc element. It still does its 22 beats (39.125 pendulum) per impulse. It is a good timekeeper, and only gains about one minute in six or eight weeks. Instead of the trigger running in ordinary bearings, I used the escapement wheel of an old alarm clock. To this wheel I soldered a short length of steel knitting needle. I then bent a piece of brass U-shaped, and centre-popped the places for the trigger centres to run in. I also put a small bolt above the trigger to pull the centre-pops to the spindle ends so that they just have enough clearance (Fig. 1). The drilling of bolt holes and centre pops should be done before bending the U-shaped bracket. A much shorter trigger can be used by this arrangement.

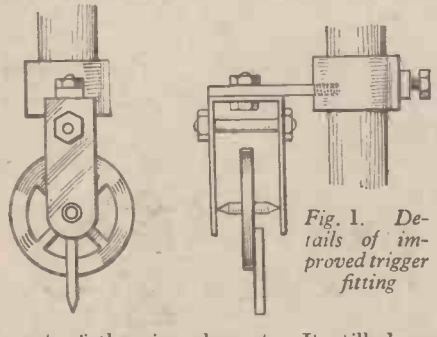


Fig. 1. Details of improved trigger fitting

The pendulum weighs 14 lbs., and was made according to the instructions in *Practical Mechanics*. I have since made a slave clock to work off the master clock. Instead of the magnet pulling a tooth when contact is made by the master clock, I reversed the procedure, i.e., the magnet lifts up the arm and, falling back when current is switched off, moves one tooth forward, thus being independent of the strength of the magnet (Fig. 2). This arrangement works very well, though I used a transformer for the slave clock only. The ordinary magnet when working off the transformer soon became a nuisance when I put the slave clock in a case, owing to buzzing due to the mains alternating current, so I have now substituted a solenoid in place of the magnet. Also, the contact in the master clock is another source of trouble due to the pointer moving back a bit after passing the contact and switching on again. To counteract this, I fixed up another method. I soldered a small pointer P (Fig. 3) on the seconds spindle in the frame front, and also a strip of flash-lamp brass S at right angles to another strip which has a small shaft soldered at L for a pivot. The duration of contact can be adjusted by the screw D. The terminals are shown at T."

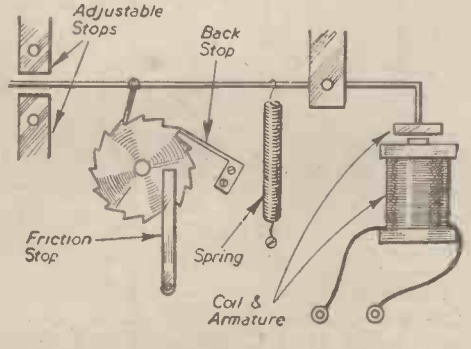


Fig. 2. Modified operating mechanism for slave clock

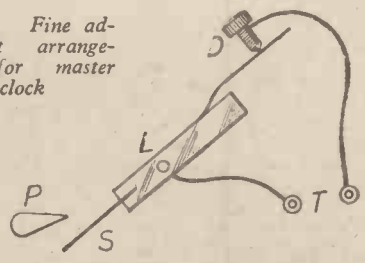


Fig. 3. Fine adjustment arrangement for master clock

An impressive picture of Britain's latest battleship, "Duke of York," of the "King George V" class.

THE MONTH IN THE WORLD OF

Science and Invention

"Remote Control" of Dogs

THE accompanying illustration shows an American war dog fitted with the new harness pack, housing radio receiving equipment, and with headphones fitted over its head. The apparatus, with its companion short-wave broadcasting receiver, makes possible remote control of war dogs whilst under enemy fire. With this equipment, dogs can be controlled within a radius of three miles under adverse battlefield conditions.

Puncture-proof Tyres

PUNCTURE proof tyres that enable armoured cars and supply wagons to go on after the tyres have been pierced are being used by our Forces in the Libya campaign. The process used in manufacturing the tyres is a closely guarded secret, but it enables them, even after they have been hit by bullets, to stand up and support the weight of the vehicle.

Four New Inventions

FOUR new inventions—details still on the secret list—accelerating shipbuilding by 30 per cent. are being applied in the U.S.A. Two of them, relating to a welding process, were perfected by five German engineer refugees, who, incidentally, refused payment for their services.

New Lathe Invention

MR. FRANK LEWIN, a Kettering engineer, has been granted letters patent for an invention designed to cut by half the time taken to finish an operation on the lathe. The invention is designed for gripping and reversing, end for end, a two-ended workpiece, and the work time is thus reduced. By name the invention is an "improved reversible machine chuck."

A "Wizard" Tool

A DIAMOND tool, representing one of the biggest recent advances in engineering cutting and grinding, is now in use in Britain's arms industry. The tool was invented in Belgium, and will cut through tungsten carbide at the rate of an inch a minute. This is a remarkable achievement when one considers that tungsten carbide itself is so hard that it is used for cutting the toughest steel, as well as stone. By its use complicated engineering processes can now be done in a quarter of the time formerly needed.

An American war dog fitted with a pack harnessing radio receiving equipment, and with headphones fitted over its head.

Secret Anti-Aircraft Weapon

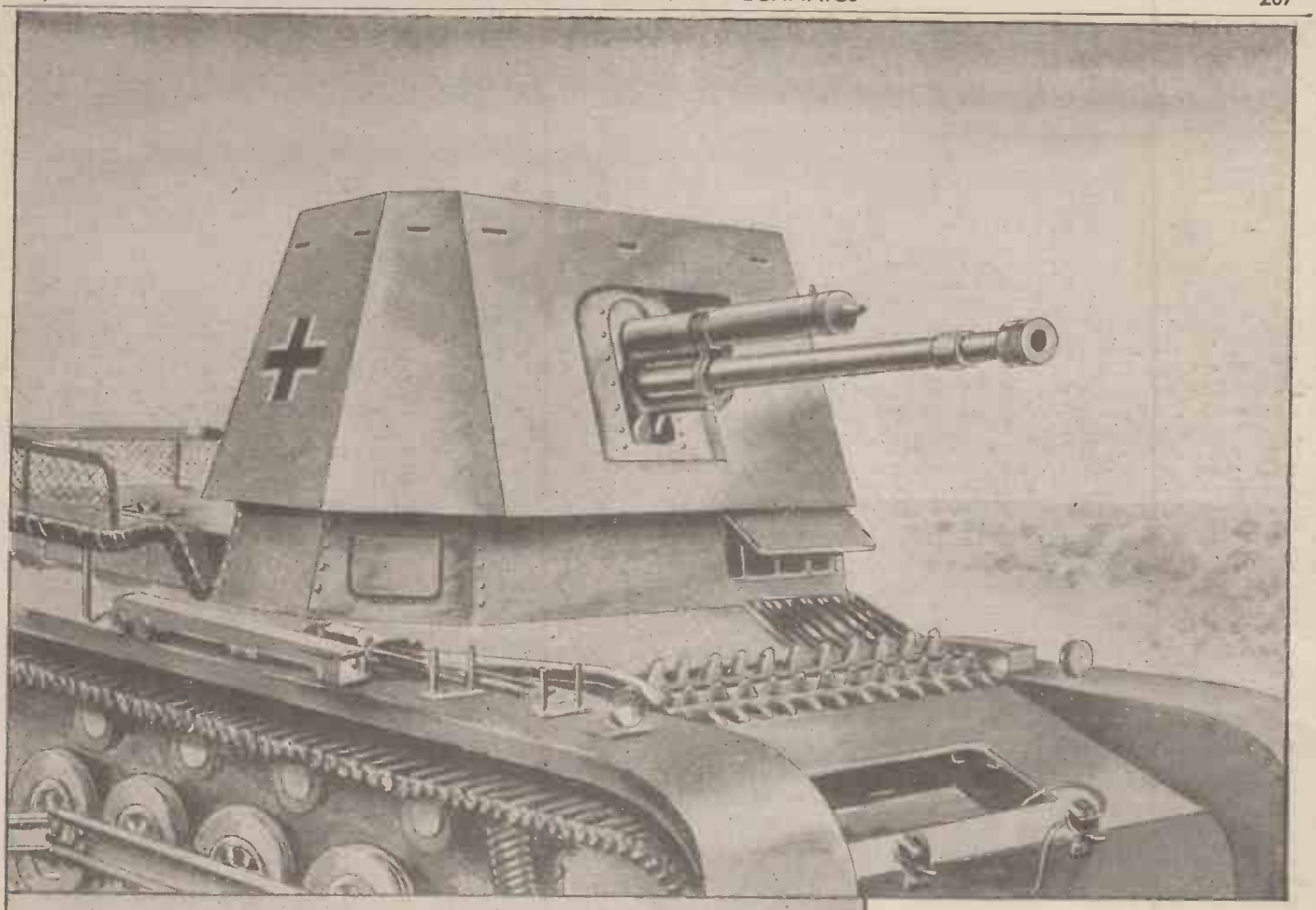
BRITAIN is at present producing a new type of anti-aircraft weapon, details of which are being kept secret. They are also making a new type of apparatus for dealing with oil tank fires.

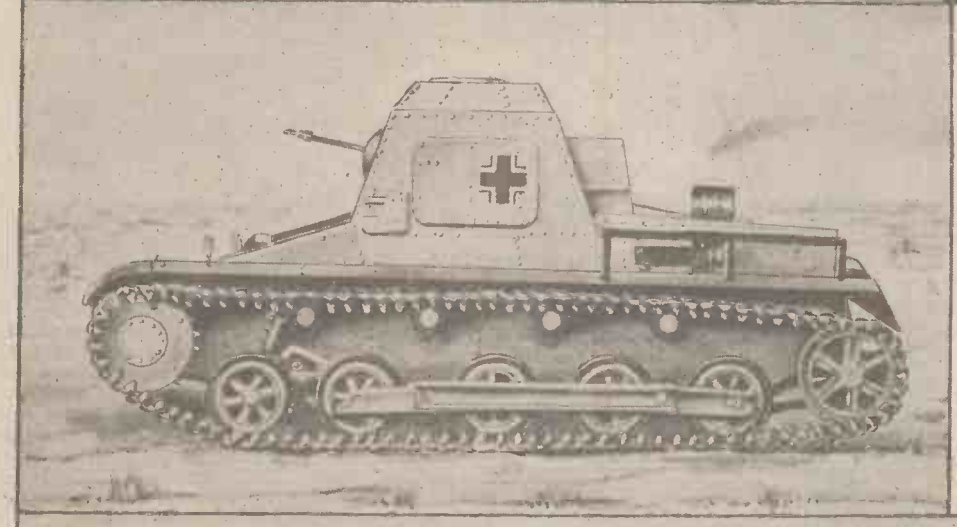
A Mammoth Boiler

A BOILER delivering 650,000 steam-hour at 1,825 lb. sq. in. and 960 deg. F. to a 25,000 kw. turbine is nearing completion at the Somerset (U.S.) power station of the Montaup Electric Co. It employs forced circulation and the heating is accomplished largely by radiation from a totally water-cooled slag tap furnace. An idea of the size of this boiler is indicated by the steam drum which is 43 ft. long, with an inside diameter of 4 ft. 6 in. The shell plate is $4^{23}/_{32}$ in. thick, and the overall weight 72 tons. The furnace is 32 ft. wide by 20 ft. 9 in. deep, and 48 ft. high, with a volume of 31,000 cu. ft. The feed water is pumped continuously through the tubes at 3,500 gal. per minute, and under a head of 50 lb. The firing is tangential with pulverised fuel, but provision is made for oil firing. Full use is made of economisers and superheaters, an interesting feature being the re-superheating of the steam from the h.p. turbine for use at 372 lb./sq. in. (765 deg. F.) in other turbines. Eight-stage turbine driven pumps supply feed, each with a capacity of 435,000 lb./hr.

Controlling Smoke

AN American Company have developed a device for checking the smoke nuisance. It consists of two photo-electric units which can be fitted to any type of boiler burning coal or oil. As soon as the maximum allowable density of smoke is exceeded, one of the cells which acts as an indicator signal apparatus gives the operator warning by means of a light





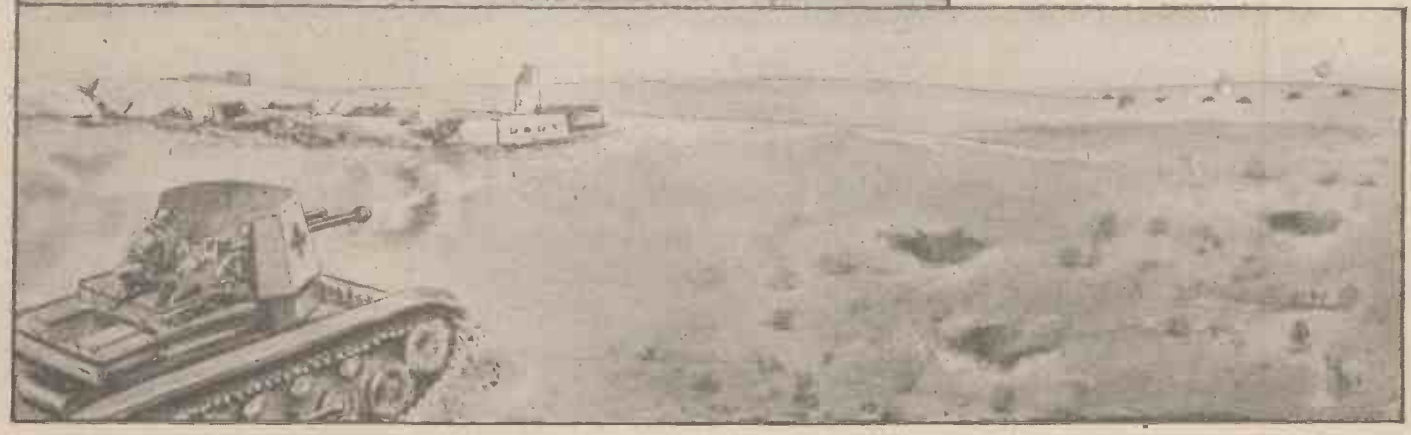
ROMMEL'S CONVERTED TANKS

Top illustration shows Rommel's converted tank with Cupola removed and replaced with light armoured gun shield.

Illustration on left shows the type of medium weight German Tank used for conversion, and with its original cupola in position.

Below is shown the converted tank in action.

In order to mount the gun of such heavy calibre, armour is limited to only frontal protection for the crew.



or bell. The other cell acts as an automatic smoke-control device that feeds steam and air, or air only, to over-fire jets as soon as the fire starts smoking excessively because of a deficiency of oxygen.

Vacuum-dried Concrete

ACCORDING to the New York Journal of Commerce, Mr. K. P. Billner has invented a new vacuum-dried concrete which can be used in the construction of concrete ships. The inventor claims that hulls of 10,000-ton tankers could be built with this concrete in a period of less than four weeks, and that they would have the same strength and lightness as hulls built of steel.

100 *Octane Fuel*

SUPER octane fuel for aircraft is now being turned out at about 2,000,000 gallons per day. The present output is seven and a half times the total of all grades of aviation spirit three years ago, when 90 octane was quite common. This new fuel was still in the laboratory stage seven years ago; not satisfied with the present high output, plans have been laid down for a threefold expansion within eighteen months, and twenty-five additional plants are either being built or designed. The petroleum industry of the States anticipates being able to turn out 5,000,000 gallons of this new super octane petrol per day by January 1943.

Radiolocation in America

ACCORDING to an announcement by the U.S. Navy Department, a new radio device for locating ships and aircraft hidden from sight has been introduced in the United States. It is thought to be similar to British Radiolocation. Skilled personnel to operate and maintain the "Radars" as the apparatus is called, must have had experience in the design, construction and operation of the U.H.F. transmitting and receiving equipment, or experience with television and cathode-ray apparatus.

Induction Hardening Copper

TO reduce wear of shafts by rocker arms a large car manufacturer in the U.S.A. used to insert copper bushes, which, in effect, acted as a soft bearing liner. The shafts, however, are now hardened from 20 to 50 Rockwell C. by high frequency induction, followed by quenching. About 5,000,000 shafts have been treated in this way in two years, and no faults from the treatment reported. About 14,000,000 copper bushes were saved annually, amounting to 350 tons.

The "Blitz Buggy" Shows its Paces

THE ugliest motor vehicle in the world is undeniably the "Blitz Buggy" or "Jeep"—but it is also, according to U.S. Army Authorities, the most useful motor vehicle they have ever had.

The "Blitz Buggy" is a stubby, bouncy crossbreed between a staff car and an armoured motor-cycle and side-car, and is as ugly as only such a hybrid could be. But in war-time it is performance that counts and, says Lieut.-Colonel I. M. Oseth, the U.S. Army's expert on light vehicles, the "Jeep" has stepped-up the American Army's transport facilities by 50 per cent.

It has a wheelbase of only 80 in. compared with 112 in. of Ford V-8s being produced in the same factory, and four-wheel drive that provides enormous traction for its 42 h.p. engine. The "Blitz Buggy" or "Jeep"—call it what you will (its users have great affection for it)—was originally designed to replace motor-cycles and side-cars for reconnaissance work, and it can go anywhere a motor-cycle can, and a lot of places where one can't. But in actual service it can haul light field guns, convey six fully-equipped men, carry weapons, such as machine-guns, anti-tank guns, mortars, etc., and serve as a radio car. About the only thing it cannot do is fly, but it has been successfully carried by 'plane, and it is now proposed to experiment in dropping it by a giant parachute.

If it should turn over, a few soldiers can set it on its wheels again without strain. The U.S. Army has about five thousand "Jeeps" in service and is planning to equip every infantry regiment in its Army with nearly 100 of them.

Southern Railway Cinema Coach

IN 1939 the Southern Railway had under construction a special coach for the purpose of showing travel films to the public and instructioal films to the staff at numerous stations and depots throughout the system. War intervened, but the Company decided to complete the vehicle with a view to its utilisation for staff instructional films on A.R.P.; Home Guard and Salvage.

This mobile cinema accommodates 56 persons and is fitted for working off the station electric lighting or on current generated by Diesel engine fitted in a van attached to the cinema coach. This van also contains an office and cupboards for stores.

At the present time the cinema is visiting a number of stations in Devon, Cornwall, Somerset and Dorset on the Southern and Somerset and Dorset Railway systems, where the principal films shown are "Saving our Scrap" made and produced by the Company's own film unit, National Savings Campaign, and War Office instruction films for the Railway Home Guard.

Hay Lifter

FOR many centuries the pitchfork with its twin prongs and long ash handle polished by the toil of the farm labourer was the sole implement for lifting hay on to the farmer's cart and rick. In times of rebellion it was occasionally diverted from its peaceful avocation to be commandeered as a weapon in civil war. Eventually it was superseded by the mechanical elevator, which facilitated and expedited the lifting of the hay. An inventor now contends that he has improved upon this contrivance.

The new invention combines a framework with ground wheels, an endless conveyor furnished with tines and carried to pulleys, and an inclined trough along which hay can be moved by the tines from the ground to a discharge position. There is a blower which delivers a blast of air under the hay for engaging it with the tines. And means are provided for driving the blower and conveyor.

A Unique Engine

IN January, 1939, the National Gas and Oil Engine Co. Ltd., introduced the gas and/or oil engine—the most important internal combustion engine development since the original Diesel. They next evolved the high-efficiency gas engine with 15-1 compression ratio. Now they have combined the two and are manufacturing an engine (at present in standard sizes from 10 to 90 b.h.p.) which is unique and possesses the following features:—1. It will run as a high-compression engine with spark ignition, as a high-compression gas engine with oil ignition, or as a Diesel engine. 2. Thermal efficiency on gas exceeds that of the best Diesel. 3. Change of fuel by the turn of a wheel.

A Self-Propelled Assault Gun

One of the Features of the German Tanks is the "Sturmgeschutz" Gun, which, Owing to its Success, is now produced as Part of Germany's Standardised Artillery.

IN 1940, the Germans introduced on the Western Front a mobile or assault gun, called the "Sturmgeschutz." Created as an improvision, this self-propelled gun proved extremely successful and is now included in Germany's output of standardised artillery. Major Philip Gribble, the military critic of the *News Chronicle*, recently wrote an interesting article on the effectiveness of this type of armament. He stated that last year there were innumerable examples from the Russian front of these mobile guns mounted on tank chassis stripped of their hulls, or sometimes on other types of tracked vehicle chassis, being used with great effect by the Germans in anti-tank defence. The full page illustration on page 207 shows the "Sturmgeschutz" mounted on a converted tank which has the cupola removed and replaced with a light armoured gun shield

Very few of these assault guns were in use at the time of the invasion of France, and owing to the shortness of the campaign, the Allies had no time to appreciate the qualities of this type of gun.

Development of the Gun

The Germans, however, did not overlook its effectiveness, and from that date its development proceeded. Arrangements were made for mounting different calibre guns and provision for greater speed was incorporated in the design. As stated by Major Gribble, the new models were built to conform in speed with that of the Panzer divisions and motorised infantry. A feature of the assault gun at this stage was the low mounting, which enabled it to be successfully hidden amongst tall crops and even full grown wheat. This apparent invisibility was extremely valuable in the German summer campaign against the Russians in the Ukraine, owing to the amount of natural cover available.

Recent illustrations of the assault gun have shown it as an armoured gun on a caterpillar track not unlike a tank, but without the protection of a turret. A light gun of about 1.5 in. calibre was mounted on the earlier models, but later models carried 2-in. guns, which in turn were displaced by 3-in. guns of the field gun class.

Another Adaptation

Throughout the German advance last year, assault guns in their several forms proved of vast use to the Germans. Last November, when the front became more or less stabilised, and advances alternated with withdrawals, it became evident that a further development in the use of the "Sturmgeschutz" might be useful. Assault gun crews then often became subject to surprise and stood in need of smaller weapons and more rapid fire power. The Nazi ordnance experts soon arranged this adaptation. Electrically-operated machine guns were mounted on a smaller chassis, which was capable of being transported by air. This latest development may have a direct bearing on future invasion operations.

Ships of the Vikings

A Brief Description of the Craft Used for the Invasion of England 876 Years Ago.

By P. F. GROD.

Figs. 1 and 2. Part illustration of Norman Seafarers on the tapestry in Bayeaux with Latin inscriptions. Fig. 1 shows the construction of the ships starting with the felling of trees, splitting of planks, the work in the wharf, and the launching of the ships. Fig. 2 shows the sea-passage with many horses; in the centre the larger ship of the Duke.

GERMAN scientists show a strange interest in some historical documents referring to the first—and we hope it was the last—successful invasion of England in modern times, the conquest of England by William of Normandy (called the Conqueror), on the 28th September, 1066. One of the most important documentary proofs of this famous historical event which fell, with the fall of France, in German hands was the well-known tapestry in the cathedral of Bayeux, and some technical scientists have made a very careful study out of it. By this study they were in a position to reconstruct the so-called "Viking" ships, which have more than a remote similarity to the modern "invasion" barges we know from German illustrations, and the famous raids of the Norwegian coast and Spitzbergen. At the outset, we fully appreciate the scientific and historical conclusions but, of course, cannot follow the underlying motive, claiming the Normans as the nordic ancestors of the present Germans, and therefore implying that the Germans may be as successful as these "claimed" ancestors in their fight against England. They evidently forget that the blood of these "successful" ancestors lives not in the Germans, but in the English, French and Norwegians, and we are proudly entitled to see in the events which led to the conquest of England in 1066 just the contrary to what German scientists see obviously infiltrated with Nazi doctrines.

Historical Events

A short review of the actual historical events, given by the Germans quite correctly, may be useful. After the death of King Edward, the Anglo-Saxon Duke Harold II was crowned in Westminster Abbey, in spite of a promise made before the death to the Duke William of Normandy. Immediately William prepared a grand fleet and landed on the 28th September in Pevensey on the south-east coast, crossing the Channel from Bayeaux. At Hastings the army of Harold was decisively defeated and he himself slain. On Christmas Day William was crowned as King in Westminster Abbey. It is stated that this invasion with a grand fleet of hundreds of ships caused excitement and surprise in the whole world.

The tapestry, above mentioned, was made by Queen Mathilda and her ladies of honour, and devoted to the cathedral of Bayeux, the place at the Channel coast from which the invasion started. The tapestry is held in eight colours in flat embroidery on white linen; it is 77 yards long and 0.55 yards wide, showing in 58 groups the whole event of the conquest, together with a full account of the very careful preparations, accompanied by a text in Latin. The tapestry is still wonderfully preserved, even in its bright colours, but this, however, cannot be fully recognised from the black and white reproductions in Figs. 1 and 2. In this wonderful embroidery the historical events seem to be documented with a thorough knowledge, great accuracy, and great historical truth, and it can be assumed that it is due to some great artists of those times, who lively illustrated the events, after having participated in them themselves. Thus. the conclusion may be drawn that this embroidery gives an accurate picture of this long-past epoch.

Shipbuilding Technique

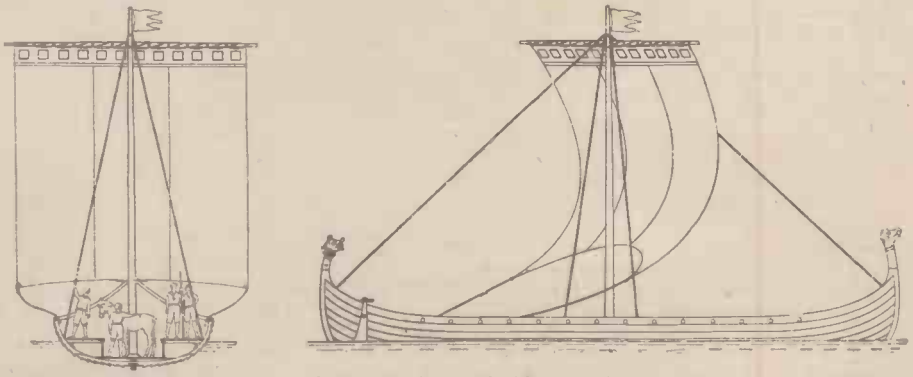
The numerous illustrations of ships and shipping on the tapestry deserve the greatest interest as they are in a position to convey some knowledge of the end of a period of audacious seafaring, and of a high technique in shipbuilding of tribes of nordic blood, who gave the name of "Viking" to a period lasting almost three centuries, i.e., between 500 to 800 A.D. In spite of the fact that the grand fleet of William passed the Channel about 200 years later, and that at this date Normandy was already a French state, and the Normans, being of Danish Viking origin, had already accepted the French language, the needlework can still be considered as embodying the nordic spirit. In the same way the represented ships can be considered as a late offspring of the original Viking ships, in spite of some special characteristics these "invasion" ships obviously possess.

A professor of shipbuilding at the technical university of Danzig, Otto Lienau, is responsible for the technical interpretation and exploitation of this tapestry, and he came to the following conclusions:—

The tapestry can be considered as a true historical document, thus in Fig. 1 in the ships wharf, the construction of the ships is shown starting with the felling of the trees by means of long axes; Fig. 2 shows the journey crossing the Channel with the big ship of the Duke and the smaller ships for the troops; other parts of the tapestry, not illustrated here, show the ships of the Anglo-Saxons, differing from the Norman ships somewhat in size and construction. Experts will easily recognise that the basic type of all these ships is the long, flat and low-bottomed rowing barge of the Vikings. This kind of ship is suitable, corresponding to its original purpose, for both journeys on the high seas, as well as cruising in coastal waters and river estuaries. Shape and construction of these Viking ships are exactly known by the Norwegian excavations of Oseberg, Gokstad, etc.

Constructional Details

These ships were propelled by numerous oars, and a simple rectangular main-yard. Since the illustrations on the tapestry proved to be accurate and reliable reproductions, it was not difficult to come to a realistic reconstruction of these ships. Starting from the side elevation, the only representation of the ships to be found on the tapestry, it is possible to determine the length and the height of the ships, whereas the width had to be indirectly determined by designing the probable cross-section and calculating the stability. The most safe indication for the true length of the ships

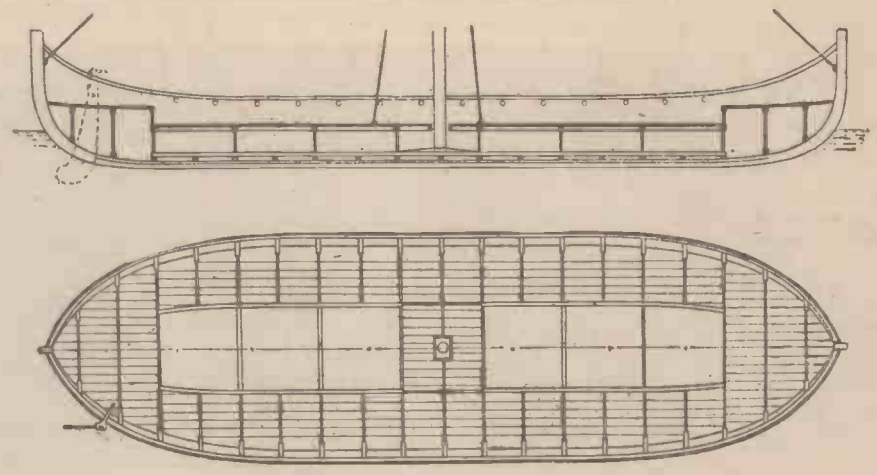


Figs. 3 and 4. Reconstructed cross-section and side elevation of the ship of about 22 yards length, used by men and horses.

are the numbers of tholes along the ship wall, since the persons as well as their shields were not shown true to scale. With an assumed distance of 1.1 yards between the thole-pins and an addition of 3.3. yards for each end of the ship, the total length of a ship with 10 thole-pins is 17.7 yards, and that of a ship with 16 thole-pins 24.3 yards. The bigger ship of the Duke can be assumed to have a length of 26.5 yards, and a very small troopship may have a length of only 11 yards. The height of sides can be assumed from the number of visible planks, the width of each may be 10 in., thus, the side heights become 1.5 to 2.0 yards. The free-board line can be computed from the height of thole-pins above water-line to 0.66 to 0.88 yards, the ship's draught to 0.88 to 1.1 yards. From the size of the horses, placed in transversal direction, the heads of which are just visible above the water line, the position of the ship's bottom could easily be determined, below which the bottom rungs and the keel had to be arranged. Under these assumptions the ship cross-section Fig. 3 was obtained, and the dimensions were in good proportion to those calculated.

The width of the ship could be calculated from a ratio of length to width necessary for the stability of the vessel, and this was assumed to be between 3.5 to 4.0 yards. The appearance of these smart vessels in the water and under sail may have corresponded to the view given in Fig. 4. For the leader ship of 22 yard length, the main dimensions were approximately as follows:—

Length overall, 22.00 yards.
Width over the ribs, 6.05 yards.
Side-heights at the keel, 2.00 yards.
Draught at the keel, 1.10 yards.
Number of oars, 28.
Length at waterline, 21.00 yards.
Width at water line, 5.50 yards.
Side-height without keel, 1.76 yards.
Displacement, 38 tons.
Number of horses to be carried, 12.
Carrying capacity, 22 tons.



Figs. 5 and 6. Reconstructed side-section and top view of the ship shown in Figs. 3 and 4.

For this calculation the weight of the armed man was assumed to be 263 lb., and that of a horse to be 1,650 lb. The larger ships had a deck, partly or fully detachable, in the apertures of which the horses were standing; arms and food were placed on the ship's bottom.

The reconstructed ships show harmonic and efficient forms, with relatively low water resistance. The wooden construction obviously corresponds to that of the Viking epoch. The high oak keel was provided with a beautifully curved stem with numerous ornaments. The cross-rafters were cut from natural compass-timber, over which the clincher work was placed. The oak planks were not sawn, but split off the trunk, as clearly shown in Fig. 1; this illustration also shows the smoothing of the planks.

The "Viking Armada"

Exaggerated data quoted in literature estimate the armada to 3,000 ships and 60,000 men, but more cautious estimates are 750 ships and 15,000 men, an army already quite big for these ancient times. In any case, the cavalry was quite numerous, and they actually brought the decision. Therefore, quite a big ship's space had to be provided for the transport of the horses. As a matter of fact, all ships, with the exception of that for the Duke, had accommodation for horses.

The sailing qualities of these ships may have been very low, owing to the primitive yard. Therefore, for the invasion, a passage was selected which led with great reliability to the English coast, complete utilisation of the direction of the gulf-stream and the west and south-west winds expected during the autumn. The only danger was that the ships would have been driven into the North Sea. For this reason, the invasion planned for the August had to be postponed till the end of September 1066.

Food from the Heavens

Feeding the Army from the Air

THE tasks of the Air Force and its adaptability are constantly increasing. Apart from attack and defence, observation, aerial photography, the transport of troops and the distribution of propaganda, the dropping of food supplies is now recognised as an important part of the airman's work.

The wars in Spain and in China have shown that the danger of long lines of communication are considerably lessened by the possession of fast planes equipped for the transport of supplies.

The supplies—mainly tinned food, cigarettes, sugar and such like—are put in a cylinder-shaped metal container, a parachute is attached to it, and the container is then fixed to the aircraft. By simply pressing a lever on the controls, the pilot releases the "bomb" which drops, while the parachute automatically opens. Safely, the container floats to earth, and by skill and training, a high degree of accuracy in dropping the cylinders over a required spot can be attained.

To the troops supplies thus received are something like Manna must have been to the Israelites in the desert. It is a gift from the Heavens, a modern miracle worked by the progress of our civilisation. The R.A.F. station at Old Sarum, Salisbury. Wilts., carries out exercises of supply dropping, and the accompanying illustration shows R.A.F. men loading up at one of their demonstrations.

Attaching the container to the aircraft. They can be released like bombs by simply pressing a lever on the controls

Squaring The Circle

The Meaning and Significance of an Age-Old Enigma.

THE famous problem of squaring the circle, although it is inherently a theoretical one, has always had many essentially practical bearings. Without a fairly exact knowledge of the ratio of the diameter of a circle to its circumference, a great mass of our present-day vital calculations would be impossible. Actually, however, it has always been impossible to calculate this ratio precisely. Indeed, no attempt to work out the above fundamental ratio can be carried out without a deep and a competent knowledge of higher mathematics, and, given even these qualifications, the would-be solver of this problem will inevitably fail in his task, for the problem is quite an insoluble one.

The expression "squaring the circle" denotes the constructing of a square equal in area to a given circle. Sometimes the problem is referred to as that of the "rectification" of the circle or the "quadrature" of the circle. These two terms ordinarily have rather different meanings. The former refers to the determination of the length of a circle's circumference in terms of its diameter, or, in other words, of finding the ratio existing between the circumference and the diameter of a circle, whilst the latter term, the "quadrature" of the circle, denotes the finding of the area of a circle in terms of its diameter.

These problems depend essentially upon the accurate determination of the circumference-diameter ratio of the circle, and the more accurately the latter ratio can be expressed, the greater becomes the degree of precision with which these problems can be solved in any given instance.

The importance of the problem from a mathematical standpoint has long impressed itself upon the minds of thinkers. So far as we can ascertain, the whole problem goes back in recorded history for some 3,000 years.

Every schoolboy knows that the ratio between the diameter and the circumference of a circle is conventially expressed by the Greek letter π (pronounced "*pie*"), which is the initial letter of the Greek word *peri*, meaning "around." π has been used as the symbol for this strange mathematical ratio from the seventeenth century.

In Babylonian Times

Early in the world's recorded history, the Babylonian philosophers tackled the circumference-diameter ratio problem. They came to the conclusion that this ratio was 3. In other words, that $\pi = 3$. Apparently, these early thinkers were deceived by the fact that, by means of a pair of compasses, it is possible to measure the radius of a circle exactly six times around the circumference. And because the radius is half the length of the diameter of a circle, the Babylonians concluded that the length of the circumference of a circle is equal to three times the length of its diameter.

This conclusion was held for centuries. One even finds indirect references to it in the Bible and in the Jewish Talmud, whilst, even at the present day, a few rule-of-thumb craftsmen sometimes pin their faith to it.

It is obvious, however, that when the radius of a circle is stepped around the circumference by means of a pair of compasses or dividers, the successive steps do not follow the curvature of the circle's circumference but are actually six short cuts (or "chords"), as indicated in the accompanying diagram.

The ancient Greeks were the first mathematicians to give extensive thought to the problem of the circumference-diameter ratio of a circle. At least half a dozen of their famous philosophers tackled the problem in one way or another. By means of geometrical and arithmetical methods they ascertained, as a result of their combined work, that the ratio which we nowadays call π must lie somewhere between 3 10/70 and 3 10/71, or, expressed in decimals, between 3.142857 and 3.140845. The Greeks, therefore, employed the approximation 3 1/7 for the value of π.

Aryabhatta, a Hindu mathematician of the

Archimedes, the ancient Greek mathematician and philosopher.

sixth century A.D., gave as the value of π $\frac{62832}{20000}$ or 3.1416, whilst a Chinese philosopher of approximately the same period, one Tsu Ch'ung-chih, announced confidently that the elusive ratio lay between 3.1415927 and 3.1415926, an approximation which was correct to six places of decimals.

Through the ensuing ages many would-be circle-squarers and solvers of π arose, had their say, and vanished.

A certain Dutchman, Jacob Marcelis by name, who was a famous soap maker, made an especial claim to having discovered the true value of π. He assessed it as:—

$$3\ \frac{1008449087377541679894282184894}{3997183637540819440035239271702}$$

After a vast amount of mathematical labour, Ludolph von Ceulen (1539-1610) obtained the value of π correct to 35 decimal places. He was so pleased with his feat that he gave instructions for this calculated value of π to be engraved on his tombstone. Ludolph's fame has managed to persist, for, in Germany, π is still termed the "Ludolphian number."

Archimedes

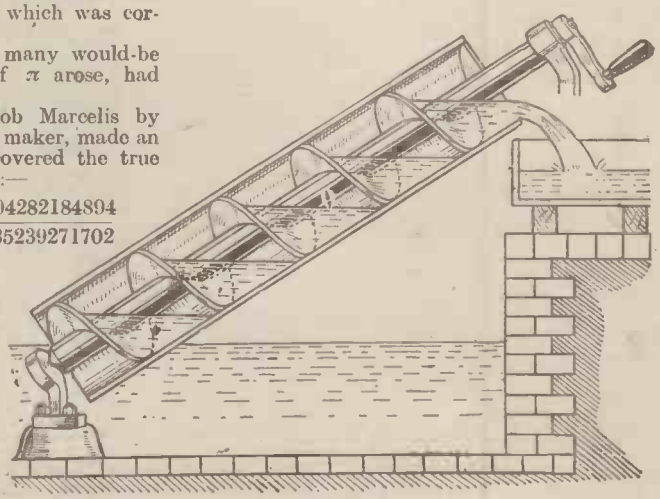
Most of these circle-squarers worked on a method originally devised by the Greek, Archimedes, which consisted in constructing polygons having a large number of sides, by means of which it became possible to measure approximately the length of a circle's circumference piece by piece. The greater number of sides a polygon had, the greater was the accuracy with which the ratio π could be evaluated. One circle-squarer, Adrianus Romanus (1561-1615) actually undertook the task of finding the perimeter (or boundary line) of a polygon having a thousand million sides!

Owing to the advances of trigonometry it became, in time, possible to attain closer approximations to π without having to undertake Archimedes' cyclo-polygonal method of assessment. With the growth of the higher mathematics which took place after the time of Newton and Leibniz, the inventors of the calculus, π, the circle circumference-diameter ratio, was many times worked out to an ever-increasing degree of accuracy. Yet, curiously enough, the ratio could never be determined out *exactly*. A few thinkers, particularly the Scottish mathematician, James Gregory (1638-1675), attempted to prove that the solving of π was impossible. Despite such endeavours, however, the pursuit of π went on continually. It proceeded through the 18th and into the 19th century. In the middle of the latter century, Zacharias Dase, of Hamburg, worked out π to 200 places of decimals. Another German, named Richter, went many stages further, and calculated out the elusive ratio to 500 decimal places.

William Shanks

But the laurels for patience and ingenuity in this circle-squaring business must surely be given for all time to a Britisher, one William Shanks, who, in 1873, worked out the value of π to no fewer than 707 places of decimals!

Still the value refused to work out completely. Shanks spent many long and weary years over his project, and his disappointment when he arrived at his 707th decimal place and finally, in despair, threw up his prolonged



The invention of the screw is attributed to Archimedes, the first approximately successful circle squarer. The illustration shows an early form of Archimedes' screw for water raising.

chain of calculations, is said to have been of the bitterest kind.

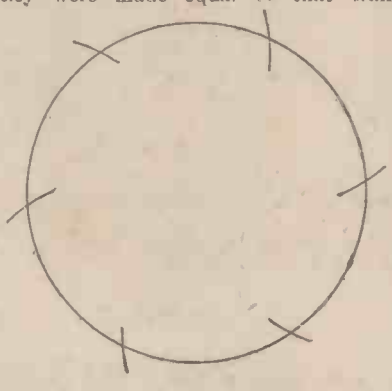
And that is as far as the orthodox and legitimate circle-squarers ever got. True it is that there have been several amateur solvers of π who have, from time to time, convinced themselves and some sections of the public that they have hit upon the secret of the circle-squaring business. Perhaps the most famous of these semi-charlatans was a certain James Smith, a rich Liverpool business man of the last century. Smith was badly bitten by the π bug. He considered that he had solved the ancient problem and that π could be worked out exactly at $3\frac{1}{8}$. In other words, according to James Smith, the circumference of a circle is exactly $3\frac{1}{8}$ times its diameter.

Smith became absolutely obsessed with his "wonderful" discovery. He issued books and pamphlets galore on the subject, and he almost became a public nuisance. Scientific societies (including even the British Association) allowed him to lecture before them in the hopes, perhaps, that he might by chance become self-convinced of his own errors. To the end of his days, however, James Smith remained confident that $\pi=3\frac{1}{8}$, and even the carefully and earnestly reasoned proofs of eminent mathematicians of his day failed to move him from his rock of self-satisfaction on this score.

"Transcendental" Number

The last quarter of the nineteenth century saw the final close of the pursuit of π. In 1882, a German mathematician named Lindemann offered the final proofs of his assertion that π is "transcendental," a fact which mathematicians had long been inclined to suspect, and even, indeed, to hope for!

It is difficult to explain without a good deal of mathematical formulae the precise meaning of a "transcendental" number. In brief, however, a transcendental number is one which cannot comprise the roots of an algebraic equation having rational coefficients. In other words, there is no possible sort of an equation having a transcendental number for a root which would check if its unknown quantity were made equal to that transcendental number.



Showing the age-old mode of stepping off the radius of a circle six times around its circumference, the results of which formed the very earliest estimate of the circle diameter-circumference ratio problem.

And so has ended the long search after the exact value of π. For practical purposes, of course, π, the ratio of the circumference to the diameter of a circle is taken as 3.1415, and, in actual fact, the ratio lies between 3.141592 and 3.141593, but if anyone tries to work out this value to an ultimate conclusion, the task will be found to be an impossible one.

All modern mathematicians nowadays accept the proofs of Lindemann to the effect that the exact value of π is transcendental, and that it can never be worked out.

William Shanks, we may remember, worked out π to no less than 707 places of decimals. Using his methods, it might be possible for any reader of this article (if his life were long enough) to work out π to 707 *million* places of decimals, yet even when he had arrived at that fantastic limit, the true and exact value of π would still elude him.

By working out π to a vast number of decimal places we may, of course, attain an ever closer approximation to its true value. Yet, no matter to how many decimal places we may take our patient evaluation of this semi-mystic ratio, we shall never know its exact value.

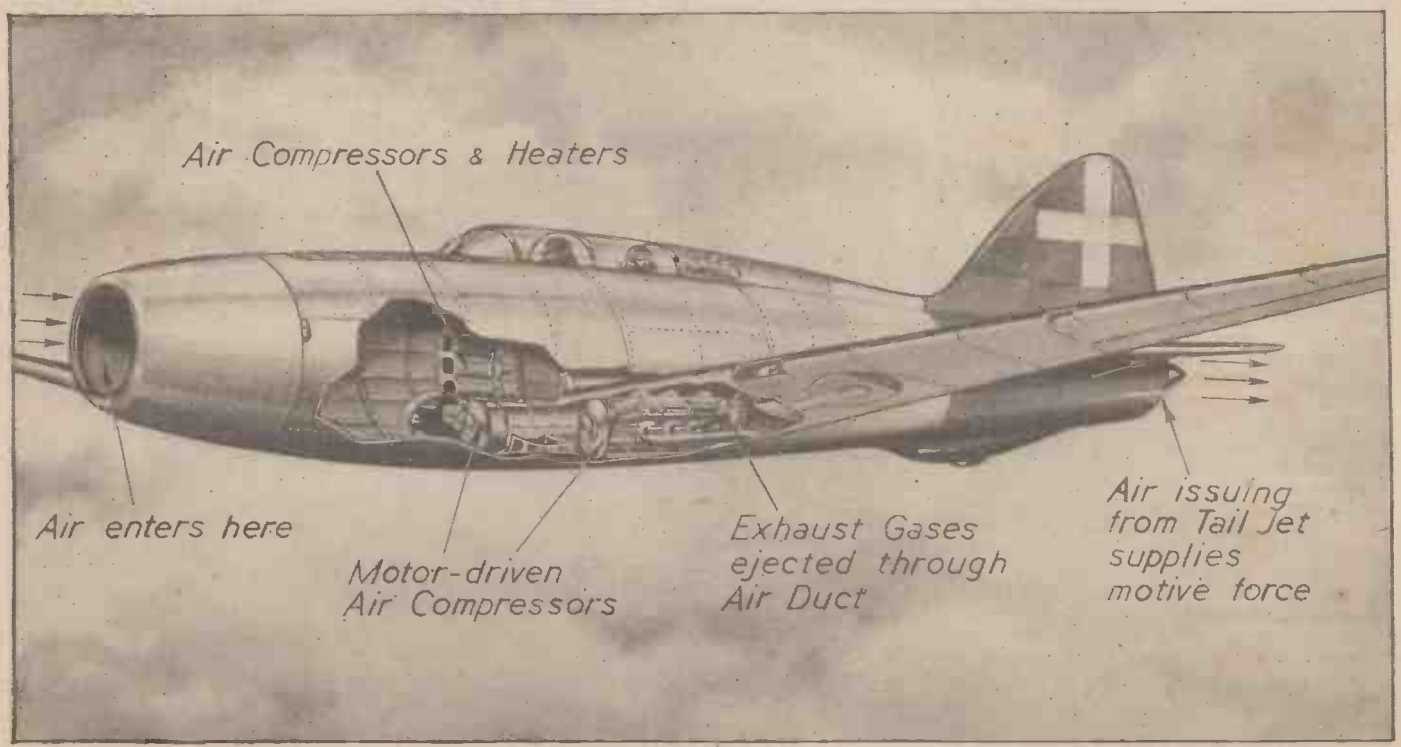
Problem is Insoluble

π is undeterminable. The circle is unsquarable. No doubt an Infinite Mind could realise the essential value of π. Nevertheless, the value of this ratio is beyond the range of our intellectual equipment.

Rather paradoxically, modern mathematical science has solved the age-old problem of circle-squaring by demonstrating that the problem is inherently insoluble. And there the matter rests. For all conceivable practical purposes, of course, we know that the value of π is 3.1415.

Modern mathematics has chased π out of its realm and over to the domain of philosophy. What that system of knowledge will, in the years to come, make of this mystic value, no one can tell, but, quite definitely, philosophy will never succeed in squaring the circle when scientific mathematics has so consistently failed to do so.

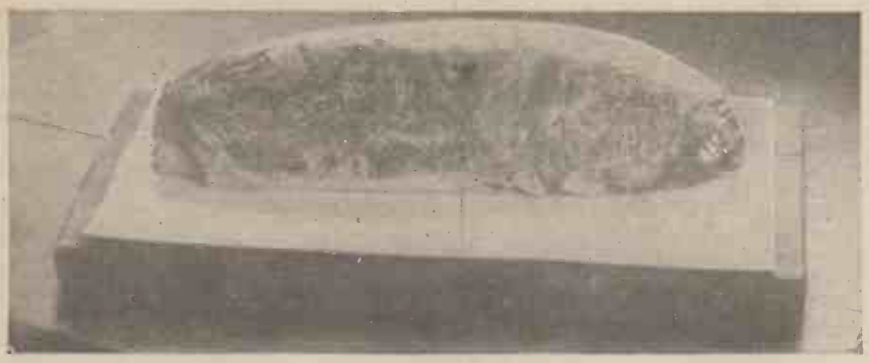
A JET PROPELLED AEROPLANE



The Italians in August 1940, at the Taliedo Aerodrome, flew the Caproni-Campini C.C.1 jet-propelled aeroplane, and it was flown by Colonel Mario de Bernardi. The Schneider Trophy Pilot flew the new aeroplane for 10 minutes or so. Experiments have continued since that time, and Signor Secondo Campini about a year ago designed and constructed a jet-propelled aircraft on somewhat larger lines, and incorporating the results of his experiments with C.C.1. The new machine is known as C.C.2, an illustration of which is given above. It is a two-seater aircraft with pilot and observer seated in tandem, and it is of low wing design with outward retracting under-carriage, and enclosed cockpit, and single fin and rudder. It has no airscrew, and weighs about 11,000 lbs.

Sidelights on Solids

Some Little-realised Facts Concerning the Marvellous Make-up of Solid Bodies and the Forces at Work Within Them.



A mass of hard bitumen which is brittle and shatters like glass when struck by a hammer, will, if left to itself, "flow" like a liquid, thus proving the intense activities of its constituent molecules

TURN on a gas tap ever so slightly in a room, and you will quickly be made aware of the fact that some additional material has mingled with the air of the room.

"The gas is escaping," another individual would observe upon entering the room and immediately detecting its strong and characteristic odour.

In like manner, one quickly observes the escape of water from a cracked and leaky vessel or from a burst pipe.

The two phenomena of escaping gases and flowing liquids are so common in everyday life that we think nothing of them. Yet we know by our own experience that it takes a three-sided vessel to contain a liquid, whilst a gas or a vapour is only to be contained within a four-sided enclosure.

In other words, gases and liquids invariably, when they are freed from restraint, refuse to stay where they are. Always they tend to move about here, there, and everywhere in quite a haphazard manner.

Groups of Atoms

The reason for this we know well. Gases, vapours, and liquids are all intrinsically made up of groups of atoms called "molecules," which are endowed with a species of perpetual motion. The molecules are always moving about in apparently haphazard directions. In a gas the molecules are widely spaced, and although there exists some attraction between molecule and molecule, this attraction is a very weak one. Consequently, a gas instantly tends to dissipate itself, its constituent particles are molecules flying apart in all directions unless they are prevented from so going by the walls of a container.

In the case of liquids, too, affairs are somewhat similar, although, in such instances, the molecules are closer together and the attraction between them is proportionately stronger. Hence it is that liquids do not dissipate themselves into space like a gas does immediately they are freed from restraining forces. Nevertheless, in view of the great mobility of their molecules, all fluids are more or less exceedingly mobile; so much so that they are able to run about in three directions out of four.

Gyrating Molecules

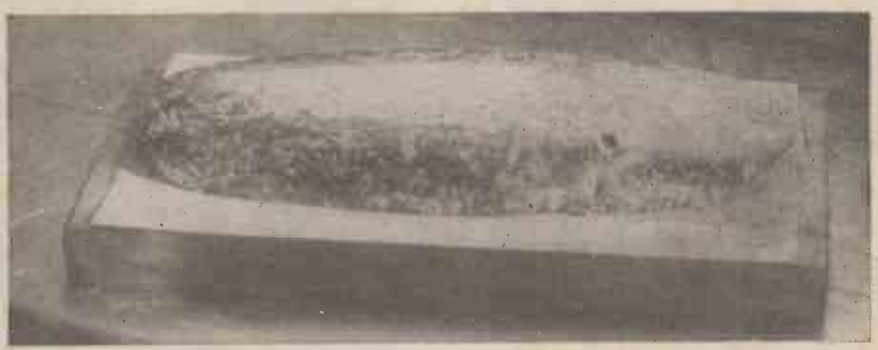
With solid bodies, however, the case is very different. A solid object is made up of almost infinitely tiny constituent particles called "molecules," just as a gas or a liquid is composed of these particles. But the molecules of a solid are packed together very much more closely than they are in a liquid. True it is that the molecules of a solid have some liberty of movement. Indeed, could we but see into the inner and visually unrevealed texture of the most massive steel girder we should at once realise it to be a shimmering mass of dancing and gyrating molecules.

We talk glibly enough of solid bodies and of massive constructions, but, in reality, for all our pride in our creations, there is nothing in this world which is really solid, really substantial.

Steel

A bar of the hardest, stoutest steel is made up inwardly on exactly the same principle as the most tenuous gas. Both the wisp of vapour and the solid steel bar are composed of masses of whirling, gyrating molecules. The only difference between the two in principle is that the molecules of the steel bar are situated more closely together and are strongly attracted to one another. Yet between molecule and molecule of the steel bar there exists a void space, a sort of private and inviolate territory which the molecule can call its very own and in which it can dance, vibrate, gyrate, and move, as it were, to its heart's content.

Even, therefore, in what we regard as the most solid of solid materials, such as steel or platinum or weathered rock, the molecules never touch. Indeed, each individual molecule in a solid body very greatly resents any approach on the part of an adjacent molecule into its own private territory. That is why solid bodies are almost completely incompressible.



The mass of bitumen after remaining undisturbed for a month

The bitumen after three months

Altering Shape of Solids

We can, of course, compress paper, feathers, wool, and similar material into a very small space, but in such cases we are not actually compressing the solid material. We are only altering its outward physical form.

Even exceedingly high pressures achieved by powerful hydraulic machines make exceedingly little difference to the determination of the molecules of a solid not to be pushed nearer together. Solids are to all intents and purposes incompressible, even, indeed, in the face of compulsion in its direst forms.

But whilst solids invariably refuse to be compressed to any appreciable extent, they sometimes admit other particles to their inner molecular voids. Quite a number of solid bodies absorb gases and vapours. The metal palladium, for instance, can be made to take up about 300 times its own volume of hydrogen at ordinary temperatures.

A Simple Experiment

There is a very simple experiment which

shows that additional particles may enter into the void spaces within a mass of matter without making any difference to the actual volume of that matter. Take a perfectly clean wine glass and fill it to the very brim with water. Now take a lump of sugar and very gently lower it in contact with the water surface. With care—and patience—it will be found possible to dissolve the sugar in the water without the latter increasing in volume and overflowing the brim of the wine glass.

Obviously, in this instance, the sugar particles have fitted themselves in between the spaces existing between the water molecules. The water molecules have not in any way been compressed, but they have allowed foreign particles to come between them.

Gas Molecules

In just this same manner, gas molecules can enter between the constituent molecules of solids, and, in actual fact, there are ordinarily very few solids which do not contain numbers of gas particles thus disposed.

The molecules of solids are all endowed with vital and enormous energies. They are all pulling at one another, one this way, another that way, and still another a third way. But usually all these molecular pulls exactly balance, so that all the molecules keep their average places relative to one another.

In a few types of solids these powerful molecular pulls are not balanced. There exists a sort of strain among the molecules, one set of molecules tending to pull more powerfully than the opposing set. The consequence of this is that when the system of molecules suffers any sharp shock, such as being suddenly heated, or banged in any way, all the molecules sever forces and instantly fly apart in all directions with a very high velocity and with enormous energy content.

Such a phenomenon constitutes an explosion, but, fortunately, explosive bodies are very much in the minority among solids and they constitute special cases of their own.

Reaction of Molecules

The reactions of the individual molecules of solid bodies are very interesting to realise. Suppose, for instance, a force is applied to the solid body which is much too strong for it. In this instance, the solid material simply breaks, shatters to pieces, as, for example, when a mass of glass or pitch or resin or some brittle metal like bismuth is scattered to pieces by a single hammer blow. Here, the individual molecules making up the solid have possessed little enduring attraction between themselves, with the result that they have parted readily at the invasion of a superior force.

Suppose, however, we give a lead pipe or a mass of this metal a blow with a heavy instrument. Usually, the pipe or the other mass of lead is merely dented. The molecules have kept together, but have merely changed their formation somewhat.

If, however, we strike an iron or steel bar with a similar hammer, there is no change. The iron or steel molecules successfully resist the blow in most cases, and they remain unconquered by the attacking force.

Another Class

There is still another class of solid materials whose molecules show a very remarkable type of behaviour. These are the elastic bodies, chief among which is rubber. If we stretch a piece of rubber, it yields to the superior force, but it returns to its former length after the stretching force has been released.

In this instance, the constituent molecules of the rubber follow the direction of the pull. They keep together and they do not permit of any fracture of the material to be set up. Yet the individual molecules are not happy in their new positions, for immediately you cease to exert a superior pull, the molecules instantly return almost to their former positions.

Note the word *almost*. The molecules do not return exactly to their original positions in a mass of rubber or other elastic body after the superior stretching or indenting force has been removed. Indeed, every time such a stretching force is applied, the molecules are less able to return to their original positions. It is for this sole reason that a piece of rubber thread loses its characteristic elasticity in time, the molecules eventually giving up the attempt to regain their former positions.

Elasticity

All solid bodies are elastic to a certain degree. Even the most rigid bar of tough steel can, by means of powerful machines, be stretched slightly and, provided that the stretching is not overdone, the steel bar will actually return almost to its original dimensions after the stretching force has been taken away.

Glass, too, is similarly elastic. You can bend an ordinary sheet of glass very considerably without breaking it if you make the experiment with care.

Owing to the attractions between molecule and molecule in solids, all such materials "stay put" when allowed to remain at rest. At least, in most instances they remain immobile. Yet, there are a few solids, such as

One or more lumps of sugar can be dissolved in a wine-glass of water filled to the brim, thereby proving that the sugar particles take their places between the water molecules, without altering the volume of the liquid

pitch and certain kinds of bitumen, which, although they are hard and even brittle, actually "creep" like a very slow-moving liquid when allowed to remain undisturbed for a period of weeks or months. Here, clearly enough, we are confronted with instances of excessive molecular activity, the individual molecules of the material doing their best to move away to other spheres in a sort of feeble imitation of liquid and gas molecules.

Again, if we place a plate of gold in firm contact with a plate of lead and allow the two plates to remain undisturbed for a few months, it will then be possible to detect traces of gold in the lead and minute amounts of lead in the gold, thus proving that the molecules of both metals had undertaken a species of localised migration in consequence of their inherent activities.

Evaporation of Solids

Some solids even evaporate when left to themselves. Take iodine, camphor, naphthalene, for instance. Place any of these materials on a plate in a warm room, and day by day you will be able to note their diminishing size. Here, of course, the activities of the molecules is so great that they jump off into space from the surfaces of the solid materials, thus causing the gradual disappearance of the solids.

Just as the molecules of solids resist compressive powers to the utmost and refuse to be pushed nearer to one another, so, also, are they able to withstand pulling-apart forces. It gives much food for thought when one quietly reflects upon the fact that the tractive power of a high-speed railway locomotive is transmitted to its carriages through the agency of the molecules existing in a steel coupling bar or hook. The locomotive is ever tending to pull the steel molecules in a forward direction, whilst the mass weight of the carriages is tending to resist this pull. Naturally, the superior power of the locomotive wins the day, yet this force is transmitted actually through the void spaces existing within the molecules of the steel coupling bar or hook. One molecule or set of molecules follows the direction of the locomotive's pull, and this set of molecules exerts a pull on the molecules immediately adjacent and to the rear of it. Thus the pulling process goes on, the molecule being linked up to one another tandem fashion, like a succession of wagons making up a goods train.

"Action at a Distance"

But exactly how the force of the locomotive is transmitted through the voids existing between molecule and molecule of its steel coupling device is a matter which nobody can tell. "Action at a distance" between molecule and molecule is equally as mysterious as it is between the heavenly bodies, and until we know exactly the mechanism whereby the sun retains the earth in its orbit we can hardly expect to comprehend why metals and other solid bodies are able to sustain and transmit powerful forces despite the fact that such solids are nothing more than assemblies of myriads of individual and space-separated molecules each pursuing an individual existence.

Burton's Experiment

The fact that the molecules of solid bodies do exert an attraction upon one another can be proved experimentally. Many years ago an experimenter named Burton made a number of copper cubes, which were ground with as smooth and as level surfaces as possible. The cubes were placed one on top of the other—about a dozen of them. It was found that the whole pile of cubes could be lifted merely by lifting the top cube. Here, of course, the adhesion between cube and cube was consequent upon the attraction of the molecules in the individual cubes.

It is a fact that, provided one solid can really "get a grip upon" another solid, the two will remain in union, quite apart from any question of external air pressure upon them.

If, for example, we take a small piece of lead having a carefully levelled surface and press it downwards (with a screwing movement) on to the surface of a piece of marble, the two objects will often adhere so strongly that considerable force will be required to separate them.

Here, the molecules have got a grip on one another and, due to their mutual attractions, the two dissimilar articles cling together.

PHOTOGRAPHY

Improving Faulty Negatives

The Process of Intensification Explained

By JOHN J. CURTIS A.R.P.S.

IT is quite safe to say that every photographer, no matter how expert, will from time to time make mistakes in judging exposure, and also in developing; the result of these errors being that in the collection of negatives there will be found some that cannot give satisfactory prints, no matter what paper or process is used. There are those which give flat, uninteresting prints lacking in sparkle or brilliance in the image, while others are so very dense that it is almost impossible to get anything in the nature of an image on the paper unless a high-power light is used, or considerable time allowed for the printing.

It must be understood that no matter how good any after-treatment may be, it is fruitless to imagine that a perfect negative can be obtained from one that in its initial stages has suffered from under- or over-exposure; some improvement may be made as regards its printing value, and in the case of an over- or under-developed film it is often remarkable what improvement can be made, but if an exposure has been so poor as to prevent the light acting sufficiently on the silver in the emulsion, it is impossible for chemicals to take the place of the light and complete the reaction.

I am not one of those who believe in keeping every negative whether it be good, bad or indifferent; but before I consign one to the rubbish heap, I do carefully investigate the possibilities of intensifying or reducing it, and if there is the chance of even a slight improvement, then it is put on one side until this attention can be given. If there is not a satisfactory response, then no more time is wasted, and that film is literally "fired."

First, we should have some idea of what is meant by intensification, and what we are striving for when putting a negative through this process.

Thin Negatives

The negative in mind is one that is very thin, the image can be seen, but mostly outline with loss of some detail, and even when printed on a vigorous grade of gaslight paper it only gives a poor and disappointing print. It is not always easy to decide whether the trouble is the result of under-exposure or under-development; long experience makes one examine any small details discernible, and also the gradation that can be traced. If it is a subject where there are strong contrasts, such as a bright sky and deep shadows, and there is a complete absence of detail in those shadows, it is fairly safe to assume that there has been a mistake in exposure, or that the subject was one that, owing to lighting conditions, was out of the range of possibility, and that the emulsion could not give the desired rendering.

Those who are using the Johnsons method of time development will have the satisfaction of knowing that the majority of their faulty negatives are due to exposure errors, for the "time" method of development is the surest way of preventing development mistakes.

Intensification seeks to build up the visible image by means of a deposit of some other salt, or by a chemical change, making it denser so that greater control in printing is obtained, and a fair range of tones in the greys and blacks secured with clean whites; such a result is what we all aim for in our prints.

There are quite a number of intensifiers, but it is a mistake to lumber the shelves of our darkrooms with stacks of bottles of unused and undesirable chemicals; therefore, I only give particulars of the two most simple, and which I know to be useful intensifiers, and which are both free from any scheduled poison.

The Chromium Process

This is one of the most convenient and efficient, and is a two-bath process, the negative being first bleached and then re-developed.

Two solutions are required for the bleacher, which is prepared as follows:

(1) Potassium Bichromate, 240 grains.
Water, 10 ounces.

(2) Acid Hydrochloric, pure, 1 ounce.
Water, 10 ounces.

These stock solutions will keep indefinitely, but the working solution must be prepared at the time of using, as it will only work satisfactorily when fresh.

When moderate intensification is desired, take equal parts of Nos. 1 and 2, and add 6 parts of water; if slight increase is wanted, take one part No. 1 and 4 parts No. 2 and 6 parts water. For considerable intensification, use 1 part No. 1 to ½ part No. 2 and 6 parts water; the weaker the bleacher, the stronger the intensification.

Metol-Hydroquinone

The negative, which must have been thoroughly fixed and washed, is placed in the bleacher solution until the black image has completely disappeared; it is then removed and washed until no yellow stain occurs in the water and is then re-developed in any non-staining developer, such as the Metol-Quinol formula made up as follows:—

Metol, 30 grains.
Hydroquinone, 60 grains.
Soda Sulphite Recryst., 1 ounce.
Potass. Bromide, 4 grains.
Soda Carbonate Rec., 1 ounce.
Water, 20 ounces.

For use, take one part of this solution and add one part of water.

Very soon after the bleached negative is placed in this bath it will begin to re-blacken, and when this blackening has completely covered the film, then intensification starts, and the film should be left in it for at least five minutes; it is then removed and washed, and if the intensification is not sufficient, the process of both bleaching and re-developing can be repeated until it is impossible to add any more density to the image. Should you have the experience of over-intensifying the film, which is very unlikely, then it is possible to reduce it by the ferricyanide process mentioned later.

Uranium Intensifier

I think most readers will recognise that this is the most simple formula, and as it is probably the most popular, I would advise you to have some of the solution always handy.

(1) Uranium Nitrate, 100 grains.
Water, 10 ounces.

(2) Potassium Ferricyanide, 100 grains.
Water, 10 ounces.

Take 4 ounces of each of these stock solutions and add to the mixture one ounce of acid acetic glacial. Place the well-washed negative in this and in a very short time you will see that the image takes a reddish or orange colour; leave it in for a few minutes, then remove it to a bowl of water for washing, which washing must not be done with running water, but in several changes in a bowl o dish until the water is no longer discoloured.

Should you desire to restore the negative to its original state by removing the intensification, place it in a weak solution of soda carbonate, say I ounce to 20 ounces of water. Probably at some future date you may wish to again intensify the film, this can be done by first washing it in clean water, and then immersing it in an acid acetic bath about one part acid to 20 parts water, and transferring it to the uranium working solution.

A print from an intensified negative

Ready Prepared Solutions

To those who do not wish to make their own solutions, it is possible to obtain these formulae already prepared. Re-developer is supplied in solution, tablets, and as pactums; any chemist or dealer stocking Johnson's

preparations will have them. If desired, you can purchase the bleacher in the form of Chromium Intensifier Tablets, and use your own particular developer.

The Uranium Intensifier is sold in solution, in 4 and 8 ounce bottles, ready for use, and it can be kept until it becomes exhausted.

You will have noticed that I recommend thorough washing of the film before starting the intensification; this is important for two reasons, first there must not be any suggestion of hypo in the emulsion, and secondly, unless the film has been very well soaked it will tend to bleach or stain in patches, and if this occurs you are taking the risk of spoiling it altogether. Should a negative which has been through the uranium bath dry unevenly and leave patches, treat it to the weak soda carbonate bath, and remove all traces of the intensification, and then put it through the process again. There is one other hint which may be useful; if the uranium bath has given too much density, and you are finding difficulty in printing, lay the negative in a bath of clean water—see that it is submerged—and leave it for five minutes; then change the water and leave it for a further period. You should now find that the colour of the film is reduced, and this will make it easier to print, especially if you are using it in an enlarger.

The Death Ray

Its Meaning and Possibilities Explained.

By Professor A. M. LOW

FROM time to time we read of the "invention" of a death ray, and, although no such ray has yet been used in warfare, most people are ready to believe that it may appear as a new weapon in the near future. The pictures drawn by novelists in speculative stories of men mown down by a beam projected from something like a searchlight, or of aeroplanes brought down by mere contact with such a beam, are actually far removed from present possibilities. From the scientific point of view, a death ray is not a likely invention of the immediate future. Its invention presupposes a degree of knowledge that we do not possess, and its early existence would probably be of far greater importance in the realm of communication than of war. The invention of a death ray might mean that we could transmit light or heat by the ether over considerable distances, and the value to the inventor of his device for purely commercial purposes would far exceed any reward a government would be likely to give for it as a military weapon. The invention, in fact, would be worth a million pounds to any wireless undertaking. Beam radio implies not an actual beam but a fan-shaped area of radiation.

What it Means

What do we mean by a death ray? If we take all the fictional pictures that have been drawn, we can say that by a death ray the average man means the projection through the air of a beam that destroys human beings whom it touches, disorganises the electrical equipment of aeroplanes so that they are forced down, or even melts their metal parts so that they disintegrate in the air. This suggests the transmission of a tremendous amount of energy. As to the form in which it is to be transmitted, novelists are less explicit.

Cosmic Rays

Our review of the various "rays" or groups of frequencies at present known, ranging from the miles-long waves of wireless to the very short waves of cosmic rays, reveals no ray likely to meet our needs. Cosmic rays, gamma rays, and, to a lesser degree, X-Rays, have considerable powers of penetration; but their range is comparatively short, and the power required to produce the more lethal frequencies is very high compared with the energy of the resulting rays. The qualification of range must be excepted for cosmic rays, but there is no known method of producing these "oscillations" artificially, and calculations suggest that a power of millions of volts would be required. We could use these rays to kill people, but the process would be very slow, and we should have to ensure that our enemies remained quite still while the rays were applied. It is unlikely, to put it moderately, that anyone would stand still for three or four days while he was "sprayed" with X-rays.

Heat Rays

When we come to the longer rays, we find various types, such as heat rays, able to cause death under certain conditions, but these circumstances are far removed from those likely to be found in war. In one "death ray" which was demonstrated some time ago, the apparatus was essentially a concave mirror for focussing heat rays. It is true that a dog was killed in the demonstration, but the unfortunate animal was tied to one spot, and the process took longer than would be possible in battle. Moreover, the "range" was only a few yards.

Wireless Waves

We come next to the group of frequencies which are classed as wireless waves. Some of these have been utilised for destroying insects, and the fact that certain frequencies can raise the temperature of human beings has been made use of medically. If the temperature were raised for a long enough period, death would result. Here, again, the present range of the frequencies is a matter of inches rather than miles. A revolver, or even a sword, would be a more effective weapon.

The longer wave-lengths offer little hope of a death ray unless the energy can be conserved and transmitted in a true beam so that the greater part of the energy from the transmitter travels to a small point. We speak of "beam wireless," but this is entirely relative. Nothing like a true beam can be achieved over a distance of miles. The proportion of the energy from any transmitter that strikes a particular point is so small that, with the most favourable conditions for reception—an aerial—the energy has to be amplified many thousands of times to be sufficient to work a loudspeaker. The discovery of a method of transmitting energy would, perhaps, result in a death ray, but it would also be of first-rate commercial importance, since it would enable us to dispense with wires in transmitting electricity for lighting, heating, and power. We should be able to run our motor cars with a simple electric motor or light a lamp by means of a small aerial connected to the bulb. Surely, in such a golden age, men would not trouble about death rays. But, even if the did, they would require that their enemies should erect some sort of aerial for the reception of energy. This is not only incredible, but it is far more likely that protective clothing would be designed so that the energy should not be received at all.

Wireless Control

As regards "death rays" which have as their object the interference with the electrical equipment of internal combustion engines, the same difficulty holds good. The stopping of a motor-cycle by a ray of this kind has been demonstrated. It turned out to be nothing more than a method of wireless control. On the motor-cycle was a device for receiving signals and, working through relays, the engine was shut off as described when dealing with wireless control. Useful as this may be for the latter purpose, it has no bearing on the death rays as generally understood. An enemy plane would not carry special apparatus for ensuring its destruction. It is more likely to be equipped with some protective device to ensure that no power was collected. Given freedom to arrange suitable apparatus, it would not be difficult to blow up a ship by a "ray" at a distance of many miles, but, as far as warfare is concerned, this has no practical application as yet.

An Interesting Experiment

Many experimenters are at work on what has proved to be a singularly fascinating subject. The most hopeful line seems to be the production of a ray, perhaps of some form of light, along which the energy can be transmitted; an "invisible wire." But achievement is still a very long way distant. The transmission through the ether of sufficient power to produce a death ray may come—but he would be a bold man who prophesied its arrival within the next two or three decades.

Were it not for relatively simple experiments in which flies or insects are electrocuted without material contact, certain tests with supersonic sound as applied to fish, and perhaps some of the early Tesla experiments, the death ray would have created far less general interest. It is vastly more probable that research of this kind will be devoted, for many years, to the perfection of some means of obtaining beam radio for secret signalling. Wireless signals are still of almost negligible energy at a distance of even a few hundred yards from the largest transmitting station. A practical death ray must not require one hundred horse-power to kill one rat.

The Story of Chemical Discovery

No. 13 Classifying the Elements: The Story of the Great Russian Chemist, Mendeleeff

DMITRI IVANOVICH MENDELEEFF is a good name for a man to conjure with, even in the realms of chemistry, a science whose adherents are normally hardened to long and difficult-sounding phrases. If D. I. Mendeléeff had done nothing more than write a few salient articles on chemistry, even his own generation might have been excused for promptly forgetting an individual having such a difficult cognomen. But it so happened that Mendeléeff exhibited a definite chemical genius coupled with a towering intellect, both of which qualities have resulted in chemical science being only too glad to honour him and his work in perpetuity.

Mendeléeff, in his earlier years, had a hard life. He was born in 1834 at Tobolsk, a sparse spot in Siberia, and he was the youngest of sixteen children. Soon after his birth, his father went blind and subsequently died, leaving his widow, Maria Dmitrievna Mendeleeva, with the care of the numerous offspring. Maria Dmitrievna Mendeléeva, however, was a woman of great and unusual energy, and one who evidently took *Nil desperandum* for a motto. She successfully started a glass works near Tobolsk, on the proceeds of which she reared and educated her large family.

At St. Petersburg

At the age of fifteen, the youngest of the Mendeléeffs, Dmitri Ivanovich, was taken by his mother to Leningrad (then, of course, called St. Petersburg), and entered at the Technical Institute of that city. The lad acquitted himself well at his studies. Eventually he passed out and became a science master at Simferopol, in the Crimea, and afterwards at Odessa. Finally, after a period of study in France and Germany, he returned to St. Petersburg and, in 1866, was made Professor of Chemistry in the University of that city, a post which he held almost until his death in 1907.

Such is the bare outline of Mendeléeff's life. His work for Chemistry, however, cannot be told so briefly, for he accomplished a mighty scientific generalisation, the details of which require for their complete understanding a very considerable knowledge of theoretical as well as of practical chemistry.

As soon as the early pioneers of chemistry had, at the commencement of the last century, introduced order into the formerly chaotic array of disunited facts and observations, as soon, also, as the conception of a chemical element as an undecomposable entity had become firmly established, and after numerous new elements had been brought to light, it occurred to chemists that there must exist some sort of "natural" arrangement, some system of family groups among the elements.

Now, the chemist is mentally an exceptionally tidy personage. He hates to be confronted with anything in a condition of non-arrangement, because, in most instances, such a state of affairs is indicative of disharmony somewhere or other. And so it was that after a considerable number of elements had been discovered, chemists, particularly the more theoretically-minded of them, turned almost instinctively to the task of arranging them into some kind of an understandable system.

"Atomic Weights"

After the famous John Dalton had enunciated his celebrated Atomic Theory, the conception of "Atomic Weights" arose. It was obvious that all the chemical elements had different weights. Gold, for example, was heavier than sodium, oxygen gas was lighter than chlorine, aluminium and magnesium weighed less than iron or copper.

Hydrogen was found to be the lightest of all the elements, so that the weight of an atom of hydrogen was assumed to be 1 (unity). Methods were evolved for determining the relative weights of the atoms of other elements, and these weights were compared with the weight of a hydrogen atom. Thus, atoms of oxygen were found to be sixteen times as heavy as hydrogen atoms. Hence, the "atomic weight" of oxygen is said to be 16. Sodium atoms are 23 times as heavy as

Mendeléeff, the renowned Russian chemist

hydrogen atoms. Therefore, the atomic weight of sodium is given as 23.

The growing numbers of chemical elements, each with its accurately-determined atomic weight, rather worried the earlier scientific chemists of the first half of the last century. They considered that it ought to be possible to fit all the various and contradictory elements in some sort of a scheme. Accordingly, many attempts were made to provide a system of pigeon-holes for the elements in which each element would be labelled and docketed according to some salient characteristic which it exhibited. All such endeavours, however, failed hopelessly, for the reason that there seemed to be no standard by which the varying elements could be classified.

True it was that at the beginning of the century, a young medical student, William Prout by name, had written an exceedingly interesting paper which seemed to suggest that the elements could all be considered to comprise compounds of hydrogen, and that some arrangement of them could be arrived at in view of this hypothesis, but this line of thought was obviously well off the required track.

Then came J. W. Döbereiner, the German, who pointed out the unmistakable fact that some of the elements seemed to run in groups of three, as for example, Calcium, Strontium, Barium, or Osmium, Iridium, Platinum, or Lithium, Sodium, Potassium, which groups of three invariably showed very strong resemblances. These "Döbereiner's Triads," as they were termed, were, however, of little use to chemical theorists, since they led nowhere.

The itch which chemists and scientific men generally experienced in this matter of the attempted classification of the chemical elements—"Nature's bricks," as they have been rightly called—remained ungratified until the Russian chemical professor, Dmitri Ivanovich Mendeléeff, gave his concentrated attention to the question.

This occurred about the year 1866, at which time Mendeléeff was writing his now classical and still very useful *Principles of Chemistry*. It struck Mendeléeff to do a very simple thing, to wit, to arrange the elements according to the order of their atomic weights. If the elements are written down in the ascending order of their atomic weights, Mendeléeff at once saw that every eighth element of the series tended to reproduce the characteristics and properties of the eighth preceding element. There came into existence by this arrangement a sort of piano-keyboard of elements, each note or key of which was reproduced in some respects by the eighth note above it.

Newlands' "Law of Octaves"

An Englishman, J. A. R. Newlands, had, a few years previously, entertained some similar ideas on the classification of elements, and he had published some papers on the subject in which he described every succeeding eighth element of the above series as being "a kind of repetition of the first." This arrangement Newlands termed his "Law of Octaves," but he failed to push the idea home to its final conclusion. Had Newlands been encouraged in his task, the tale might have been different, but, seemingly, Newlands was a sick and a nervous man, and when, at a meeting of the London Chemical Society in 1866, he was mockingly asked if he had ever examined the elements according to their initial letters, he went home and gave the whole matter up.

It seems clear that Mendeléeff made his generalisation entirely independently of Newlands' "Law of Octaves." The result of Mendeléeff's generalisation was his famous "Periodic Law," which states that if the chemical elements are arranged in order of their ascending atomic weights, their properties vary from element to element but return more or less to a similar value at definite intervals or "periods." Thus, the elements sodium and potassium strongly resemble each other, as, also, do magnesium and calcium or carbon and silicon. Each of these pairs of elements is situated an "eighth" apart in the arrangement previously described, and it was by means of such indisputable facts that Mendeléeff built up his first "Periodic Classification of the Elements."

Periodic Table

Mendeléeff's classification was at first not wholly satisfactory. There were all sorts of gaps in the series and not a few uncompromising misfits. Despite such imperfections, however, the "Periodic Table" gave to chemists a comprehensive scheme of their elements in which, for the first time, a reasonably successful attempt had been made to systematise the "natural" properties of the elementary bodies. Most of the elements, under this new system of classification fell into groups or families and sub-groups and sub-families, all the members of any particular group or sub-group showing a very strong relationship to one another, as, for example, Fluorine, Chlorine, Bromine and Iodine, or, Arsenic, Antimony and Bismuth, or, again, Zinc, Cadmium and Mercury.

Mendeléeff gave to chemists and to scientists generally a sort of card-index of all the chemical elements, which, to say the least, was an extremely useful asset to the practical as well as to the theoretical chemist. But, more than this, Mendeléeff's Table of Elements showed up a number of gaps which should have been occupied by elements but which were not so occupied, these "missing" elements being then undiscovered.

So certain, however, was Mendeléeff of the fundamental soundness of his Periodic Table that he actually predicted in detail the properties of three elements which at that time were undiscovered and entirely unknown. Sixteen years later all three of the predicted elements were discovered, and were given the names *gallium*, *germanium* and *scandium* respectively. When the properties of these elements were ascertained, they were found to comply amazingly well with Mendeléeff's predictions. The "Periodic Table," which is nowadays the standby of the world of inorganic chemistry, was vindicated, and its major criticisms were extinguished.

"Atomic Number"

In Manchester, in the years before the 1914-18 war, there worked with Lord Rutherford in the Department of Physics of the Victoria University, a young scientist,

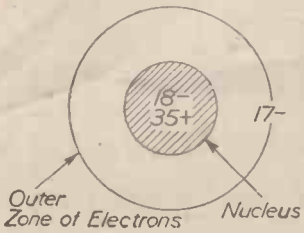


Diagram representing the electrical changes present in an atom of chlorine gas. It illustrates the conception of "atomic" number described in the article.

Moseley by name. Moseley was only in his early twenties, and he was vitally interested in questions concerning the atoms of elements, their nature and their make-up.

Now, one of the first-rate fundamental discoveries which Moseley made was his introduction of the "atomic number." To explain this in any way at all, we must consider very briefly the constitution of an atom.

As most readers will now be aware, an atom of matter is considered to comprise a central nucleus, positively charged, around which revolve a number of negatively charged electrons. The charge on the nucleus exactly counterbalances that on the electrons. Consequently, the atom is electrically neutral.

All atoms have fundamentally the same constitution. The only way in which they differ is in the number and arrangement of their electrons and of the protons (positively-charged particles) which make up most of the nucleus of the atom.

An atom is, indeed, a sort of solar system in miniature. The central nucleus, consisting of protons and electrons, forms the "sun" of this miniature solar system, whilst the revolving electrons comprise the "planets."

Chlorine Atom

Now let us, by way of illustration, consider an atom of chlorine gas. This has 35 protons and 18 electrons in its nucleus and 17 outer revolving electrons. The nucleus of the chlorine atom is positively charged because it has 17 more protons (positively-charged particles) than electrons, but this excess of protons is exactly neutralised by the 17 outer electrons of the atom.

The chlorine atom has 35 protons in its nucleus, and this number represents the *atomic weight* of this element. The difference between the 35 protons and the 18 electrons in the nucleus of the chlorine atom is 17, and it was this figure which Moseley called the "atomic number" of the element, chlorine.

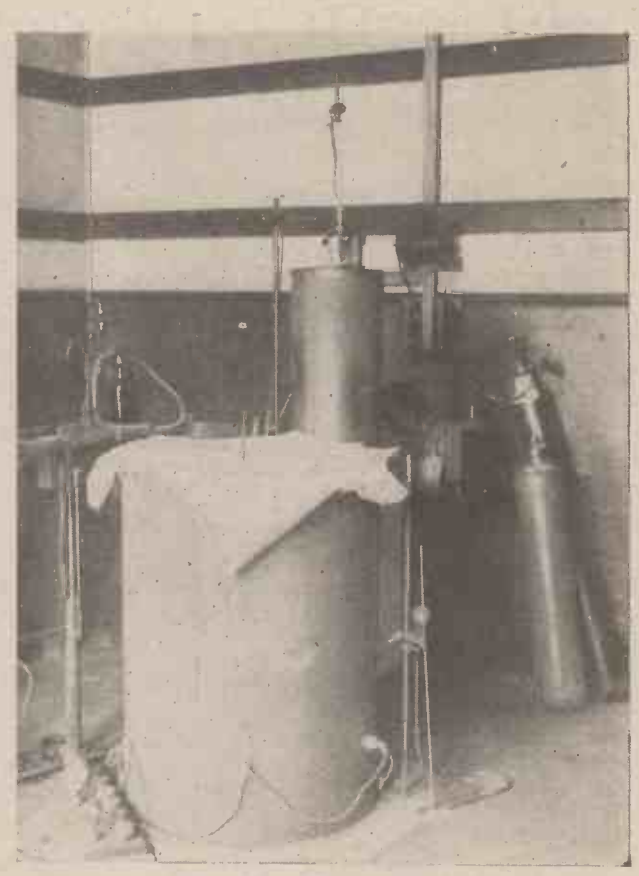
All elements have atomic numbers, this value being even more important than the atomic weight, because the atomic number of an element represents the actual number of revolving or "loose" electrons outside the nucleus of the atom of that element.

Hydrogen, for example, has an atomic number of 1. That is to say, it has only 1 loose electron in its atom. Uranium, on the other hand, the last number of the Table of the Elements, has an atomic number of 92, which means that its atom embodies 92 loose electrons.

Now, if we arrange all the elements in ascending order of their atomic numbers, we find that they fit in amazingly well with Mendeléeff's Table. Moseley therefore, besides delving deeper into the constitution of atoms than Mendeléeff ever did, managed to give a striking confirmation of the correctness of Mendeléeff's Table of Elements.

Moseley's Death

Unfortunately, however, Moseley's reign of genius was a very short-lived one. There came the 1914-18 war and, with it, the ill-fated expedition to Gallipoli. Moseley went with it and, before long, succumbed to a Turkish bullet. Science, indeed, has not yet forgiven the British military authorities for thus wasting the life of this ultra-brilliant young physicist.



Apparatus for ascertaining some of the physical constants of a number of the gaseous elements.

At the present day, all the gaps in Mendeléeff's great classification of the elements between Hydrogen (Atomic No. . . 1) and Uranium (Atomic No. . 92) have been filled, with the exception of four places which still await undiscovered elements. These places are for elements having the atomic numbers, 43, 61, 85 and 87. It is possible to predict the properties of these elements, but, despite careful search, they have never been discovered. Some scientists think that they will never be discovered on this earth. Be that as it may, however, it is not likely that any element having an atomic number greater than 92 (that of uranium) will ever be discovered, since any such element would be unstable. Consequently, science has apparently discovered nearly all the elements which exist and has correctly classified them. In this gigantic task, the name of Dmitri Ivanovich Mendeléeff stands paramount, but, perhaps, if the English genius, Moseley, had been allowed to live, his name would have attained even greater eminence in consequence of the exceptionally deep and fundamental chemical and physical problems to which he devoted his abilities and his brilliant intellectual powers, and the scientific world would have been enriched by his attainments.

PROTECTING SOWN SEED

Immunising Seed from Attack by Pests

THE advent of spring synchronises with the sowing of seed. In view of the fact that those tiny marauders, the birds, are ever preying on the fields, it is necessary for the farmer to take precautionary measures.

It is not only the birds which endanger the life of the seed. The latter is subject also to the attack of soil fungi and other enemies.

An inventor who has devoted his attention to the immunising of seed from the attack of pests, remarks that, to protect the seeds from soil fungi and to control seedborne disease, the seeds have sometimes been treated with solid or liquid preparations containing mercury or copper, or with solutions containing formaldehyde. He states that these preparations tend to inhibit the germination of the seed. And mercury is injurious to man and animals.

Treatment with Sulphur Nitride

It has been proposed to render seeds unattractive to birds by treating the seeds with crude tar or with carbon blacks. This type of black-out is said to repel the feathered world. But it is affirmed that the use of crude tar is liable to cause injury to the seeds and delays their germination. And neither treatment, it is declared, gives any protection against attack by soil fungi or affords control of seedborne diseases.

The inventor in question has submitted to the British Patent Office a process for immunising seed and minimising the attacks upon them by pests. His process consists of treating the seeds with sulphur nitride or mixtures containing the same.

According to this invention, seed may be treated by feeding it and a suitable quantity of powdered sulphur nitride, or of a powdered mixture containing the same, into a rotating drum. By this means seeds receive a coating of the powdered material. As a rule, effective adherence of the powder to seeds, for example, to wheat and oats, can be secured by this method. But in the case of seed with a very smooth surface, it may be necessary to furnish an adhesive in the seed dressing or on the seed in order to obtain a satisfactory coating.

NEW SERIES

Odd Jobs in House and Garden

I. Repairing Fences and Gates

By "HANDYMAN"

ONE of the odd jobs that usually call for attention in the garden about this time of the year is the repair of fences and gates that show signs of deterioration due to wet weather.

In close-boarded fences, of the type shown in Fig. 1, signs of rot may be noticeable where the supporting posts enter the ground, as at A. A good method of repairing them is to drive in short stakes, as at B. Fig. 2 the stakes being

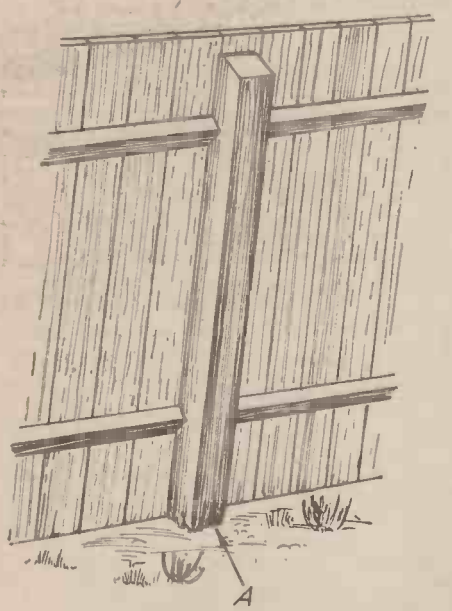


Fig. 1. Part of a close-boarded fence, showing where rot usually starts.

screwed or bolted to the fencing posts, as indicated. The lower parts of the stakes which should be of the same cross-sectional area as the fencing posts, and at least two feet in length, must be well coated with hot tar or creosote before they are sunk in the ground.

Supporting Struts

Sometimes a fence begins to wobble owing to the fencing posts becoming loosened by wind and rain. In such cases it is a good plan to fit a supporting strut to each post, in the manner shown in Fig. 3. The struts can be cut from 2 in. by 2 in. quartering, and the upper ends sawn at an angle to fit against the posts. To the lower end of each strut a cross-piece is securely nailed, as at C, to form an anchorage for the end of the strut when it is sunk in the ground. The top of each strut can be fixed in place with a 4in. French nail, a hole for this being carefully bored through the top of the strut to prevent splitting the wood.

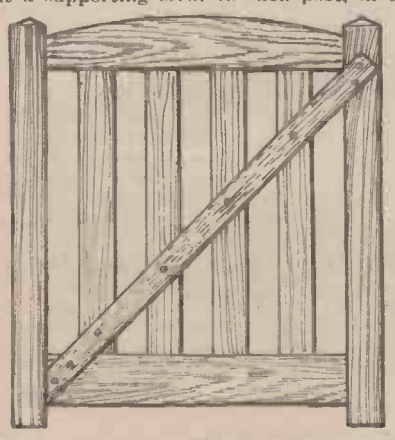


Fig. 4. Using a diagonal bracing piece for a sagging gate.

Preserving Fences

Garden fences are likely to give a good deal of trouble if they are neglected, and it pays to give them a coating of preservative every second year to prevent decay setting in. Several preparations are obtainable for the purpose, but ordinary creosote is as effective as any other preparation. Before the creosote is applied, the soil should be scraped away from the fence, except that round the posts, so that all the fence can be coated. This job should not be carried out in wet weather, and it should be noted that the creosote will burn

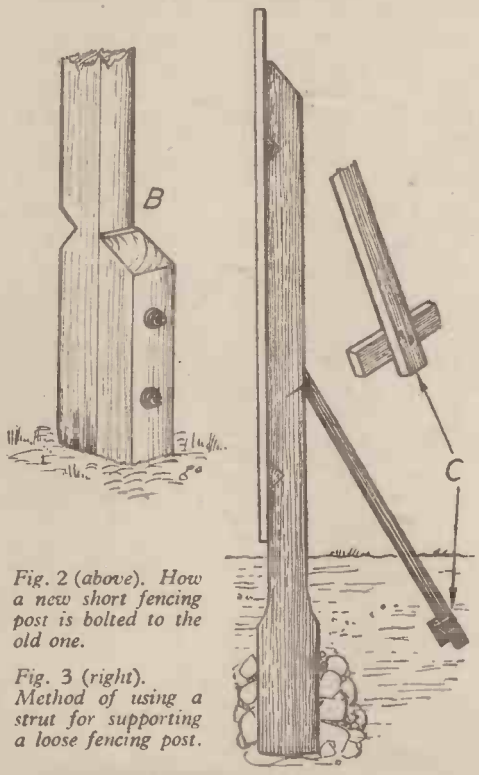


Fig. 2 (above). How a new short fencing post is bolted to the old one.

Fig. 3 (right). Method of using a strut for supporting a loose fencing post.

any growing plants it may fall on.

Where a few fencing boards show signs of decay at the bottom, it is a good plan to carefully knock them off the cross-rails, and re-fix them upside down. It is at the lower ends that the decay first begins, and by inverting them they are given a new lease of life.

Sagging Gates

Front-garden gates of the pattern shown in Fig. 4, often show signs of sagging after being in use for a number of years, the bottom of the gate rubbing against the ground. This can easily be put right by fitting a hard-wood bracing piece, as shown in the illustration. The wood should be about 1½ in. wide and ¾ in. thick, one end being screwed to the hinge post, and the other end to the bottom board of the gate. Pack up the latch side of the gate clear of the ground before screwing the bottom end of the bracing piece in position. Having done this, it is a good plan, if convenient, to unscrew the gate hinges from the post, and raise the gate an additional couple of inches from the ground before re-fixing the hinges.

Repair Plates

Occasionally, broken tenons in a gate cause it to sag, and this can be remedied by screwing on iron repair plates, either angle pattern or straight, as shown in Fig. 5. These plates, with the exception of the pattern shown at D, should be fixed to the inside of the gate, and if painted the same colour as the gate, they will hardly be noticeable.

Fitting New Posts

In cases where a fencing post has rotted beyond repair, a new post will have to be erected. Fencing posts are provided with enlarged ends, or butts, of rough timber, as shown in Fig. 3.

First remove the old post, and dig out the butt. Clear out the hole to a depth of 18 ins. and put a layer of large stones in the bottom of the hole and tamp them down.

Before inserting the new post, give the lower end two coatings of hot creosote and allow to dry. After placing the post in position, fill the hole with soil mixed with small stones well rammed down. To ensure the post being vertical, test once or twice with a plummet line during the ramming process.

Filling Cracks in Posts

Sometimes wide cracks, or splits, develop in the top part of fencing posts, and if rain water is allowed to lodge in them, rot will begin to set in. A good dodge to counteract this is to pour a thin mixture of Portland cement into the cracks and smooth it off flush with the surface of the wood. This will prolong the life of the affected posts considerably.

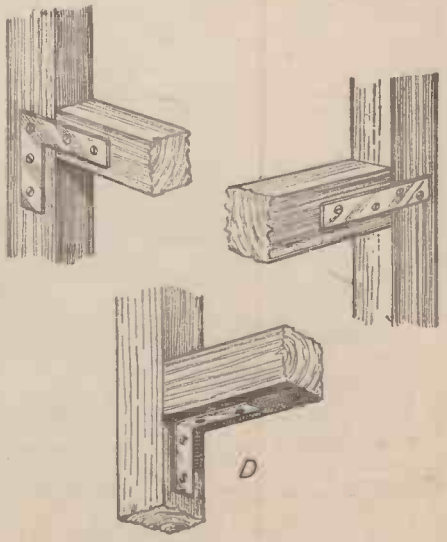


Fig. 5. How iron repair plates can be used to remedy loose joints.

THE WORLD OF MODELS

The main station and dockside on H. V. Morton's T.T.R. Railway, with the continental boat express just arriving drawn by a Pacific type locomotive.

By "MOTILUS"

A famous English travel writer's Wartime hobby

A Fine "OO" Gauge Layout

ONE of the more recent converts to that fascinating hobby of model railways is H. V. Morton, the popular and well-known travel writer of to-day, whose articles, appearing from time to time in the daily press, are considered the peak of absorbing interest by that important person, the "average" reader.

As far back as December 1938, I remember Mr. Morton writing in his "Fellow Men at Play" series in the *Daily Herald* an article on model railways, which was entitled "This makes them Boys." Several model-making friends of mine agreed with me that for a man "outside the hobby," this was one of the best articles they had read. One would have considered him a model railway enthusiast since his early youth!

In this article he mentions the battle then going on between "O" gauge and "OO" gauge, and adds: "An outsider like myself would probably vote for the smaller gauge every time. There is something particularly charming in these perfect little scale models with their lines of coaches, their shining piston rods, smaller than matches, moving vigorously with that motion which, for some reason or other, never fails to enchant the eye."

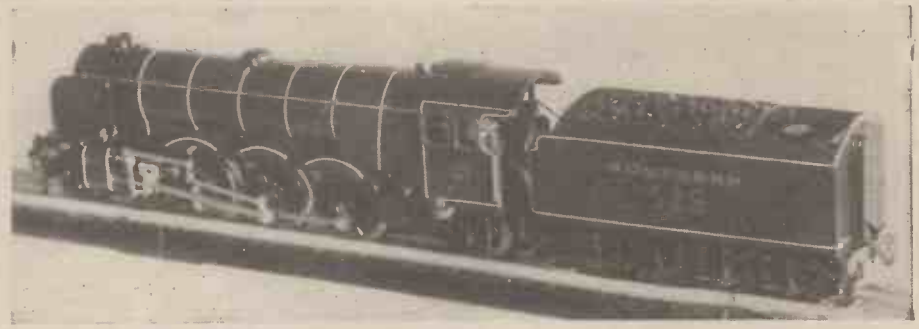
Well, since then Mr. Morton's eye has been even more enchanted, for he has himself become a devotee of "OO" gauge, and has chosen the Trix Twin Railway for his layout. He has taken advantage of the many ranges of equipment provided in the Trix series, not only track, locomotives, rolling stock, but also the unit system of stations and railside buildings.

From the accompanying photographs it will be seen that the vividness and realism of his writings are also apparent on his railway.

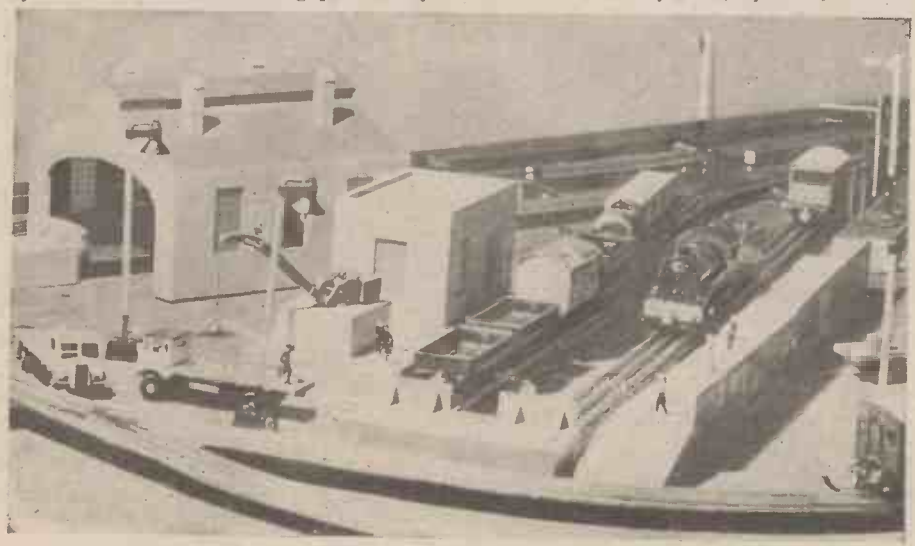
It began on a ping-pong table, and now occupies a room, representing rail communication between London and one of the Channel ports. The main stations are (*a*) Victoria, although for technical reasons connected with reversing, this is not a terminus, and (*b*) a dock station with Customs House, etc., and a dockside with a row of cranes, behind which can be seen the masts and funnels of the Channel steamer.

Track Supported on Trestles

An up and down line runs side by side on trestles right the way round the room. These lines lead at both ends to the central table on which is the main station and the dock station. There are three shunting yards and six dead sections on this table so that, by moving an electric-light switch, he can bring into action, or put out of action, the six locomotives he possesses. The system is fitted with signals which light up, and with yard lamps and illuminated buildings.

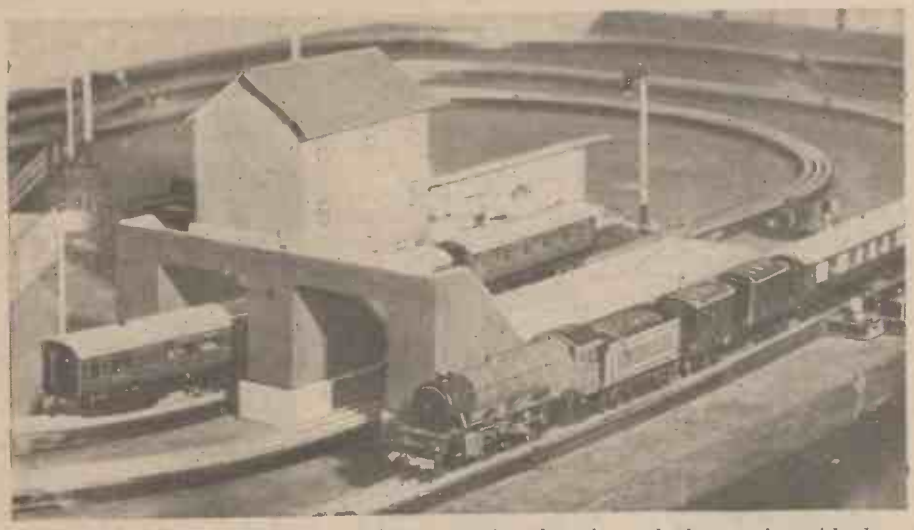


This is not a dead-scale model but a wartime alteration to produce an S.R. 6-coupled express locomotive from existing models. It is really the standard L.N.E.R. Pacific fitted with smoke deflectors, repainted, lined and lettered in Southern Railway livery.



One of the shunting yards and engine shed on H. V. Morton's railway.

Of his railway, Mr. Morton says: "I chose the Trix railway because it works, and because I, who am non-mechanical, can understand it. The fun of working this system, so far as I am concerned, consists first of all in assembling a Boat Express composed of three Pullman coaches, and a Post Office van from various lines by means of a tank engine. Then having got this train ready, I bring out the Southern Railway boat express locomotive, get the train in the station and take it out over a fairly complicated system of points to the main line. I then run it round the room, to represent a run from London to Dover, and bring it to rest in the dock station. I can then do one of two things. I can run it back, pretending that the Channel Boat has come in, and that the Boat Express is returning to London, or I can do something much more exciting. I can plunge the system into dark-



The London-Dover express with Pullmans, passing through a suburban station with the three-coach Southern Electric at the platform.

ness, save for a few yard lamps, and I can pretend that we have crossed the Channel and are in France. I then bring into action a big blac . Continental locomotive with red wheels, whi n can pull up to six scale model coaches. I have two French " blue train " coaches, four red Mitropa coaches, and two green German coaches. This train is taken round the system on an imaginary journey across Europe. It drops a sleeping car at Milan and goes on to Rome, or it can drop a sleeping car here and there and pick up a restaurant car now and then, all the time making an imaginary journey to Istanbul."

Mr. Morton was very keen recently to have a Southern Pacific locomotive, but owing to wartime difficulties, it was not possible to make one specially, so he had an L.N.E.R. Pacific fitted with smoke deflectors and painted, lettered and lined in S.R. colours. The effect is excellent, as the photograph shows. He also features one of the three-coach electric S.R. trains of the suburban service.

Message to Readers

In conversation with him the other day, over a very pleasant " wartime lunch," I asked if he had any " message " for those interested in the model railway hobby, and he said :—

" The psychologist would say that in this railway I have sublimated my sense of frustration ; for no longer am I able to travel about the world as I used to do. Still, in imagination, I am able, for such brief moments as I can spare from work, to be traveller, engine driver and signalman. And I must admit that, as I see these little trains running, the locomotives with their small bright piston-rods geared to about eighty miles an hour, I do get an enormous satisfaction, and I do taste again, in no matter how small a way, that part of the larger freedom which, to me, is so important: freedom of movement. I don't want to enter the model railway world under false colours ! I look at my railway with the eye, not of a mechanic, but of an old traveller who loves travel, and cannot travel again until the war is over.

"I was greatly assisted in designing and fitting up the railway by two enthusiasts, Officer Cadet Alan Beer, and my versatile gardener, Mr. George Baker, who is a very capable amateur electrician ; indeed, without their help I am sure I would never have embarked upon such an ambitious lay-out.

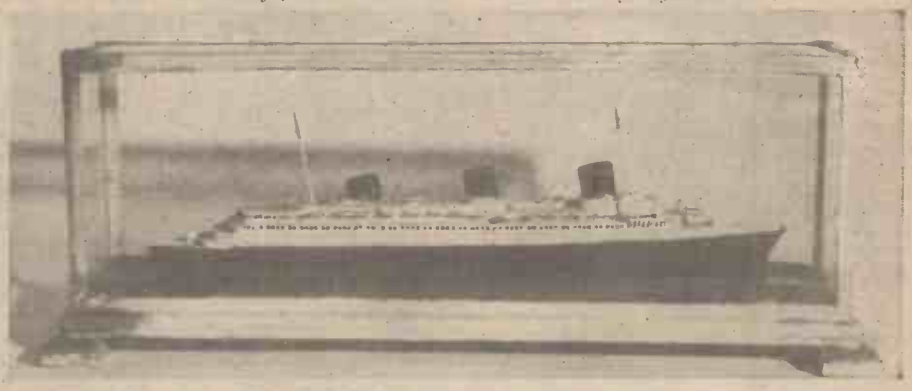
"And, by the way, if any fellow Trix enthusiast would like to sell me a blue Wagon-lit restaurant car, I should be very glad to buy it. Or I will give him in exchange a brand new red Mitropa restaurant car. If he would prefer an autographed copy of anything I have written he can have that. It's perfectly true tl at ' this makes them boys,' for I have not offered to swap anything for at least forty years ! "

Miniature Model of " Normandie "

Readers will remember that I showed photographs in my article some six months ago of the work of the Y.M.C.A. Grafton Boys Club at Northampton. The photograph accompanying this note is of the 100 ft. to 1 inch model of E.S. "Normandie "—beautiful and tragic French liner, which has been so badly damaged recently in New York Harbour, by fire. The model has been built from a set of parts presented to the club by Mr. W. J. Bassett-Lowke, and is mainly the work of Leslie Griffin, a member who is just 18.

Mr. Bassett-Lowke has examined the model, and considers it a good effort, but the modeller certainly has unusual ideas in the matter of colouring. The base-plate instead of being the usual " blue sea " is a glowing red, and the adhesive tape holding the glass case together is painted gold and silver. Still, the model has a bright appearance; and is being kept among the club's archives.

It was one of the exhibits at the club's twenty-first anniversary, which was in November, and it was opened by Princess Helena Victoria on November 22nd, 1920. The Mayor of Northampton was present at this gathering, and over ninety boys attended.

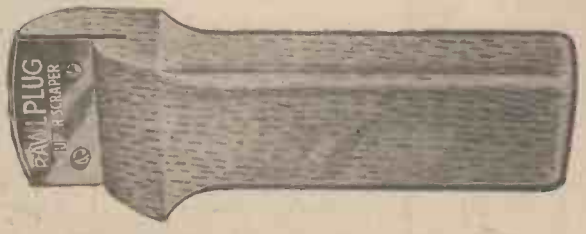


The finished model of the " Normandie " complete in glass case, built from a set of parts by a member of the Y.M.C.A. Grafton Boys Club of Northampton.

Rawlplug Super Scraper

A HANDY scraper tool, recently put on the market by The Rawlplug Co., Ltd., has a shear-steel blade, cadmium plated, the handle and blade carrier being made in one piece of seasoned hardwood. The total length of the tool is about 6 in. and the steel blade, which is 2½ in. wide, has a cutting edge ground like a razor, and is renewable. A special feature of the tool is the curved scraping edge of the blade which gives it a real " bite."

In the home the Rawlplug Super Scraper will be found very handy for easing sticky window frames, doors and drawers, and scraping paint off woodwork. There are also many uses for this scraper in various trades. The price of the tool is 2s. 6d., and a spare blade costs 10d.



The Rawlplug Super Scraper Tool.

Skybird Model Aircraft

ONE of the most popular hobbies at the present time is undoubtedly the building of scale model aircraft, and it is interesting to note that a folder has recently been ssued giving particulars of the well-known " Skybird " miniature scale model aircraft and accessories. These models are 1/72 scale reproductions, and there are complete models or sets of parts for various civil and military machines, including many well-known types of the last war, German as well as British. Present-day types such as the Hawker " Hurricane," Supermarine " Spitfire," Handley Page " Hampden," Bristol "Blenheim," Lockheed " Lightning," Blackburn " Skua," and the Westland " Lysander " are among the range of miniature models which are obtainable as constructional sets, ready for assembling, or as completely finished and painted models.

QUERIES and ENQUIRIES

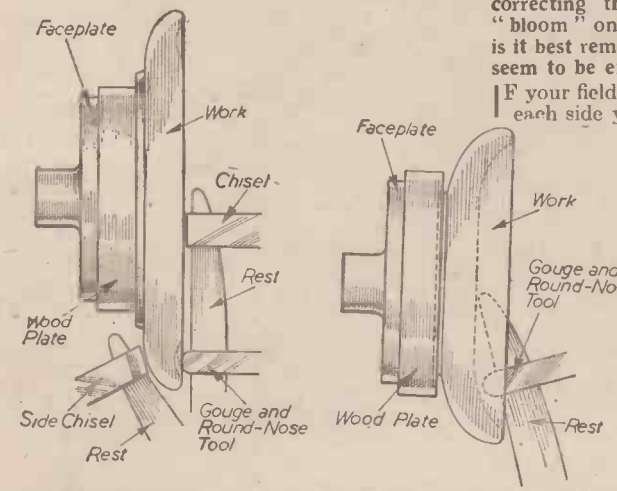
A stamped addressed envelope, three penny stamps, and the query coupon from the current issue, which appears on back page of cover must be enclosed with every letter containing a query. Every query and drawing which is sent must bear the name and address of the reader. Send your queries to the Editor,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

Hardwood Turning

CAN you inform me as to the method of turning hardwood fruit bowls and bread boards with gouges, and not with scrapers nor hook tools? Information on the following points would be particularly useful:—

Position of rest for outside turning and inside turning, and method of holding the gouge; method of turning V's and hollows on outside of bowl, and method of turning hollow around face of the board.—D. S. Prosser (Mountain Ash).

THE accompanying sketches may help to answer your questions about positions of rest and tools for hardwood turning. The views are supposed to be looking down on the work from above. The rest should be adjusted to keep it moderately close to the place where the tool is cutting. As you have not had much experience, it would be safest to cut with the point of the gouge only, and not allow it to roll over. All surfaces must be finished by scraping, with round-nose for concavities and chisel for convexities and flats. A wood plate should be screwed to the metal one and the work held to the latter by two or more screws from the back. The holes made by these screws should be in the under surface of the article, and may afterwards be plugged with wax or putty. It would be an advantage to turn both back and front of the articles without reversing them on the plate, and to do this the plate diameter should be considerably less than that of the work. The bowl, however, could very well be reversed on the plate by turning the back first, as the screw holes in the other face could be turned out in cutting the concavity. To reverse it in a concentric position a shallow recess would be turned in the face of the wood plate into which the flat part of the back would fit. Screws would then be put in to hold the work while the concave part is turned. Glasspaper is used after the tools have finished cutting.



Sketches showing positions of rest and tools for turning hard wood articles. Work on faceplate is viewed from above.

Leaking Radiator

IN my work as an agricultural engineer, I have recently had several radiators leaking, some with over 200 tubes. My chief trouble is locating the defective tube. Could you please tell me how this is usually done, and also the best method of stopping the leaks?—F. Tuck (Crewkerne).

THE leakage can be located as follows: Put soapy water into the radiator, and plug the overflow pipe and outlet pipe. Blow in air from filler cap and look for bubbles. Oatmeal makes a temporary sealing, but soldering is the permanent cure.

Adjusting Field-glass Prisms

THE prisms in my field-glasses are out of adjustment. What is the proper method of correcting this? Also, there is a kind of "bloom" on the glass. What is this, and how is it best removed? Ordinary cleaning does not seem to be effective.—H. Franks (Blackpool).

IF your field glasses have a different focus on each side you may be able to improve matters by altering the separation of the prisms. Focus up one side, then adjust the other by the best means you can command (screw adjustment if provided, or cardboard packing if not) until both foci are equal. A process of trial and error is about all an amateur can do.

If a different image is visible with each eye, one or more of the prisms is probably out of square. Correct by trial and error as above, packing the crooked prism in its housing until the images coincide.

For cleaning you can try a little whitening and ammonia (diluted about 4-1 with water). If this is not satisfactory, the glass requires repolishing or possibly separating and resealing. In either case it is a job for the makers.

Reducing Speed of Universal Motor

I HAVE a small AC/DC motor, running on A.C. 240 volts 50 cycles, and I do not know the consumption or power. The speed is approximately 12,000 r.p.m. I append details of the motor, and shall be glad if you will kindly advise me how I may reduce the speed to about 3,000 r.p.m.

Armature: Laminated iron, 2¼ in. by 2¾ in. long, over windings 2¼ in. by 5 in.

Comr.: 1 1/8 in. diameter by 1 in. wide; 28 segments.

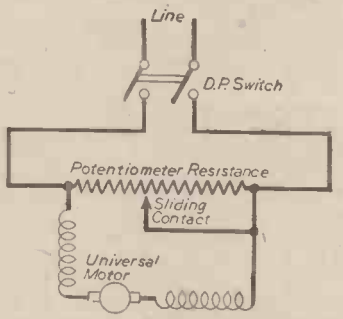
Core: Laminated 4 5/16 in. dia. by 2½ in. long.

Pole pieces: Two (laminated), 2½ in. long by 2 in. wide.

Brushes: Two—set at 180 deg., size ⅜ in. wide by ¼ in. thick.

Field coils: Two—one end of each being connected to mains through double pole switch incorporated in motor, the other ends going one to each brush.—H. R. Marshall (Boston).

A UNIVERSAL commutator-type series wound motor with an armature of the dimensions stated, running at 12,000 r.p.m. might be expected to develop nearly ¼ horse-power, but whether it would maintain this output without seriously overheating is a matter dependent entirely on the ventilation factor, concerning which no details are available. The current consumption on a 240-volt A.C. circuit would be in the region of 1½ amperes, and if the field coils are only No. 22 S.W.G. they would not carry this amount long without getting dangerously hot, hence the motor must be regarded as "short-rated." Universal motors have a very steep speed characteristic, the running speed rising and falling very rapidly with variations in load, but with sufficient resistance in series, there is no reason why the speed should not be reduced to 3,000 r.p.m., or any other value,



Circuit diagram using a potentiometer for reducing the speed of a universal motor

but it must be a variable resistance. Probably the best speed control will be secured in this case by putting in a potentiometer-connected resistance of 160 ohms 1½ amps. carrying capacity, and connecting the motor as in the accompanying diagram. The motor can then be run on any voltage which gives the speed desired. Its power output will be proportionate to its speed.

Running Car on Diesel Oil

I HAVE an 8 h.p. Ford car, and although I get very little petrol, I have plenty of light diesel oil to spare. Could I convert the carburetter system to use this fuel fairly satisfactorily, starting and stopping on my allowance of petrol, or would it be possible to distil the fuel-oil and use what I would get off mixed with petrol satisfactorily with, say, a change of choke-tube or jets?

I tried this fuel on a Baby Austin with bad compression, and I find when the car has been well heated up it will run on it fairly well with the choke "half on," but emits lots of white damp smoke.

How about putting a small tank on top of the cylinder or exhaust manifold, and running a pipe with tap in it along the manifold and into the petrol-pipe near the carburettor so that fuel-oil could be turned on when the engine heated up? I have heard of the dodge of running a ¼ in. pipe out of the exhaust manifold through the inlet manifold and out into the exhaust pipe again, and then using fuel-oil when the engine heated up, but I am afraid this method is too simple to work satisfactorily.

How about mixing the petrol and fuel-oil, or distilling the fuel-oil to get off the lighter parts of it, and using it with petrol?—W. McGowan (Donegal).

IN answer to your queries there are two legal points that you must consider before attempting any practical or technical solution.

(1) Would you be allowed by the authorities to use light Diesel oil in your Ford saloon even if you succeeded in overcoming the technical difficulties? We would advise you to approach the local police on this point as we think permission is very unlikely.

(2) If any good purpose were to be served by distilling Diesel oil, you must not carry out such a process without a licence. The technical problems must, be answered from first principles, as the practical problem has innumerable considerations and rendered more difficult by your wish to avoid expense and to limit the modifications made:—

First, any fuel can be used in an internal combustion engine provided all the following conditions are fulfilled:—

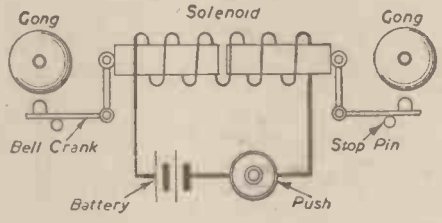
(*a*) The fuel is thoroughly mixed with the correct amount of air for combustion.

(*b*) The mixture can be ignited by the spark.

(*c*) That combustion is reasonably complete and sufficiently rapid. Petrol having a low boiling point vapourises readily and mixes with the air in the induction system giving an explosive mixture in the cylinder, easily ignited by the spark. Diesel oil on the other hand owing to its high boiling point does not readily vapourise so that conditions (*a*), (*b*) and (*c*) are not fulfilled. In order to ensure vapourisation, the fuel must be heated and you cannot use the petrol carburettor or the cold air would condense the vapour again. You would, therefore, have to have a fuel-oil metering device before passing it to be vapourised. The air would have to be preheated, controlled and added to the fuel vapour in the induction system or the cylinder. This is, of course, the normal Diesel cycle, air induced by the piston is heated by compression, and almost at the end of the stroke a metered amount of fuel is injected under pressure by the fuel pump. There is no simple means of converting your Ford engine to this system.

The second method, which has more possibilities from your point of view would be to use the present carburettor with a larger jet, and to have an immediate hot spot followed by an induction system heated by the exhaust. Care would be necessary to prevent local over-heating and pre-oxidation of the fuel. This method has the disadvantage that as you are adding the fuel as a vapour, and not as a liquid as with petrol, you will lose volumetric efficiency, hence your experience with the Austin 7 and the need for choking the air. The smoke was due to inefficient combustion due to partial condensation, but the damp, if by this you mean water vapour, must have been caused by a leaking gasket. Such a system would suffer from lack of flexibility, but you should get a reasonable power output. The half-inch pipe system in the exhaust manifold is right in principle, but the resistance would be too high; at least an inch pipe would be necessary.

Mixing Diesel oil with petrol would be unsatisfactory without preheating the induction pipe, as condensation would occur. There would be no point in distilling the oil even if you could obtain a permit to do so. This would not be easy as a vacuum still for the quantities you would require is not easy to improvise.



Method of operating two gongs electrically.

Electric Gong

I SHOULD be pleased if you will kindly forward instructions for the following: I wish to make a gong, or pair of gongs, to work from a 4-volt battery with a bell push from a door. Should the solenoid coil be wound on a brass former? Also, could you suggest the type of soft iron plunger to be used?—S. T. Wendard (Enfield).

THE device shown in your sketch (not reproduced) would scarcely prove successful without some alteration to detail, as the split core inside the magnet would close up and the plungers draw away from the gongs at either end instead of striking them. Also it would be necessary to have some location to the plungers to limit their travel and leave them in the most effective position when at rest. It is suggested that matters should be rearranged according to the accompanying sketch. The iron core or plunger is in two halves, normally adjusted so that there is an air gap of not more than ¼ in. between their ends internally in the solenoid winding. The plungers are pivoted to two light bell cranks so that when drawn together by the magnetising effect of the coil, the hammers are brought up smartly to the gongs. When current is interrupted, the bell cranks drop against stop pins by the action of gravity. For the solenoid winding operating from a 4-volt battery, the bobbin should be 2 in. overall diameter by 3 in. long, made up preferably of vulcanised fibre, and wound full with No. 20 S.W.G. enamel covered copper. The plungers can be made from pieces of soft iron ⅜ in. diameter.

Cutting Multi-start Thread

WILL you please inform me how a multi-start thread is cut on a modern lathe which has the usual gear-box on the lead-screw, and a revolving dial on the saddle?—W. O. Hodgson (Leeds).

THE pitching out for a multiple thread is done by using a bent-tail dog entering into slots in a catch-plate. For a two-start thread the first groove is cut as usual, then the dog is disengaged, and placed in the slot on the opposite side of the plate and the other groove cut. For a triple thread, there are three slots. Some lathes carry a divided plate which has the front portion adjustable, and twisted round according to the divisions for the required spacings, then locked by bolts. A straight-tail dog is then used, and the plate has a forked stud to embrace the dog, and secure it between the tips of two set-screws.

Silver-Plating Solution

I WOULD be obliged if you could give me particulars of the formula of solution, voltage and current required for depositing silver on small parts. I have tried silver nitrate solution, but find brass parts immediately go black and any further deposit is in the form of a black sludge.—P. H. Duke (Tamworth).

SILVER plating with a solution of silver nitrate is not a success. You should use a cyanide bath made up as follows:—

Nitrate of Silver	3½ ozs.
Potassium Cyanide (98%)	4 ozs.
Water	1 gallon

Use a silver anode. Current density should be from 1 to 3 amps. per 100 square inches. This should be obtained by a voltage of from 2 to 4. We advise you to read up the practical details of silver plating as there are many possible difficulties depending upon the material on which the silver is being deposited.

Re-magnetising a Magnet

PLEASE inform me how to remagnetise a circular magnet taken from a cycle lighting unit. I have the bobbins for the wire.—P. Partington (Manchester).

THE details of arrangements for re-magnetising a weak permanent magnet depend entirely upon its shape and dimensions, concerning which no information has been supplied. The technique is to place the two poles of the magnet under treatment in contact with two poles of a powerful "master magnet" electrically excited, and flash a heavy current momentarily through the coils of the latter. Care must be taken that the original polarity of the weak magnet is not reversed: the polarity of both this and the master magnet should be tested before re-magnetising, the safest plan being to suspend the smaller magnet with a string over the larger one some little distance away, and let it rotate into its own natural position before bringing the two into actual contact. If you can refer to "The Motorist's Electrical Guide," by A. H. Avery, you will find the process fully described and illustrated.

Ferrotype Plates

CAN you inform me what emulsion is used in making ferrotype plates, and how they are manufactured?—T. Prentice (Glasgow).

FERROTYPE plates are usually coated with an emulsion of silver and collodion, instead of the usual silver and gelatine as used on ordinary film or glass plates. For working instructions you should refer to one of the older works on Photography, such as Abney's "Instruction in Photography." You should be able to obtain such a book from a Public Library.

If you buy the ferrotype plates already coated, you can, of course, obtain instructions on their use from the makers.

WHY WORRY?

WORRY uses an immense amount of vital force. People who worry not only use up their energy during the day by worrying, but they rob themselves of that greatest of all restoratives, sleep. People who worry can't sleep. They lose their appetite. They often end up by getting really ill. How often have you heard it said, "I am worried to death"?

What do you suppose would happen if a person who was putting himself into mental, moral, and physical bankruptcy by worrying, were to convert all this worry energy into constructive action? In no time at all he would have accomplished so much that he would have nothing to worry about.

Nothing is more discouraging to a worrying person than to have someone say, "Oh, don't worry, it will all come out right"?

That is not reassuring at all. The worrying one can't see how it is going to come out all right. But if the men and women who worry could be shown how to overcome the troubles and difficulties that cause worry, they soon would cease wasting their very life-blood in worrying. Instead, they would begin devoting their energies to a constructive effort that would gain them freedom from worry for the rest of their lives.

You say that sounds plausible, but can it be done?

Half fees for serving members of His Majesty's Forces (Apply for Services Enrolment Form)

It can be done, and is being done, by Pelmanism every day in the year. This is all the more remarkable because to-day the whole world is in an upset condition and people are worrying to an unusual extent. Yet, every mail brings letters to the Pelman Institute from grateful Pelmanists who have ceased to worry.

People to-day are all too prone to complain that they just have to worry. But once they become Pelmanists they cease this negative form of thought.

Remember—Everything you do is preceded by your attitude of mind

The Pelman Course is fully described in a book entitled "*The Science of Success.*" The Course is simple and interesting, and takes up very little time; you can enrol on the most convenient terms. The book will be sent you, gratis and post free, on application to:—

Pelman Institute,
(Established over 40 years)
130, Albion House, New Oxford Street London, W.C.1.

Readers who can call at the Institute will be welcomed. The Director of Instruction will be pleased to have a talk with them, and no fee will be charged for his advice.

PELMAN (OVERSEAS) INSTITUTES: NEW YORK, 271 North Avenue, New Rochelle MELBOURNE, 396 Flinders Lane. JOHANNESBURG, P.O. Box 4928. DURBAN, Natal Bank Chambers (P.O. Box 1489.) DELHI, 10 Alipore Road. CALCUTTA, 102 Clive Street.

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Editor: F. J. CAMM

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Comments of the Month

By F. J. C.

The Ban on Sport

CYCLISTS, and especially sporting cyclists, will view with satisfaction the fact that the Government restriction on certain branches of sport, including dog-racing, horse racing, etc., does not apply to Time-trials. The Government realises that a sport which keeps cyclists fit is not one which should be interfered with. It would indeed be a danger to interfere with any form of sport which improves the physique and the national health. For more than half a century road sport has been developing, and there may be those who feel that during the war it should be abolished, and that cyclists should concern themselves with the more serious problem of winning the war. On paper, of course, such an argument seems plausible enough, but we must remember that a certain amount of healthy relaxation is needed by all. It would be dangerous indeed to cut out all forms of exercise and entertainment, for that would affect the national health and undoubtedly have a depressing effect upon national morale. For, of course, the sport of cycling does not take anything out of the national effort. It does not indeed impose a drain upon the national resources of material. Replacements do not occur with the same frequency as they do with a car, and in any case, the amount of material involved in that is small. On the other hand, cycling gives a lot to the country in that it provides an opportunity now and then for the munition worker to refresh himself mentally and physically, and to forget the war for a while. Motoring does impose some strain upon the resources of the country. The more motor cars and motor cycles that are in use, the greater number of men required to keep them in running condition and supply spares. Petrol has to be brought from abroad, and thus occupies valuable shipping space, quite apart from the point that the petrol must be reserved for war purposes. We cannot afford the petrol for pleasure motorists. Those are cogent reasons why the Government does not wish to interfere with a harmless sport which does so much good and they are sufficient answer to those critics—even those in Club circles—who feel that we should abandon all forms of sport during the war. Undoubtedly, the Government has considered cycling sport when it reached the decision to curtail other sports. It came to the inevitable conclusion that no useful purpose would be served in interfering with it.

Basic Petrol Ration

NO doubt the decision to abolish the basic petrol ration will occasion some difficulty to Time-trials promoters, for in most large opens, cars are used for the transport of helpers, food, spares and for rapidly transporting to the finish those helpers who have to report upon the progress of the Trial. This will mean that Events will have to be organised well in advance and that helpers must transport themselves on bicycles, perhaps the night before the event, to their appointed places; such was indeed the practice until the motor car became a popular vehicle.

The abolition of the petrol ration must also sound the death knell of all attempts on road records until the war is over. A long distance record such as the Lands End-John O'Groats, entails following cars which use up tens of gallons of petrol, as it is quite certain that petrol would not be granted for this purpose. As the records stand, so will they remain until hostilities cease. Clubs must rehabilitate themselves to the new Order.

Shorts

SHORTS may now be worn by Time-trialists. This is an example of a national body being led instead of leading. There are those serving on the committees of ruling bodies who have been adamant in their opposition to anything but tights, formerly introduced to render the racing cyclist inconspicuous. Such a description of a cyclist so garbed is, of course, fantastic, but it is pleasant to know that those with their heads in the past or in the sand have been over-ruled by the clubs themselves. At most of the Annual General Meetings, members expressed themselves in favour of shorts and opposed to tights. The one small advantage of a cyclist conspicuously attired in tights was that (paradoxically enough) they were easily recognised by motorists and the drivers of other road vehicles who, realising that a Trial was in progress, more often than not gave way to them. This argument, however, scarcely holds water, because most Trials are held at an hour when motorists are still in a state of sweet repose. Such few vehicles as there are on the road in the early morning are too trifling in numbers to warrant the continuation of a rule which is opposed by the majority, and in any case maintains a Victorian complexion to a sport which has moved with the times, and is far more democratic than those in which it was introduced. We should like to see some younger blood on the committees of ruling bodies, and we should also like to see some of the older men whose services have been valuable in the past, but which have ceased to be so, resign in favour of the younger generation for youth is knocking at the door and demands to be heard.

Holidays

GOVERNMENT speakers have made it plain that the railways and motor cars as well as motor cycles are not to be used for holiday-making. Here, again, the bicycle demonstrates its great advantages. The Government does not discourage cycling; it encourages it. This year there will be many more thousands of cyclists on the road. A fair percentage of them will be motorists who are now perforce cyclists. In this respect we shall be glad to extend the facilities of our Touring Advice Bureau to any reader who wishes to have a Holiday Tour planned. Particularly does this apply to members of the Cyclist Road Club, for although the activities of this large organisation have been suspended for the duration of the war, its benefits are still available to its members. Mr. Noel Baker recently stated in the House of Commons that he hoped people would spend their holidays in cycling or walking, for this would avoid imposing a strain upon the railways. At least seven days' notice should be given to us to enable adequate time to be given to the plotting of the tour. Where possible we also recommend suitable accommodation.

No Award

THIS year there has not been an award for the greatest improvement in cycle design for the year 1941. It is extremely unlikely that an award will be made during 1942, for bicycle design at the present time is at a standstill.

The New Lamp Mask

THE new lamp mask for cycle lamps has been approved by the Ministry of Home Security, but it is unlikely that it will be in production for some months. Possibly it will not be available until June or July. The new mask somewhat resembles the motor car lamp hood. It consists of a hood 4½ in. long, reduced down to ½ an inch at the remote end. Thus the whole of the light from the lamp itself is passed through the small outlet at the end.

The Tyre Shortage

THERE can be no doubt that the war situation in the East will create difficulties in the rubber industry, and this must reflect upon the supply of bicycle tyres. We must accustom ourselves to the fact that we shall not be able to buy tyres from the same full-range as formerly was available. Possibly the tyre manufacturers may introduce a standard wartime tyre. Tyres for racing machines are not required in sufficiently large quantities seriously to affect the situation, and stocks of those are possibly adequate to satisfy demands during the war. If this proves not to be the case, a shortage may affect road tyres. Tyre economy can be effected on touring machines, but such methods are not feasible with tyres intended for racing. No time-trialist likes to start out on a trial with doubtful tyres. A great deal depends upon the tyre, and once a racing tyre becomes weak, it is practically useless, except perhaps for training purposes.

Touring cyclists can do much to ensure a greater mileage from their tyres. A weekly inspection of the tread to pick out trapped flints, the filling of holes in the tyre with tyre stoppage, and regular attention to the tyre pressures will do a great deal to ensure longer tyre life.

A wayside windmill now in use again

Paragrams

Cat's Eyes for Manchester

MANCHESTER now has cat's eye studs instead of white lines on several of the main roads leading out of the city. It is not generally known that there is a restriction on the use of these eyes. The cost of the eyes must not exceed the cost of painting white lines over 2½ years.

Cyclists as Dispatch Riders

GLASGOW has a corps of young cyclists acting with the Home Guard as dispatch riders. Interested cyclists, who must be more than 16½ years of age, should apply in person at the Drill Hall, Main Street, Bridgeton, Glasgow, S.E.

New Club President

G. A. OLLEY, old End-to-End record breaker, is president of the Southampton Wheelers.

"Danger Board" Dray

ANOTHER old-timer to pass over is "Danger Board" Dray, who was responsible for the erection of many of the early danger board notices for cyclists.

Club Rider's Marriage

PILOT Officer H. J. Ivory, Southend and County Wheelers, has married.

Club Members Meet in Desert

FOUR members of the Charlotteville C.C., all serving in the Middle East, found themselves together "somewhere in the Western Desert." The occasion was appropriately celebrated.

Club's Diamond Jubilee

MR. R. E. WATKIN, club champion 1894 and 1905, who joined the club in 1885, is president of the Southgate Cycling Club in this its Diamond Jubilee Year.

Prisoner of War

HARRY WILKINSON, Oldland Century Road Club, a prisoner of war in Germany since Dunkirk, is fit and well and working on a German farm.

Club Member as Flying Officer

BILL BARNES, Charlotteville C.C., is now a flying officer piloting one of Britain's biggest bombers.

Scottish C.A.'s Sixteen Events

AYRSHIRE and Dumfriesshire Cycling Association hope to promote at least 16 events this year.

Eric Povey at Sea

HAVING finished a course on shore, Eric Povey, Marlborough Cycling and Athletic Club, has again been posted to a ship.

Scottish Rider in R.N.

ONE of Scotland's most prolific open events winners, George Turner, Central Scotland Wheelers, is now in the Royal Navy.

B. Bunlark Wins D.F.M.

A MEMBER of the Yorkshire Stanley C.C., Sergeant Pilot P. Bunlark has been awarded the D.F.M.

J. Blair Passes Over

JAMES BLAIR, famous N.C.U. official and old-time member of the Catford C.C., has died.

D.S.O. Award

SON of George Gatehouse, the famous old-time rider, Brigadier General Gatehouse, Royal Tank Corps, has been awarded the D.S.O. He is with the tanks in Libya.

Sheffield Club's Jubilee

SHEFFIELD Central C.C. celebrates its Jubilee this year.

Clubman as Army Captain

A MEMBER of the Southampton Wheelers, W. D. Watson is now a Captain in the Army.

Scottish Rider Killed

TOM MOFFATT. Goldberry C.C., of Kilmarnock, was killed during the fighting around Tobruk.

Progress on Merseyside

MERSEYSIDE Regional Group of the Y.H.A. made good progress in 1941, the year's bed-night figures being 100 per cent. more than those of 1940. New hostels are badly needed in North Wales, however.

Highest Yet

SCOTTISH Y.H.A. membership is now 21,584, 33 per cent. higher than in 1940. This is the highest figure yet, and compares with 18,720 in 1939, which had the previous record. The 1941 figures are 6,000 more than those of 1940.

Wallington Hall Given to Nation

SIR CHARLES TREVELYAN has given Wallington Hall and estate, Northumberland, to the National Trust. The Hall was one of the earliest youth hostels, while the grounds cover 13,000 acres.

Tom Leslie in Scotland

TOM LESLIE, former championship secretary of the Scottish Amateur C.A., is serving with the R.A.F. in Scotland. He is posted in a remote part of the country, but is comfortably settled, and has his bicycle with him.

Hostels Continue in Ulster

ALTHOUGH tourists from England and Scotland are now barred from Northern Ireland, the Y.H.A. of N.I. continues its work. Some 12 hostels have kept open this year, and have been popular with Ulster wheelmen.

Swiss Hostels Continue

YOUTH hostels in Switzerland continue to exist, although some of the buildings are used by the military. Membership of the movement last year was 75,000, compared with 90,000 the previous year.

Sixty Days for Cycle Thefts

SENTENCE of sixty days' imprisonment was passed at Falkirk recently on a man who admitted stealing eleven bicycles at various dates. The machines were mostly taken while their owners were in shops.

Support for Welsh Highland Proposal

MR. CLOUGH WILLIAMS-ELLIS, chairman of the Council for the Preservation of Rural Wales, has lent his support to the proposal for using the route of the former Welsh Highland Railway as a footpath.

Ghost in Larig Ghru

THE Larig Ghru Pass, in the Cairngorms, and familiar to pass-storming cyclists, is now reported to have a ghost. According to a Scots account, its footsteps follow travellers through the pass. Another Loch Ness myth?

Poor Old Feet!

WHEN a Stotfold man was charged at Biggleswade for riding without lights, he stated that he had bad feet owing to war service, and thought that he ought to ride even when his lamps were out!

Club's Diamond Jubilee

BOTH the University C.C. and the Southgate C.C. celebrate their Diamond Jubilee this year.

Armour Best "25" Miler

JACK ARMOUR, Auchterderran Wheelers, is the best 25-miler of 1941. A Fifeshire miner, Armour won twelve out of fourteen "25's" in which he rode during the year. He is 21 years of age, and has been a serious time trialist since 1939.

Of the six fastest time trials during 1941, Armour won the 1st, 3rd, 4th, and 5th. His best time was 1 hr. 1 min. 11 secs. in the Glasgow Nightingale open, fourteen seconds outside the Scots record held by Will Scott, Crawick Wheelers.

Clydeside Clarion Prepares for 1942

AT its annual general meeting, the West of Scotland Union of the National Clarion C.C. drew up the usual list of monthly union meets for 1942. An innovation this year is to link the normal Sunday meets with youth hostel week-ends. There are sixteen local sections operating under the auspices of the Union, and the new secretary is James Carlile, 12 Willock Street, Glasgow, N.W.

Revision of Scots Catering Appointments

THE Glasgow District Association of the Cyclists' Touring Club has overhauled the list of Scots catering appointments. A meeting of Chief Consuls and others combed the 1939 list for lapsed houses, and added new caterers. The revised list was sent to the headquarters of the Club in connection with the proposed publication of a 1942 handbook.

Popular Glasgow Hostels

GLASGOW district hostels are the most popular in Scotland, according to Scottish Y.H.A. figures. Loch Eck heads the list with 11,088 overnights, followed by Glen Loin (8,148), Creag Dhu (7,845), Strone (7,666), Fintry (6,696), and Crianlarich (6,185), all in the Glasgow area. Most popular hostel outside this area is Troon, in Ayrshire, with 6,015 overnights.

Few Presentations in Scotland

OWING to the demands of war work, few cycling clubs on Clydeside are holding prize-givings. Dundee and Fifeshire clubs have held successful presentations, however, while the Douglas C.C., of Glasgow, is expected to go ahead with its annual event shortly.

Rider as Sergeant Pilot

ANDY BURNS, Douglas Water Clarion C.C., has completed his training in Canada as a sergeant-pilot.

Y.C.F. Time Trials

THE Yorkshire Cycling Federation have planned to promote six time-trials during the coming season: three "25's" for members; a "50," a hill-climb, and an open "25."

Road Time Trials

WEST London District Council of the R.T.T.C. have received 27 applications for permission to promote road time trials during the coming season. The road game holds its own.

Saved from H.M.S. Prince of Wales

W. KINGHORN, Manchester Clarion, at first feared lost, was among those saved from H.M.S. Prince of Wales.

Rider Missing

ALEX McGREGOR, first member of the De Laune C.C. to become a member of an air-crew in the R.A.F., has been reported "missing." He was with the Coastal Command.

Clubman Gets D.S.C.

LT. B. H. BAND, R.N.V.R., of the Anfield Bicycle Club, has been awarded the D.S.C. for his share in the exploits of H.M. Submarine Upholder, which claims to have sunk a U-boat and ten other Axis ships.

Poly. Rider Home Again

DAVE RICKETTS, Poly C.C., now invalided out of the Royal Navy, hopes to take up track racing again. He was wounded in a Naval raid on occupied territory.

Club's Open "50"

NORWOOD Paragon C.C. anticipate promoting an open "50" this year.

Junior Club Champion

CECIL LANE, now in the Army, of the Barnet C.C., was awarded a trophy as Junior Club Champion for 1941.

Brunton, Wiltshire

Around the Wheelworld

By ICARUS

Shorts

THE National Committee of the Road Times Trial Council has modified the rule which says that a rider must be clothed from neck to ankle by adding the words "Except that the knees may be bare." This amounts to their approval of riders being clothed in shorts, but it also means that stockings must be worn. We shall see how many riders take advantage of this modified rule, for that would be a measure of popular desire to scrap tights. I have never liked tights; they smack of the past. It is nice to reflect upon the good times which have gone before, but there is always a tendency to live too much upon memory. Those who have grown old in the sport have a natural tendency to dislike change. They do not bring their ideas up-to-date, and they want to continue in 1942 the methods which were found successful in 1882. But times change and conditions change with them. With those changes must come changes in rules. No one can agree that the conditions of road sport in its early days are the same as they are to-day. In some respects cycling sport has remained static; that is always bad, for it does not denote progress.

It may be that we shall see some faster times as a result of the use of shorts. It has often been argued that tights hamper knee action. I do not think that there is much in this, for open shorts must have greater wind resistance. In wet weather tights shrink, and doubtless this does to some extent hamper free movement of the legs. However, it is nice to reflect that the National Body has been forced to change its inflexible attitude, and thus has answered the criticism that it tended to become a dictatorship.

Now there is a debate as to how many square inches of exposed knee will be permitted. My advice to all clubmen is not to bother about that. The R.T.T.C. has not seen fit to define this, and evidently intend to leave it to the discretion of the riders. Under the present rule, however many square inches of knee are exposed, a rider will not be breaking a rule. It would seem from some of the criticisms that riders are anxious to have another rule to break—or to ignore, as the case may be.

"Victory Bicycles"

A SPECIFICATION has been drawn up by the bicycle manufacturers of America and another body, for wartime bicycles. The specification is intended to conserve materials. I give the specification here.

Frame: 19 in. plus or minus 1 in.—adult—male and female; 15 in. plus or minus 1 in.—juvenile—male and female; no more than 15 per cent.; 18 gauge 1 in. diameter; $\frac{7}{8}$ rear; $\frac{5}{8}$ upright; no truss bar; finish in any non-critical enamel or paint.

Mud Guards: $1\frac{5}{8}$ in. by $\frac{5}{8}$ in.; .020 gauge steel; front not to extend over 8 in. ahead of fork; rear not to extend beyond 30 in. from rear fork.

Handlebars: Maximum spread 24 in., grips whatever available; finish non-metallic.

Handlebar Stem: Plated. Spokes and nipples: Steel.

Saddle: Single coil spring only; maximum metallic weight 3 lbs. Seat Post: Plated; length 6 in.

Fork: Forged or built up tubular, no truss rods, no springs; spread as determined by the tyre.

Front and Rear Sprocket: Non-metallic finish 1 in. pitch by $\frac{3}{16}$ in. Crank: Chromic acid. Pedals: Non-metallic finish wherever practicable. Chain: 1 in. by $\frac{3}{16}$ in.; length 57 in. for 26 in. wheel; length 52 in. for 24 in. wheel.

Rims: Non-metallic finish; 26 in. for adults; 24 in. for juveniles. Front Hub: Non-metallic finish exterior.

Coaster Brake and Arm: Non-metallic finish exterior; no copper or copper base alloys. Tyres: No white wall; $2\frac{1}{4}$ in. for 3 months; $1\frac{3}{8}$ in. thereafter. Lights and Warning Equipment: (Weight not included in the 34 lbs. net weight); optional, as specified by law; light not to exceed 16 ozs., no critical materials. Miscellaneous: Non-adjusting nuts, bolts, screws; non-metallic finish, no critical material; no chain guards; no shirt guards; no stand; no luggage carrier; no tanks; and the total net weight, 34 lbs. Chromic acid cranks will strike cyclists as quaint,

London Centre Re-union

THE London Centre of the N.C.U. held a re-union at the Royal Hotel, Russell Square on March 17th. The programme included dancing and a cycle roller contest in aid of the Red Cross. It was well attended, and we gather that the London Centre has now set its house in order. N.C.U. Secretary Chamberlin tells me that the N.C.U. membership continues to increase; he is a practical cyclist and has worked unremittingly not only to keep the N.C.U. going during the war, but to increase its membership. The N.C.U., I think, will be an even greater force when the war is over.

Salisbury Cycling and Social Club

THAT old-established club, the Salisbury Cycling and Social, reports a successful year, and according to the Balance Sheet, there is a record profit of £303 17s. 1d. This was reported at the 57th annual meeting. The Chairman said that the membership was higher and takings from "billiards and the bar" showed increases.

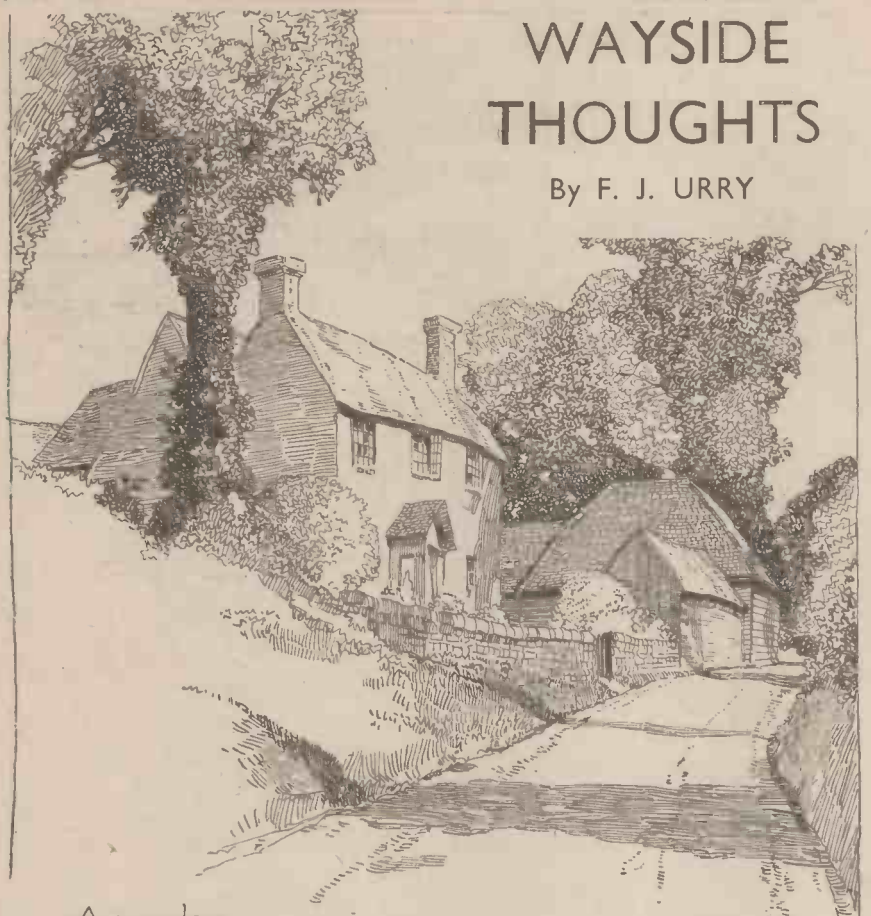
The Institute of Cycle Traders and Repairers

ON January 15th the Board of Trade authorised the registration of the Incorporated Institute of Cycle Traders and Repairers. Here is the official notice:

Incorporated Institute of Cycle Traders and Repairers.—Registered January 29, as a company limited by guarantee, without share capital. The word "limited" is omitted from title by licence of the Board of Trade. The objects are to raise the status and promote the interests of cycle traders and repairers, their managers and mechanics, to provide for examinations and grant diplomas and certificates (but disclaiming any Government authority) to disseminate useful trade information, to print, publish, support and distribute newspapers, magazines, books and pamphlets, etc. The first members of the Council are: Arthur S. Gillott, 39 Railton Road, S.E.24, president; Christopher Hall, 321-323 Wimborne Road, Winton, Bournemouth, hon. treasurer; Hugh G. de Willmott Newman, F.C.I., 91 Kingsley Road, Northampton, secretary and registrar; Geo. Moss, 47 New Hall Lane, Preston, governing director of Geo. Moss & Sons (Preston), Ltd.; Arthur J. Bradbury, 2 Avonlea Drive, Manchester, 19; Wm. T. Coutts, Spreacombe Lodge, Woolacombe, N. Devon; Norman Ingram, 6 Campsbourne Parade, Hornsey, N.8. Registered office: 104 High Street, Watford, Herts. The original number of members is declared to be 100, each liable for not more than £1 in the event of winding-up. Members are to be of three grades, viz.: Fellows, to be entitled to use the letters "F.I.Cyc.T." and the designation of "Incorporated Cycle Trader and Repairer"; Corporate Members, to be entitled to the designation "Incorporated Cycle Traders and Repairers," but no qualifying letters; Associates, to be entitled to use the letters "A.I.Cyc.T." and the designation "Certified Retail Cycle Manager" or "Certified Cycle Mechanic," as the case may be.

WAYSIDE THOUGHTS

By F. J. URRY



A sunny lane
PYRFORD
SURREY.

Will you try it?

THERE must, I suppose, be some people who glance through this column just to discover what the old thing who indites has to say, while abjuring the advice he may happen to hand out. If that be so, then let me just ask, beg or persuade such folk to remember we are on the threshold of Spring, that travel facilities are restricted to all types of wanderer except the cyclist and the walker, and even the latter usually needs the aid of bus or tram to put him on a fair ground where the acres roll untrammelled in green loveliness to the skyline.

All I have said of cycling is perfectly true to the moderately fit expert, but it may not pass muster with a rider who comes new to the saddle, or returns there unto after a lapse of many years. That an ordinarily active individual can get reasonably fit for pleasure cycling in three weeks of gentle travel every other day or so, is a fact awaiting your confirmation, and I ask you who read but ride not, to test this means of making every odd hour of leisure a spring or summer holiday. If you do not own a bicycle for the purposes of proving this fact, borrow one, it should not be difficult, or hire one, but do see that you fit easily to it. Then go quietly, don't struggle uphill or force the pace on the level, ride as you would walk, well within yourself. In an hour turn home again or stay for a smoke or a drink; treat yourself normally and rationally, and I swear that after very few such journeys you will be riding easily at an average speed of nine to ten miles an hour, with a comfortable range of forty to sixty miles of travel within the confines of a leisure day.

Be intelligent about it

I DO not want to exaggerate this matter by telling you it is as easy as falling off a house. It isn't. You must be fairly fit for cycling to sit comfortably and to ride without strain. If you cannot do the first, then the saddle is the wrong type for your make-up, and or, the bicycle does not fit; it is probably geared too high. For myself, I ride a sixty inch normal gear and always use a Brooks B72 saddle. Other folk may find ease and comfort in the use of springier seats or slightly higher gears. It is a matter of taste, and to some extent use; but the saddle and gear I name are a sound basis from which to experiment. Many people are apt to accept the bicycle as an unalterable machine, whereas it is most assuredly not. Reach, saddle position and handlebar are all adjustable to suit almost any rider, while a saddle can always be changed, and a gear lowered or raised at little cost. If you are to obtain the full enjoyment from cycling, the machine must fit you, and you must not try to make yourself fit the machine. This matter is of the utmost importance when buying; if, as I suggest, you borrow or hire for trial, take the advice of a cycling friend on the question of position. In other words, give the pastime a chance to please you as a travel method for holiday-making, as a means to see the lovely land in your limited leisure, the land for which you are working to preserve—among other things—the freedom of cycling.

The simple reasons

MAYBE you who read these lines are using a bicycle daily for utilitarian purposes, as I am. Maybe, too, you are glad to be released from it at the week-ends because of its contacts with the daily grind. That condition of mind is just a habit, and in saying that I am but giving a very long experience of work-a-day and pleasure cycling extending over more than forty years. During that long passage of time I do not recollect a day of leisure when I would have abjured cycling for pleasure, simply because to me it is the expression of perfect pleasure freedom, with the ever-changing visions of a beautiful countryside and the varied moods of a delightfully varied climate. I am not so narrow in outlook to suppose everyone can obtain the same measure of joy from the pastime; but I do feel that thousands of folk, particularly in these days, can discover in cycling, quiet philosophic roaming, and a degree of enjoyment of which they are largely ignorant. I do not like the word escapism, it smacks of running away from responsibility; but to some extent it does interpret the new world that cycling can open for the individual whose life is mainly spent in industry amid the crowded areas. Spring is nearly with us, and a new earth is unfolding its magic and its glory; even war cannot change its broad beauty, but rather seems to add a measure to its loveliness: and all I ask you is to try out a simple and healthy method by which to make contact with Nature, the mother of all of us, and still the great consoler.

Take care of them

EVERYTHING is short in these days except work, and most of us would agree, I suppose, there is rather too much of that, but it's got to be done. On the best authority I am told that tyres will be in short supply, and advised to tell all and sundry to take special care of these necessities because they will not be readily replaceable. Most of us are a bit careless, I think, with our covers: I know I am—or have been—for when one shows signs of disintegration and liable to cause me roadside repair, I generally scrap it for the purpose of economising time and trouble. I know we are told to do this, that, and the other to our tyres in order to give them a longer useful run, but from my observation, and certainly from my own experience, such excellent advice falls mainly on deaf ears. Well, if we are wise we shall now take precautions, pick out the flints and glass spicules from the treads of the covers and treat the wounded spot with tyre stopping, for by so doing one can certainly add anything up to 25 per cent. to the useful life of a cover. Although I use the lightest wired-on tyre of 1¾ in. section obtainable, and a third of my mileage is over city roads, my average running for a rear cover is 7,000, and slightly more for a front. But I do keep the tyres up to pressure, and I'm afraid that desirable economy is not always carried out by the work-a-day rider, and accounts for a lot more tyre wear than the miles covered. It is true, I think, that the quality of tyre is not quite so high as it was before the war, probably due to the fact that the period of maturity has been reduced, that important lapse of time between the manufacture and the date the cover is put into service. Generally speaking, however, we have little enough to complain about, particularly when comparisons are made between the pre-war covers of 1914 and the tyres we get to-day. For toughness, durability and speed, the present types are truly wonderful in their resistance and mileage wear.

Challenge your critic

AS most of my readers are aware, I have rather a high regard for cycling for reasons which have been printed dozens of times, and in numerous places. There must be many thousands of folk who think similiarly in reference to the pastime, but perhaps seldom speak about it, and I should like all such people to take up the challenge whenever they hear the pastime derided by some superior person who has more money than sense, or that worst kind of individual who has less sense to match the little money he fails to spend for the acquisition of sound healthy advantages. Usually the criticism of cycling is that it's hard work, and it nearly always comes out of the mouth of a naturally idle individual, and occasionally from a man whose riding has been confined to short and hurried distances on an entirely unsuitable type of machine. Argue with such people and you will discover that the hard work excuse is just about their limit of explanation as to why they do not like cycling; that, and the half-hidden impression that the pastime is rather beneath them, though the latter reason is seldom given in a downright denunciation, but comes via the channel of half concealed snobbery. Wherever or whenever you meet this kind of talk, take up the challenge on behalf of your game, not violently, but in the kindly spirit of toleration, and the regret that the experience of life has not given the critic one of the simplest and supremest of its joys. We cyclists need such champions, and because we know the pastime is so very good we ought not to lack for missionaries. For too long has cycling suffered from the unchallenged criticism of the semi-conscious snob; let us have done with it by stressing the value of the game, and the overwhelming weight of numbers that play it.

A NEW FEATURE

NEWS FROM N.C.U. HEADQUARTERS

ASSUMING that the war situation remains in any way static in the country, there is every indication to believe that the sport of cycle racing will be much more active in 1942 than since war began.

Every N.C.U. Centre which has the smallest opportunity to promote Track Meeting or Meetings is being urged by Headquarters to prepare their plans immediately. Many districts will, of course, be hard put to it to find competitors, and here is an opportunity for Club Competitions and Junior Championships.

Several meetings have already been booked at the Slough Track, and programmes for Paddington are progressing favourably.

Centre officials throughout the country are reminded that Headquarters are only too willing to help financially and in every way possible.

In Aid of Red Cross

All Centres of the Union are being urged to hold a Rally in aid of the Red Cross between Easter and Whitsun where possible. A programme of suitable events is being prepared by Headquarters for circulation to Centre Secretaries, and Centre Meetings should be called to discuss this question at the earliest moment.

The Union are greatly disappointed with the result of their efforts with the R.A.F., inasmuch as the R.A.F. have now officially declared that cycling cannot be recognised as a sport, and that it must be left to the discretion of Commanding Officers as to whether such will be permitted or not. This is indeed an astonishing decision, and one which both members of the Union and every cyclist in the country will be at a loss to understand.

Every known sport is, of course, encouraged both in the Army and Air Force, and is as much a part of the men's training as is the pursuit in which they are actually engaged, and why the sport of cycling should be singled out for what amounts to a veto is incomprehensible, to say the least.

Very fortunately, numbers of R.A.F. Commanding Officers are good sportsmen, and encourage the formation of Cycling Clubs in their actual units. If this can be done, it is difficult to see why the order cannot be made general, because it would be very hard luck on keen cyclists who were stationed under the command of an officer who was opposed to the game and could consequently veto cycling, to see boys in a neighbouring unit encouraged to pursue their sport. There seems to be neither rhyme nor reason in the edict.

Membership Figures

Members of N.C.U. Clubs have given good striking proof of their power in the Union, and have by their own efforts, both on the Club membership and Associate side, been materially responsible for increasing the Union's membership for 1942, over the corresponding period of 1941 by very nearly 10,000.

My Point of View

BY "WAYFARER"

Retrospect

AT this juncture in the March of Time, it is always interesting to look back over the winter season—now, one hopes, departing in peace—and to look forward to the promise of spring. Those of us who have remained faithful to the pastime through the dark days and the inclement weather are at this moment in the way of reaping our reward. Gone are the days when we had to fight our way "through snow and ice" to our destination: gone the days when darkness overtook us before we stopped along the road for a well-earned tea. We have traversed the difficulties of the winter with our flags flying, and now we step forward to the better days immediately ahead, and to those even better days of brilliant sunshine, cloudless skies, acceptable warmth, and long evenings, that will follow. It has been worth while paying the price to keep ourselves fit during the winter so that we can be ready to take full advantage of the joys on the threshold of which we now stand. That is an impression I formed many years ago, and a very long term of cycling all through the dark months of the year—some of which, by the way, can be most delightful—has done nothing to alter my opinion.

Encounter

NATURALLY, one occupying my place in the world of wheels has some curious and interesting meetings from time to time. For instance, the other Saturday, when I was meandering through a pleasant lane in Worcestershire, on my way to Shropshire, I was overtaken by a young cyclist who had just ridden past me in the other direction, and he said: "Excuse me, but aren't you 'Wayfarer'? You won't remember me, but we had tea together in a cottage a few miles from Killarney three or four years ago." I did remember the chance meeting with two Liverpool boys, the jolly tea up at Windy Gap, and the pleasant ride back into Killarney. My young friend, who was wearing a clerical collar, told me that he is now a Methodist parson located in the Black Country, with three churches to look after. In the intervals of his work he is wisely making a point of exploring the Midlands with his faithful cycle.

Questionnaire

THE fact that *The Cyclist*, owing to the war's exigencies, is temporarily embodied with a periodical whose readers are probably, in the main, non-cyclists (though many of them may possess bicycles—there's a subtle difference there!), prompts me to do the proselytising act in the hope that the eyes of some of the supporters of *Practical Mechanics* (as such) may stray to this section. Normally, a cycling publication appeals principally to cyclists, and one "preaches to the converted," but in this place we are surrounded by the unconverted—I won't say by "the heathen!"—and one has a chance of putting in a good word for the prince of pastimes: a word which may be read with interest by those who view the bicycle merely as a handy instrument of travel—a method of "quick walking" to the shops, or the post office, or the factory.

Cycling is a pastime which is very much misunderstood, and there are still millions of people who have failed to discern the magical properties of the bicycle. The bicycle is looked down on because of its cheapness. It is despised because every Tom, Dick, and Harry rides one. But before our non-cycling readers join in the chorus of condemnation, will they be good enough to wash all prejudice out of their minds and see what answers they can provide to the following questionnaire, the details of which I set down just as they tumble out of my mind:—(1) Are you interested in what Robert Louis Stevenson picturesquely called "the living out-of-doors"? (2) Would you like to be in a position to use that delectable world in an easy, inexpensive, happy, and practically unrestricted manner? (3) Are you concerned with securing physical and mental fitness? (4) Are you intrigued by the thought of exploring the land in which you live? (5) Would you like to be on speaking terms (so to say) with the Lake District, the Yorkshire Moors, the Welsh holiday-ground, the Wye Valley, the Cotswolds, and the New Forest? (6) Do you desire to come in the category of "travelled men" (Tennyson), and to find that the mention of this place and that place strikes a responsive chord in your memory? (7) Would it please you to have your mind enriched and your store of knowledge enlarged through the medium of travel? (8) Would it interest you if you were master of an open-air recreation which is possible on almost every day of the year—a recreation which knows no seasons, and one which is as good in the dark as in the light? (9) Would you like to be so weather-proofed that the minor "ills that flesh is heir to" ignore you as they plough their way through the populace as a whole? (10) Would you like to have, week by week, sparkling memories to look back upon and provocative joys to anticipate? (11) Would you like to secure the abolition of "Black Monday"? (12) Would you like to have at your command a pastime which fits in so well with many other pastimes? (13) When it comes to holidays, would you like to have a cheap and thrilling method of spending your time, and one which provides you with utter freedom, with long, long days in the open, and a perfect procession of new and acceptable sights and experiences? (14) And, in the evening of life, when old age ties you to the chimney-corner, would you like to possess a vast store-house of memories which, with the aid of your maps, will enable you to fight your battles o'er again?

There are the questions. What are the answers? The way lies open to thousands of people. One who has been enjoying the pastime of cycling for over 50 years, and who is now obtaining greater delight out of the game than ever before, suggests that the matter is worthy of the closest consideration.

Notes of a Highwayman

By

LEONARD ELLIS

A Unique Claim

THE county of Northamptonshire possesses two of the three surviving Eleanor Crosses in the country. It is not certain how many were originally erected—some stories say ten, others twelve, and even thirteen has been suggested. It is said, however, that the most beautiful survivor is the one proudly owned by the town of Northampton. This stands about a mile south of the town, on the road that strides almost due north and south through the centre. It stands on nine octagonal steps and follows the pattern adopted for all the crosses, that is, spire-shaped and diminishing by sections towards the top. The other Northamptonshire cross is to be found in the village of Geddington, a few miles from Kettering, and although perhaps not so attractive as that at Northampton and the third survivor at Waltham Cross, it is fairly obvious that this contains more of the original than the other two, which have been considerably restored. Geddington is said to differ from all the others, present and past, in that it has three sides. Most of the original carving has disappeared, some by weathering but most, it is to be feared, by sheer vandalism. It is said locally that at one time the inhabitants indulged in a so-called sport of releasing wild squirrels and then pelting them with stones. The cross suffered as many of the frightened animals took shelter among the pinnacles.

A Queen's Last Journey

THE story of the Eleanor Crosses is, of course, well-known, although no two versions are exactly alike. King Edward I and his Queen, Eleanor, were travelling in the year 1290 when she sickened and died at a mansion in Harby, Nottinghamshire. Her body was taken by road to Lincoln Cathedral to be embalmed, and thence to London, via Grantham, Stamford, Geddington, Northampton, Stony Stratford, Woburn, Dunstable, St. Albans, Waltham, Charing Cross, and Westminster. Edward built a chapel at Harby, and at each of the other places in the list, where a night was spent on the journey, he caused a beautiful cross to be erected. The cross standing at Charing Cross Station is a faithful copy of the original, and was erected by the Southern Railway Co. Only three of the originals survive, the others have just disappeared, and it is said that most of the vandalism was carried out by the Parliamentarians in 1643. The cross originally erected in Cheapside to mark the rest at St. Paul's was destroyed and replaced in 1486, while a third suffered in 1643.

The Eleanor Cross, Northampton.

A Little-known Abbey ruin

THERE is a little spot in Staffordshire, rarely visited, or so I imagine, by tourists other than the local cyclists, and yet there is much of interest. The fame of Alton Towers has spread far beyond the borders of Stafford, but few tourists would reach Alton by way of Croxden. It is, however, worth trying. To reach the village it would be necessary to branch off the Uttoxeter-Ashbourne Road, a mile or so short of Rocester village, near a mill. In the village of Croxden will be found the fine ruins of the old Abbey. It was built by the builder of Alton Castle, only a few miles distant, one Bertram de Verdun, a Crusader in the 12th century. A considerable part of the building still remains to be seen, and the old stone coffins of the monks may be found in a field nearby. There is a story that King John, on his death-bed was tended by the monks of Croxden Abbey, but the supporters of Croxton Abbey in Leicestershire make a similar claim. It is said, also, that although the body of John was laid in Worcester Cathedral, his heart remains at Croxden. Although there are several dismal spots in the neighbourhood to be avoided, there is, on the other hand, a considerable amount of interest and beauty.

A Fine Vantage Point

MIDWAY between Congleton and the northern end of the Potteries lies Congleton Edge, perhaps better known as Mow Cop. To the traveller along A34 this long hog-back is a prominent landmark and seems to call for a further exploration. Any tourist who succumbs to the temptation will be amply rewarded, even though he must shut his eyes to a certain amount of squalor and sordidness. The very first thing that will strike the cyclist is the appalling gradient of some of the roads, some of the slopes are as steep as 1 in 4, and seem to stand up like the wall of a house. The summit is not exactly beautiful, and there is a distinct air of deserted quarry about the place. Shattered stone, broken banks, miserable cottages, and the like go to make up the scenery. But on a clear day all this is forgotten or overlooked in the appreciation of the magnificent views presented from the vantage point. From an altitude of over 1,090 feet we can look right over the Cheshire Plain to the hills and mountains of North Wales and eastward in ever higher terraces rise the foothills to the Derbyshire heights. Away to the north-west the jagged outline of the Roaches can be seen only a few miles away.

What the Clubs are Doing

West Kent R.C.

THE West Kent Road Club has resumed its activities.

Port Talbot Wheelers

TWO R.A.F. members of Port Talbot Wheelers are reported "missing believed killed." They are D. Francks and K. Quick. The club has 28 members serving with H.M. Forces.

Jessie Springhall Marries

POPULAR hon. sec. of the Women's R.R.A. and road rider of repute, Jessie Springhall has married Engineer-Officer John Moss, Royal Navy.

Bidlake Memorial Plaque

THE Bidlake Memorial Plaque has been awarded to Mr. A. S. Gilliott, president of the National Association of Cycle Traders, for his work as founder of the Institute of Cycle Traders and Repairers.

Tommy Goodwin Married

THE man who rode 100,000 miles in 500 days, "Tommy" Goodwin, has married. He is serving in the Royal Navy.

Club Official Weds Caterer

BILL HUNTER, secretary of the famous record-breaking Crawick Wheelers, of Dumfriesshire, was married last month to Miss Mary McGugan, who is serving in the W.A.A.F.

Miss McGugan is well known to tourists through her connection with the McGugan catering establishment at Ballintoy, County Antrim.

Waterson in N.F.S.

JOHN WATERSON, the West of Scotland Clarion time trialist and Road Records Association of Scotland record holder, has joined the National Fire Service. He is about and well again after an operation for appendicitis.

12 Hour for London

WEST London Cycling Association contemplate holding a 12-hour event this year. It will fill a much needed want among London time-trialists.

Barnet C.C. President

C. W. COOKE, well-known North London worker for the cycling cause, has been elected president of the Barnet C.C.

New T.T. Secretary

CYRIL HEPPLESTONE, former road-record aspirant and record holder, is time-trials secretary for the Yorkshire Road Club.

Crouch Hill C.C.

CROUCH Hill C.C., now celebrating its 62nd year, has combined for all fixtures with the old-established North London C.C.

The Panther R.C.

THE Panther Road Club has disbanded; all its members have been called up.

Edinburgh Cyclists Protest

THE Cyclists' Touring Club, Lothians and Peebles D.A., has passed a resolution expressing concern at the low standard of driving by the drivers of public service vehicles in Edinburgh.

An Alternative Jacket

THE West of Scotland T.T.A. has decided to ask the Scottish Amateur C.A. to permit an alternative form of jacket for time trials in consequence of clothing coupon troubles.

Cyclist Escapes from Hong Kong

A WELL-KNOWN Ayr cyclist, Colin McEwan, was one of the British who escaped from Hong Kong, where he was assistant supervisor of physical education.

Club Award

ALTHOUGH only 16 years of age, Guy Davis, Southgate C.C., covered 10,015 miles in 1941, of which 1,243 were to and from school. He tied for his club's attendance medal.

Rosslyn Ladies' C.C.

ROSSLYN Ladies' C.C. celebrated their coming-of-age with a dinner-dance, Miss Jessie Springhall presiding.

Sir Wm. Rootes and Sir Albert Atkey at the meeting of the Cycle Trades Benevolent Fund

Camden Wheelers

CAMDEN Wheelers serving members include Sergeant Len Brown, who is with a parachute unit. Miss M. Steer, Camden Wheelers, is serving with the Australian W.A.A.F.

Killed in Action

SERGEANT Air-Gunner C. Wright, North Road C.C., has been killed in action.

Help for Services

GLASGOW United C.C. is to permit serving members of the club to enter its open and club events free of charge.

Nineteen Events Proposed in West Scotland

THE West of Scotland T.T.A. has approved of nineteen open events this season. This is two less than in 1941.

Jack Whitear

A FORMER winner of the North London Open "50," Jack Whitear, East Anglian C.C., has been killed in action.

Bristol Severn R.C.

THE Bristol Severn Road Club has been resuscitated.

Jack Holmes Wins "25"

JACK HOLMES, Yorkshire Road Club, now serving with the Royal Air Force, won the first of the season's important open events, the Balbain Rough-Stuff "25."

E. Jones, Club Champion

F. JONES, Wolverhampton Wheelers, retained his unbeaten certificate in club events held under the auspices of the South Staffordshire time-trials, and ultimately the club championship.

Arthur Solomons Married

ARTHUR SOLOMONS, former chairman of Willesden C.C., has married Miss Gladys Moggridge, present club secretary.

One-Armed Cyclist

THE Hounslow and District Wheelers 21-year-old "live wire," Ron Brown, has only one arm, but he has many outstanding rides to his credit.

Mid-Scotland Events

MID-SCOTLAND T.T.A. and its affiliated clubs are holding eight open events this season, as last year.

Massed-Start at Edinburgh

IT has been suggested that the grounds of Holyrood House, Edinburgh, should be used for a massed-start race.

W. W. Robertson Dead

A FAMOUS old North Road stalwart, W. W. Robertson, has died. He was 73, and had been a member of the club—whose captain he was in the last war—for 50 years.

Rockingham C.C.

ROCKINGHAM C.C. have lost practically all their active members. One well-known pre-war stalwart, Bill Wadsworth, is in Libya.

H. W. Buckingham

ONE of London's premier massed start riders, H. W. Buckingham, Queen's Park C.C., is now a sergeant-pilot in the Middle East.

Prisoner of War

J. BYROM, Colne Valley C.C., is a prisoner of war in Italy.

East Liverpool Wheelers

NEARLY half of the 22 members who attended the 52nd annual general meeting of East Liverpool Wheelers, could boast of 20 years' membership.

Scotland Proposes Sixty

SOME sixty open time trials are proposed for Scotland this season.

Calleva R.C.

A SUBSTANTIAL increase in membership is reported by the Calleva Road Club.

Southgate C.C.

NATIONAL conditions permitting, Southgate C.C. will promote their Open "25" and club events at 25 miles (twice), 30 and 50 miles. The "50" will be an inter-club event with the North Road and Finsbury Park C.C.

Club Champion

THE club champion of Twickenham C.C. is J. G. Whitcombe, who had an aggregate of 8.11.43 for 25, 50 and 100 miles.

Manchester Clubs

SIX well-known Manchester clubs, Aston B.C., Brookfield C.C., Boundary C.C., Manchester Victoria Wheelers, Peterloo C.C., and Trafford Park C.C., have decided to amalgamate.

Cycling in India

BERT CROSDALE, Manchester Athletic Club trackman, now serving in India, won a 15 mile race in the Poona district.

Fastest in South Scotland

FASTEST time trialists in the South of Scotland in 1941 were Jack Tudhope and David Scott (brother of the Scots record-holder, Will Scott), of the Crawick Wheelers.

Baldock Clubman Killed

A. B. PETER HENRY CLARKE, of Baldock, a member of the Nomads (Hitchin) C.C., has been reported missing, believed killed. He was a gunner on a merchant ship, and was nineteen years of age.

Better Pay for Hostel Wardens

AT the annual meeting of the Scottish Y.H.A., Glasgow Distrrict, a resolution that wardens at busy youth hostels should receive a minimum wage of £3 per week was passed.

Herefordshire Hill for Nation

BRADNOR Hill, near Kington, in Herefordshire, has been left to the National Trust by Mr. C. A. Benn. The hill is well known to West Midlands tourists.

Glasgow Sprinter Out East

TOMMIE POTTER, Glasgow Wheelers, who was the most successful Clydeside trackman in the immediate pre-war days, is serving with the Army in the Near East.

Thirty-three Years at Rutherglen

THE National Clarion C.C., Rutherglen Section, is now 33 years old, and is the oldest in Scotland, except for the parent Glasgow Section.

Paris Has Tandem Taxis

PETROL shortage in Paris has caused attention to be turned to tandem taxis. These pull light two-wheeled trailers.

Marriage of Glasgow Official

JAMES THOMSON, the general secretary of the Glasgow United C.C., was married recently to Miss Cathie Campbell.

Over the Million

SINCE the foundation of the Scottish Y.H.A. in 1931, over 1,100,000 overnights have been spent at its hostels.

Clarion Girl For Land Army

MISS ETTA BOYD, Clydeside Clarion girl, who competed in the Midlands Ladies' "25" in 1939, is joining the Land Army.

Increase at Manchester

MEMBERSHIP of the Manchester Regional Group of the Y.H.A. increased during 1941 from 6,165 to 7,766.

Latest Black Market

THE latest "black market" is in accessories and fittings taken from stolen bicycles.

Salcombe is Most Popular Hostel

A VOTE amongst Y.H.A. members on the most popular youth hostel resulted in Salcombe topping the poll.

Lack of Cotters

IN some parts of the country there is already a shortage of cotter pins for bicycles.

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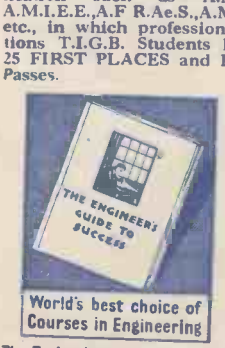

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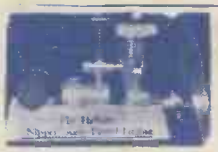

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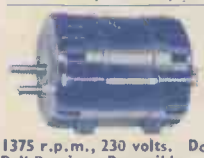

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