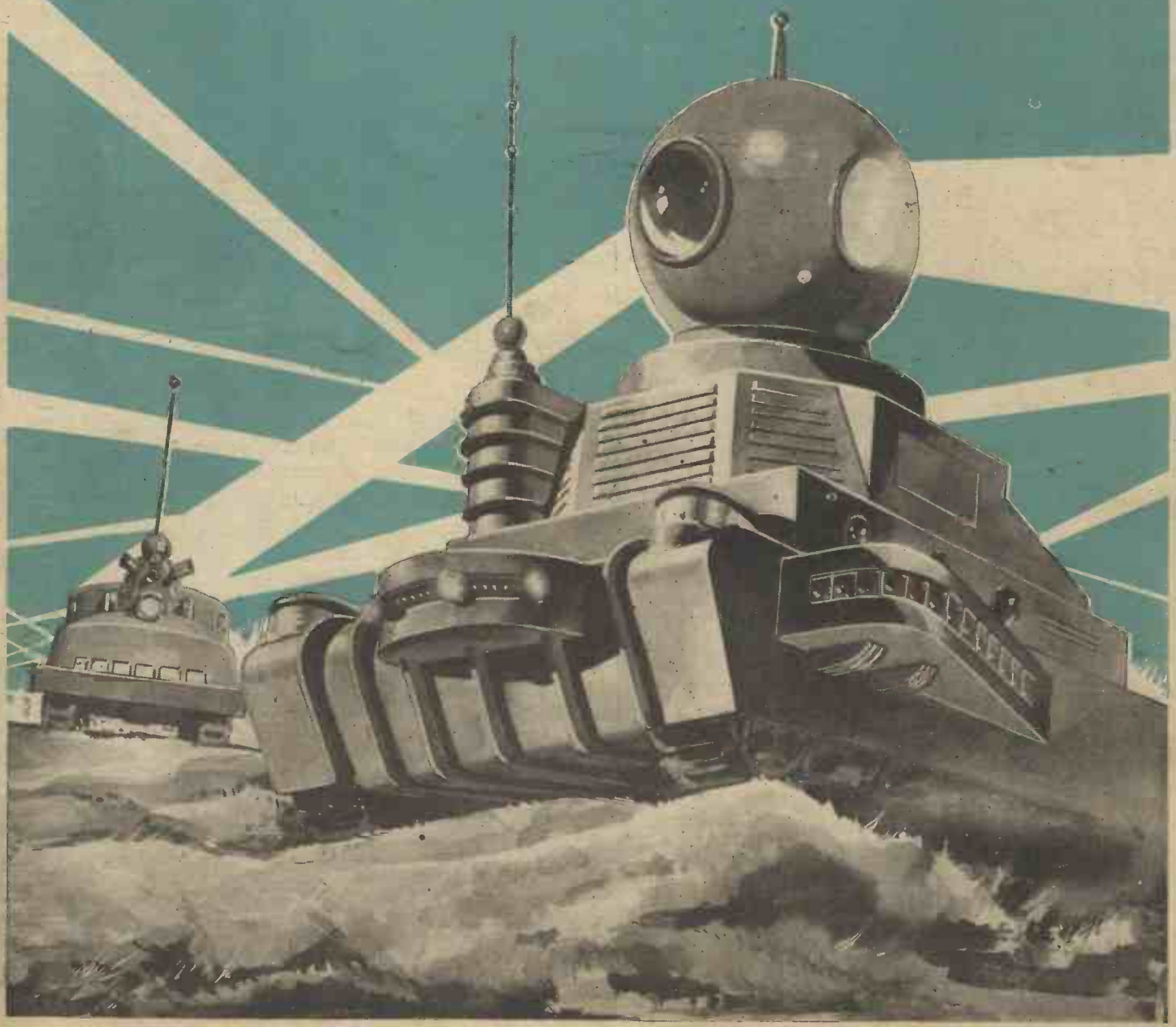
ELECTRODYNAMICS IN WARFARE

9D.

NEWNES

PRACTICAL MECHANICS

JULY 1942



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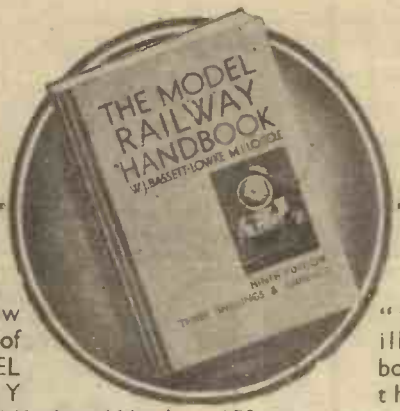

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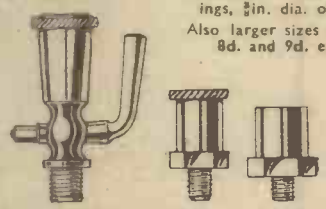

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PRACTICAL MECHANICS

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

Editor : F. J. CAMM

VOL. IX. JULY, 1942 No. 106

FAIR COMMENT — BY THE EDITOR

Scientific Research

PROFESSOR A. V. HILL, F.R.S., vice-president of the J.I.E., recently gave the ninth quadrennial Gustave Canet Memorial Lecture, and his subject was "Scientific Research and Development in the Empire." Canet was a great French engineer who lived so long in England that he became almost English. France does not come very far into the story of scientific research, unfortunately. Professor Hill indicated how closely more effective scientific co-operation within the Empire can be obtained, and he dealt with the efforts which have been made to bring this about. Membership of the Industrial Research Associations is open to firms in the Dominions and Colonies. Research fellowship and studentship bring young workers from all parts of the Empire together, particularly in Britain. The familiar co-operation in scientific work between Britain and the U.S.A. is paralleled by similar co-operation between the U.S.A. and the other countries of the British Commonwealth.

The contributions which have already been made to this organised collaboration have been important, and greater results still will accrue. Prof. Hill said :

"The war is one of unparalleled speed. Success depends upon rapidity of communication, and of detection and interception of the enemy. The time-scale of earlier wars is no guide ; science must be as rapid in dealing with new problems as its products must be rapid in bringing the enemy to action. The essence of effective communication is speed ; the essence of effective co-operation in research is speed ; until frequent personal contacts and rapid communication are available, that speed will not be reached and the potential advantages of collaboration with America will not be fully realised."

The presence in London of so many representatives of science in the Empire, in close and frequent contact with their colleagues at home by visits and correspondence, offered the opportunity of instituting a discussion of joint problems, quite apart from those immediately connected with the war. The persons concerned would naturally be very busy with urgent work, but the question of future scientific collaboration within the Empire, arising from that, with the United States, was so important that a general consideration of it at occasional informal meetings would be possible and fruitful. The two main objects of discussion might be, first, emergency problems of the immediate post-war era, and, secondly, the possibility of making the most of our common scientific resources and heritage, for improving both scientific knowledge itself and the life of the peoples of the Empire.

Royal Society Conference

WITH this in view, the officers of the Royal Society called a conference in October, 1941, of the representatives of the countries of the Empire, together with the officers of the Society, the secretaries of the three research councils (A.R.C., D.S.I.R. and M.R.C.) and others. The president, Sir Henry Dale, in opening the conference, mentioned the ideal of continued collaboration in time of peace, saying that the material structure of society depends on science, and that if reconstruction was to be tackled on a properly international scale science must once more become an international activity. A first step towards this could probably best be taken on the initiative of scientists of the British Empire and the United States together. For example, the international scientific unions would have to be started again, if possible on better lines. Sir John Madsen, from Australia, felt sure that great interest would be taken by the other Governments of the Empire in the view of the United Kingdom Government in this matter ; he suggested that an extension of facilities for meeting and working with their colleagues elsewhere would greatly improve collaboration, and that the first activity of a committee to be set up, following the conference, might be to explore the facilities at present available and the means of extending them.

Government Laboratories

GENERAL A. McNAUGHTON, as president of the National Research Council of Canada, offered every possible help and support for the objects of the conference, and considered that the interchange referred to should occur, not only between universities, but between industrial and Government laboratories in the different countries, including, if possible, the United States. He did not believe that if scientific people were convinced that this interchange was necessary financial difficulties need stand in the way.

Sir Edward Appleton, secretary of the D.S.I.R., hoped that permanent liaison officers would be maintained in scientific and technical matters in peace-time as well as war. Sir Henry Tizard foresaw financial stringency as regards interchange of educational purposes, as distinguished from scientific research, and urged that exchange would be particularly valuable between the universities of the Empire during undergraduate years, especially in applied science. Lord Hankey welcomed the calling of the conference and felt sure that during the exploratory work proposed to be undertaken the enquiry would branch out and important new points of interest emerge. He referred to the advantage of having a scientific advisory committee with a Cabinet Minister as chairman, to bring science into direct contact with the centre of Government. If in each country of the Empire the scientific organisation was thus arranged, there would grow up gradually an official appreciation of science, since from time to time, as ministries changed, one Cabinet Minister after another would be taking a special interest in science.

Colonel Schonland (South Africa) urged the importance of considering the scientific needs and possibilities of Africa as a unit ; and he added in later correspondence, "It is not a question of money at all, but of brains and sound organisation." A number of others took part in the discussion, and it was recognised that later on it would be desirable, if possible, to secure collaboration with official and unofficial science in the United States ; all were agreed that popular lecture tours did not at all fulfil the purpose in mind ; special reference was made to co-operative work in agriculture ; and the conference then appointed a committee to look into the various proposals made.

Collaboration

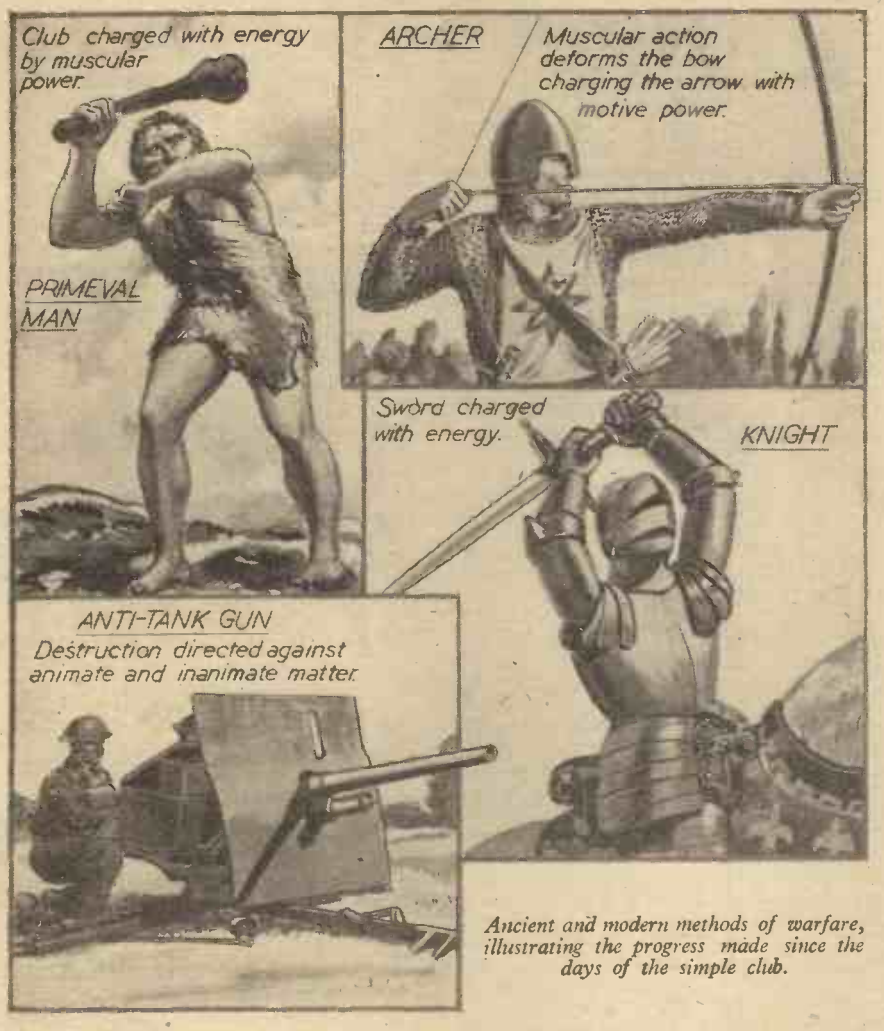
CO-ORDINATION is necessary within limits, to help to guide research into profitable channels and less waste, overlap or its converse may occur ; but in dealing with a group of proud and independent nations, however friendly and co-operative, we and they must all beware of attempting to introduce a degree of direction, authority or control which many will certainly resent. The Imperial Agricultural Bureaux represent an ideal of equal partnership in the co-operative dissemination of information on research. There is no reason why similar collaboration should not be built up about similar bureaux in other scientific subjects, or—for example—around the libraries and information services of the Industrial Research Associations, the Imperial Institute, or other similar bodies in Britain or the Dominions. London need not necessarily be the focus for all. Co-ordination will then come naturally with increase of knowledge, contact and information. Co-operative research is a living, growing organism ; it must be carefully tended, it cannot just be pushed into a mechanical framework planned from outside.

Improvement in knowledge, contact, communication, familiarity, between the scientific people of the Empire—and the United States—will allow that co-ordination.

Electrodynamics in Warfare

In This Article the Author Discusses the Possibilities of Electrical Energy as Applied to Future Methods of Warfare

By KURT DOBERER



Ancient and modern methods of warfare, illustrating the progress made since the days of the simple club.

THE application of electricity for military purposes was discussed in a small book published in Vienna in the year 1883. Since that date electricity has developed into a hydra with a thousand heads, capable of dealing death in a thousand different ways.

Oscillatory Energy

As the methods of electric warfare alter the common methods of warfare in a revolutionary, and not evolutionary manner, we have to go back to the beginning. We have to cut out emotion, experiences and the belief that we know "all about" modern warfare. It is indeed an exercise to forget our prejudices and to clear the way for fundamental new designs of war machines and fundamental new tactics and strategy originating from them.

Abstractly speaking, war consists in directing energy, generated by us, to the positions of the opponent where it can be converted into mechanical or chemical deforming effects when contacting matter. This applies both to animate as well as to inanimate matter, to human beings just as well as to bridges.

The simplest and the most general method of transmission of these deforming powers is the work of destruction performed by bodies charged with energised motion. This pompous explanation tallies with a primitive practice. Primeval man swings his heavy wooden club in a circle, charges it with energised motion generated by his muscles, and then, with full force, lets it go down upon the head of his foeman. There the club performs the deforming work already referred to. This process recurs in a somewhat modified form with the sword of the knight and its effect upon armour and body of the enemy. In this second stage of development the work of destruction is already directed against animate and inanimate matter.

Parallel with this we must register another method, representing a second large domain of the transmission of energised motion. There is muscle power of the archer which deforms the string of the bow. But it is the oscillatory elasticity of the material which turns the force which deforms the sinew of the bow into motive power in the arrow hurled away. Reaching its aim in the body of the enemy, the energised motion re-converts itself into a deforming effect. Somewhat modified, this entire process recurs with the bullet of a rifle and the shell of an anti-tank gun. In this stage, the work of destruction is already again directed towards animate and inanimate matter, towards human beings and their protective armour plates.

Sound Waves

Even though we are now applying higher forms of elastically oscillating energy in the action of sound waves, of electrical oscillations, of visible and invisible vibrating waves, it is in fact only a repetition of the whole primitive process of the transposition of different energies. Always they are transformed into work of destruction when reaching their objective. It is a simplification, accomplished by modern thought, that, in this respect, chemical and mechanic-physical processes here no longer differ from each other in principle, but only gradually, and, what is more, they can be brought together into one large fundamental scheme.

In connection with the different kinds of oscillating energy, it has proved most difficult to study the special peculiarities of the possibilities of its transmission. As, however, all possibilities of a rational exploitation depended upon a knowledge of the specific process of the flow of current, the aim of man was, above all, directed towards the study of the coherence, the commensuration and the differentiation of the various kinds of energy which are transmitted by oscillation. To-day, this enormous domain of science has been combined into one huge system. This scheme distinguishes itself more by giving exact results in all practical cases than that it would claim to be, from a philosophical point of view, a finality of the incontestable truth of nature's ultimate secrets.

Transmission of Energy

Before we venture to look into the great system of oscillating energy, we will once more properly acquaint ourselves with the basic idea. We will find out the difference between the transmission of energised motion —as demonstrated by the previously described examples of the arrow and the bullet—and the transmission of oscillating energy through a simple example. For this purpose, let us go to a skittle alley. There we put the "King of ninepins" alone on the square slab and set ourselves the task of overthrowing this skittle by the transmission of energy from the opposite end of the alley. In keeping with the manner in which we dealt with the arrow and the rifle bullet, we will arm ourselves with a skittle bowl, charge it with motive energy from our arm-muscles, and then drive the bowl down the centre-plank of the skittle alley. At the end of the alley, it will then have conveyed a part of its energy to the "King of ninepins" and knocked him over.

Now let us apply the new process of the transmission of energy to the "King of ninepins" alone. We again place him upon the square slab, take the ninepins and when necessary a further nine from the adjoining skittle alley, set them up in a long row in such a manner that the length of each ninepin is always somewhat greater than the space between two of the ninepins. If we then wish to impart energised motion to our skittle bowl, it is no longer necessary to let it out of our hand and to send it on its uncertain long journey to the "King." We simply strike the bowl against the first ninepin. It absorbs the energised motion and, in the act of falling over, relays it to the next skittle. As one after the other of the ninepins falls in exactly the same manner, it happens that in the end the last ninepin has transferred its energised motion to the "King" and knocked him down.

This experiment has given us a striking picture of the process of transmission of energy from one particle to the adjoining next

one and of the resulting propagation of energy. Now we only have to use a more elastic material than wooden skittles to get the oscillations repeated. Here then we can observe and study a resulting wave movement during the propagation of oscillatory energy.

Oscillations and Waves

Instead of the skittle bowl, we get a handy stone and go down to the pond at the back of the skittle alley. We then charge the stone with energised motion from the muscles of our arm by throwing it into the water in the middle of the pond. Similar to our skittle bowl, it conveys energy by its impact to a group of minute aqueous particles, and a circle of drops of water are dragged down a certain distance under the surface. As one can observe by the round drops falling from a water tap, the most minute particles of a liquid adhere to each other by a strange power, the power of adhesion. That is why the water-particles, struck by the sinking stone, finally seek to evade it and rebound to their old position. But the other water-particles, scattered around the drops affected by the impact, had meanwhile also been forced a little way under the surface in consequence of the power of adhesion. And they in their turn had similarly submerged the drops in a more distant circle. In the meantime, the water molecules first affected have long since rebounded to their old positions, yes, they have even—similar to the pendulum of a clock—oscillated beyond this distance and then receded again.

In the meantime the power of adhesion has forced more and more particles of water to join the others. Farther and farther out in the pond, bulges of water particles can be seen. As, however, every one of these circular bulges oscillates a fraction of a moment later than the circle of water-drops, situated farther inwards, to which impetus had been given just before, the characteristic round crest and trough of a wave are formed. A part of the energised motion of the stone, oscillating in these waves, travels across the surface of the water.

What we observed here was only a surface wave. Notwithstanding this, as an object lesson it amply explains the wave phenomena. Surface waves exist also in another, and for military science a most important, wave-band. Electro-magnetic oscillations, emitted as longest radio waves by broadcasting stations, travel along the surface of the earth.

The kind of oscillations which are confined to a conductor can easily be demonstrated by a simple experiment. If we stretch a freely suspended rope over a certain distance and hold the one end in our hand, then we are able by moving it, similar to a whip-lash, to transfer energy from one end of the rope to the other. The energy will be transmitted along the rope at a certain controllable speed in an easily visible wave, and perform work at the end of its way.

These examples make the process of the transmission of energy by oscillation so easily intelligible that it is no longer an obstacle for us when we find that transmission in the largest and the most important section of the wave-band proceeds in a manner and speed beyond the reach of direct observation.

Tank Attack Without Men

In summer, 1915, during the Great War, a curious vehicle rattled through the streets of Berlin. There was no driver at the wheel of this iron monster, or he must have been lying in hiding behind the steel plate. In reality, the driver of this tank—for a tank it was—was sitting a good way off in a motor-car, following the war machine and from there the obedient tank received its orders. This remote controlled tank was already then constructed in such a manner that it could also cross trenches. Barbed wire, coming in its way, was automatically cut without special instructions. It would have been easy to fit this tank with Mills bomb-throwing machines, and also machine-guns, able to automatically sweep a sector of the territory with a hail of bullets.

At that time, the idea of this tank was definitely turned down after a demonstration in the presence of a number of military experts, although officials of the Ministry of War in Berlin approved of this war machine. We know to-day that this expert opinion, at least as far as it dealt with the use of tanks generally, was wrong. The constructor of this somewhat prematurely rejected war machine was the engineer, Anton Flettner, who was more successful with other inventions at a later date. Already one year before the outbreak of the Great War, Flettner had filed his application for the final patents for his remote-controlled machine in conjunction with the Felten-Guilleaume-Lahmeyer Works of Frankfort-on-Main.

After the tank had played such a decisive part towards the end of the Great War, it was certainly no wonder that efforts to clear the problem of its remote control were again resumed.

The idea of an unmanned tank, steered from a position of safety, breaking into the enemy's lines, belching forth fire and destruction, was too attractive at first sight. As a result, tanks of this type were designed in all their minute details in the constructional departments of concerns engaged on the production of armaments. Now and again one of these tanks was actually built. For instance, a remotely controlled tank was demonstrated before a number of high Japanese military officers in the Chibel Park in Tokyo.

The Ramming Robot

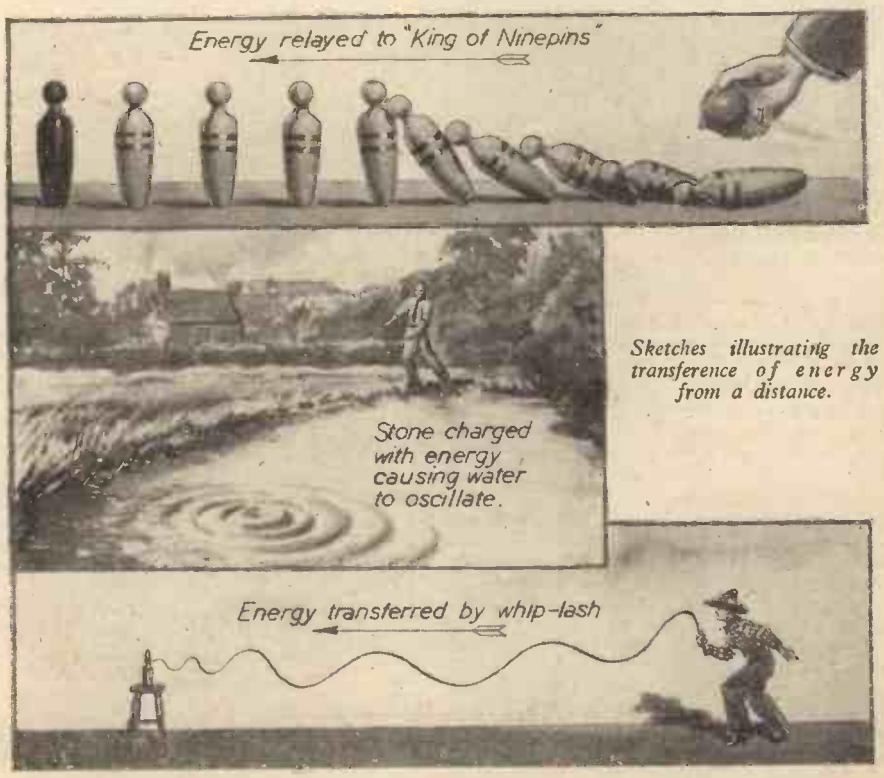
Although the English Air Ministry has always thought of also employing the robot for air defence purposes, and although the robot flying machines were made so popular among the general public in 1935, perhaps for the same reason, remote controlled robot fighter 'planes have not put in an appearance yet.

Perhaps one has altogether given up the idea of robot fighters. In an air battle it is difficult to navigate a robot in such a manner that its guns can be effectively brought into action. The remote controlling centre lacks the lightning-like survey which the gunner has in an attacking machine. Two considerations, however, make the position more favourable for the remote controlled robot. Certainly it is somewhat slower in thought, but all the quicker in deed, as the attacking machine is a heavy bomber, whilst the robot is an agile fighter 'plane. And, secondly, one really cannot say if the attacking bombers are one day themselves unmanned.

But now we make a suggestion, which fundamentally changes the whole situation in this air battle: The modern robot fighter shall be entirely unarmed. In its fight it applies a more dangerous tactic. The design of this robot fighter enables us to foreknow this to a certain extent. It is no longer the biplane, but the heavily and compactly built, all-metal type of a monoplane. All the weight saved through an entire lack of armament has been packed on the front of its body, where it forms a sharply tapering-off steel chrome armour. On its short, streamline-shaped undercarriage it carries a pair of powerful searchlights.

The operating centre on the ground only needs to direct the rays of the searchlight on the grey body of the bomber as soon as the robot fighter has risen high enough over it. Then the robot fighter plunges down like a falcon. It follows the white ray of its searchlight quicker and quicker. With a thundering noise it cuts the grey body of its opponent to pieces. Although one could hardly find the expedient to shield the propeller of the robot fighter in this conflict—there are a few ways for this. It is possible to place the propeller at the rear of the airplane as in a pusher type machine, and in many cases it should certainly be possible to bring the machine down to the ground in a glide. The strength of the robot compared with the human aeroplane pilot is here revealed. During this dangerous manœuvre the robot will never, not even for a moment, lose its nerves, or in the dive its eyesight.

It is interesting, however, that it was not the careful, man-sparing mind which hit upon the idea of these swordfishes. Bomber ramming was actually accomplished first by Republican pilots over Madrid, and in the present war by daring British pilots.



Sketches illustrating the transference of energy from a distance.

The Dry Gas Meter

Constructional Details, and Principle of Operation

By E. F. WALLER

ALTHOUGH an instrument for the measurement of gas consumption, the dry gas meter is in every respect a reciprocating machine, the necessary power to drive it being taken from the gas pressure. It works in a manner similar to that of the steam engine, but being a machine for measuring the gas passing through it, it is fitted with a pair of bellows in place of the more orthodox piston. It is these bellows which do the actual measuring, so that a positive measurement of the gas is obtained without any undue friction. This is of considerable importance when coupled with the fact that a gas meter passing 5,000 cu. ft. per hour must not absorb more than 5/10ths of the gas pressure, or in other words the power necessary to overcome the inertia of the meter must not exceed .018 lb. per sq. in.

The reason for this will be clearly understood when it is realised that to cause complete combustion in any appliance having a Bunsen flame, 25/10th pressure is necessary even with a moderately high quality gas, so that if a meter absorbs more pressure than is allowed, the efficiency of the gas appliance in use is going to be affected.

Unlike other engines, the power output of the meter is not considered, for although it does develop a fairly high output it is not wanted, as the meter does not have to perform any other work, except that of measuring and recording the volume of gas passing through it in terms of some cubic measurement, which in this country is the cubic foot.

Improvements in Design

Much thought has been expended by inventors on the improvement of the dry gas meter, many attempts being made to break away from the more orthodox method; but with the exception of minor improvements, the principle upon which the meter is constructed is the same to-day as when originally designed some 80 years ago by Samuel Clegg. The most noteworthy improvement was the reduction from seven bellows made of silk and cotton fabric, with as many valves to control the flow of gas to and from them, to only two bellows of a special leather, and a pair of valves. Another more recent improvement has been the reduction in overall size of the meter; this has been achieved by increasing the speed at which the meter works and enlarging the gasways. Fig. 1 shows a comparison between the old type and a modern meter of equal capacity. Other improvements consist mainly in the moving parts and the general layout of the meter.

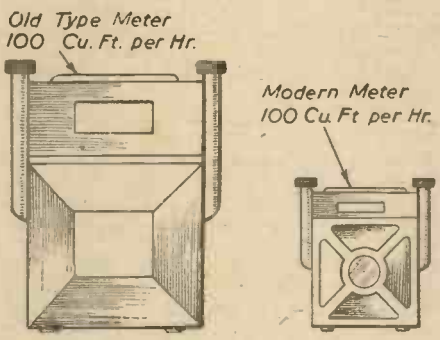
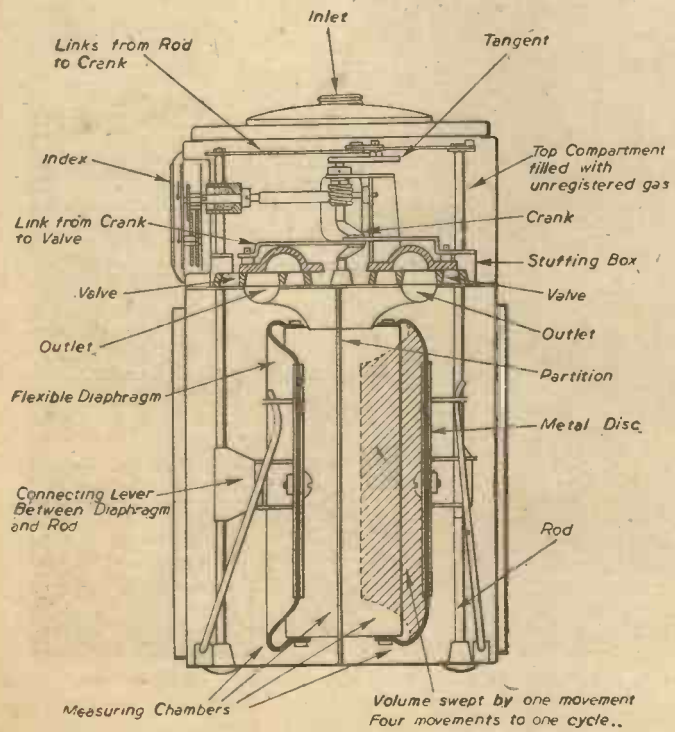


Fig. 1.—Comparative sizes of an old type and modern meter of equal capacity.

Fig. 2.—(Below) Diagrammatic cross-section of a gas meter showing the measuring chambers and valve gearing.



known as the valve plate; gas enters into this top part of the meter and cannot pass below the valve plate except by way of the valves. The compartment below is divided into two separate parts by means of a centre partition, on either side of which are mounted two bellows in such a manner as to form four separate chambers, gas being permitted to and from these four chambers at predetermined intervals by the valves. The flexible diaphragms of the bellows have metal discs attached to them which are connected by means of jointed levers to vertical rods which pass through stuffing boxes to the top or valve compartment. At the top of these rods are fixed linked arms which are connected to an adjustable arm (called the tangent) mounted on the top of a vertical crank. The tangent is made adjustable so as to vary the amount of horizontal movement of the bellows. It is the amount of horizontal movement given to the bellows which determines the volume of gas passed through the meter for one complete cycle of movement; if the amount of horizontal movement is increased then the volume of gas passed per revolution increases in proportion, whilst the reverse happens if the travel is reduced. The linked arms convert the reciprocating motion from the bellows to a rotary motion on the crank, which actuate the valves by means of connecting arms, so regulating the flow of gas to and from the four lower measuring chambers. Mounted on the shaft of the crank is a worm which is geared into a spur wheel mounted on a spindle connected to the index showing the amount of gas consumed.

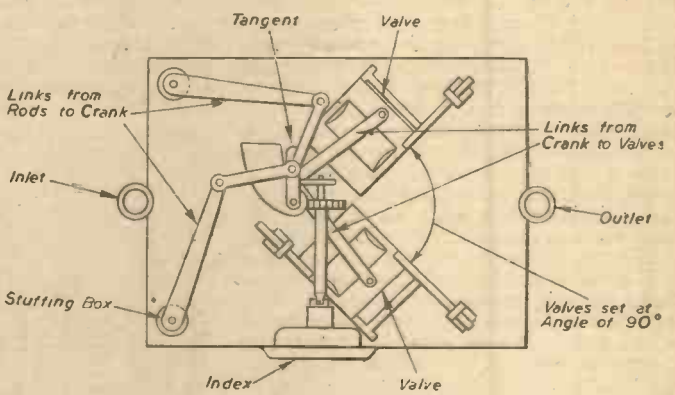


Fig. 3.—Plan of the valve plate layout in a gas met.

Construction and Principle of Working

Figs. 2 and 3 will give a general idea of the dry meter in common use in this country to-day. The casing is made of a stout tinned iron plate, divided up into five separate compartments in the following manner:—

At about a quarter of its height down there is fixed a horizontal platform which carries the valves and their component gear mechanism, and is

The measurement of the volume of gas used is ascertained by the index automatically multiplying the volume of gas contained in one of the lower chambers by the number of horizontal movements of the two bellows.

The Valves

These are usually of the sliding type, made of an alloy of tin and antimony which is capable of taking and maintaining a high polish, with very little friction, and hard enough to work together without grinding.

The valves have each three ports, one connected to the centre lower chamber, one with the outer lower chamber, and the centre port forms an outlet from these chambers, in turn, through the hollow of the valve cover. An important thing to note is that gas is not registered until it has passed through the centre port, which is connected to the outlet

of the meter. That is to say that any leak, either internally to or externally from the meter at any point is unregistered gas.

Leather Diaphragms

The material used for the leather diaphragms of the bellows is imported from East India, and is the skin from the Persian goat. These skins, unlike that of the wool sheep, are hairy and possess a very close textured skin, which, when the hair is removed, tans into a solid yet supple leather. The natives remove the hair and treat the leather with a bark tanning before exporting them.

On arrival in this country, the leathers are shaved to eliminate small imperfections and the vegetable tannage is washed out. They are then subjected to a chroming process. Before fixing in a meter, all leathers are soaked in almond oil containing plumbago in suspension, for three days, and this has the effect of sealing the pores of the leather and keeping it pliable and soft under normal conditions for many years.

Materials Used

As previously mentioned, the external and internal parts of the casing are made from a good quality tinned iron plate, the mechanism being made of a non-ferrous metal, or, if of the ferrous type, then treated in some manner to resist corrosion.

The main materials in the past were brass and white metal, but in the modern meter, where higher speeds have to be contended with, stainless steel and nickel silver predominate, owing to their hard-wearing properties, and their resistance to corrosion. Tinned iron is also used where wear does not take place; ball bearings are being extensively used for main bearings to reduce friction, but they must be carefully packed with grease to prevent corrosion. The whole assembly is carried out by soldering the parts together.

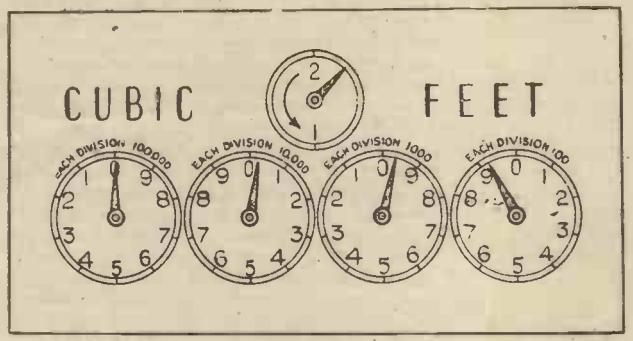


Fig. 4.—A typical gas meter dial plate, calibrated to read in cubic feet.

Reading the Index

Fig. 4 shows a typical index calibrated to read in cubic feet. The top dial is for testing purposes only, and is not taken into the reading at all. It is from the bottom row of dials that the reading is taken. There need be no difficulty about reading the index if it is remembered that, commencing from the *right*-hand side, the first dial records in 100's, the second in 1000's, the third in 10,000's, and the fourth in 100,000's. If there are any more dials on the index, then each one goes up in multiples of ten. It is the first dial on the right-hand side that gives the key to the correct reading, for it must make a complete revolution before the next dial can be read to the next highest figure. Thus, to take the reading shown in Fig. 4, first note the position of the pointer in the first right-hand dial, then, commencing from the left-hand side, write down in order the smaller of the two figures between which the needle points.

In the example shown the reading is taken as 999,900 for, although the pointers are on the noughts in three dials out of four, the first right-hand dial is only showing 9, therefore it has not made a complete revolution, so that the other dials cannot be read to the next highest figure.

Notes and News

A Large Bomber Plant

A YEAR ago Willow Run was just a lazy little creek in America's Middle-West. Its only link with industrial enterprise was that it contained a few plantations of soya beans—the wonder bean which has revolutionised motor-car manufacture in recent years.

To-day, however, Willow Run is the centre of America's greatest industrial development to aid the war effort of the United Nations. At Willow Run there now stands a huge aircraft factory. More than half a mile long and nearly a quarter of a mile wide, it was built by the Ford Motor Company, from which it is planned to produce "Liberator" four-engine bombers—some of the giants which are now plastering Germany every night—at the rate of one an hour. The raw material will go in at one end, and from the other end of the vast assembly lines the thirty-ton aeroplanes will emerge and go straight on to the huge aerodrome which is now being completed. So fast will be the production that no effort will be made to store the finished aeroplanes, and construction work is being concentrated on the factory and on the runways at the aerodrome, rather than hangars.

Factory Area of 255 Acres

THIS wonder factory has cost approximately £11,000,000 to build and covers a total area of 255 acres—nearly as big as Hyde Park, London. Twenty-five thousand tons of constructional steel have been used in building the framework alone.

Only twelve months ago the ground was broken, and excavation started for this huge factory. In less than a month the first piece of the structural steel framework was erected, and on September 1st, 1941, the first machinery for building the "Liberator" bombers was installed. And so this speedy time-table has gone on until to-day the factory is settling down to regular production. In two or three months 70,000 men will be working in this factory, and by the end of the year approximately 90,000 will be in full employment.

Daylight Sweeps

IN the course of offensive sweeps during the past 16 months—for the first was on February 10th, 1941—our aeroplanes have shot down 878 of the enemy over France by day, in addition to many more unconfirmed, and we have lost 607 fighters and only a dozen or so bombers.

Germany Loses More Diesel Engines

THE Humboldt Deutz works in Cologne, on the east bank of the Rhine, were effectively hit in the course of attacks on industrial targets in the city a few weeks ago. Recent reconnaissance has shown that nine bays of a large multiple-bay factory building are completely gutted, and five or six smaller buildings are damaged. These buildings all lie in a corner of the Humboldt Deutz works.

Though it also produces engines and machinery of other kinds this Humboldt Deutz plant's chief contribution to the German war industry is the production of Diesel engines for submarines. In this respect it is almost as important as the M.A.N. factory at Augsburg, hit in the famous daylight raid last April by low-flying Lancasters. Anything which will hold up production in a factory so vital to the German Navy must be counted as a victory by the R.A.F. in the Battle of the Oceans.

Last-minute instructions to Beaufighter pilots before taking off for a daylight sweep over enemy occupied territory.

The World of Aviation

Strong British Air Base : The "Halifax" Bomber : New Italian Fighter

Four-engined Stirling bombers being serviced and "bombed-up" ready for the take-off.

Fighter Pilots

"FIGHTER pilots should be on a strict eight-hour week," said Dr. J. W. Heim, of the Aero Medical Research Laboratory, Wright Field, Dayton. "Medical information from England has shown," said Dr. Heim, "that the average flying life of a combat pilot is about 300 hours. Some men may last several times as long, but for maximum efficiency a pilot's time at the controls should not exceed eight hours a week."

Replacing Blenheims

UNTIL recently, Bristol Blenheims were our main light low-level day bombers; now the American Boston III, twin of the Havoc night fighter, has begun to take their place. It is easily identified by its cock-up tail and tricycle undercarriage. It is armed with six machine guns and carries twice the Blenheim's bomb load.

Air Raid Base in Britain

IT is stated that Britain is to become the strongest air base in the world. A striking force capable of levelling half Germany will be assembled at aerodromes in the United Kingdom. Bomber forces of the R.A.F. have already reached considerable strength, and in addition America builds all the types of medium bomber and dive-bomber which would fill in the gaps in Britain's own programme.

Over 3,000 'Planes Monthly

THE Speaker of the U.S. House of Representatives, Mr. Sam Rayburn, has stated that the U.S. is now making more than 3,330 'planes a month. "We and our Allies can and will build two and a half times as many planes as all our enemies put together," he declared. Mr. Rayburn added that the administrative leaders are confident that President Roosevelt's schedule of 60,000 'planes for 1942 would not only be met but exceeded.

Flying Fortresses

PRODUCTION of the famous Flying Fortress bombers, made by the Boeing Aircraft Company, has been more than doubled since December 7th last.

Tank-lifting Helicopter

REPORTS from Germany suggest that the Focke-Achgelis concern has developed a new helicopter capable of lifting a light tank. In the United States the Russian-American pioneer designer, Igor Sikorsky, has made great progress along similar lines.

Facts About the Halifax

A 'PLANE which is now doing very good work with the R.A.F. is the four-engined Halifax. The following performance figures of this giant machine make interesting reading. It has a speed approaching 300 m.p.h., a range of 3,000 miles, and a bomb load of 5½ tons. The four Rolls Royce Merlin XX engines with which it is powered are each rated at 1,175 h.p. at 20,500 feet, and the machine weighs approximately 27 tons. The Halifax was originally intended as a twin-engined bomber. Design work was started towards the end of 1937, but after seven months it was altered so as to take four engines. The prototype was flying by the late summer of 1939 and the Halifax first went into action towards the end of 1940. Since then it has played a steadily increasing part in the R.A.F.'s offensive. It carries a crew of seven—two pilots, navigator, W/T operator, front gunner, midship gunner, and rear gunner. The total armament of eight .303 Browning machine guns is carried in three Boulton and Paul turrets—one in the nose, one in the top of the fuselage amidships, and one in the tail. The Halifax has a wing span of 99 feet, and is 70 feet long.

Gliding Plan Ready

THE new A.T.C. gliding scheme for the West Riding is now ready. Alderman A. R. Bretherick, vice-chairman of the Yorkshire A.T.C. Association and chairman of the Leeds A.T.C., said that gliding had now been officially recognised by the air authorities as part of the A.T.C. curriculum, and gliding schools were being established in the West Riding. Cadets would build their own gliders, and in each unit in the West Riding a production officer had been appointed to supervise cadets who were capable of doing metal and wood work for producing the glider components scheduled to their unit.

German Radiolocation Claims

ACCORDING to information which has reached this country by a roundabout route, it is indicated that the Germans are now employing almost exclusively as night fighters two-seat aircraft driven by Diesel engines. The machines carry radiolocation equipment which, it is claimed, not only determines the position of enemy aircraft, but enables their course to be plotted. The apparatus is said to pick up the radio-electric waves set in motion by the ignition system of the aircraft engines of the enemy. A Diesel engine is used by the German night fighters so that they have no magneto to interfere with the working of their radiolocation apparatus. The above statement, however, should be treated with reserve, as it was put out by a German newspaper correspondent.

New Italian Fighter

A NEW fighter aircraft which has recently been put into service by the Italian Air Force is the Macchi C.202, which is similar in appearance to our Spitfire. Up to now, most of the Italian aircraft have been fitted with radial, air-cooled engines, but this new machine has a liquid-cooled in-line motor. It is considered to be a development on the Macchi C.200, which, with its blunt nose and somewhat tubby body, had an ugly appearance.

Japs Copying German 'Planes

IT is reported that the Japanese are using a new type of fighter, the Mitsubishi 00, which is a copy of the German F.W.190. Actually the Germans supplied the Japanese with blueprints of the Me.109 and later with details and the services of skilled engineers for the production of the F.W.190.

The Warhawk

THE first American aeroplane in which a British-designed Rolls-Royce Merlin engine built by Packhard Motor Company is used, the Curtiss-Wright Corporation's Warhawk, was recently tested in America. This machine, the successor to the Kittihawks and Tomahawks, is now in production. The War Department has authorised publication of the statement that the Warhawk is faster and has a higher service ceiling than its predecessors, and has exceptionally good striking power.

PHOTOGRAPHY

Making Lantern Slides

Using an Enlarger, Focusing, Toning, Masking and Spotting

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

(*Continued from p. 266, June issue*)

THOSE who possess enlargers will be able to adopt an alternative method of printing lantern slides for, instead of placing the negative in a printing frame and then putting the lantern plate on top of it, and exposing to a light as for the contact printing of gaslight paper, the negative can be placed in a carrier frame in the enlarger and focused on to the easel till the image appears perfectly sharp and covers about 3in. square. This method has the advantage that it is not necessary to include all the picture contained in the negative; it is possible to cut out quite a lot when working on such a small size; or to put it another way, it is easy to focus into the space of a lantern plate quite a small portion of the film.

There are a few points which it is necessary to remember when making slides by means of the enlarger. It is very necessary to dust the negative carefully when the enlarger is the medium for printing, for if the actual slide is an enlarged portion of the negative, and the spot of dust is on that portion, then the spot will be enlarged also, and you can imagine what it will look like when that slide is put through the lantern and the size increased possibly 10 or 20 times.

A very particular rule to cultivate is dead-sharp focusing. If you have not made yourself a focusing plate with some thin cuts made with a sharp knife, and a few dots with a needle point on an old plate which has been exposed, developed and fixed, then I strongly advise you to get one of the Holborn Enlarger Focusing Screens; they are made in various sizes including 3¼ by 2½, ¼ plate, etc. They only cost one or two shillings but their use completely avoids the risk of diffused images when making slides; you will recognise that if a mistake is made, and the image is not sharp in the slide, then it can never be in focus on the screen. Also, be sure to centre the light; by this I mean arrange your light so that there is a circle of consistent lighting without colour fringe exactly where the frame holding the lantern plate is to rest on the easel.

If the enlarger is of the vertical type then it is quite easy to place the plate in position, and without using a printing frame, but I would advise the use of a piece of black paper cut to the size, 3¼ by 3¼, placed just where the plate is to be. This will avoid any halation from the white paper of your easel, and should the enlarger be an horizontal one, and you do not want to bother with a frame, then cut two pieces of narrow moulding from an old photo frame, about 3¼in. long, carefully measure the depth of the rebate and fix the pieces of moulding temporarily by means of a couple of push-pins on to the easel, as in Fig. 1, so that the plate will slip easily between the two, and do not forget the black paper.

Slide-making by Copying

There is another alternative method known as negative copying direct on to the lantern plate. Those who have cameras by which the focusing can be done on a ground glass at the back of the camera will be able to make their slides this way.

The camera is arranged so that it can slide firmly but easily at right angles to the board holding the negative, the board being cut to take a frame holding the negative so that it is open to the light at the back and is facing the lens of the camera; daylight is best, therefore the board holding the negative should be in front of a window as in Fig. 2,

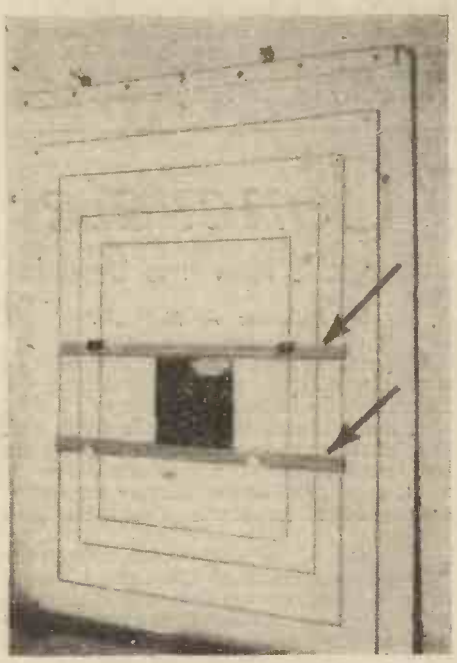


Fig. 1.—Two pieces of moulding forming a slide for the easy insertion of lantern plates when making slides by enlarging. The mouldings (indicated by arrows) are pinned to the easel by darkroom pins.

preferably one facing the north. Between the window and board it is necessary to hang or pin a sheet of thin white tissue paper, and a sheet of ground glass, for the purpose of diffusing the light; sometimes two sheets of paper will serve the purpose. It is not possible to give the mathematical details of the copying tables here, but it is a simple matter to accurately focus on the ground glass screen of the camera and to get the image to the size of the lantern plate. For this work you will require a dark slide for the camera that will take the 3¼ by 3¼ lantern plate. An important point to remember is that the space between the camera and frame on which the negative is fixed must be covered with a dark cloth to prevent any light getting into the lens other than that transmitted through the negative.

The question of exposure, both when using this transmitted light for copying, and when making the slides through the medium of an enlarger, is governed by the light, therefore it is advisable for the worker to make a series of tests on the one plate similar to those suggested for contact printing.

Toning Details

It is necessary, at this stage, to consider the toning of slides, for there is a definite charm in seeing a slide go through the lantern that is different from the black-and-white variety. It has already been mentioned that there are two distinct types of plates, the fast for black tones, and the slow for warm; the former can also be developed to give warm tones, but generally they must be considered only for cold tones. With the slow variety warm colours ranging from brown to red are obtainable simply by varying the exposure and time of development.

Either Azol developer or the solution made from an M–Q packet will enable a good range of tones to be obtained, but users will have to add potassium bromide to the working solution, and for this it is best to have a bottle of 10 per cent. solution of the bromide. The quantity varies according to the tone desired, but assuming that you are working with 10 oz. of developer you will require from 25 to 50 drops of the bromide solution to be added to each ounce of the developer. The 25 drops would necessitate increasing the exposure time by three, and the resulting colour would be a warm-brown; the addition of the 50 drops would require eight times the exposure, and the colour will be a reddish tone. It should be noted that the time of development is increased by the addition of the bromide up to about twice that for normal solutions. For those who wish to make some experiments and tests for a longer range of colours I would suggest the Thiocarbamide developer as recommended by J. Dudley Johnson, of the Royal Photographic Society; the colours obtained from this range from

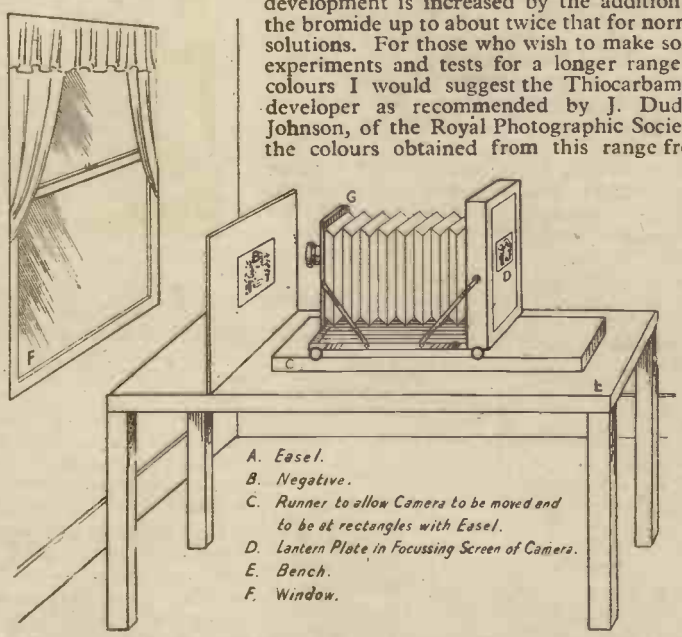


Fig. 2.—The direct copying method of making lantern slides. Space between easel (A) and the front section of camera (G) must be completely covered in to exclude all light, and this should be done with a black focusing cloth, or similar material.

magenta red, warm brown, purple to blue and bluish grey, and grey and black. Here is the formula:

(A)	Metol	22 grains
	Hydroquinone ..	11 ,,
	Soda sulphite cryst.	½ oz.
	Soda carbonate cryst.	½ ,,
	Water to make ..	10 ,,
(B)	Ammon. carb. ..	1 ,,
	Ammon. bromide ..	1 ,,
	Water to make ..	10 ,,
(C)	Thiocarbamide ..	33 grains
	Ammon. bromide ..	11 ,,
	Water to make ..	10 oz.

For warm-browns use A 14 parts, B and C 1 part each. For blue-grey, A 12 parts, B 3 parts, C 1 part. For warm-blacks, A 10 parts, B 5 parts, C 1 part.

Masking and Spotting

Before a slide can be considered finished it has to be masked, spotted and bound, and for this reason there should always be a section on each edge of the pictures that is not required, or care must be taken to leave a margin of clear glass on each of the four sides when making the slide. Sometimes these margins are considerable, and have to be masked so that when the slide is shown on the screen they are not visible. Some workers use ready-made masks, but many prefer to mask by means of strips of the black gummed paper used for the binding.

Assuming that the slide is ready for this final work, lay it on a flat surface with the film side upwards, place the mask in position, and on top of this place a thoroughly clean cover glass; now moisten one strip of the black binding, lay this flat on a piece of card and, taking the slide and cover glass, bring them together as closely as you can and both squared with each other, stand the bottom edges on the strip as near the centre as you can, hold with one hand and with the other turn the strip so that it grips both sides of the glasses; turn them over to the opposite edge and run the thumb and finger along the strip to make certain that it has adhered. Repeat this with all four edges, gripping the slide all the while to ensure a perfect contact between slide and glass.

Those slides which have not been masked before binding can now have the strips of gummed paper stuck on the outside of the cover glass in whatever position is required, and finally the white spots are placed at the top of the slide and on the cover glass, not on the back of the actual slide. If you want to title or nnumber the slide, do this with white ink, and on the same side as the "spots."

Concrete

Its Remarkable Qualities, and How it is Used for Defence Purposes

By Professor A. M. LOW

IN the nineteenth century a scientist, Joseph Aspin, discovered that by heating together clay and limestone, while grinding the resulting substance very finely, a substance was formed which, by the addition of water, produced a cement greatly exceeding in hardness any yet known. It is no great exaggeration to say that this invention was destined to influence warfare hardly less than did the invention of another grey powder some five hundred years earlier.

It is concrete, made by mixing this powder with water, small stones and sand, that has helped man to build fortifications capable of withstanding the blast of high explosives. Over half the modern world lie fortresses which constitute the greatest concrete defences ever known. In all great cities concrete air-raid shelters have been constructed.

The greater the power of high explosive became, the stronger has concrete been made by the addition of steel bars. Anyone who has seen a "pill-box" which has been hit by a large calibre shell will realise the strength of ferro-concrete, which is made in this way, wires and mesh acting as a universal binding for a large mass of concrete. The fortification may be broken, but it is not blown to pieces, for the twisted bars still hold the concrete blocks together.

Pinch a little of the grey powder between your fingers, and you will appreciate its fineness; the particles are so tiny that they should pass through a sieve with 40,000 holes to the square inch. This mesh is closer than a piece of ordinary silk, and water will not pass through it because of the surface tension.

Portland Cement

Portland cement—which, by the way, does not necessarily come from Portland—is not a natural substance but the result of chemical action brought about by great heat. The raw materials are clay and limestone, the clay providing the silicon and aluminium and the limestone the calcium. Cement manufacture is a scientific and complicated process, and even to-day not all the complicated reactions which take place are known. Manufacture is carried out on a large scale, but every step must be carefully controlled. So thoroughly is the mixing done that thousands of bags of concrete, if examined, will be found to contain powder which is chemically exactly the same. Speed at which concrete sets can be regulated by additions to the cement.

Concrete, as already mentioned, consists of a mixture of sand, stones, and cement, the latter, with the sand, forming a mortar which, as a result of chemical action in which heat is released, sets hard and binds together the small stones. The exact proportions of water, sand, stones, and cement are very important, for they determine the strength of the finished product.

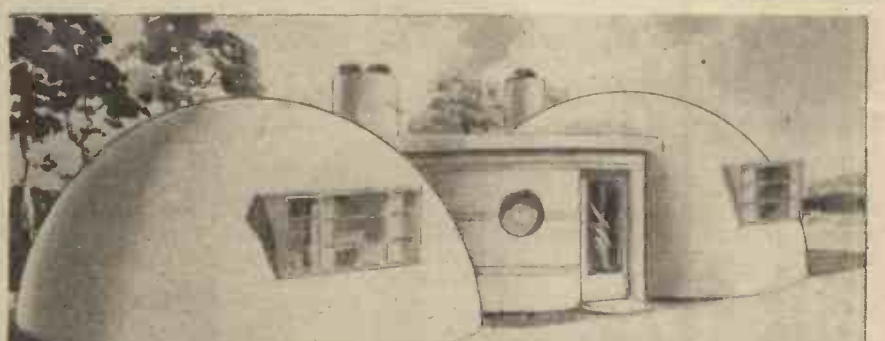
The size of the stones also affects the mixture, since the sand and cement merely fill up the gaps between—the larger the stones the less, proportionately, the cement required. For vital work, where lives depend on its strength, the mixture is most carefully weighed, and engineers can calculate the strength of the concrete as accurately as they can the strength of steel or cast-iron.

As concrete sets it gives off heat, and when large masses are being worked this heat must be carried away to prevent cracking. In the case of the great Boulder Dam, where over seven million tons of concrete were used, special refrigerating apparatus was installed and examinations were constantly made during erection.

One great advantage of concrete for defence purposes is that it is non-inflammable and practically impervious to heat. Experience has shown that even large incendiary bombs, unquenchable by ordinary methods, do not destroy buildings of concrete and steel.

Shelter Construction

Air-raid shelters, at least the strongest of them, are now built in a series of layers designed to take up the shock of bombs which, when exploding, strike downwards and sideways along the ground. In a deep shelter there would probably be a layer of "small" material on top to burst the bomb. This acts as a cushion for the shell, taking up a large part of the explosive force. Should the bomb go right through this layer of earth before explosion, instead of the solid earth forcing the explosion downwards to the shelter, there is a yielding layer which easily gives way and allows the shock wave to reach the air. Underneath this is a layer of soft earth designed to take up shock still further, and then under this final covering is the concrete layer covering the actual building. Double walls have a cushion effect on explosive waves, and, while a single concrete wall a foot thick is stronger than two walls close together, two walls are better for protection against explosion, the first acting as a cushion, greatly reducing the blow on the second structure.



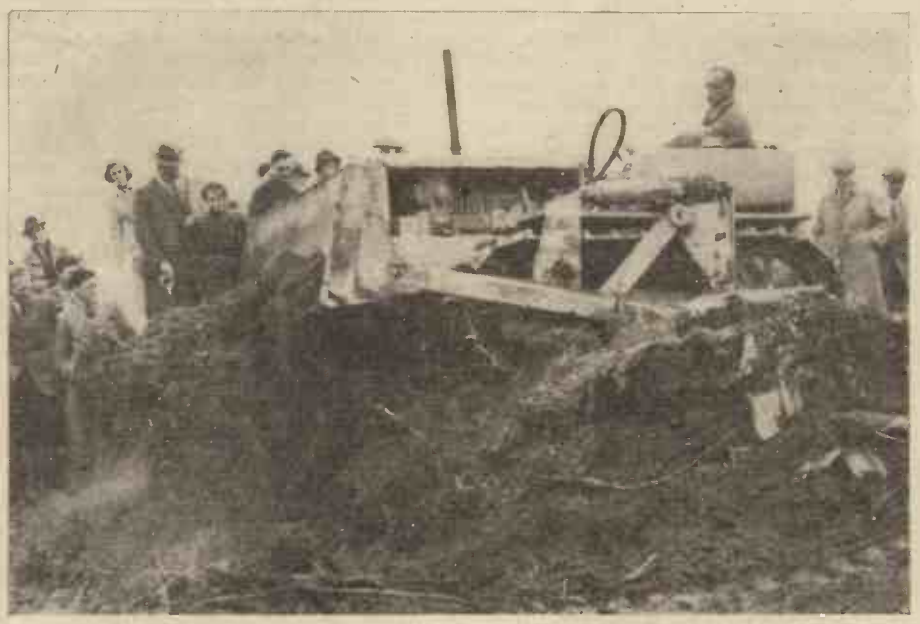
Small blast-proof buildings made by spraying concrete on to a framework consisting of inflated balloon fabric.

On the Continent, concrete shelters of conical shape are used against bomb damage. These are much thicker at the base than at the top, a bomb hitting one being deflected sideways so that maximum force of the blow is directed towards the base, which is better able to withstand it.

Concrete can be so used as to provide buildings which are quite as pleasant in appearance as any brick structure. Prefabricated houses will play a very great part in the building of a new and better Britain.

THE MONTH IN THE WORLD OF

Science and Invention



A hedge-clearing tractor at work during a recent demonstration organised by the Surrey County War Agricultural Committee, at Witley Park, near Godalming.

Concrete Sleepers

IN order to save timber and ship space, the L.M.S. has laid 250yds. of its Crewe-Euston main line with concrete sleepers instead of timber. It is the first time concrete sleepers have been used for high-speed main line permanent way.

All-welded Tank

THE first all-welded 30-ton tank was recently completed at a Detroit, U.S.A., factory which was previously producing motor-car bodies. The factory was turned over to war work in the minimum time, and the welding was done by a secret process.

Buses to Run on Producer Gas

AT the request of the Ministry of Transport, London Transport is converting part of its fleet of buses based on its eastern area, to producer-gas, to save petrol. Producer-gas, which is derived from coke or anthracite, is already being used on 2,000 vehicles.

Electric Power from Wind

A 200-ft. high windmill, erected on the top of a hill in Vermont, has been supplying electric power to the local inhabitants since the beginning of the year.

A Midget Stove

IT is reported that a tiny heating stove, weighing only 17oz. and ignited by a sparking device similar to that of a cigarette-lighter, has been designed for the use of U.S. ski troops.

Eyes Like an Owl's

ACCORDING to a report presented to the American Physiological Society, eyes like an owl's, blinded by light, but able to see in the dark, have been discovered in human beings.

People with this eye condition, known as achromatopsia, possess only the nerve mechanism which sees dim light. To see in the daytime they must wear dark glasses or stay in shaded places.

There may be military possibilities, such as airplane spotting, for people with "owl eyes."

The sight of two of these people was recently measured. One saw objects ten times dimmer than could be seen by the best airman's eyes, and the other 16 times dimmer. It is believed that this night-seeing may go as high as 30-fold.

Russia's New Gun

FOUR Russian artillery specialists have invented a naval gun which is reputed to have a greater range and more rapidity of fire than any gun of its kind known.

Tanks from Scrap

A RECENT announcement by the Works Ministry states that more than 200,000 tons of metal have been recovered from railings and gates all over Britain—the equivalent in weight of about 12,500 Valentine tanks. London has already contributed about 100,000 tons.

Jap Fighter Secrets

DETAILS were given in London recently concerning the Mitsubishi "00" navy fighter 'plane used by the Japs in the Far East.

A low wing single seat monoplane of all metal stressed skin construction, it is powered by a Nakajima N.K.I. 14-cylinder air-cooled radial engine developing 900 horse-power at 15,000ft.

The armament consists of two 7.7 mm. cannon firing through the airscrew disc and two of 20 mm. situated in the wings. Its maximum speed, with a normal flying weight of 5,140lb., is 315 m.p.h. at 10,000ft., and the service ceiling is 36,000ft.

Round the World Flight

ACCORDING to a U.S. War Department announcement the fastest journey ever made round the world was achieved by the group of the U.S. Army Air Corps fliers who last September took Mr. Harriman's Mission to Moscow and continued their flight to the East. Their total flying time was 121 hours 55 minutes.

This was revealed when the official awards to the men concerned were made. It was also stated that new air routes and possible landing fields were established.

Speeding Up Our Fire Bombs

A REPORT from Canada states that a young Montreal scientist, Dr. Lloyd M. Pidgeon, has discovered a new method for extracting magnesium, which is an essential ingredient in the making of incendiary bombs. To deal with the special process involved the Canadian Government is erecting a large factory near Renfrew, Ontario, on the site of large deposits of dolomite, from which magnesium metal is derived.

Magnesium is also used with aluminium in the structure of aeroplanes, while its manifold further uses range from photography to chemical preparations.

Their New Output

AMERICA'S furniture industry is being rapidly turned over to war production. Three large factories are already making 'plane parts from plywood.

An Undersea "Tube"

IT is reported from Tokyo that the first trial trip recently took place in the new undersea "tube" connecting the main island of Japan with the southern island, east of the Korea Strait, a few miles away.

Oil Prospecting Made Easy

THE work of oil prospecting has been made easier by means of scientific "ears" which can hear 20,000ft. below the earth's surface. The modern prospector simply sets up a seismic recorder, and connects it to geo-phones. When a dynamite charge is touched off, the phones pick up the reverberations which penetrate from 10,000 to 20,000 feet down. The reverberations then record on the seismic machine the density of the earth layers. If the bed is arched there may be oil lying under the dome.

Synthetic Rubber

THE Senate Committee in Washington recently saw an interesting demonstration when an expert of the Goodrich Rubber Company, Mr. K. D. Smith, poured liquid "Ameripol latex" into a beaker, added acetic acid, squeezed out the surplus, and within ten seconds bounced a rubber ball on the floor. Mr. Smith showed tyres in which the new synthetic rubber had been used, and said tests showed that they had 90 per cent. of the durability of natural rubber tyres.

Salvaging Steel By Magnets

MR. R. T. PARSONS, a New Zealand engineer, has been successful in salvaging steel from a wrecked cargo steamer, by means of a large magnet. Magnets for the salvage of sunken ships have long been in the minds of engineers, and as long ago as 1898 there was a scheme to lift the battleship *Victoria* from the bottom of the Mediterranean by huge magnets, but this was found impossible. Two difficulties to be overcome are the weight of the magnets employed, and the means of preventing the water short-circuiting the electric currents.

Our Busy Inventors

By "Dynamo"

Patent Blood Vessel

OF recent years the medical faculty has attached great importance to the transfusion of blood. From Australia there comes an improved apparatus not only for the transfusion but also for the storage of the vital fluid.

This apparatus is of the type consisting of a bottle having a stopper covered by a thin flexible sealing disc which can be pierced by a hollow needle for transferring blood from the donor to the bottle. It is so constructed that, upon the withdrawal of the needle, the pierced aperture closes automatically.

When such a bottle is being filled, it is imperative that the pressure in it be maintained less than the blood pressure of the donor. This difference in pressure could be effected by providing the stopper of the bottle with a vent for the exit of air. But it has been pointed out that an arrangement of that kind would involve the risk of contaminating the contents of the bottle. Consequently, hitherto, before filling, it has been the invariable practice to exhaust air from the bottle to an extent which enables the donor's blood pressure almost to fill it.

The current practice is open to the objection that a bottle cannot be filled unless it is forwarded to some centre where what is termed "vacuumising" and re-sealing plant is installed. In field hospitals and districts subject to air raids, refilling plant may not be available. As a result, the blood requirements must be furnished entirely by incoming bottles. Owing to this fact, there is a danger of transfusion being prevented because the line of communication may be broken by enemy action.

Blood Bank

THE inventor of the new apparatus makes provision for the transfusion and storage of the precious fluid in what is known as a "bottle bank," in which case bottles may be used many times, without the necessity of special plant. The only pre-requisite to filling is the sterilisation of the apparatus in accordance with the recognised method.

Broadly described, the apparatus comprises a bottle fitted with a stopper having an orifice and sealing disc and also a rigid template which itself has an orifice. There is means for clamping the stopper, disc and template upon the bottle. The template and stopper, moreover, are provided with locating means in order to secure the registration of the orifices when the sealing disc is interposed between the template and the stopper.

To Frustrate Frost

THERE has recently appeared a device relating to pressure relief valves for preventing damage to pipes caused by freezing.

The inventor of this contrivance states that, owing to the icing-up of the pipe, commencing from the external wall working inward, it is not always certain that relief valves, as hitherto proposed for the purpose, will function satisfactorily. The valve, he remarks, is invariably placed completely on the outside of the pipe, the relief opening being located at the inner surface of the wall to which the valve is attached. As a consequence, the opening is liable to be blocked by ice and the movable parts of the valve are inclined to stick.

To obviate, or at least reduce to a minimum, this defect, the seating of the pressure relief valve body, according to the new invention, is carried internally into the pipe. Consequently, the part of the body incorporating the seating projects from the inner surface of the wall of the pipe and is immersed in water, and the valve aperture in the interiorly projecting body part is placed away from the inner surface.

Reinforced Concrete

TO-DAY, concrete plays an important part in our building operations, and in order to impart additional strength, the material is reinforced. Among recent applications to the British Patent Office is one relating to what is termed "Reinforced Reinforced Concrete." This evidently is designed to make doubly sure. One object of the invention is affirmed to be the provision of a metal reinforcement which will effectively anchor itself in concrete and is capable of withstanding both tensile and compressive stresses of very great intensity.

It appears that there has already been proposed a reinforcement for concrete which consists of two separate steel rods of circular cross-section twisted round each other along their entire length and stretched beyond their elastic limit. In contradistinction to this proposal, in the case of the new invention, there is comprised one rod of metal, preferably of iron or steel, of lobe-shaped cross-section. This rod is twisted and stretched along the entire length beyond the elastic limit of the material composing the rod. And it is twisted and stretched to such an extent that the length of the twisted rod is equal to its length in the untwisted state.

Cuff Joinery

THE shirt-cuff fastening is sometimes a source of inconvenience to the wearer. As far as the shirt-sleeve is concerned, ordinarily there are two ways of making ends meet. One is the old-fashioned button; the other is the cuff-link. At the present juncture, the latter is not so easily obtainable as in pre-war days. And, owing to the narrower cuff, in which case expanding links are desirable, these accommodating links are not always procurable.

An improved means of fastening, for which a patent in this country has been applied, has made its début. This consists of a snap fastener including a stud and socket.

Vehicle Window Motor

THE opening and closing of a window in a vehicle is normally performed by turning a handle. To dispense with this somewhat primitive procedure, an inventor has designed an automatic method. His device includes a reversible electric motor and a link or lever system by means of which motion can be imparted to the window. A hand-operated switch directly controls the supply of current and the direction of rotation of the motor. And there are limit switches for interrupting the supply of current when desired movement in either direction has been completed.

An Improved Ladder

IT seems that long ladders, especially those of the extension type, are liable to bend under excessive strain. To oppose this tendency is the aim of an invention, for which an application for a patent has been accepted by the British Patent Office.

The ladder, according to this invention, has straining wires extending along its sides. These wires serve as ties to prevent bending of the ladder under its load. Each of these straining wires is anchored to its side of the ladder near one end of that side along which it extends to the remote end, where the wire is attached to a tensioning device.

Dr. John C. Neill, of Philadelphia, demonstrating the spectacles he helped to develop to permit the nearly-blind to see for normal work. Like two pairs of glasses held together over an inch apart by thin rods, they permit more normal perspective than thick-lensed glasses.

To Block the Blast

YET another invention relating to air-raid shelters has been submitted to the British Patent Office. The subject is an improved building block. This article consists of an open-ended shell made of terra-cotta, baked earthenware, or other material. It is adapted to be filled with concrete and has deep notches at the end to register with similar notches in the adjacent block. The object is to provide a dowel or key substantially connecting the concrete fillings of the adjoining blocks. The aim is to block the blast of the blitz.

NEW SERIES

Odd Jobs in House and Garden

4.—Some Practical Hints on Painting and Distempering

By "HANDYMAN"

WITH the arrival of summer-time many householders will probably be contemplating the repainting of the woodwork in one or two rooms; and possibly a ceiling requires whitewashing afresh. The following notes are intended to help the handyman carry out the job successfully.

In all repainting work the first process is to thoroughly clean the surfaces, to remove any traces of grease, otherwise the new paint will not adhere, or harden properly. A door, for instance, may appear clean, and yet be dirty from a painter's point of view. A pailful of clean hot water in which a packet of soap powder has been dissolved is a good medium for the washing-down process. Use a hard sponge for the large surfaces, and an ordinary nailbrush for the corners of mouldings. Any unevenness on the surface of the old paint can be rubbed down with a flat piece of pumice stone, or a strip of glasspaper wrapped round a small block of wood (Fig. 1). When using the pumice stone, apply it with a circular motion, and keep it wet by dipping in the pail of hot water.

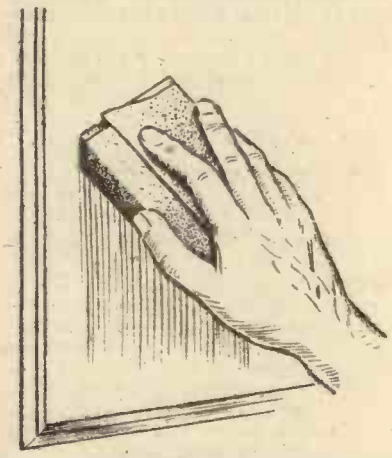


Fig. 1.—Rubbing down the surface of the old paint with glasspaper wrapped round a block of wood.

Good Brushes Essential

Another important point to remember is to use good quality paint brushes. These cost a little more but are cheapest in the end. The kind known as enamel, or flat paint brushes are best for the amateur to use. Three will be ample for decorating work in a small house—a 1in. brush, a 2in. and a 3in. brush.

Do not attempt to paint a surface till it is quite dry, or the paint will blister. Remember, too, that it always pays to buy a good quality paint. The cheaper kinds usually give very unsatisfactory results.

Undercoats

In most cases two coats of paint will be necessary to give a good finish, and the first coat should be an undercoat. Suitable undercoats (non-glossy) are obtainable for all good paints, and are essential when using a light-coloured paint over a darker colour. It is also necessary to use an undercoat when painting a porous surface, such as a plaster wall which has not previously been painted. Porous surfaces absorb the oil from the paint and the undercoating will prevent this.

Fig. 2.—A piece of string tied across a paint can for removing superfluous paint from the brush.

Applying the Paint

Before commencing the painting, give the paint a good stirring with a clean wooden stick, and to avoid splashing dip only about half of the brush in the paint, as in Fig. 2. It is a good plan to tie a piece of thick string across the paint can, as shown, and to stroke the tip of the brush against this after dipping it in the paint. Hold the brush as shown in Fig. 3, and apply the paint with straight strokes, up and down, gradually working from the left-hand side across to the right. Do not apply the paint too thickly, as it will take much longer to dry than a thin coating, which gives a better finish, and lasts longer. Always finish painting with the grain, not across it. With a door, for instance, first paint the edge of the door and the mouldings, then the panels (Fig. 4), and finally the stiles.

Distempering

Distemper is an excellent medium for brightening the walls of a small room. It can be applied over wallpaper, and it is an advantage to do so if it is known that the walls are cracked or unevenly plastered.

In cases where the paper is torn, and pieces are missing, it is best to remove the paper by well soaking it with clean water, using a brush or sponge for the purpose, and then removing it with a "scraper," as in Fig. 5.

Distempers of the washable kind are obtainable in many colours in dry powder form, or in a semi-liquid condition, and in either case are ready for use when water is added.

When applying distemper over a patterned wallpaper two or three coats may be necessary to obliterate the pattern, and each coat must be allowed to dry thoroughly before the next coat is applied. One or two coats will be sufficient when distempering a bare wall.

Applying the Distemper

Mix the distemper in a pail, and use a flat distemper brush, as shown in Fig. 6. It is false

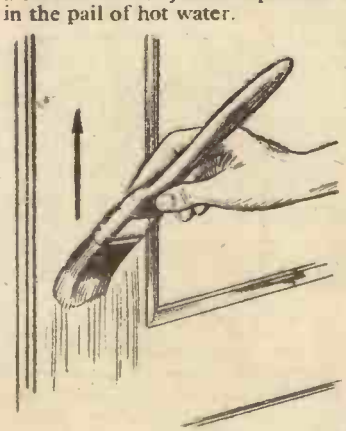


Fig. 3 (Above).—The correct way to hold the paint brush.

Fig. 4 (Right).—When painting a door, start with the edge, then coat the panels and mouldings, and finally the stiles.

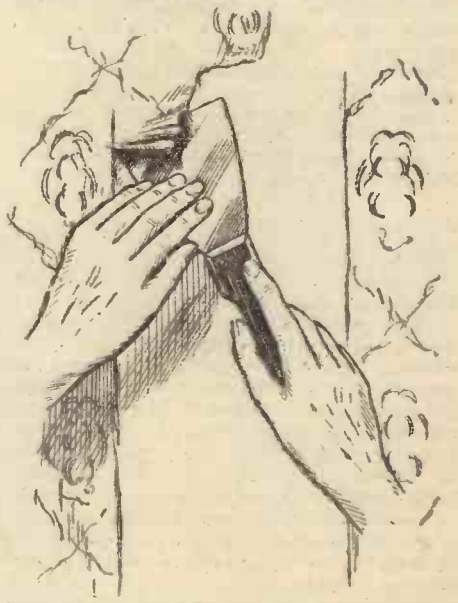


Fig. 5.—Using a scraper for removing old wallpaper.

Fig. 6.—Mix the distemper in a pail and use a wide, flat brush, as shown.

economy to try and "make do" with a cheap brush, as the bristles are liable to come out while the brush is being used. Dip about half of the brush in the distemper, and then tilt over the pail, as indicated in the illustration, before applying it to the wall. Hold the brush at arm's length (Fig. 7), and work as quickly as possible, so that the part of the wall you covered last does not dry before you have dipped the brush in the pail again. Commence work from the left-hand side of a wall and work downwards, and from left to right. It is a good plan to keep a damp rag handy so that any splashes on the paintwork can easily be removed while they are wet.

In order to avoid streakiness, frequently stir the distemper with a clean stick. If possible, do not leave the work until one wall of the room has been covered, so as to avoid "leaving off" marks showing when the job is completed.

Whitewashing a Ceiling

For this work a whitewash brush, a sponge and a pail of clean water will be required. Something to stand on will also be necessary, and a pair of steps, or the kitchen table can be used.

The first process is to remove the old whitewash, and to do this first soak part of the ceiling at a time, by dipping the brush in the water and applying it to the ceiling. Having soaked the part of the ceiling within reach, take the wet sponge, and thoroughly wash off the old whitewash. As soon as one part is cleaned, move the steps, or table, and "wash off" the next portion, and so on until the entire ceiling has been cleaned. It will be necessary to frequently change the water in the pail.

Coating with Size

The next operation is to prepare the ceiling for the whitewash by giving it a coating of size, dissolved in a pail of hot water, and applied with the brush evenly over the whole surface. The ceiling must now be left to dry before applying the whitewash.

Ordinary whitewash consists of whitening, size and water, and can be obtained ready for use from any oil-colourman's shop. In applying the whitewash it is important to keep the edges of the part completed wet and until the adjoining portion is started on, as with distempering. Apply the whitewash with the flat side of the brush, working to and fro. It is also advisable to use the brush in two directions—one at right angles to the other—as brush marks will then be less likely to show when the ceiling has dried.

To avoid splashing any furniture in the room, which cannot be removed, it should be covered with dust sheets.

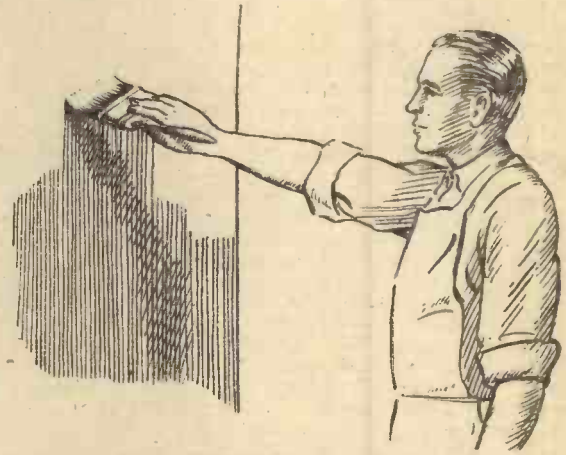


Fig. 7.—Hold the brush at arm's length, and apply the distemper quickly, and evenly.

BOOKS RECEIVED

Model Airplane Design. By Charles Hampson Grant. Jay Publishing Corporation, 551, Fifth Avenue, New York. 512 pages; 189 illustrations. Price $3.75 per copy.

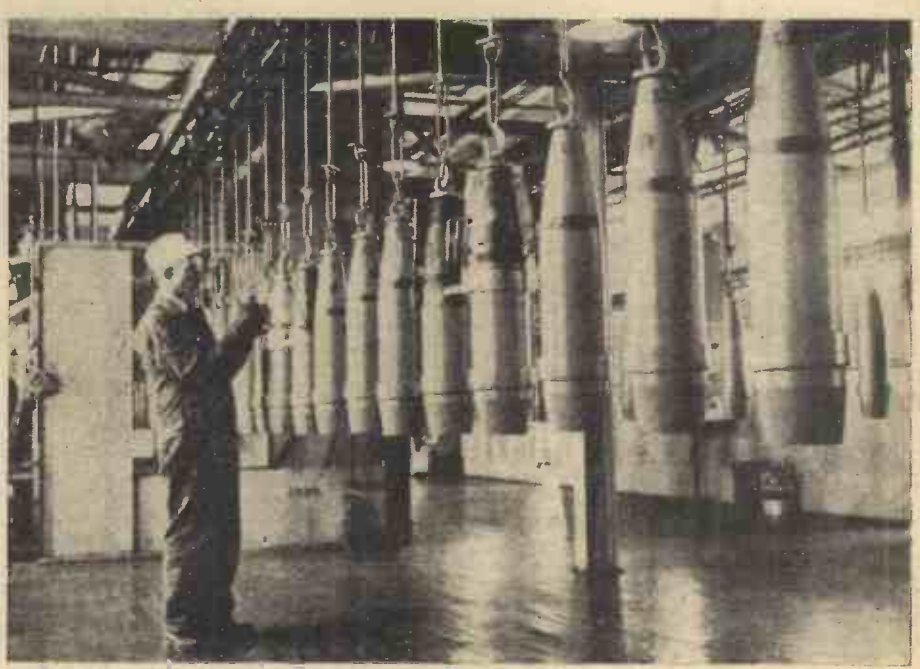
THIS is an important work on the design of model airplanes and the theory of flight—a complete exposition of the aero dynamics and design of flying model aircraft with fundamental rules, formulæ and graphs. The author is well known as the editor of the American publication *Model Airplane News*, and as one who has been closely associated with model aircraft design for very many years. It is one of the most important works on the subject which has yet appeared. The chapters include Flight Requirements; Wings; How to Obtain Stability; Principles of Stability; The Rubber Driven Propeller; The Theory of Blade Area Effect; How to Determine Required Dimensions of a Propeller Block; Gas Engine Propellers; Rubber Power; Rubber Power Formulas; Application of Power; Principles of Gas Engine Operation; Designing a Stability Stick Model; Designing a Stability Fuselage Model; Designing the Speed Model; Designing the Distance Model; Designing a Duration Model; Designing the Gas Model; Control of Flight by Design; Checking for Adjustment and Balance; Flight Testing, as well as an Appendix and Index. This book is most attractively produced and should certainly be purchased by all those interested in the scientific construction of model aeroplanes, and their use as scientific instruments rather than as amusing toys.

Everybody's Watches. By Arthur Tremayne. Published by N. A. G. Press, Ltd. 64 pages; Paper covers. Price 6d.

THIS is a handy little booklet on the design and manufacture of watches. It deals in a non-technical way with the subject and provides a useful fund of information for the wearer of watches. It is not, of course, a technical work. Those interested in watches will find in it a mass of useful and interesting information.

Tanks. By Prof A. M. Low. Published by Hutchinson and Co., Ltd. 134 pages. Price 9s. 6d. net.

IN this lively and informative book the author, with his wide scientific knowledge, gives the reader a vivid pen picture of the development of the tank from the early "Mark I" tanks of 1916, to the huge tanks of the present day. Written in non-technical language, the book is intended for the general reader, but is so packed with historical and scientific facts that it should prove equally absorbing to the student or expert. The tank to-day can hardly be considered apart from the vast array of armoured and unarmoured vehicles which make up an armoured division, so that particulars of these machines and a note as to their employment have been included in the book. It is interesting to note that the tank was invented and developed in Britain. The future of the tank is dealt with in the last chapter of this interesting book, which is illustrated by several full-page half-tone illustrations.



Slowly revolving on the endless trolley, these huge shells are borne into the painting room at one of Canada's munitions factories. Quickly, a painter sprays the shell from top to bottom with an air-pressure gun, and the trolley carries it along to the next operation.

MASTERS OF MECHANICS

No. 76.—John P. Holland, Irish Schoolmaster and Successful Submarine Inventor

FROM the British point of view, perhaps one of the most curious features of the first successful submarine was that it constituted a vessel which had been expressly designed and constructed with the object of challenging the recognised world supremacy of the English Navy.

Its inventor was an Irishman who had, for reasons real or imaginary, nurtured in his heart the bitterest grievances against Britain and against British policy. John Phillip Holland was the name of this individual. It is a name which is seldom heard of nowadays, yet the career of Holland is full of interest, for without any doubt he was an original genius and he was fortunate enough to bring his inventions to successful conclusions.

Holland was an Irishman. He was born on a farm near Liscannor, in County Clare, in 1841—four years after Queen Victoria came to the throne. Holland's birthplace was in one of the wildest and the most unfrequented regions of Ireland. His parents were poor people, humble settlers who eked a scant living from a not very fertile soil. We know little of the early history of John Phillip Holland. Perhaps he trudged daily to a distant National school during the years of his boyhood, for it is certain that he grew up with a love of learning, and with a mind which was capable of conceiving novel ideas, and of expressing strong opinions.

Ireland was in a very unsettled condition at that period of her history. Famine stalked the land, and in some regions the condition of the people was pitiful. There was no scope for anyone with a mechanical turn of mind in the country. The few "born engineers" who originated in Ireland left the country and found jobs in England, mostly in the cotton mills of Lancashire. Holland, it seems, had strong mechanical leanings in his boyhood days, but later, receiving a rudimentary systematic education in a school in Limerick he resolved to become a school teacher himself, that profession constituting practically the only avenue of employment which was then open to him.

An Emigrant

In a small school near Limerick, J. P. Holland became a pupil teacher, then an assistant teacher in a village school. It was not long, however, before economic conditions worsened considerably in Ireland. General distress increased and Holland eventually numbered himself among the crowds of emigrants who month by month left the shores of their native land to seek, if not fortune, at least a better living in the United States of America.

Arriving in America, Holland made his way to the New Jersey district, where he obtained employment as a school-teacher, thus perpetuating his Irish job under considerably better circumstances.

Perhaps J. P. Holland might have ended his life as a mentor of youth had it not been for the outbreak of the American Civil War, a bitter contest which was fought out between the Northern and the Southern American States in the years 1861-65.

One of the famous incidents of the American Civil War was the clash between two rival boats, the *Merrimac* and the *Monitor*, both of them heavily armoured with the equipment of the day. The *Monitor* (the Northern States' vessel) was designed by John Ericsson, the noted Swedish engineer. Owing to superior tactics it triumphed, its victory over the *Merrimac* being said to have shortened considerably the course of the war.

During and after the American Civil War, John P. Holland continued his teaching, but his imagination was fired immensely by the *Merrimac-Monitor* clash. He became engrossed in the subject of naval warfare, particularly in up-to-date sea contests. If only, he thought, a vessel could be contrived which would actually travel *under* water it would be able to be employed with deadly effect against even a numerically superior hostile naval force.

(Below) Holland's experimental submarine of 1881, together with a bronze plaque of the inventor, forms an interesting memorial in Westside Park, Paterson, U.S.A.

An early American submarine undergoing surface trials.

Early Experiments

Still, Holland kept on with his teaching. It was not until about 1875 that he took the first step in a practical direction towards the construction of an underwater boat, the design of which had been simmering in his mind for years.

The idea of a submarine was, of course, by no means a new one. The basic notion of a vessel capable of travelling distances under the waves dates back to the beginning of the sixteenth century. King James I. of England was interested in the subject of submersible boats, and he actually encouraged one Cornelius van Drebbel, a Dutch designer, to build one. Drebbel is said to have produced two or three of these boats about the year 1620 (each vessel being rowed by a dozen men), and to have had some success with them on the Thames, but details are lacking.

The American engineer, Robert Fulton, pioneer of American steamships, actually built a variety of submarine which he named the *Nautilus*, and which seems to have had a little success. But Fulton's invention was demonstrably before its time. It was inefficient and, what was more, there was a public outcry against the morality of submarines, so that in the end Fulton wisely bowed to the prevailing opinion and went on successfully with his steamships.

Without any doubt, John P. Holland, when he came to construct his first model submarine in or about 1875, took many of its fundamental principles from older ideas.

His first submarine, which he named the *Holland No.* 1, failed. It was, of course, only a model, for no private individual, even in those days, could afford out of his own unaided pocket the construction of a full-sized undersea vessel.

Another model followed—the *Holland No.* 2. That failed, also, and so did many ensuing models. One "outsize" model submarine which Holland completed in 1881 had some measure of success. It had a displacement of approximately 19 tons and was 31 feet long. With a couple of lightweight men aboard, it could operate at a depth of 60 feet. This "model" (which is now preserved as an open-air exhibit in Westside Park, Paterson, New Jersey) was several times put through its paces on the Passaic river, in New Jersey, this deep, slow-flowing waterway being the one in which Holland had tried out his earlier submarine models. However, there were several serious faults about the 1881 Holland submarine, chiefly concerned with motive power and, also, with questions of buoyancy, so Holland, who had now obtained financial backing, scrapped his only semi-successful creation, and at once proceeded to the building of another under water ship.

First Successful Submarine

Not until he had designed and built nine separate and distinct submarines did John P. Holland attain the degree of success which he had originally aimed at. The *Holland No.* 9, as the first really successful submarine was called, was finally completed in 1898. It was 54 feet long and had a speed of 7 knots. Its crew numbered six "medium-sized men."

The *Holland No.* 9 was put through its first serious trials in 1898 and again in 1899. In Staten Island Sound, New York Bay, the *Holland No.* 9 was successfully submerged

for a period of 1 hour 40 minutes, then an unprecedented time for a submarine to be under water. Immediately, the United States Naval officials, who had formerly looked upon Holland and his submarine projects with good-humoured tolerance, if also with a watchful eye, displayed an intensive zeal for the development of submarine design and technology. This first successful underwater boat was officially purchased by the United States Government in 1900, and was at once put into commission, while several other similar vessels were ordered straightaway.

Holland's great achievement with the submarine was his idea of equipping the vessel with two distinct and dissimilar types of engines, a petrol engine for the surface propulsion of the craft and electric power (derived from accumulators) for use when the vessel was submerged. The *Holland No. 9* submarine had a 50 h.p. petrol engine which was made in one of the early American engine factories. It proved so successful that it quickly led to the use of more and more powerful engines in successive vessels.

Although John P. Holland's avowed purpose (as he repeatedly stated) was to invent an underwater craft which would, if the necessity should arise, at least seriously harass the activities of the British Navy, the British Admiralty, by dint of good handling of a delicate matter, managed to acquire by purchase all the patents for Great Britain in connection with the Holland submarine. The inventor, however, does not appear to have worried himself unduly over this, and after the year 1900 he devoted the whole of his energies to the continued improvement of his submarine designs.

Although little mention is made of J. P. Holland in this country, there is no doubt that he constituted the "father" of the modern submarine. He was the first inventor and submarine designer to attain practical and lasting success with his underwater vessels. His notion of the employment of petrol-cum-electric power for submarine propulsion was, in many respects, the basis of his success, although, let it be mentioned, Holland had had success with his submarines before he adopted this then revolutionary principle.

"Long Distance" Submarines

During the opening years of the present century, Holland devoted his time to the development of "long-distance" submarines for ocean-going purposes. Despite the fact that he constantly improved upon his original model of 1898-1900, he had now many competitors from other nations in the same field of endeavour. Every nation saw in the submarine a most useful implement of modern naval warfare, and, when the torpedo had been applied to the underwater vessel, the race of the various nations to submarine supremacy intensified itself immensely.

Gradually, Holland dropped out of the running; having played the rôle of the pioneer, he ultimately retired and allowed others to take up the development of his notions.

Just at the beginning of the Great War—on August 12th, 1914, to be exact—J. P. Holland died at his home at Newark, New Jersey. Had he lived a year or two longer he would have witnessed the first deadly development of submarine warfare by Germany against England.

Despite the fact that the modern submarine has, up to the present, been employed more or less entirely for purposes of aggression in naval warfare, it must not be imagined that nothing good has come out of this radical invention. It is a fact that many of the major changes which have taken place in the propelling machinery of seagoing vessels in the last thirty years were first tried out and developed in submarines. Since their first introduction to the modern world in 1900, submarine vessels have provided the laboratories and trial-grounds with subjects for research and investigations into numerous matters of nautical technology. The submarine led the way in the use of oil fuel, and so brought into being the clean and comfortable stokehold of the modern steamship in place of the veritable inferno of the past.

Few people are aware of the fact that the submarine gave us the first automatic windscreen wiper. Yet it was for the conning-tower of a submarine that this nowadays ubiquitous article was first invented and designed.

The development of the submarine is by no means finished. Rather, it has yet far to go, for, after the present world-upheaval, cargo and passenger-carrying submarines will be in demand and much inventive energy and ingenuity will be needed to bring them into being.

John Phillip Holland, the Irish schoolmaster who hated Britain, gave to the world a war weapon. But the submarine has many peace-time possibilities, and doubtless, in the years to come, the inherent good which is contained in the invention will successfully outweigh the bad.

Steam Power Printing

The Story of William Clowes

THE marvel of modern mass-scale printing constitutes one of engineering's many triumphs. To a large extent it has been made possible by the pioneer experiments of a handful of isolated individuals such as William Clowes, who, being both engineers and business men, if not always actual inventors, have each demonstrated the efficacy with which large-scale "power" printing can be undertaken.

Clowes, in particular, is one of the "fathers" of modern printing. To him is due the introduction of power-printed periodicals and magazines. Books, before the pioneering activities of Clowes, were, to a large extent, luxuries for the leisured classes and for the well-to-do. By his introduction of steam-powered presses, however, Clowes lowered production costs and initiated our present era of accurately-printed, low-cost books.

William Clowes was a Chichester man. He was born on the New Year's Day of 1779, his father, who had been educated at Oxford, being a master in a large school in the neighbourhood of Chichester. But Clowes senior died during the infancy of his son William, leaving the family in severely straitened circumstances. William, therefore, instead of receiving the classical education which had been planned for him, had to struggle out of his childhood as best he could and find a means of gaining a living as quickly as possible.

Journeyman Days

At an early age he was put to the printing trade in Chichester, being bound to a printer of that city for a period of seven years. During his initial career in this Chichester establishment he acquitted himself well, so much so that when he became a journeyman in the printing trade in 1802 he removed himself at once to London, and eventually succeeded in finding a position with a Mr. Teape, a printer, of Tower Hill, under whom he worked as a jobbing compositor. His wage in this occupation was a very scanty one, for it is recorded that he found himself unable to pay for his lodgings, amounting to five shillings weekly, so that he had perforce to remove himself to cheaper lodgings, which comprised an almost empty garret, rented at half a crown a week.

Clowes' first job under his new master, Teape, was the setting-up of a large poster bill. He put it together so expertly that he made an immediate reputation for himself as a neat and competent compositor.

At first Clowes did not take kindly to the London streets and to the new ways of living which were necessarily enforced upon him. Before long he found himself wanting to return to his native town of Chichester. Indeed, he would have returned had it not been for the fact that he had not sufficient funds to undertake the journey. Hence he remained in the Metropolis, plodding away at his ill-paid job, living with the greatest possible frugality but, at the same time, managing to scrape together a few sparse savings out of his weekly wage. He remained with Teape, the printer, for a couple of years. Then, fired by a sudden gust of determination, he threw up his post and commenced business for himself in a very small way as a jobbing printer in Villiers Street, off the Strand, London.

In this business he began with a small hand-press and a few odd assortments of type. For weeks it was for William Clowes an urgent struggle for mere existence. Eventually, however, printing orders began to trickle into his diminutive office, and after a time Clowes found himself having to work day and night in order to deal with the work which was offered to him.

At this point, Clowes took on a young assistant, who was able to relieve him of much of the routine work. He also increased his stock of type and added an extra room to his premises.

About this stage of his existence William Clowes added an extra responsibility to his affairs by taking to himself a wife. "He married early," his biographer tells us, "and he married well." The lady in question happened to be a young cousin of a certain Mr. Winchester, a stationer in the Strand, and it appears that this Mr. Winchester was in some way connected with the Government printing work of the day. Mr. Winchester, it seems, had no objections to putting the right word in official quarters on behalf of the still struggling Clowes, and thereafter the latter found himself favoured with a small share of the Government printing work, a share which, due to the characteristic excellence of his printing technique, quickly increased in amount.

An Official Printer

The humble beginner in the printing trade, with one press and a few founts of type, now found himself fast becoming an official printer on quite a large scale. Clowes now took over larger premises in Northumberland Court, Charing Cross, which was equipped with several large presses and a huge assortment of type.

The things which William Clowes aimed at in his business career were quality, quantity

and speed—the latter factor being to him in no way subservient to the first. You cannot, however, attain speed in printing with a hand-press, and consequently you cannot obtain quantity of production thereby. Those were obvious conclusions to William Clowes. Yet when he looked round at other printing establishments he saw most of them more or less contented to plod along in their old accustomed ways, employing the traditional hand-printing methods which were fast becoming impracticable for the needs of the times.

Although he had never received any engineering or mechanical training, Clowes had many of the innate instincts of the true engineer. He was mechanically gifted. He could do mechanical repairs to his presses and to other simple mechanisms. In his spare time he toyed with making models and he devoted time to reading accounts of the extension of steam power and its many new applications.

If steam could be utilised for driving the machinery of cotton mills why, reasoned Clowes, could it not be equally as successfully employed for the driving of printing presses? A machine press driven by steam power would, in Clowes' opinion, run quite satisfactorily, provided it was carefully designed and erected and, naturally enough, it would be capable of turning out an abundance of work.

Two inventors, Applegarth and Cowper, of this period, had brought out an improved variety of machine-press which secured a perfect inking and register of the printed sheets, and which enabled large sheets to be printed on both sides at the same time.

First Steam-driven Press

Clowes procured one of Applegarth and Cowper's machine-presses and coupled it up to a small steam engine which was probably of his own construction. The engine operated the press successfully. At once, Clowes installed other Applegarth and Cowper presses in his works and coupled them up to a new stationary-type steam engine which he then acquired.

The machine presses did not require very much power to operate them. When, eventually, William Clowes had no fewer than twenty of Applegarth and Cowper's largest presses continuously running, he found that he could obtain all the power he needed for their satisfactory running by the aid of a couple of 5 h.p. steam engines.

It was in 1823 that Clowes commenced his steam-driven presses. It so happened, however, that these machines and the steam engines which drove them were anything but silent in operation. Before long, Clowes had the Duke of Northumberland on his track. The Duke lived within a stone's throw from Northumberland Court where Clowes had his presses, and this outraged worthy at once proceeded legally against Clowes, requiring him to abate the alleged nuisance, and to remove his boilers and engines to some other locality.

The case was tried at the Court of Common Pleas in the June of 1824. The august Duke described the noise of Clowes' engines as being like continuously rumbling thunder, like the sound of a threshing-machine, and like the rumbling of heavy carts and wagons. But Clowes, the printer (who had the Attorney-General of the day on his side), won his case, the Duke's objections to the disturbance being officially overruled.

The Duke of Northumberland's next move was a rather startling one. Since he was unable to remove Clowes and his steam-powered printing plant from his vicinity by force of law, he arrived at the decision that it would pay him to buy the go-ahead printer out. Ultimately, Clowes consented to such a scheme, and, in the following year (1825) he removed his presses and engines to the Blackfriars district of London, leaving the Duke of Northumberland in peace and quietness. A sum of many thousands was paid over to Clowes by the Duke for the removal of the printing establishment, and, with this sum, Clowes was able to begin again his printing activities with satisfactory financial backing.

New Premises in Blackfriars

Firmly settled in his new establishment in Duke Street, Blackfriars, Clowes went from success to success. We do not hear of him inventing or designing any new form of printing press, but he certainly extended the application of steam power to printing machinery, with the ultimate result that his firm was turning out work continuously to its utmost capacity.

In 1832, William Clowes was chosen as printer for the "Society for the Diffusion of Useful Knowledge." For this society he undertook the power-printing of the first popular "scientific" journal—the *Penny Magazine*—the production of which is said to form the world's first example of the reproduction of drawings and illustrations by power printing. He also printed the *Penny Cyclopædia*, an associated publication. Both these publications were issued regularly for fourteen years, being machine-printed throughout their career by William Clowes. The publications are, of course, long defunct, but, nevertheless, to all interested in the progress of mechanical printing and in printing engineering generally, they comprise veritable landmarks in printing science, since they are the prototypes of the popular and technical journals which play such an important and an indispensable part in our modern scientific civilisation.

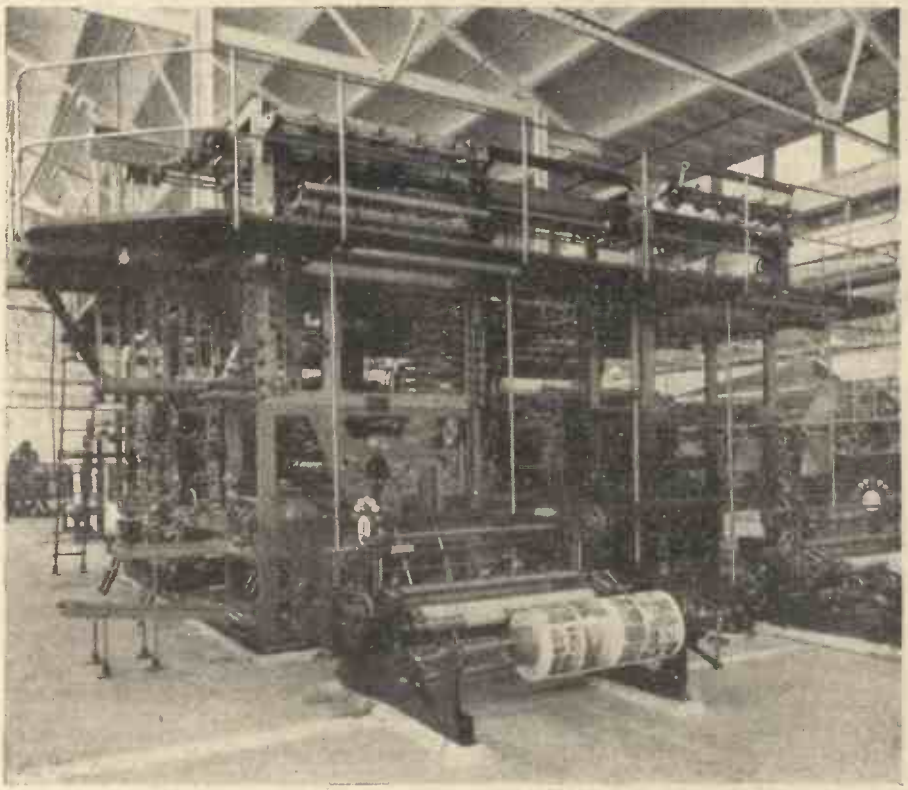
When William Clowes reached the zenith of his career he was employing directly some five hundred operatives. Indirectly, of course, he gave employment to perhaps ten times that number of people, for, in later years, Clowes established a type-casting foundry which was able to produce 50,000 new pieces of type daily. From his printing works he turned out, at the height of his career, about 750,000 printed sheets every week, which amount of printed matter, it was calculated, was equal to about 30,000 printed volumes.

There was one curious trait in Clowes' character. After making a fortune for himself, he discouraged any mechanical invention connected with printing which, in his opinion, would be liable to cause unemployment in his industry. For instance, when, in 1840, an inventor confronted Clowes with a mechanical type-composing machine, he turned the project down on the score that it would interfere with the livelihoods of his compositors.

"Resting on His Laurels"

Probably, therefore, for the above reason, William Clowes never shone as an actual inventor in the printing trade. Having introduced a new mechanical era into printing he remained more or less serenely content with it. His life was full of hard yet successful work, and in his retirement he never ceased from his erstwhile interests in the mechanical side of the great printing industry which, by his application of steam power to printing machinery, he so greatly helped to expand.

William Clowes died, eventually, in Wimpole Street, London, on January 26th, 1847, at the age of sixty-eight. By the members of his craft he was styled the "Prince of Printers." It was an excellent appellation for a man who had devoted an energetic life to the mechanical side of a traditional and an honoured industry.



A typical example of a modern rotary printing press. The machine shown in the illustration is the actual one on which "Practical Mechanics" is printed.

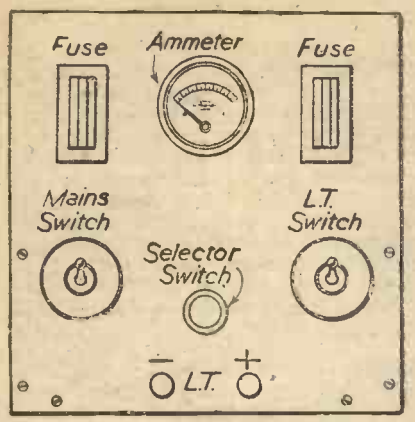


Fig. 5.—The panel layout incorporates all controls, thus providing simple operation.

A Small Low-tension

Essential Considerations. Valve or Metal

By L. O.

CHARGING stations—vastly different to those we know to-day—first appeared with the introduction of the storage cell. By comparison, they were unpretentious installations, and were—in the main—owned and operated by storage-cell manufacturers and those practical pioneer electrical engineers who were concerned with the production of small generating plants and associated equipment. In those days the various systems of A.C. rectification now available were not then developed, and the charging plant usually consisted of a gas- or oil-driven prime mover driving a D.C. generator, the output of which was split up or reduced to satisfy the charging requirements by means of somewhat cumbersome switchboards, complete with an assorted array of variable resistances and/or carbon filament lamps.

Importance of Charging

As the popularity and applications of the accumulator increased, so also did the number of charging stations, and the part they played in industry and everyday life became more important year by year. It was not, however, until wireless broadcasting became a part of our social structure that the public in general began to understand the national importance of charging stations. Charging stations sprang up all over the country, but, unfortunately, they were not always owned or operated by people having a sound knowledge of accumulators and charging. The alleged charging stations did great disservice to accumulator manufacturers, and caused considerable dissatisfaction among those using battery-operated wireless sets. Fortunately, the life of such stations was not too long; the public were quick to realise that the accumulator was a reliable article, provided it was given the correct treatment, and, with the help of the manufacturers and technical press, the charging "racketeers" were almost eliminated, although the dabbler and side-line merchant still exist; some of them do give a measure of satisfaction, but there are many more who are making easy money out of the ignorant, and those forced to patronise them.

Present Conditions

Charging now forms an essential part of our war effort and, therefore, demands that everything possible should be done to ensure that it satisfies all requirements. Charging stations normally serving the public are experiencing some difficulty in obtaining replacements, and the labour to enable their peace-time service to be maintained.

From the inquiries received by the Technical Section of our associated journal, *Practical and Amateur Wireless*, it would appear that the majority of those wishing to open up a charging station are ex-Service members who received electrical training while serving with the Forces, or electricians who had retired from business.

Charging Systems

There are various reliable systems now in use, but ignoring for the moment D.C. generators and rotary converters, they can be divided into two main groups under the headings valve and metal rectifiers, as in this article A.C. mains only are being considered for the initial electricity supply.

The advocates of each of the two systems put forward claims as to their merits and advantages over the other, therefore it is not intended to contribute to the controversy by analysing the methods, although for the guidance of those lacking wide experience a few facts are given.

It will generally be found that the initial cost of equipment using a metal rectifier, such as the Westinghouse, is greater than that incorporating a valve. Against this, however, one must take a long-sighted view of future running costs, i.e., current consumption, replacements, and the possibility of loss of trade through breakdown of the plant.

The question of efficiency of the two

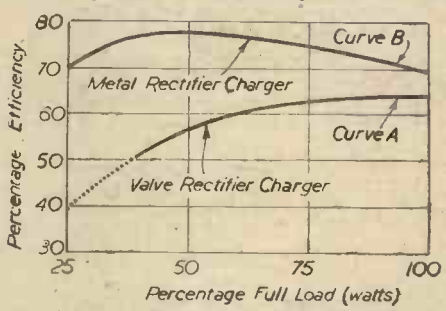


Fig. 1.—The efficiency curve published by the makers of the Westinghouse Metal Rectifier.

systems is of great importance, and it is only possible to obtain high efficiency if the losses in the whole charger are low and if the control methods applicable are such that economical operation—under various loading conditions—are obtainable. The losses in a valve rectifier consist of a constant loss imposed by the heater circuit, plus a drop due to the resistance in the valve itself, a loss which will depend on the applied load. In the case of a Westinghouse metal rectifier, however, the losses take the form of a very small—almost negligible—steady leakage current, to which must be added a resistance drop which, unlike the valve, is less in proportion to the load, this being entirely due to the characteristics of the rectifier.

The applied load plays an important part in determining what might be called the overall efficiency; for example, on full load the two systems are about equal. At low voltages the metal rectifier definitely scores, but at the other end of the scale—at voltages higher than those advisable for safe charging—the valve comes out on top. Perhaps the most important figures to observe are those giving the efficiencies at half-load and lower, as it is under these conditions that charging plants are usually operated. Fig. 1 shows the efficiency/load curves of the two systems, and it will be seen that the metal rectifier has the definite advantage at 50 per cent. of the load.

The efficiency of the control system is an item often overlooked by many, whereas in practice it demands consideration. Quite a number of so-called multi-circuit chargers incorporating valve rectification utilise only one valve and obtain the multi-circuit effect by means of resistors. This means that the valve is delivering its full voltage the whole time, and any output circuit that is not fully loaded has to have an artificial load, so to speak, applied in the form of resistance. Consider an imaginary two-circuit charger, having outputs of, say, 40 cells at 1.5 amps and 40 at 3 amps. Assuming sufficient work is available to fully load the first circuit, but there are only three cells in requiring a 3-amp charge, it is obvious that a resistor must be introduced into circuit number two to break down the voltage from 40 cells to three cells, thus creating a wattage wastage, which, over 24 operating hours, would become an item to be considered on the power supply cost.

With chargers using metal rectifiers, quoting as an example Westinghouse multi-circuit installations, separate rectifiers are used for each output circuit, together with tapped transformer secondary control, thus allowing correct balancing of circuits to be obtained with a considerable reduction of waste.

A Small Charging Plant

The equipment described below is intended for those who wish to construct a small charging station, or those who already own a plant and wish to provide an emergency outfit as a safeguard against complete stoppage in the event of breakdown of an existing installation. To avoid unnecessary correspondence it should be noted that although in normal times metal rectifiers can be obtained from Westinghouse Brake and Signal Co., Ltd., supplies are now restricted owing to the requirements of the Services and industries directly connected with the war effort. It is possible, however, to obtain certain types of metal rectifiers from several of the firms who deal in surplus radio and electrical equipment. Therefore, it is suggested that if the types mentioned in this article are not available, alterations should be made to the mains transformers to suit those which can be secured from the sources mentioned above.

In view of the purpose for which the charger is intended, and the prevailing supply problem, it is not proposed to consider the larger types of metal rectifiers, such as those used in the plants having a large output. The circuits are based on those types included in the standard Westinghouse list. For example, the L.T.10, the L.T.11 and the A.4

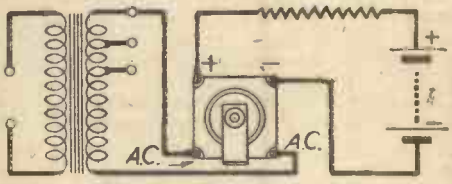


Fig. 2.—The fundamental L.T. charger circuit using a metal rectifier.

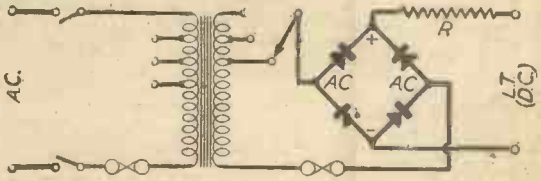


Fig. 3.—The theoretical circuit of the charger using a L.T. 10 rectifier. The ammeter can be connected in series with one of the L.T. leads

Charging Station

Rectification? Constructing a Small Plant.

SPARKS

are capable of dealing with 3, 5 and 6 two-volt cells at 2 amps; 1, 2 and 3 two-volt cells at 4 amps, and 1, 2 and 3 two-volt cells at 2 amps, respectively. These outputs, as small as they may seem from the commercial charging standpoint, can be quite useful and cope with a reasonable number of cells during a working week. For a start, therefore, I would suggest using one L.T.10 and one A.4 in a two-circuit arrangement, as these would cover all requirements—considering two-volt cells—from 1 to 10 at a 2-amp rate. The L.T.10 could also be used for trickle-charging 6-volt and 12-volt car batteries, and the A.4 could cope with a 6-volt battery. The L.T.11 has a higher charging current—4 amps—but considering that the majority of the load is likely to consist of 2-volt cells for radio and hand-lamps, etc., the other two types would have the greatest utility value.

Circuit

The fundamental circuit for the rectifiers is shown by Fig. 2. It should be noted that the tapped secondary system of control is indicated, and, bearing in mind the previous remarks about efficiency, it is essential to adhere to this system as recommended by the makers. The limiting resistor must also be incorporated, as it not only serves the purpose of "swamping" any variation in the charging current due to fluctuation in the applied voltage, but it also limits the current in the event of the cells being accidentally connected the wrong way round, i.e., with reversed polarity.

The complete circuit of a charging panel using one L.T. 10 is shown by Fig. 3. On the mains side of the transformer, a double-pole Q.M.B. switch is fitted together with a fuse in one lead. The transformer should be of reliable make and have good insulation between windings and between windings and core. The secondary is designed to supply 20 volts, 17 volts and 14 volts A.C., these values being obtained by providing two tapping points in addition to the two normal connections to the ends of the windings, thus making, in all, four leads from the secondary. To allow easy control to be obtained, three of the leads are taken to a three-way single-pole selector switch, having, for preference, Q.M.B. (quick make and break) action.

Measuring Charging Current

Another fuse should also be fitted between the rectifier and the secondary winding, and, if available, an ammeter connected in one side of the D.C. circuit. The latter need not be in circuit the whole time, but it is advisable to fit one to the panel to enable the actual charging current to be checked during the charging period and after making adjustments. Knowing the shortage of these instruments, the writer will give details for the construction of a simple hot-wire ammeter, which, while not claiming to be a precision instrument, will be found satisfactory for the purpose to which it is put.

Layout

The rectifier must be *mounted* so that its spindle is in a horizontal position, i.e., the fins vertical, and so located as to permit unrestricted circulation of air.

A panel of ebonite, fibre or metal—providing all parts mounted on the latter are well insulated—having dimensions 12ins. by 12ins. will be ample. This should be screwed to a stout base 12ins. by 12ins. and supported by right-angle brackets; the transformer and rectifier are best mounted on a skeleton shelf (Fig. 4) fitted half-way up the panel. The fuses,

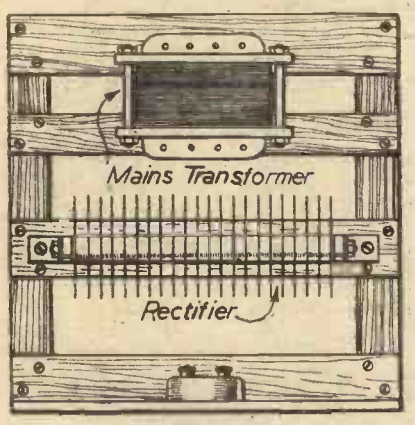


Fig. 4.—By supporting the transformer and rectifier on a skeleton shelf, maximum air cooling is secured.

selector switch, output terminals, mains switch and ammeter should be fitted to the panel as indicated by Fig. 5. The whole assembly should then be enclosed in a metal case which is connected to earth. In the absence of metal sheet, perforated zinc or even fine-mesh wire-netting can be used, in fact, the former is most satisfactory as it allows adequate ventilation. The general constructional details are shown in Fig. 6.

Mains Transformer

For those able to obtain transformer stampings, here are the details of a transformer suitable for use with the L.T. 10, or, in fact, any similar type of rectifier provided that the secondary windings are adjusted to suit the model.

Six dozen pairs of stampings having the dimensions shown in Fig. 7 will be required—on the Stalloy list they are known as size No. 32. When these are assembled, a core having a cross-sectional area of 1 sq. inch will be formed, and this will have a turns-per-volt ratio of 8 to 1.

For the primary winding, 1,600 turns will be required for 200-volt supplies; 1,760 turns for 220-volts; 1,840 turns for 230 volts and 2,000 turns for 250 volts. The wire for this section should be 32 S.W.G. enamelled.

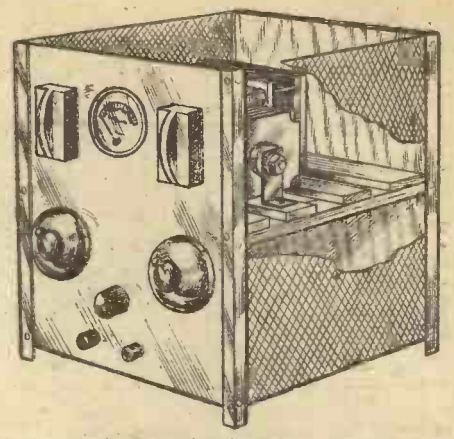


Fig. 6.—The completed charger showing how adequate ventilation is obtained by the use of perforated zinc sides.

The secondary winding will consist of a total of 160 turns, tappings being taken at the 112th and 136th turns for the 14-volt and 17-volt points. No. 22 S.W.G. enamelled or D.C.C. wire should be used.

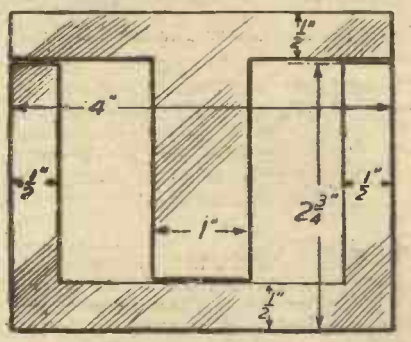


Fig. 7.—The dimensions of the stampings.

The Bobbin and Winding

To carry the above mentioned windings, a strong bobbin of reliable insulating material must be made, the dimensions being determined by the stampings. For those specified, the measurements shown in Fig. 8 will be satisfactory, and the material should be paxolin, fibre or presspahn. Care must be taken to see that a sound job is made and that the cheeks are secure and of sufficient rigidity to hold the windings.

Any slight errors in marking or cutting out of the pieces, or failure to assemble them accurately, may result in the stampings cutting into—and possibly through—the body of the bobbin, and the likelihood of the winding space being reduced.

Poor winding, careless handling of the wire or lack of attention to the insulation between windings and winding layers, may well be responsible for the breakdown of the whole insulation plus the ruination of the component parts, prospects which cannot be considered or tolerated these days.

The wire must be free from the slightest kink; its insulation must be perfect, and the tension to which it is submitted during the winding must be just sufficient to produce a firm winding without the slightest suspicion of any turn cutting into the others.

The layers should be even and free from "hills and dales"; between alternate or, at least every other two layers, a strip of insulating material—empire cloth, bakelised paper or even dry smooth brown paper—should be wound on.

(To be continued.)

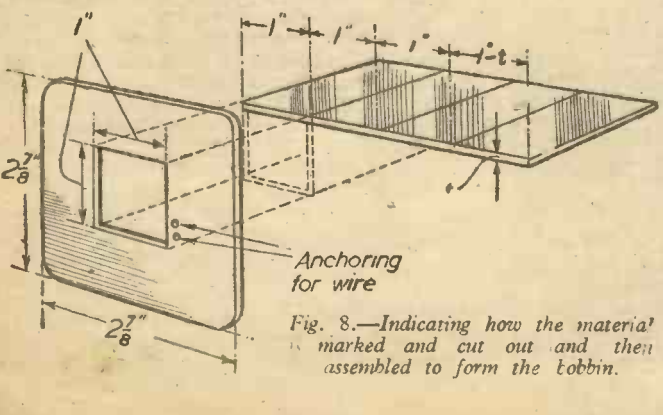
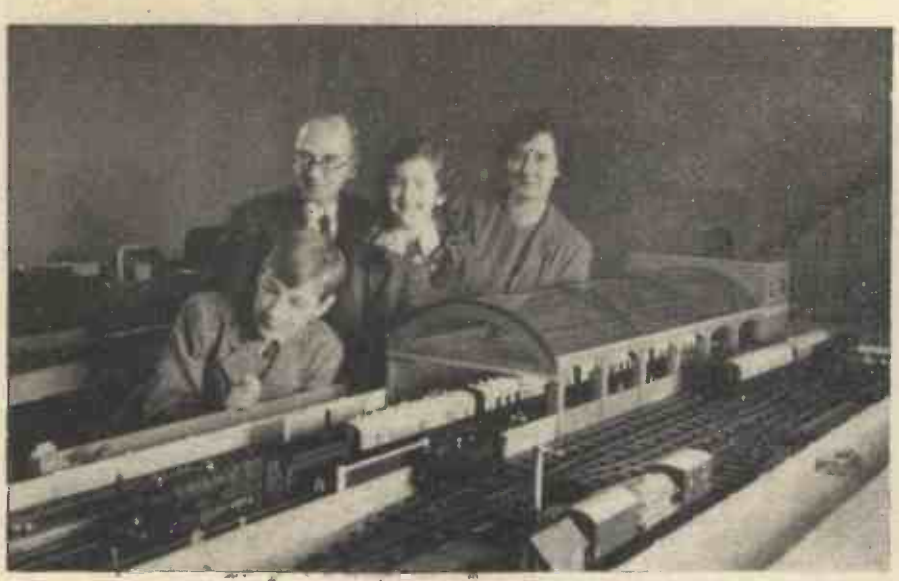


Fig. 8.—Indicating how the material is marked and cut out and then assembled to form the bobbin.

THE WORLD OF MODELS—

Models in Silver : Motor in Model Railways :



Mr. Gilbert Thomas, and family, with their realistic model railway system.

Model Liner in Silver

I WAS in a famous London silversmith's not long ago when I chanced to see the photograph of an exquisite ship made of silver and mounted on a base of onyx. I was at once deeply interested in this piece of fine craftsmanship and read the inscription on the silver plaque: "Model of *R.M.M.V. Capetown Castle* presented to the city of Capetown by the Union Castle Mail Steamship Co., Ltd. on the occasion of the arrival at Capetown of the *R.M.M.V. Capetown Castle* on her maiden voyage. 13th May, 1938."

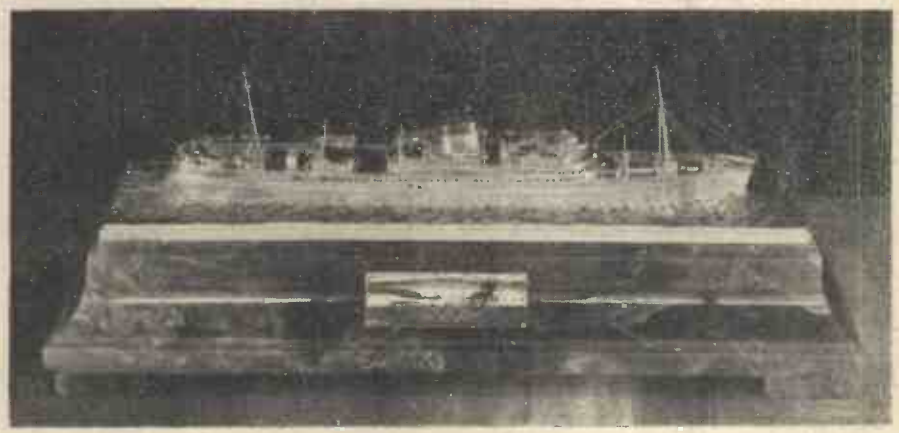
I asked about the craftsmen who had made this princely gift—workers in silver, whereas we model in the less precious metals, and in wood and clay—and here is a little of what I was told:

This model *Capetown Castle* was wrought in sterling silver to the scale of $^1/_{32}$ of an inch to 1 foot, giving a waterline length of approximately 22½in. The hull was shaped by hand with hammers and stakes to a set of shadows prepared from the designer's drawings, and then silver soldered to each side of the keel. All the superstructure was made from sheet, and such details as windows and doors were built up, fitted into the walls of the staterooms, etc., and afterwards hard soldered. The bridge was built up in the same way, also the open air café, enclosing which were railings made from fine wire in filigree fashion.

All deck fittings, air-conditioning fans, winches, windlasses, derricks, lifeboats and davits were made from sheet or turned from bar on a small watchmaker's lathe. Where the scale permitted certain gear was made to work, as in the case of the anchor windlass. The gear wheels in this piece were turned blanks with the teeth filed by hand. The anchors, too, were sawn from suitable gauge plates, and filed to size and shape by hand. One of the greatest problems in making the model was the production of the ship's railings. Their minute size, of course, made this no easy matter, as each one was little more than ⅛ of an inch, but a successful technique was evolved by the craftsmen, which also gave a satisfactory means of attachment.

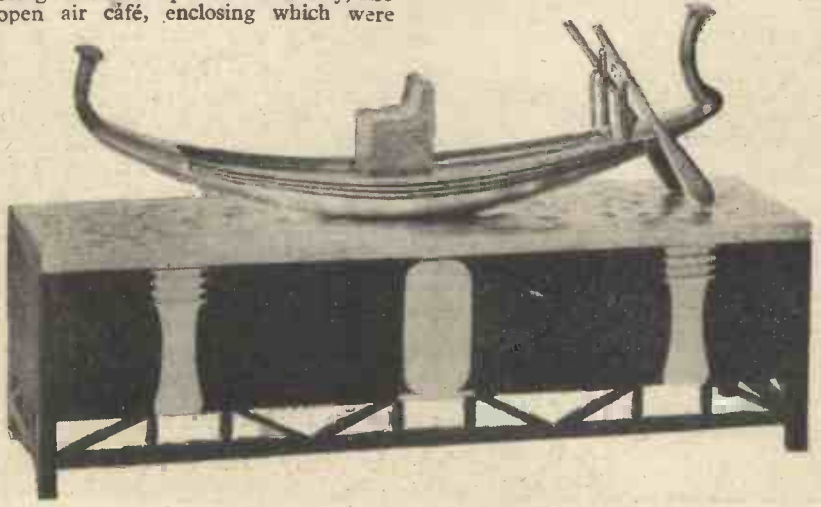
The only casting on the model was the silver base representing the sea. Everything that required soldering was silver soldered, for no soft solder may be used on sterling silver, and the number of separate solderings ran into several thousands! Seven BA was the largest screw thread used, and approximately 90 per cent. of the screw threads made ranged between Nos. 8 and 13 in the watchmaker's screw plate.

The model on its sea base rests on a Brazilian onyx plinth, and can also be illuminated by a series of dry batteries and bulbs placed in the interior of the vessel



A sterling silver model of the "Capetown Castle," made to a scale of $^1/_{32}$ of an inch to the foot, by the craftsmen of Messrs. Mappin and Webb, of Sheffield.

The entire production, as seen in the illustration, was carried out by Messrs. Mappin and Webb, Ltd., at the Royal Works, Sheffield.



Model of the Canoe found in the Tomb of King Tutankhamen. The model was made in sterling silver for the proprietors of a well-known illustrated paper.

The Prototype

As readers may know, the *Capetown Castle* is one of three modern motor liners of the Union Castle Mail Steamship Company, built between 1936 and 1938 by Messrs. Harland and Wolff for the Union Castle's express mail and passenger service between Southampton and the Cape. The *Athlone Castle* and the *Stirling Castle* are about 725 feet overall, twin-screw motor vessels of 25,500 tons gross, and came into service in 1936, but the *Capetown Castle*, which came into service in 1938, is even larger—27,000 tons—and, in fact, holds the record as the largest ship in the world on the regular service to South Africa.

These three vessels all do 21 knots, and are probably the finest motor ships ever built in this country—if not the world—and with their lavender grey hulls and white upperwork, and their bright red and black funnels, make a striking picture at sea, and so it was, in my humble opinion, fitting that a model should have been made in silver of one of these ships

By "Motilus"

boating in Miniature : The "Family" Interest The Army's Model Railway System

The art of designing and modelling in silver is a craft on a par with skilled model making, and takes years of experience to perfect, and Messrs. Mappin and Webb have made several other interesting models of ships in silver. One photograph I was shown was of a scale model in silver of an old Thames tilt boat, presented to the Corporation of Gravesend, another was of an Egyptian dhow, and yet another picture represented a scale model of the *Santa Maria*, Christopher Columbus's ship, in silver, presented by the Nassau Yacht Club, in the Bahamas, for a championship.

Perhaps their most interesting ancient ship model was that made for the proprietors of a well-known illustrated paper—that of the canoe found in the Tomb of King Tutankhamen. Altogether this famous firm of silversmiths have modelled a wonderful variety of ships.

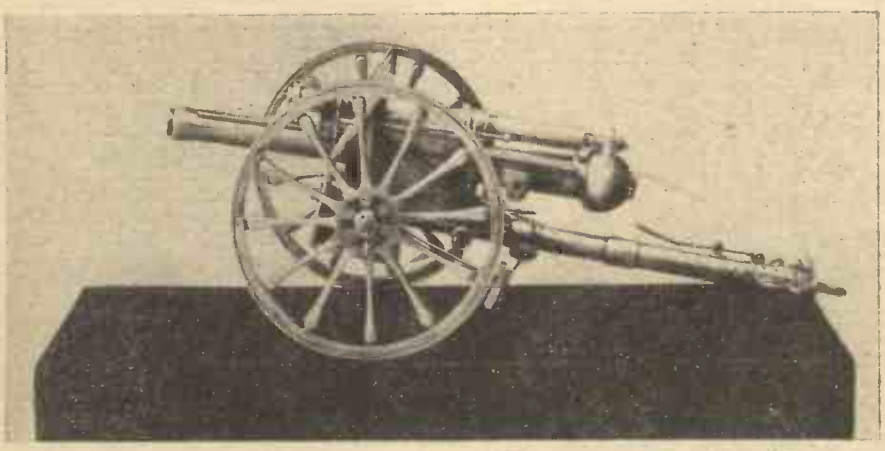
A "Family" Model Railway

Passing through Teignmouth when in South-West England recently, I spent a few hours with my friend, the author and critic, Mr. Gilbert Thomas, and found him and his family as engrossed as ever in the running of his railway, which is housed in the billiards room built on to his home. He has not made any additions to his line lately, but in the hall I spotted a large parcel from a well-known model firm containing, I was told, more points and track materials, with which he was going to make an extension as soon as time and circumstances permitted. The illustration shows the Thomas family, Mr. and Mrs. Gilbert Thomas and the children, Ann and David, who is now an eager deputy for his father with the layout. Mr. Thomas says when happier times bring holidaymakers to Teignmouth he will be pleased to show his models to anyone interested. His address is Leigh Bank, Ferndale Road, Teignmouth; and he adds "preliminary notice would be appreciated." Some day I hope he will ballast his track—the only lack of realism on his railway!

Model Motor-boat

Now that holidays are to be taken at home, I was not surprised to see some of the younger generation—the lucky ones who have secured model boats—having fun sailing them on the local sheet of water. I believe a few yachts are still available, those of the *Star* type and some of the well-known *White Heather* series, but model steamboats are practically extinct for the duration! The model illustrated is the Bassett-Lowke motor-boat *Iolanthe II*, which is one of the smartest of its type yet produced. There were a few of these about at the beginning of the season, with either clockwork or electric propulsion, at 3 guineas each. The *Iolanthe* is 27½in. long, with 5½in. beam and 4½in. depth. The electric model will run for 1½ to 2 hours when fitted with two batteries, while the clockwork model will drive for six minutes on one winding. The *Iolanthe* motor-boat was introduced many years ago, but each year it turns up with some new improvement, and the polished mahogany cabin is one of the later additions. For those who have boat hulls and need power units there are still a few clockwork mechanisms for driving the smaller types available at the time of writing, but to try for a steam plant these days is hopeless, and for an electric motor not much better.

Model motor-boat, "Iolanthe II," cutting through the water on a windy day.



A fine model of a field gun, wrought in silver.

The Army's Model Railway

It is interesting to note that troops who may be running our main line expresses in the event of an emergency, or invasion, have a standard gauge railway of their own to train on. It is in the South of England, covers a distance of eight miles between terminal points, and has double tracks. There are seven stations and one halt. Civilians with business at the training camp can travel free—at their own risk. Constructional training is given to Army men as surveyors, draughtsmen, blacksmiths, fitters, welders, carpenters, etc.

There are workshops, lecture rooms and stores, and a signalling school with equipment ranging from primitive to most up-to-date apparatus. Constructional engineering, bridge building and demolition work are carried out. In the signalling school there is a complete working model railway system, shown in the accompanying illustration, which is used for instructional purposes.

A group of N.C.O.s receiving instruction in railway signalling with the aid of a model railway system.

Heat and Cold

Notes on an Interesting Subject

By E. A. SMITH

A girl graduate of an American university is here seen using an optical pyrometer for studying metals at high temperatures in an electric research laboratory in Schenectady.

HEAT is a troublesome problem in the engineering world, where one is either endeavouring to get rid of it or to prevent its escape. To ask for a definition of heat is calculated to trip up the most intelligent person for, like electricity, it is something which can be discussed quantitatively without knowing much about its fundamental nature. One definition of heat as "an active agent postulated to account for changes of temperature" takes us very little towards understanding the agent *per se*.

There is no mystery about heat, for if we keep in mind the fact that solids, liquids and gases are all made up of atoms free to vibrate, it can be identified in mechanical terms quite simply. In the solid state of a substance the atoms are packed relatively tightly together, and exerting an attractive force on each other they, as it were, interlock, to give the system the rigidity which we associate with a solid. A liquid, on the other hand, flows because the atoms are spaced wider apart, and having greater freedom of movement, they tend to accommodate themselves to the shape of the vessel in which they lie. In a gas, however, the atoms are sufficiently far apart for them to exert a negligible effect on each other, and so free are they to move that they can easily wander off altogether, or diffuse away, as it is called.

Mass and Inertia

Atoms possess mass, inertia and most of the attributes of any body, so that the atoms in a substance can be treated mechanically. Above all, they have potential energy and may be considered to be in a state of constant vibration. Heat has its origin in combustion of one sort or another, so that it is necessary to understand the mechanics of combustion. Certain atoms can be made to coalesce with others, as, for example, oxygen and carbon. The atoms of both these substances have a natural vibratory energy, but when they combine some of this energy becomes superfluous to the little twin planet which is formed, and is released. It is kinetic energy, and is passed to other atoms nearby, which become excited. The latter vibrate more and it is this vibration which is really heat. By interaction between adjoining atoms the heat is passed on and the rate of vibration of the whole system increases; in other words, its temperature increases. In effect, heat is a degree of atomic agitation of a substance. We feel heat when the highly vibrating atoms come into contact with our skin, and excite the atoms in the tissue which go to make up the latter.

Combustion is not the only source of heat. If we rub a material we put energy into that material, and this goes to increasing the rate and amplitude of vibration of the component atoms; that is to say, the temperature of the material is raised by friction. Whether our heat is developed by combustion, mechanically or by chemical reaction, the mechanism is expressed by $1/2\ mv^2$. If the atoms have a mass, m, and a mean velocity of vibration, v, and there is a huge number of them (as there most assuredly will be in a minute piece of any solid), then the system has a potential energy which can be expressed by $f\frac{1}{2}\ mv^2$, where f represents the sum of an indefinitely large number of atoms. If we represent the mean square of the velocities of the atoms, by C^2, of a system of mass M, then the heat energy is expressed by $1/2\ Mc^2$.

Specific and Latent Heat

Looking at heat from this mechanical viewpoint such school-day terrors as *specific heat* and *latent heat* lose much of their grandeur. It is clear that the atoms of different substances will possess different masses and aggregates into molecules, and consequently they will require differing amounts of work put into them to give the momentum which is expressed by temperature, or, to be more exact, the period of vibration for a particular temperature. Remembering that there is a fixed relation between heat and work, called the Mechanical Equivalent of Heat, it will be apparent that if the work required to raise the period of vibration of atoms of a particular substance is a constant for that mass of atom, then also will the heat equivalent be constant. This is another way of saying that the heat required to raise the energy level of the atoms of a substance is *specific*.

It so happens that the amount of heat required to raise one gramme of water by one degree Centigrade has been adopted as unity. The unit is the calorie, and if we wish to raise the temperature of aluminium by one degree we would require 0.218 cals., or, in other words, the specific heat of that metal is 0.218. Generally speaking, metals have a specific value of less than unity, and the higher the atomic weight the lower the specific heat.

Vibrational Energy

It has been explained how a vibrating atom can transmit some of its vibrational energy. Thermal conductivity is such a condition, while radiation is a transfer of the energy from the atoms in a solid or gas to the atoms of the surrounding atmosphere. The passage of energy, however, during radiation is a little more subtle than a mere handing on of momentum from one atom to the neighbouring one, and may be likened to radio waves.

Having dealt with *heat* from the mechanical point of view, the question is now: What is *cold*? *Cold* as an entity does not exist, for it has a purely relative meaning. If we regard temperature as analogous to electric potential it will be seen that heat flows from higher temperature to a lower one, just as does current. If one body at a certain temperature is in contact with another at a lower value, heat will flow from the former to the latter. We would say that the latter is cooler, and it is this quality of being able to abstract heat which we call *cold*. There is a theoretical minimum temperature to which matter can fall (−273 deg. C.), which is sometimes referred to as *absolute* temperature. This may be regarded as zero heat potential. If, however, we choose, say, the temperature of the human body (98 deg. F.) as our zero potential, anything below that may be regarded as a negative potential, or, to use our vague expression, *cold*. As a general rule one can regard anything below the normal atmospheric temperature in this country as cold, although this is quite arbitrary, and will range from what we term *cool* to real cold, as, for example, the temperatures of below — 60 deg. F. encountered by high-flying aircraft

Dr. Lee A. Dubridge, a U.S. scientist, who revealed that by a sort of "reverse alchemy" gold has been turned into radio-active mercury in a 5,500,000-volt atom-smasher. He is here seen with part of the apparatus.

Annular Bearings for Bicycles

The Applications of Standard Ball Bearings to the Bottom Brackets and Front Hubs of Bicycles

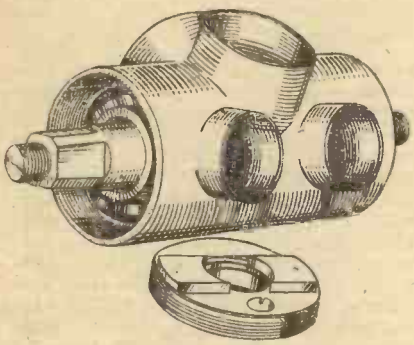


Fig. 1.—General view of a bottom bracket with covers which screw into the housing.

OWING mainly to a demand for increased accuracy in the cycle industry, coupled with the rapid development of ball-bearing technique, the old familiar cup-and-cone ball-bearings are now being steadily superseded by ball bearings of standard design. This applies especially to the bottom-bracket bearings, which were never remarkable for reliability and often proved unequal to their task. Cycles, however, that also have standard bearings in the front hub are now far from rare.

The results of the change have so far been very satisfactory, and show clearly that, thanks to the well-known merits of SKF bearings, especially their low co-efficient of friction and their high carrying capacity, very substantial advantages are gained as a result of the addition of bicycles to the very long list

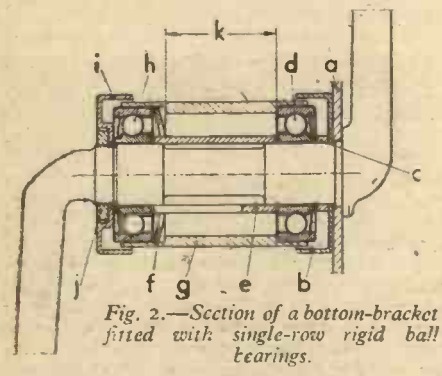


Fig. 2.—Section of a bottom-bracket fitted with single-row rigid ball bearings.

of machines of every kind for which such bearings are now used.

All the problems, economic as well as technical, involved in applying ball bearings to cycles, have been satisfactorily solved by SKF. The cost, however, of providing cycles with high-grade bearings constitutes no obstacle if the bearings are wisely selected and of standard type, standard bearings being, of course, produced in large quantities.

The bearings ordinarily used for the bottom bracket of bicycles consist, as every maker knows, of two sets of balls situated at opposite ends of the bracket and each running between a cup and a cone. The bearings are adjusted by means of nuts screwed on to the journals or by screwing the cups into the housing. To employ this method successfully, however, requires considerable care, for if the adjustment is too tight the bearings run stiffly, while if it is too loose an undesirable slackness results. Even when a cup-and-cone bearing is adjusted exactly as it should be, the initial load on the balls, and consequently also the stresses in them, are greater than in the corresponding single-row rigid ball bearing.

Single-row Rigid Bearing

The standard type of bearing found by experience to be the most suitable for bicycles is the single-row rigid design. In this bearing the tracks on which the balls run are deep, accurately-ground grooves, and since the difference between the radii of these grooves and the ball radius is extremely small, the contact between balls and tracks is very intimate and the carrying capacity of the bearing in consequence very high. The single-row rigid ball bearing is accordingly far superior in this respect to the cup-and-cone bearing, whose design is such that the relation between the groove radii and the ball radius is often very unfavourable.

With the help of the accompanying illustrations a few examples are given showing how standard ball bearings may be used with advantage for the bottom brackets, front hubs, and steering heads of bicycles.

Fig. 2 shows a bottom-bracket bearing arrangement that has been tried out by SKF. Its principal features are :

(1) The bearings—single-row rigid ball bearings—cannot be subjected to initial thrust as a result of careless mounting.

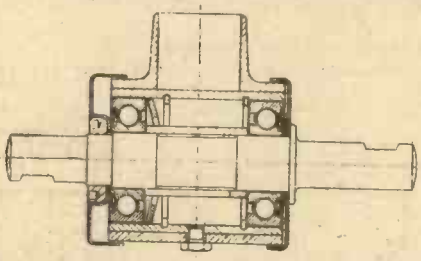


Fig. 3.—Bearing arrangement for a built-up crank.

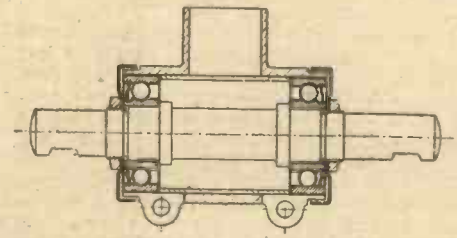


Fig. 4.—Modified form of the bearing shown in Fig. 3.

(2) No adjustments are necessary in order to ensure accurate axial location of the crank.

(3) The seals are designed on the labyrinth principle and therefore function without friction.

(4) The bearings are lubricated with grease, one filling of which lasts practically as long as the machine.

(5) Between the end cover and the side-plates closing the bearings is a space filled with grease, which collects dust and other foreign matter and prevents them from entering the bearings. The grease recommended for this purpose, and also for lubricating the bearings, is insoluble in water ; it has a high melting-point and a suitable consistency.

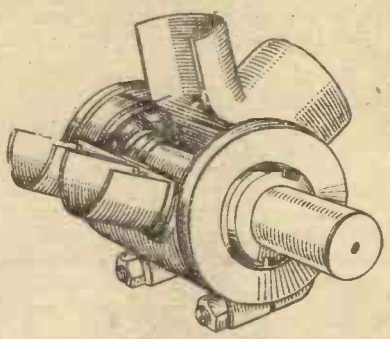


Fig. 5.—Exterior view of the bottom bracket shown in Fig. 4. Note the end covers which are fitted outside the housing.

Sealing Devices

The sealing devices seen in Fig. 2 are adaptable for use with either solid or built-up cranks. When the crank is of the former type the bore of the bearings must be large enough to admit of their being threaded over the crank. The mounting in such cases is carried out as follows :

(1) The sprocket *a* is placed in position. (2) The end cover *b*, the distance piece *c*, one of the bearings *d*, with its protective side-plate facing outwards, and the slotted distance piece *e* are inserted. (3) The dished and hardened spring washer *f* is placed against the shoulder in the housing *g*. (4) The other bearing *h*, also with its side-plate facing outwards, is fitted. (The spring washer *f* now makes contact with the bearing outer ring at two diametrically opposite points. At right angles to these two points it makes contact with the shoulder in the housing.) (5) The end cover *i* is put on, and the whole is tightened up by means of the nut *j*.

The spring washer must be made so that it will be compressed to the extent of 1 to 1.5 mm. when mounted, and will consequently subject the bearings to an initial thrust of 20 to 30lb. This initial thrust is too small to affect either the fatigue life or the friction loss where the bearing concerned is of the deep-groove type. Use of the bearing arrangement described above, moreover, is

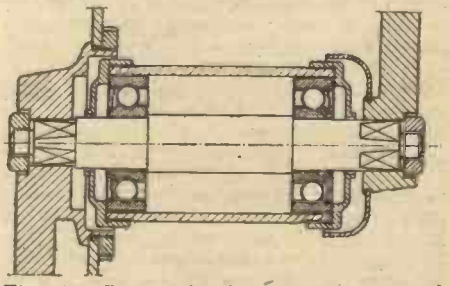


Fig. 6.—Bottom bracket arrangement with special end covers.

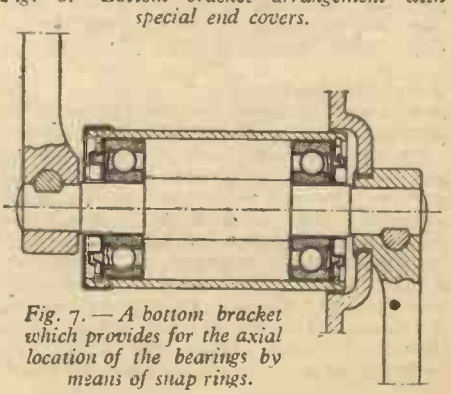


Fig. 7.—A bottom bracket which provides for the axial location of the bearings by means of snap rings.

attended by the advantage that the distance *k* between the shoulders in the housing does not need holding to such fine limits as are otherwise necessary, all risk of jamming of the bearings being avoided when this design is used. In addition, the whole of the mounting can be done without any fitting work whatever.

Greasing

The housing is filled with grease when the bearings are fitted, and the grease is subsequently retained by the side-plates with which the bearings are provided. The filling with grease of the space between these plates and the end cover to which reference has already been made is also done at the time of mounting.

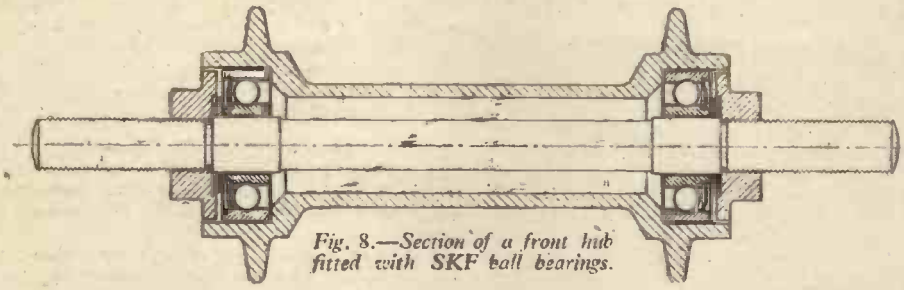


Fig. 8.—Section of a front hub fitted with SKF ball bearings.

For this purpose, of course, it will not do to use any kind of grease. A number of suitable greases with satisfactory cohesive properties have been subjected by SKF to tests, which showed that the quantity of such grease in the sealing cavities remains undiminished after a year's pedalling, the cavities having then been found to be still quite full. The same tests also demonstrated the efficiency of this method of sealing, no dust or dirt having succeeded in entering the bearings, which, on being examined, were found to be in the same condition as when fitted.

Fig. 3 shows a bearing arrangement for use with a built-up crank. Here the housing shoulders, against which the bearing and the dished washer in the former design abut respectively, are replaced with snap rings, and the design is in consequence somewhat simplified. When accurate machining of the shoulder distance in the spindle and the length of sleeve in the bracket is to be relied upon for obviating initial end thrust, the design shown in Fig. 4 is recommended. (See also Fig. 5.) The former dimension should exceed the latter by 0.1 mm. or so.

In the design shown in Fig. 6, which is also a bottom-bracket bearing arrangement, the spindle is located axially by means of the end covers, which are screwed on to the outside of the housing. Covers, however, like those seen in Fig. 1, which screw into the housing, answer the purpose equally well. Whichever type is used it is, of course, important to see that the distance between the faces of the covers is about 0.1 mm. greater than the distance between the spindle shoulders plus the combined width of the bearings. The sealing obtained with the design shown in Fig. 5 is particularly effective, there being here two grease-filled chambers on the outside of each bearing to protect it from dirt and moisture.

The design shown in Fig. 7 provides for axial location of the bearings by means of snap rings accommodated in grooves in the housing.

In all the designs so far referred to the bearings are lubricated and protected on the same principle as indicated in Fig. 2.

Front Hub Bearing

Fig. 8 shows a front-hub bearing arrangement that has been tried out and found very efficient. It is so designed that the bearings cannot be subjected to excessive end thrust during mounting. The nuts, as may be seen from the illustration, are tightened up against shoulders. Between the nut and the inner ring of the bearing at each end of the spindle is a hardened dished washer capable of exerting a thrust of 20 to 30lb. The inner rings are mounted on the spindle with a push fit, employment of such a fit under loading conditions such as prevail here being unattached by any drawback whatever. The outer rings, on the other hand, must be a tight fit in the hub.

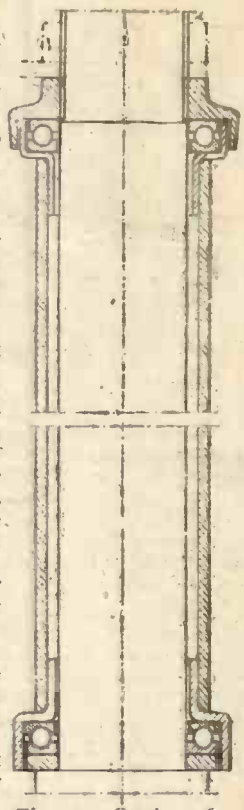


Fig. 9.—Section of a steering column, showing how the ball bearings are fitted.

SKF bearings are at present being tried for the steering column of bicycles. Only ball thrust bearings are used for this purpose, but being of a type with very deep grooves, they are fully capable of dealing with the radial stresses arising. The bearing arrangement adopted, which has now been functioning for two years, is shown in Fig. 8.

The pedals of bicycles have also been fitted with standard ball bearings, but the experience obtained with the bearing scheme adopted is as yet insufficient to warrant a definitive statement on the subject.

ITEMS OF INTEREST

James Watt International Medal

THE Council of the Institution of Mechanical Engineers has unanimously awarded the James Watt International Medal to Mr. A. G. M. Michell, F.R.S., of Melbourne, Australia, on the nomination of the Institution of Engineers, Australia, the South African Institution of Engineers, and the Engineering Institute of Canada.

The medal was founded by the Institution in 1936 to commemorate the bicentenary of the birth of James Watt on January 19th, 1736—an event which was destined to bring about a revolution in the utilisation of power. The medal is awarded every two years to an engineer of any nationality who is deemed worthy of the highest award that the Institution can bestow, and that a mechanical engineer can receive. In making the award the Institution has secured the co-operation of the leading mechanical engineering institutions and Societies in all parts of the world.

To be worthy to receive a medal struck in commemoration of one who was at one and the same time a scientist, an inventor, and a producer, the recipient himself should be an engineer who has achieved international recognition both by his work as a mechanical engineer, and by the ability with which he has applied science to the progress of mechanical engineering.

The last award of the medal was made to an eminent continental engineer, Professor Dr. Aurel Stodola, who was associated with the development of the scientific basis of the design of steam turbines.

Mr. Michell's name is best known because of his work in connection with thrust and journal bearings, but he has, in addition, made a number of extremely valuable contributions to the science of engineering in connection with centrifugal pumps and crankless engines. His outstanding achievements as a scientist, a mathematician of international fame, an inventor, and a producer, fulfil in a unique way the conditions of the award of the medal. Without the Michell bearing the high-powered modern ship and the large central power station would hardly have been possible to-day.

Starter Technique

MOTORISTS know only too well that they need to take extra care of their electrical equipment these days, since batteries are almost irreplaceable and all spare parts and replacements are difficult to obtain. Expert advice on care and maintenance, such as that offered in the following paragraphs by the Lucas Company, is therefore well worth attention.

They emphasise, in the first place, that the starter takes from 10 to 20 times as much current from the battery as the whole of the remaining electrical equipment would if it were all switched on together. It follows that the starter should be used as sparingly as possible, and all the equipment kept in first-class condition to ensure quick and trouble-free starting.

The starter switch should always be operated firmly, and released instantly when the engine fires. If it fails to fire, do not press the switch again until the engine ceases to revolve, and if it persists in failing, do not run the battery down by keeping the starter on, but try readjusting the controls. If the engine still does not respond, take steps to trace the trouble—it may be a fault in the petrol or ignition system. In cold weather the clutch pedal should be depressed while starting, to relieve the starter of drag in the gearbox (this does not apply in the case of a self-change gearbox).

About every six months the commutator and brushes will need attention. The commutator should be clean, free from oil and dirt, and appear highly polished. If it is dirty, press against it a soft duster while the starter is rotated by hand. The duster may be moistened with petrol if the dirt is difficult to remove. Check that the brushes move freely, by holding back the brush springs and gently pulling the flexible connectors. If the movement is not free, the brushes should be removed from their holder and cleaned with a petrol-moistened cloth; care must be taken to replace them in their original positions, to retain their "bedding." If the brushes are too worn to bear correctly on the commutator, they should be replaced and properly "bedded" by the nearest service station or Lucas service depot.

QUERIES and ENQUIRIES

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

Size of Building Seen by Observer

CAN you inform me if there is a formula for ascertaining the height of an observer compared with the size of the object or building seen on the ground? For example, when standing over a scale drawing of a building how far up would an observer have to be to see the building to that same scale size? —E. T. Holock.

ASSUMING that the plan of the building is to the usual architects' scale of 8ft. to 1in., and that the eyes of the observer are, say, 18in. above the plan, then the equivalent full-size height will be 8ft. × 18in. = 144ft.

A.C. Motor Failing to Work

I HAVE a ½ h.p. motor (induction type) 200 volt (50 cycles), 2.6 amp., split phase. It has run well, but now refuses to start. The rotor makes a few turns and then the fuse blows. Can you make any suggestion as to the cause?

The switch is of the centrifugal type, the contacts being broken by a brass sleeve on the spindle, which pushes forward when the motor begins to rev. up.—T. Brandon (Bowes Park).

THE symptoms described would be accounted for by some fault in the starting winding, or centrifugal switch. If there is no indication of burning in the starting coils, and the insulation resistance by megger is not below one megohm, the probable trouble lies in the starting switch. Take out the rotor and centrifugal switch, and run it between centres in the lathe at about normal speed and see how the switch behaves. It may be that the sliding sleeve of the centrifugal device is not free on the shaft, or that the retaining springs which hold the weights in position have become weak or broken, allowing the switch to operate before the rotor has picked up speed. Examine the two contact points which are separated by the switch action, and see that their contact faces are clean. If all seems correct the only other inference that can be drawn is that the starting coils are open-circuited or burnt out, a matter that can only be settled by "drop-testing," as described in A. H. Avery's "Electric Motor Management."

Lamp Resistance

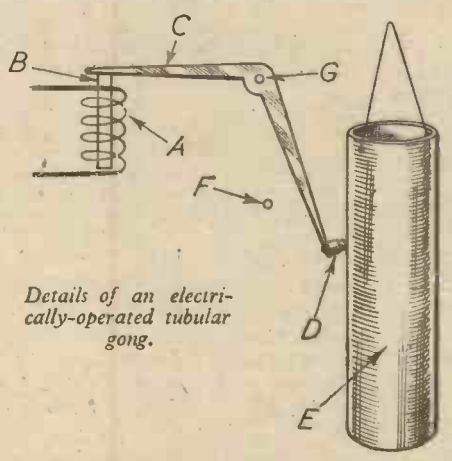
WILL you please enlighten me as to the following?

(1) I have ten 12-volt 4-watt bulbs connected in series. I want to make a resistance to light all these bulbs at once. The mains voltage is 220 A.C. Could you tell me the length and gauge of wire required?

(2) If I want to switch one bulb off, what length and gauge of wire will be required to make a resistance to stop the other bulbs from fusing?

(3) Where can I obtain this resistance wire?—H. Hammond (Hove).

YOUR ten 4-watt bulbs connected in series will require 40 watts total and, if all are 12 volts each, will consume one-third of an ampere for full illumination. On a 220-volt circuit, therefore, you will need additional series resistance to cause a volt-drop of 220 − 120 = 100 volts, when a current of 0.33 amperes is passing, in other words 300 ohms. This would be met by making a resistance consisting of 30yds. of No. 34 s.w.g. enamel-covered Eureka wire, obtainable from The London Electric Wire Co., Ltd., Church Road, Leyton, E. If one bulb is switched out the volt drop due to the series resistance will have to be increased from 100 to 113 volts with the same value of current flowing, and an increase from 30yds. to 33.6yds. will compensate.



Details of an electrically-operated tubular gong.

Electric Gong

I AM trying to make a door-bell for home use consisting of three brass tubes that can be struck by a hammer actuated by a solenoid.

Can you tell me how to make or wind a coil that will cause a plunger to strike at the tubes and yet return to the original position?

It is to be used on 230 volts A.C., stepped down through a bell transformer, or batteries.—G. Armitage (Selby).

THE striking action for the 3-tube electric gong shown in your sketch (not reproduced) would be better if arranged with the hammer or striker at the lower end of a bell crank, free to turn on a small pivot. This is indicated in the accompanying sketch. A is the solenoid winding, B a soft iron strip about 1¼in. long, ⅛in. thick and ¼in. wide, attached to a bell crank C pivoted lightly at G. D is the striker of the gong E, and F is a stop pin. After the gong is struck and the circuit through the solenoid interrupted, the bell crank and its attachments fall back against the stop pin by the action of gravity. For working on a 6-volt or 8-volt bell transformer secondary wind the solenoid with 1 oz. of No. 22 s.w.g. d.s.c. copper.

Petrol to Acetylene

WITH reference to the details of conversion from petrol to acetylene in the July, 1941, issue, I would much appreciate information on the following points

(1) Could such a conversion be made in connection with an Austin Seven 1934 motor?

(2) Could supply and demand be regulated according to the various loads upon engine as normally regulated when petrol used?

(3) Are there any restrictions as to use of calcium carbide other than the limit of storage of not more than 28 lb. in special containers?

(4) Can storage of calcium when converted to gas be maintained without loss, or must direct use be made of it?

(5) Suitable size jets to be used, and approximate amount of air mixture required? — W. L. Chaston (West Wickham.)

IN reply to your queries we think that before you proceed with the conversion of a motor vehicle from petrol to acetylene gas, particularly if you wish to run it on the public highway, it would be advisable to obtain the views of the Divisional Petroleum Officer, or the Road Fund Licensing Department. We suggest this in view of the recent Government announcement on the subject of alternative fuels for motor vehicles, and the fact that the supply of calcium carbide is restricted.

From a purely technical point of view an Austin 7 can be converted to run on acetylene gas quite satisfactorily, the power output being about 20 per cent. lower than on petrol. The adjustment of gas supply to the varying engine requirements can be achieved by means of a water supply valve on the acetylene generator coupled with the carburettor throttle, or if a simple generator of the rising water type is used you will find this is

sufficiently flexible without any modification, other than a small gas reservoir to overcome the inertia of the system.

Restrictions on the storage of calcium carbide are in force, and the local police should be able to give you these together with any local by-laws on the subject.

It is not advisable to store acetylene gas in any but the special solution bottles made for the purpose. The gas is very inflammable, and also has the property of combining with itself an explosive force under certain conditions.

Jet sizes for acetylene should be adjusted to give a 1 : 12 gas air ratio. The actual size will depend on the diameter of the air inlet of the carburettor and the pressure of the acetylene at the jet.

Dynamo Winding for High Tension

PLEASE inform me if I can re-wind a motor-car dynamo (6-volt Delco Remy) to give an output of about 120 volts at 10 to 30 milliamps. There are 14 slots in the armature, length of which is 2⅜in. and diam. 2 1/16 in. What quantity and guage of wire will I require?—L. S. Burke (Newtownmountkennedy).

IT is quite practicable to wind your car dynamo for 120 volts 30 milliamperes, provided care is taken with the insulation, and all winding spaces protected with slot linings of leatheroid or empire cloth at least 15 mills. thick. Assuming the 14-slot armature is 2 1/16 in. diam. by 2⅜in. long, the winding recommended will be as follows:

Armature.—14 former wound coils, each containing 136 turns of No. 32 s.w.g. d.s.c. copper, lap connected. Coil span from slot 1 to slot 7 inclusive, if intended for running in two-pole fields.

Fields.—Two coils each with 4,000 turns of No. 34 s.w.g. enamel covered copper, the two coils in series with one another and shunt-connected to the armature.

Brushes.—Hard carbon "Link A" grade, not less than 5/16in. square or equivalent section.

The approximate weights of wire for armature and fields will be 1lb. for the former and 3lb. for the latter.

Electric Furnace

CAN you inform me how to make an electric arc furnace of a simple type for home use? I would also like details of the power unit required, as I wish to operate it from A.C. mains (230 v.).—B. Lyth (Linthorpe).

A DESCRIPTION of an electric arc furnace sufficiently explicit for home construction purposes would extend far beyond the space available in a brief reply. There are at least 22 different types of furnaces employing carbon or graphite electrodes as the source of heat, and it is recommended to study their various forms and details by referring to the section dealing with electric furnaces in general in "The Practical Engineer" Electrical Pocket Book. The following works can also be consulted with advantage: "Industrial Electric Heating" (Beauchamp), "The Electric Furnace" (F. J. Moffett), and "Refractories for Furnaces and Crucibles" (A. B. Searle). These are 2s. 6d. technical primers, published by Pitman and Sons, Ltd., Parker Street, Kingsway, W.C.2. Generally speaking, arc furnaces will be found expensive to operate and extravagant of current on a small scale and most high temperature requirements are now being met by the use of the "Salt Bath" furnace, such as the "Ajax-Huligren." Particulars of this are to be found in Vol. 70 of the Electro-Technical Society, 1937, Columbia University, New York, which can be seen at the Library of the Iron and Steel Institute, 4, Grosvenor Gardens, London, S.W.1.

Epidiascope Details

I HAVE a projection lens, 3in. long by 1⅞in. diameter, with 18in. stamped on the brass sleeve at one end. I wish to rig up a "reflectoscope," more commonly called an "epidiascope," but do not know how to arrive at the various distances.

I wish to project drawings a distance of about 30ft. for a screen picture of about 6ft. to 7ft. square. I have not yet settled the question as to whether the drawings should be vertical and attached to the rear door, or lying down on the bottom of the lantern or box.

Would you kindly put me right on the following points, please:

1. The distance of the two lamps from the lens.

2. The distance of the apparatus from the screen.

3. The power of the lamps.

4. Are the size of the drawings limited by the diameter of the lens?

5. Would a 4½in. condenser, interposed between the lamps and lens, help in giving a larger and a brighter picture?

6. What distance should the condenser be from the lens?—J. T. Pulham (Dagenham).

1. The distance of the lamps from the lens need not be considered directly, but should be arranged to illuminate the drawings as evenly and brightly as possible.

2. You do not give sufficient information to determine this. It is necessary to know the size of the drawings which you are projecting.

3. As bright as possible. The brighter you can get the lamps the larger and brighter the image on the screen.

4. There is no direct connection between the size of drawing and the diameter of lens, but the aperture in the lens should be as large as possible for the same reasons as given in 3.

5. There must be no condenser between the drawings and the lens in any case. If you use a condenser at all there should be one between each lamp and the drawing.

6. See 5.

Stampings for Electric Motors

CAN you inform me where I can obtain field and armature stampings for fractional h.p. A.C. motors, particularly in small sizes (say, ¾in. diameter armature) and cylindrical commutator? Also, can you give details of the small motors, such as employed in electric high-speed hand tools (e.g., "Dremel" and Handee" makes), such as size of fields and armature, gauge of wire required and turns required for speeds of 20,000 r.p.m.? Also, where can I obtain ebonite or bakelite tube of about 1⅝in. diameter?—S. A. Amos (Bath).

FOR field and armature stampings suitable for fractional horse-power motors, apply to Joseph Sankey and Sons, Ltd., Albert Street Works, Bilston, Staffs. For ebonite, micanite, paxolin, and other insulating material, try Micanite and Insulators, Ltd., Empire Works, Blackhorse Road, Walthamstow, E.17. There is no standard size for motors used in high-speed drills, etc., each one being designed to suit the general scope and capacity of the drills used. If you select a standard size of stamping from Sankey's list, and will let us know the sizes decided upon, specifying voltage and the speed you propose to work at, a suitable winding can be given. It would be advisable to choose something with an armature not smaller than 1 in. diameter, otherwise winding becomes a difficult problem. At the present time we do not think you will be able to obtain quotations for ready-made commutators, but drawn copper segments of suitable section in the bar are obtainable from Messrs. Thomas Bolton and Sons, Ltd., Oakamoor, N. Staffs.

Acetylene Generator

CAN you give me a description of a Bell type acetylene gas generator? How is the generation of gas controlled? Can the carbide in container be left there when the required amount of gas has been used, or must all the carbide be exhausted?—B. J. Pudan (Wittersham).

IN the Bell type of generator the gas forces the water out of the carbide container when the pressure exceeds that of the head of water. Arrangements are usually made to prevent too large an area of contact, so that there will be no sudden rush of gas.

In the "Low" pressure generator the gas is occluded in a special lining plaster, and a small needle valve is operated by a bellows so that water is cut off when a predetermined pressure is reached.

Sandblasting Outfit

CAN you inform me of any data concerning the working of a sandblasting outfit suitable for cleaning cycle frames after brazing and before enamelling?

What I should like to know is, what would be the output of an air-compressor for continual working, and what size motor to drive it?—J. Fothergill (Liverpool).

THE air compressor will need about 40.5 h.p. to produce a flow at 90lb. pressure of about 211 cu. ft. of free air, through a ¾in. nozzle. If the nozzle is allowed to wear, air flow will increase and power required rise. For ferrous metals the pressure used ranges from 60-100lb. according to the degree of cleaning required and the condition of the work. For non-ferrous metals the pressure is from 10-60lb.

Making Leaden Toys

FOR making simple leaden toys there is no soft metal better than the lead taken from disused accumulators, such as the tops or plates of old car batteries. It is a composition of tin, antimony and zinc, and requires very little heat to melt. When changing colour from silver to a faint rainbow, it is best for casting.

Making Moulds

Have at hand some dental plaster of paris, as well as some ordinary plaster of paris. Dental plaster should feel like flour, soft and not gritty. It can be obtained from most chemist shops for a few pence per pound. When boxes containing patterns are ready—not forgetting that plaster of paris sets fairly quickly—mix sufficient dental plaster to just cover pattern to a thick cream, so that it just runs out of the pot and covers the pattern; this will be nearly set by the time a sufficient quantity of ordinary plaster to fill box has been mixed.

Remember to well grease or oil the patterns to prevent the plaster from sticking to them.

The moulds should then be well baked for at least two hours.

All moulds, whether of duralumin, iron, or plaster, when casting should be first held over a smoky lamp (an old cycle oil lamp will do), to give them a good coat of soot, as metal runs easily in soot.

L. S.

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

Comments of the Month By F. J. C.

Sunday Racing

WE know, from conversations with officials of many clubs that they are seriously perturbed concerning the difficulty of continuing club events and "Opens" during the war. Some of even the very old clubs are promoting "Opens" merely in the interests of the sport, for some of the start carrds before us show that they are unable to put up even one rider in the events they promote, whilst the club programme is subject to cancellation after cancellation.

The war has caused a great shift of population, some into the Services, some to remote districts on munitions. Even the women are now being "directed" to jobs far away from their homes and their club. When such clubmen and clubwomen find themselves removed to a district where live clubs exist they often have to work long hours of overtime and in most cases week-ends. They therefore have no time to link up with a new club.

At the end of June the petrol ration ceased for all except those who use cars for work of national importance, or for strictly business journeys, and this has given rise to a fresh crop of difficulties, not the least of which is the transport of marshals and helpers. Few clubmen are now able to give a whole week-end to an event, as they were in peace-time, for without motor transport to assist in a club event means a journey on Saturday afternoon to a point within easy travelling distance of the start in the early morning.

Cyclists have in the past regarded themselves as the natural enemy of motor propelled vehicles, and are now realising what they owe to the motor-car. Some of the leading events in the cyclists' calendar have only attained their success and pre-eminence because members of the club have been able to lend motor-cars to transport the officials, the helpers, the food, and, in many cases, the riders and their bicycles.

Social Side of Cycling

AS we have mentioned before, in the earlier days of the sport, when events were held on Saturdays, these problems did not arise. Several of those who had been associated with the sport for many years have expressed the opinion, during discussion with us as to ways of overcoming the difficulties, that Sunday racing has caused many clubs to go out of existence. It has, they say, spoilt the social side of cycling; whereas with Saturday racing the race finished on the Saturday evening, leaving the Sunday for pleasurable rides and social intercourse, nowadays the whole week-end is given over to the racing man.

The pastime, in fact, has been given over to the racing man, and the social side confined to the annual dinner and prize giving, and a few poorly supported dances. One very prominently associated with all branches of the sport, whose name is revered in cycling circles, informed us that Sunday racing sounded the death knell of cycling as he knew it in his younger days, when the week-ends were spent in pleasurable rides. He pointed proudly to photographs of the Green at Ditton, where many famous cyclists had arrived on their bicycles and were engaged in pleasant conversation. In the last 20 years the pastime has been handed over to the sport. Everything is designed around the promotions of "Opens" and racing, consideration being given to the 30,000 or so who wish to ride in races—the "pot-hunters" as he called them—with little, if any, thought for the millions who ride bicycles for pleasure and make the continuation of the industry possible. There is a lot in these arguments and there is considerable support for the argument against Sunday racing. The racing man expects all those necessary for the successful running of the event to give up a whole week-end and to go to a certain amount of expense in order that he may enjoy his narrow aspect of the pastime.

Cycling for Pleasure

WE were asked whether the racing game was worth all this attention, all this time and trouble, especially during the war, when it was only meeting the selfish desires of a few? That is a difficult question to answer. There are those who believe that the clubman is the only individual worth considering, and that the rest of the cyclists use bicycles perforce as utility vehicles for conveying them to and from their work. We do not agree. There are far more cyclists who cycle for pleasure than for sport, and we are quite at a loss to understand why so much attention is given to the racing man. It is too small a section of a large community to be worth it. There is a tendency for the tail to wag the dog. Certainly Sunday racing should be abolished if only during the war. If a man selfishly does not wish to give up a Saturday afternoon or evening for racing he should not be permitted to race on Sunday. There will, we know, be little support amongst the racing community for this point of view. It will be interesting to compare the number of those actively engaged in time trials with the number of officials necessary for the promotion of time trials. We think the latter almost equal to the former.

We therefore think that clubs should carefully consider whether the promotion of the *pastime* of cycling and the social side of it is not more likely to hold the club together than time trials. It is an aspect of club life which has been neglected ever since certain sections have pushed the sporting side to a position out of all proportion to its importance.

The Club Run

THE club run, it may be argued, provides this opportunity, but any organised club run with a particular meeting place at a particular time has many disadvantages. In fact, it is true to say that all clubs have found the club run a failure. One has only to read club journals, with their frequent references to poorly supported club runs, and inter-club runs, to realise that this is so.

The war has illumined the problem, and now is the time to get the house in order for the post-war period. There are those who think all racing should cease during the war, and that men should not be permitted to spend time racing whilst their club-mates are in the Army or in some other branch of the Services. The answer to that is that if a man is not in the Services he is performing useful national service in another direction.

The expansion of the Home Guard and the increasing calls upon the time of those rapidly diminishing numbers not in the Services will accentuate the problem during the next few months. This year, indeed, it may be difficult under the new Food Control Orders to hold annual dinners and annual luncheons. Several restaurants have given notice that they will be unable to undertake banqueting this year. The time to wrestle with the problem is now.

Centenary Club's Run

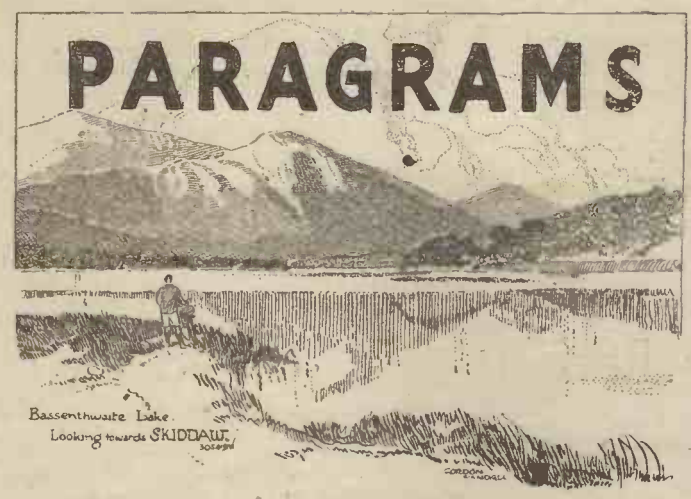
THE Centenary Club held another of their runs last month, about 25 of them meeting at Solihull and riding for 20 miles through the Warwickshire lanes. The president acted as the leader. The annual general meeting was held during the run, when all the old officers and the committee were re-elected. The club donated 10 guineas to the Cycle Trades Benevolent Fund, and 5 guineas to the C.T.C. Comforts Fund. The following took part:

W. A. Church, J. A. Phillips and Co., Ltd.; L. Wilkinson, Armstrong Cycles; H. Turnpenny, Bluemels; H. R. Horden, J. B. Brooks and Co., Ltd.; H. N. Brealey, B.S.A.; A. D. Mayo, Coventry Eagle; L. Camillis, Cyclo Gears; W. P. Dawes, Dawes Cycles; W. Tovey, Monitor Brake; Sir Edmund Crane, Hercules; F. C. Parkes, Sun Cycles; W. H. Henman, Blumfields; Major F. W. Smith, Enfield Cycle Co.; W. Williams, Edward Williams and Co.; H. G. Jones, Villiers Eng. Co.; Major H. R. Watling, Manufacturers' Union; H. G. Gibbs, New Hudson; S. F. Smith, Standard Cycles; T. Perry, Standard Cycles; H. Joyce, Tube Products; H. W. Capener, Sun Cycles; M. Miller, H. Miller and Co., and F. J. Urry.

One Type of Dunlop Tyre Only

THE Dunlop Rubber Company have announced that because of the rubber situation, and in the interests of national economy, they will until further notice produce one single all-purpose cycle tyre instead of the existing Dunlop range. This tyre will be known as the "Dunlop War Grade," and it will be available in all the normal roadster and juvenile sizes. The cover will cost 5s. 6d. and the tube 2s. 3d. For high-pressure rims the cover will cost 9s. and tube 3s., for tandem rims 8s. and 2s. 9d., and in the junior sizes 3s. 11d., 1s. 6d. and 1s. 10d. The company will continue to produce carrier tyres.

PARAGRAMS



New American Highway

A NEW road has been driven across the dense tropical jungle of the Panama Isthmus, connecting the Atlantic and Pacific Oceans. It is 48 miles long, and will be used mainly for military purposes.

Golden Eagles in Scotland

CYCLISTS in Ross-shire recently saw three golden eagles flying high—and taking great note of a bomber which was also in the vicinity.

Messenger Boys Ride Past

IN Edinburgh recently some hundreds of Civil Defence Boy messengers took the salute from Lord Provost William Y. Darling after riding *en masse* down Princes Street. The demonstration was part of a campaign to increase the number of cyclist messengers.

Bicycles "Verboten"

THE Nazis have introduced a new order in France which forbids Frenchmen to ride, or even to walk with, a bicycle between the hours of 8.30 p.m. and 5 a.m. in certain of the northern Departments.

The reason for this wholesale ban, say the Germans, is that when outrages have been committed against German soldiers, as well as acts of sabotage, those responsible always used bicycles.

Mayor Was Horrified

THE Mayor of Bury St. Edmunds, Suffolk, stated at the Petty Sessions recently that he was horrified at the way in which motorists treated those on bicycles, and appealed to motorists to extend to cyclists the courtesies of the road.

Warning to Cyclist Servicemen

THE chairman of the Dereham Petty Sessions has suggested that the Military authorities should warn Servicemen of the dangers of using bicycles at night without lights. Many have been summoned in recent weeks for the offence.

New Hostel near Berwick

THE Scottish Y.H.A. has just opened a new youth hostel at Coldingham Bay, twelve miles north of Berwick-on-Tweed. There is room for 50, and the hostel is within week-ending reach of Edinburgh, Newcastle, and Glasgow.

Victor Uses Bicycles

G. L. REAKES, the successful candidate in the Wallasey by-election, used bicycles for canvassing and messages. After the declaration of the poll, he rode round the constituency thanking supporters.

Knocked Policeman Off Bicycle

A MOTORIST who knocked a policeman off his bicycle at Rochdale was fined £2. It was stated in court that the driver tried to pass between two cycling policemen, and the kerb.

Fewer White Lines

ONLY main trunk roads and Class 1 highways are to have white lines in future. The road authorities aim at reducing the amount of paint used to a minimum.

Shropshire Hostel Reopens

WILDERHOPE youth hostel, Shropshire, has reopened in time for the holiday season. It is situated in one of the choicest corners of the West Midlands.

Carry Cutlery and Crockery

CYCLISTS who use youth hostels for week-ends and holidays are being advised to carry their own cutlery and crockery, as hostel supplies are running ow

Slough - Maidenhead By-pass Plans

PLANS for the route of the proposed Slough by-pass have now been approved, but work is not to commence until after the war.

Parking Facilities at Car Club

SINCE the cessation of private motoring in Eire, members of the Royal Irish Automobile Club are parking their bicycles on the premises.

New Swiss Highways

THE Swiss Government is making a number of new highways as a measure of unemployment relief.

Minister Fined for Road Offence

WHEN a Tunbridge Wells minister was fined 10s. for carrying his six-year-old son to school on the crossbar of his bicycle, Sir Robert Gower, M.P., who was on the bench, stated that while he was in the House when the Road Traffic Act of 1934 was passed, he did not know that it was an offence for two persons to ride on a bicycle made for one and not adapted for two.

Advance Hostel Bookings

THE Scottish Y.H.A. is now accepting the advance booking cards of the Y.H.A. of England and Wales.

Future of Lakeland

IN the House of Commons recently Sir William Jowitt (Paymaster-General) lent his support to the proposals to make the Lake District a National Park, with youth hostels, after the war.

Cycling Boom in Ireland

IT is reported from Dublin that since the private petrol ration was abolished, the city has once again become alive with thousands of cyclists. Even members of the Dail ride to their duties on bicycles, and second-hand machines are fetching more than £20 at auction sales.

Clubman Killed in Action

GUNNER B. LANE, Westerly C.C., has been killed in action in Libya.

Club Ceases Activities

STANLEY C.C., of Wakefield, has ceased to operate for the time being. Hope is expressed that arrangements will be made to continue the club's good work.

Newly Elected President

GEORGE HAMPTON, well-known worker for the R.T.T.C. and its first chairman, has been elected president of the Finsbury Park C.C., of which he was secretary for many years.

Clubman in Commandos Raid

TROOP SERGEANT TOMMY SHERMAN, Anfield C.C., who is serving with the Commandos, was wounded in the St. Nazaire raid. He has now fully recovered.

Norwich Club's 63rd Year

NOW in its 63rd year, Norwich A.B.C. still carries on although some 40 members are serving with H.M. Forces.

President of Warrington R.C.

GEORGE W. RHODES, founder member, has been elected president of the Warrington Road Club.

Road Racing Events

IT is anticipated that there will be over a million miles of road racing this season. There are 282 events in the R.T.T.C. handbook, which includes 167 "25's."

Northampton Club Suspends Activities

NORTHAMPTON and District Cycling Association has suspended all activities until "six months after the war."

Missing in Malaya

AMONG those missing in Malaya is M. C. Bird, popular member of Colchester Rovers C.C.

Fastest Time in Three Opens

G. EDWARDS, Glasgow Nightingale C.C., made fastest time in three consecutive open events.

Cyclist H.G. Unit

BRADFORD is forming a cycling Home Guard unit.

Clubman in Parachute Unit

JACK HOLMES, Yorkshire Road Club, and famous mass-start rider, is now serving with a parachute unit.

Time Trials Entries

ENTRIES for open road time trials show no sign of diminishing.

Club Secretary Missing

THE former honorary assistant secretary of the North Middlesex and Herts Cycling Association, Pilot Officer Arthur Lewry, has been reported missing following a raid over Hamburg.

Club's Monthly Gazette

THE Marlborough Cycling and Athletic Club, now in its 50th year, has recommenced the production of its pithy monthly gazette.

From R.A.F. to Civilian Life

AN outstanding official of the Sheffield and District Cycling Association, C. E. King, formerly of the Royal Air Force, has returned to civilian life in his home town.

Winner of T.A. "25"

WITH the exceptionally fast time of 1h. 9m. 53s., C. F. Mullner, South-Western Road Club, won the Tricycle Association "25."

Girl Rider's Son

MRS. BILLIE DOVEY, the girl who rode 30,000 miles in 1938 to demonstrate the ease of cycling, has presented her husband with a son.

Club Cancels Open Events

OWING to "unforeseen circumstances" Leo Road Club has had to cancel open events arranged for this season.

Boy Scout's Salvage Task

BECAUSE he worked so hard on collecting salvage—he wore out a pair of cycle tyres in his task—Buryan (Cornwall) Rural District Council have presented a Boy Scout (Douglas Weinberg) with another pair.

T.A.'s Annual Meeting

OVER 25 tricyclists were sufficiently interested in the Tricycle Association's 1942 programme to attend the organisation's annual general meeting.

Club Rider in Submarine

G. S. ROWLAND, University C.C., is serving in a submarine.

Club. Sec. Receives N.C.U. Award

CHARLES GRIFFITHS, secretary and captain of Stretford Wheelers, has received the special award of the National Cyclists' Union for enrolling no fewer than 120 associate members.

Clubman—Now Staff-sergeant

ARCHIE FULLER, Doncaster Wheelers, has been promoted to staff-sergeant in the Royal Engineers.

Club's 100 Members in Forces

SHEFFIELD PHŒNIX C.C. have over 100 members serving with H.M. Forces, including George Postlethwaite, prominent pre-war speedman, who is a sergeant in the Royal Air Force.

Moncton C.C. Rider in Near East

ARTHUR HOLLENDER, one of the famed Moncton C.C. trio, is in the Near East.

Veteran Clubman's Golden Wedding

FIRST secretary of Southgate Nondescript Bicycle Club in 1882, Mr. Will Howe, five times Mayor of Port Melbourne, Australia, celebrated his golden wedding recently. He still cycles occasionally.

New Scottish Club

THE Edinburgh United Cycling Club is the name of a new organisation which comprises members of the pre-war Edinburgh Road Club Lothians C.C. and the Musselburgh C.C.

Scottish Road Records

ACTIVITY in Scottish road records is anticipated this season. For the past two years interest has been low, but certain young clubmen have designs on place-to-place records.

Access to Open Spaces

THE Ramblers' Association (Southern Federation) has adopted a resolution urging the Government to declare that during the period of the war all uncultivated mountains, moorlands and downlands not occupied for war purposes shall be open to the public for air and exercise. The Federation points this out in connection with Mr. P. J. Noel-Baker's plea for the public to take walking or cycling holidays this year.

West Wycombe, Bucks : Looking down the hill from the church towards the picturesque High Street. The building in the centre is the Church Loft (15th century).

Around the Wheelworld

By ICARUS

Speed Limit

THE speed limit was introduced with the object of reducing road accidents. At the end of June the basic petrol ration ceased and the only cars which will remain on the road are those which will be engaged on essential public services, work of national importance, and business journeys. The speed limit should be abolished during the war when we are all urged to " Go to it," and told that every minute we waste at our bench or our desks costs lives. There can be no valid reason for a speed limit when only a few thousand vehicles are left on the road. A speed limit under these conditions is delaying the war and hampering the war effort.

Another point is that the police are still engaged in trapping motorists on perfectly straight roads devoid of traffic, and the mobile police still trail motor-cars in built-up areas, burning up valuable petrol which is denied to private motorists.

It is grotesque that during the war busy citizens should be prevented from getting about their business speedily by insistence on the observance of the speed limit. What incentive is there for a man to hurry about his business when there is the risk of a prosecution? The only cars remaining on the road, as I have said, will be those connected with the war effort, and it is a scandalous thing that the police should still be engaged in trapping motorists for the heinous offence of exceeding the limit. Surely, if there is no better work for the police they should be released for the Services, or for work in the factories.

Now that fewer cars are on the road some of the police have been trapping munition workers on their way to work. Some of the workers have been prosecuted for hurrying to work, and fined varying sums which seem to start off at about £1. The magistrates, I understand, have a tariff of fines according to the speed. Once a munition worker has been fined in this way it is unlikely that he will hurry to work again. He will prefer to lose two hours' pay rather than £2 in fine.

The speed limit has always been bad law because it cannot be enforced. It has not succeeded in the object for which it was introduced. Accidents have been reduced on the open road where the speed limit does not apply, and they have increased in built-up areas where it does apply. I know that the cyclist associations have supported the speed limit, but I have consistently opposed it. These views have been communicated to the Minister of Transport and I await his reply.

Traffic Lights

THE traffic lights also should be abolished at all except multi-crossings now that the roads are comparatively free from traffic. They waste time, and do not contribute to road safety. Bus stops should be fixed, at such traffic lights as remain, remote from traffic lights. We must promote the idea of urgency about our business journeyings, and we must equally promote the idea that the pedestrians must adopt the principle of the law of self-preservation being the first law of nature. Hore-Belisha encouraged them to believe that they could be as careless as they liked. He imposed no regulations or penalties on the careless pedestrian who was responsible for a higher proportion of accidents than statistics disclosed. The pedestrian crossings should be abolished with ignominy. We want no further memorials to a Minister of Transport who conducted expensive experiments, regarded himself as the recording angel of accidents, and confounded the whole traffic problem, aided and abetted by those whose minds still live in the past and oppose progress.

Cyclists and the Red Cross

APROPOS the article in last month's issue inviting cyclists to contribute to the Duke of Gloucester's Red Cross and St. John Fund, donations should be sent to the Hon. Sec., Red Cross and St. John Fund, 22, Lancaster Gate, London, W.2, marking the envelopes in the top left-hand corner " Special Cyclists' Appeal." Many cyclists are sending donations to the Red Cross without this, and the pastime is not getting credit for the support. Up to the present cyclists have shown up very badly—they are are almost at the bottom of the list—and it is essential if the pastime is to retrieve the position that all donations sent by cyclists should be credited to cyclists. Do not forget, therefore, to send the donations to the address given and to mark the envelopes in the manner suggested.

Pedestrians' Right of Way on Beaconless Crossings

ALTHOUGH many of the globes marking pedestrian crossing places have been destroyed in air raids, drivers of vehicles are required to pay the same regard to crossings which are indicated by two lines of studs as to those marked by both studs and globes.

An Order to the effect, entitled " The Road Vehicles (Pedestrian Crossing Places) Order, 1942," has been made by the Minister of War Transport.

The lost globes cannot be replaced at present owing to the demands on labour and materials for war purposes, and the Order is intended to ensure that authorised crossing places retain their full legal significance.

Pedestrian crossings were first introduced in London in 1934, and later extended throughout the country. The need for a sign which would indicate the location of the crossing both to pedestrians and to drivers of vehicles was early recognised, and after a number of experiments the Minister of Transport decided that the sign should be in the form of an orange beacon, and that such signs should be erected at all pedestrian crossings except those which are controlled by traffic light signals.

Originally only glass beacons were provided, but as many were damaged, globes made of metal painted the appropriate colour were substituted.

During the air attacks on London and provincial towns a great many beacons were broken, but the conclusion has been reached that in view of the urgent demand for labour and materials for the war, it would not be appropriate to replace them at the present time.

Road Accidents, April, 1942

THE number of children killed on the roads of Great Britain in April averaged four a day.

Compared with the blitz period of 1941, fatalities to road users generally in the first four months of this year are down by nearly one-quarter. Blackout deaths also show a substantial reduction. Fatal accidents to child pedestrians, on the other hand, totalled 328, compared with 373—a reduction of only one-eighth, while the number of fatalities to child cyclists actually increased from 52 to 61.

Accidents to children are mainly daylight accidents. Three of the most common causes of fatalities to child pedestrians are : playing around stationary vehicles, escaping from the charge of an older person, and, above all, running into the road. The increase in deaths among child cyclists may be attributed to an increase in the number of inexperienced riders.

The remedy lies largely in the hands of parents who might do worse than copy the war-time rules of safety at sea—escorted crossings, avoidance of the most dangerous routes, constant vigilance and a dash of naval discipline.

Cyclorama

By H. W. ELEY

Lion Rock
Dovedale
Derbyshire

Nation Becoming "Cycle Conscious"

THE bicycle (often called the "humble bicycle," though I know not why) is in great demand! Not only are people making somewhat urgent enquiries as to where they can buy new bicycles, but I see that the Board of Trade is contemplating asking owners of bicycles who are not using their machines to dispose of them through the cycle trade so that there may be an augmentation of the supply of cycles for the use of munition workers, etc. One supposes that up and down the country there must be many hundreds of bicycles stored away which, with a little care and attention and some slight overhaul, would be perfectly serviceable for use.

More and more the nation is becoming "cycle conscious," and those pioneers who ever since the early days of the bicycle have preached its utility and unique position in the world of transport are finding their arguments vindicated with a vengeance.

Cycle lovers have always said that the bicycle was the mount for everyone—old and young, light-weight or heavy-weight, tourist or "potterer." The fact is well exemplified these days, and this last week-end whilst out on the road I was struck by the varying ages and types of riders—there was the small boy just promoted from the scooter to his first juvenile bike; there was the not-so-slim matron; the vigorous young man in rational cycling clothing, accompanied by the inevitable girl friend; there was the typical grizzled out-of-doors man who seemed to eye the passing buses and coaches with scorn. All finding in the bicycle the ideal means of escape from the town into the green countryside.

Rubber Control

THE effects of the recent Rubber Control Order will obviously be far reaching. I see that it prohibits the use of rubber in the manufacture of cycle pedals. Personally, I do not like the idea of going back to the rat-trap type, but possibly the inventive minds in the cycle industry will evolve some new type—there is nothing like a war to stimulate research and the discovery of new ways and means.

Some little time ago I bought a pair of rubber trouser bands, marketed by Dunlop. One end was slotted, the other pointed and to fit or remove was the work of a split second. A simple enough idea, but most effective and handy. I take it that in view of rubber control this new line will automatically disappear and I shall have to go back to my old metal clips. I have said that rubber control will be far reaching, and I am reminded that those who in winter time do not care to get into bed without the comfort of a hot-water bottle, may have to be a little more spartan in their habits next winter. Rubber hot-water bottles will disappear. There should be no grumbling and possibly we should be better off without this luxury. No doubt some medical man will write to the Press and point out that in any case the hot-water bottle was a menace to health.

Disappearing Country Customs

NOT the least of the sad effects of war is the disappearance of old country customs and festivals. Of course, many had disappeared before the war came, but a few remained to link us with more precious and romantic times. I recall that in the good old days the first of May had special significance, particularly for the lover of the countryside. I should hate to count up how many years ago it is since on May 1st I was greeted by laughing children carrying a gaily bedecked maypole. The construction of the maypole was a simple matter—all the youngsters needed was a broom stock, a wooden hoop, a few ribbons and garlands of wild flowers. With these simple components a very decorative maypole was made and taken round the village on May-day morning. Usually the youngsters sang snatches of old-time songs, and by the end of the day had collected as many pennies as the bands of carol singers do during yuletide. Years ago May 1st was also notable for the custom of decorating horses. Each carter or drayman took a pride in braiding his horse's mane and tail with ribbon, and in putting rosettes on the animal's harness. Such pleasant touches have gone.

It was in May that many of the old village and country town festivals were held. Probably one of the most impressive was the May Day Carnival held at Knutsford, in Cheshire. This was a very colourful affair, and the town made high holiday to greet the spring. Knutsford, by the way, is always held in affection by those who have read and remember that quiet moving story "Cranford."

Repair Outfit in "Battle Dress"

A DUNLOP advertisement caught my eye the other day, and conveyed the news that owing to the war the familiar red and yellow Dunlop Repair Outfit tin would shed some of its colours. The advertisement, of course, stressed the fact that the contents would be unaltered, but that they would for the duration of hostilities be marketed in "battle dress." But if colours on tins, etc., tend to disappear, the war fortunately cannot alter Mother Nature's habit of garbing herself in colourful garments now that summer is here. Buttercups make the green meadows carpets of gold. Soon the hedgerows will be foamy with hawthorn blossom. The edge of the wayside is gay with dandelions, and the cyclist who loves the open country knows that there is no better time of the year in which to go riding than in this joyful spring season.

Bikes of Yesteryear

TALKING recently with some old cronies at a Warwickshire inn the conversation turned to the bikes of yesteryear, and some old names were mentioned which struck some very pleasant chords of memory. Someone mentioned the famous Osmond, in its day one of the best-known bicycles of all. The memory then recalled the Monopole, a Coventry make of great popularity many years ago. Other names came tumbling to the tongue as memories were probed—Campion, Gloria, Royal Ruby and Premier. No such conversation could have ended, of course, without someone mentioning that distinctive and famous machine the Dursley-Pedersen. Perhaps if one appeared in the street now it would but call forth the derisive laughter of small boys!

Tyre Inflation

HARKING back to that knotty question of rubber control, it is noteworthy that most of the tyre manufacturers are using their space to give useful hints on the care and maintenance of their products. We are apt to forget that correct inflation is a good thing for cycle tyres as well as for motor. Luckily the cyclist need not be bothered with intricate schedules, and I suppose that all he need do on the inflation question is to keep his tyres inflated hard. Plenty of cyclists however run their tyres badly under-inflated, and by doing so are indirectly wasting rubber. And to waste rubber to-day is almost criminal.

County Towns

"SPELLING Bees" and general knowledge questions are very much the order of the day. Recently I saw a general knowledge paper and among the questions was one asking for the name of the county town of Middlesex. I tried this question on several cyclists whose riding had always been in the Home Counties. I got a variety of answers, but only one cyclist was correct and gave me the name of Brentford. This set me thinking, and I have come to the conclusion that there is a great deal of ignorance about the county towns of England. Just as a matter of interest, next time you chat with your fellow riders over a pipe and glass in some friendly tavern, ask them the names of the county towns of Westmorland, Cumberland, Cornwall and Sussex. I think you will get some extraordinary answers!

The Housewife's Cycle

MORE and more housewives are using their bicycles for shopping expeditions. Now that the shopkeeper cannot deliver the small parcel to the "Gables," or "Fernlea," or "Ivydene," the housewife has to carry her own purchases, and there is no more convenient way than carrying them in the basket attached to cycle handlebars. Now that shopping is increasingly done by means of the bicycle, it might be well if shopkeepers would try to arrange for some simple cycle racks to accommodate the machines—the narrow shopping street of an old-fashioned provincial town is not easy to negotiate when all the housewives are making their purchases and have left their machines precariously parked against the kerb.

Gears and Toothform

By C. A. (Bath Road) Smith

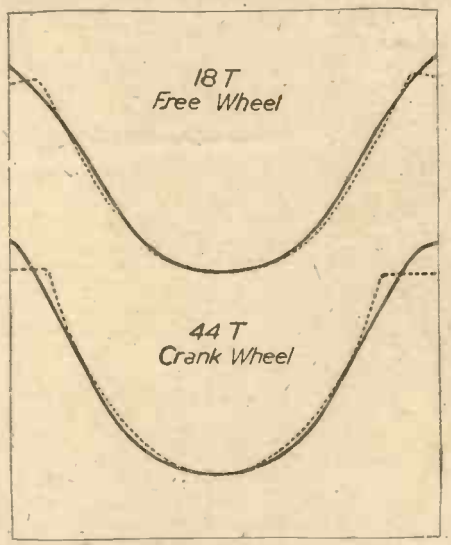
SINCE my last notes on this subject appeared I have had several interesting letters from readers. There is satisfaction on all sides that the Government has insisted on production being based on B.S.I. standards, and as I pointed out previously B.S.I. adopted Hans Renolds toothform after considerable investigation. The cycle manufacturers have been the victims of out of date plant. Modern machinery to cut chainwheels and sprockets is now available. This parent body, B.S.I., should now see that the child has cut its teeth, Hans Renolds form. How would this do for a motto, "You want the best gears, we cut them!" One can say with a chuckle that nearly all the babies—sorry, "cycles"—born up to now have decayed teeth! One might also remark that bicycles are born with the rickets. The cycle, like a baby, needs the skill of the expert. Here B.S.I. must step in, quickly diagnose the disease and apply the remedy. The chain is only as strong as its weakest link, and that is the chainwheel.

Chainwheel manufacturers will begin to take notice of the wanted improvements when they receive contracts endorsed, "Duty will only be taken of gear-wheels and sprockets built to B.S.I. standards." It is not my business to tell cycle manufacturers how they must order their goods, but that seems the only way to me. In large quantities, a slight increase in price might be conceded, but it should not exceed five per cent.

B.S.I. Standard

As I have previously set out, British Standards Institution, a body carried on by the Trade, financed by the trade, adopted Hans Renolds toothform and conveys all information as to this in a little book called "Steel Roller Chains and Chain Wheels." It is dated 1934, and one would imagine that the cycle trade would have jumped at the idea of providing proper toothform for the chainwheel. But there is not a maker of cycles that has considered the question! On this page are reproduced two diagrams of chainwheels, which show bad design. In the case of the 44T wheel the toothform is not at all satisfactory. The roller seating, except at the lowest point, falls inside the standard form, and will tend to nip the roller, whilst the form is much too steep towards the top of the teeth, leaving a "land" inside the form of a degree that is most undesirable. The tooth has been "cut" with an improvised cutter as none of the essential elements of a correct toothform appear to have been catered for. The tooth width is a fraction oversize and the spacing of teeth irregular.

In the case of the 18T wheel the flanks of the teeth tend to fall away from the standard form and finish with a projection inside the form towards the tip of the tooth. This latter feature will tend to cause the chain to cling to the wheel rather than leave the tooth freely. These two wheels were supplied to me to go on a machine



Diagrams showing the incorrect cutting of cycle gear wheels.

True form of Rotary Cutter (black line). Actual form of Wheel Gap (dotted line).

of a well-known make. Needless to say I have not made use of them, and have another pair, which follow B.S.I. specifications.

If the cycle trade will not make their own chainwheels, because of the trouble it may bring the managers, the difficulty is soon got over by the manufacturers if they would only insist upon the chainwheel providers using B.S.I. specifications.

I started to cycle some time in 1883 and began communicating with Mr. Hans Renolds in 1891. For years the trade was suffering from troubles with chains. Of course it was really the chainwheels that were at fault. Each member of the trade had his own opinions on the toothform. About 1890 I started insisting upon Humbers sending the "blanks" to Hans Renolds to be cut and that brought my gear troubles to an end. You must bear in mind that any noise in a gear proceeds from an ill-fitting chainwheel. Chains are made to such wonderful perfection that they cannot be blamed.

"Cycle Transmission"

I UNDERSTAND that my remarks in these columns, "On Cycle Transmission," have come before the P.O. Well, now is the time for the P.O. to take up this point about gears. As I have set out before, the gear job is an engineering business. Results cannot be got by "stampings" made of poor material, poor design and faulty toothform. We unfortunate cyclists have had to put up with these gears quite long enough! All these different chainwheels on the variable gears have led to some investigation, perhaps, but not everyone yet will admit that it is the chainwheel which is at fault. They will have it that the fault lies with the chain. After nearly 50 years' consideration of this matter I can only write as I find it, the toothform is incorrect. And we can look upon the P.O. taking up the question as a blessing indeed. Giving their orders for thousands of machines the P.O. can insist now that they will take delivery only of cycles fitted with gears made under B.S.I. specifications. All the cycles now in use by the P.O. have incorrect gears, and the staff have to push the things about. Unfortunately this gear business has never cropped up before. I think I am the only person who has referred to toothform in the press, and the question arises in my mind can the P.O. demand now that their present stocks of machines should be returned to the makers for proper gear equipment? The cycle manufacturers have done very well out of the P.O. trade. They should pay the cost of replacements now!

Rollers fitting snugly into correctly formed tooth spaces are intended to relieve the links of all duties of 'pitch-line location, their sole function being to act as tension members to take the driving pressure and maintain the pitch of the rollers.

What the Clubs are Doing

David Scott Better

DAVID SCOTT, Crawick Wheelers, who sustained a serious accident while riding in a time trial, is now very much improved.

Waterson in N.F.S.

JOHN WATERSON, West of Scotland Clarion, and holder of several place-to-place records, is now serving in the N.F.S. at Glasgow.

Scotsman Still Fit

BILL SCOTT, Crawick Wheelers, holder of the Scots 25, 30 and 50 records, and now serving with the Royal Engineers, came in third in a recent time trial while home on leave.

Husband of Speedy Girl in Air Force

CHARLIE DRAGE, husband of Joy Drage, the speedy Bedfordshire Road Club girl, is at present serving with the R.A.F. in Scotland, where he has already made contact with the local clubs.

Conner in Wales

SERGEANT-MAJOR ALEX. CONNER, former member of the Scottish Amateur C.A. executive, and also minutes secretary of the Mid-Scotland T.T.A., has recently been stationed in one of the most attractive parts of North Wales.

Taylor Comes Back

JACK TAYLOR, the pre-war Scots champion, "came-back" after two years' absence from the sport in the West of Scotland T.T.A. open 25. He was second to Alex. Hendry, Glasgow Wheelers, and clocked 1 hr. 4 mins. 27 secs., compared with Hendry's 1-3-12. Following his success in the West of Scotland T.T.A. 25, Jack Taylor, the ex-Scots champion, is to ride in further Scots opens

Yorkshire Rider in Scots Event

JACK SHACKLETON, who did some very fast times before joining the Army early in 1940, clocked 1-11-2 in the West of Scotland T.T.A. 25. A Yorkshireman, and a member of the Queensbury Road Club, he is at present stationed in Scotland.

Dundee C.A. Rider Missing

ERIC WRIGHT, Dundee Cycling Association, is reported missing at sea.

Pennine C.C. Activities

PENNINE C.C. are very active. They cater for social and for racing cyclists, and have as many as 20 members on week-end runs. Over 30 members are serving with the Forces, including Bob Williamson, who was safely evacuated from Malaya.

Prisoner of War

"BILL" TAYLOR, former reporting secretary of Acme Wheelers, is a prisoner of war in Italy. He was taken prisoner in Libya.

Old Timer Passes Over

ORGANISER of the first cycle show to be held in Scotland, and as secretary of the Glasgow Cycle Trades Association for many years organiser of many of their shows, Andrew George Rennie has died.

Popular Spot Cleared for Cultivation

MAIDENHEAD THICKET, one-time haunt of highwaymen, popular picnic spot for cyclists, and the "cemetery" of certain Bath-and-back record attempts, has now been largely cleared for food cultivation and may be sown with wheat.

Vegetarian Rider in West Africa

"BILL" SHILLIBEER, famed Vegetarian rider, is with the Forces in West Africa.

Club Members Meet in S. Africa

TWO Barnet C.C. members, R. H. Thomas and A. L. Dawson—the latter with the Fleet Air Arm—unexpectedly encountered each other in South Africa.

N.C.U. Man Missing

BRIAN McGRATH, formerly of the staff of the National Cyclists' Union, is among those missing at Singapore. He was serving with the Cambridgeshire Regiment.

Clubman's 70 Miles a Day!

ERNIE HALL, Notts Falcon C.C., who won the Leicester Forest "25" with 1.5.45, rides over 40 miles to and from work each day, and often makes a detour to bring the mileage to about 70!

Tandem Rider in R.A.F.

W. A. THOMPSON, joint holder with L. Innes of the Liverpool-Edinburgh, the Land's End-London and the End-to-End tandem records, is serving overseas. He is a corporal in the R.A.F.

Australian Record Breaker Retires

HUBERT OPPERMAN, the famous Australian rider, who made special visits to this country to break road records—some of which he still holds—has definitely retired from racing. He is 37 and a sergeant in the Royal Australian Air Force.

Tandem-tricycle Record Attempt

G. E. LAWRIE and R. Morford made the first attempt on R.R.A. records this year. They tackled the London-York tandem-tricycle record and after many difficulties *en route* finished a considerable time outside record. They hope to make another attempt.

Midland "25" Helps War Relief Fund

AS a result of a prominent 25-mile road event held in the Midlands and won by Ralph Dougherty, Leamington C. and A.C., with 1.4.3, the B.R.C. and the Lord Mayor of Birmingham's War Relief Fund benefited jointly by over £40.

WAYSIDE THOUGHTS

By F. J. URRY

Standardised

ON my desk lies a heap of letters dealing with various cycling subjects which bid fair to be out of date before I can comment on them in these columns, for time and space are precious, and much as I would like to talk to my correspondents, I am afraid the chances are dubious. Another heap of letters, and the largest of the two piles, is concerned wholly with "what kind of bicycle should I buy, and where can I get one?" The first portion of the question is easy to answer, but what is the use of saying anything about it when I know not where such a specification could be obtained? Having so close a connection with cycling it comes as a revelation to me that so many knowledgeable people should have thought that in war-time they could just walk into a cycle depot and find the article they need without the slightest trouble. It doesn't work that way now; the bicycle to-day is standardised, and the only thing the buyer can do is to select the best possible, see that the gear is about 60in. (and not more than 65in.) and endeavour to obtain a first-class saddle. There are no speed gears available and, of course, all my friends and correspondents want them, and seem to think I know a secret source of supply, and can conjure them from a reluctant manufacturer. Well, I can't: the makers have none, and, indeed, tell me their supply of bicycles is so limited that it is doubtful if they can satisfy Service demands and still find a few for their own loyal dealers. That, then, is the position as I write, and it will not alter for the better as long as the war lasts; so if you know of a good bicycle, new or secondhand, buy it quickly and be thankful for your lucky find. How important it is to care for your bicycle properly should need no emphasis, yet strangely enough I still see and hear on my daily travels hundreds of machines in a neglected condition, squeaking for want of a little lubricant, the tightening of a loose crank, or wearing away tyres for the need of a little pump exercise by the owner.

Taking It Easy

RECENTLY I had a week's holiday, mainly for the purpose of restoring a member of my family to something approaching normal health. I made the journey to Aberdovey by bicycle, taking two windy days for the 130 miles of travel, and thoroughly enjoying the buffeting, because the use of a four-speed gear took the sting out of the heavy going. That last statement is a fact, and once more I proved the value of the sensible use of low gears when steering into a vigorous breeze, always provided, of course, that the rider is fit. When so many people cannot now obtain any form of speed gearing, it seems a trifle unkind to mention this ease and comfort to touring cycling; but I should be doing less than my duty if I kept silent on the question, for speed gears will be available again after the war, and, in my opinion, will be a necessary part of the equipment of every touring machine, and of many utility and racing models also. It was a west wind, full and heady; but then there are always some holes in the "warm wet western wind" that are never noticeable when the draught comes from the east. I knew the journey was to be a tough one five miles out, so made up my mind to let the wind have its own way and dictate the pace, using my lowest ratios whenever the grade was inclined to make me bend to my work. A cup of tea at 20 miles, lunch—and lucky to find a good one—at 32 miles, and rather less than 20 miles farther I was eating toast and drinking tea in the early evening. Only a trifle over 50 miles from 9 o'clock until 5 o'clock, but then I had enjoyed the freshness and the freedom, and thought the breeze may ease up with the dropping of the sun. It did, as is often the case, so that I had a glorious gallop in the orange glow that burnished the hills as I entered Wales. Eighty-five miles I had ridden on that windy day, and except for a most vigorous appetite, and the red-rimmed feeling of the eyes due to wind pressure, I was a fit and happy man.

The Handicap of Lone Riding

THE next day's journey to Aberdovey was easy, and I lingered among the hills and streams over which occasional gleams of sunshine fell and varnished their beauty. Short of the long rise over the pass to Mallwyd I stayed for the 11 o'clock cup of tea at a cottage and, thus fortified, crept to the summit of the rise and drifted into the mountains that cluster around Dinas Mawddwy, most of which were hidden under the slatey banks of cloud that even so vigorous a breeze could not dislodge. By Cemnaes I obtained a very frugal lunch, the most meagre meal of the trip, and under a gloomy sky followed the Dovey to the sea, reaching the hostel that sheltered my people just before the storm broke. During the next few days the chances of riding were slender, though I did get in a couple of trips in the morning and evening of two separate days, and was lucky on both occasions to escape the sweeping rain and hail storms that swung in from the sea. It was hefty riding, after one had penetrated the hill roads, to return seaward and face those Easter winds; but when time is of little moment and your use of it is wholly within your own mood it does not matter, and the very fact of being part owner of these beautiful ways gave to me a rare feeling of satisfaction. It was on the return journey that the luck of the wind was with me, and while the half-gale held to blow me home, the sunshine also came to regret my going. It was then I would dearly have loved a companion with whom to commune, for I find this lonely travelling is apt to make one hurry, and even the stoppages for vision and the burning of incense are cut to a minimum mainly because restraint is not imposed through the pleasant channels of conversation and comparison. I had left myself a couple of days for the return, and I rode too far on the first of them because it was so easy, leaving for the second just a matter of miles to reach home.

Luck of the Road

IT takes a whole heap of resolution not to gallop when the wind is a willing assistant, and the dead beech leaves crisp past you as you ride. I sat on Dovey bridge hard by Machynlleth about 11 o'clock on that sunny morning and looked at the map to see if I could find a new route, for I dearly like to break a mile or so of road I have never previously travelled. I could at least follow up the River Dnlas over the Corris, look down on Tal-y-llyn Lake and up to the rugged flanks of Cader Idris, and as several years had slipped away since I was last in the area, I took the easy climb in several stages punctuated by fragrant smokes. Yet even this method of slowing my progress found me above Corris before noon, and it was then that I wondered where I could refresh, for I was not sure that Cross Foxes Inn was open or would welcome me. And there ahead of me was a sign at a bungalow named Tremlyn, where the good lady fed me heartily what time I filled my eyes with the sapphire lake set in its greenery 400 feet below, or swept my gaze over the cloud-smoking ridges of the lower Idris bastions. An hour later I found the Inn at Cross Foxes still indicated good intentions, so probably I would have been fed here had I carried on. A mile along the main road to Dolgelly a lane runs off to the right, and keeping to the right for some five miles runs along the knees of the hills above the River Wnion. A wonderful lane, a perfect paradise of glen and hillside, but better still a beautiful platform from which to view the wide and noble valley running from Aran Mawddwy, the mighty mound at the head of Bala, to the sea beyond the great ridges of Cader Idris. That few miles of ridable track gave me a bit of new and very delectable country, and I was sorry when the wayward route crossed the bridge at Drws-y-nant and joined the main road. Mark that lane on your map for the earliest visit: it is a gem.

Wasting Time

WIND wafted, I came to Bala and stayed awhile to have tea with friends. Taking the hill road to Corwen was an easy passage and down the Vale of Llangollen the hills were a funnel for the breeze, and I sailed gaily along with little pedal persuasion. Really the draught was too tempting; I should have turned aside while beauty still surrounded me; but so capricious is the average human that few of him can resist such elemental aid as that breeze over a road almost free of traffic. So I finished that evening in Shrewsbury, with the last orange rays of the sun gilding the steeples, as easy a day's journey as ever man made aboard a bicycle. But I shall not do it again; no, I will train home from Salop, for it is an anti-climax to creep disconsolately through the edges of industrialism after a few days of perfect pleasure amid the comeliness of unfettered earth.

The Moral of the Tale

THIS story of a little Eastertide wandering is given for the express purpose of trying to make you realise the many-sided delights of cycling beyond the mere journeyings of the daily ride. To-day, cycling and walking are the only forms of touring in which you can indulge without feeling uncomfortable, and I say that the wide range and penetrating power of the bicycle is a thing for which we, who own such vehicles, should be devoutly thankful. Many of us do not make sufficient use of it to prove its value to ourselves or our friends, and the main reason why we fall short of its ever waiting facilities is that we are too lazy to get fit. There the trouble lies with most of us; we will take pains with all sorts of games and pastimes, we will go to endless trouble and expense to become proficient in them; but cycling—anyone can ride a bicycle with arms and legs and an eye to see with. That is not true in the touring sense, for if you want to enjoy cycling—and without that desire it is a mere convenience to cover a strictly limited distance—then you must be riding fit as the enthusiastic walker is walking fit. For no man or maid can enjoy the ever changing visions that circle round you if the ache of the saddle and the pedals is in their muscles. A little practice—and so very little is needed—and "the hard work" disappears, for the hard work is simply and solely a measure of lack of form. Cycling is a game, a magnificent game, but its highest pleasure is only for those who are prepared to treat it as such, and recognise it is well worth playing in the right spirit of easy fitness.

The Future

MANY prominent cyclists, I am glad to notice, are of the opinion that the sport and pastime will go forward by leaps and bounds directly our present war troubles are ended; and while some of them in their enthusiasm think this will happen mainly on the sporting side, and voice rather extravagant views thereon, I am not so sure that the quieter forms of cycling both for pleasure and convenience, will not outnumber the ardent advocates of the game. In any case, this consideration will not occur as a result of wishful thinking; it must be organised and controlled or the movement will run wild, and, in the case of the road sport particularly, may do more harm than good. What is needed most of all is the goodwill of the trade, for only in such quarter can we keen cyclists hope to find the money to put into operation the projects likely to advance our numbers and our status.

A NEW FEATURE

NEWS FROM N.C.U. HEADQUARTERS

New Clubs

The following new clubs have been affiliated to the Union during the past few weeks, which again shows the rising keenness of the present-day cyclist:

DOLPHIN WHEELERS, Birmingham Centre.—S. Salmon, 121, Uplands Road, Handsworth, Birmingham, 21.

HANWELL GARAGE C.C., London Centre.—C. E. Sinton, 11, Ellesmere Road, Greenford, Middlesex.

POTTERS BAR N.F.S. CLUB, London Centre.—E. B. Batchelor, N.F.S., Oakmere House, High Street, Potters Bar, Middlesex.

ROBIN HOOD C.C., London Centre.—K. F. Booth, 116, Dalston Lane, E.8.

BANKSIAN C.C., London Centre.—A. G. Harris, 49, Harewood Road, Osterley, Middlesex.

GANTS HILL METHODIST C.C., London Centre.—K. B. Manley, 70, Bute Road, Ilford, Essex.

AVON PARAGON C.C., Bristol Centre.—Miss S. Welch, 8, Laurel Street, Kingswood, Bristol.

SPRINGWELL BORDER WHEELERS, Newcastle Centre.—S. Emerson, Guide Post Inn, Springwell, Gateshead, 9.

TRINITY HOUSE (SOUTH SHIELDS), C.C., Newcastle Centre.—S. Sanderson, 61, South Eldon Street, South Shields.

ANTRIM PARAGON C.C., N. Ireland Centre.—A. B. Casey, Bankhead, Cloughmills, Co. Antrim.

LONG EATON C.C., Notts Centre.—E. Butler, 70, Tamworth Road, Long Eaton, Notts.

SOUTH YORKSHIRE CLARION C. AND A.C., S.Y. and N.D.—A. Palmer, 57, Lancaster Street, Thurnscoe East, Nr. Rotherham.

STAINFORTH R.C., S.Y. and N.D.—W. Hodge, 8, Large Square, Stainforth, Nr. Doncaster, Yorks.

KYLE ROAD CLUB, Scotland West Centre.—T. Hall, Craigdarroch, New Road, Mauchline, Ayrshire.

DEWSBURY MOOR YOUTH GROUP CYCLING SECTION, W. Riding Centre.—L. Halliwell, 178, Heckmondwike, Dewsbury Moor, Yorks.

WEST RIDING C.C., W. Riding Centre.—W. Hirst, 93, Lorraine Place, Leeds, 7, Yorks.

My Point of View

BY "WAYFARER"

HEADLINE in last month's issue: "No events at Aberdeen." Not even the banging of saxpences!

If . . .

A PARAGRAPH reprinted from a daily newspaper of 50 years ago speaks of a cabman who knocked down a woman and her baby. He was so filled with remorse that he drove straight into the nearest canal and drowned himself, his horse, and the cab. If remorse had happened to function at any time within the last few years, why, our canals would be cram-jam-full of motor-cars and their drivers!

Ours Again

AS my typewriter clicks its way across the paper on this golden evening, I realise that it is the last Saturday of May. In the course of a 50-mile half-day jaunt, I have been speeding along main roads, meandering about distorted lanes, and stumbling up and down very narrow and very rough tracks—the last-named process resulting in my shoes becoming very "mucky." Oh! the joy of it all! The fragrance of the hawthorn blossom and of growing beans: the glory of the bluebell carpets in the woods, with that amazing haze which seems to be suspended in the air above them: the delight of the tiny groups of forget-me-nots glowing amid the rich green of the grass: the stately tulips . . . a breezy day with glorious sunshine, and an occasional splash of rain. And then I emerge from the maze of lanes to join the most popular main road in the Midlands, and a church clock tells me it is time to streak for home, 16 miles away.

In pre-war days I would have fought shy of that road, especially on a Saturday or Sunday evening. There being other ways home, I preferred to leave that particular highway to folks who apparently knew no other—to those who enjoyed travelling in a procession, absorbing the smell of fried petrol from the cars ahead of them, and bequeathing a like smell to those who followed. But to-day—already—a change has come o'er the scene, a change which is going to be accentuated in the immediate future. For the roads are ours again—*ours*! I have never admitted that we cyclists ever relinquished one jot or iota of our proprietorship in the roads which, with the march of time, we came to share with others, although, for comfort's sake, we may often have left to motorists the few roads they knew, ourselves seeking (and finding) seclusion and delight in other ways.

But to-day it is clear to me that the roads are ours again. We can now use, and use in comfort and perfect safety, the busiest of highways at the busiest time of the week. Mr. Motorist has been driven into retreat by war conditions, and the immediate future will see him almost completely submerged. There is no need to "rub it in," and I have no intention of doing so. But we can't get away from the fact that Mr. Motorist's loss is our gain—our very great gain. And so the hands of the clock have been turned back to the beginning of the present century, and we are able to enjoy the travel conditions of the 1900 period, plus vastly improved highways and byways. Modern traffic conditions have never been anything like so desperate as loose thinkers and ignoramuses would have us believe, but there is no denying that they have now altered out of all recognition. The roads are ours again. I suggest that we cyclists will indeed be fools if we fail to take full advantage of the Utopia which the war has temporarily bestowed upon us. Halcyon days are at hand. Let us get busy and make the most of them. This is indeed the opportunity for the nervous cyclist: it is the opportunity of every man-jack and woman-jill of us to see our noble land by the best possible medium—the bicycle.

Easily Answered

A QUESTION which many people have been asking themselves (and others) in recent weeks is easily answered. War conditions have compelled such people to contemplate a mode of locomotion other—and, in my view, better—than that derived from petrol, and they wonder whether they would be able to ride a bicycle again after so many years of neglect. The reply is that one never forgets how to ride a bicycle. It is a matter of instinct, and a parallel will be found in the case of a man, able to swim, getting into deep water after years of non-bathing. Instinctively he strikes out and uses his old knowledge to keep himself afloat. So it is with the cyclist: he automatically revives the lesson he learnt in days gone by, and keeps an even keel, with about the same facility as that displayed by a child in wolfing ice-cream!

Differing Outlooks

ON a recent morning when the sun was actually shining (accidents will happen!), and an exhilarating wind was blowing, a neighbour agreed with me that it was a grand day, and added that it would be "great" to be on his allotment. I did not demur, for even to a non-gardener, an allotment, on such a day, would be a better place than a stuffy office—especially if the digging could be dodged! But, as we drifted apart, I realised that different people possess differing outlooks—which, perhaps, is just as well. Some folks never let their minds stray beyond their allotment, or the golf links, or the tennis courts (all commendable things, of course), while the mind of a cyclist projects itself to the far horizons which the handiest travel-instrument in the world has brought within his ken. So, as I went on to my work, I thought of some of the places at which, in the word of my friend, it would be "great" to be on such a morning . . . at the top of Fish Hill, Broadway, looking down into the Vale of Evesham; on Thurstaston Common, Cheshire, gazing at the broad expanse of the River Dee, with its glorious Welsh background; at a high point in the New Forest seeking out that grey outline which the map marks as the Isle of Wight; approaching the Lake District from the direction of Lancaster; loitering at Capel Curig, with that stupendous view along the Gwryd Valley to Snowdon; topping the Mam Rattachan Pass in the Western Highlands of Scotland, with (so soon) a staggering view of the Isle of Skye to greet one's vision; cycling along the south side of Galway Bay with the glory of Connemara ever "on tap" across the tide. Those are some of the places to which I would have loved to transport myself.

I have an abiding respect for people who "dig for victory" on their allotments, but, when the time comes to think of how one could use a grand day—well, as has been suggested, the mind of a cyclist automatically goes farther afield, and seeks out the distant horizons, which, in miniature form, dwell with him for ever and ever.

Notes of a Highwayman

By LEONARD ELLIS

Life is Too Short

A LIFETIME in the Midlands has not been enough to see all the little gems tucked away in the red folds of the Cotswold slopes. Many tours in Devon and Cornwall make me realise that my earlier excursions were merely main road scrambles, and that the later ones were slowly filling in the blanks. Several visits to Scotland leave an aching void and the certainty that I could go again and again and still leave more to see than I had seen. This state of affairs should not be allowed to set up a feeling of futility or frustration; rather should we be glad that there is such an infinite storehouse on which to draw. I am afraid that many of us, born and bred in one of the loveliest islands in the world, take those beauties too much for granted. We are born with a consciousness that to cycle means to experience beauty and constantly changing scenery. It came as something of a shock to see another point of view. I recently received a letter from a friend, moved to South Africa for war reasons. He is, or was, a most keen cyclist, and like most of us assumed all too readily that cycling was fun, no matter whatever the conditions. He had a terrible shock and tried to convey his impressions to me. There was no point in cycling for pleasure at all; the scenery did not change, in fact, there simply was no scenery.

Where Cycling is not Pleasure

MILE after mile of dusty veldt, no distant hills to lend enchantment to the view, no pleasurable anticipation of the something round the corner. There were no corners—just veldt. There was not even the inducement of a distant town, perhaps something different from the one he had left, perhaps with something piquant in the way of architecture, and nothing by way of an inn or village on the way. As he said, he might just as well put his machine on a stand and pedal away until he was fed up. At least he could get a drink or pack up when he felt like it. We should therefore be thankful that in every corner of this little island there is something of beauty; there is something of interest in even the blackest of the black country. It is often in these maligned areas that one finds architectural gems hidden away, neglected, and as a consequence trebly welcome when "discovered" far from the madding crowd. The black areas sometimes acquire such a reputation that they and the immediate surroundings are avoided by tourists who miss much thereby. There is some charming scenery to the west of Wolverhampton, some real gems in the heart of the Potteries, magnificent views from the outskirts of Sheffield. It is in those early tours that these places are missed, but as the tourist grows older and starts to fill in the gaps, his education begins anew. I conclude without answering my own question, given in last month's notes. There is no such thing as the best touring ground. Go anywhere in this country on a bicycle and the reward is worth while.

Badger Dingle—within sight of the smoke of Wolverhampton.

The Fascination of Touring

IT would be interesting to analyse the opinions of a number of enthusiastic cycle-tourists in order to discover what they consider is the thrill of touring. We know, of course, that the question does not arise in the heart of the touring country—the joy of exploring an old castle or cathedral, the quiet peace of the quaint old-world town, the indescribable thrill of watching a waterfall or the breakers on a rocky coast, the sense of adventure along the cliff path or in the cool depths of a cavern—all these are understandable. But what of the long stretches of flat, uninteresting road that must be traversed in order to link up the beauty spots? In some circumstances even here the question demands no answer. To most the pastoral countryside brings its own reward, the colour of the moorland road has its own charm, but sometimes there is a stretch of highway that possesses no tangible beauty and we are forced to fall back on that something that makes cycle touring what it is. For many there is the sheer thrill of speed or even the rhythmic joy of turning the pedals. Underneath all this, however, is the double joy of retrospection and anticipation, when realisation is a little difficult. Quite apart from the store of memories that a cycle tour brings in its train, one tour teaches us to anticipate the charm of the next.

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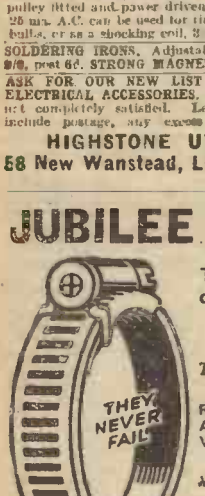

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