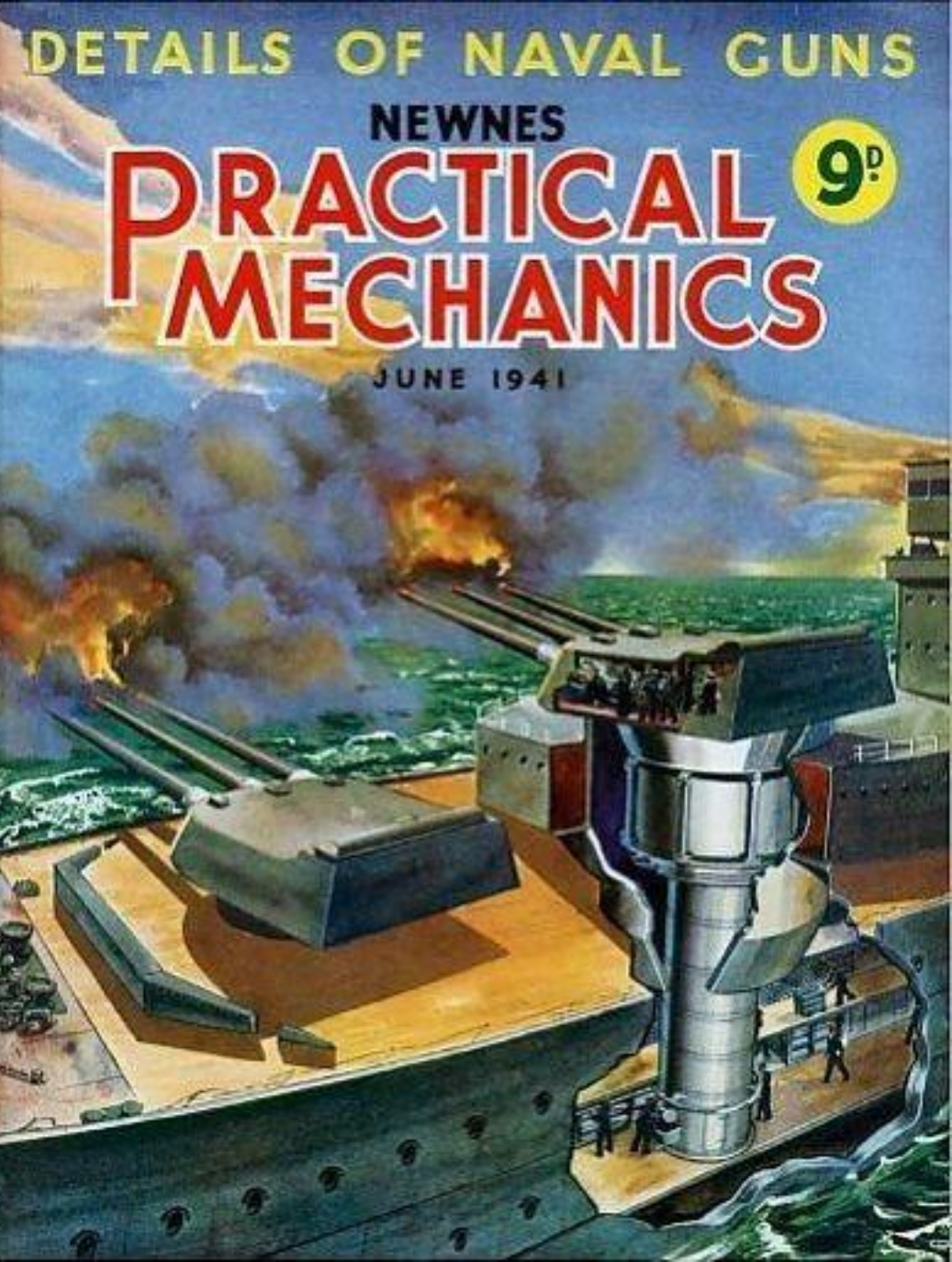
DETAILS OF NAVAL GUNS

NEWNES

PRACTICAL MECHANICS

9D.

JUNE 1941



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PRACTICAL MECHANICS

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

Editor: F. J. CAMM

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FAIR COMMENT
By the Editor

The Brains Trust

THE Government has at long last heeded my request so often made in this and our companion journals for a Ministry whose sole task it will be to investigate ideas, and to advise the Government on all engineering problems. The present system in which each Ministry considers suggestions made to it by members of the public or particular firms is unsatisfactory. There has been considerable overlapping, and those with suggestions to make have not known where to send them.

There has been considerable delay and general complaint on the part of those anxious to help the war effort that suggestions are not given proper attention. Preoccupied as the various Ministries must be with fighting the war it is understandable that they are not able to give the same prompt attention to ideas and suggestions as is possible in peace-time.

Realising this very early in the war. I made the suggestion that a separate Ministry, staffed by capable engineers, scientists, chemists and technicians, should be formed and whose duty it would be to give careful consideration to all suggestions submitted, to investigate their possibilities, to pass them along to the Government Departments concerned, and where necessary to see that effect was given to them. Now the Government has formed the Engineering Advisory Committee. Lord Hankey is the Chairman, the other members of the Committee include Lord Falmouth, Sir Henry Tizard, and a number of leading engineering and chemical experts. This Committee will select engineers to undertake special work such as finding methods of improving engineering science for war purposes and, additionally, they will develop new ideas, new devices, and bring new inventions and industrial developments to the notice of the War Department.

Selection Board

AS it seems to be the sole purpose of this Committee to select technicians, we hope in the first place they will give extreme care to the construction of their Selection Board. We do not want names that are famous unless those names are associated with engineering and science. We want practical people behind the war effort, not those who happen to know someone in high quarters. We do not want selection by School Tie but we do want ability, and there can be no doubt that this will be found equally among those who are not famous, and are comparatively unknown. We do not want figureheads to collect the credit and the honours due to those who prop them up. Another point. It may be that suggestions will be made, which, for one reason or another, cannot be adopted. Careful consideration should be given to the qualifications of those who make them, however. They may be men useful in another direction, or alternatively, they should be advised as to where their suggestion is impracticable so that they may have an opportunity of revising it.

We do not want the cold blooded but polite official document turning the suggestion down flat without reasons being given—the sort of letter which commences, "I am instructed to advise you," and which ends "I am, dear Sir, Your Obedient Servant." That Victorian lingo is out of touch with the times. We do not want the patois of Pepys in 1941.

Institute of Patentees

IT is my view that the Government should make use of the services of the Institute of Patentees. Sir Arrol Moir who has done so much work in connection with inventions, and whose father was associated with the Ministry of Inventions during the last war, writes *a propos* the suggestion I made last month.

"The suggestion last month for the encouragement of the ideas of inventors for war purposes through a Government Department is a good one and should be put into operation immediately, but the idea can be carried further with additional national advantage.

There are many ideas being put forward now which would be of great national importance for the post-war development of our export trade and the prevention of another slump and unemployment period which is going to be a problem of the greatest national importance when this war has been won. It is on immediate success and development that the national trade strength of our Empire will depend. There are also a great many ideas that are not being put forward at all because of this lack of national encouragement.

There are, however, many older brains in the country who do not consider themselves in a position to take too active a part in the conduct of the war but, through their past experience and knowledge, are eminently suitable for the unbiased investigation of inventive ideas to find out whether they are suitable for introduction to the trade through the unbiased channels of exhibitions, the contracts to be completed at a later date, when times are more settled and trade is returning to its usual peacetime international struggle.

Help for Inventors

IF there was a body in existence backed by the Government through which inventors would be sure of obtaining efficient and unbiased help, many more ideas would be put forward for the benefit of our post-war trade, with the result that we and the Colonies would get a good start over the rest of Europe and most parts of the world except America, and so quickly re-establish our trade activity and ensure our financial stability throughout the world.

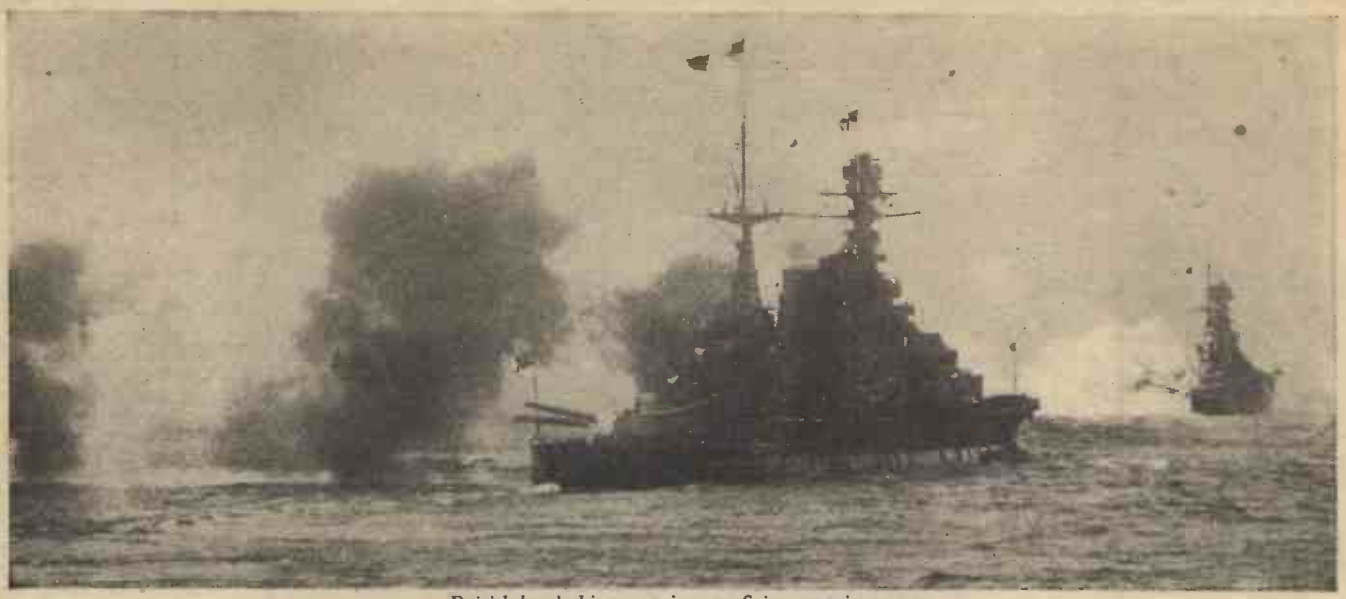
The scope of such an investigation department is unlimited as any idea from a new internal combustion engine to a bent hairpin can be of national importance, as long as it can be proved that the public wants it and that, therefore, it can create trade both at home and abroad.

Such an Institution has proved its worth in America with proper support and development, and now works in a building bigger than Buckingham Palace, turning work away, its activities being confined to the investigation and development of inventions. This is the Mellon Institute situated in Pittsburgh. Since its inauguration it has put right over 400 inventions that were introduced to industry wrongly or insufficiently developed, besides carrying out investigation and experimental work for the benefit of inventors, and collected a vast library of books and publications the contents of which are of infinite value.

There are many refugees in the country at present with talent sufficient to start new trades ready for post-war development which could be maintained in this country, and the Colonies, once the initial stages of commencement have been got through.

Preparing for the last war, the Germans knew the value and strength of inventive talent, as was shown by the Key Industries Exhibition held in Westminster afterwards. There were shown some of the essential items needed in wartime such as magnetos for aeroplanes and lorries, heat-resisting glass for miners' lamps, optical glass for ranging instruments, tungsten steel powder for armour plating, etc., which were sold at a false value, through secret government subsidy, to the rest of Europe for years before the commencement of hostilities, so that when the latter was launched their opponents would not be able to supply themselves with the additional quantities suddenly brought into demand by the expansion of war equipment.

It is only when the bulk of the world is plunged into war such as now, and in 1914, that the true value of inventive talent is realised to the full and demanded. Encourage it also in peace-time as well as in war for the benefit of trade and national health and comfort."



British battleships carrying out firing practice at sea.

Naval Guns

Constructional Details of Various Types of Naval Armament

By Commander Edgar P. Young, R.N.

PERHAPS the most fundamental difference between gunnery at sea and gunnery ashore is that the former requires that the trajectory of the projectile shall be as flat as possible.

The Army gunner, firing with a fixed gun at a fixed target or point on the map, and able, by means of observation, to correct as necessary any mis-estimate of the *definite and unchanging* range, is not concerned about the height to which his projectile rises during its *parabolic* journey to its goal —that is to say, its "trajectory." Indeed, since there are always liable to be obstacles in the path of his projectile, and since such obstacles are frequently high ones, he is inclined to prefer that the trajectory of his projectile shall not be too flat.

In naval warfare, however, both the gun and its target are usually in rapid *and variable* motion, so that the most perfect estimate of the range between them may be thrown out while the projectile is actually in flight, more especially when the range is a great one. It is, therefore, desirable that the trajectory shall be the flattest possible at any given range, so that a minor error in estimating the range will not necessarily mean a total miss. As the space over which the projectile must travel is flat and, for practical purposes, unobstructed, a high trajectory offers no advantages.

This is true only, of course, in the case of a naval action; not when ships are bombarding positions ashore. Naval guns are intended primarily, however, for the former use.

"Muzzle Velocity"

In order to achieve the required flatness of trajectory—and also for the purpose of attaining longer ranges—it is necessary that the projectile shall have a greater "muzzle velocity," that is to say, that it shall leave the muzzle of the gun at a greater speed. This necessitates the use of a more powerful propellant charge and the lengthening of the gun.

Naval guns must, therefore, differ very considerably in their construction from those used ashore. Except, of course, in the case of guns used for coastal defence work, which are, in effect, naval guns. This difference does not appear, though, in the preliminary stages of construction.

Gun Steel

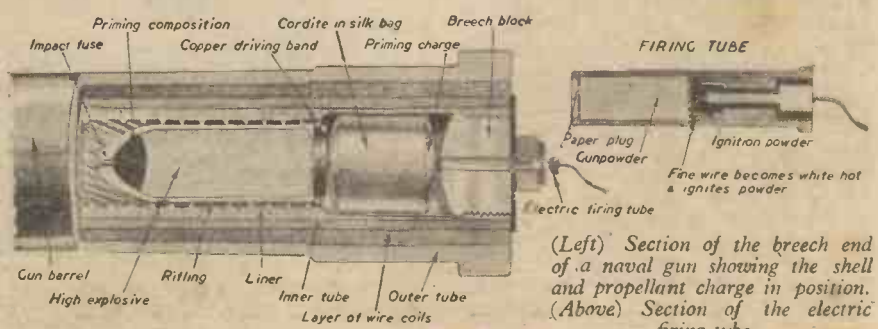
Steel in its fluid state may be regarded as a homogeneous solution of iron and carbon. When cold, it may, like other alloys, be compared to a mass of concrete, in which grains or pebbles are embedded in a matrix of an entirely different composition. In *medium carbon steel*, the matrix is ferrite free from carbon and the grains are of ferrite and carbon in some form of combination.

The physical characteristics of steel depend very largely on the size of the grains and on the relative proportions and form of the iron and carbon in them, which, of course, determines the quantity of matrix in which they lie. These, in their turn, can be regulated by suitable regulation of the speed at which the steel, when cooling, passes through certain critical points of temperature; in other words, it is necessary, in order to produce a steel with given physical characteristics, to cool it rapidly through those critical points of temperature at which its composition is such as will give it those characteristics. It is for this reason that gun steel is subjected to processes of hardening, tempering and annealing, which give it the required characteristics of being ductile and having a high limit of tenacity and elasticity.

Gun steel is an alloy of ferrite and carbon and other necessary ingredients. First of all, pig iron and malleable iron scrap are melted down. Haematite ore is then added to the molten mass, in order, being rich in oxygen, to decarbonise the mass by combining with the excess carbon in it. This reduces the carbon content of the mass to practically nil. Weighed spiegel, rich in manganese and carbon, is then added in quantity sufficient to bring the carbon content of the mass to a little above that which is finally required. Various other ingredients are, or may be, added before the final result required is attained.

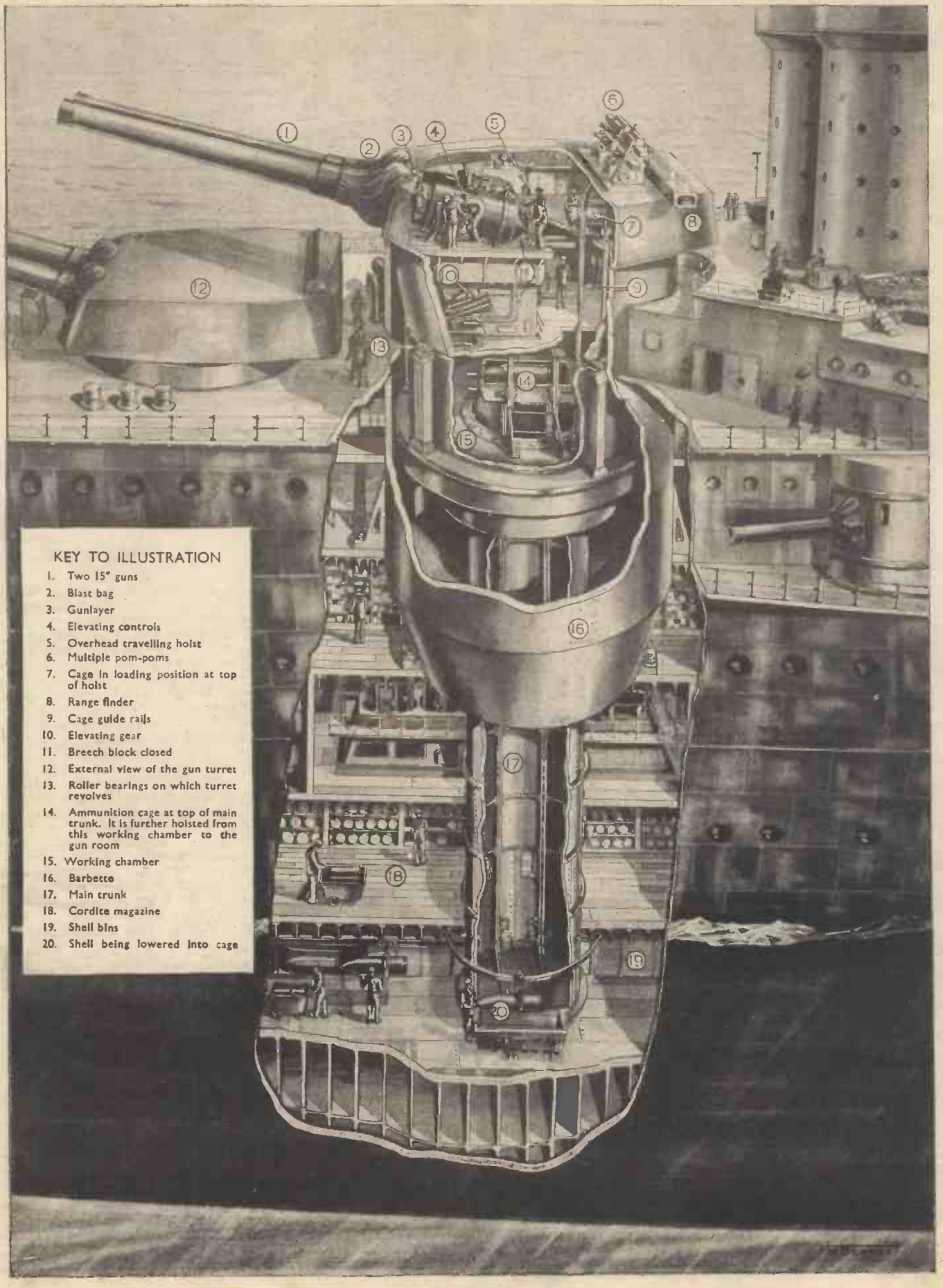
"Trepanning"

When it has been ascertained by tests that the alloy is correct, it is run off into special moulds and allowed to cool into ingots. The ends of the cooled ingots are cut off, in order to eliminate as large a



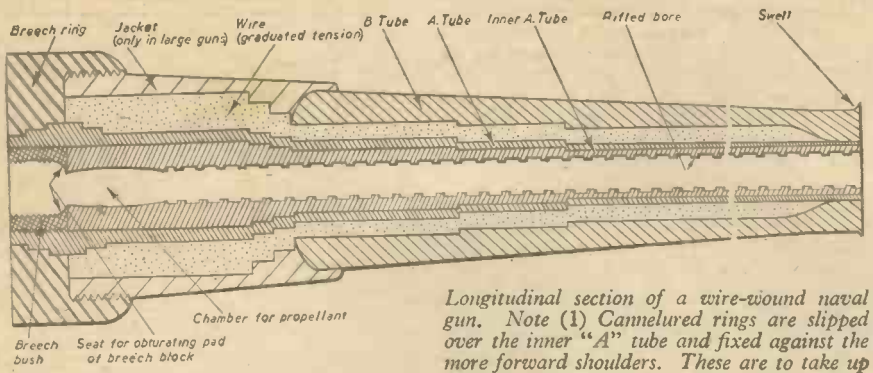
(Left) Section of the breech end of a naval gun showing the shell and propellant charge in position. (Above) Section of the electric firing tube.

SECTION OF A 15-INCH GUN TURRET AND OPERATING MECHANISM



KEY TO ILLUSTRATION

1. Two 15" guns
2. Blast bag
3. Gunlayer
4. Elevating controls
5. Overhead travelling hoist
6. Multiple pom-poms
7. Cage in loading position at top of hoist
8. Range finder
9. Cage guide rails
10. Elevating gear
11. Breech block closed
12. External view of the gun turret
13. Roller bearings on which turret revolves
14. Ammunition cage at top of main trunk. It is further hoisted from this working chamber to the gun room
15. Working chamber
16. Barbette
17. Main trunk
18. Cordite magazine
19. Shell bins
20. Shell being lowered into cage



Longitudinal section of a wire-wound naval gun. Note (1) *Cannelured rings are slipped over the inner "A" tube and fixed against the more forward shoulders. These are to take up some of the great strain which is thrown on the inner shoulders of the "A" tube when the projectile moves down the bore, tending to carry the inner "A" tube with it.* (2) *The jacket has thrust ribs which engage in channels in the cradle to prevent the rotation of the projectile from turning the gun.*

percentage as possible of injurious elements, which tend to segregate themselves towards the ends and into the central core of the ingot in the process of cooling. The ingot is then "trepanned," that is to say, the central core throughout its length is cut out. The result is what is called a "billet."

This billet, after all its treatment, may be considered as being composed of sound-metal. Further treatment is necessary, however, before it will acquire the characteristics that are required.

Forging

The next process to which it is submitted is that of "forging." The billet is heated to a temperature of about 1,750 deg. F., and then squeezed by steam or hydraulic presses more or less into the shape and dimensions finally required. Several heatings may be required for this process, as it is undesirable that the metal should be worked after its temperature has fallen below about 1,100 deg. F. The object of this process is not merely to form the billet, but also to improve the quality of the steel by changing its coarse crystalline formation into one of finer grain, more homogeneous and more uniform.

Next, it is "annealed," that is to say, heated to a certain critical temperature (which is different for different gun steels) and allowed to cool slowly in the furnace.

If the result fulfils the required specifications, it is now handed over to the gun manufacturer.

Making the Gun

The principle on which a gun is made is to have an equal strain throughout the walls of the gun at the instant of firing and until the projectile leaves the muzzle of the gun.

As will be seen from the illustration on the opposite page that the tension produced by the charge at the instant of firing is very great on the inner surface of the firing chamber, but decreases rapidly as one gets away from that inner wall. The inner layers are stressed far beyond their "limits of tenacity," with the result that, in normal circumstances, fracture would occur. If such fracture were to occur in the inner layers, it would not be long before it extended through the cracks in those inner layers to the outer layers also, and during the process much muzzle-energy would be wasted owing to the leakage of gases through those cracks.

In order to prevent this happening, the modern gun is composed of several tubes, and the inner tubes are placed in a stage of *compression*, so that the excess pressure on them, which would normally cause their fracture, is partially absorbed in overcoming that compression. By suitably graduating the compression and tension on these tubes, the "firing stress" is equalised throughout the walls of the gun. By suitably "tapering" the gun, the stress is equalised longitudinally.

Some guns are made up simply of a series of such tubes, but the best ones, more especially in the case of large guns, are what is called "wire-wound"—that is to say, that one of the tubes is replaced by layers of wire, wound on at a graduated tension.

In the example shown here, the gun is made up of an "Inner A Tube," an "A Tube," wire, a "B Tube" and a "Jacket," and is reinforced with a breech ring. In making such a gun, the component billets and wire are got ready simultaneously. Each billet is then heated to about 900 deg. F. and straightened, after which it is bored and turned up to within narrow limits of its final dimensions, and carefully examined for flaws. It is then "hardened" by heating up to a high temperature (of some-where between 1400 deg. and 1700 deg. F., according to the character of the steel and the size of the billet) and quenching in a tank of rapeseed oil at a temperature of 60 deg. F. *The effect of this oil hardening is to increase elasticity and tenacity, and to diminish ductility.* It may tend to set up internal stresses, and in order to counteract these the billet is then "annealed." The process of "annealing" is done by heating the billet to between 800 deg. and 1000 deg. F. in a special furnace in which the flame does not touch it and allowing it to cool there slowly.

After further tests, the billets, now tubes, are bored and turned to within scope of the finishing tools. The "Inner A Tube" is tapered on its outer surface at 1-500 from breech to muzzle, and shoulders are formed at required intervals along it, the interior being bored to within about .03 inch of its final dimensions.

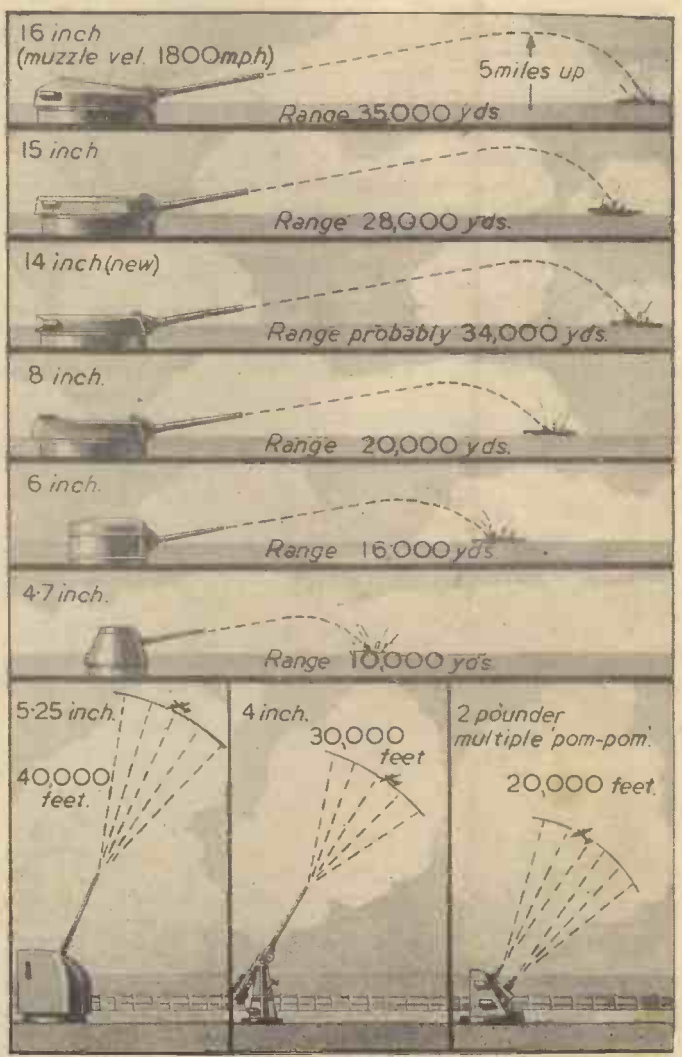
The interior of the "A Tube" is bored to *dimensions slightly smaller than those of the exterior of the* "Inner A Tube," and is given the same taper and corresponding shoulders.

Cannelured rings (rings with a grooved cross-section) are slipped over the muzzle of the "Inner A Tube" and fixed against the shoulders. The "Inner A Tube" is then pushed as far as it will go into the "A Tube" lying horizontal. Both tubes together are then up-ended by means of a crane and lowered into a gun-pit, where the "Inner A Tube" is forced right home inside the "A Tube" by a powerful steam or hydraulic press.

This process obviously puts the "Inner A Tube" in a state of *compression*, and the "A Tube" in a state of *tension*. The amount by which the tubes contract or expand is carefully measured and noted.

From this stage onwards the forgings are regarded as a gun, with a registered number which sticks to it for the rest of its life.

The breech end of the "Inner A Tube" is now chambered, while the rear end of the "A Tube" is screw-threaded to receive the breech bush, the interior of which has been roughly machined to the required radii for the reception of the breech block.



Pictorial diagrams illustrating the approximate ranges of British naval guns.

The rear end of the "A Tube" is then heated until it has expanded about .05 inch, when the breech bush, which is .005 inch larger than its seating when cold, is screwed home quickly. When the "A Tube" cools, it grips the breech bush firmly, and the latter is then flushed off level with the breech face of the gun.

"Winding" the Gun

The gun is now ready for winding on the wire, which is of ribbon section and with dimensions of about .25 inch by .05 inch. The wire is wound on to the gun in successive layers from muzzle to breech, the inner turns with a tension of from 30 to 50 tons and the outer turns with a tension of from 20 to 30 tons; the outer turns relax the inner ones, the result being to reverse the tensions of the inner and outer layers, the last layer being wound on at the correct tension. When this winding is completed, the wire is lathed up to receive the "B Tube" and "Jacket."

The "B Tube" is about .04 inch smaller in internal diameter than the wire-wound tubes over which it must go. It is necessary, therefore, to heat it until it has expanded sufficiently to pass over the wire. Meanwhile, the gun is lowered into the shrinking pit, where the "B Tube" is lowered over its muzzle and *shrunk on*. The "Jacket" is shrunk on in a similar manner, and finally the breech ring, if used, is heated up, screwed on with great force, and shrunk on likewise.

This completes the gun, so far as its strength is concerned. The bore is completed to within .002 inch of its plain size, the chamber is machined to shape and the obturating seat is machined to take the obturating pad of the breech block. The breech bush is now screw-threaded, the threads being cut on their varying diameters. Great skill and accuracy are here demanded, in order that the breech blocks may be interchangeable.

Rifling the Bore

There remains to be done, however, the most important process of "rifling" the bore, that is to say, of scoring it longitudinally with a spiral groove which grips the soft copper driving band of the projectile and imparts to it a rotating movement.

Calibre (in inches)	Length (in calibres)	Weight (in tons)
16	45	103½
15	42	97
14	(No official figures published)	
8	55	16½
7.5	45—50	13½—16
6	45—50	6¾—8½
5.5	50	6
4.7	40—50	3
4.5	45	—
4	40—45	1¼—2
3	45	1
1 (pom-pom)	40	1¾ cwt.

Table showing calibre, length and weight of the principal naval guns.

Rifling permits of the use of an elongated projectile and secures for that projectile greater accuracy, by centreing it as it leaves the muzzle of the gun. It also simplifies the action of the fuse in the projectile and, to a limited extent, overcomes mechanical imperfections in the manufacture of the projectile.

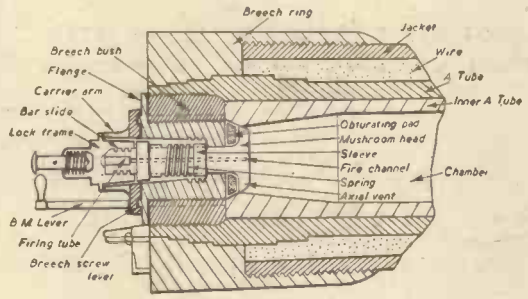
The "twist," or form of the spiral groove, of the rifling is expressed as one turn in so many calibres (diameters) of the bore. For ideal conditions each type of shell, according to its length, would require a special twist, but that it would of course be impracticable to provide, so the average twist provided is one of about one turn in 30 calibres.

The size, shape and number of grooves is still a matter of experiment, and varies to-day in different types of guns. Broadly speaking, it must be such as will a little more than carry the projectile nose first to the end of its flight. If the grooves are deep, the gun will not need re-tubing so quickly, but the strain on the gun and on the driving-band of the projectile will be greater. If they are shallow, the rifling will last longer, but the shell may not be so effectively rotated.

Fitting the Breech Block

It now remains only to fit the gun with a breech block for closing the rear end of the chamber. In the smaller guns a horizontal or vertical sliding block is used, but in larger guns, such as shown in the diagrams, the breech block is of the screw type, the *Welin System* being used.

The Welin System referred to is one in which threads of different radii are used, rising in two or three steps to a maximum and then returning in one step to the minimum. This secures, in the first place, that the block moves inwards as it is rotated, thus forcing the obturating pad well home into its seating and securing the occlusion of gases; and, in the second place, that the block is completely locked by one-twelfth of a turn if it has three steps, or by one-sixth of a turn if it has two.



Cross section showing the construction of the breech-end of a naval gun, together with the breech mechanism.

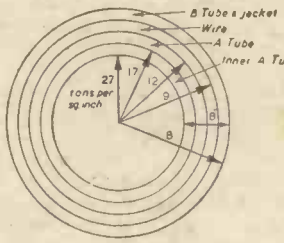


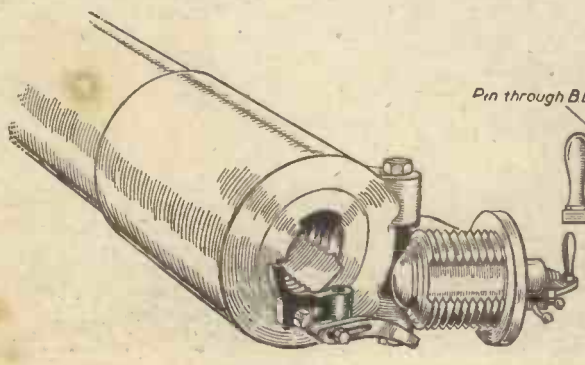
Diagram illustrating the graduation of stresses in a large naval gun.

	Tons per sq. inch
Pressure of Charge	27
Elastic Limit of Gun Steel	16
Tension on Inner Surface	27
,, 2" from Inner Surface ...	17
,, 4" ,, ,, ,, ...	12
,, 6" ,, ,, ,, ...	9
,, 8" ,, ,, ,, ...	8

The gun, consisting of 3 tubes and wire, should be built up as follows:—

		Tension
Inner Surface	—11+27	16 tons per sq. in.
Inner "A" Tube, exterior	—1+17	16 ,, ,,
"A" Tube, exterior	+4+12	16 ,, ,,
Wire, exterior	+7+9	16 ,, ,,
"B" Tube, exterior	+8+8	16 ,, ,,

— denotes compression
\+ denotes tension



Details of a gun breech block and its operating mechanism. B.B.=Back of breech block. H.L.=Hand lever for opening and closing the block.

It will be appreciated, of course, that the construction of a gun is not only a difficult and costly process, but also a very lengthy one. Indeed, it may take just about as long to make the guns for a modern battleship as to complete the ship which will carry them. The importance of this will become apparent when it is realised that the life of a gun is far shorter than that of a ship, depending, of course, on the amount of use it gets. Each shot that is fired means that the rifling in the bore is just a little bit worn away, and the cumulative effect of this wear is that more and more muzzle velocity is lost owing to leakage of the gases in the chamber past the driving band of the projectile. That means loss of range and of accuracy, and will eventually become sufficient to render the gun useless.

Fortunately, however, owing to the system of construction which is employed, as already described, it is possible to render a worn gun as good as new by withdrawing the worn-out "Inner A Tube," and replacing it by a new one.

In order to do this, since, as will be recalled, the "Inner A Tube" is originally too thick to fit inside the "A Tube," which is shrunk on to it, the process of shrinking-on must be reversed. The external layers of the gun must be heated up gradually, while the "Inner A Tube" is kept cool, until the former have expanded sufficiently to permit of the withdrawal of the latter. While still in this state, a new "Inner A Tube" is inserted and forced home, and then the outer part of the gun is allowed to cool down and shrink on to it.

If wire-winding is not carried out, the layers of wire being replaced by a simple tube, the process of construction can be considerably speeded up and cheapened, but the resultant gun is not one which can be re-tubed in the manner described above. It is questionable, therefore, whether the economics effected are real ones, though it may be that, in certain circumstances, it is preferable to go on turning out quickly a stream of the simpler type of gun, rather than to turn out more slowly a smaller number of those which have more permanence.

An Australian listener hears on the radio an English speaker before his own audience at the back of the hall.

Some Scientific Facts Explained

Noise, and how it helps the engineer—Science and observation—Senses of Insects—and Germs as engineers.

By Prof. A. M. LOW.

TO me it is almost unbelievable that there are men still living in the world who do not see the romance and excitement of science. People say of an engineer that he is a practical man whose duty is to turn pieces of metal into beautiful machinery and whose life is spent in contemplating facts. In my humble opinion there is no such thing as a fact on this earth, for I find that nearly everything that was taught a few years ago has since been proved to be untrue.

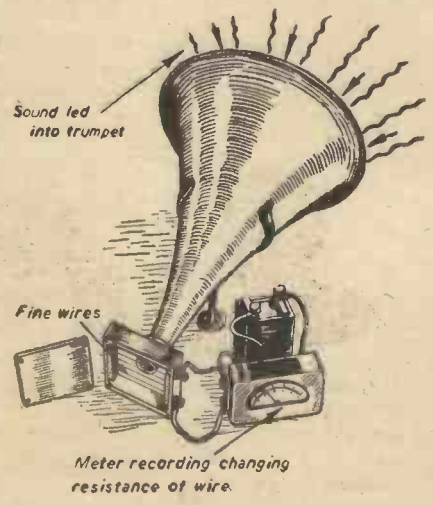
We used to be told that an atom was the smallest part of any substance, yet to-day we speak in terms of electrons, and have come to consider the possibility that these again may be split into various subdivisions. Chemists always thought in terms of "inorganic" for things which were dead and "organic" for living substances; until it was discovered that life might pervade everything. So it soon became necessary to invent nice words like biochemistry and "electrochemical physics" to conceal the one real truth that knowledge is mostly a matter of opinion.

I have always thought that across every lecture room should be a huge placard bearing the words "In my opinion." Science is no longer represented by a series of boxes into which little scraps of learning can be thrown; it is an attempt to explain how and why we live. It concerns itself with a telephone, an electron microscope, a new metal, or a process for bringing an engine into being. Neither are there any longer those divisions which can be held within hard and fast limits. Even the friendly motor-bus is a triumph for the physicist, the engineer and the chemist. Botany plays a most important part where its tyres are concerned, while the movement of the earth round its axis may be said to come into the picture when the engineer calculates the gyroscopic effects under which the main bearings of his motor may suffer.

Simple Observations

In this series of articles I propose to deal with everyday happenings and to discuss, as it were, the way in which our lives are wrapped up with modern discovery. It is commonplace to remind you that, were it not for scientific engineering, we would have no spoons and forks, no clothes, no talking pictures, vacuum cleaners, or radio. But these are not all. Even better is it to walk along a pavement and to think how it came into being; to imagine the steps through which its composite materials passed before reaching the hand of the engineer. To glance at a pool of dirty water, and to realise that the thin oil film, which to others is dirt, may be far more interesting when looked at with microscopic eyes, which see a film so thin that white light from the sky is broken up into each of its component parts.

Then we might remember, if we are observant, that light itself is by no means understood. It does not even come from the sun. The sun sets the ether into motion, and this ether chances to produce on your body the sensation of light, when it might just as well cause a flower to open or to record a picture upon a photographic plate. Perhaps I can best make this point clear by explaining that, if I were to drop a brick on your toe, you would not say that the pain had travelled from my hand to your foot! So it is with light, for this is an exact example of what is believed to be the truth.



Sound actually heats the air, and a method of measuring this is shown in the illustration

On this matter of observation—and afterwards we shall be able to talk of things as far removed as the streamlining of an aeroplane or the composition of a silk stocking—let me beg of you to adopt the air of a detective who notices everything and tries to find a reason.

Novel Experiment

Have you, for example, ever worn a bowler hat?

For the uninitiated, I should explain that this was (and, I believe, is) a queer, round arrangement, made of comparatively stiff felt. At a pinch, even a hard trilby will do for the experiment. Well, as you are walking down some busy street, take off your hat and, holding it between the thumb and forefinger by the brim, touch your other fingers lightly to the crown. In almost every case you will find that, at certain unspecified moments, a kind of trembling occurs, and—if I might be allowed a little poetic licence—there are occasions when the thing nearly jumps out of your hand.

This is due to noise and sound. Motor buses, and other similar vehicles, are driven by internal combustion engines which are really quite unsuitable for such purposes, because they have no starting torque. Some other time I shall have much to say about internal combustion engines—which owe pride of place almost entirely to the fact that the fuel upon which they run is clean and distributed by a marvellously complete system. These engines must run comparatively fast to be efficient in order that the transfer of energy from chemical to heat, and thence to mechanical work, may be accomplished without a huge loss. It is bad enough to lose about 40 per cent. through the exhaust after you have paid for the petrol, and a further 30-odd per cent. from the radiator—but even more

irritating is the necessity for high crank-shaft speed, because this leads to gear-boxes and other noise-producing mechanisms.

Noise and Sound Waves

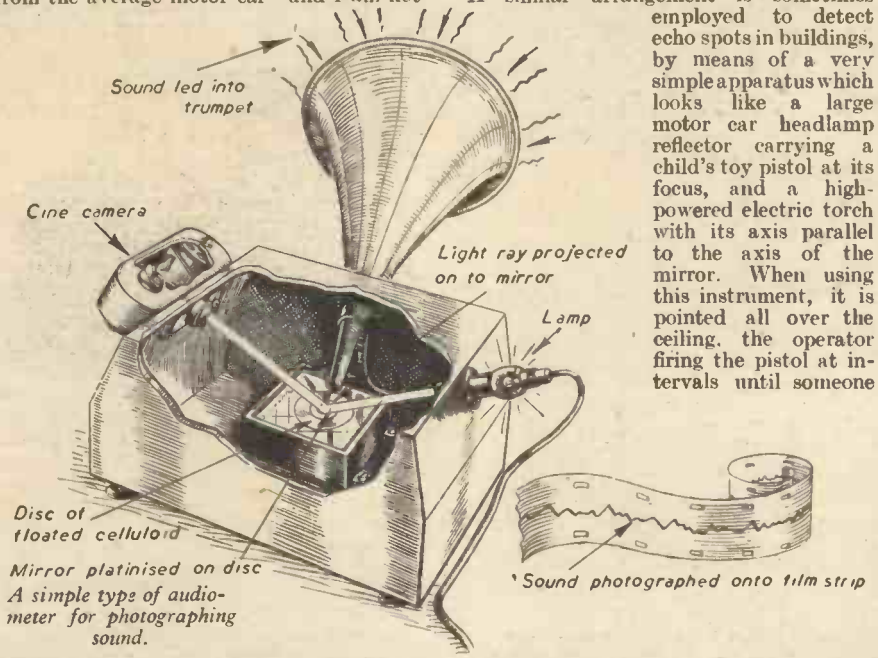
The noise and sound waves proceeding from the average motor car—and I am not only considering the syren-like whine as a car accelerates on its gears—is a direct indication of loss, so it is as well for every engineer to consider the mechanical nature of sound or noise, and to realise how vitally important is this subject.

Sound and noise are quite different . . . sound is produced by regular periods of compression and rarefaction in the air; noise, by irregular waves of a similar nature. It is one of the most important effects in the world—for, without it, it would be most difficult to convey our thoughts . . . locomotive engineers would find it hard to time their valve gears accurately . . . and every skilled mechanic would be hopelessly lost without the possibilities possessed by noise and sound in regard to "tuning up."

As in most cases where we notice physical effects, it is useful to study them by finding out their main characteristics—which, in the case of sound, are quite simple. Sound and noise heat the air through which they pass. They are capable of reflection, a small amount of refraction (according to Lord Kelvin), and they are of a strictly mechanical nature. The best known property—that of reflection—is obvious to anyone who has heard a thunder clap, for the initial noise produced by the expanding air from the hot spark of lightning reflects from cloud-banks, layers of hot air, and houses, until it achieves the familiar rattle or "reverberation."

Many other reflection effects are well known. In old books on Physics there was always an amusing illustration of two parabolic mirrors placed at either end of a long room. At the focal point of one mirror was a watch, and at the other a man held his walking stick with the ferrule at the focus and the handle at his ear—somewhat in the fashion of a water inspector looking for a leak.

Beyond demonstrating how nicely sound can travel up solid bodies—such as a stick of wood—this experiment has had many uses. It is now employed to collect the sound of aeroplanes which are reflected on to a microphone and sent to the observer's ear. In making talking films, a mirror is employed which, focussed on the hero, enables him to dash about the "set" after the heroine without any microphone making an untimely appearance on the film.



A simple type of audio-meter for photographing sound.

Acoustics

A similar arrangement is sometimes employed to detect echo spots in buildings, by means of a very simple apparatus which looks like a large motor car headlamp reflector carrying a child's toy pistol at its focus, and a high-powered electric torch with its axis parallel to the axis of the mirror. When using this instrument, it is pointed all over the ceiling, the operator firing the pistol at intervals until someone sitting in the place of the audience hears the echo. The torch is then switched on and where the light strikes is the place needing acoustic treatment. This usually takes the form of some absorbent mattress. It is, by the way, not always easy to choose the right kind of absorbent material, for some "soak up" high notes more than the low—thus causing music or speech to be inaccurately received at the listening end.

The science of acoustics has become of greater importance during the past ten years owing to the popularity of talking pictures. In its earliest form, reproduction was so inaccurate that the general result was to render the final effect more unreal than ever. It might be remarked, in passing, that in the old-fashioned silent film a band was employed not so much for the interest of the music as to drown the "sound of silence."

All kinds of strange combinations of reflection and refraction can be detected in modern acoustics. You may have noticed that, when a motor cycle passes you on a hot day, the noise seems to die away and then it may grow louder again as the result of partial "refraction" from layers of hot air rising from the ground which bring back the wave to the ear of the observer from the upper layers.

A Sound-Reflecting Roof

There was one hotel in London where conversation from a certain table could be heard quite clearly right across the room, and it cost the proprietors several thousand pounds to alter the shape of the roof, which was acting as a very nice mirror for sound. At another building, I have been able to hear the conversation taking place in a bedroom fifty or sixty feet from the room where I was situated. In this case, the result was due to sound transmission along girders which, attached to the wall, formed a direct path between two diaphragms. One can learn a great deal by careful observation!

The human ear, it should be explained, is not always a satisfactory detector for sound, for it is only sensitive between, say, sixteen cycles per second up to about 6,000—although this upper limit is often greatly increased, especially in the case of young people. This explains the old saying that the squeak of a bat can only be heard by a child. By using this principle it is possible to make a whistle which will call a dog, but which is quite inaudible to a man. It is only necessary to cut off half-an-inch at a time from a long whistle until the note, to you, sounds more like the hiss of escaping steam.

The other property of sound, which has been used for gun-ranging and similar purposes, is that the waves of compression heat the air as they pass. This was used in the Great War to estimate the distance or direction of gun fire. The sounds were led into a trumpet which carried a number of fine wires across its base. As these wires were heated by the sound waves, their electrical resistance changed, and could be measured as an indication of the nature of the sound itself. Noise and sound turn into heat when they strike the walls of a room, although the "heat" produced in this way by a large jazz band is less than that from one safety match. Noises in a room actually warm the air (irrespective of what is said!)—but for practical purposes this effect is negligible.

Bending of Light

The bending of light, as it passes through layers of compressed air, has also been applied to a very pretty method of discovering the "echo period" of a building before the structure is actually completed. A model is built of, say, plaster of Paris, and on one side is placed a photographic plate. At the opposite point in this model a sound is made at stated intervals, and a record obtained on the plate of the spark as it passes through the undisturbed air in the "building." Another record is taken as the light from the spark passes through the waves of compression produced by reflection of the noise from the preceding spark. By measuring the distance between these two "images," a great deal of useful information can be deduced.

A method employed in locating unpleasant echo in a room.

In modern engineering, acoustics form a most important part of the equipment of every designer, for by it he is able to check such details as exact valve-opening moments as distinct from design period, the proper functioning of gears, and even the exact path traced by ball bearings when over-stressed. As may be imagined, such delicate observations are not made by the unaided ear. It is necessary to employ apparatus which is sensitive to frequencies up to 30,000 or even more—and for this purpose many kinds of audiometer have been devised.

One of the simplest forms can be made from a trumpet which carries the sound to a disc of floated celluloid on to which has been platinised a small mirror. As this mirror oscillates, so a beam of light reflected from it is thrown on to a travelling strip of photographic film, where the wave-forms may be traced and prepared for analysis.

Slow Speed of Sound

The comparatively slow speed of sound in air—1,100 feet per second—is responsible for many queer effects, notably the ease with which Big Ben may be heard to strike twice by means of a portable set placed a few hundred yards from the tower itself. It is rather amusing to think that, if a man is speaking in a large hall in England, and someone is listening close to a loudspeaker in Australia, the Australian observer will hear the words *before* they are audible to a man at the end of the room in which the speaker himself is situated in England. It is obvious, of course, that the transmitted sound is travelling at the speed of light, while, at the back of the hall, the sound takes its course through the air alone.

Fortunately for human beings, most of our senses have become somewhat atrophied by civilisation and, for this reason, we are not unduly distressed by the noise of a great city. An antelope, in similar circumstances, might not live very long if he had the brain of a man—because this creature's ears are far more sensitive than our own. The worm, on the other hand, does not seem very interested in any musical note, but is extraordinarily sensitive to slow vibration. You may have noticed that, when driving a golf ball, worms many yards away keep still as the club touches the ball (if it does !). The worm probably thinks that a bird has alighted on the turf. Experiments have shown that worms can detect the shock made by a bird's foot through at least twelve inches of earth. No man has such delicacy as this, for, although he may have the best *average* collection of senses, there are many creatures with whom he cannot compare for individual sensitivity. Even a bird listens for worms under the ground.

Imagine how embarrassing it would be if we had eyes which could see germs in water. We would be terrified of our bath, frightened to breathe the air, and generally more discontented than we are to-day. Nor has the sense of touch been forgotten by nature, for what jeweller has the delicacy of a spider as it builds its home ?

Increasing Delicacy of Senses

My point in these humble comments is to bring home once again the romance of science, and to remind you that the heaviest machinery is not built without instruments which have for their sole purpose an increase in the apparent delicacy of our existing senses. I do not need to give examples for it is so obvious; but think for a moment of the capacity balance which is so delicate that it can measure the bending of a 2-inch section bar of wood when a 2-foot length is bent by the weight of a halfpenny at the centre. Think of the importance of surface treatment to permit hot metal to work in its accompanying bearing when the microscope would show what you thought to be a good polish to look more like the hills of Wales. I always remember that Stephenson thought a piston was a nice fit in its cylinder if he could not get his thumb in between, and I wonder how long it will be before our own workshop practice is looked upon with the same mixture of interest and contempt which we bear for the past.

I hope to write soon of speed, and of how hardness is little more than a function of speed. Of "ersatz," and why it is that certain substances are better than the original materials; of plastics, and of the difference between the products of nature and those of the laboratory, for every one of these is of vital importance to the engineer who cannot achieve progress until he grasps that the watertight compartments between one science, or even one art, and another, are quite out of place in this century. Above all, let us never be bored when we can observe and seek reasons for everything we see around.

Story of the Pond

Have you heard the story of the pond? Some years ago three young men walked past a pond and speculated as to the possibility of fishing, until one of them observed the recurrent presence of bubbles. Neglecting the laughter of his companions, he collected samples of this water, and of the pond mud underneath. An examination showed that a peculiar type of fermentation was taking place, and he wondered if the germs causing all the excitement could be made to multiply. They could. To-day this method has been applied to commerce with such success, that there is at least one big city in England drawing most of its electric lighting power from bacteriological overtime !

Ingenious Ideas

For Flat Feet

THREE current inventions for which applications have been made to the British Patent Office have been designed to produce foot comfort and correct walking.

One of these is a shoe containing a support fashioned in such a way that, when walking, the wearer quite naturally exercises the feet at each step in a manner recommended by orthopaedic experts. The foot is tilted over from the inside at the heel to the outside or offside of the shoe at the fore part. When shoes made in accordance with this invention are worn by persons with normal feet, incorrect foot movements and weakening of the arches, tendons and tissues are prevented. In the case of people with weakened foot arches, the shoes correct wrong action and ultimately the arches are strengthened and rectified. Such at least is the claim of the inventor.

According to a chiropodist all successful athletes have not gracefully curved arches and the flat foot is not necessarily an obstacle to speed. This subject recalls the story of a genuine howler made by a schoolgirl—a budding Mrs. Malaprop. Reading about the fleet messenger of the gods, she described him as Mercury, the flat-footed.

Home-made Ink

THE fountain pen is the helpmeet of a countless host of scribes. But its utility is entirely dependent upon ink being available. There may be times and climes in which the supply of liquid ink is not procurable. A ready means of dealing with such a deficiency has been conceived by an inventor, whose application for a patent in this country has been accepted. This source of supply enables liquid ink to be made from a powder. There is an outer container with an inner vessel holding ink powder, and the internal receptacle is removable. Having removed the latter, one takes powder from it and places it in the outer container, in which water has been poured. The powder rapidly dissolves, providing a quantity of liquid ink. The inner container holds enough powder for eight or nine fillings. Though primarily intended for ink, the device may be used for other purposes, such as the mixing of medicine.

Mechanical Foster Mother

THE milking of cows by machinery has become a general practice. It is, on the other hand, possible for the juvenile bovine world to retaliate by using a feeding apparatus.

An improved artificial method of suckling calves and other animals is now proposed. Without going into details, it may be mentioned that it is claimed that this mechanical foster-mother will enable a calf to take its milk at the same rate and in the same manner as if it were nursed by the cow. It is also contended that the invention permits the young animal speedily to empty the vessel containing the nourishing fluid. This is stated to be an advantage when a large number of calves have to be fed.

The Unglazed Age

AN old book published in the smug Victorian era of which the writer declares that in his day the meanest beggars were clad, fed and housed far better than were all the people, except the nobles and the richest gentry, in those early times. He adds that, apart from some few churches, windows had no glass. Verily, enemy action has caused many of us involuntarily to hark back to the unglazed age.

One's mouth waters when one learns that the serf had then milk, butter, cheese, eggs, and plenty of wild mutton and beef. And the author affirms that his readers ought to be grateful that they lived in a day so very much better than the Good Old Times.

Musical Rattles

THERE is no law in toyland for the suppression of noise. The plaything which is inconveniently audible to adults appeals especially to youngsters. The drum, the trumpet and the whistle are favourite noise-producing toys. And tiny police rattles have for at least half a century delighted the juvenile.

There has lately been granted in the United States a patent for a musical rattle, presumably for the amusement of children. Assuming that the note or notes are of a pleasing character, this new toy will not "rattle" the grown-up hearer.

A striking picture of a Blackburn Skua fighter dive bomber These machines are operating with the Fleet Air Arm.

Aircraft Recognition

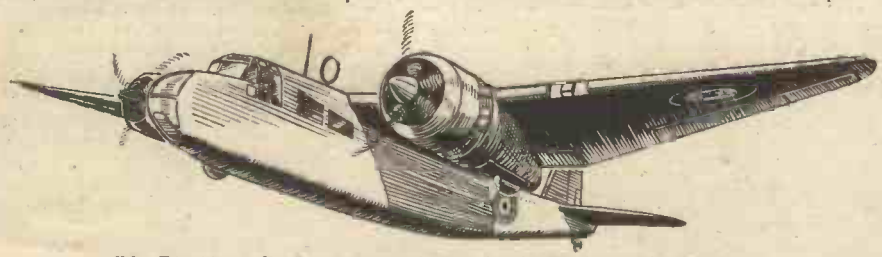
Suggestions for Home Study, *by* R. A. *Saville-Sneath*

Aircraft of the Fleet Air Arm—6

THE Fleet Air Arm, following the brilliant success of its independent action against the Italian battle fleet at Taranto, has played a notable and perhaps decisive role in the battle of Cape Matapan.

Found by Fleet Air Arm reconnaissance, harried, damaged and delayed by repeated Fleet Air Arm torpedo and bombing attacks, a considerable Italian naval force was unable to avoid close engagement with a British battle fleet, and in the space of a few furious minutes was swept to the bottom of Mussolini's "Mare Nostrum."

This branch of our Air Force within the Navy, comprising chiefly ship-borne aircraft, has had a long and stern fight to establish its present position as a naval unit, manned, maintained and operated by the Admiralty. The "naval wing" of the Royal Flying Corps, as it was then called, had its origin about 1911, when a small group of Naval and Royal Marine officers received their first flying training at Eastchurch. By 1914, when war broke out, the naval wing had become better known as the Royal Naval Air Service, under direct Admiralty control.



The Blackburn Botha, a reconnaissance bomber and torpedo carrier.

Merging of R.F.C. and R.N.A.S.

In April 1918, the R.F.C. and the R.N.A.S. were merged into the Royal Air Force under the control of a single Air Minister. This arrangement, theoretically ideal, proved in practice inadequate to provide for the distinct technical and operational needs of a naval air service. After preliminary skirmishes, in 1923 the Navy scored a partial success with the establishment of the Fleet Air Arm under joint R.A.F. and Admiralty control. This preliminary success was not consolidated until 1937, when the Fleet Air Arm passed under the entire control of the Admiralty, except for the ordering of aircraft, and the responsibility for initial flying training.

In addition to controlling all ship-borne aircraft the Fleet Air Arm operates a number of shore training stations. Like other land depots under naval control these shore establishments of the Fleet Air Arm are officially known as "ships"—for example H.M.S. *Daedalus*, H.M.S. *Peregrine*, H.M.S. *Kestrel*, etc.,—and not a little amusement is caused when these too, too solid "ships" are "sunk" from time to time by Haw-Haw and his colleagues.

Although the Fleet Air Arm and the R.A.F. Coastal Command, which is responsible for shore-based aircraft operating round the British Isles, work in close co-operation, the need for a greater measure of Admiralty control over all types of coastal reconnaissance and marine patrol aircraft became acute during the critical period of Axis attacks on shipping in the late autumn of 1940.

As a result the Prime Minister announced in December last that the Coastal Command had not only been largely reinforced, but that control of its operational policy would in future be *determined by the Admiralty*, in consultation with the Air Officer Commanding-in-chief.

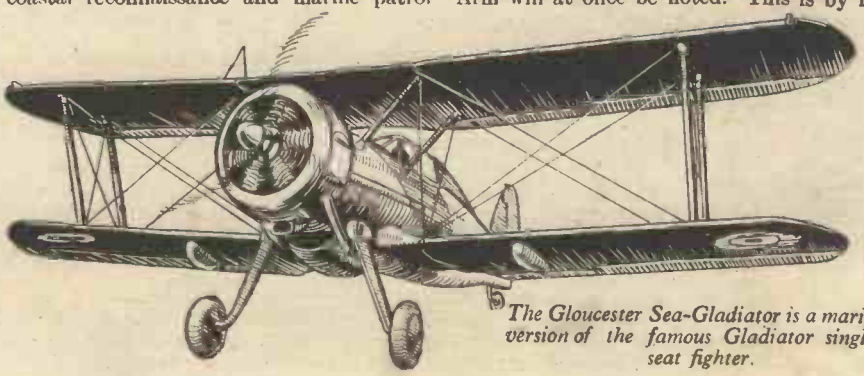
The principal types of aircraft operated by the Coastal Command are well known, and have been described in previous articles of this series. They include the flying-boats Sunderland, Lerwick, London, Stranraer, Singapore and Catalina, and the land-planes Anson, Blenheim, Beaufort, Botha, Hudson and Ventura.

The following list gives the chief types of aircraft in service with the Fleet Air Arm:

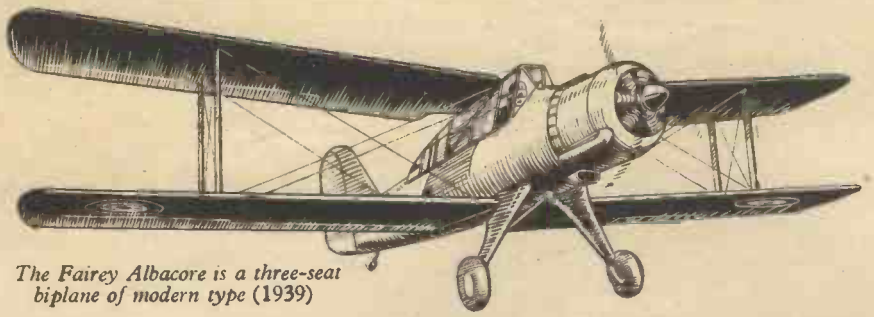
Albacore	Nimrod	Seal
Bermuda	Osprey	Shark
Botha	Roc	Swordfish
Fulmar	Seafox	Walrus
Martlet	Sea Gladiator	Skua

The Bermuda and Martlet—two recent American additions to the Fleet Air Arm—were described in last month's article on the American "invasion." The Walrus was described in the preceding article on long-range marine aircraft. The dozen different types which remain provide a convenient and interesting group for study.

Running through this list, the preponderance of biplane types in the Fleet Air Arm will at once be noted. This is by no



The Gloucester Sea-Gladiator is a marine version of the famous Gladiator single-seat fighter.



The Fairey Albacore is a three-seat biplane of modern type (1939)

means due to any reluctance on the part of the Admiralty to employ modern high-speed monoplane types, but to inherent difficulties in designing monoplanes which will answer all the requirements of operation from aircraft carriers.

Extremely Manoeuvrable

The need for a type of aircraft which occupies small stowage and deck space; which can take off and land within a restricted area at slow speeds and therefore with a high margin of safety, and which is nevertheless extremely manoeuvrable, has until quite recently determined the choice of biplanes.

The Fairey ALBACORE is a three-seat biplane of modern type (1939) and clean lines, designed to perform the same functions as its highly successful predecessor, the Fairey Swordfish. Armament consists of two machine-guns. A torpedo may be carried under the fuselage instead of the normal bomb load. The power plant a single 1,065 h.p. Bristol Taurus 11 sleeve-valve radial air-cooled engine, is reported to give a top speed of about 200 m.p.h., but official figures are not yet released. The single-bay braced wings fold for stowage.

Distinctive points are: Wings of equal span without taper, with wide rounded tips. They have moderate dihedral, and both upper and lower planes are cut away at the trailing edge. The large glazed cockpit divides the upper plane into two sections, giving the crew an unobstructed view overhead. The fuselage is slender and of oval section. The large single fin and rudder has typical well-rounded "Fairey" lines. The tailplane is high on the fuselage, and tapers to well-rounded tips with deep cut-away for rudder. The wheels of the fixed, braced undercarriage are without fairings.

The Hawker NIMROD is the Fleet Air Arm version of the famous Hawker Fury single-seat fighter, which it resembles in all major features. Fitted with a 480 h.p. Rolls-Royce Kestrel liquid-cooled in-line engine, the clean, sharp lines of the nose are characteristic.

Like the Fury, its maximum speed is around 214 m.p.h., and both types are largely used for training.

The staggered wings of unequal span are without taper and have uniformly rounded tips. The upper plane has negligible dihedral, the lower wing moderate dihedral. The fuselage is short, of oval section, with well-rounded "Hawker" single fin and rudder. The tailplane is high on the fuselage, with straight leading edge, rounded tips and deep cut-away. The large radiator between the struts of the fixed, braced undercarriage is a conspicuous feature in the head-on or side view.

The Hawker OSPREY fleet fighter reconnaissance aircraft is a member of that numerous and confusing family of Hawker two-seat Kestrel-engined biplanes generally known as "Hart Variants." In their time these well-known types formed the backbone of the R.A.F. They included two-seat fighters, day bombers and army co-operation machines—Osprey, Hart, Audax, Demon and Hind. These variously-named machines differ chiefly in the arrangement of armament, equipment and in engine output.

Biplane Trainers

Fitted with Rolls-Royce Kestrel liquid-cooled engines ranging from 480 to 640 h.p., the Hart Variants are now chiefly used as biplane trainers, having a maximum speed of about 170-180 m.p.h.

Distinctive features are: Characteristic short nose of Kestrel engine, staggered wings of unequal span and chord, without taper. The wing-tips are well rounded, the upper plane having appreciable back-sweep. The lower plane is cut away from the trailing edge towards the fuselage. The upper wing has slight, the lower wing full, dihedral. The single fin and rudder of the Osprey is larger and more rounded than that of the Hart, Audax, etc. The tailplane, high on the fuselage, is tapered on leading and trailing edge, with rounded tips, and is cut away for the rudder. The fixed, braced undercarriage has neither fairings nor wheel spats. There is a float-seaplane version of the Osprey.

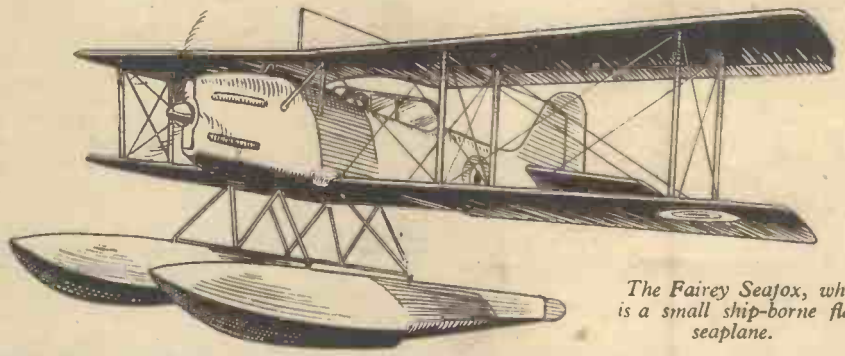
A Fairey SEAFOX, a small ship-borne float-seaplane, was employed in reconnaissance and spotting duties during the action which resulted in the destruction of the notorious raider *Graf von Spee*.

A two-bay braced biplane of equal span, the Fairey Seafox is fitted with a Napier "Rapier" air-cooled in-line engine of 395 h.p., giving a top speed of 125 m.p.h.

The wings are slightly swept back without taper, with square-cut tips and slight dihedral. The trailing edge of both planes is cut away at the centre section. The tailplane is large, high on the fuselage, with very slight taper, almost square-cut tips and large cut-away. The general impression of squareness is emphasised by the almost rectangular nose, a characteristic point due to the Rapier engine. The twin floats project well forward of the nose, and well aft of the glazed rear cockpit. The somewhat angular shape of the single fin and rudder is distinctive.

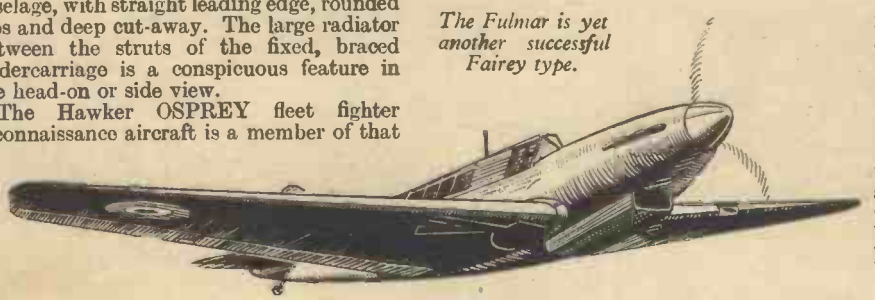
The Gloster SEA-GLADIATOR is a marine version of the famous Gladiator single-seat fighter, last of a long and distinctive line of biplane fighters. Modifications from the land fighter include the provision of a collapsible dinghy, catapult points, and deck-landing hook. Two guns are in the fuselage, and two under the wings.

The 840 h.p. Bristol Mercury air-cooled radial engine gives a maximum speed of around 250 m.p.h. Both versions are single-bay braced biplanes of equal span. The staggered wings have no taper, with tips rather sharply rounded off. Both wings have slight dihedral and are cut away at the centre of the trailing edge. The radial-engined nose is short and squat, the short fuselage with large fairing behind the cock-pit giving a hump-backed appearance. The wide, well-rounded and braced single fin and rudder is distinctive. The tailplane, set low on fuselage, is nearly elliptical and has a deep cut-away. The fixed undercarriage of cantilever or single-pillar type has no wheel-spats.



The Fairey Seafox, which is a small ship-borne float seaplane.

The Fulmar is yet another successful Fairey type.



Spotter-reconnaissance Aircraft

The Fairey SEAL appeared in 1932 as a development of the famous Fairey IIIF series of biplanes. It was designed as a three-seater for fleet-spotter-reconnaissance duties in both land-plane and seaplane versions. The landplane version differs only slightly from the Fairey Gordon general-purpose two-seat biplane.

The single 525 h.p. Armstrong-Siddeley "Panther" radial air-cooled engine provides a maximum speed around 150 m.p.h., and a cruising speed of 120 m.p.h. (landplane).

The Seal is a two-bay braced biplane with wings of equal span and high aspect ratio. The wings, with moderate dihedral, have neither sweepback nor taper. The wing tips are rounded and the centre section of the trailing edge is cut away. The radial engine is uncowled, and two long exhaust pipes can be observed. The fuselage is slender, with open cockpits. The single fin and rudder is wide and well rounded. The braced tailplane is mounted high on the fuselage and has the rectangular and stepped tail-plane of the Fairey IIIF series. The fixed, braced undercarriage of the landplane has neither fairings nor wheel spats.

Torpedo-carrying Plane

The Blackburn SHARK is a three-seat biplane designed for torpedo-carrying, spotting and reconnaissance. Developed in 1934, it is fitted with a single Bristol Pegasus radial air-cooled engine of 775 h.p., giving a maximum speed of about 160 m.p.h., and a cruising speed of around 120 m.p.h. Like many of the older types of aircraft it is largely used for training purposes.

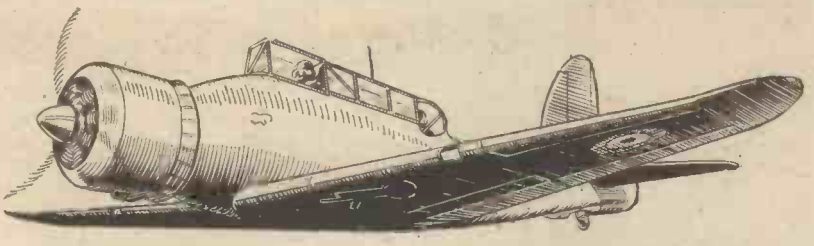
The Shark has many distinctive and easily-recognisable features. The straight, braced wings of marked unequal span are slightly staggered and have considerable sweepback, with the centre-section cut away from trailing edge They have no taper, and dihedral is negligible. The wing-tips are square-cut, and this marked characteristic is again observed in the clean-cut outlines of the rectangular tail-plane, which is braced and set high on a rather long fuselage. In contrast, the single fin and rudder is tall and gracefully rounded. The cowling of the radial engine is of greater diameter than the nose of the fuselage, and it is not faired into the fuselage as is customary in later designs. The cockpits are open, and the fixed under-carriage of divided type has neither fairings nor spats. There is also a float-seaplane version of the Shark.

The exploits of the Fairey SWORDFISH at Taranto, off Sardinia, and in the battle of Cape Matapan have by now passed into history, but we have certainly not heard the last of this veteran of the Fleet Air Arm. Although it has already struck several times, this Sword(fish) of Damocles still threatens Mussolini's head.

Originally developed in 1934 as the Fairey TSR (Torpedo Spotter Reconnaissance) the Swordfish was evolved in 1935. Fitted with a single 750 h.p. Bristol Pegasus radial air-cooled engine, the land-plane version has a top speed of 154 m.p.h., whilst the float-seaplane is about 10 m.p.h. slower. The Swordfish is a three-seater, armed with one fixed and one movable machine-gun. It carries either a normal load of bombs, or one big bang in the shape of an 18-inch torpedo.

A braced two-bay biplane of unequal span and chord, the staggered wings of the Swordfish have an unusual and distinctive feature. The wing-tips of the *upper* plane are only half-rounded—i.e., they are pointed at the leading edge and well rounded at the trailing edge. The lower wing-tips are fully rounded. Both wings have a wide cut-away centre section. The dissimilarity of the wings is accentuated by the sweep-back of the *upper wing* only. Further, the upper wing has moderate dihedral outboard of the centre section, whilst the lower wing has practically none.

The long, slender fuselage and the stepped, rectangular braced tailplane resemble those features of the Fairey IIIF, Seal and Gordon. The single braced fin and rudder is large, wide and well rounded. The cowling of the radial engine is not faired flush with the fuselage. The fixed undercarriage of divided type—between the struts of which the torpedo is usually carried—has neither fairings nor wheel-spats.

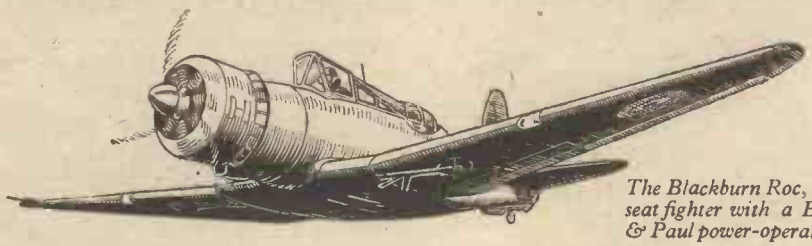


The Blackburn Skua which was the first monoplane fighter and dive-bomber designed for operation from aircraft carriers.

A High-Wing Twin-Engine Monoplane

The Blackburn BOTHA, a reconnaissance bomber and torpedo carrier, was recently announced as serving with the Fleet Air Arm, although as a twin-engined landplane it has more in common with the shore-based types of the Coastal Command. It is chiefly employed in operational training. A *high-wing monoplane*, it is powered by two 930 h.p. Bristol "Perseus" sleeve-valve air-cooled radial engines. No particulars are released concerning armament and performance.

Distinctive points are:—Wide, straight centre section of wings, with sharp taper and full dihedral outboard of motors; low aspect ratio: narrow, rounded wing-tips. The tall single fin and rudder is mounted forward of the extremity of the fuselage. The tailplane, which is mounted high and somewhat aft of the fin, has a tapered leading edge, straight trailing edge, and rounded tips. The fuselage is unusually long, with the control cabin forward of engine nacelles, an offset glazed bomb-aiming panel in the nose, and a rearward-facing turret on top of the fuselage, amid-ships. The engine nacelles are large, fully underslung, and they house the partially-retracted wheels.



The Blackburn Roc, a two-seat fighter with a Boulton & Paul power-operated gun turret.

Low-Wing Monoplanes

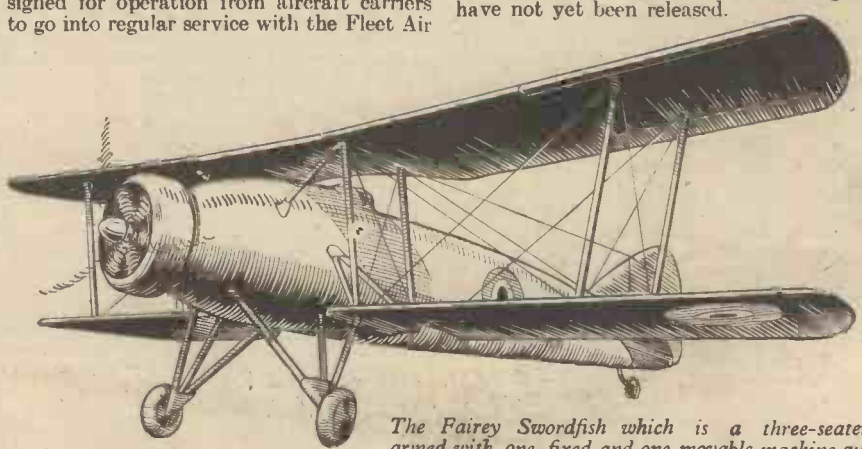
The Blackburn SKUA was the first *monoplane* fighter and dive-bomber designed for operation from aircraft carriers to go into regular service with the Fleet Air Arm. Developed in 1937, the latest type is fitted with a 905 h.p. Bristol "Perseus" sleeve-valve radial air-cooled engine, giving a top speed of 225 m.p.h., and a cruising speed of 187 m.p.h. Special features of design are folding wings, catapult points, deck-landing gear, and water-tight flotation compartments in the fuselage.

Principal recognition points are: Low-wing monoplane with radial engine and long two-seat glazed cockpit. Tapered wings have moderate dihedral outboard of centre-section, with sharp dihedral at the tips. The taper is more marked in the trailing than in the leading edge. Wing-tips are narrow and rounded off. The tail unit is most distinctive, the tall, rounded single fin and rudder being placed well forward of the end of the fuselage. The narrow tapered tailplane is mounted on top and at the extremity of the fuselage. The under-carriage retracts.

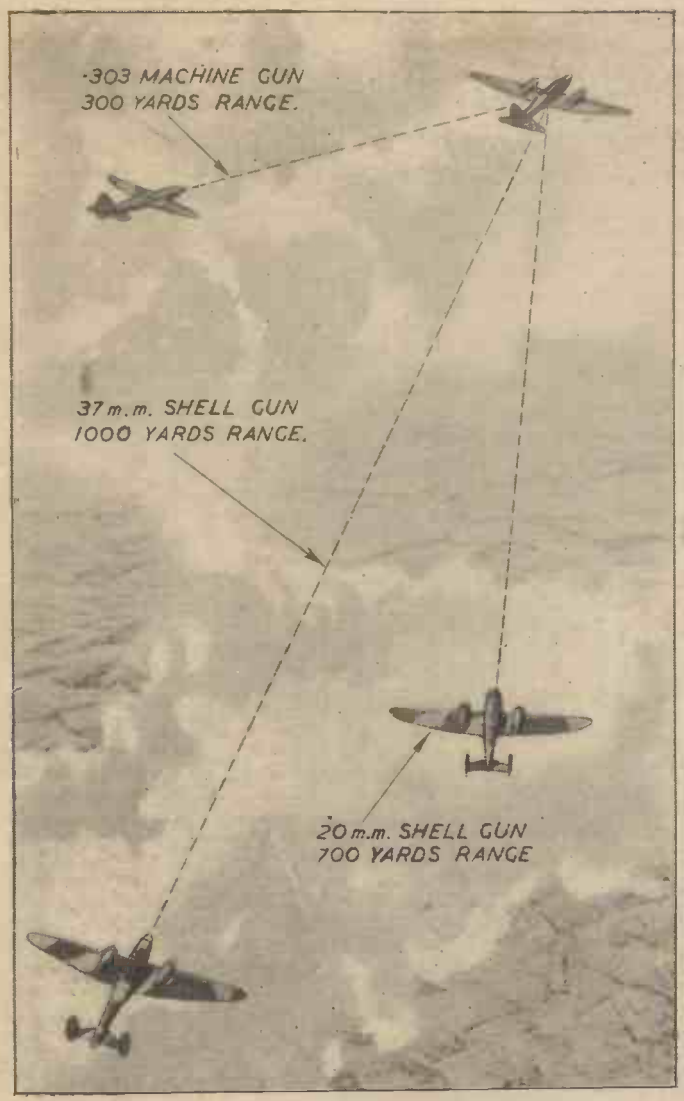
The Blackburn ROC, a two-seat fighter fitted with a Boulton Paul power-operated gun-turret, was developed in 1938. Apart from the changes in the design of the cockpit, etc., necessitated by the addition of the gun turret, its power plant and general lines are the same as those of the Skua. In the side view the turret and its retractable fairings provide a notable recognition point. In the head-on view the wing dihedral is slightly more marked than that of the Skua. On the other hand, the Roc has not the sharp dihedral at the wing-tips which characterises the Skua. The under-carriage retracts. There is also a float-seaplane version.

The FULMAR is yet another successful Fairey type, developed from the experimental P4/34 bomber. A two-seat fleet fighter, it is a formidable aircraft, having eight wing-guns with rate of fire corresponding to that of the Hurricane and Spitfire. The Fulmar was first mentioned in action last autumn and it has recently been reported as protecting the operations of Swordfish torpedo-carriers.

Fitted with a Rolls-Royce Merlin liquid-cooled in-line engine of 1,145 h.p., the Fulmar is estimated to have a top speed approaching 300 m.p.h. Official figures have not yet been released.



The Fairey Swordfish which is a three-seater, armed with one fixed and one movable machine gun



In our May issue an article in Aircraft Armament dealt with the advantages and disadvantages of machine guns and cannon. This illustration shows the effective range of each type of gun.

Coal Mine 2,000 ft. Up

IN the South Island of New Zealand there is one of the strangest mining towns in the world. Denniston is nearly 2,000 feet above sea level and is a self-contained town perched on the brow of a mountain, and having a population of only 1,880. There are three mines on this site which are operated by the Westport Coal Co., Ltd. The miners who burrow into the mountain for coal, claim that, in quality, it is equal to the world's best. When naval ships were coal burners, Westport sent its coal away for the use of the British Navy. H.M.A.S. "Sydney," of "Emden" fame, did twenty-nine and a half knots on Westport coal, compared with twenty-five knots on picked English fuel.

Six Miles up at Sea Level

THE Meteorological Office have erected new "altitude" plant for the purpose of discovering what effect high altitudes and the stratosphere have on man, aeroplanes, and the instruments they carry. Atmosphere exactly similar to that experienced at a height of over six miles can be created with this new plant.

A refrigerating machine which can be controlled by one mechanic, who also attends to other details, creates the correct pressure and temperature. Thermostat control is set to get the plant going, and the mechanism does the rest.

The susceptibility of men to the rigours of stratosphere flying can be tested in this chamber, and instruments can be tested for their accuracy and proper operation under stratosphere conditions.

It takes only forty minutes to reduce the temperature in the new chamber to thirty degrees centigrade, and it is properly strengthened and insulated to prevent it from collapsing under the tremendous pressure from the external atmosphere when the internal pressure is reduced.

Building a House Roof First

A Swedish inventor claims that if you put up the roof of a house first, the workmen are protected from wet weather and building costs are cheaper because work is not interrupted. He has invented a motor which lifts the roof progressively as the walls are built. The workmen erect the walls from platforms which are suspended from the roof.

Flour in the Foundry

FIVE hundred tons of flour are consumed in a normal year by the Ford Works at Dagenham in the production of cars. The flour is milled from maize and is used in foundry work, being mixed with sand used in making the intricate cores into which the molten metal is poured. The flour gives the sand sufficient bond until the core is baked.

Measuring Soil Moisture

MOISTURE in the soil is measured by means of a new device which consists of a block of gypsum in which a pair of electrodes is embedded. It is set in the soil in such a way that soil moisture passes into the gypsum. The resistance to the passage of an electric current becomes lower in accordance with the amount of moisture the soil is able to deliver to the block. It is thus possible to calculate the amount of water available for plant.

Road Magnet

THE American Public Works Association reports that Missouri has produced a "Road Magnet" on wheels, which is designed to rid the roads of nails, bolts and other objects which play such havoc with tyres. Three powerful electric magnets are carried on the device, each of which will cause a three-pound object to leap as far as four inches. The magnets are suspended from the chassis of a two-ton truck, a generator mounted on the chassis is driven by a separate engine and supplies the current. They pick up four and a half pounds of iron objects per mile of travel.

New Tank Weapon

A SELF-PROPELLED anti-tank gun is being developed by the United States Army. Army Ordnance officers describe it as an answer to the German armoured divisions.

THE MONTH OF SCIENCE

Colour Aids Munition Workers

NEW women workers of the M.G. Car Co., engaged on drilling, have their job made easier by using drills coloured to correspond with the marking of the holes to be drilled. Each size drill has a colour and drilling jigs have coloured lines painted on them from hole to hole. The same colours appear on the top part of the drills of the respective sizes.

New Stratosphere Plane

AT the Farmingdale, Long Island, factory of the Republic Aviation Corporation, a new U.S. Army plane designed to pursue enemy bombers at an altitude of 35,000 and 40,000 feet is being constructed. The Army Air Corps plan to build 1,000 of these machines. The new plane, which will be in the 400 mile an hour class, will be the first single seat military aircraft to be equipped with the secret turbo-charger for its engines. It will be as large as a small transport plane and will weigh in excess of 11,000 pounds in contrast to the 6,000 pounds of ordinary pursuit machines.

Creosote for Diesel Engines

BEFORE the war at least one transport company made investigations into the use of creosote as a fuel for Deisel engines. It has since been given attention by other authorities and tests in different parts of the country have taken the form of running buses on a mixture of 30 per cent. creosote with 70 per cent: Diesel fuel oil. The object has been to obtain data which will show the extent to which creosote could be used generally for similar purposes throughout the country.

Soviet's Latest Cure

SLAG from blast furnaces is now being used by Soviet scientists for curative purposes. Slag contains silicic acid, lime, magnesia, sulphur compounds, and alkaline. It has been found that when hot slag is put into water it assumes the same qualities as the waters of sulphurated hydrogen springs. At many iron, steel, and chemical plants special hospitals have been

established, and thousands of patients receive slag water baths.

1,000 *m.p.h. Planes*

IN ten years there will be 1,000 m.p.h. aircraft forecasts Robert J. Woods, the man behind the design of the bullet-nosed 400 m.p.h. Aerocobra fighter. "These aeroplanes will have new types of wings, new power plants, new everything," he said. Planes will run on radio tracks, there will be pressure-proof cabins, and the speed won't affect the flyers.

World's Largest Battleships

IT was stated recently by Mr. Maas, a member of the Naval Affairs Committee of the House of Representatives, that the next five battleships to be built under the estimates for the two-ocean navy programme will be from 60,000 to 65,000 tons each, the largest in the world.

Aid to Navigation

MAURICE POIRIER, a watchmaker and inventor employed at Burbank (California, U.S.A.) aeroplane factory, has invented a device which will eliminate time errors in navigation and will enable navigators to determine their position more quickly. The "Conversion of Arc and Time Clock," as it is called, consists of a chronometer with movable dials which may be adjusted without interfering with the running of the timepiece, and a vernier at the top of the clock to record minutes and seconds of time with the corresponding conversion of arc during elapsed time of observation. An original feature of the chronometer permits it to be set to the second from the radio time signal.

A Wooden Aeroplane

A LAMINATED wood training aeroplane built to Army and Navy specifications has been accepted by the civil aeronautics authority as airworthy and entitled to registration. The material is called "Aeromold" and the machine is a low-wing two-seater monoplane constructed without the use of aeroplane metals, but stronger and more manoeuvrable than a metal machine.

IN THE WORLD AND INVENTION

New Aero Engine

IN his recent broadcast, Lord Beaverbrook, then Minister of Aircraft Production, disclosed that a new aero engine, the Sabre, was in production. This engine has a smaller frontal area than any other aero engine, and follows to some extent in the line of Napier H type engines. During nine months five new engines have been brought from experiment to manufacture.

Cotton Shelters

MR. E. C. WALLACE, a New York engineer, has planned cotton raid shelters. He says a seven-foot thickness of cotton would resist penetration by a 6,000 pound bomb falling from 30,000 feet, whereas a 2,000 pound bomb falling 15,000 feet would penetrate six feet of reinforced concrete. Cotton, he said, can also be made fire-proof.

Tinned Cheese

MR. NORMAN GOLDING of Washington State College, has invented a means of tinning Roquefort-type cheese, matured in a cold storage cylinder like an "iron lung" and ripened to suit different tastes. The "iron lung" is a substitute for the natural caves near Roquefort, France, where the genuine Roquefort cheese is made.

Letters in Miniature

THE Postmaster-General has announced that in order to meet the need for cheapening and expediting homeward postal communications from the British Forces in the Middle East, the Airgraph Service, the first of its kind in the world is to be introduced. The operation of the service is summarised as follows. The sender writes his message on a special form 11 in. by 8 in., with his address in a panel in block letters. This is photographed on to a very small film and sent by plane to its destination. On arrival in England an enlargement is made and forwarded to the stated address. The cost is 3d. per letter and as 4,500 film negatives weigh only one pound the saving of space and weight in the plane can be easily understood.

Bonded Abrasives

THE home of carborundum, it is not to be wondered at that the U.S.A. leads the world in the development of cutting tools and abrasives. R. C. Benner and A. L. Ball of the Carborundum Co. have patented a process by which diamond particles are mixed with powdered glass and a carbon-base binder. The mixture is first heated in air to disperse the binder through the whole, and then heated in a reducing atmosphere to above the melting point of the glass. The latter encases the diamond particles, and when cool, the vitreous mass is ground, and dispersed in a resin, which is moulded under heat and pressure.

Another patent emanates from E. T. Rainer, United States Rubber Products, Inc., in which the abrasive particles are united with synthetic resin or a rubber product. To these are added a salt, such as potassium chloride or sodium carbonate, the properties desired in the salt being a melting point of 700°—1,200° and water solubility. There appears to be a keen interest in resin bonded abrasives these days, judging from the number of patents on the subject, and it is clear that the manifold character of synthetic resins will enable a fine control to be effected over the action of the abrasive particles, so bringing in wheels where formerly they might have been inadvisable.

Shedding Petrol Tank

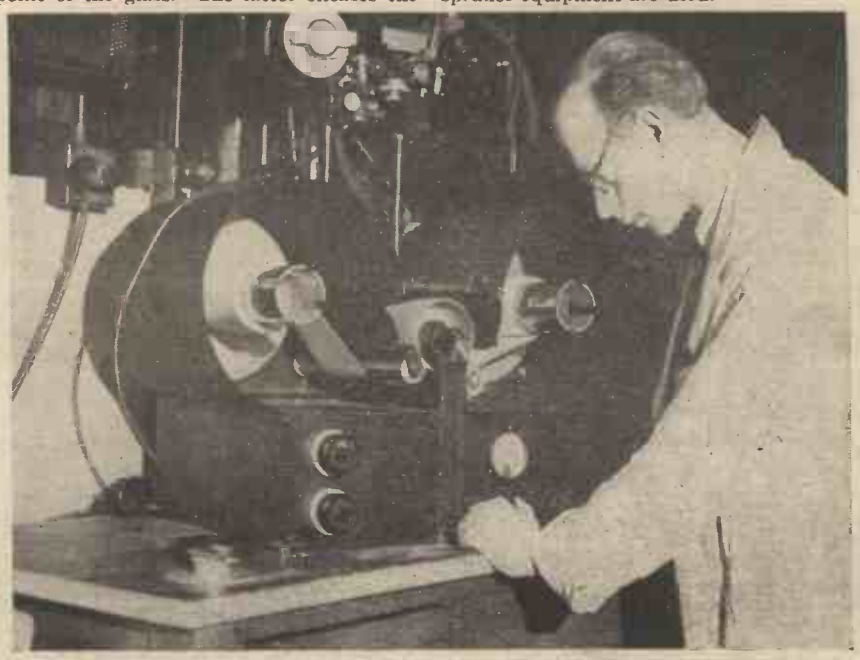
IT is claimed that, among other unusual features, the Aerocobra has an additional detachable petrol tank, enabling it to cruise at 250 miles an hour up to a range of 900 miles. The pilot presses a lever, when the plane is in action, and automatically sheds the heavy additional petrol tank. This leaves the aircraft free to manoeuvre at a top speed of "400 m.p.h. plus."

Giant Film Screen

PART of an abandoned airport at Valley Stream, New York, which has been turned into an outdoor motor car theatre, has a moving picture screen which cost over seven thousand pounds and is said to be the largest in the world. The screen is supported by a five-storey structure containing more than fifty tons of steel girders. Projectors of special high power throw pictures on to the screen, and directional loudspeakers carry the sound to the audience sitting in cars parked on a series of ramps.

Loudspeakers on the Underground

SEVERAL of the large London Underground stations now have porterettes, who are provided with sound apparatus so that they can make themselves heard. Tannoy power microphones with their associated loudspeaker equipment are used.



Showing a continuous enlarger printing the film message on to photographic paper at the rate of 60 per minute. (See paragraph "Letters in Miniature.")

The World of Aviation

New Types of Planes, and an Ingenious Method of Combating Bombs.

The Hawker Typhoon

THE Hawker Typhoon, which is now in full production for the R.A.F., is the most formidable air fighter in the world. It is powered with the Napier Sabre engine which has the distinction of being the most powerful and most unorthodox engine in the world. Owing to its compactness the pilot has excellent vision, and this feature has enabled the designer, Mr. Sydney Camm, Director and Chief Designer of Hawkers, to achieve the tight-turning circle, which is so vital in combat. Major B. Halford is the designer of the engine and in spite of its incredible output it is exceedingly small. The Sabre develops something like 2,400 h.p. which is nearly two and a half times as powerful as the engine fitted to the first successful Hurricane. The Typhoon is capable of a speed of over 400 m.p.h. and its fire power, which consists of machine guns and cannon, makes it a formidable fighter. Flight-Lieut. Lucas, who tested the plane, dived it faster than any plane that has ever been built. Another feature of the plane is its remarkable climbing power.

New Dive Bomber

A NEW type of dive-bomber will be produced in large quantities at the new Curtiss-Wright Corporation factory at Columbus, Ohio, U.S.A. B. S. Wright, vice-president of the Corporation, said in an interview that the new machine is designed to meet navy requirements for:

"Twice as many heavy bombs as any existing dive-bomber, a range twice that of present models, twice the gunfire of any other single-engine navy aircraft, and a maximum speed of 100 m.p.h. faster than current types." The plane, a two-seater, is fitted with a 1,700 h.p. Wright Cyclone engine.

New American Fighter

WING-COMMANDER J. R. ADAMS has recently completed tests of the Bell Air Cobra fighter aeroplane, which company officials say has proved the fastest single-motored craft in production. A ceiling in excess of 35,000 ft. has been established and the aeroplane's cannon and six machine guns have been tested satisfactorily above 30,000 ft. in temperatures under zero. The speed of the fighter is reported to be about 400 m.p.h.

The Botha Withdrawn

THE Botha torpedo-bomber reconnaissance monoplane, whose existence was disclosed only four months ago, has been withdrawn from operational use—that is, active service—and is now used as a training aircraft.

Woman Aircraft Designer

A WOMAN is the chief aeronautical engineer of a Canadian aeroplane factory at Fort William, Ontario. She has recently designed a new type of trainer aircraft which is now undergoing tests at the Canadian Car and Foundry Co. It has been heralded as a distinct advance on existing types of primary training machines and will doubtless be used extensively in connection with the Empire Air-training Scheme.

"Pick-up" Air Mails

THE "pick-up" air mail and freight services operated by All-American Aviation have been such a success that the company is applying for permission to extend the system to seven more routes, serving some 250 cities and towns in New England, New York State, New Jersey and Pennsylvania.

(Top) The "Wilford-Latta" centrifugal bomb destroyer seen operating above a model naval docks.
(Below) The inventor adjusting the steel cords before demonstrating the device.

Aeroplanes on the "pick-up" service lower a cable, to which the mail-bag for delivery is attached, on approaching an aerodrome. The bag is released so that it falls at the required spot. Mail for collection is suspended between two vertical posts on the aerodrome and is picked up by a hook suspended from the aircraft.

Britain's Lead in Air Design

SO far, the test of actual war has proved British air design to be remarkably sound. Fundamental principle has been the stress of armament. With bomber aircraft this was carried to the length of sacrificing some of the possibilities of higher performance. Germany's more lightly armed bombers planned for the war—He. 111's and Do. 17's, for example—were several m.p.h. faster than comparable British types. But whereas R.A.F. bombers have been able to fight it out successfully with enemy interceptors, the German bombers have proved comparatively easy victims whenever Hurricanes and Spitfires make contact. First steps in Britain's wartime progress, aside from numerical increase, was consequently focussed on armament. Existing bombers which had been found to be under-gunned were given more guns. New types already projected, both bomber and fighter, had increased armament specified. Cannon, not previously used in British fighters, was given a place, and to carry the extra armament, new or improved engines were fitted.

Main Bomber Types

THE three main bomber types with which the R.A.F. fought during the first eighteen months—Hampden, Wellington and Whitley—were thus given such increased performance and striking power as to be almost different aircraft. Behind these redesigned bomber types are forming up the fleets of newer and bigger bombers—Britain's Stirling, Manchester and Halifax; America's Boeing B. 17.C. and Consolidated Liberator—all faster and more heavily defended.

Similarly, later mark numbers of the R.A.F.'s standard single-seat fighters, the Hurricane and Spitfire, were given the extra m.p.h. and ceiling which would enable them to catch anything the Nazis have flying. Also completely new types were produced, the two-motor Beaufighter and Whirlwind and the single-motor Tornado and Typhoon carry further the tradition of speed with high hitting power.

All these advances in design rely ultimately on getting more power into a limited space. That is why the new Napier Sabre engine mentioned previously, with its unique construction giving it a very small frontal area, is so significant. It is a portent of Britain's determination and ability to press on to air supremacy.

600 Weather Climbs

AN R.A.F. officer recently broke the record for a Meteorological Flight by making 587 weather "climbs" to 25,000 ft. By now he has made 600. The previous individual best was 586. The record-breaking pilot—now a Flight Lieutenant—was recently promoted to command the Flight. In just over four years these "Met" fliers have not missed a single scheduled flight in a total of 2,376 climbs.

A Bomb Umbrella

AS we have dealt with bombing planes let us now turn our attention to the latest American device for combating bombs, which is now being investigated by the U.S. War Department. It consists of an umbrella of long steel cords attached to a hub. The hub, which is mounted on a tower, is revolved at high speed, and the steel cords spread out fanwise thus forming an "impenetrable" curtain. A falling bomb coming into contact with it would, the American inventors claim, explode. so saving buildings or ships below.

NEW SERIES.

Making a Success of Your Photography

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

A First Lesson in Development

EVERY photographer, whether amateur or amateur turned professional, will readily acknowledge that the greatest thrill they have experienced since they received their first camera was when they developed their first negative.

Those who started the hobby in the days of plates, or before roll films made their appearance, will assert that it is not possible to get the same thrill or fascination in these days of roll films and developing tanks; that, however, is not quite right, for in the opinion of most amateurs there is a thrill every time the tank is opened, and we see the result of our efforts, and realise that another batch of good negatives have been secured.

The plate user certainly did get a fuller and a longer thrill for he was in the happy position of being able to watch the whole process from the time the dark-room ruby light was switched on, the plate placed in the dish, and a measure full of chemical solution poured on to it. Then with eyes glued on to the dimly lighted dish a ghostly image of a 'something' began to appear on the plate, and gradually the details presented themselves, and it became possible to recognise what the camera had seen a few hours or days before; a few minutes and a blackness had taken possession, and the image could not be seen. After a few minutes in another solution the plate was examined by means of a white light and revealed the portrait, or landscape, on which we had exposed the plate.

The thrill and fascination is still awaiting you who have never tried your hand at developing a film; you can still watch the progress of that ghostly image by developing by the see-saw method in a dish, or pudding basin. The process is so simple that when you have done one film you will always want to do your own work.

The Process of Developing

Before commencing to explain the various means which can be employed for the process of developing you should first understand why the process is necessary, and what actually takes place in the emulsion of the plate or film.

You have already been told that the sensitised emulsion of the film consists of gelatine in which certain chemicals have been dissolved and very carefully incorporated, and that the chief of these is nitrate of silver, the salt which makes the emulsion sensitive to the action of light. The light reflected from each point of the scene, or subject, is collected in rays and passed through the lens on to the film in sharp points, causing a definite reaction to take place on each of the grains of silver in the emulsion. There are various theories as to this reaction, but it is still an open query; it is thought by some that a physical change takes place in the grains of silver where the light strikes, others think that this takes place only when the developer is poured over the emulsion.

Now try to follow the workings of the developers. There are several developing agents or, as they are termed by the chemist, reducers. Here are some of the most popular, and they are given in the order in which they were invented: Acid Pyrogallic, Hydroquinone, Metol, Amidol, Paramidophenol, Glycin, Chlorquinol, and Meritol; most of these chemicals are derived from coal tar and several were invented by English chemists and scientists. Their action is to reduce or throw down the silver salts in accordance with the amount of light action which each grain has received. If used by themselves they would be unable to do this correctly, as some of them would throw all the silver

A portable dark-room lamp operated by a flash-lamp battery. It is fitted with interchangeable glasses.

down without any discriminating influence, and others would be so slow that a general fog would appear over the surface of the film, and so it is necessary to use other chemicals to accelerate or restrain the working, and for this we find in the various formulae that it is necessary to include soda or potassium salts such as soda sulphite and carbonate, potassium bromide and potassium metabisulphite, which latter serves to preserve the solution, and to stop it deteriorating. By the judicious use of these chemicals the early photographers were clever enough to evolve certain mixtures which controlled the reducing power of the developing agents, and so enabled them to develop those parts or grains of silver in correct ratio to the light action, thereby getting a true rendering of the subject in reverse, or as we term it, "negative."

The "Perfect" Negative

Now, unless the rendering is correct, we cannot expect to obtain perfect negatives, we shall miss the long range of half-tones or gradations to which reference was made in the previous issue, the image would be obscured in parts by fog, or be so dense that it would be impossible to print through and so get a perfect positive or print. When therefore, any reader desires to make his, or her, solution for developing, it is very essential that a formula is selected that is known to be correctly balanced, that is to say, the developing agent must have its right accelerator and preservative, and if it happens to be one that requires it, its restrainer. With such a properly constituted solution the worker can be satisfied that a good result is possible provided other factors, to which reference will be made, are correct.

In developing work there are certain pieces of apparatus that are necessary, but the expense is not much, and the appliances will last for many years; at the commencement it is possible to do with makeshifts, as for instance, a couple of pie or pudding dishes borrowed from the kitchen, an ordinary tumbler to serve as a measure; if it is the regulation size it will be found to hold 10 ounces of liquid. It is, however, necessary to have a dark-room lamp, and you will be wise to select one having both ruby and orange glasses which can be alternated to suit the work in hand. A thermometer is also a useful item.

Equipment

For the benefit of those who intend to make a serious hobby of their photography, and would like to have some idea of the cost of various items, I am giving what must be recognised as the most economical sizes for future, as well as present use. The prices are taken from one of Ensign's price lists, but doubtless some of these

This dark-room lamp is attached to a bracket which can be fitted to the wall or bench.

Effective washing can be carried out with a supply of water measured in ounces.

must have altered recently, and I would advise readers to send for the latest list. As this firm has been taken over by Johnsons, of Hendon, N.W.4, enquiries must be sent to that address.

Dishes.—2 Half-plate (6½ x 4¾) Porcelain, deep. Approx. 3/- each.

Measures.—1 to 4 oz. at 2/- and 1 to 10 oz. at 3/-.

Thermometer.—1 at 2/-.

Darkroom Lamps.—The prices for these vary according to the illuminant: those for night-lights range from 2/- (ruby glass only), for oil burning from 2/6 to 5/-; extra for separate orange glass—a few pence only.

For electric lighting the prices range from 16/- to as much as 35/-, but it is possible to have one fitted with a flash-lamp battery, and costing approx. 4/6.

There is still a further alternative, which may prove the cheapest:—Philips dark-room electric bulbs of the right colours at 3/- each.

With these items installed it only remains for the amateur to get a supply of the necessary chemicals, and in order to make the work as simple, and as sure of success as possible I am going to advise the use of a developer named Azol; it is in the form of a solution, and only requires water to be added to it, no weighing or mixing of other chemicals at this stage. This developer is probably the most popular amongst amateurs, as it has been on the market for about 35 years. A 3 oz. bottle will cost 2/-, and incidentally this is enough to develop about 2 to 3 dozen spools. The only other chemical required is some acid fixing powder, and an 8 oz. tin costs 10d., and makes from 60 to 120 ounces of solution, according to the work in hand.

The "Dark" Room

We will now assume that a film has been exposed, is waiting to be developed, and that you have the kitchen or bathroom at your service for an hour or so. In one of the measures some developer has been prepared by taking ¼ oz. of Azol to 6 oz. of water, and in the other measure the fixing bath has been made by dissolving one oz. of the powder in 7½ ozs. of water. On the table there is a jug of clean water together with the two dishes. The temperature of the solutions should be about 65 degrees Fahr. At the back of the dishes is placed the darkroom lamp.

The time has now arrived when all white light must be switched off; take a look round the room to see that there is no light leaking through the bottom of the door or

A thermometer is necessary for ascertaining the temperatures of your developing solution.

through any window, and when this has been found satisfactory pour the solutions into the dishes making sure which is the developer and which the fixing bath, then switch on the ruby light. Now take the spool of film which, for this lesson, we must presume is just an ordinary popular make, not panchromatic, unroll the paper from the actual celluloid strip taking hold of the first end when you reach it, and allowing the paper to fall to the floor until the second end of the film is reached which must then be taken by the other hand; bring the two hands fairly close together to form the film in a hanging loop. Now lower this loop into the jug of clean water and move the hands, first the left and then the right, up and down until the film has been completely submerged for two or three minutes, care being taken to avoid any air-bells forming on the surface of the film. On no account must the film be allowed to touch and stick to itself. Keeping hold of the film lower one hand to the edge of the dish containing the developer and pass the film into the developing solution, drawing it through by raising the hand and lowering the other gradually. Make a note of the time when the film is placed in the developer because it must remain in this bath for about 8 or 9 minutes; keep the see-saw action of the arms going, and be sure that the film is under the surface of the solution for the allotted time.

The Fixing Bath

When the 8 or 9 minutes is reached lift the film from the developer and pass it into the dish containing the fixing bath and continue the see-saw action in this for at least another four or five minutes, then, if the dish is a deep one, you may drop the film into it but be certain that the solution completely covers it and leave it like this for another five minutes, and you may then turn on the white light.

While the film was in the developer you will have enjoyed watching the gradual appearance of the ghostly image, and when it was in the fixing bath you will have noticed that the greyness on the back of the film was being gradually dispersed; this was the free silver, which had not been acted upon by the light, being reacted upon by the hypo to make it soluble in water.

When the white light was turned up it was possible for you to examine your first spool of film that you had developed, and all that now remains to be done is to give it a thorough washing for about half an hour in running water, and then to hang it in a dustless place to dry.

During the course of this process you must be careful to avoid touching the surface of the film with your fingers or knocking it against any sharp edge, as it is so very soft that it can be easily and irreparably damaged.

Dock Sluices

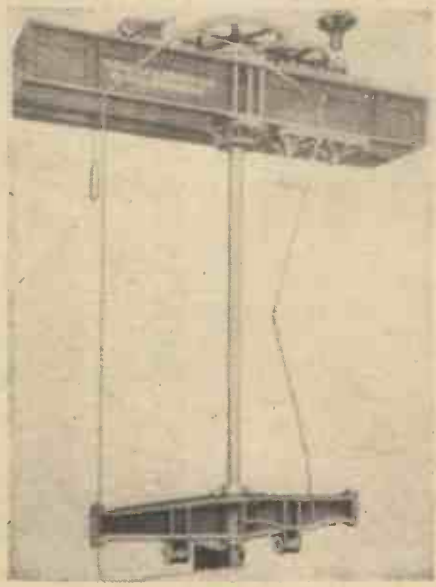
IN dock work, the gate of a sluice is known as a paddle, and it is suspended from a crosshead from two links referred to as spear rods. The paddle, which may be of parallel or taper section, works in a groove formed in the dock culvert, the two faces of which are of dressed and polished granite.

Paddles

With a parallel sluice there is usually an inch or so of clearance between the paddle and the faces of the paddle, which is articulated with the spear rods, moves on to the inner or outer face in accordance with the relative water level inside and outside the dock. The sluice well, in this case, fills with water to the high level.

The paddle of a taper sluice when closed, is, of course, wedged on to its seat and seals the culvert from the well, making a flow-tight joint on both the inner and outer faces of the culvert groove. Leakage is usually sufficient to fill the sluice well, but the water can easily be kept down with a small pump, should inspection of the gear within the well become necessary.

Some paddles are 12 ft. in height and



Capstan Gear for operating a 6ft. by 12ft. sluice.

6 ft. in width, and weigh as much as 10 tons.

They are made of tough wood from a tree known as Greenheart, which grows in British Guiana and the West Indies. The wood is of light to dark olive green, marked with brown and black streaks of dense even texture, very hard and straight grained. This timber is particularly difficult to machine, although it planes well.

Operation

Sluices for dock work are operated either by hand, by hydraulic power, or by electricity. With electrical operation provision is always made for auxiliary hand control in the event of failure of current. There is no difficulty in designing for hand operation, but the speed of opening and closing which can be obtained is necessarily less than by power.

Hydraulic operation is used to a great extent, and it is usual for operating cylinders to be designed for high hydraulic pressures. One example of operating mechanism is shown in the accompanying illustration: it is the capstan gear used for the operation of a taper paddle.—*Glenfield Gazette.*

The Hythe Motor-driven Lifeboat, The "Viscountess Wakefield"

Launching Lifeboats

A Description of the Method of Launching a Lifeboat by Tractor—A Paper Read Before the Recent Annual General Meeting of the Institution of Mechanical Engineers, by Lt.-Colonel P. H. Johnson, C.B.E., D.S.O., M.I.Mech.E.

(*Concluded from page 290. May issue*)

THE unditching beam was carried on the tank and its ends could be chained to the tracks through side openings in the driver's turret without any member of the crew getting out of the machine. As the name implies, the unditching beam finally standardised on mark IV and mark V tanks could, if necessary, operate continuously. This was arranged by fitting a pair of angle rails to the top of the machine over which the beam could slide from rear to front, being drawn forward by the chains attaching the beam to the tracks. The rails were, of course, raised high enough above the roof of the tank to allow the unditching beam to clear all obstructions such as turret, exhaust pipes, etc. In this way, without appreciable exposure of the crew, hundreds of yards of otherwise impassable mud could be traversed until firm ground was reached.

It is interesting to note that the mark V tank, as used in the Great War of 1914-18 was fitted with a continuous unditching beam.

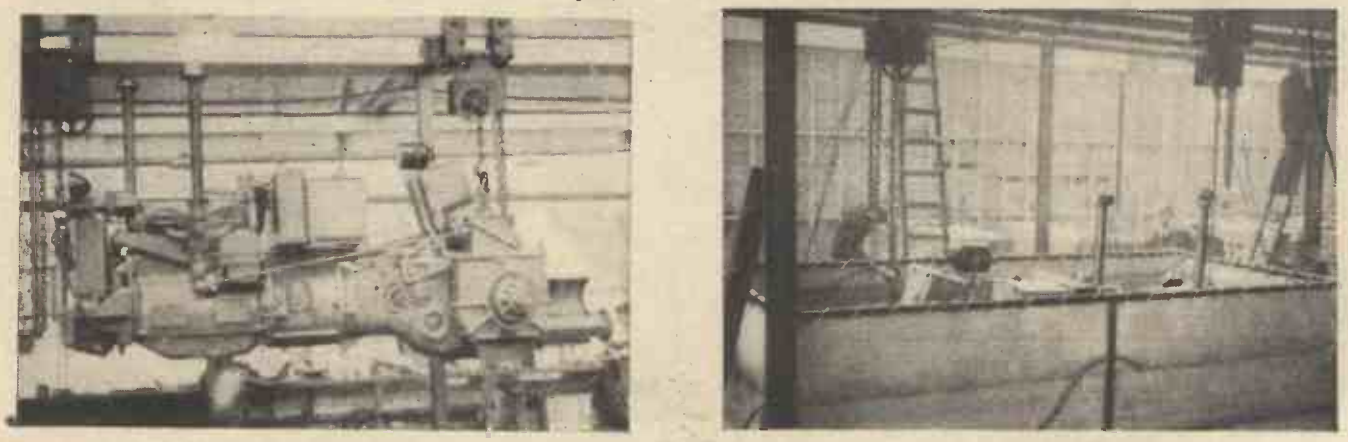
The conditions which obtained for tanks in Flanders in 1917, and those which at times apply to lifeboat tractors on beaches where quicksand and mud pockets abound, are sufficiently alike to call for similar action. There is no necessity, however, in the case of the lifeboat tractor to provide for continuous action of the unditching beam as the boat crew can easily handle the beam from rear to front if one application of it is insufficient to bring the machine on to firm ground. Lugs are provided on the beam which engage with the tracks by a small sideways movement so that attachment and detachment is a matter of seconds. When the sprag beam is used for unditching purposes, it is important that there should be no relative movement between the two tracks and thus arises one reason for the necessity of the differential locking device with which the machines are fitted.

Differential Lock

When a differential lock is fitted, it is important to provide a safeguard to prevent any attempt to steer the tractor when the lock is operative. This is effected by means of an interlocking device which ensures that the steering wheel cannot be moved when the differential gear is locked and that the differential lock cannot be engaged until the steering wheel is in the neutral position.

Tractor Tests when Submerged

It is probable that with very few exceptions there is no British service which



Figs. 18 *and* 19. *Watertightness test for lifeboat tractor. (Left) Power and transmission unit being lowered into tank. (Right) Unit submerged and engine running.*

The Barrett cabin-type motor lifeboat "The Rankin" stationed at Aith

demands a higher standard of mechanical perfection than the Royal National Lifeboat Institution. No effort or expense is too great to guard against the possibility of failure or breakdown which may directly or indirectly involve loss of life. Thus, when every possible precaution has been taken to ensure that the internal mechanism of a lifeboat roadless tractor is effectively watertight, the most rigid tests are applied to ensure that nothing has been overlooked or is inadequate. The first of these tests consists in closing the exhaust and air intake pipes and subjecting the interior to air pressure. In this condition the tractor is submerged in water until it is completely covered, when the minutest leak of air is discernible. The first test of this nature is carried out before any oil is put in either the crankcase or gearbox as it has been found that oil tends to close a slight leak. After immersion for several hours under these conditions, the internal pressure is released, oil is provided for the engine and gearbox, and the tractor is then run under water, being repeatedly stopped and started while submerged. In this way complete watertightness in working conditions can be initially ensured.

Figs. 18 and 19 illustrate the procedure adopted for testing the tractor for watertightness as described above. This work is, of course, done before the frame, tracks, and track mechanism are added, but when the machine is otherwise complete with all working parts.

Alternative Method of Waterproofing Tractor

It might appear that it would be a simpler process to house the tractor power and transmission unit in a complete and separate waterproof casing, instead of individually waterproofing every possible inlet and joint. This alternative was carefully examined when the lifeboat roadless tractor was designed some four years ago. After a great deal of work had been done in this direction, the conclusion was reached that to make the machine waterproof by this method was quite impracticable without approximately doubling the weight of the machine. It was even then doubtful if permanent watertightness could be ensured in this way, bearing in mind the racking strains to which the tractor is necessarily subjected over rough ground. A multiplicity of spindles, shafts, controls, and wires have necessarily to be brought outside any such casing, and the waterproofing of these involves even greater difficulties than are encountered in the method actually adopted. Overheating would be likely to occur in any complete enclosure in a separate box, and accessibility to essential components would be difficult.

Running and Performance Tests

After concluding the submergence tests, each completed tractor is subjected to an eight-hour non-stop run at full engine speed before being dispatched to the coast for the final acceptance tests. The latter include a trial launch and the hauling of the carriage and boat over the most difficult portions of the beach ever likely to be used.

Internal Corrosion and Condensation

Experience has shown that slight accumulations of water can be found in the enclosed parts of the tractor, which are not traceable to leakage. They are accounted for by condensation. It will be realised that after a launch when the engine is shut down, the interior is filled with moisture and salt-laden air and that as the tractor cools and the heated oil drains from the metal surfaces, this moisture condenses on them and in a very few days can lead to serious corrosion.

To guard against trouble from this source, the standard procedure at all Royal National Lifeboat Institution stations, where these tractors are in use, is roughly as follows. Every time the tractor is used and before it is put away in the boat-house, it is thoroughly hosed down with fresh water. The engine is run daily for a period of about 15 minutes, until thoroughly hot, the tractor at the same time being both moved and steered. Samples of crankcase and gearbox oil are drawn off at frequent intervals from the lowest point to ensure that no leak has developed. Inspection of chambers not directly connected either to the sump or the gearbox is made at frequent intervals through the inspection covers provided.

Automatic Protection for Radiator Fan when Submerged

While many unexpected difficulties were met with and overcome in the design and experimental stages of this tractor, there was one item from which trouble was expected and which, in practice, gave none. It was feared that when running into the water, the radiator fan blades might easily be broken or distorted, and that it would be necessary, though extremely difficult, to find means of enclosing the fan. In practice it was found that immediately on entering the water, before the fan blades actually came into contact with it, the water picked up by the fan belt acted as a lubricant and had the effect of stopping the fan from working as long as it remained under water. As the engine cannot overheat during this time and as the services of the fan are not required, no adverse results arise, and a few moments after emerging from the water the moisture drains away from the fan belt and the fan starts working again.

Initial Disappointment

The lifeboat roadless tractor described in the foregoing paragraphs was by no means successful in its initial stages, in fact, trials with the first machine were in many ways disappointing. As in so many matters, success was the outcome of a series of failures. Even to-day the details of construction are continually under review with the object of introducing improvements wherever scope for them can be shown. Nothing is regarded as final. Lifeboats even heavier than those now used are under consideration for beach launching.

The Dover lifeboat, "Sir William Hillary"

MASTERS OF MECHANICS

No. 67—Inventor or Copyist? The Problem of Richard Arkwright, Pioneer of Cotton Manufacture.

THERE is a mystery concerning the life-story of Sir Richard Arkwright, the one-time Bolton barber, which will never properly be solved.

Official history has long attributed to this Lancashire worthy, who, after a crowded career, became possibly the world's first millionaire, the honour of having invented the art of mechanically spinning cotton, but then official history has often proved itself to be a lying jade, and, in the case of Arkwright, there exists, to say the least, very much doubt as to whether he ever invented anything at all.

Like Watt, swindler and the so-called "inventor" of the steam engine, Arkwright, in many respects, appears to have been an improver and an "arranger" of other men's ideas rather than an original inventor. He was not a mechanic, although he possessed some inborn mechanical ability. Yet it is doubtful whether he ever understood the practical use of tools, and, although he was gifted with extraordinarily quick mechanistic perceptions, he could never possibly have put together unaided the machine which he ultimately patented and successfully passed off as his own invention.

Thomas Carlyle, the author and historian, dubbed Arkwright "a plain, almost gross, bag-cheeked, pot-bellied Lancashire man, with an air of painful reflection, yet also of copious free digestion." Nevertheless, despite Carlyle's ill-chosen words, there were good points about Richard Arkwright. He was without the shameful villainies of James Watt, for he did not seek to grind other inventors down, although, naturally enough, he fought actions at law against infringers of his patents. All Arkwright claimed was a place in the sun, and Fortune favoured him sufficiently to enable him to reach such a position.

Richard Arkwright was born at Preston, Lancashire, on 23rd December, 1732, the thirteenth child of very poor parents. So impoverished were Arkwright's parents that the lad was forced out to work almost as soon as he could walk. Consequently, he never had any schooling apart from a few desultory lessons at a night school. This lack of rudimentary education weighed heavily with the future Sir Richard, for, throughout his life, he lamented his almost constitutional inability to write and to read with ease. When he was well over fifty years of age, it became his wont to spend four hours each evening in an endeavour to learn spelling and grammar.

Arkwright the Barber

Arkwright's first job of any consequence was that of lather-boy in a barber's shop in the Fylde village of Kirkham, not far from Preston. Here he became apprenticed to the trade of a barber, which trade he continued to follow throughout his youth and early manhood.

In 1760, at the age of 28, Arkwright moved to Bolton, a more populous Lancashire cotton centre, where he occupied a cellar "saloon" and placed over its dingy street-entrance a placard bearing the legend "Come to the subterranean barber, he shaves for a penny."

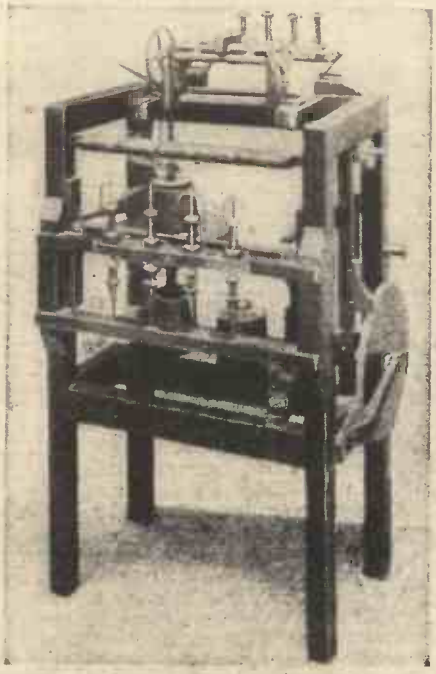
But the "subterranean barber" was more enterprising than the general run of his fraternity were in those distant days.

He obtained—it is not known how or where—a secret recipe for dyeing hair by a chemical process. In addition, Arkwright made a practice at times of shutting up his cellar establishment in Bolton and of touring the country, and of frequenting rural fairs in search of the much-coveted

Sir Richard Arkwright

long hair which was to be found on the heads of the country women of the period.

It is recorded that this enterprising barber became expert in the diplomatic art of wheedling from the rural lasses and the young women who attended the various country and town fairs their often luxuriant tresses which he generally managed to purchase for a trifling sum. After dyeing the hair by his secret process, Arkwright would then sell it on very advantageous terms to the London wig-makers who gave good sums for such human material.



One of the original water frames set up by Arkwright at Crompton Mill, Derbyshire

In the course of time, barber Arkwright, of Bolton, got such a name for the hair which he sold, that many of the London wig makers considered Arkwright's hair supplies to be the best in the country.

It was during his barber career at Bolton and, also, in the course of his periodical visits to the various Lancashire fairs that Richard Arkwright first came into direct contact with many of the Lancashire working folk, both spinners and weavers, who were directly concerned with cotton production. From their general conversation and from the various items of news which they brought to him, Arkwright began to realise the pressing need which was then arising for larger supplies of cotton yarn.

If only machines could be made to perform the task of the handworkers, Arkwright mused, the output of cotton goods would be increased many times, and the successful creator of the machines would almost certainly be rewarded with a fortune.

About this period, Arkwright is said to have occupied much of his time in trying to solve the problem of perpetual motion. Whether this was actually the case, or whether Arkwright's asserted quest for perpetual motion served merely to cover up his secret attempts at inventing a machine for the mechanical spinning of cotton, we shall never know.

Clockmaker

One thing, however, is certain concerning Arkwright at this period of his life. He evinced a taste for clock-mending and even for clock-making and, for a time, he toyed with the idea of changing over from the trade of a barber to that of a clockmaker. Indeed, in his first patent for the spinning machine which he subsequently "invented" Arkwright actually describes himself as a clockmaker, thus stressing his association with that mechanistic occupation.

In 1767, Arkwright, who was still carrying on with his barbering work at Bolton, formed an acquaintance with a clockmaker in Warrington named John Kay. (This John Kay is a totally different individual from the John Kay, of Bury, who made the first "flying shuttle," whose life story has been retold in article No. 23 of this series).

Arkwright commissioned John Kay to make for him some sets of wheels and "to turn him some brass and bend him some wires." Whether these articles were for Arkwright's excursions into the realms of perpetual motion, whether they were intended for his clock-making activities or whether they were wanted to aid him in his endeavours to construct a mechanical cotton-spinning machine we do not know. We do know, however, that although these seemingly haphazard efforts of his came to naught, he stumbled, through his association with John Kay, into a set of circumstances which led ultimately to his own personal fame and fortune.

"Water-Frame" Spinning Machine

In this year (1767) Arkwright produced what he subsequently called his "water frame," owing to the fact that water power was employed to drive the machine.

The water-frame comprised an arrangement of rollers and spindles whereby the raw cotton was spun into thread by being rolled out between two pairs of rollers, and by being subsequently twisted into thread and wound on to a spindle. Many threads of cotton could be spun simultaneously by means of this machine and, naturally enough, at a much quicker rate than even the most experienced and expert of hand-spinners could do it.

The great problem of Arkwright's life, as we see it now, is this : where did he get his idea of the "water-frame" spinning-machine from? Was this spinning machine, which, afterwards, revolutionised the world's cotton manufacture, genuinely his own invention, as official history has so often asserted, or was the whole invention borrowed, copied, or even stolen from another, as many indications tend to prove?

The question has been frequently discussed, there being upholders of both sides of the case. As mentioned at the commencement of this article, the problem of Arkwright's true share in the invention of his cotton-spinning machine will never be solved satisfactorily, although the evidence seems to point to the fact that Richard Arkwright was never a true inventor, and that in this matter of the spinning machine, he contrived to make a profit out of other men's minds just as he had done, in his barber days, out of women's hair.

Highs' Spinning Machine

In the year 1767 there lived at Leigh, Lancashire, a maker of weaving reeds named Thomas Highs, an individual of very humble origin, but, in many ways, an undoubted mechanical genius. To John Kay, clockmaker, of Warrington, Highs entrusted the making of various parts for a spinning-machine which he had invented.

Highs' machine was a successful one, and the details of it were conveyed to Arkwright at Bolton by John Kay. In a statement made in after years by Kay, the latter averred that Arkwright requested Highs to allow him to make a model of the spinning-machine, whereupon the trusting and, perhaps, somewhat simple Highs invited Arkwright to Leigh to view the machine in operation.

Arkwright, aided by Kay, seems to have got together a model of Highs' machine at this period, which model he removed to his native Preston, in which town, being financed by a local publican named Samuel Smalley, he set up the machine in the front room of a house belonging to the Free Grammar School of Preston.

Rapidly, however, Arkwright's circumstances in Preston became exceedingly straitened in consequence of his having neglected his trade of a barber. Moreover, he and Smalley did not venture to make public the spinning machine, since they feared its destruction by the mobs of enraged workmen who had previously broken-up other cotton machinery in nearby Blackburn and district. As a result of these circumstances, Arkwright removed his machine to Nottingham and there interested a banker named Wright in its possibilities. The machine, however, not being perfected as rapidly as Wright had anticipated, he withdrew from the project.

Arkwright's First Patent

Arkwright then took into partnership a certain Jedediah Strutt, of Derby, who had himself constructed a stocking-frame, and, also, a Samuel Need, of Nottingham, Having thus formed a miniature syndicate, Arkwright then proceeded to take out his first patent, which was dated July 3rd, 1769.

In the Specification of his Patent, Arkwright says :—

> "I have by great study and long application, invented a new piece of machinery never before found out, practised, or used for the making of weft grown from cotton, flax, wool, etc. That part of the roller which the cotton runs through is covered with wood, the top roller with leather and the bottom one fluted, etc., by one pair of rollers moving quicker than the other, draws it finer for twisting which is performed by spindles, four in number, each twisting one of the four threads delivered by the four pairs of rollers."

Fortunately, nowadays, inventors have to set out their Patent applications more clearly, but it will be seen from the above

In a secluded part of Preston, Lancs., stands the house in the front downstairs room of which Richard Arkwright first assembled his spinning machine.

extract that Arkwright expressedly mentions rollers, which device he undoubtedly obtained from Thomas Highs.

Having obtained his Patent, Arkwright, aided by the financial resources which he was able to command, erected a spinning mill at Nottingham. It was the first cotton mill in the world, its machinery being operated by the power of horses.

Arkwright's success with mechanical cotton spinning was almost immediate. In 1771, he erected a new mill at Cromford, near Matlock, in Derbyshire, which mill was operated by water power, and in which Arkwright's new "water-frames," as they were now termed, were installed.

In 1773, a further mill was set up in Derby, and, a couple of years later, Arkwright patented some additional improvements on his machinery.

The detailed story of the setting-up of these early cotton mills under Arkwright and others has never been told. One day such a narrative will be placed on record, and it will not make happy or edifying reading. For Arkwright and his imitators pushed into their mills women and even very young children, making them work long, exhausting hours under almost the worst of conditions. The workers hated the mills and, in some districts, they rose up and endeavoured to assail them and to destroy the machinery as soon as it was pu into action.

Patent Actions

Arkwright next erected mills at Manchester and at Chorley, Lancashire. He was now, however, beginning to meet with competition and opposition on all sides. Infringements of his patents sprang up here, there and everywhere. In desperation he was driven to seek legal redress. He sued nine of his infringers in 1781, but, after a lengthy trial which now forms one of the famous Patent Cases of legal and industrial history, the infringement action ended in Arkwright's total defeat.

Two ghosts of the past rose up at the Arkwright Patent action to remind the prosecutor of his past life. They were none less than the persons of John Kay, of Warrington, the ingenious although somewhat unscrupulous working clockmaker, who, years previously, had made wheel-trains and other machinery parts for barber Arkwright, of Bolton, and, more serious still, Thomas Highs, of Leigh, who point-blank accused Arkwright of having appropriated his invention.

The end of the case was that Arkwright's patents were declared invalid. It was now open for any manufacturer to make and use the "water-frame" and other spinning machinery. As a result, mechanical cotton-spinning rapidly increased to an enormous extent in Lancashire. Cotton mills sprang up in many of the populous centres, being first driven by water power, and subsequently by the newly-introduced steam engines.

The removal of the "water-frame" monopoly from Richard Arkwright did little to affect his growing success. He still continued to make, use and to sell his machines, and, before long, he made such a name for himself in connection with these articles and with the consequent enormous expansion of the cotton industry that his fame attracted the notice of the King, George III, who, in 1786, conferred upon him the honour of knighthood.

Sir Richard Arkwright can never be styled an indolent or a slothful man. He was truly indefatigable in all his activities. Often he worked from five in the morning until nine or ten at night, and even after these arduous hours he would put in another protracted spell at nights, struggling with the elements of English grammar and the rudiments of handwriting, punctuation and spelling, in an endeavour to make up for the lost education of his boyhood.

Arkwright died at Cromford, Derbyshire, on August 3rd, 1792, leaving his fortune of nearly a million sterling to his son, Richard and his daughter, Susannah. He also left an uncompleted castle in which he had hoped to reside.

A "Copyist"

It is nowadays difficult to judge the moral issues involved in the Arkwright case. It seems certain that Arkwright did, by one means or another, actually "lift" the invention of the spinning-machine or "water frame" from Thomas Highs, the reed-maker, of Leigh, and convert it to his own uses without acknowledgment or recompense. On the other hand, although Highs may have been the original inventor of the cotton-spinning machine, Arkwright was far superior to him in natural strength of character and in general commercial and industrial ability and acumen.

Yet the pity of the circumstances is that Thomas Highs went to his grave a poor and an embittered man, whilst Richard Arkwright received a knighthood, and vast financial wealth.

Our Busy Inventors

By "Dynamo"

False Impressions

DURING the war of 1914-1918, the term "camouflage" came into general use. It is derived from a French word meaning "smoke-puff," and that which it connotes is a common object in current warfare. The idea is very old in the animal world, where certain creatures, for the purpose of protection, resemble their surroundings.

The advent of aircraft has made the disguise of camouflage a general feature of modern warfare. Camouflage is the art of creating a false impression. We are all familiaj with its deceptions, which render the bird's-eye view the acme of misrepresentation, concealing aerodromes, factories, motor cars and lorries.

The aim of a recent invention is to provide a method of camouflage which will not entail a large amount of labour and which is of such a nature that the means employed can be easily removed and conveniently transferred from place to place. The inventor has endeavoured to make it strong, light and eminently suitable for its purpose.

The device consists of a meshed backing, the interstices of which are completely filled with a light material. Being in sheet form, it can be rolled up like linoleum. It is handy for transport and easy to erect.

To the meshed backing, feathers (including down and flock), leaves, grass, seaweed, etc., are made to adhere by a coating such as paint, varnish. bitumen, size or other gummy substances. These can be appropriately coloured whilst being applied to the backing. Wire netting of the kind used for chicken runs is a particularly suitable backing.

This method of camouflage is the subject of an application accepted by the British Patent Office.

The Art of Aging

IN Sparta such was the respect for old age that, when an elderly gentleman once entered the theatre, every young man in the house immediately rose and offered the venerable person his seat. In the present day, age is not an asset, although in these critical times, owing to youth being commandeered by Mars, even doddering senility almost has a chance of getting a job. But aged wine and whisky have always been revered. And there is more than one method of rendering liquor prematurely old.

Another of these ripening processes is being patented in this country. The inventor points out that freshly made alcoholic beverages are characterised by a somewhat sharp and acrid taste. In order to produce a fine, mellow flavour, it has been the practice to bottle and store the liquor for many years. This involves long delay and considerable expense. With the same object, blending has been utilised. For example, 20 per cent. of a 20-year old beverage has been mixed with a new product to reduce its acrid taste or harshness.

It is stated that finely divided sesame press cake—preferably unroasted—from which the oil has been extracted, added to and infused with alcoholic drinks, imparts to them characteristics which have hitherto been associated only with properly and fully aged liquor.

This process, it is asserted, is equally effective with innocent fluids, such as ginger ale.

By the way, sesame, which recalls the old Arabian tale of the Forty Thieves, can be replaced by pea-nuts, otherwise known as monkey-nuts.

Vibration for Health

KINESITHERAPY is an elongated term which has been invented to express the treatment of disease by muscular movements. To this kind of cure is related an apparatus for which a patent in this country has been applied. The apparatus, which is styled a Vibrator, includes a treadle, upon which the patient stands. An electric motor causes the treadle to vibrate.

Maurice Poirier, with his "Conversion of Arc and Time Clock" which he has invented. It is claimed that the new clock will eliminate time errors in aerial navigation. Details of the clock are given on page 335.

It is stated that the mechanism operates quietly and, though comparatively small, it is powerful enough to cause vigorous vibration, regardless of the weight of the patient.

According to the old story, the instruction on the label, "Well shaken before taken," was applied to the patient instead of to the bottle. The conversion of the patient into a human cocktail, on the principle of the vibratory cure, should have had a salutary effect.

How To Cure Gout

APROPOS of this topic, I recall the account of a surprising cure of the gout, which appeared in one of those moral story books which instructed the Victorian juvenile. The patient was a flabby gormandiser whose highly seasoned diet and lack of exertion resulted in inflammation of the great toe and other physical evils. He was recommended to place himself in the hands of an eminent specialist. This physician not only restricted him to a very simple menu, but, one day, he shut him in a room with no seat and a metal floor. The unwieldy patient propped himself against the wall. Presently the floor became inconveniently warm, necessitating a continual lifting of his feet. The heat became so intense that this action was greatly accelerated. The exercise had a most beneficial effect and the patient left the doctor's establishment completely cured.

I understand that there used to be in America a sect called the Holy Rollers. It is said that their devotions included rolling over and over up and down the aisle. There was method in their madness, for it meant considerable physical exertion, which, undoubtedly, is one of the most important factors of health.

Light on the Address

A NEW address indicator enables the caller by night conveniently to find the house he is seeking. The device makes the address clear by means of luminous paint or luminous radio-composition. On the indicating plate separate letters are detachable which permits them to be changed. The container holding the address has a transparent waterproof cover which can be removed to give access to the letters, without detaching the container from the gate or wall.

In normal times, nocturnal address finding is not easy. And this is accentuated by the black-out. I have myself experienced difficulty in discovering my own residence. This luminous indicator should receive a hearty welcome. It will certainly in the words of the song, "Show me the way to go home."

Home Guard

IN the last century there was a popular ditty which ran thus :

Jeremiah, blow the fire
Puff, puff, puff.
First you blow it gently,
Then you blow it rough.

I presume that the instrument used by the said Jeremiah was the now obsolete bellows, which enabled one artificially to get the wind up.

To induce and control the draught, there has been devised an improved fire screen. It comprises a curtain or screen made of asbestos or other fireproof material, and it is mounted on a roller concealed above the fireplace and capable of being unwound into different positions. This screen also acts as a home guard protecting the family from that relative of the incendiary bomb, the falling ember.

One-Piece Knife

THE average table knife—the sort without which little Tommy Tucker could not cut his supper—is formed by attaching a handle to a blade. I note that an application to patent a one-piece knife has been accepted by the British Patent Office. This is a cutlery knife having an integral blade and handle. The entire piece is made by punching or stamping it fromfl at strip metal. The handle is corrugated with the object of increasing the grip, and also for the purpose of ornamentation. This invention will prevent the divorce of the handle from the blade, which sometimes occurs in the old type.

A NEW SERIES

The Story of Chemical Discovery

No. 6. The Theory of Atoms and their Weights. Dr. John Dalton, of Manchester, and his Influence on Chemical Science.

EVER since the philosophers and thinkers of old began, thousands of years ago, to speculate upon the ultimate composition of material things, they all seem intuitively to have come to the one conclusion that every material substance is not, as it were, continuous throughout its mass, but that it is, in reality, made up of innumerable finite units of matter which are held together by some interior forces.

To-day, we call these units of matter "atoms," the word coming from the Greek, *atomos*, signifying something which cannot be cut up or divided. Nowadays, we know that this meaning is far from being true as regards the chemical atoms, for these particles, minute as they are, have yielded to the probe of the modern chemist and physicist and have proved themselves to be combinations of protons and electrons.

All the ancient philosophers considered these ultimate units of matter to be hard, impenetrable particles, something like round balls. A few of these early thinkers, as, for example, the Greek philosophers, Leucippus and Democritus, who flourished about 440-400 B.C., actually visualised these particles as being in motion, a really brilliant and truthful conjecture on their parts, considering that these nowadays almost mythical individuals had neither experimental apparatus nor past accumulations of knowledge and observations to help them.

The idea of atoms seems hardly ever to have struck the alchemists who were, possibly, too engrossed in their never-ending searches for the Philosopher's Stone and the Elixir of Life to worry about anything less utilitarian than these fanciful notions. True it is that the great Robert Boyle, with whose ideas the earliest vestiges of scientific chemistry came into being, believed in the existence of atoms, and so, too, did many of the other chemical experimenters who came after him. Yet it was to the gentle John Dalton, the Quaker philosopher and erstwhile school-teacher, of Manchester, that it was left to place, once and for all, the scientific doctrine of atoms on a firm foundation and, more than that, to give to Chemistry the one underlying theory which carried it from triumph to triumph through the ensuing century.

A Teacher at Twelve

Dalton, among his many papers, left an autobiographical note which he wrote about a dozen years before he died. It is given here, since it forms an admirable summary of the essential background of this famous man's life:—

"The writer of this was born at the village of Eaglesfield, in Cumberland, on 5th September, 1766. Attended the village schools there and in the neighbourhood till eleven years of age, at which period he had gone through a course of mensuration, surveying, navigation, etc. Began at about twelve years of age to teach the village school and continued it about two years; afterwards was occasionally employed in husbandry for a year or more; removed to Kendal at fifteen years of age as assistant in a boarding school; remained in that capacity for three or four years; then undertook the same school as Principal, and continued it for eight years; whilst at Kendal employed his leisure in studying Latin, Greek, French and the mathematics,

John Dalton, "The Newton of Chemistry."

with natural philosophy. Removed thence to Manchester in 1793 as tutor in mathematics and natural philosophy in the New College. Was six years in that engagement and was after employed as private and public teacher of mathematics and chemistry in Manchester, but occasionally by invitation in London, Edinburgh, Birmingham and Leeds."

In that succinct paragraph one has the gist of Dalton's life. Beginning at a very early age as a school-teacher, he, in partnership with his brother, Jonathan, aspired to a school of his own. But somehow or other, the school failed and Dalton removed

The original air-pump with which Dalton made his experiments on gases.

from his native hills to the smoky atmosphere of Manchester, then one of the most rapidly rising cities in England.

Dalton was twenty-seven years old when he arrived in Manchester. The "New College" which he speaks of was a recently established educational Institution run by the dissenters of the town, and therein Dalton settled down to the humdrum of teaching until, in 1799, the New College was removed to York.

From that time until his death, Dalton remained in Manchester, living, for a time, at the house of one of his acquaintances, and afterwards on the premises of the Manchester Literary and Philosophical Society, of which far-famed body he became a member in 1794, the year following his move to Manchester. During these long years, the famous philosopher contented himself with giving lessons to a few pupils at a charge of 2s. 6d. per hour (which charge was reduced to 1s. 6d. if more than two pupils took the lessons together).

Every year, Dalton returned for a week or two to his native fells. Occasionally, he went to London, which city he found to be "a surprising place," but "the most disagreeable place on earth for one of a contemplative turn of mind."

In the later years of his life, after he had become famous, Dalton was awarded a Civil List pension which maintained him in frugal comfort for the remainder of his days. He died on the 17th of July, 1844, at the house of the Manchester Literary and Philosophical Society, full of renown and honours, and was accompanied to his grave by a procession more than a mile long.

Theories and Discoveries

The fame of John Dalton, who was elected a Fellow of the Royal Society, and was awarded Doctorates by the Universities of Oxford and Edinburgh, rests upon the fundamental nature of his theories and discoveries. During Dalton's hey-day, chemistry had arrived at such a degree of progress that the science necessitated the formulation of some lasting basis upon which to develop itself still further.

As an experimentalist, Dalton was but a poor one, although due allowance must be made for his early poverty which prevented him from acquiring the requisite apparatus for his researches.

On coming to Manchester, Dalton's first scientific studies concerned the state of the weather. It is from his work on the subject that meteorology took its rise. On the 24th of March, 1787, John Dalton, while he was still teaching in his school at Kendal, began a record of the weather, which he entitled "Observations on the Weather, etc." This record he kept faithfully day by day throughout his life, the last entry being made fifty-seven years later on 16th July, 1844, the night before his death. His first published work, which concerned these Weather Observations, directed much attention to the study of climatic conditions which was then an almost unknown subject.

Colour Blindness

Throughout his life, Dalton suffered from that peculiar malady known as colour.

blindness. Many anecdotes are related on Dalton's visual failing, as, for example, the incident when, visiting Kendal, he took his mother a pair of new silk stockings.

"Thou hast brought me a grand pair of hose, John, but what made thee fancy so striking a colour?" exclaimed old Dame Dalton, on receipt of the present. "I could never show myself at a meeting in them!"

John insisted that the stockings were of a subdued grey colour, but his mother was equally as emphatic in her assertions that the stockings were as red as a cherry. Finally, the neighbours were called in to settle the dispute. Their verdict was that the stockings were "varra fine stuff, but uncommon scarlety!"

This episode, it is believed, was the first occasion upon which Dalton had his attention forcibly drawn to the fact that his

With this apparatus, Dalton studied the compression of gases and liquids.

colour vision was not normal. His brother, Jonathan, suffered in the same way, also, but whilst the latter regarded the defect as an annoying inconvenience, John Dalton studied it with great scientific interest.

John Dalton's first paper to the Manchester Literary and Philosophical Society, which he read in 1794, described these peculiarities of colour vision. He described how his colour perceptions were all awry, and that he was unable to distinguish blue from pink or red from grey. "Colour-blindness" is now a well-known defect of vision, it having been studied very closely since Dalton's day. Nevertheless, it was apparently Dalton himself who first drew scientific attention to its existence.

Experiment with Gases

The beginnings of Dalton's work on the formulation of the Atomic Theory are to be seen in a paper which he read before the Manchester Literary and Philosophical Society in 1803 on the "Constitution of Mixed Gases." Thanks to the discoveries of Priestley and others, many different kinds of gases were now well-recognised and their properties had been noted and classified. Dalton, in the little laboratory which he had fitted up for himself, had prepared a number of these gases, and he noted that the total pressure set up by mixed gases on the walls of their container is equal to the sum of the pressures of each individual gas.

He was then led to speculate upon the actual nature of a gas. In his mind's eye he visualised a mass of gas as being made up of innumerable little particles, all of which are in a high state of motion. The particles hurl themselves against the walls of the containing vessel and thereby give rise to the pressure exerted by the gas. Gases, or, as Dalton sometimes puts it, "elastic fluids," are nothing more than assemblies of atoms, each individual atom being separated from its neighbours by relatively large spaces.

"A vessel full of any pure elastic fluid," says Dalton in his book, "New System of Chemical Philosophy," in which he gives to the world his new theories of atoms, "presents to the imagination a picture like a vessel full of small shot."

Matter is not solid through and through. It consists of finite particles, each having a separate individuality and existence.

So far, John Dalton had only resurrected the age-old theories of the Greeks and of ancient philosophers even before that famous race. Unlike the ancient thinkers, however, Dalton was able to base his assertions upon experimental evidence.

There was one consideration regarding these atoms which fascinated Dalton very much indeed. Had all these atoms similar properties and, in particular, did they all weigh the same?

Weight of Atoms!

Obviously, it seemed impossible for the atoms of oxygen, for instance, to have similar intrinsic properties to the atoms of chlorine, and it seemed hardly likely, too, that both sets of atoms would have the same weight.

It was, of course, impossible to take an atom and to weigh it, but it was possible, averred Dalton, to compare the weights of one set of atoms with another set.

Dalton selected hydrogen as being the lightest of all gases (a remarkably shrewd guess, for, in actual fact, hydrogen is the lightest of all material substances) and, giving this the number 1, he determined the relative weights of other gases and substances in terms of hydrogen. From these determinations, he drew up a "Table of the Relative Weights of the Ultimate Particles of Gaseous and Other Bodies."

Needless to say, there were many mistakes in this table, Dalton's experimental apparatus being of the crudest kind. Yet the principle of the thing was correct enough. This, the first embryo table of Atomic Weights, was not merely a step in the right direction; it was a veritable leap thither.

Another matter of theoretical, yet, at the same time, of very practical interest, perplexed Dalton as it had done the experimental chemists immediately preceding him. It was this. When any definite compound of chemical elements is carefully analysed, those elements are invariably found to exist in exactly the same proportions.

To take an example. Common salt (sodium chloride) always contains 23 parts by weight of sodium and 35.5 parts by weight of the gas, chlorine. No matter where the salt has come from, this proportion of elements invariably remains constant.

If, asserted Dalton, we give to sodium the element-weight of 23 and to chlorine the element-weight of 35.5, we may assume that when sodium and chlorine combine together they will always do so in the weight proportions of 23 and 35.5 respectively, and this ratio will always remain the same no matter how great a number of sodium and chlorine atoms enter into union or combination.

Atomic Theory

By studying the combining proportions of elements in this manner, Dalton gradually built up a system of relative weights of atoms. Many of his methods of arriving at his results are complicated in the extreme and cannot be detailed here. Suffice it to say, however, that, in the completed framework of his Atomic Theory, Dalton listed practically all the known elements of his day and assigned to their individual atoms weights which were relative to the weight of a hydrogen atom.

Thus, when Dalton said that the atomic weight of chlorine is 35.5, he meant that one chlorine atom is 35.5 times as heavy as one hydrogen atom.

As we have remarked previously, Dalton made many mistakes in his observations and calculations. For instance, he gave to oxygen the atomic weight of 8, whereas we know nowadays that its atomic weight is 16. Such inaccuracies, which are now readily explicable in the light of modern knowledge, in no way invalidated Dalton's theory. On the contrary, they served to confirm it after they had eventually been detected and rectified.

As a result of the monumental service rendered to the science of chemistry by this gentle, quaint and almost ascetic Quaker gentleman of Manchester, who charged no more than half-a-crown an hour for his lessons, and who asked little else of the world than a plentiful supply of tobacco, and a good game of bowls every Thursday afternoon, chemical discovery and the

The simple microscope with which Dalton carried out many of his researches.

interpretation of chemical laws soared ahead.

At first, Dalton's theory of atoms and their relative weights was decried, notably by Sir Humphry Davy, who ought to have known better, since, he, too, was the author of many brilliant discoveries in chemistry. Gradually, however, the essential truth of Dalton's theory of atoms and their relative weights sank into the minds of chemical investigators. Due, mainly, to the Swedish chemist, Berzelius, who set himself to make extremely accurate determinations of the relative weights of atoms, the validity of Dalton's Theory, and his conjectures concerning atoms was ultimately vindicated.

In the Atomic Theory, chemical science had attained a creed which placed it once and for all upon the soundest possible basis. Even to-day, our knowledge of the existence of the electron and its mechanics has no more done away with the truth of the Atomic Theory than has Einstein's Relativity Theory refuted Newton's fundamental laws of mechanics.

Like the laws of Sir Isaac Newton, the Atomic Theory of Dr. John Dalton is for all time. It represents an inherently brilliant conjecture which is essentially valid, and upon which the entire structure of scientific chemistry has been built.

Epilogue

To the foregoing sketch of the life of John Dalton and his fundamental service to Chemistry, a modern epilogue will not be without interest. More, perhaps, than any other nation, the Germans have risen to commercial success on the wings of chemical science, which, filching, in many instances, from English discoverers, they have been shrewd enough to apply technically in their own country. But the Nazis, the modern Germans, apparently have little regard for even the historic shrines of their adopted science.

Ninety-six years after Dr. John Dalton had been laid in Ardwick Cemetery, Manchester, the Huns came to Manchester on a night raid. On that tense occasion, Fate was unkind to the immortal memory of the gentle and amiable Dalton, for it did not prevent a Nazi bomb from demolishing the historic home of the philosopher and destroying almost completely his more than a century old apparatus, his books, manuscripts, and even his hat and his slippers.

The actual home of Dalton in Manchester is now no more, but the memory of the man and the far-reaching work which he did for chemistry lives on, and will naturally do so centuries after the present Hun regime has perished.

Drain Valves for Super Pressure

Details of a Special Valve in Operation at a London Power Station

FOR severe conditions of drain service in high-pressure steam plant, where normally two drain valves arranged in series would be fitted, the "Series-Uniflow" valve of Hopkinsons Limited is well known to be of particular value.

A notable equipment of ¾-in. valves is operating at an important London super-power station, which has two super-pressure forced circulation boilers of 210,000 lbs. per hour evaporation, each with super-pressure steam conditions of 2,130 lbs. per sq. in. and 950 deg. F. maximum temperature, and a back pressure turbo-alternator set, exhausting at 200 lbs. per sq. in. to a condensing set, the combination being 50,000 kW. Also similar ¾-in. drain valves have now been made for the second new section of the station, which has two slightly larger forced circulation boilers, of 250,000 lbs. per hour normal evaporation, for the same steam pressure, operating a back pressure set, exhausting at 350 lbs. pressure to a condensing set, representing 60,000 kW total capacity.

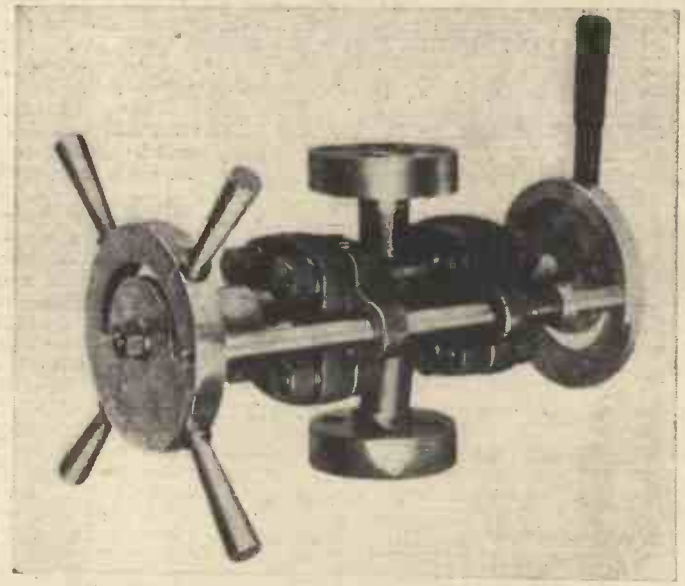
The above firm have supplied a wide range of valves and mountings for the boilers, and medium and high-pressure pipe lines of these two sections of the station, including safety valves, parallel slide valves, centre pressure turbine stop valves, economiser safety valves, electrically controlled stop valves, drain valves, combined stop and isolating valves, and controlled non-return valves.

Details of Construction

The "Series-Uniflow" drain valve consists of two interlocking valves in one housing, occupying no more space than an ordinary single valve, designed in such a manner that the master valve must be fully opened before the regulating valve can be opened, while the latter must be completely closed before the master valve can be closed, so that the combined unit remains perfectly fluid-tight under the severest conditions, because of the avoidance of wire drawing of the master valve.

As indicated, the design is on the efficient slide-valve principle, consisting of an eccentric-operated valve disc held by the steam pressure down on the seat, over which it slides smoothly when opening or closing, without any possibility of wedging action.

The construction is that of the firm's usual high-grade quality, the housing being machined from a solid mild steel drop forging of uniform thickness, while both the valve discs, which move on their axes, and seats, as well as anti-friction washers, are of "Platnam" metal, resistant to very high steam temperature, and the valve spindles are of stainless steel, with deep stuffing boxes. Each valve has an operating lever at the master valve end, and a spoked wheel at the regulating valve end of the housing, and the sequence of movement is controlled by a horizontal locking rod outside the housing.



Hopkinson's patent "Series-Uniflow" valve for a well-known London power station (working pressure 2,130 lbs per sq. in., temperature 950 degrees F.).

Operation

When both the valves are closed, the rod is held by a spring at one end against a cam on the master valve index plate, whilst at the other end it slots into a hole in the regulating valve index plate, which is thereby locked. In this position, therefore, only the master valve can be opened, and the latter action, that is, rotation of the valve index plate, causes the locking rod to slide off the cam and, because of the action of the spring, withdraw from the hole in the index plate of the regulating valve, so that the latter can be opened. When this happens, the master valve is locked automatically by the rod, which cannot now slide over the cam. Consequently, the master valve remains open until the regulating valve has been closed and the rotation of the latter index plate has placed the hole in its former position opposite the end of the locking rod. Both valves also open and close easily with a half turn of the levers, and the seats can be re-ground without removal of the housing from the pipe line.

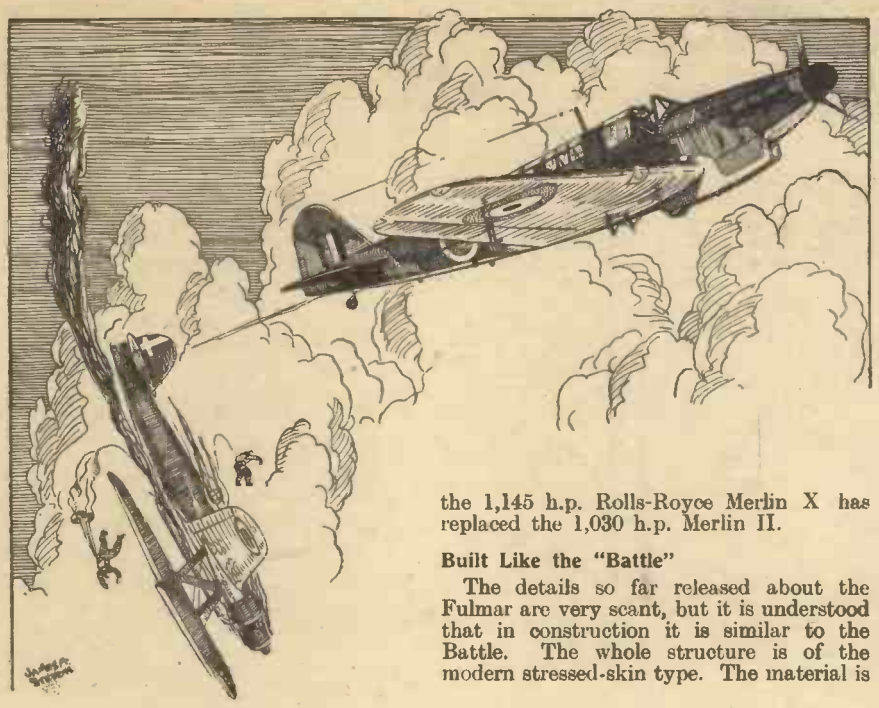
GUIDE TO CAREERS IN ENGINEERING

WE have received a copy of the latest edition of *Success in Engineering*, the extremely useful and well-illustrated Guide to Careers in Engineering, Building and Technology issued by the National Institute of Engineering. This 124-page book gives important information on entry and advancement in all branches of Engineering and Building, and will be sent post-free to readers of "*Practical Mechanics*" who apply to The National Institute of Engineering, Dept. 29, 148-150, Holborn, E.C.1.

The National Institute of Engineering, which is the specialist Technical Dept. of Chambers College (founded 1885), has, by means of its highly efficient postal courses enabled many readers to secure important examination successes or to secure well-paid positions, in Engineering, Building, Civil Service and Municipal Work.

It is pleasing to know that large numbers of the students are working regularly whilst serving in various branches of H.M. Forces at home and overseas.

When replying to Advertisers please mention "Practical Mechanics."



SCALE MODEL AIRCRAFT No. 11

The Fairey Fulmar Fleet Fighter

By J. H. Stevens, Ae.R.A.S.

A Fast Monoplane Used by the Fleet Air Arm

ALTHOUGH the fact that it was in service with the Fleet Air Arm, and had had successes against Italian nava aeroplanes, was only released in October last year, the Fulmar is not an altogether unknown quantity. Under the title of the Fairey P4134, the prototype was first shown to the public in May, 1937. As a smaller and faster day bomber than the Battle, the P4 was notable for the slender elegance of its lines. The type was originally intended purely for light bombing duties—it was designed to the same specification as the Hawker Henley (described in "Practical Mechanics," June, 1940)—but it proved to be so manoeuvrable that it was developed into an eight-gun fighter. A slightly modified prototype was exhibited by the Belgian Fairey Company at the Brussels Aero Show in 1939 and, at about the same time, it was announced that the licence for the P4 had been acquired by the Danish Government.

A Modified Design

The Fulmar has been considerably modified from the P4 in order to improve those qualities which are desirable for operation from aircraft carriers. Some of these alterations are obvious, others are internal. In the first place, it was essential to provide folding wings. This has been done with little external evidence. In order to improve the view for alighting on the restricted deck of an aircraft carrier, the pilot's seat and, in consequence, the cockpit cover, have been raised considerably. Against this latter modification the tail plane has been lowered from the top to the middle of the fuselage and a small lower fin removed from beneath the fuselage. The fairing of the radiator has been carried forward under the nose to enclose the engine air intake. All these alterations, particularly the new cockpit cover, have conspired to give the Fulmar a very "Battle-ish" look. Also the 1,145 h.p. Rolls-Royce Merlin X has replaced the 1,030 h.p. Merlin II.

Built Like the "Battle"

The details so far released about the Fulmar are very scant, but it is understood that in construction it is similar to the Battle. The whole structure is of the modern stressed-skin type. The material is mainly duralumin, and the design is said to be even better suited to mass production than the Battle, which was a very easy machine to manufacture considering that it was one of the first stressed-skin monoplanes to be built in this country.

Although its proportions are more those of a large aeroplane than of a fighter, the Fulmar actually lies mid-way between the Hurricane and the Battle in size. The large main plane is used to house the undercarriage, which is completely retractable, the openings being entirely covered by hinged panels. All landing, navigation, and recognition lights are carried inside transparent windows in the wing. Inset Frise-balanced ailerons are fitted and, between these and the fuselage, split trailing-edge flaps are mounted.

A Rolls-Royce Engine

The fuselage is of a good shape, with two large glazed sections for the pilot and navigator. The engine is the 1,145 h.p. Rolls-Royce Merlin X. It is fitted with ejector exhausts and a Rotol three-bladed controllable-pitch airscrew. Radiator, oil cooler, and air intake are housed in the long, shallow faired duct beneath the nose of the fuselage.

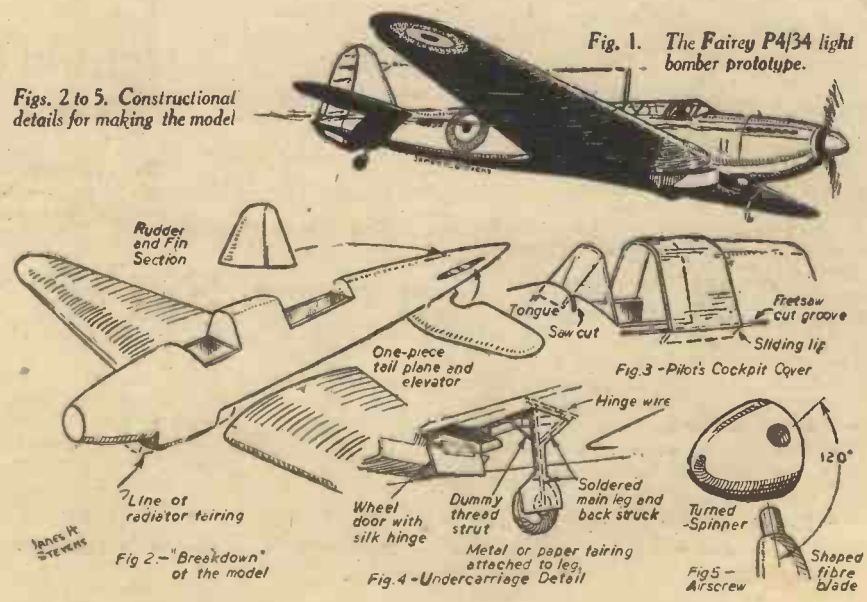
Although no figures have been released regarding the performance of the Fulmar, there is no harm in making a rough comparison with the P4, of which detailed figures are given in the accompanying table. Improving the pilot's view has probably slightly reduced the streamlining of the fuselage, but the more complete fairing of the radiator, removal of the lower fin, and fitting of the ejector exhausts should have more than compensated for any loss of speed due to spoiling the line. Again, the small protuberances occasioned by fitting deck-arrester gear and catapul points must have added some drag, while the extra hundred-odd horsepower of the Merlin X must have improved the performance. Weighing all these points, it seems that the maximum speed of the Fulmar must be little short of 300 m.p.h.

The Need for a Navigator

It may at first seem strange that a machine of such a size, and consequently reduced performance, should be used as a fighter. The reasons are that naval aeroplanes must carry a quantity of special equipment, and have a reasonably low landing speed for deck landings, both qualities that require increased wing area; while for long oversea patrols a navigator

Fig. 1. The Fairey P4/34 light bomber prototype.

Figs. 2 to 5. Constructional details for making the model



is almost essential. It must be remembered that a naval aeroplanes's base is always moving, and in wartime the use of wireless is restricted, so that, on a patrol of, say a thousand miles, some pretty problems in navigation are set. To solve these a "shot" of the sun may be necessary, a feat which is practically impossible for a pilot to perform. In pre-war days fighter patrols often consisted of a two-seater Osprey and a couple of Nimrods, but in the heat of a combat such a patrol might easily be split up, leaving the unfortunate single-seaters to find their way own home to a moving base over a completely trackless ocean.

For those interested in aeroplane design and development, the sketch of the P4, shown in Fig. 1, gives an idea of the alterations made during the evolution of the Fulmar, while a glance at any illustration of the Battle will provide an interesting study in family likeness.

The Model

The Fulmar makes a very attractive model and is easy to make, being particularly suited to "solid" modelling. The choice of scale is largely a matter of individual preference, but the most convenient is certainly the 1 : 72, which is now so generally popular. This has the advantage of making a model large enough for the easy inclusion of most details, and yet a considerable collection need not occupy much space—the Fulmar works out at about 8 in. span and 6½ in. in length. The greatest asset, however, of the 1 : 72 scale is that there are so many accessories available Most model dealers stock machine-guns, engines, airscrews, wheels, and lead figures of mechanics, etc., which are very effective. The former save the modeller a deal of intricate work, while the latter are useful to convey the actual size of the models.

Whatever scale be chosen, it is advisable to re-draw the three-view general-arrangement drawings to full size, as scaling from the flat on to a solid is always a rather doubtful proposition, even with the help of proportional dividers.

The Best Materials

The war has begun to affect the supply of the best materials for making such models as these. The fuselage is most easily carved from a fairly close-grained wood, either soft or hard—it is a matter of individual preference. The harder woods (such as plane, birch, beech, black walnut, or holly) permit more fine detail to be carved than do the softer types (whitewood or bass). The hard, gnarled woods, like oak and ash, are bad because, not only are they hard to work, quickly dulling tools, but they require a great deal of filling in order to get a decently painted surface. Mahogany is another wood which is unsatisfactory because of the porosity between the grain. Good, knot-free pieces of pine (red or white) or deal are fairly satisfactory, although the open grain, with alternate layers of soft and hard wood, require careful handling in order to get a good smooth surface. The main plane is preferably made from thick fretwood—satin-walnut, birch, or whitewood.

The tail unit—tail plane, elevator, fin and rudder—can be made from very thin wood if they are of comparatively thick section, but are better if some grainless material, such as washer fibre or commercial cellulose-acetate sheet be used. The red washer fibre, used by most garages, is the most satisfactory.

The Cockpit Cover

Fig. 2 shows the "breakdown" of the Fulmar into the most easy units for assembly. The cockpit covers can be pressed from thin celluloid or stout cellophane, as has been described before in this series. (The Lockheed P.38, December, 1940, issue.) These covers are, however, even simpler than that on the Hurricane (see February issue). Fig. 3 shows how the pilot's front screen can be cut, folded and glued to the wooden fuselage—a cellulose adhesive is advisable, as it makes the best joint. The sliding part of the cover is simply cut out and bent to shape. If the material is heated and then held until cool, it should assume an accurate and permanent shape. The navigator's cabin is best made as a single fixed section.

The radiator should be made rather short and covered with a paper, or if possible metal foil fairing, in order to obtain the proper hollow effect. The various lights in the wing should be represented by appropriately notching the wood : the landing light opening to be covered with cellophane and the smaller lights to be represented by filling the gaps with colourless cellulose glue.

Undercarriage Details

The undercarriage consists of two simple units and the method of modelling it is shown in Fig. 4. The main leg and back strut are soldered to a cross wire which, being set into a slot in the wing and wedged there with plastic wood, serves as a hinge. The inwardly sloping retracting strut is best simulated by a thread which can serve as a check cable when down and folds itself away when the leg is up. The fairing plates may be made from either paper or thin metal foil glued or soldered respectively to the leg. The wheel doors attached to the wing can be similarly made and should be attached by a thin cloth hinge—any other form of hinge tends to be clumsy.

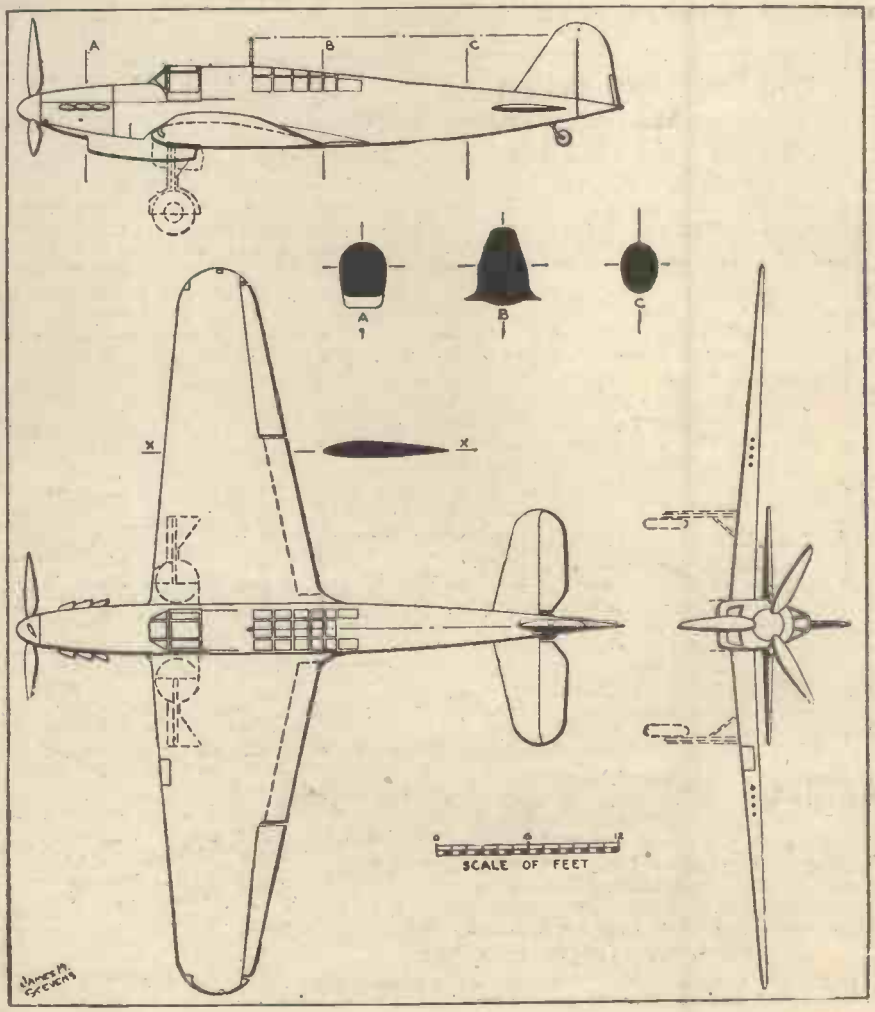
The airscrew is the only other part of the model which is not quite straightforward. The spinner is turned from wood and fibre blades glued into it. A method for turning a spinner in the chuck of a drill, intended for those not fortunate enough to possess a lathe, has been described on several occasions and the reader is referred to the November and December, 1940, issues.

Painting Materials

It has been said before that there are three types of paint suitable for aeroplane models—poster paint, cellulose or oil enamel. The former is recommended for photographic work owing to the lack of reflection from the matt surface, but for general work it is too easily marked. The cellulose gives a good finish, but dries very quickly, making the drawing of fine details very difficult. The oil "art" enamel is too glossy to truly represent camouflaged machines (and is bad to photograph), but it looks well and is by far the easiest to use. A No. 5 camel's hair or sable brush is best for general work, with a very small liner's brush for details.

Before painting, the model should be

SIDE, PLAN, AND FRONT VIEW OF THE FAIREY FULMAR FLEET FIGHTER



cleaned from all greasy fingermarks by wiping it with a rag dipped in methylated spirit. It is understood, of course, that all wooden parts must be rubbed absolutely smooth, first with fine and later with *worn* fine glasspaper. The first coat should be along the grain, if possible; the second across it and the third along it again. It is essential that each coat should be thoroughly *hard*, not just dry, before the application of another one, and that the paint should be applied thinly. It is almost impossible to make the coats too thin—even if it means three or even four applications.

Colour Schemes

The aeroplanes of the Royal Navy are "shadow-shaded" like those of the Royal Air Force, but the colours are *battleship grey* and *sea green*. The grey is the dark, blueish shade which is painted on ships in home waters. The green is the dark, rather muddy colour of shoal waters under a grey sky. It is difficult to be more explicit for those who do not know the sea, unless to liken the colour to a yellowish and "watered-down" bottle green. The colours are applied in large, uneven patches like those of land-going machines.

PRINCIPAL CHARACTERISTICS

Fairey P4/34, 1,030 h.p. Rolls Royce Merlin II

Span	47 ft. 4½ in.
Length	40 ft. 0 in.
Wing area	346 sq. ft.
Weight empty	6,405 lb.
Weight loaded	8,787 lb.
Wing loading	25.4 lb./sq. ft.
Power loading	8.52 lb./b.h.p.
Speed at sea level	245 m.p.h.
Maximum speed (17,200 ft.)	284 m.p.h.
Cruising speed (15,000 ft.)	230 m.p.h.
Stalling speed	55 m.p.h.
Initial rate of climb	1,175 ft./min.
Rate of climb at 10,000 ft.	1,330 ft./min.
Service ceiling	29,600 ft.
Cruising range	1,000 miles

The colours of the under-surfaces have been changed frequently, but at the moment they are pale pigeon-egg blue. The airscrew and spinner are dull black with yellow blade tips—though a coloured spinner is sometimes fitted.

Red and blue cockades are painted on top of the main planes; red, white and blue cockades beneath them and yellow-outlined red, white and blue cockades on the sides of the fuselage. Red, white and blue stripes are painted on a panel on the fin, the red being the foremost colour.

Simple Chucks for Repetition Work

Constructional Details of Three Fitments for Turning Work *in Situ*

WHEN accurate repetition work is to be turned out—perhaps sub-contract munition work—a good deal of time can be saved, and greater assurance of accuracy, if the usual three-jaw chuck method of chucking pieces in the lathe is substituted by a more simple and accurate arrangement

The three devices shown in the accompanying drawings required no great skill in construction; they involve only simple turning and screw-cutting operations.

Their advantage lies in their very easy application to any repetition job, and their continued accuracy without requiring more than a very small outlay in either time or material.

They are turned up in the position they will occupy when in active use, as far as the main body, the essential feature for accuracy, is concerned. After removal from the lathe mandrel they can be replaced again, any number of times, with dead accuracy.

For Small Stock

The chuck shown in Fig. 1 is for small stock, and is turned parallel outside. It may be any kind of piece so long as it has a small straight cylindrical part by means of which it can be chucked. The chuck consists of a mild steel body with a long standard taper to fit the internal taper of the headstock mandrel.

It is threaded on the outside with a moderately fine thread and forward of the thread is a parallel part which acts as the basic guide to true concentricity of the work turned out.

The inside is turned to a taper, as shown, and in this taper fits a contracting, split taper sleeve to exactly fit the taper in the chuck body. It is bored dead parallel inside.

When this taper sleeve is pushed up in the taper body of the chuck it contracts on the job. To adjust it to different diameters of jobs parallel split sleeves are used to a near fit to the taper sleeve on the outside, and a near fit to the job on the inside.

The taper sleeve has a shoulder at X, as shown, and against this shoulder is screwed up the outside fastening collar which screws along the external thread of the chuck, and exactly fits the parallel part at Y. It has an inturned lip which engages with the shoulder at X on the taper split sleeve, and when screwed to the left along the chuck body it forces the split taper sleeve inwards and contracts it on the job to be held.

Parallel split sleeves can be made in cast iron as required to fit inside the taper sleeve and to hold any diameter of work.

Outwardly Expanding Chuck

The chuck shown in Fig. 2 is on the same principle but expands outwardly.

The body has a disc, formed with it, and a long taper to fit the lathe mandrel taper. It is faced quite flat but has a central projecting tapered part at A and a central tapped hole to take a long hexagon-headed set screw.

On this taper part is a split collar, parallel outside but tapered inside. It is expanded by being pushed up the taper of the chuck by the set screw and washer.

The end of this sleeve can be thus pushed up into the annular recess so that work held in it can always be put up close to the back plate of the chuck, and thus accurately aligned square with the lathe axis.

Split collars parallel inside and outside are provided in cast iron to suit the job, and should just fit the inside of the job to be turned, and the outside of the split taper collar in the chuck.

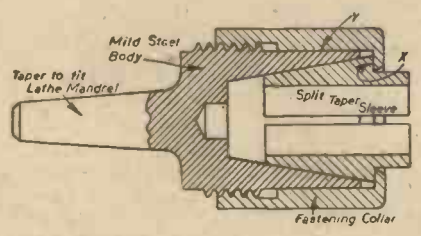


Fig. 1. A chuck for small stock.

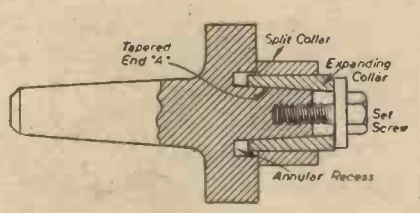


Fig. 2. An outwardly-expanding chuck.

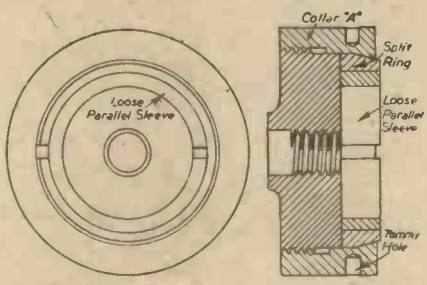


Fig. 3. A contracting chuck for larger work.

For Larger Work

In Fig. 3 is shown a chuck for larger pieces to be held by the outside. The principle is the same as in Fig. 1, but is intended for pieces of larger diameter. The body is in effect similar to the lathe driving plate. It screws on the lathe mandrel nose like a face plate. On its outer periphery it is threaded for half its thickness (or width) and the remaining half left parallel to bottom thread diameter.

On this screws the collar A, which is threaded internally and has a plain part forward of the thread to exactly fit the plain part on the body.

A split contracting ring of cast iron fits in this collar A, and is tapered in front to conform with the taper inside the inwardly projecting flange in the collar.

When the collar is screwed up, its taper, acting on the taper on the contracting split ring, holds the work like the outside jaws of a chuck but, of course, holding it in a tight grip all round.

Loose sleeves or rings parallel inside and outside and split for contraction are provided to fit the job being done and the contracting split ring.

To tighten the tightening collar A, and so hold the work, a tommy bar is used in radial holes around the collar: two of these holes are shown.

In the case of all three chucks, once the body has been turned to fit the lathe mandrel, the chuck is fitted to the mandrel and all turning work is carried out *in situ*. Therefore all must be true whenever replaced

"MOTILUS" PEEPS INTO THE

A Realistic Model Railway

Captain John Rodgers and his railway—the Atlantic Coast Express passing under "A" box at Waterloo, approaching the station entrance. The scene depicts operations on this railway between the Signal Box and Waterloo station.

IN the preliminary bombardment before the retreat of the German 5th Army in 1918, at La Fere, near St. Quentin, Captain John Rodgers was badly gassed and practically blinded. There followed years in military hospitals, but at length Captain Rodgers sought quiet and peace at Broadstairs on the English coast. This was in 1926, and as soon as he had settled there he began to look around for some hobby to keep mind and body occupied, and he hit upon the hobby of model making.

Within an incredibly short space of time he had a small but perfect railway system, and to-day in 1941 he has an amazing 1¼ in. gauge railway, built with his own hands, and which is the envy of all who have seen it.

He receives letters almost daily from all parts of the world from people who have seen or heard of this marvellous model railway. "People from India and the Far East came to see me." he said to a newspaper reporter on the occasion of the railway's tenth anniversary in 1937, "one commander of the United States Navy called, and has visited me many times since. He lectured on models and miniatures, and took away voluminous notes and scores of photographs of my railway system."

His particular pride in the railway is not so much in the individual miniatures,

Bassett-Lowke Ltd.'s London shop. A new and inexpensive window which is certainly very striking.

though these are fine enough, but in the fact that his railway as a whole is a true replica of sections of one of our great railway systems. The system extends over some 2,000 feet of track, and no less than fifty of the chief "Southern" stations are on the system, each in its correct order, and reached from the London termini by the prescribed route as laid down by Bradshaw !

A Remarkable Model Military Display

As the "Western" area of the model contains the important military and naval stations—Aldershot and Portsmouth—to allow full scope for suitable displays of the Forces, a large table (the size of an average room !) was erected in the central space, around which are the control gangways for both this and the railway, and one of our illustrations shows part of the military area, Aldershot Command. A royal review is in progress in the Long Valley, royal train on the right with saluting base in the right foreground. Massed bands are passing H.M. the King and the Brigade of Guards can be seen on the right of the river. A foreign service division, wearing pith helmets, are to the left and on the extreme left front are the artillery and tanks. In the rear of the parade are supply columns, engineers, signals and medical services. It is interesting to know that the correct regimental music and marches, etc., are rendered by a portable gramophone hidden under the parade ground.

There are five cross-Channel steamers operating from the main ports, and passengers from London are run in Pullman coaches to the marine stations at Dover and Southampton, where miniature steamers await them at the miniature quayside. Sixty-six locomotives are now employed on all services, and if Captain Rodgers has assistance in operating them, a dozen trains run at once on the system, with no more danger of a train disaster than there is on the main line railways. The "aristocrats" of the Southern Railway are there, the "Golden Arrow" and the "Brighton Belle" and not the least admiring of those who have seen the railway have been the officials of the S.R. !

The L.B.S.C. and the S.E. and C.R. sections of the Southern Railway were the first to be constructed, being commenced in September 1926, and then in 1930 the L.S.W.R. was added. The Aldershot troop area was built in 1931 and also the Portsmouth fleet.

In the beginning the model was housed in a hut only 10 ft. by 20 ft. but it has grown and grown, and now Captain Rodgers has several larger huts to contain it satisfactorily. The track is gauge "O" tinplate, of which Captain Rodgers is a staunch supporter (the rails are laid on wood sleepers ballasted with tiny stone chips). The locomotives are run by clockwork and the passenger and goods rolling stock amounts to about 300 models.

The Aldershot Command and light railway, showing the Royal Review of the British, Colonial and Foreign Armies. There are 2,500 models on parade, and in the background can be seen a distant view of the English Channel towards the French port of Havre.

MODEL WORLD

and Ship Models

Owing to the war the railway is now closed, and it is hoped to insure same against enemy destruction, but monetary compensation would never replace the pleasure of owning and operating such a wonderful model, nor the fifteen years daily work on it since 1926.

Bassett-Lowke's New Window

Passing along one of the main London thoroughfares the other day, I was pleased to note that Bassett-Lowke Ltd., have made their window quite attractive again,

Model boating days are here again. Two fine miniatures of the "Queen Mary" and the "Normandie" "take the water" !

after a recent blitz.

The whole of the window space has been covered with a light wooden structure, and on a ground of primrose colour a series of silhouettes in black and red have been designed, giving the whole range of their model activities of railways, engines and ships. Along the bottom of the window is a striking outline of the L.M.S. Coronation Scot, while a scale silhouette of the L.M.S. Royal Scot in colour above the window makes an excellent top piece for the display.

This illustration shows the appearance of Bassett-Lowke's London shop before the alteration shown on the previous page was carried out.

A woman worker painting a model L.N.E.R. Coronation train for the export trade.

In the small glass inset windows an attractive display of Bassett-Lowke products can be viewed.

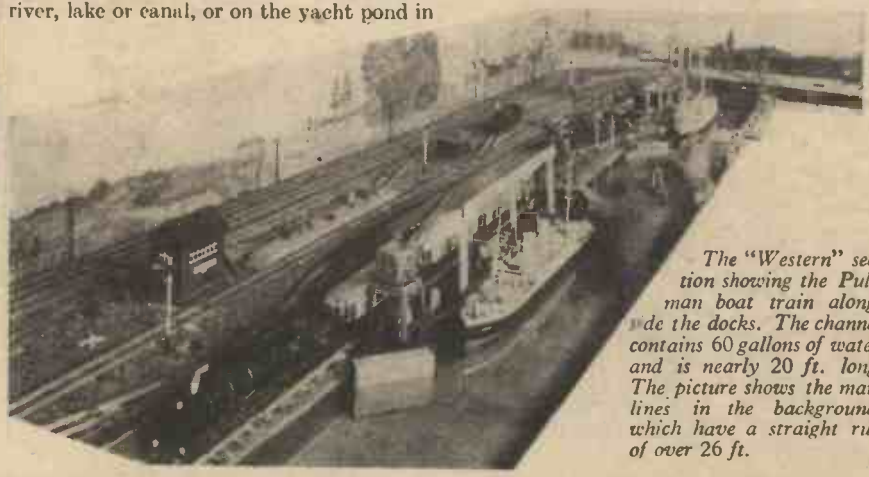
My two pictures show the window boarded up after the blitz and a general view of the new shopfront, and the difficulty I can tell you was to get a photograph when there was no-one looking in the small windows !

Miniature Liners

Summer days are here again, and if you cannot go for a holiday you can at least sail your boats on the water of the local river, lake or canal, or on the yacht pond in the park, as a little relaxation from the wartime work you are doing.

Here are models of two famous liners which have been and still are in the news from time to time. In the foreground we see a miniature of the Cunard-White Star "Queen Mary" and behind is the famous French liner "Normandie." Where the "Queen Mary" is must not be said at the moment, but at the time of writing the luxury "floating palace" "Normandie" is still in New York.

Both the models are 39 inches long, and to the waterline bear the leading characteristics of their prototypes. They can either be fitted with a powerful electric motor driven by dry batteries, or be propelled by steam using a brazed copper boiler with the usual fittings, and an "Eclipse" double-acting marine engine with methylated spirit firing on the automatic-feed system.



The "Western" section showing the Pullman boat train alongside the docks. The channel contains 60 gallons of water and is nearly 20 ft. long. The picture shows the main lines in the background, which have a straight run of over 26 ft.

Women Workers

In these days when the shortage of male labour grows, women workers are being employed on many processes in model work which were previously done by men, now engaged on more important work or serving with His Majesty's Forces.

The illustration at top of page shows a girl worker painting a model of the famous Coronation train of the London and North Eastern Railway, that popular and speedy peace time express from King's Cross to Edinburgh. A model of this should appeal to our Dominions overseas and the United States, as one of England's finest streamline trains.

A CORRECTION

We regret that Mr. D. Glasspool's model railway at Yarmouth, Isle of Wight, was wrongly described last month as "main equipment Hornby Dublo." All his rolling stock is hand made, and all the buildings and locomotive stud, with the exception of three Stewart-Reidpath east body Tank Engines.

Fig. 1. (Left) A table prepared for vanishing anything up to the size of a human being. Fig. 9. (Centre) A conjuror's chair with the back filled in with material to match the background. Fig. 12. (Right) The material of the conjuror's suit here provides the necessary background

CONJUROR'S CAMOUFLAGE

Some of the Ways in Which Backgrounds Can be Used for Magical Purposes

By Norman Hunter
(The Well-known Conjuror of "Maskelyne's Mysteries")

Further Articles on the Secrets of Conjuring will appear Regularly and Exclusively in this journal.

WHEN a conjuror wants to make a large object disappear or appear, one of the easiest ways for him to do it is to drop the article into a receptacle behind a table or chair, or, conversely, bring it out under suitable cover. Chairs with obviously solid backs, however, and tables with heavy drapings are apt to be regarded with suspicion by modern audiences. So present-day magicians camouflage their hiding-places instead of merely covering them up.

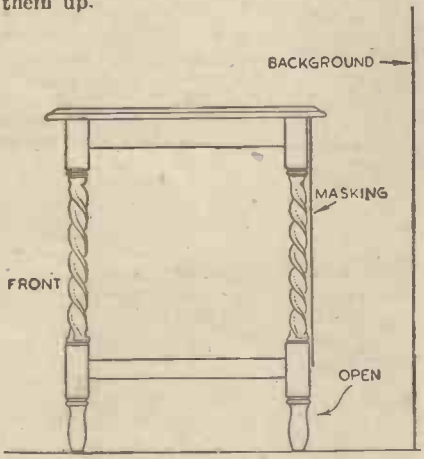


Fig. 2. A chair with the back filled in with material which matches the background.

Fig. 1 shows a table prepared for producing or vanishing anything up to the size of a human being. The space between the two back legs of the table has been filled in with material to match the background. The principle is simple, but there are some tricky points to be considered. In the first place, the lighting must be arranged so that the filled-in space between the table legs does not throw a shadow that the audience can see is "solid" instead of being the shadow of two separate legs. This is best managed by keeping the light almost directly overhead. Even then the table top may cast a shadow on the camouflaging material, but, as this shadow might well be cast on the background if the other material were not there, this is not important.

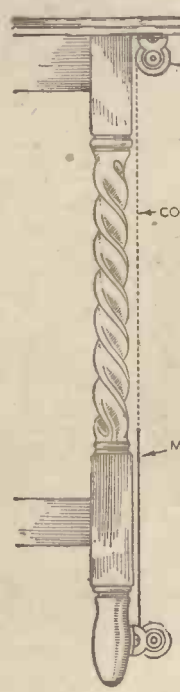
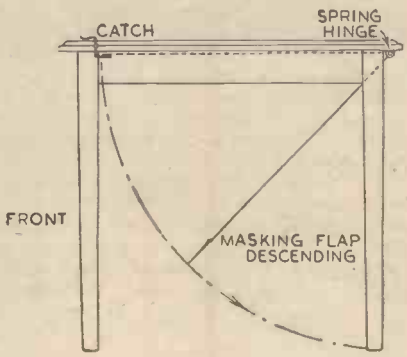


Fig. 3 (Left) A table fitted with a masking blind on spring rollers. Fig. 4. (Right) Showing how the masked hinged flap works.

Background

It should be noted that for this type of background work the material must be continued along the ground under the table, otherwise the filled-in space will cut off some of the floor and give the show away. A way to avoid this and not bring the background down over the floor is shown in Fig. 2. Here the filling-in between the back legs reaches only to the stretcher rail of the table, leaving a few inches of open space below. In this case articles to be produced from or disposed into the camouflaged space must have some kind of shelf or bag attached behind the table, something like a large servante. If a living person is to be conjured with on this principle, a shelf just above the stretcher rail will be needed, and the table must be fixed to the ground or it will tip backwards.

It is a considerable advantage if, before causing the disappearance of an object or person from a table prepared in this way, the performer can casually walk behind the table and prove that the table is a mere skeleton affair, without directing suspicion upon it by actually saying that no masking is used. For this purpose the masking material is mounted on a roller placed at the bottom, between the legs of the table. Cords are carried from a lath along the edge of the material, up the back of the table legs, and are fixed to a spring blind roller just under the back edge of the table. When the masking is needed to be brought



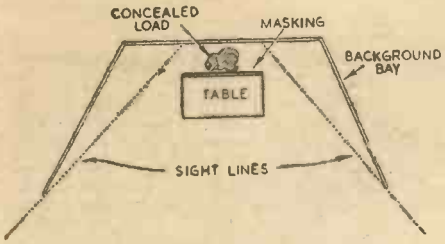


Fig. 5. Plan view showing the table, masking device and the background.

into position, the spring roller is released, winds up the cords, and so brings the camouflaging material up behind the table. It is, in fact, a spring blind working upside down, unfurling instead of rolling up by the action of the spring. See Fig. 3. The action of the blind is masked from the audience by opening a large cloth and holding it in front of the table prior to covering the person or thing to be vanished. When the cloth is taken away from the table the blind is in position, and no difference can be seen in the appearance of things, yet the secret hiding-place is in readiness.

Hinged Flaps

In place of a piece of cloth, a solid flap of plywood may be used, hinged to fold up against the under side of the table and be let down or forced down by the action of a spring at the right moment. As will be seen from Fig. 4, the under side of this flap when up can be painted dead black, when it will not be noticed beneath the table. The other side, which is concealed in this position, but which faces the audience when the flap is down, is painted or covered with material to match the background.

When background masking of this kind is to be used, it is always wise to present the particular illusion in a little bay of its own and not attempt it in the middle of an open stage. The reason for this is that spectators seated at the sides will be apt to see round the edge of the masking on an open stage or their positions may make good matching of masking piece and background impossible. By placing a portable screen round the back and sides of the table to be used, everything is made secure from detection. In addition, a curtain may be fitted to draw across the front of the bay so formed, and the camouflaging need therefore be in view only for the few moments that the actual effect takes place, thus giving the audience literally no time in which to look for the secret. Fig. 5 shows the arrangement in plan.

Secret Flap

There are other advantages in having a screened-off bay of this kind. One of them is that sides and floor of the bay can be covered, as well as the background, with appropriately patterned material and so make the camouflage more natural and complete. Another advantage is that a secret flap may be cut neatly in the background so that the person who is made to vanish from the table can creep through this while screened by the flap or blind between the table legs. This latter masking material can then be allowed to fly up out of sight and, after the vanish, the performer can again show that the table is a mere skeleton affair and that a clear view is really obtained right under it.

Fig. 6 shows the position of the secret flap in the backing screen. This is best made as two doors, opening outwards to the back on weak spring hinges. It is vital for the success of the illusion that the doors should fit well and that no light shall shine through the cracks from the back. For this purpose an additional screen should be placed behind the first, as shown in Fig. 7.

Vanishing a Person

Another method of disposing of a vanished person through the background is shown in Fig. 8. Here the masking at the back of the table reaches only to the leg rails, and there is an open space between this and the floor through which a genuine view of the background is obtained throughout the trick, so that a borrowed article may be put behind the table and be kept in view of the audience all the time, thus apparently proving the absence of any masking. The

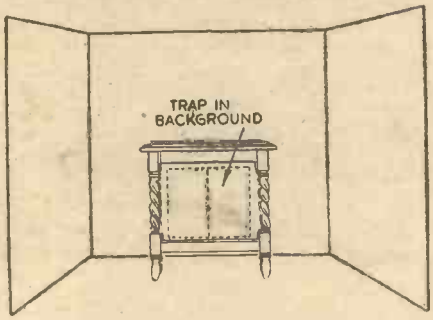


Fig. 6. Showing the position of the secret flap in the backing screen.

assistant makes his escape through a trap in the background, along a plank pushed through for the purpose. The end of the plank that is behind the background is attached to a heavy box or trolley and a second assistant on this acts as a counterweight to prevent the plank from tipping.

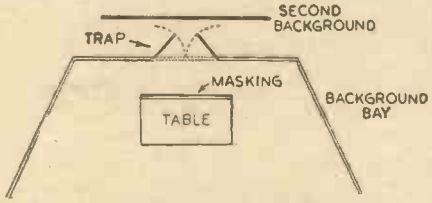


Fig. 7. A second background screen is used as shown.

It will, of course, be understood that this way of effecting the get-away of a person to be vanished is only part of the trick. The other part consists in counterfeiting the presence of the individual by a shape in a cloth, or with a trick box, various methods of which have been described in this series in connection with articles. Further methods of adapting these principles to illusions with living people will be dealt with in a later article.

Faking a Chair

Fig. 9 shows a chair, the back of which has been filled in with material to match the background in the same way as the table. In this photograph I have purposely used an unsuitable material. The lines of the pattern here are so definite that the masking on the chair would match up with the background only from one point in the auditorium. Anyone sitting slightly to one side would probably detect the presence of the camouflage by noticing that the pattern did not continue properly behind the chair. To obviate this the background and masking material should be either plain or with a small all-over pattern. A small irregular or floral design is the best, as it breaks up the surface so well that the eye cannot detect the presence of masking even though one knows it to be there.

Fig. 10 is a back view of the chair shown in Fig. 9. Here will be seen the large bag servante that can be concealed behind what is apparently an open-backed chair. Or, again, a shelf can be fitted from which objects of considerable size can secretly be taken under cover of a cloth.

Another way of camouflaging a chair for conjuring purposes is to fill in the space between the seat and the stretcher rail at the back as shown in Fig. 11. Behind this masking, which, of course, matches the background, a large bag may be fixed. To vanish, say, a rabbit from a chair so prepared is very simple. The animal is placed on the seat of the chair and pretence is made of wrapping it in a large sheet of newspaper. Behind the paper the rabbit is dropped neatly into the bag and the paper is shaped round as if containing the animal. The parcel is then brought carefully forward and finally crushed into a ball. In this case the camouflage is particularly effective, even at very short range, as the seat of the chair prevents those spectators who are sitting close to the performer from seeing the masking material at all.

"Black" Magic

By using black velveteen as the background a still further extension of the principle of camouflage can be employed. As long as the lighting is arranged to eliminate shadows and give even illumination, an object covered with black velvet will be invisible at quite short range against

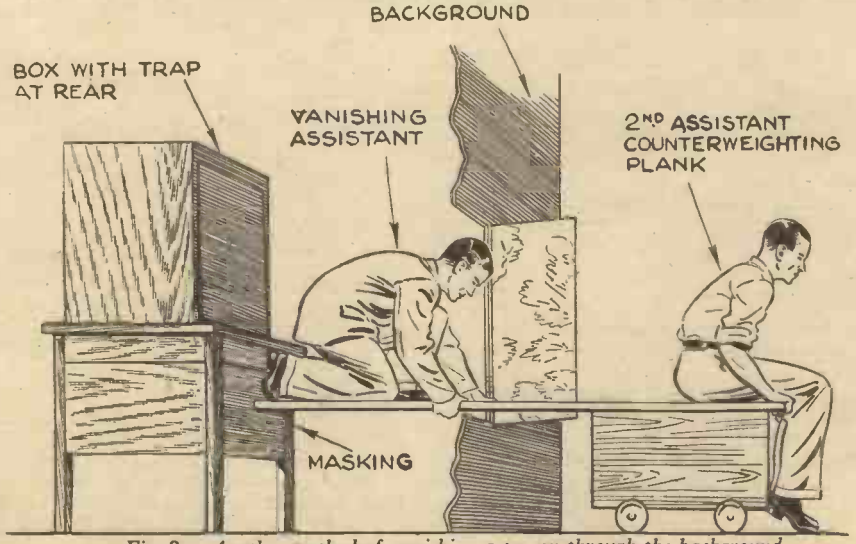


Fig. 8. Another method of vanishing a person through the background.

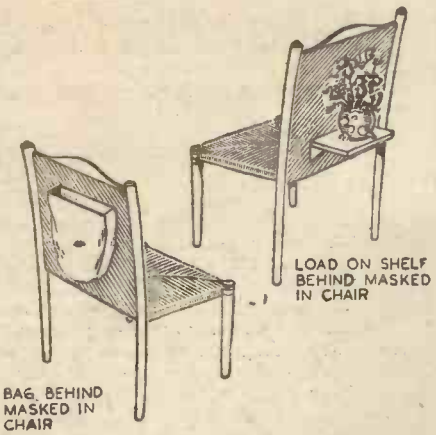


Fig. 10. A back view of the chair shown in Fig. 9.

a similar background. And if the presentation of the trick is arranged so that the camouflaged object is exposed for only a short time, the risk of detection is reduced to negligible proportions.

For example, a large cone stands on the floor and inside it is another cone, fitting loosely within it. The inner cone is covered with black velvet. In the inner cone are a quantity of coloured balls, sweets, toys, or other small objects. The bottom of the cone is made like a trap, so that when a catch is released it will drop down and let out the contents. At the beginning of the trick the fake cone is covered with the visible one. This is lifted and shown empty, then dropped down over the fake again. A glass bowl is next shown and held by an assistant. The cone is picked up and with it the inner lining; the two are put in the bowl and the catch released. The two cones are lifted as one, and the toys or sweets gush out into the bowl.

It will be seen that in this trick the camouflaged fake cone is exposed only for a second or two while the outer cone is being shown empty.

Another Method

This brings me to a development of this principle. The same trick, on a smaller scale, could be performed without the use of special backgrounds. In this case it would be performed on a tray held by an assistant. The assistant would be dressed in a dark uniform and the fake inner cone covered to match it. The fake, being only exposed while the outer cover was shown, would be sufficiently camouflaged against the similarly coloured uniform of the assistant to escape notice. Observe once again here the value of the conjuror's "rarely departed from rule" not to let the audience know in advance what he is going to do. Not knowing that something is to be produced from the cone the audience do not particularly watch for anything when he lifts it up to show it empty.

In Fig. 12 the conjurer is providing his own background, although in order to make the secret clear I have used a grey suit instead of the conventional black evening dress in which one normally performs. The glass box is fitted with a black flap, hinged at the bottom as shown in Fig. 13. There is a little space between the flap and the back of the glass box in which a handkerchief or two or some spring flowers may be packed. The flap is held vertically parallel with the back of the box, by a

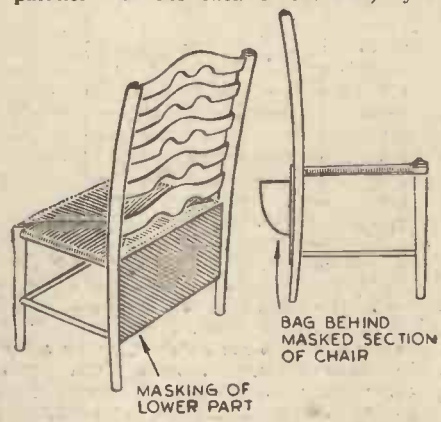


Fig. 11. Another method of camouflaging a chair.

simple wire catch. The audience imagine they can see through the box because the black of the conjurer's coat is taken to be visible through the glass, though actually it is the flap that can be seen. The flap is then released and the box is filled with the expanding flowers or silks.

Masking

The system of masking a piece of furniture by filling in a space to match the background can be used very conveniently with a large easel of the vertical pattern made to run on castors and known as a studio easel. If this is backed with material to match the background, many interesting effects can be produced on the lines of causing pictures to come to life. The secret space made available behind the apparently openwork easel by the masking will conceal an assistant, who can either hand up objects to be produced or appear herself through a picture frame. The frame in this case would not contain a picture, but be simply covered with paper on which the performer would sketch a representation of whatever was to be produced. By using a succession of paper-covered frames, a complete performance could be devised in which the performer would draw and produce through the paper everything he wanted. A small trap in the background behind the easel would enable the concealed assistant to obtain supplies of anything required secretly from behind the scenes.

Background camouflage is also frequently employed upon a horizontal surface as well as a vertical one. For example, a plain black tray is shown, confetti is sprinkled over it, the confetti is flung into the air, and the audience see that some of it has stuck to the tray to form either the letters of a chosen word or a selected number.

The Secret

The secret of this quite sensational trick is simple. The required design is made on the tray by sticking confetti on with gum. A piece of black cardboard is then covered on one side with newspaper. The card is laid in the tray, which it exactly fits, with the black side uppermost. In this condition the tray appears to be quite blank and unprepared. Having been shown, it is rested on edge for a moment on a sheet of newspaper spread over the table to protect the cloth from the confetti. A bag of confetti is picked up and, under cover of this action, the flap is allowed to fall from the tray on to the paper. The uppermost side being covered with newspaper, its presence is completely camouflaged by the matching background. Confetti is now sprinkled all over the tray, care being taken not to expose the design to the audience. When the tray is well covered with confetti, it may be freely shown. At the desired moment the tray is given a tossing movement, the loose confetti flies into the air, leaving the design exposed. The choice of the design or word or number is, of course, forced during the early stages of the trick by one of the methods already described in this series.

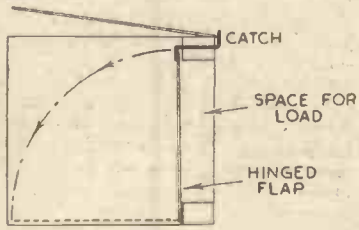


Fig. 13. The glass box shown in Fig. 12 is provided with a hinged flap as shown here.

"The Discovery of Man." By Stanley Casson. Published by The Scientific Book Club. 338 pages. Price 2s. 6d. to members.

In this book the author presents the story of the inquiry into human origins, and students and others will find the contents interesting reading. There are six chapters under respective headings of The Inquiry Starts, The Decline of Curiosity, New Worlds to Search, The Age of Reason, Great Discoveries, and Modern Advances. The story of the slow realisation that Man is as suitable a subject for objective study as any other organism is a strange and fascinating tale, and the author tells the story in a very entertaining manner.

"The Woodworker." 1940 Volume. Published by Evans Brothers, Ltd. 324 pages. Price 7s. 6d. net.

The home craftsman, and others interested in woodwork, and woodworking tools will find this useful volume a mine of information. It is packed with articles dealing with the construction of furniture and outdoor woodwork of every description. No matter whether you want to make an attractive dining table, a wardrobe, garden fencing, or an adjustable easy chair, full working details are to be found in this book. All kinds of woodwork joints, workshop hints, the use of tools, and several light articles suitable for handicraft centres, are also dealt with. Not the least important feature of this handy volume is the excellent clear-cut drawings with which it is profusely illustrated. There is also a very full index.

"Flying Model Planes." By Harry McDougall. Published by Lutterworth Press. 160 pages. Price 6s. 0d. net.

The building and flying of model aeroplanes is one of the most fascinating of hobbies, especially at the present time, when we read so much about the exploits and performances of the various prototypes. In this book the author gives the newcomer to model aeroplane construction a clear insight into the basic principles underlying the construction and working of all model aircraft. There are fourteen well illustrated chapters, and at the beginning of the book there is a brief history of model aeronautics; then comes descriptions of various types of plane, followed by explanatory notes on aerodynamics. Among the other subjects dealt with are Fuselage Construction; Undercarriages; Accessories and Fittings; Covering the Model, and Flying Hints. At the end of the book there is a useful glossary of model aeronautical terms.

QUERIES and ENQUIRIES

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

"Solidifying" Waterglass

CAN you tell me if it is possible to solidify the water glass which is sold in liquid form for preserving eggs ; I have tried several times to make it set in a mould but without success. I desire to make a transparent ball. —John W. Sym (Boreland, By Dysard).

OUR best method of "solidifying" waterglass (sodium silicate) is to heat the solution in a suitable vessel, and to dissolve 6 to 12 per cent. of gelatine in it, stirring the solution well, in order to prevent the gelatine from burning. On cooling, the mass will set to a solid, plastic state. It can be subsequently immersed in a weak (half per cent.) solution of formalin in water, if required, and this treatment will serve to render the gelatine insoluble.

Making Safety Matches

CAN you give me some information concerning the making of safety matches ; Will wood chips dipped in a mixture of Pot. Chlo., Antimony Sulphide and Glue, and thoroughly dried, ignite on an ordinary safety match box ? If not, is red phosphorous easily obtainable ? Also, can nitrate-potass. be substituted for Chl. Potass. ?—E. Bland (Ipswich).

SAFETY matches are usually tipped with a mixture of potassium chlorate, red lead, antimony sulphide and glue. These are ignited by being rubbed against the box side which is prepared with a paste consisting of red phosphorus, glass powder and glue. Sometimes the above ingredients are modified to some extent, and the exact composition of the safety match "mixes" is maintained a secret. It is *not* possible to substitute potassium nitrate for potassium chlorate in the manufacture of safety match compositions.

Red phosphorus is readily obtainable from any firm of wholesale chemists, as, for instance, Messrs. Harrington Bros., Ltd., London, E.C.1.

Softening Plastic Compositions

CAN you suggest an acid that will turn Ivorine into a liquid or paste? By Ivorine, I mean the composition used for knife handles, tooth-brushes, etc. I have tried dry heat which, of course, was useless, and boiling in water only softens it enough to bend.—W. J. Bradfield (Catterick).

IT is not possible to soften knife handle composition sufficiently to turn it into a plastic paste, since if you were to employ any drastic chemical treatment to this end you would merely destroy the ivorine material. Most of the present-day plastic compositions are synthetically produced, and they are moulded under very high pressures and at elevated temperatures. Once moulded, they become insoluble and non-softening. Your best plan is to procure a quantity of rennet casein material from a firm such as The British Lactonite Company, London, E.C.4, and to knead this up into a doughy mass with very hot water, afterwards allowing the mass to set hard in moulds. This should enable you to obtain very satisfactory plastic material similar to knife handles.

Relay with Time Lag

I AM desirous of constructing what is known as a sluggish or slow-to-release relay (a type widely used in automatic telephony). The essential feature of this relay is that it operates as soon as the circuit containing it is closed, but a momentary break by about, say,1/100 sec. in the current through this circuit does not cause any corresponding break in the circuit controlled by the relay.

I should be glad if you can give me constructional details for such a relay ?—I. A. Hennell (Wimbledon).

THE usual method of obtaining a quick make and slow break to a relay action is to link up the iron plunger of the solenoid, or the moving armature of the electromagnet, with a dashpot. This need only be of very light construction, consisting of an outer tube of thin brass closed at one end

in which a second short length of tube is fitted to slide quite easily, and also closed at one or both ends. The closed end of the outer tube is provided with a one-way valve controlled by a very light spring, which, when released by the downward pull of the magnet, allows air to escape freely so that the inner member can slide without restraint. Any reverse motion of the plunger, however, causes the air valve to close and delays the action to an extent limited only by the amount of air leakage between the sides of the inner and outer tubes, or at the valve which may be kept off its seating by an adjustment screw.

Converting Two-Phase Motor

I HAVE a ¼ h.p. 2-phase 230 volt induction motor and would like to know if I can alter the windings to make it work on single phase, or failing that, can you give me details of rewinding the stator? The particulars of the motor are as follows: Rotor. 3⅜ dia. 36 slots. Stator Bore 3 7/16 dia. and 2¼ in. wide. Speed 2800 r.p.m.—S. Wright (Walsall).

YOU may have some difficulty in converting your 230 volt ¼ h.p. 2-phase motor to run on single-phase at 2800 r.p.m. unless the stator is designed with an exceptionally liberal amount of iron in the web at the back of the slots; in a 2-pole winding such as would be required to give you this speed on 50 cycles the yoke ring has to carry the whole of the flux at the back of the teeth, whereas in a 4-pole design only half the flux is carried between each pair of poles.

Another point is the exceptionally large airgap between your rotor and stator bore, amounting to 31 thousands of an inch all round, whereas the usual airgap in a machine of this size would be from twelve to fifteen thousandths.

The winding recommended as a single-phase motor with split-phase start for 230 volts 50 cycles 2800 r.p.m. full load speed is given in the following specifications:

Rotor. Squirrel cage type, no alteration required.

Stator. 18 coils arranged for 2-pole winding with 9 coils per pole, each coil containing 37 turns of No. 21 SWG d.c.c. copper. These are to be grouped concentrically and are placed first in the slots. Over these, with their centres half a pole-pitch in advance are wound the starting coils, 18 in number, each of which consists of 40 turns of No. 27 SWG d.c.c. copper, also grouped concentrically.

In starting a "Twinob" external switch can be used, by which the two sets of coils, running and starting, are put in parallel until the motor speeds up, and the running coils alone left in circuit when the motor is running.

Nodon-Valve Rectifier

I SHALL be pleased if you could possibly enlighten me on the following points:—I have recently constructed a "Nodon" rectifier (one electrode of lead and the other of aluminium) and have been using as the electrolyte a solution of bicarbonate of soda. The results have so far not been satisfactory and I have been wondering if a solution of ammonium phosphate would give better results?

My particular rectifier consists of one plate of each metal, the size of each plate being 2 in. square, and a distance of ¼ in. separates them.

(1) Would this rectifier be suitable for charging a 2-volt accumulator at 3 volts at 5 amps?

(2) What strength of solution would give the most satisfactory results?

(3) Could the electrolyte be solidified without loss in efficiency, by means of gelatine or glue?

(4) How long would such a rectifier last charging at the above rate, if the capacity of the cell was 4 cubic ins.?

(5) Could you please tell me what the brown deposit consists of which forms on the lead plate when bicarbonate of soda is used as the electrolyte?—R. W. Poole (Oulton).

IT would not be possible to give complete answers to your many queries concerning the Nodon-valve type of rectifier in these columns, but the following should clear up the chief points on which you require assistance.

Ammonium phosphate is the best electrolyte, of which 2 lb. of the commercial salt should be dissolved in each gallon of water—or a proportionate amount for a smaller quantity of electrolyte. The current output should be in the region of 30 mA per sq. in. of aluminium immersed in the electrolyte. From this you will appreciate that your cell is far too small for accumulator charging.

It is not practicable to solidify the electrolyte, and this represents one of the major disadvantages of this type of rectifier, which is very "messy."

Presumably you realise that a cell of this type has to be "formed." This may be done by connecting two or more in series, and also in series with a 60-watt electric lamp bulb to an A.C. supply. The forming should be continued until the cells will not pass any D.C. current.

Corrosion of the aluminium electrode may be minimised by slipping a short piece of rubber tubing over it at the point where it enters the electrolyte. A layer of paraffin oil on the surface of the electrolyte will reduce the tendency of the liquid to "creep."

Preparing Ferric Oxide

COULD you tell me the easiest method of preparing Ferric Iron Oxide in the home laboratory?—P. Strong (Manchester).

IT is a simple matter to prepare ferric oxide in the home laboratory. All you need do is to obtain an ounce or two of ferrous sulphate (sulphate of iron) and heat it strongly in a clean tin can. Clouds of sulphurous gases will be evolved, and the ferric oxide will be left behind in the can as a red amorphous powder. Provided that the heating has been done thoroughly, the ferric oxide will require no further purification. If, however, some unchanged ferrous sulphate still remains in the can, this can be dissolved out with hot water. Ferrous sulphate can be obtained from Messrs. Frederick Jackson & Co., Ltd., Salford.

Heat Treatment of Steel

IN the course of my work recently, I have been confronted with the following problem:—The material I am using is free cutting mild steel, and it is 1⅞ in. dia., the overall length being 3 in. There is a hole in the centre .268 in. dia. —000 + 001. Now after heating in cyanide sodium for 5 to 7 minutes at a temperature of 750-800 degrees and quenching them in oil or water I find that the hole has contracted approximately .006 in the centre, but not at the ends. As these holes have to be honed I find it wears the stones too quickly, also, it takes too long as there are a few thousand to be made.

Can you please enlighten me.—E. S. Woods (Brentford).

THE temperature appears to be too low. 845° C. is a better temperature and the time of immersion is too short to give uniform heat penetration. A minimum of 30 minutes is required to give a case depth of 0.01 in. at 845° C., or 15 minutes to give 0.00175 in. at 815° C. If growth still persists, keep the quenching water in motion. A tempering or stress relieving at 120-150° C. may prove beneficial.

Converting D.C. Motor to A.C.

I HAVE a D.C. 230 volt ⅛ h.p. electric motor which I want to convert to 230 volt, 50 cycle, A.C. The armature and commutator have 17 bars and slots respectively. The field poles are cast in solid to the casing of the motor, there being 2 poles, and the coils are fastened in place with a bar passing through the poles. The brushes are 2. ⅛ in. by ¼ in.

Is it possible to convert this motor by only altering the field windings?—E. H. Bromley (Church Stretton).

ASSUMING the motor is at present shunt wound for D.C. it will run at practically constant speed, but if changed for operation on A.C. it will have to be series wound, and the speed will then be very variable according to load. Also, being designed with solid fields instead of laminated, considerable heating will take place, and the motor should not be used for continuous running. Owing to the small number of commutator bars there will be a good deal of incurable sparking at the brushes, as the windings are not sufficiently sub-divided for successful commutation. There is no necessity to rewind the armature, but as an A.C. motor the rating will have to be reduced from ⅛ h.p. to about ¼ h.p. at 2000 r.p.m. The field coils will consist of 325 turns each of No. 20 SWG d.c.c. copper, in series with one another and with the armature.

Tube-Straightening Machine

I WISH to make a tube straightening machine, and would greatly appreciate any help you can give me. The tubes are made of steel about 4 ft. long and ⅜ in. diam.: they are not badly bent, but there are kinks which need taking out. I have several ideas in mind including three rollers working "mangle-like."—T. E. Edwards (Flint).

THE proper tube-straightening machines have an arrangement of inclined hollowed rollers which would be too complicated for you to attempt. If you only have moderate numbers to deal with it would be possible to do them in an arbor press with suitable die blocks. Three rollers would not give a satisfactory result. Plate flattening machines or "mangles" have either five or seven rollers, and we suggest that you try the former, three below, the two pitched above to come between them. Put the top rollers in a screw-fed slide.

"THE R.A.F. IN ACTION"

In our review of this book in the May issue of "Practical Mechanics," the published price was incorrectly given as 7s. The correct price is 7s. 6d. net.

THE Cyclist
Editor: F. J. CAMM

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'Phone: Temple Bar 4363

Telegrams: Newnes, Rand, London

Comments of the Month

By F. J. C.

Wanted—New R.T.T.C. Rule

ALTHOUGH the R.T.T.C. has cluttered itself up with a lot of rules, some of which are unnecessary, and several of them more honoured in the breach than the observance, it is a somewhat surprising fact that there is no rule concerning how riders should be started, nor any rule concerning the assistance which may be rendered to them in the starting. It is common practice when the time-keeper announces the last five seconds for the rider to be held up and pushed off at the word "Go!" Should the starter go beyond the starting line? If so, how far should he push the rider? These are points which ought to have been laid down in the rules but they are not.

We were present at the start of a "50" during a recent week-end, and we observed the starter run down the road pushing the rider for a distance of at least 12 yards because the rider was having some difficulty with his toe strap. We consulted the rules and were astonished to find that there is not one dealing with this important point. On the face of it, it seems a small matter, but let us investigate it a little further. Suppose, for example, the rider is merely entitled to be pushed beyond the starting line and then has trouble with, say, his toe strap and falls off; that incident might delay him for 30 seconds—an important period of time in any road time trial. If the starter continues to hang on to his machine whilst the rider is completing the necessary adjustment, the latter is saved that 30 seconds, and thus has received unfair assistance.

A Flying Start

PURSUING the matter still further, there is nothing in the rules at present to prevent the rider making a flying start. It is not laid down that road events must commence from a standing start. There is nothing in the rules to prevent a rider hiring an expert harrier to push him 50 yards or so. This is an important matter, and we suggest that the R.T.T.C. has been remiss in not giving attention to it. It is certainly a matter which should be placed on the agenda for discussion at the next A.G.M.

Strangely enough, the R.R.A. has no rule relating to starting, and it would, therefore, seem to be proper for a rider attempting records to make a flying start. The rules do not suggest that he may or may not be pushed off. Precise instructions should be given as to the exact amount of assistance which a rider in a time trial or record attempt should be given, and it also should be laid down that the start should be a standing one.

We have discussed this matter with several prominent cycling officials, and with a cycling journalist, and they agree with us that the absence of a rule is a serious omission. It is absurd to insist upon accuracy of course measurements and Kew A watches, if there is to be this considerable latitude in starting. That, too, needs precision.

Travel Restrictions

THE Ministry of Labour and National Service approve the suggestion that we should take a week's holiday. But they qualified the recommendation with an expression for the need for caution to reduce travel by car, coach or train, to the lowest figure. This means, in effect, that all those who can should take holidays by bicycle and thus not only conserve the resources of the public services, but also enjoy the holiday in its best possible form, that of gentle physical recreation, change of scene, and low cost. A week's holiday taken on a bicycle will be far more beneficial than a train journey to the seaside and a week tied to a hotel or boarding house, providing easy victims for the voracious landlady. You will return from the holiday refreshed, invigorated, and free from the usual end of holiday boredom.

Cut Chain Wheels

C. A. SMITH, famous Bath Roader, has for half a century advocated the use of cut chain wheels and sprockets. His voice has cried alone in the wilderness, for whilst certain manufacturers pay lip service to the idea and all chain manufacturers agree that their chains would last four times as long, nothing is done. C. A. Smith has in his possession a machine fitted with cut chain wheel, cut sprocket, and a block centre chain. It has been in continuous use for nearly 50 years, and when we tested it recently we found it to be in new condition. The chain has never been replaced. Perhaps that may be a snag from a commercial point of view. But is it not advertising the deficiencies of stamped and pressed chain wheels when instructions regarding the adjustment of the bicycle tell you to adjust the chain to a certain degree of deflection *at its tightest point*? Hobs for the accurate generating of chain wheels and sprockets are a stock tool obtainable from all manufacturers of small tools. On a mass production basis the cost of hobbing would be no more than that of pressing or stamping, and if cast steel were used, the gears could be hardened and tempered and would last practically for ever.

Inaccurate Gears

CHAINS are now so accurately made that it seems a pity to use them on inaccurate gears. Some idea of the accuracy of the modern chain can be gained from the fact that chains are now used as drilling jigs when it is necessary to drill a series of holes an equal distance apart. The creaking and clicking noises which you get in the transmission of even new bicycles is an audible indication of the accuracy of the chain and the inaccuracies of the gears. Spin the chain wheel on any machine. You will notice that in almost every case it does not revolve truly, being anything from a 1/16in. to 3/32in. eccentric, and also that it wobbles sideways. Spin the back wheel and you will notice that the sprocket has the same errors. A point about sprockets is that, no matter how accurately they are cut, it is impossible to get them to run true if they are screwed to the hub. They must be splined, or driven on to a coned hub extension as is the case with motor cycle engine sprockets. These defects have been so obvious that we are astonished that someone has not marketed a machine with cut chain wheels and sprockets. The argument has been advanced that it will be more costly, but with this we do not agree. It is merely that we have got into a rut. There has been a general tendency of recent years to ignore refinements and build machines down to a price. It merely needs one manufacturer to include in his specification correctly cut gears for all others to follow.

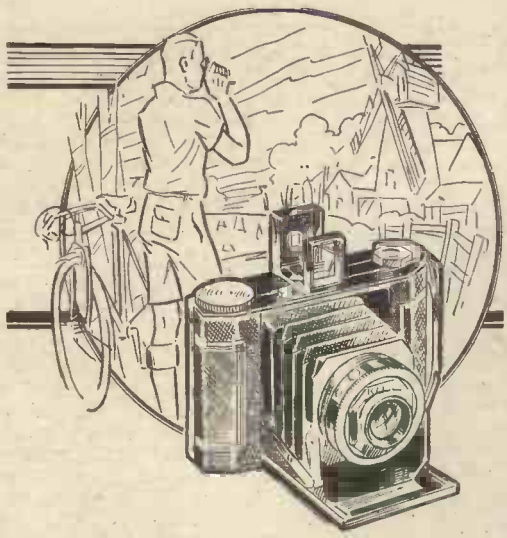
"An Unnecessary Refinement"

THERE are some cyclists who feel that it is an unnecessary refinement and that the present pressings are good enough. They affirm that it would not make any difference; having tried both we assert that they are wrong, and that is why they so frequently have to renew transmission items. It would seem, therefore, that the first move should come from cyclists demanding correctly designed and manufactured transmission, for unless cyclists demand them, they will not get them. We support C. A. Smith's plea.

Inanities

WE thought that by this time every road user was aware of the reason why cyclists do not like cycle tracks and therefore do not use them. Apparently, however, the Junior Car Club believes in flogging the point for in a recent issue of its journal it offers the suggestion that accidents will be reduced if the use of cycle tracks is made compulsory. It is true that in a previous paragraph the J.C.C. concludes that its influence must be waning, because in a previous issue it made further suggestions which have been ignored. But if the suggestion it makes is as unsound as the present one, we can well understand why they are ignored. We suggest that the Junior Car Club studies past issues of this journal where the whole question of cycle tracks has been fully discussed.

The compulsory use of cycle tracks would affect the accident problem to about the same degree as a speck of dust colliding with a battleship. The J.C.C. does not suggest why it believes that the compulsory use of the tracks would reduce accidents. If that body inspects the track along, say, the Great West Road, it will observe why there are good reasons for believing that use of the tracks would increase the number of accidents.



Paragrams

Two Clubmen in Ark Royal

AT least two London clubmen are serving in the Ark Royal which has been "sunk" so many times. They are Jack Milton (Letchworth C.C.) and Alex Saunders (Hitchin Nomads).

Club Suspends Activities

AS so many members are serving with the Forces, Allondon Road Club, which produced such a fine string of riders, has had to suspend activities for duration.

Lady Racing Secretary

MISS JOY HAWKINS, well-known lady time-trialist, is the 1941 racing secretary of the Wellingborough C.C.

Tricyclists Opening Run

A NUMBER of well-known tricyclists attended the opening run of the Tricycle Association to Welham Green, Herts, recently.

Well-known Tricyclist in O.T.U.

GORDON THOMAS, champion of Southgate C.C. for three consecutive years, and winner of the T.A. championship, and the Major C. Liles Trophy—as the best all-round tricyclist in 1939, is now with an Officer Training Unit in Scotland.

Another Clubman in R.A.F.

FOUNDER member of the Bedfordshire Road Club, R. N. Welham is now serving in the R.A.F.

Millions of Cyclists in Denmark

DESPITE the German occupation, Denmark is still the greatest cycling country in the world. Out of a population of 3,703,350, she has more than 2,250,000 cyclists.

Copenhagen, the capital, has a population of 900,000, and of this figure, 500,000 ride bicycles. Best-known of Danish cyclists, King Christian, has ridden a bicycle for 50 years.

New Bicycle for Midland Heroine

WEST Bromwich George Medallist, Miss Charity Bick, has been presented with a new bicycle by her employers. As a spare-time A.R.P. messenger, Miss Bick was blown from her previous machine by bombs, but continued her work, and helped to put out fires.

Bicycle Couriers in Clydeside Strike

BICYCLE couriers once again played a part in last month's strike of Clydeside apprentices, who asked for an increase in wages, as they were receiving less than women working in the workshops. The messengers kept the various works committees informed of the latest developments in the other factories.

Entirely New Hostel Handbooks

TWO entirely new editions of the hostel handbooks for England and Wales, and for Scotland, were available for Easter.

Glasgow Trams Condemned

BUGBEAR of Glasgow cyclists, the Corporation trams, were condemned last month by Assistant Chief Constable Doherty in an address. He advocated trolley-buses, and a tunnel under the Clyde in the west end of the city.

Royal Visit to Tyre Works

DURING a recent visit the King and Queen visited the works of the North British Rubber Company, and saw how cycle tyres are made. Five thousand workers are employed by the North British Rubber Company, and more than 50 workers, each with a record of at least 45 years' service, were interviewed by the Royal visitors.

No Need to Smile

DON'T smile—it is something to be ashamed of," said Bailie Matthew Armstrong at the Govan (Glasgow) Juvenile Court, when a 14-year-old boy pleaded guilty to stealing a bicycle worth £5. A fine of 10s. 6d. was imposed, with the alternative of seven days' imprisonment.

Scots Girl Cyclist Joins Wrens

MARY HARVIE, Shotts Wheelers, one of the speediest of Scots girl cyclists, has joined the Wrens. Formerly an official of the Scottish Women's C.A., she has competed on road and track with outstanding success during the past six years.

Club Secretary's Marriage

BUSY hon. sec. of Lancia C.C. as well as keen West of Scotland T.T.A. official, Frank Scott was married recently to Miss Dorothy Clinton. Frank Scott, and his club, did much to assist Clydeside clubs go ahead with a strong road time-trials programme last season.

Tandem Partners

H. CHAPMAN (R.A.S.C.), of the Norwood Paragon C.C., is now in the North of England, together with his tandem partner, C. C. Melhuish.

Veteran Roadman Passes On

MR. CLAUD K. MILLS, veteran roadman, and for many years president of the North London C.C., has passed on.

Manchester Events

MANCHESTER Road Time Trials Council have approved the holding of twenty-four events in their area. North and South London plans include the promotion of almost one hundred events.

Six-day Rider in Canada

"TORCHY" PEDEN, winner of the Southgate C.C. open "25" in 1928 (the only event he won on English roads), is to be a Six Day Race promoter in Canada. He has ridden in "Sixes" all over the world, including two at Wembley.

Scots Rider to Attack Records

JOHN WATERSON, the only male rider in Scotland last year to attempt road records, has paired up with a West of Scotland clubmate (John Tocher) with view to attacking some road records.

Club Members Marry

TWO members of Doncaster Wheelers C.C., Dennis Clamp, famed road racer star, and Eileen Roberts have married. Clamp is serving with H.M. Forces.

Club's Ten Mile Event

BRENTWOOD Road Club and Chelmsford Cycling Club are to hold a combined Ladies' ten-mile event in June. They are also debating the possibility of holding a track meeting for the funds of the British Red Cross.

Cyclists and Y.H.A.

CYCLISTS are playing a greater part than ever in the Youth Hostel Association. In the Merseyside Group of the Association it was reported that last year 59 per cent. of the visits paid to Hostels was by cyclists.

Scottish Clubrooms Requisitioned

THE clubrooms of the Ardgowan Touring Club at Ravenscraig, near Greenock, have been requisitioned. They were formerly a popular place of call with West of Scotland wheelmen.

Scottish Clubman Joins R.A.F.

A REGULAR rider in West of Scotland important road events, Kenneth Cochrane, champion of the Douglas C.C., and the club's most outstanding rider of recent years, has volunteered for service with the R.A.F.

Northern Road Time Trials

THIRTEEN road time trials are planned by the North Midlands R.T.T.C.

Club's Open "50"

FINSBURY Park C.C. hope to include an open "50" in their programme this year.

Club Treasurer's Death

THE Midland Cycling and Athletic Club have suffered a great loss in the death, at the age of 72, of their treasurer (Mr. George Gough). Until he retired seven years ago, he was headmaster of Marlborough Road School, Small Heath.

Sailor-member Safe

MEMBERS of the Oak C.C. are relieved to learn that their sailor-member, M. Bird, who was serving on a ship damaged by enemy action, is safe.

Veteran's Night Ride

IN order to attend a meeting of East Suffolk County Council, Cr. C. W. Whatnough, who is nearly sixty, followed up a hard day's work by cycling all through the night from Chiswick, Middlesex, to Ipswich.

A.F.S. Cyclist's Narrow Escape

TWO bombs dropped by a hostile plane in North London smashed a bus and caused the death of many people. Riding behind the vehicle at the time of the impact was a Southgate A.F.S. fireman. He was flung from his machine, thrown on the pavement, but in no way injured. When daylight came, his machine was found on the top of a block of flats 200 yards away.

Club has 25 Members in Forces

THE Redditch Road Club have twenty-five members in the Forces, but they are planning a full programme.

Hon. Sec. for 29th Year

MR. J. W. LACEY has been re-elected for the 29th consecutive year, hon. sec. of Birmingham Crescent Wheelers.

British Clubman in Canada

SHORT-DISTANCE specialist of the Marlborough Cycling and Athletic Club, J. L. Howell, is now in Canada finishing his training as an R.A.F. pilot. He has become an enthusiastic ice-hockey player.

Australian Record Holder Injured

HUBERT OPPERMAN, the "great-little" Australian who holds several British road records, and is a former holder of the Land's End to John O'Groats record, recently strained a thigh muscle when running! Now with the Australian Air Force (he's a Corporal), he was competing in a ten mile cross-country run, which he won.

Old Club Member Passes On

LEEDS Wellington C.C. have suffered a loss by the death of Walter Keeble, an early member, who was honoured with life membership only a few years ago.

Club Suspends Activities

AS so many members are serving with the Forces, Allondon Road Club, which produced such a fine string of riders, has had to suspend activities for duration.

Lady Racing Secretary

MISS JOY HAWKINS, well-known lady time-trialist, is the 1941 racing secretary of the Wellingborough C.C.

Tricyclists Opening Run

A NUMBER of well-known tricyclists attended the opening run of the Tricycle Association to Welham Green, Herts, recently.

Well-known Tricyclist in O.T.U.

GORDON THOMAS, champion of Southgate C.C. for three consecutive years, and winner of the T.A. championship, and the Major C. Liles Trophy—as the best all-round tricyclist in 1939, is now with an Officer Training Unit in Scotland.

Another Clubman in R.A.F.

FOUNDER member of the Bedfordshire Road Club, R. N. Welham is now serving in the R.A.F.

Millions of Cyclists in Denmark

DESPITE the German occupation, Denmark is still the greatest cycling country in the world. Out of a population of 3,703,350, she has more than 2,250,000 cyclists.

Copenhagen, the capital, has a population of 900,000, and of this figure, 500,000 ride bicycles. Best-known of Danish cyclists, King Christian, has ridden a bicycle for 50 years.

New Bicycle for Midland Heroine

WEST Bromwich George Medallist, Miss Charity Bick, has been presented with a new bicycle by her employers. As a spare-time A.R.P. messenger, Miss Bick was blown from her previous machine by bombs, but continued her work, and helped to put out fires.

Bicycle Couriers in Clydeside Strike

BICYCLE couriers once again played a part in last month's strike of Clydeside apprentices, who asked for an increase in wages, as they were receiving less than women working in the workshops. The messengers kept the various works committees informed of the latest developments in the other factories.

Entirely New Hostel Handbooks

TWO entirely new editions of the hostel handbooks for England and Wales, and for Scotland, were available for Easter.

Glasgow Trams Condemned

BUGBEAR of Glasgow cyclists, the Corporation trams, were condemned last month by Assistant Chief Constable Doherty in an address. He advocated trolley-buses, and a tunnel under the Clyde in the west end of the city.

Royal Visit to Tyre Works

DURING a recent visit the King and Queen visited the works of the North British Rubber Company, and saw how cycle tyres are made. Five thousand workers are employed by the North British Rubber Company, and more than 50 workers, each with a record of at least 45 years' service, were interviewed by the Royal visitors.

No Need to Smile

DON'T smile—it is something to be ashamed of," said Bailie Matthew Armstrong at the Govan (Glasgow) Juvenile Court, when a 14-year-old boy pleaded guilty to stealing a bicycle worth £5. A fine of 10s. 6d. was imposed, with the alternative of seven days' imprisonment.

Scottish Road Events This Season

AT its March meeting, the Scottish Amateur Cycling Association approved 61 open events for this season. Since then, two further clubs have stated that they will promote four events, making the total 65. It was confirmed at the meeting that the Ayrshire 30 course which produced alleged individual and team records last year was 1½ miles short. Organisers of opens in this district are to be asked to verify all courses before use.

The "McGougan Case" was again discussed, and the S.A.C.A. is to attempt the conciliation of the West of Scotland T.T.A. by offering a speaker, Alex Conner, to explain its point of view.

There will be open promotions this season in most Scottish areas, including Clydeside, Mid-Scotland, Ayrshire, Fife, Dundee, and Aberdeen, but no notices of events have been received from Greenock, Edinburgh and the Borders.

Enthusiasm in Aberdeen

IN spite of aerial intervention, road cycling continues in Aberdeen and the north-east of Scotland. Six open and five confined events are to be promoted this season, although the programme does not go beyond the end of June, owing to the prospect of extensive calls-up.

The inter-city event between Aberdeen and Dundee is also to be run.

"Best All-Round Sportsman"

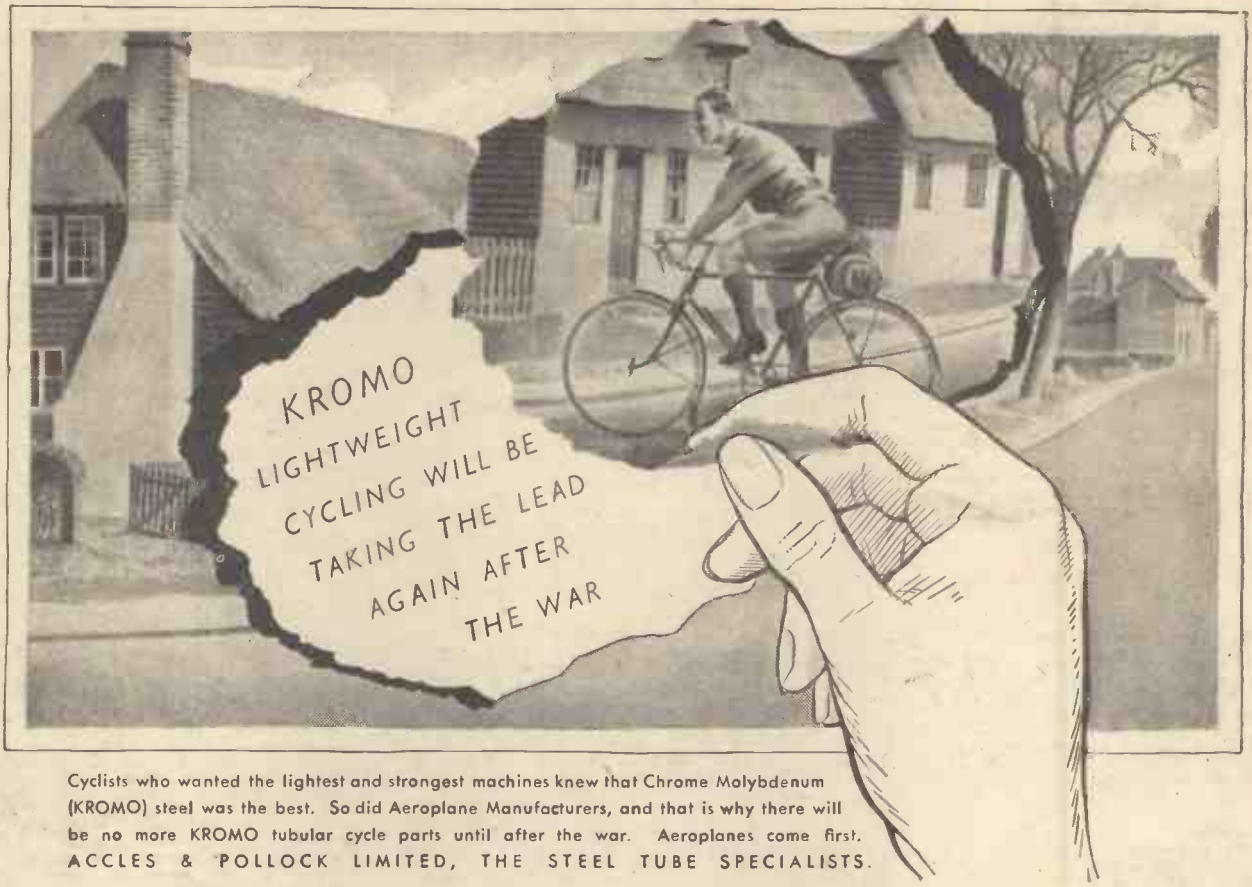
ANDREW CRICHTON, an Uddingston (Lanarkshire) cyclist, has been awarded a bicycle frame, presented by a Scots firm to the "best all-round sportsman" at the 1940 Cumnock rally, which was attended by 4,000.

More Scots Promotions

THE West of Scotland Time Trials Association will promote open events during 1941, including a novice 25, 50, and 100. Another body which has decided to promote its 25 is the Royal Albert C.C., of Larkhall.

February Road Deaths

THE Ministry of Transport's Return of February road deaths shows that they were less than in January, but show an increase of nearly 65 per cent. on February of last year. The total deaths during Febuary of this year were 689, as compared with 418 in February of last year.



Cyclists who wanted the lightest and strongest machines knew that Chrome Molybdenum (KROMO) steel was the best. So did Aeroplane Manufacturers, and that is why there will be no more KROMO tubular cycle parts until after the war. Aeroplanes come first.
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AROUND THE WHEELWORLD—By Icarus

Bath Road Jubilee "50"

THE famous Bath Road Jubilee "50" was run according to plan on the 4th May. The field was not so large as in former years, and it did not attract many well-known riders. None the less it was extremely well organised as usual, and went off without any of the proverbial hitches. Out of an entry of 46, 36 started and 31 finished. Timekeeper Dudley Daymond gave the following results:

Position	Name	Club	25 Miles	Finish
1.	CROWTHER, T.	Derbyshire R.C.	1 10 0	2 14 22
2.	WILLIAMS, D.	Ealing Manor R.C.	1 12 0	2 17 18
3.	HARDING, A.	Middlesex R.C.	1 13 0	2 18 48
4.	HUTSON, H. J.	Bon Amis C.C.	1 14 0	2 19 20
5.	HORROCKS, R. G.	Archer R.C.	1 11 0	2 19 32
6.	JENNER, A. V.	Charlotteville C.C.	1 10 0	2 20 8
7.	HURLOW, W. B.	Galena C.C.	1 10 30	2 20 19
8.	BAKER, R. R.	Addiscombe C.C.	1 14 0	2 20 40
9.	SORE, F. H.	Charlotteville C.C.	1 12 30	2 20 46
10.	PERRYMAN, W. F.	Archer R.C.		2 21 54
11.	PAUL, W. G.	Addiscombe C.C.	1 9 0	2 22 30
12.	WYSOM, R.	Calleva R.C.	1 14 0	2 22 37

Team Race:
1. Charlotteville C.C. (Jenner, A. V., Sore, F. H., Dean, M. W.) 7h. 6m. 14s.
2. Archer Road Club (Horrocks, R. G., Perryman, W. F., Perryman, J. W.) 7h. 6m. 15s.
3. Bon Amis C.C. (Hutson, H. J., Higson, S. G. R., Wright-Mawson, J.) 7h. 10m. 6s.

I had collected a party including the judge, E. Coles-Webb, and a former President of the Club, C. A. (Bath Road) Smith, who has just been made first Hon. Life member of the Club. It is many years since C. A. witnessed a race over the course which he discovered over 50 years ago. It was evident from the discussion during the run down that he has lost none of his virility and none of his enthusiasm for the sport he did so much to found; except for the catering van, which, of course, was unheard of when C. A. was racing, things now are very much what they were then. He spent some time examining the modern racing bicycle, and deplored as I do the fact that no one has yet appreciated the merits and great advantages of cut chain wheels and sprockets. The bicycle is the modern giant's boots but you can only take giant strides if the boots fit and do not give rise to "corns," in the form of lost power due to teeth being out of pitch, and gear wheels eccentric. On a mass production basis cut chain wheels would be no more expensive than the present stampings. Chains, of course, are extremely accurate, and are, in fact, a gauge which measures the inaccuracy of the wheels over which they run. That is why you have clicking noises, and tight spots in the chain. It is also the reason why you have so often to renew your chain. C. A. showed me a block centre chain running on a cut chain wheel and sprocket which had been in continuous use for nearly 50 years and it is as good to-day as when first fitted. Incidentally, I notice that a competitor in the Jubilee "50" was using a block chain. In my view the selection was wise. All chains stretch, but a roller chain more so than the block chain. Of course, there are disadvantages to the block chain in that it more readily gathers mud and dust and a gear case is out of the question with a racing bicycle. But a ½ in. block chain in an oil retaining gear case is C. A.'s recommendation for transmission, with, of course, cut hardened and tempered chain wheels and sprockets. Another important point. The Air Ministry insists upon gear cut sprockets for aircraft control, and they are only subject to intermittent use. They will not pass stampings. Here is a chance for some manufacturer after the war to steal a march on his competitors by marketing cut chain wheels. They do not use stampings in the gear boxes of motor cars!

Bidlake Memorial Trust

OWING to the reduced and limited activity in cycling affairs during 1940, the Committee of the S. T. Bidlake Memorial Trust have resolved to withhold making any award in respect of that year.

Benevolent Fund

AT the Annual Meeting of the Midland Centre of the Motor and Cycle Trades Benevolent Fund, Mr. J. W. Bryan (President of the Manufacturers Union and Director of B.S.A. Cycles Ltd.) was elected Chairman for the fifth successive year while Mr. J. Bayliss took the office of Vice-Chairman, also for the fifth occasion.

In presenting his annual report, the secretary, Mr. Lambley, referred to the fact that there had been a slight decline in membership but that apart from the annual concert the work of the centre had been carried on, though under difficulties. The Chairman spoke enthusiastically of the work undertaken by the Relief Secretary, Mr. Harman (who has held this office for 26 years) and his committee. The meeting voted the sum of £100 to be remitted to headquarters in London, making a total of over £2,500 given by the Midland centre to date.

Barnstaple Imperial Wheelers

A SIGN of the Times! I learn from Miss B. Bawden, of 16 Joy Street, Barnstaple, that she has been elected to act as Club Secretary in place of Mr. Jeffrey who held the combined position of Treasurer and Secretary prior to joining the R.A.F. Mr. T. J. A. Bissell, of 8 Portland Buildings, Barnstaple, is Hon. Treasurer.

Watch Testers

THE Secretary of the R.T.T.C. informs me that they have now appointed the following watch testers:
C. N. A. Ruff, 7a Stoke Road, Gosport.
C. E. Janes, 74 Risborough Road, Bedford.
H. C. Henderson, The Watch Shop, Effingham Street, Rotherham.
T. E. White, 48 Amhurst Gardens, Isleworth.
W. J. Carroll, 33 Walbrook, Bank, E.C.4.
A. A. Oxman, 33a Upper Tooting Road, S.E.17
A. Kelsey, 23a Bowesfield Lane, Stockton on Tees.
Meaders Ltd., 645 Christchurch Road, Boscombe, Bournemouth.

Any of these Local Watch Testers can examine and certify a watch for R.T.T.C. purposes. The fee is 5s., plus 1s. for packing and postage.

N.C.U. Notes and News

SIX new cycling clubs have become affiliated to the N.C.U.—one with a membership of more than 50. As Mr. A. P. Chamberlin says:—"It is curious that, whilst some clubs have found it impossible to carry on, others are being formed with almost peace-time memberships." Where difficulties in running a club are experienced, members are asked to get into touch with the Secretary of the N.C.U., 35 Balliol Avenue, Highams Park, when every assistance will be given them to enable them to carry on.

During the first four months of this year more than £2,200 has been obtained by the Union for its members involved in accidents on the road.

N.C.U. Ties are now available at 2s. 6d. each, plus 2½d. postage; the N.C.U. Spitfire Fund has now reached £950.

First Civilian Pigeon Post

BRITAIN'S first Civilian Pigeon Post was first inaugurated by permission of the Air Ministry and the Home Office, when two pigeons flew from a loft of fifty-eight at Fort Dunlop to Wardington, near Banbury.

One of them carried a message on a slip of rice paper from the workers at the Fort to Sir George Beharrell, the Dunlop chairman; the other took "The Battle of Britain," reduced in facsimile to a strip of photographic film eight inches long.

The workers' message ran:

> "Hitler's threats of Spring offensive against Britain stimulate efforts of all Dunlop employees, who pledge themselves once more to maximum day and night effort to provide essential supplies."

In reply, Sir George Beharrell released a pigeon with the acknowledgment:

> "I warmly appreciate Council's inspiring message. There is one motto for all of us—'It all depends on me.'"

The messages are carried in inch-long containers. One of these would hold three film facsimiles of "The Battle of Britain," each 15,000 words in length.

This novel service, which is as quick as an express train, will be available to and from Fort Dunlop, Coventry, Wardington and Manchester, in the event of disorganisation of other means of communication. Each of these centres now has apparatus for reducing messages and for magnifying them to a readable script when received.

The Revised S.R.O.

THE reserved age of cycle mechanics has been raised from 25 to 35, and this, coupled with the shortage of spare parts, will add to cyclists' difficulties. We do not think that the Government is wise in denuding industry of workers essential to the maintenance of proper public service. Thousands of munition workers cycle to work, and production is bound to be held up if their machines are not maintained in a usable state. On the question of the shortage of spares, Capt. Waterhouse said in the House of Commons recently: "Steel has been allocated within the restricted limits imposed by the supply position, for the production of spare parts and accessories for bicycles. I am not aware of any shortage." I can take Capt. Waterhouse to districts where the shortage is acute.

Centenary Club Spring Tour

NEARLY 40 members of the trade comprised the merry company that started from Shrewsbury on April 25th for the Spring Tour of the Centenary Club. They spent two days in Wales along the Welsh Border. I understand that Frank Urry will be dealing with the matter in greater detail.

The Workers' Dilemma.

AT the moment of writing, the Government's views about holidays have just been published, and I am largely in agreement with what has been said concerning the value of a proper break. I do not believe that the seven-day week is a paying proposition, and I am certain that men and women cannot go on without a holiday. But what a dilemma confronts those workers who do not happen to be cyclists! With one breath the Government dwell on the desirability of "a physical and mental change from one's ordinary work": with the next breath the toilers are told to reduce "travel" (travel by public transport is, of course, meant) to the minimum, and warned that there will be no special facilities. What are work-folk to do? The bicycle is surely the answer—the well-nigh costless, the convenient, non-commodity-using, health-giving and happiness-producing bicycle! And what a magnificent holiday one can have, through the medium of cycling, in the course of a week—or even a week-end—pinched from work!

No Paid Timekeepers in Scotland.

IN view of the advocacy in *The Cyclist* and elsewhere of a system of unpaid timekeepers in road time trials, it is interesting to note, that all road time trials in Scotland are timed by voluntary officials. The standard of timekeeping is high.

At present, there is only one paid timekeeper in Scotland, but he does not charge amateurs.

WAYSIDE THOUGHTS

By F. J. URRY

The Great Neglect

NO matter how frequently one tenders advice on the lubrication of the bicycle, it still remains the outstanding neglect in upkeep. Folk who are meticulously careful with the mowing machine or the garden tools still seem to think a bicycle only needs the tyres inflating occasionally, and many of them are even surprised when they find a few spots of oil will work miracles. I am always meeting this kind of neglect; people ask me why a brake does not work smoothly; I have a look at it, and generally the only trouble is lack of oil. A pedal squeaks; same thing, or a wheel turns stiffly. Recently I had a complaint from a friend that the four-speed gear I had recommended him to fit was not functioning as it should. Investigation proved he had run it nearly a thousand miles without lubrication. No wonder delicate machinery protests at such treatment. Take a glance at the machines you see along the road and notice the chains; often bone dry, and many of them red with rust. Now there is a cure for all this and it is as simple as A.B.C. to apply. Buy a tin of good lubricating oil, and spend five minutes every fortnight attending to every moving part of bearings and brakes and chain, if you are a regular rider; and if an occasional one, do the job after every 200 miles of travel. Do not over oil, particularly the wheel bearings, or you will find the oil running down the spokes and penetrating to the inner tubes, and that will rot them more quickly than anything. This is so simple a matter that the wonder is so many bicycles are spoiled for lack of its application. Yet such is the case.

The Right Way

IN making the foregoing remarks, I do want people to understand my sole object is to make cycling so easy that this means of travel shall become almost universal. If one goes their way easily, then the going is a pleasure, and that is precisely what I desire cycling to be for all of my compatriots. And, indeed, that is what it can be with the right type of machine properly equipped, correctly ridden, and given the minimum of attention necessary for its right adjustment and lubrication. I was talking to a clergyman acquaintance some days ago, a man near my own years, who seemed to envy my easy ability to ride and enjoy sixty miles in a day. "I do not think I could do it now," he said: and when at his invitation I examined his machine, I was not surprised. It was the kind of bicycle you can imagine would be foisted on a parson; and I say that in no disrespect, but rather in a spirit of sadness to think the modern lightweight machine is not considered "respectable" for use by the professional man or woman. It is such utter nonsense. This machine weighed over 40 lbs., had a normal gear of 70", a high frame and curly up-turned bars, and the riding of it would have tired a fit man in less than twenty-five miles. It may have looked very "nice" to some folk, but I am quite certain the reason it would wear for years was that no one would care to ride it far if any other form of transport were at hand. For goodness sake, if you intend to take to cycling, let it be the easy comfortable manner of introduction or improvement. In other words, be sure the bicycle fits you; do not try to make yourself fit the bicycle: gear low, sit comfortably, and carry about with you the least poundage of machine commensurate with safety. Then ride for pleasure as well as convenience, and never mind how long or short your journeys are, or what time is occupied with these occasions, so long as you are happy and comfortable.

The Simple Pleasure

KEEP this going for a few weeks and you will be surprised how easy cycling is for the fit person, for by then you will be fit. For cycling is like every other game, you must be fit to get the top-weight enjoyment from it. The main difference is that you need not consciously "train" to acquire that fitness, it just comes to you as the result of a few evening and week-end journeys leisurely undertaken; or better still by the daily ride to work which gives you a certain air of independence extremely valuable in these days of traffic delays. I notice we have been told that office workers should use bicycles whenever possible; that is sound advice for there is nothing so good as the daily journey through the freshest air of your working neighbourhood to keep you well and hearty. Never mind what the other fellow says to you about "descending" to a bicycle, for the independence of travel is by no means a descent, but rather the ascent of a man's spiritual activity; and in any case the sneerer is a snob, and there is still too much snobbery about to encourage democracy to gather the best the world has to offer. I am a cyclist because I love cycling, and firmly believe the majority of people who find enjoyment in natural beauty would love the

means that gives them this grace so silently and so healthily, if they allowed themselves the chance of becoming proper followers of the pastime. The days are ahead when we shall need all the economy we can practise, yet we shall yearn to retain our little pleasures. I am but pointing one way in which you can accomplish the need and the desire, and be a fitter and happier individual as a result.

And Again Home

THIRTY-FIVE miles away, on the other side of the country, an old friend of mine has recently bought a farm, and I had promised to inspect the land at Easter, not that I know much of such things, but a trifle of praise as the light expression of envy, gives folk a whole heap of pleasure. It rained all the way, not fiercely, but with just sufficient persistence to need the service of a cape, and of course the wind was against us, which was possibly the reason we took the longest route. But what a lovely way it is by Westbury to Minsterley, and then the long climb of the Hope Valley over to Bishopscastle. Near the summit we changed a wheel for a couple of ladies struggling with a little Austin (our good deed for the day), swept past the foot of Bishopscastle and by Lidbury North to Aston Clun and thence into the lanes for Clungunford. Another farm meal of generous proportions washed down with perry, and then an inspection committee of land and stock, implements and fixtures. By the time it was all over, tea was ready, and I was ready for tea, too; and the romp home to our comfortable farm with the half gale dead behind was a glorious gallop amounting almost to a rest. Next day alas, we had to return, and made Bridgnorth with ease in a couple of hours, including the climb of Harley Bank, so friendly was the wind; and just beyond that ancient town we ate our lunch near Quat and watched the April sky clouds weep, and then glitter again with smiles. When we came within striking distance of Birmingham above the boom of our helping wind, we heard the voice of the siren as if to remind us that for the time being the pleasant hours of peace were over, and the toil and struggle were on again. But the good days will come in due time, and every passing hour is one less to live amid the turmoil that men call war.

Youth Hostels

The Scottish Youth Hostels Association has decided not to re-open most of the youth hostels inside the north-west Highlands "Protected Area." Very few cyclists and hikers entered this district last summer.

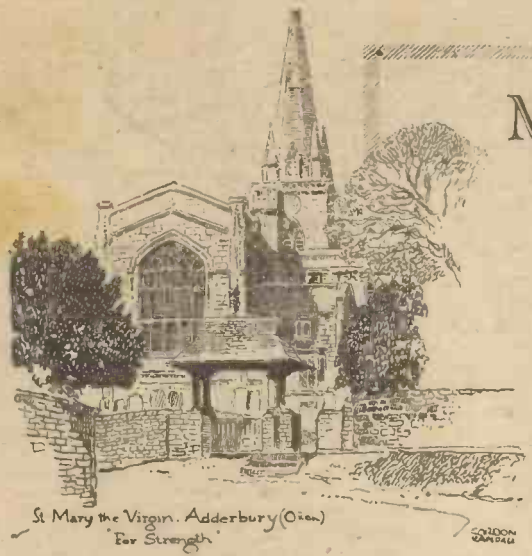
The hostels at Glen Nevis and Auchterawe, and, possibly that at Buntait, are to remain open, however, while the Association is to repeat its experiment of last year of opening schools east of the Caledonian Canal as temporary hostels.

Glasgow youth hostel, familiar to thousands of English cyclists who visited it during the 1938 Empire Exhibition, is now being used as a hostel for young Polish refugees.

The Warren House Inn, Dartmoor. Built in the traditional West Country style, this lonely inn is situated at the highest point (1426 ft.) of the Moreton-Hampstead — Postbridge Road.

At Easter

LIKE other folk, I had a short break at Easter, and in three days rode just over 200 miles on the tandem with my son-in-law making up the crew. Ah! you will say, age at the prow and the engine room abaft; but comfortable tandeming doesn't work like that, for the crew has to "nick" and share the effort of propulsion if the journey is to be a happy one. And happy it certainly was, with a nightly anchorage at a farm I know close to the Severn plain where Vyrnwy joins its waters with the big river, under the shadow of the Breidden hills. We made the seventy miles' journey into a cool windy day, arriving in time for high tea which I will not attempt to describe for fear of creating a touch of envy. Not content with the hard journey (for the brisk breeze ran straightly at us all the way) we used the remaining daylight to climb the 1200 ft. hill to the Rodney Pillar, a thing I have wanted to do for years, but have always by-passed it in order to reach Wales quickly. It is a magnificent view from the summit, where at last you understand the significance of the terms Severn Plain and the Highland of Salop; and the fine panorama of the Berwyns deeply empurpled, lying against the sunset. But it was chill on that ridge, and we did not linger long; but the log fire was good an hour later, a steaming dish, and then the solace of a long quiet sleep.



My Point of View

BY "WAYFARER"

Predicament

IT is not often that I feel the need for sustenance between meals (thanks, probably, to my ingrained habit of fitting a proper lining internally at those delectable moments when knives and forks are the order of the day !), but there do come occasions, in the course of a non-stop 40-mile journey, when I am conscious of "that sinking feeling" which is so readily cured—or *was* so readily cured in pre-war times. A small slab of chocolate, a banana, one or two squares of toffee, a few raisins, or even a piece of chewing-gum, would do the trick, and give me a new pair of legs. Nowadays, however, almost vacant shop-windows mock you. Chocolate, for instance, is as scarce as onions, while bananas simply do not exist. So far as I can see, the best you can buy is a bottle of Worcester Sauce, a jig-saw puzzle, a tin of boot-polish, and some aspirin tablets, none of which is of the slightest use—so far as I am concerned, anyhow—to ward off the hungry knock. This all represents a real predicament for cyclists, but, aware of its existence, it is up to us to arm ourselves with a small nose-bag before leaving home. Those of us who know from experience something of the discomfort and incapacity produced by an empty tummy will need no further warning.

Admirable Roads

A FRIEND who waved to me through his motor-car window the other evening, just as I was on the final stretch of an 80-mile ride, unconsciously set the wheels of my memory in motion. Now, where did I last see him ? Ah, yes ! It was a Sunday morning, and I was making my way towards England, after a few joyous days in the Land o' Cakes. He was travelling in the reverse direction, and at speed, and the opportunity for a "crack" at the roadside passed into history like a flash. During the morning in question, after a somewhat noisy night spent at Abington (in the Clyde Valley), I had traversed that adorable road which climbs up to Beattock Summit and then swoops down to Lockerbie and Ecclefechan, and so to the rather tame "flats" about Solway Firth.

An admirable road, indeed—an entrancing road, whether you actually travel along it, or merely see it from the adjacent railway—a road which sets fire to the imagination and fills the mind with longings and with provocative thoughts. Whenever the train takes me that way to Glasgow (or Edinburgh), my book is closed long before the hills are reached, and I am more than content to sit in my corner and watch the road speeding by, now on one side of the railway, now on the other. But, not unnaturally, I prefer to be on the road itself, taking the hills in my stride, enjoying the spacious views, revelling anew in the freedom of our great pastime, and displaying an interest in the vast trains which come pounding along the steel ribbon linking London with the far north.

Killarney to Thames Valley

BUT it does not stand alone—not by any manner of means. My mind pursued the "hare" which had been set in motion by that chance meeting, and I began to "collect" admirable roads. Being then, mentally, in Scotland, I stayed there, and went in imagination through Glencoe and the Great Glen and the Pass of Brander—along the troubled road towards Mallaig and coastally through Ayrshire. Leaping over to Ireland, I "collected." the Antrim Coast road, and the Tunnel road near Kenmare, and the "Ring of Kerry" road, and the Clifden to Killary road, and a brute of a road leading from Mallow towards Killarney—giving you, as you bump along it at five or six miles an hour, all the gorgeous pageantry of Killarney's mountains.

I was home before I had begun the "collecting" process in Wales, where I cycled (in imagination) from Conway to Penmaenmawr, and from Capel Curig to Snowdon, and from Harlech to Beddgelert, and from Barmouth to Dolgelley. Later on, when actually going to bed, I was still gathering in interesting roads I know—in the Thames Valley and the Cotswolds, in the Wye Valley and the Chilterns, in pastoral Cheshire and churned-up Yorkshire and—on my very doorstep—the picture-gallery road from Stratford-on-Avon to Warwick, and that panoramic road called The Ridgeway, between Redditch and Alcester.

The harvest of so much cycling is rich and varied, and the many admirable roads which dwell in the store-house of the mind are among the greatest of prizes.

Notes of a Highwayman

By Leonard Ellis

Satisfaction without success

CONTINUING my story of "Photography in War-time" in the last issue. The sun was not yet visible and the mist was swirling along the surface. My pal generously gave me first innings on the sheet and he, most ostentatiously and noisily, took his departure. It is well known that birds cannot count, and we hoped in this way to convince them that the intruders had gone. Some time elapsed. My elbows were getting sore and my feet cold, when I heard the familiar "Zeet zer" of the kingfisher call. I had carefully focussed the camera, fitted with a telephoto lens, on a spot on which he should have settled. But he didn't. He chose the broken handrail of a plank bridge. After squatting there for a few minutes, his mate arrived, and he at once dived under the bank. There was evidently another nest there, but I found it quite impossible to reach them from my hide, as they were fully forty feet away. After another short interval, number one appeared, took his place on the stump, and the other disappeared into the hole. They were obviously preparing the nest for occupation. During my long vigil they went through this performance so often that I decided I was in the wrong place. I cast discretion to the winds and changed my site when they were both away. I settled down twenty feet from the stump and squeezed myself as far as possible under a screen of reeds. Another long wait and then with an impertinent and derisive "Zeet" he skimmed over my head much higher than he usually flies. His mate followed suit a few seconds later. They knew I was there and were spying out the land. They did this several times, and then suddenly changed their tactics. Defiantly, one landed on the stump. Alas, I was not ready. Excitedly I reached for the release—but he was gone. They had, however, decided that there was nothing to fear, and very shortly one settled boldly. My finger pressed. He jerked his head round and looked at me. I pressed again, and once more he angrily shook himself. A third time he waited while I pressed the trigger, and with a vivid blue flash he was gone.

Anti-climax

MY pal took his place on the ground, erected and focussed his camera, and the home guard walked straight into his view finder. In the dark room I assured myself that he was there on the film, but too small for practical purposes. We shall try again and hope for better luck. We had the thrill of the chase, and a day out, more or less, on the bicycles, so what !

An Ideal Place to Stay

MUCH WENLOCK lies in a hollow at the northern end of the famous Shropshire ridge bearing its name. Wenlock Edge is only one of the many ridges that make Salop a delightful touring county. From every direction roads drop steeply into the town and as every tourist knows this means that there is a hill to climb whichever way we decide to leave. For this reason Much Wenlock is an ideal place in which to stay the night ; a place to be reached at the end of the day by an easy downhill road ; a place to leave in the morning by an uphill road, just at the time of day when we are most apt to admit that hills were made for cyclists, and that without them cycle touring would be a poor sort of game.

Wenlock history is a long one and there are many pleasant and romantic reminders of its bygone importance. The Parish Church has a mixture of styles, and

Parish Church and Guildhall, Much Wenlock.

the Norman tower and Perpendicular windows will offer an interesting spectacle to the architecturally-minded. Next door to the church is the beautiful half-timbered Guildhall, somewhat cramped for breathing space and decidedly handicapped by the narrow streets. It is, however, well worth visiting, and here will be found the old stocks, unusually mounted on wheels, the relics of the ancient whipping-post, and some very fine oak panelling.

The town, however, is probably more justly famous for the picturesque ruins of Wenlock Abbey or Priory. Originally founded in the seventh century by St. Milburga as a nunnery, it was destroyed by the Danes some two hundred years later and restored by Lady Godiva. Further restoration as a Cluniac Priory took place in 1080. The Chapter House ruins are exceptionally beautiful, displaying fine arcaded wall tracery and richly decorated Norman arches resting on columns of different designs. The fifteenth century Prior's Lodge was restored and used as a dwelling-house until quite recently, in fact it may still be occupied. All around lie the wooded valleys and rolling hills of Shropshire's paradise, and provided that one is careful not to ride to the north-east, where lies the county's own little "black country," it is quite impossible to be disappointed or bored. I would not say avoid the north-east, because even among the sordid pit banks and derricks there is a great deal to be seen and enjoyed. It would never do to miss Buildwas Abbey, Ironbridge and the Severn Gorge.

A Miniature Cathedral

FEW tourists in that delectable region north of Lichfield can have failed to notice the square sandstone church tower that is visible for many miles round. This landmark proudly rears its head above the tree-tops of Needwood Forest and needs no introduction to local cyclists. Strangers, however, are nearly always amazed to find such a magnificent edifice built in the midst of a forest and quite a distance from even a small hamlet. Hoar Cross Church, designed by one of the architects of Liverpool Cathedral, has often been described as the most beautiful church in the country, and not many will care to disagree. It was built by the widow of the local squire, Hugh Meynell-Ingram, in his memory. From 1872 she devoted the rest of her life to the completion of this memorial. The church is built in warm red sandstone on which the setting sun seems to linger, causing it to glow with colour. It has a central tower surmounting a cruciform building in which there are four chapels. The interior is a revelation, every corner has been lavishly decorated with sculpture, carvings and paintings.

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