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PRACTICAL MECHANICS

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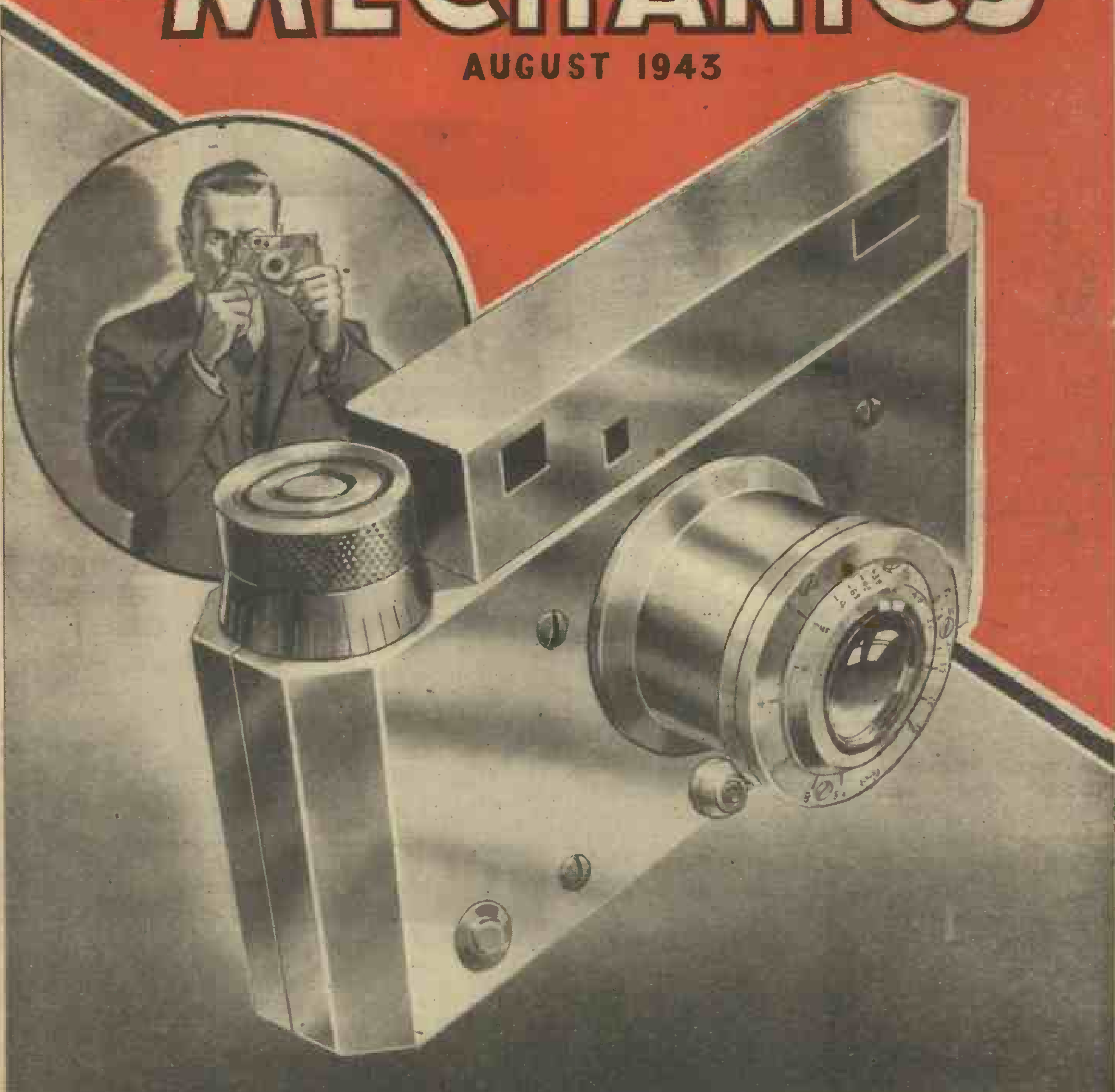

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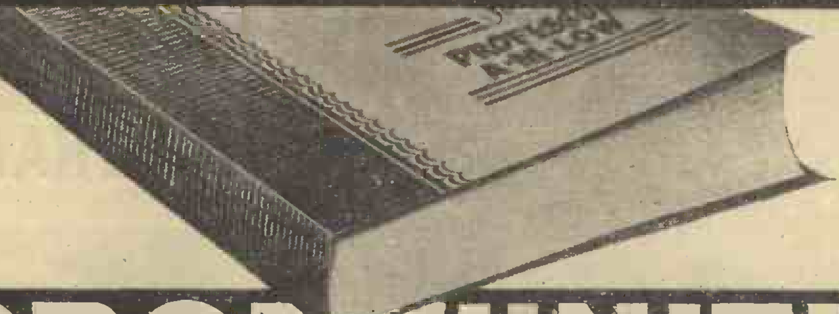

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PRACTICAL MECHANICS

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

Editor: F. J. CAMM

VOL X. AUGUST, 1943 No. 119

FAIR COMMENT—BY THE EDITOR

On Bicycles

AMONG the inventions, or rather the developments of a number of inventions, which have benefited the whole of mankind, the bicycle must surely rank among the greatest. No one knows who first invented the wheel, which made vehicular traffic possible, and no one really knows who first suggested the two-wheeled vehicle. The earliest known reference is in a stained glass window in Stoke Poges Church, and the window is known to date back to 1640: The original can be seen by anyone in this old church four miles from Windsor and two miles north of Slough. The church is famous as the scene of Gray's famous elegy, and the churchyard contains his remains.

The invention of manumotives, as they were originally described, is ascribed to Herrin Garthener, a famous mechanic of the seventeenth century, and we have also the direct evidence that Bishop Wilkins (born 1614 and died 1672) in his "Discovery of a New World," foretold flying machines. In another work of his, entitled "Mathematical Magic," published in 1680, he refers to and illustrates a chariot propelled by wind, acting on a vane, and communicating power to the axle. In Holland these sailing cars were then in regular use.

In 1820 an English-built carriage was sailing in the streets of Paris. To trace the history of the bicycle through all its various forms would be an impossible task. The possibility of man propelling himself by mechanical means had been considered possible for centuries, and no doubt in one form or another it had been achieved, but the imperfect records of the past furnish but a slight clue to the student who is desirous of tracing manual locomotion to its birth.

One of the most remarkable patents, and one of the earliest granted, No. 153 (Patent No. 1 was granted in 1617), and bearing the date July 3rd, 1667, was granted by King Charles II to Sir Ellis Leighton, and it was entitled "Engine to be attached to coaches, chariots, wagons, and suchlike conveyances to actuate their motion." The endless chain is also very old, having been patented, No. 407, by R. Evans on July 31st, 1716.

"Ye Hobby Horse"

COMING to the eighteenth century, it is evident that the subject received the attention of inventors, and, as Griffin says in his famous work, this is proved by the lines entitled "Ye Hobby Horse," which run:

Though some perhaps will me despise,
Others my charms will highly prize,
(Yet nevertheless think themselves wise).
Sometimes, 'tis true, I am a toy,
Contrived to please some active boy;
But I amuse each Jack-o'-Dandy,
E'en great men sometimes have me handy!
Who, when on me they get astride,
Think that on Pegasus they ride.

This poem appeared in the "County Magazine" in the year 1887.

The first public reference to manumotive machines was made in 1766 by a professor of Trinity College, Dublin, in the course of a lecture to students of Ireland's famous university. Illustrations of the machine appear in the "Gentleman's Magazine" for August, 1769, page 376; the "London Magazine" for August, 1769, pages 468–469; and the "Universal Magazine" of September, 1679, pages 132–133.

We do not hear much about the development of the bicycle until Paris resumed its normal life after the departure of the Allies in the early part of the nineteenth century. Then, in the year 1816, those who visited the Luxemburg Gardens saw a curious machine having two wheels, connected by a beam and ridden by M. Niepice, of Chalons, who was better known as the Father of Photography. This machine was known as a celeripede.

The hobby horse became fairly popular in other countries, but it was not until 1818 that Londoners first saw a hobby horse. Dennis Johnson, who was in business as a coachmaker, at 77, Long Acre, patented a design for a hobby horse on December 22nd of that year, under the name of the pedestrian curricle. It became a fashionable rage.

A large number of designs were produced throughout the country, but they were all propelled by striking the foot upon the ground. It was not, however, until Kirkpatrick MacMillan, a blacksmith, of Courthill, on the Dumfriesshire estate of the Duke of Buccleuch, produced the first rear-driven machine in 1839 that bicycle design really began to progress. He thus was the first man to propel a bicycle by mechanical means. MacMillan had owned a dandy horse, and in or around the year mentioned he applied cranks to the rear wheel and connected them by long rods with swing levers pivoted to the head of the main frame, these having adjustable rocking foot plates at the bottom. The original can still be seen in the Science Museum at Kensington.

The *Glasgow Herald*, of June 10th, 1842, reports that MacMillan, in riding from Thorne Hill to Glasgow, knocked over a child and was fined 5s. at the Gorbals Police Bar. He thus achieved fame not only as the inventor of the rear-driven bicycle, but also as the first cyclist to be fined. MacMillan died in 1878.

Advent of the Safety

SINCE that time developments have been rapid. The pneumatic tyre was invented in 1888, and this revolutionised the two-wheeler. The old ordinary penny-farthing style of bicycle gave way to the new safety, in which wheels of equal diameter were used. One of the arguments used in favour of the ordinary was that you could look over the hedges and see the countryside. The tangent spoked wheel, the differential invented by Starley for tricycles, improved saddles, chains, cut gear wheels, improved steel, better lighting, reliable brakes—these are but a few of the directions in which bicycles have developed to provide the modern counterpart of the pair of giant's boots of the fairy story.

Cycling is nothing but geared walking, and to-day over 12,000,000 people are using the two-wheeler. It gave birth to the motor-cycle, the motor-car, and the aeroplane, and many firms famous to-day first achieved their fame as bicycle manufacturers.

But finality in design has not been reached. The developments in metallurgy which have taken place during the present war will benefit bicycle design. Bicycles will become even lighter. There is still room for a properly designed lighting set, and for a really thief-proof lock.

The sporting side of cycling has never been large. Out of the millions who use bicycles, something less than 50,000—often termed the "noisy minority"—indulge in racing. This sport is surreptitiously conducted, and it is a breach of the rules for any prior publicity to be given to a so-called time trial, which is nothing more nor less than a race under another name. No one can envisage a world without bicycles, and no one can foresee any device to replace it. It would seem that bicycles have become an accepted part of civilisation, and those who intelligently use the bicycle benefit not only physically but mentally.

Mechanical Man

Automatons and Robots : Tesla's Inventions : Tele-mechanics : The Coherer

By K. DOBERER

Our artist's impression of robot battle units of the future. Tele-mechanical machines capable of dealing out death and destruction under the influence of remote control by a master mind.

NORMAL human beings react in a normal manner to certain impressions upon their sensitive faculty, in other words, they react by definite performance of certain functions. This notion is the foundation of a mechanical interpretation of nature, as was undertaken by the French philosopher René Descartes in the seventeenth century. As these impressions upon our sensitive faculty are nothing more than an expression of the active forces surrounding us, man is a product of his surroundings, a product of the diffusion of forces.

This theory would only then be transformed into an uncouth materialistic one, if one would reply by stating : Consequently man or even every living creature is an automaton. But that is not so. The basic principle of the automaton is the lever. The automaton is the consummate embodiment of the mechanical laws governing the lever, the screw, and the toothed-wheel. The task of the automaton is to do the predetermined, once or more often. Actually, it is stationary, immovable. Where the automaton moves, it keeps to its predetermined course. What takes place is only an uncoupled, externally transferred lever effect.

The uncouth image of man is not the automaton, but the robot. Man is guided by impressions reacting on his senses. To-day we know that these impressions are nothing else than registered energy, which has reached us in a wavelike manner. Energy serving to ungear other independent energies—a human being is struck by disagreeable sound waves emanating from the mouth of another person and turns away. Energy serving to be converted into other energies and for the storage of energies—man warms himself at the stove or exposes himself to the rays of the sun.

The artificial imitation of man is, therefore, quite conceivable. It would have to be an apparatus not solely dependent upon leverage, but also based on the transformation of energy. We can, as is well known, to-day register every kind of oscillating energy—much better than man with his senses, and can transform it into other energies. Consequently, we must be able to produce this artificial man, this robot, who continuously fulfils the fundamental principles for mankind laid down by René Descartes. Robots which can be described as well built react upon certain wavelengths in a normal way, that is, they reply by certain answers.

However philosophical the fundamental idea of the robot problem may appear to us, so uncannily realistic is the inference one can deduct therefrom for its immediate application. Creatures made of chromium steel, not damageable by bayonet thrust and by every splinter of an H.E. shell, creatures without the complicated commutation of waves we call soul in their body, creatures which in a far more palpable sense—something like a kind of specially well-trained slaves—adhere to the principles of Descartes, those are the robots.

It would, of course, be childish to assume that these robots must look like human beings. Mediocre inventors have also got on this wrong track. No, these robots will play the role that man even to-day fills so imperfectly to far greater perfection. They will be the thinking and guiding part of the machine to be employed in warfare for the destruction of life and property. The master of these absolute slaves will sit far behind the front in the security of concrete and they will carry out his commands until their mechanical destruction is brought about—right up to their " death "—with the complete obstinacy of one-sided, perfect creatures. Long before we had done so, great inventors had carefully reflected upon the consequences of the construction, erection, and the use of these robots.

The Obedient Machine

For the engineer Nicola Tesla—who was used to observe complicated machines just as often as himself—the mechanical theory of life, primarily evolved by Descartes about three centuries ago, was absolutely fascinating. This principle induced him to assume that he also was only a complicated machine without free play of thought and action. A machine solely acting and reacting in its activity upon the stimulation it is affected by—as it were : replying to the power exerted by the surroundings. He studied himself very carefully with regard to the reciprocal action and, as he says, only on the rarest occasions, when he happened to be in a state of special concentration, was he unable to exactly determine the original impulses uncoupled by his actions. Tesla studied the experiments of Professor Jaques Loeb concerning heliotropism, by which this scientist demonstrated how the power of light governs and guides the organism of very minute animals of the lowest order. It is comprehensible, and Tesla says so himself, that his invention of the tele-automaton, of the robot, had to be the logical result of these observations and deliberations. The idea to construct a machine of this description to positively check his deliberations came to light very early in his career. But he could only realise this plan in the year 1893 when he was engaged upon his radio investigations. In the following two or three years he built a whole group of mechanism worked by remote command. Then he constructed a robot, with " organs of sense," already so perfect that it received and carried out many commands, transmitted by oscillating energy, like a human being. When Tesla demonstrated this robot to the general public early in the year 1898, he produced a sensation with which no other of his inventions could again compare in the eyes of the public. The Patent Office in Washington refused to grant Tesla a patent, as the demands he made upon his machine were so exacting and appeared impossible to accomplish without resorting to the employment of tricks. The most famous of such pseudo-robots, the automatic chess-player, whose mechanism was operated by a man hidden inside the figure, put the Patent Office on its guard and great circumspection was deemed necessary. Only after the chief examiner of the Patent Office had personally travelled from Washington to New York, and after the apparatus was explained and its action demonstrated to him, did the Patent Office grant the fundamental patent. Following the advice of his patent agents, Tesla had not fully specified the complicated nature of his invention in the first application for a patent he filed, but had—if one may say so—reduced the details to certain, more easily understood fundamental operations, so as to make his invention intelligible to the Patent Office.

Tesla's Views

Personally, Nicola Tesla was immediately quite alive to the great significance of his invention. He clearly envisaged the possibility of a revolution of warfare in its entirety by the agency of such machines because they would exclude human beings from the battlefield and signify progressively growing, unlimited powers of destruction, freed from psychological considerations. In his patent application Tesla even went as far as to assert :

" The distinctive feature of my invention will, however, be that its unlimited powers of destruction will contribute to the avoidance of war and to the preservation of peace."

Although Tesla even to-day does not for one moment doubt the power and dangerousness of such robot machines, he has in the meantime learnt to think differently about the possibility of preventing wars. How little understanding even authoritative offices often have for the significance of such discoveries is best illustrated by a very bitter experience of Nicola Tesla on one significant occasion. It was the intention of Tesla to offer his American patent for remote-controlled steering to the American Government. For this purpose, he telephoned to a high official in Washington, but all he could get from this bureaucrat at that time was a burst of foolish laughter.

Two years later, in 1900, Tesla again offered his invention of remote-controlled speed-boats to the American Government in due and proper form, after having demonstrated to all discerning spectators the military value of remote-controlled boats on the ocean near New York. Tesla is firmly convinced that the negotiations would have been successful, if he had agreed to pursue the customary method of approaching the shepherds of the Great Alexander if one wishes to secure advantages from King Alexander.

The Tele-mechanics

From a fundamental point of view, it must be again emphasised that only the commands are transmitted electrically by tele-mechanics which then liberate certain forces for certain work. The force itself must be generated for the purpose of carrying out the orders at the locality where they were accepted. The general use of certain vague figures of speech just for the sake of convenience to describe tele-mechanic phenomena has resulted in a confused conception of the process of remote control and the process of remote transmission of energy.

The first fundamental attempt to transmit a command by tele-mechanical means was undertaken by the French physicist Edouard Branly in the laboratory of the Catholic University at Paris. It reveals the process of remote control with considerable clarity.

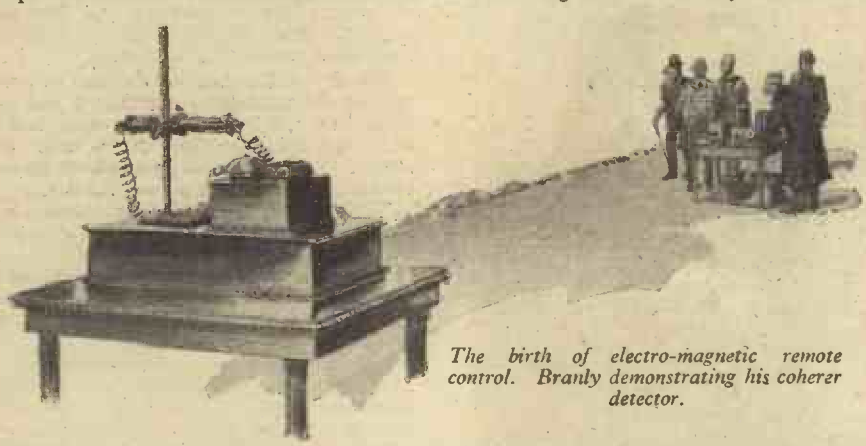
If we say in the usual manner of speech: Branly succeeded in 1890 in ringing a bell which was 30 metres distant, then we already have asserted too much. He only had transmitted a command, arriving as a tiny electrical impulse, just able to pull a lever which then released a strong electric current, held ready on the spot to work the bell. For this purpose he had devised an ingenious arrangement:

The emitter, which he used to send his wireless commands with, was a simple inductor, constructed by Daniel Ruhmkorff in Paris. It consisted of a battery producing flickering current impulses, with the help of a vibrating hammer interrupter, in a short coil wound with thick wire. These surges generated high voltages in a second coil wound with thin wire. As soon as the apparatus was switched on, these oscillations propelled through space by way of the spark gap.

Opposite, at a distance of 30 metres, the ultra-short waves were accumulated by a properly tuned receiving circuit. But the receiving circuit was no longer the plain wire hoop used by Hertz, with the two knobs at the end and the small spark gap between them. A better instrument than the primitive spark gap had been found.

Branly used a glass tube, of 15 cm. length, containing iron filings. At the contact terminals of the glass tube a battery with an electrical bell was in circuit besides the receiver circuit.

Normally, the iron filings of the tube offered the battery current so much resistance that the bell could not be set in motion by it. But when the waves of command arrived from the distant inductor, the end of the numerous fine filings easily melted together and suddenly the battery current was able to find its way to get the bell working. Released by the tiny impulse, the battery current would make the bell ring until the battery was exhausted.



The birth of electro-magnetic remote control. Branly demonstrating his coherer detector.

But Branly was not satisfied with his tele-switch. He also wanted to be able to stop the bell by remote control. For this purpose he devised a further very ingenious contrivance. He elongated the tongue of the bell somewhat and fitted it on to his tube with iron filings in such a way that simultaneously with the ringing of the bell the tube was tapped.

If the bell was set into motion, the coherer was also tapped and then the small smelted particles of metal dissolved again. The bell immediately stopped working, if the newly arriving wireless waves had not connected the filings again. The bell now should sound as long as the waves from the distant transmitter arrived, the connection, constantly interrupted by the tapper, being restored by new waves.

Thousand Commands by Air

With an apparatus functioning so excellently as Branly's remote control of a bell, it seems quite obvious that we should be able to use it in a much more striking way. We no longer use the push, produced by the electro-magnet, to strike the bell, but this time we use it to drive a cogwheel. Every impulse from the electro-magnet to the cogwheel turns it forward one cog, and if the cogwheel is fitted with different contacts for different electrical apparatus, they then can be supplied with current in the given order. This can equally well apply to switching on an electric lamp or an electric motor or a signalling bell, it can also refer to the electric uncoupling of a shot or every other work an electric apparatus can perform. With the aid of a mechanical retarder, the actual switching is delayed a certain time after the contact has been made, and it is possible to switch past a number of contacts with the switch handle without exciting them. This trick enables us to switch the various apparatus connected with the contacts of the cogwheel selector dial on and off not only in their given order, but optionally. Our automatic telephone exchanges are to-day operated on a somewhat more complicated method of this system of contact-closing current impulses, and we think nothing of it to connect thousands of different numbers —in this case not direct through space, but by the copper wire conducting line—so that thousands of different commands can be promptly conveyed by this selecting device.

When Branly succeeded in getting a bell to strike by remote control, two facts prevented the contrivance of even the most simple devices for remote steering. On the one hand, it was only possible to transmit electric waves by wireless for a distance of about 30yds., and on the other hand, an inventor did not have at his disposal the large selection of cleverly utilised electrical effects which we can use to-day in a hundred different primary types.

At a school of tank technology, officer students take courses on the engineering side of tank construction and design. The illustration shows some of the students inspecting a damaged tank.

Masters of Mechanics

A Builder of Bridges

John Rennie, Constructional Engineer and Civil Designer

IT is possible for a man to lead so successful a life that his career becomes positively uneventful by reason of his continual triumphs. A few of the great Victorian engineers and constructionalists managed to attain this not unenviable condition of almost perpetual prosperity, and, of these, perhaps, none experienced a greater measure of engineering fame, to say nothing of its material reward, than John Rennie, the Scotsman bridge builder and civil engineer.

Rennie was born on a farmstead at Phantassie, in East Lothian, on June 7th, 1761. His father was a fairly successful farmer, the owner of a small estate, and the possessor of the reputation of being the best agriculturist in the district.

In 1766, tragedy overtook the growing Rennie family. Farmer Rennie died, leaving his eldest son, George, to care for the family. John Rennie, the future engineer, was then only five years old, and, being the youngest son, he received, perhaps, the greatest amount of attention at the hands of his mother, who, if we are to believe the recognised biographical narrative, brought him up and gave him the rudiments of a sound schooling almost unaided.

John Rennie was a budding mechanician almost from his very earliest days. As a youngster of six years of age, he had no toys to play with, except those which he managed to make for himself with the aid of a hammer, a few nails and a small blunt saw. He infinitely preferred his crude toy-making activities to the rough country sports of the village lads. His chief delights were in frequenting the neighbouring forges, the village smith's and the few carpenters' and wheelwrights' shops in the surrounding locality and in watching these country craftsmen ply their trades with hammer, saw, chisel and anvil.

Andrew Meikle

Near Phantassie lived a millwright, Andrew Meikle by name, who had been a close acquaintance of Farmer Rennie's and who, in consequence, took a fatherly interest in young John Rennie. Indeed, it was Andrew Meikle's interest in the youthful Rennie which inspired the lad to mechanical pursuits, for Meikle, with the true craftsman's patience and patronage, allowed the lad Rennie to have the run of his workshop. He taught him the correct use of tools, the properties of materials, together with some of the fundamentals of woodworking, so that, within a year or so Master John Rennie found his acme of contentment in Mr. Meikle's shop, in which he was allowed to indulge his toy-making to his heart's content.

It is said that before Rennie left Phantassie neighbourhood, he had completed, under Meikle's tuition, a working model of an atmospheric engine, which became the wonder of the locality.

Rennie's mother subsequently sent him to the parish school nearby, at Prestonkirk, which was kept by a man named Richardson, an individual who took the greatest possible liking to Rennie and who laboured enthusiastically to impart to the youngster the fundamentals of a superior education. From this school, Rennie went back to work with old Andrew Meikle in his shop for a time, but, after a year, he was, through the generosity of a few friends, sent to the burgh school of Dunbar, a Scotch High School of considerable renown.

At this school Rennie made particular

John Rennie.

friends with the mathematics master. His practical experience in Andrew Meikle's workshop, coupled with his aptitude for theoretical learning, stood him in the greatest possible stead. Ultimately, he came out as first scholar in the school.

In that year, just as Rennie was finishing his course of study and had arrived at the age of 17, Gibson, the mathematics master, was promoted to the Rectorship of the High School of Perth. He recommended Rennie as his successor at Dunbar, and, what is more, Rennie, in spite of his youth, received the appointment.

Teaching, however, was not one of Rennie's strong points. He had accepted the appointment dubiously and conditionally, and, after a couple of months or so, he gave up the post, returning to his homestead at Phantassie, performing various odd tasks thereabouts, and, in particular, assisting his old friend and mentor, Andrew Meikle, in bringing to completion the construction of a new form of thrashing machine.

In this manner, Rennie started his career in the world. He became Meikle's assistant, performing and superintending a variety of constructional and repairing jobs, and, at the same time, continuing, on his own account, his studies of mathematics, mechanics and general science.

Rennie's eldest brother George was now making the farm pay more than it had ever done before. John Rennie's idea was to settle down at the farm for a time as a sort of practising millwright, whose services would be available to all and sundry.

This, indeed, is actually the career which Rennie started upon, and within a year or so, when he was only 19, we find him employed in superintending the erection of new corn mills at Invergowrie, near Dundee. He designed the buildings as well as the machinery.

Next followed several more commissions of a like nature which were all successful. Business flowed in upon him, so much so that he began to employ assistants.

But it seems that John Rennie had no notion of settling down for a lifetime at the Phantassie farm. His ideas centred themselves around the towns in which the main and by far the more interesting engineering activities were to be found in everyday increasing amounts.

Before launching out for himself on a larger scale, Rennie took a course of studies at Edinburgh University, entering the classes there in 1780. For three winters he studied at Edinburgh and during the summers he did mill work on his own account to pay for his tuition fees.

Boulton and Watt

Finishing his college training in 1783, Rennie made his way to Lancashire. After a short time in that industrial country, he proceeded by easy stages to Birmingham. There he called on James Watt, of the firm of Boulton and Watt, at that time would-be monopolists of the steam engine. Watt, after some hesitation, gave Rennie a job, but, after a time, the Boulton and Watt firm, recognising Rennie's abilities, sought to bind him to refrain from carrying out work on his own account. This was yet another instance of James Watt's intensely jealous disposition. John Rennie, however, to his credit, refused to be bound by the unscrupulous Watt, and, consequently, he left the firm.

Turning his back upon Birmingham and upon Boulton and Watt's Soho Foundry, John Rennie, Whittington-like, wended his way to London. He arrived there for the first time in 1785. His association with Boulton and Watt had not been entirely severed, for he held a contract to superintend

Rennie's cast-iron bridge over the Wye at Chepstow. Erected in 1817.

the erection of the Albion flour mills on the Thames, near Blackfriars Bridge, and to assemble some of Watt's machinery therein. Rennie's handling of this task proved to be somewhat spectacular in its quickness, thoroughness and efficiency. In fact, the job served to establish his reputation in London engineering circles. He settled down as a practical and consulting mechanical and civil engineer, members of this profession then being very few and far between, even in the great metropolis.

For several years after his first settling in London, John Rennie was chiefly occupied in designing and superintending the erection of mills and machinery in the London dock area. Flour mills, dye works, waterworks, rolling mills and various other industrial projects were his chief objects of attention at this time.

Then, following the retirement of the celebrated John Smeaton from engineering practice, Rennie became acknowledged as his legitimate successor. Smeaton had been interested in canal construction. The canal companies and undertakings began to take John Rennie into their schemes. Bit by bit he became chief canal planner for Britain. His canals were numerous and were constructed throughout the country. Indeed, throughout his working career as a civil engineer, Rennie ever continued his activities as a canal engineer.

Rennie's first bridge, which he designed in 1799. It was erected over the Tweed at Kelso, and completed in 1803.

Bridge-building Activities

But it was in the sphere of bridge building that Rennie achieved his most spectacular constructional feats. Rennie had studied bridge building at Edinburgh, and he had his own particular ideas on the subject. He claimed to have scientifically deduced the best theoretical proportions for a bridge of any given design and span. He claimed, also, to be able to build a bridge of the strongest load-carrying capacity with the greatest possible economy of material.

Rennie's first bridge was designed in 1798. It was a cast-iron one to span the river at Aberdeen But, seemingly, Rennie's design was far too costly for his Aberdonian countrymen, for they rejected the project on the score of its expense, a fate, also, which they meted out to no fewer than three other bridge designs of Rennie's some years later.

The first of Rennie's actual bridges was one which crossed the Tweed at Kelso. This was designed in the year 1799 and completed in 1803. Actually, the bridge formed the basis of Rennie's masterpiece, the old Waterloo Bridge, which he subsequently erected over the Thames.

Rennie's first English bridge was erected by him over the river Witham, in Boston, Lincolnshire, in 1803. It was a perfectly flat-top structure, resting on a single arch—simple, elegant and efficient in design.

Waterloo Bridge

The design and erection of the Waterloo Bridge over the Thames was a task into which John Rennie threw the whole of his energies, capabilities and enthusiasm. It was formally opened on June 18th, 1817, and was then called the "Strand Bridge," but subsequently, it received its name of "Waterloo" in honour of the Duke of Wellington. the far-famed victor of Waterloo, who opened the bridge.

Rennie, ever a rather whimsical sort of a fellow, wrote to a friend of his regarding his successful carrying through of the Waterloo Bridge project. "I had a hard business to escape a knighthood at the opening of the bridge," he said. It was, indeed, a fact that Rennie was offered a knighthood by the Prince Regent (afterwards George IV) but he declined that distinction with thanks.

For many years Rennie's Waterloo Bridge was considered the finest bridge in the world, its clean lines and its quiet, simple design commending it to the admiration of even the most non-technical of observers. Throughout the erection of this structure Rennie himself personally superintended the construction of every portion. He even personally tested the quality of the cement-mortar used for the bridge stonework, rejecting, it is said, great masses of this material because it did not come up to his high standards of quality.

John Rennie undoubtedly had an eye on posterity when he built Waterloo Bridge. Contemporary accounts credited the bridge with lasting hundreds of years, a prophecy which might have come true had not the internal combustion engine been invented. But the increase of mechanical traffic across Rennie's bridge over the Thames rendered it imperative to provide an adequate successor to that masterpiece. That is why the recently-opened Waterloo Bridge, replacing John Rennie's original structure, created so great a measure of world interest. To oust old Rennie in our days with a new bridge was not far short, in point of severity of the task, of replacing Wren's St. Paul's with an entirely new edifice.

Besides functioning as a bridge builder (he engineered, also, the Southwark Bridge over the Thames), Rennie attained fame as a designer of docks and harbours. Perhaps his incursions into these activities resulted from his bridge-building successes, although Rennie showed an interest in the London docks (and was actually officially consulted on that subject) as far back as 1798, the year of his first bridge design.

Perhaps Rennie's successes in dock erection were consequent not so much on any revolutionary design of his, but, rather, upon his utilisation of steam power for draining, pumping, raising, carrying, and for the many other mechanical activities inherent in dock construction. At any rate, Rennie's dock successes included the East India Docks at London, several docks on the Clyde, harbour works at Grimsby, Hull docks, Ramsgate harbour, Plymouth breakwater and, last, but certainly not least, the celebrated harbour works at Holyhead.

"Every harbour," wrote Rennie, "should be so constructed as to have its mouth as much exposed as possible to the direction from whence vessels can most conveniently enter in stormy weather when they are least manageable; but the Head should be made of such a form as to admit of the least sea entering it, or so as to occasion as little swell with the haven as possible."

The Eddystone of the North

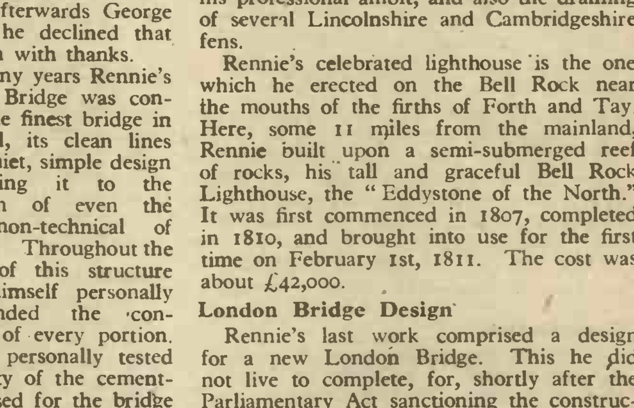
Even the design and construction of harbour works did not complete the long list of Rennie's civil engineering activities. He included lighthouse construction within his professional ambit, and also the draining of several Lincolnshire and Cambridgeshire fens.

Rennie's celebrated lighthouse is the one which he erected on the Bell Rock near the mouths of the firths of Forth and Tay. Here, some 11 miles from the mainland, Rennie built upon a semi-submerged reef of rocks, his tall and graceful Bell Rock Lighthouse, the "Eddystone of the North." It was first commenced in 1807, completed in 1810, and brought into use for the first time on February 1st, 1811. The cost was about £42,000.

London Bridge Design

Rennie's last work comprised a design for a new London Bridge. This he did not live to complete, for, shortly after the Parliamentary Act sanctioning the construction of the bridge had been passed, he was seized with an illness which carried him off. It was on October 4th, 1821, that John Rennie died at the by no means advanced age of 60 years. But into his span of life Rennie had crammed the activities of half a dozen men of first-rate calibre. Life, for him, was hard, earnest and unrelenting. He seldom relaxed. Work, and still more work was his pleasure.

It has been said that, in his structural designs, Rennie carried his love of durability to extremes and thus made some of his structures unduly costly. If such a trait were a fault, then John Rennie was undoubtedly, at times, a guilty man. But, having the sincere heart of the innate engineer, he put quality first at all times. And that is why his structures lived on so strenuously and served, long after his decease, to carry the story of his fame and efficiency throughout the land of Britain and over the seas as well.

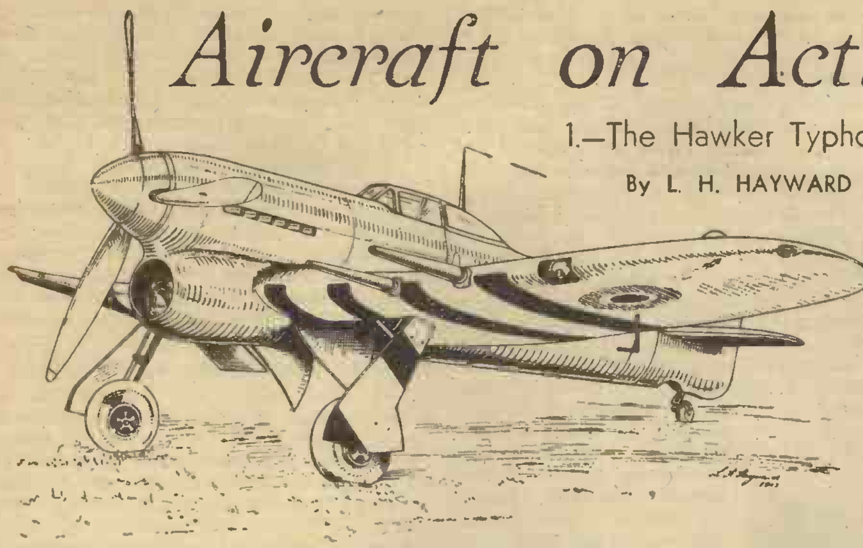


The old Waterloo Bridge, which was demolished a few years ago: It was considered to be Rennie's masterpiece, and was first opened in 1817.

Aircraft on Active Service

1.—The Hawker Typhoon

By L. H. HAYWARD



A front view of the Hawker Typhoon.

THE Typhoon is a single-seat day and night fighter, manufactured by Hawker Aircraft, Ltd. It is powered by the 2,400 h.p. Napier Sabre engine. Two types of Typhoon are now in service with Fighter Command, MK.IA, equipped with twelve 0.303 machine guns, and MK.IB, with four 20 mm. cannon. The leading dimensions are given at the foot of the third column.

Construction

All-metal construction is used throughout the aircraft, and a three-blade, 14ft. diameter airscrew is fitted. The undercarriage, which retracts inwards and backwards into the centre section of the wings, has a wider wheel track than is usual and enables the machine to be landed safely on rough ground and to be turned in a small circle at high speed without the fear of tipping over. Flaps cover the retracted undercarriage, making a smooth surface. The tail wheel is also retractable.

Pilot's Comfort

The pilot's comfort and safety have been well looked after by the Hawker designers. A roomy and comfortable cockpit, well protected by bullet-proof glass, is provided. A small mirror built in the cockpit cover enables the pilot to see any enemy 'plane which may attempt to get on his tail, and the complete cover, which provides the pilot with a good all-round view, can be jettisoned in an emergency by pulling two small levers. Blind flying instruments and a two-way radio are installed.

Radiator

The large radiator fairing, housing the engine coolant radiator, the oil cooler and the engine air intake, distinguishes the Typhoon from all other British aircraft. The rear of the radiator housing incorporates a hinged flap enabling the pilot to adjust the amount of cooling air flowing through the radiator.

Wings

The wings are of all-metal construction, the centre section slopes slightly downwards and the outer wing section slopes upwards. The very strong wing construction has already enabled Typhoons to be adapted as fighter-bombers, and frequent references are now made by press and radio to their exploits in this sphere of activity.

Engine

The Napier Sabre, 24 cylinder, liquid-cooled engine, develops 2,400 h.p., and is the most powerful engine in the world. It is the first successful in-line aero engine to be produced on the sleeve-valve principle. It is officially described by the Ministry of Aircraft Production as "an 'H' type engine lying on its side." This means that the engine is installed in the aircraft with its cylinders horizontal instead of in the usual vertical position. The six L.H. exhaust manifolds, which each serve two cylinders, can be seen protruding through the cowling in the illustration.

Camouflage

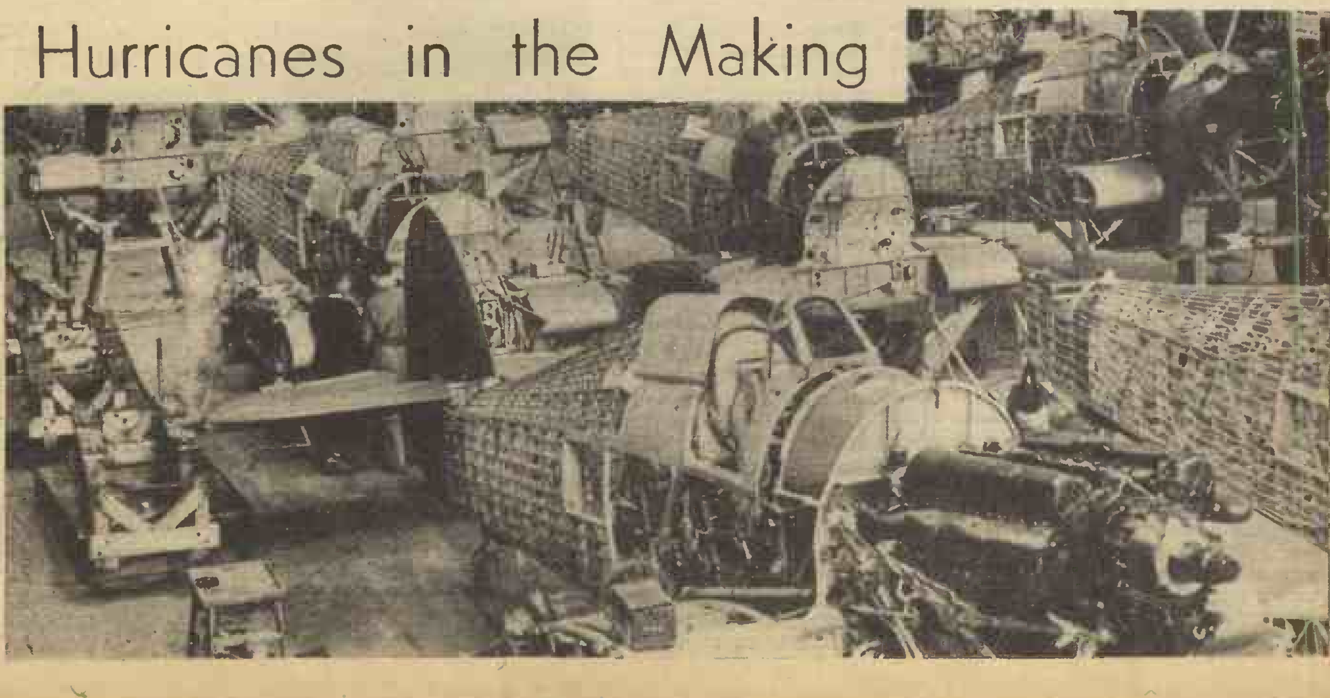
To distinguish the Typhoon from the German FW. 190, to which it bears some resemblance, and to prevent unfortunate incidents from anti-aircraft batteries, broad black and white bands have been painted on the under surface of the wings, and a single white band has been painted on the upper wing surfaces. Excellent flying qualities, combined with high speed, rapid climb and heavy fire-power, make the Typhoon the R.A.F.'s most outstanding single-seat fighter, and German pilots have learned to dread its appearance.

In Service

First official announcement of the Typhoon being in action was made at the time of the Dieppe landing, where they were used as part of the air umbrella covering the combined operations. Since that time they have come into service in ever-increasing numbers and have shot down a large number of bomb-carrying FW. 190 aircraft, making hit-and-run raids on our South Coast. Enemy shipping and locomotives have been destroyed by our Typhoons during their devastating daylight sweeps.

Span	Length	Height	Max. Speed m.p.h.	Landing Speed	Motor	Motor Power
41' 7"	31' 11"	15' 4"	Over 400	105 m.p.h.	Napier Sabre 24 cyl.	2,400 h.p.

Hurricanes in the Making



Repairing Alarm Clocks—3

Completing the Dismantling of the Movement

By G. F. LEECHMAN

(*Continued from page 357, July issue*)

Dismantling Train and Springs

HAVING completed the removal of the various members of the escapement, the rest of the train can now be dealt with more rapidly. The alarm spring should be allowed to run down, if it has not already done so, by allowing it to actuate the hammer when the various releasing triggers are in the clear position ; full details of these will follow, but meanwhile we will confine our attention to the main-spring and "train," as the series of wheels which impart the power of the spring to the 'scape wheel is called.

By screwing on the winding key, the tension on the spring may be released, and the piece of brass wire or other stopper used may be allowed to fall out of position, while a firm grip is maintained on the key. The full strength of the spring will now be imparted to the body of the movement, so that it tends to turn as a whole in the hands ; this it may be allowed to do and the spring in this way permitted to run down, but care must be taken that the key does not slip out of the fingers, otherwise a nasty blow will probably be received, very unexpectedly, on the back of the thumb, particularly if the spring is nearly fully wound. If the main-spring has been broken, or become unhooked, or if the "click" (the ratchet which normally prevents it from unwinding) is out of action, there will be no tension in the spring and these precautions as well as the original placing of the "stopper bar" are unnecessary. Another way to release the spring is to turn the third or fourth wheel of the train slightly in the reverse direction to that in which it normally runs, remove the bar, and, keeping the fingers pressed on the main-spring itself, to prevent it enlarging too rapidly, allow the wheels to turn, slowly, until the power is expended.

The two plates which carry the ends of the pinions of the train wheels may now be separated, by further loosening the four nuts on the pillars, and in some cases it will also be necessary to remove a pin which may sometimes be found passing through the set alarm spindle or, occasionally, on the spindle of the centre wheel, and in some cases these pins may be supplemented by, or even replaced by, a spring and washer or spring-washer or nut and lock-nut which may have to be removed—after examining the arrangement in order to be able to put them back correctly. It should now be possible to separate the plates sufficiently to remove the third and fourth wheels comfortably, and they should be laid aside for cleaning after it has been noted in which position they have to be re-assembled, that is with the pinions up or down, although this may also be determined later. At the same time it will be necessary to note if any of the alarm assembly has become loose from the plates as it is sometimes rather puzzling at first to ascertain where they fit. This having been attended to, the plates may be finally separated, and the springs on their wheels lifted out together with any remaining pieces which may be free ; it may be that the plates will not come entirely apart owing to the design of the staff of the centre wheel, and unless it is absolutely necessary to dismantle this, it may be better to leave it in place, and, in those alarms which are fitted with a seconds hand, or with an extra long staff which may take a seconds hand, the fourth wheel may require some manipulating in getting it clear of the centre wheel. It will generally be found, however, that with a little extra manœuvring it may be removed without damage, but if this is not possible it will have to be cleaned in place, and if repairs are needed the centre wheel staff will have to be stripped down. On the reverse side of the front plate will be found a short series of wheels which co-ordinate the movement of the hour and minute hands (the seconds hand, if fitted, is always independent), and usually the wheel which releases the alarm is fitted here as well ; the latter may be identified by its construction which includes, near the centre, a cylindrical wall which at

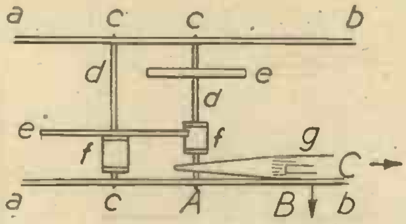


Fig. 1.—Removing wheel from between plates. a b = plates ; c = pivots ; d = staffs ; e = wheels ; f = pinions ; g = pliers.

one point has a deep notch cut with one vertical and one inclined side, reference to which will be continued under a separate heading.

The wheels comprising the motion work do not call for much attention, so far as cleaning is concerned, and if they appear to be in good condition it is frequently not necessary to disturb them. The train wheels should be examined carefully for bent or damaged pivots which must be *straight, smooth* and *well polished* ; the pinions must be inspected for bent or broken leaves (or bars if of the cage type), any defects being remedied. Broken leaves will, in general, call for a new wheel as it is almost impossible to solder a leaf into place with the accuracy necessary with fine gearing, but if it is attempted, hard (silver) solder must be used so that the pinion and staff may, at least, be partially re-hardened afterwards. A broken bar in the lantern or cage type pinion may be replaced more easily, as described when dealing with the 'scape wheel. If the teeth on the circumference of the wheel are damaged, they may be repaired by carefully adjusting and filing them if they are not straight, but care must, of course, be used to ensure that they are not broken off or filed too heavily. This may, however, have already occurred, particularly if the main-spring has broken and caused damage which might aptly be described as "explosive." In this case it will be necessary, if a replacement wheel cannot be obtained, to cut away a comparatively large part of the wheel, including at least two or three teeth, and soft solder in a piece of brass of the required thickness which will subsequently be filed into the shape of the missing teeth ; this must be done as precisely as possible, as faults in the train will naturally cause a clock to stop. The centre wheel must next carefully be examined, not only for the same faults, but also to see that the staff is not bent (a rather common fault, but luckily one that is fairly easily remedied by judicious use of a small pair of pliers).

Clicks and Click-springs

The "great" wheel—that is, the one on which the main-spring is mounted—frequently suffers from damaged teeth (together with a damaged pinion on the centre wheel), especially if the main-spring has broken. The teeth of the click wheel also may be badly out of shape as they have to stand up to a very considerable load, the heaviest in the whole clock, or the point of the clock (or pawl), may be mutilated, or the spring which controls the click may be broken ; in any of these cases it will be necessary to take the great wheel to pieces. First, the spring is removed from the arbor, and this is followed by the steel disc which, usually, will be found fitted below it, and which serves the purpose of giving the spring a smooth bed to run on instead of it having its edge impeded by the spokes of the wheel. This disc is kept in place by the brass centre being pressed over its inner edge, so that it is, in a way, riveted on, and in order to remove it this part of the brass will have to be eased back, always bearing in mind that later on it will have to be worked into place again. After the latter is removed, and this is best done by inserting the thin blade of a penknife between the disc and the wheel, and gently separating the two equally all round as the brass at the centre is pressed back, the rivets which hold the click spring and the click itself in place will be visible, and if the click-spring is broken it can now be removed by filing away the rivet heads. It is not usually necessary to remove the click ; its rivet may be slack or it may be a little too tight, or its point need improving with a file, but these details can be attended to without taking it off. A new click-spring may be made from a piece of hardened brass wire, and it will perhaps be advisable to score a fairly deep recess in the edge of the click, or, alternatively, to drill a hole in it in order to ensure that the end of the wire retains its position. It will need to be bent very exactly to fit properly in the holes where the rivets were, and it should be made plenty long enough to reach over the end of the click with a little to spare. These remarks also apply to the click arrangement on the alarm spring, but in some makes a much lighter type of click is fitted and the methods of repair vary accordingly. In some makes the click and click-spring is all in one piece with the wheel, which is a thin piece of steel and is simply produced by stamping a shaped section in the main body of the wheel, so that it only needs to be sprung up into place to fulfil its function. If this piece should be broken off it will be necessary to improvise a click by means of a suitable piece of springy steel which must be hard soldered to the wheel and afterwards hardened as much as possible ; soft soldering will, in most cases, not be strong enough. A good deal of attention must be paid to a faulty click arrangement since, as has been said, a very heavy load has to be carried and failure will not only make the clock useless but also, since it usually occurs when the spring is nearly fully wound, will be very painful to the fingers.

Repairing Springs

Where a spring is broken it is always advisable, whenever possible, to replace it with a new one—any attempt to use the old one may merely be a waste of time since it will generally be found that the spring is too short for the clock to run even 24 hours, and certainly not the 30 for which most are designed; further, in the manipulations to get the spring softened, drilled, the hole shaped and the spring rewound on the arbor, it may have lost so much of its resiliency as to be unable to drive the train satisfactorily. Also a spring which has once broken is always likely to do so again, especially after a certain amount of manhandling. On the other hand, if a replacement is out of the question, and it is decided to attempt to utilise the old spring, no great loss is incurred if this should prove a failure.

In general springs break near the inner end, since this is the part which suffers most bending, and if the piece lost represents only a small fraction of the total length it may not be of great importance. To repair it, the inside end must be opened out so as to be easily accessible, and the last inch or inch and a quarter heated until it has been softened. If a spring-punch is available, a nicely shaped hole can be made very easily, otherwise an indent is made with a hammer and ordinary sharp punch, sufficiently heavy to permit of the top of it being filed off on the other side, and this is repeated until a sufficiently large hole has been worked through the spring for the smallest file to pass through, when the hole can be shaped in such a way that it will readily engage with the hook on the arbor. The hole should be about a quarter of an inch from the end of the spring, smooth and well finished, and should have the edge bevelled where it makes contact with the inner surface of the hook, so that it will be less likely to unhook when the spring is run down. It is not advisable to harden this inner end, since if it is soft it will fit more closely round the arbor.

When the spring has broken near the outer end the repair is more simple, since all that is necessary is to soften an inch and a half of the end and bend it so that it will hook round the pillar—usually this is the pillar nearest the spring and not adjacent to the escapement; a sufficient length needs to be softened so that the end may be bent over (inwards towards the centre of the spring) and turned with enough to lie inside the outermost coil, which will thus prevent it from opening out and tending to unhook when the spring is wound up fully and all the strain exerted at this end. Some springs have a riveted loop at the outer end, but in repairing these it is not necessary to drill fresh holes and rivet again, as the turned-in end just described is quite satisfactory, but riveting a new loop may save a little length when this is of importance. Where a spring is broken nearer the centre it is hopeless to attempt a creditable repair, but if it is wished to experiment, the two broken ends may be softened, turned back slightly and heated again until they are right back and will hook into each other, when they may be rehardened, or, alternatively, a triangular hole may be made in one end, as in the sketch, Fig 2, and in the other a T-piece cut so that the two may be linked up. This method does not prove to be too weak for practical use, and will work satisfactorily temporarily so long as care is taken not to overstrain it when winding, but it is not to be expected that it will make a workmanlike job, and it should not be resorted to except in extreme cases. It would be better generally to use only the longer part of the spring, even if it were somewhat short, making it necessary to wind the clock twice a day.

Replacement Springs

A point which must be stressed in connection with springs is that replacements, when obtainable, should be exact. If they are too short, the clock will not go its full time, but if too long the case is much worse, for either the end must be softened and cut as just described, or else in winding too much material will be cramped into the space provided, and the pillars, centre wheel staff or the confining studs bent. Fortunately these errors are rare, but springs may be too wide or too narrow, in which case they either make a bad fit or else bind up when the plate is put in position.

Generally, however, the trouble is that the spring is too thin or else too heavy; before being bought they should be checked in a proper spring gauge, since it is obvious that a spring that is too thin or weak will not drive the movement satisfactorily. On the other hand, it is only too common to find an inclination to fit a stronger spring if the clock seems sluggish—this is very definitely poor practice—a heavier spring will certainly impart more kick, but it will also strain the teeth of the great wheel, the pinions of the centre wheel will be taking far too heavy a load and the holes in which the pivots of these wheels run will rapidly become worn, so that before long the whole clock will be useless. Some may perhaps be under the impression that a heavier spring will make the clock go faster, but it must be remembered that it is the balance wheel which controls the speed, the spring merely provides enough power to keep it turning, and, excepting for a certain margin, there should be no more.

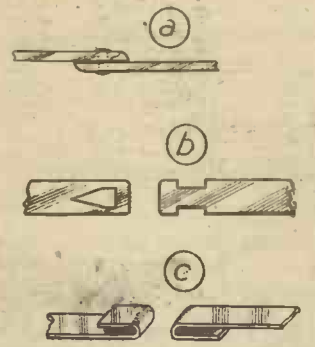


Fig. 2.—Temporary repair to spring.
a—riveted.
b—T-hook.
c—double hook.

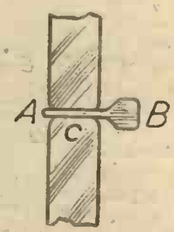


Fig. 3.—New hook for arbor.
A—Part to be riveted after B is pressed in place; B is subsequently shaped to form hook.
C—small hole in arbor.

Mention has just been made of confining studs—these are small uprights of steel or brass, such as a riveted pillar or a bent-up lug stamped from the plate itself, which are fitted to prevent the spring from expanding too much in certain directions. For instance, it may tend to touch the 'scape wheel, or one of the others, when it is nearly run down, so a stop is arranged to prevent this, thus causing the spring to develop where it will not interfere with any other part. It is necessary when assembling to remember these rather inconspicuous parts, otherwise it may be necessary to retrace one's steps in order to get the spring within its required limits.

One other type of breakdown which occasionally occurs is that of the hook on the great wheel arbor being broken off or else so mutilated as to be ineffective; the design of these hooks is not strikingly effective—frequently the bearing surface, instead of being under-cut, is vertical, that is, truly radial to the arbor, so that if the outer part becomes at all worn, the end of the spring is almost sure to slip off. The remedy is fairly simple, all that is necessary being to file away the inner part near the base to the surface which is in contact with the spring so that there is no tendency for the end to work clear, but if the hook is broken completely away the best plan is to drill a small hole right through the arbor and countersink each end of it. A fairly heavy pin, such as may be made from a 1-inch nail, is then made, definitely thick at one end, as in the illustration, Fig. 3, but filed down at the other so that it will pass right through the hole in the arbor. It is then cut off, leaving about $\frac{1}{16}$ inch clear, which is riveted well down into the countersunk part and afterwards smoothed off, while the thicker end is cut off and shaped into a new hook, which may be better than the original, but it must not be too long, or it will interfere with the next coils of the spring.

From the general principles outlined earlier, it will be obvious that the number of turns the fourth wheel (which carries the seconds hand when one is fitted) makes in a day or in 30 hours depends upon the number of oscillations the balance makes in that period and also upon the number of times the mainspring can turn it. This involves the number of teeth in each wheel and in each pinion, and, although these may sometimes vary (particularly in some American models), in general the great wheel turns five and a half times in 24 hours or seven times in 30; this point is valuable when counting the number of turns of the winding key in considering the staying powers of the spring.

Preparing to Reassemble

The main-spring must, of course, be kept free from all dust or grit, but it is a mistake to clean it too thoroughly, so that the grease is removed—this thick oil is necessary to ease the very considerable friction which occurs when the coils press against each other—sometimes a clock working may be heard to give a sudden, sharp click, usually an indication that the spring is dry and the turns prevented from opening regularly by the pressure existing between them. Special oils are made for lubricating springs, but the clock oil will do quite well; it should be applied when the spring is wound up quite full, as it then works its way in more readily by capillary attraction. The teeth of the great wheel should be brushed out (a discarded tooth-brush will do) and oiled, as also should the pinion and teeth of the centre wheel. The pivots of the third and fourth wheel are cleaned by pushing them several times into the piece of elder-pith until they are bright, and the teeth also brushed out, while the teeth of the 'scape wheel are cleaned with the pith.

(*To be continued.*)

Exide Industrial Exhibition

A section devoted to the R.A.F. This included equipment, bombs and a rubber dingy.

One of the vital activities of the R.A.F. is vividly portrayed by this striking picture.

The fine "tank" display, showing the radio and inter-communication equipment in the foreground.

(Below) One side of the large display panel which carries its own message in pictorial form.

VERY few people outside the electrical industry realise the important part played by batteries in the war effort. To a lesser degree, that is also true of many engaged within the industry—particularly the actual workers themselves. From observations made at the Exide Battery Works (the largest battery factory in the British Empire), it became apparent that many workers, while vaguely appreciating the fact that they were engaged in the making of parts of or the assembling of batteries, had little idea as to what kind of batteries they were making, in what armaments the batteries were employed, or what functions they performed when used in the respective armaments. Some of the workers felt they were not even assisting the war effort in any degree and thought they could be better employed on "munitions" (shells, bombs, guns, etc.).

It was agreed by the company's management that some form of education was necessary. The scope of the subject was a very large one, covering almost every activity of the three Services. Unfortunately no indoor space was available in the works and reluctantly the idea was shelved. Later, however, the M.O.S. promised the loan of an army hut with inside dimensions of 24ft. by 24ft. and it was decided to proceed with four exhibitions each of three weeks' duration covering the following subjects: The Army, The Royal Air Force, The Royal Navy, Workers' Health.

The first exhibition opened on April 19th, and an average of approximately 150 workers visited the exhibition each day *in their own time*. The Naval Exhibition opened on June 14th. The interest of the visitors was beyond question and the company felt that the cost and time spent had been fully justified.

Each exhibition was divided into four sections. In the case of the Army these covered (a) Tanks ; (b) Anti-Aircraft, (c) Field Communications ; (d) Transport. Two of the enlarged photographs measured 9ft. by 5ft. 6in., and the others 6ft. 7in. by 5ft. 6in. The remaining photographs are standard M.O.I. sizes—20in. by 16in. All interior lighting was by fluorescent tubular lamps.

For the sake of economy in time and money, much material already in existence was used again for each subsequent exhibition. For example, the word "Army" in the slogan "No Batteries—No Army" had only to be changed to "R.A.F." or "Navy," as the case may be, to make it suitable for further use.

Engineer-built Houses of the Future—7

Ground Floors Around Fireplaces : Odd Dimensional Fillers · Floorings Pre-laid on Units

By R. V. BOUGHTON, A.I.Struct.E.

(*Continued from page 333, July issue.*)

PROJECTIONS into and outside the rectangular-shaped floors in ground storeys, as they are in other storeys, are inevitable. Fireplaces and hearths of ordinary coal and coke fires cause very considerable projections into rooms under traditional principles of construction; it will often be found that the breast projects about 13in., and the hearth a further 16in. or 18in., making a total of 29 to 31in.; and, if these dimensions are coupled with a width of breast of between 4ft. and 5ft., it will be realised what a considerable space is taken up to just provide an ordinary fire. Gas and electric fires require no or but little projection of a breast into a room, and, as will be evident in the articles on walls (to be started in next article), pre-building will permit a great saving of space in fireplace construction which will be dealt with in detail. Before leaving the subject of ground floors, it is essential to study how floor units may be most practically and economically fitted up to and around fireplaces and other projections into and beyond the rectangular space of ordinary shaped rooms, etc.

Fig. 33 is an isometric view of parts of ground storey rooms adjoining party and external walls and partitions. Dimensional standardisation of pre-built housing units will, it is certain, incorporate many sizes of standard units to suit normal requirements, and many of these units will allow for tolerances and for making-up odd inches. By studying Fig. 33 it will be seen that the floor units on one side of the party wall are of timber framework, and on the other side of concrete construction. There is an important difference caused by the use of these two materials. One is combustible and cannot be used under the fireplace opening, nor under the front hearth, and therefore the whole of the fireplace must be of incombustible construction and be quite independent of the floor units which must be trimmed around the breast and hearth. The concrete floor units, being incombustible, may, with perhaps a little extra concrete under them, ride right under the whole of the fireplace and hearth, and this will give two very considerable advantages, viz.: (1) form the support for the whole fireplace, etc., and (2) make unnecessary any special size units to trim around the fireplace.

By simple arrangement and setting out of the sub-structural parts, such as bases or piers and any beams which are essential, it is practicable to cause the floor units to have their length running either at right angles to or parallel with the main front and rear walls. Fig. 34 depicts a few of several good methods by which standard dimensioned unit frameworks may be made up to give several extra inches to the width of units, and the same principle may be adopted to make up or increase lengths. It is advisable to standardise the centres of joists or bearers, as these have the important function to perform of carrying safely all floor loads and to ensure that the most economical minimum thickness of flooring material may be used over maximum spans between the joists or bearers. Therefore any temptation to increase centres of joists, etc., to make-up lengths or widths should be resisted as a general rule. It is perfectly safe and in accordance with good codes of practice to let floor-boards, or any sheet material used as flooring that is capable of resisting ordinary bending stresses, to cantilever over a bearing for a distance equal to one-quarter of span between ordinary bearings. This is shown by one of the illustrations of Fig. 34. If the cantileverage would exceed such one-quarter, then brackets may be used as depicted. It may be stated that the L.C.C. by-laws for timber construction, and other authorities, allow flooring boards to cantilever a distance not exceeding three times the actual thickness of the boards. In my opinion this is too little, and the rule given above is quite safe for normal conditions which prevail in housing work. Floor units to suit bay windows which are square, splayed, or segmental shape on plan will probably be designed and manufactured to accord with the window units which will be of various widths and projections to cater for different utilitarian demands and æsthetic tastes.

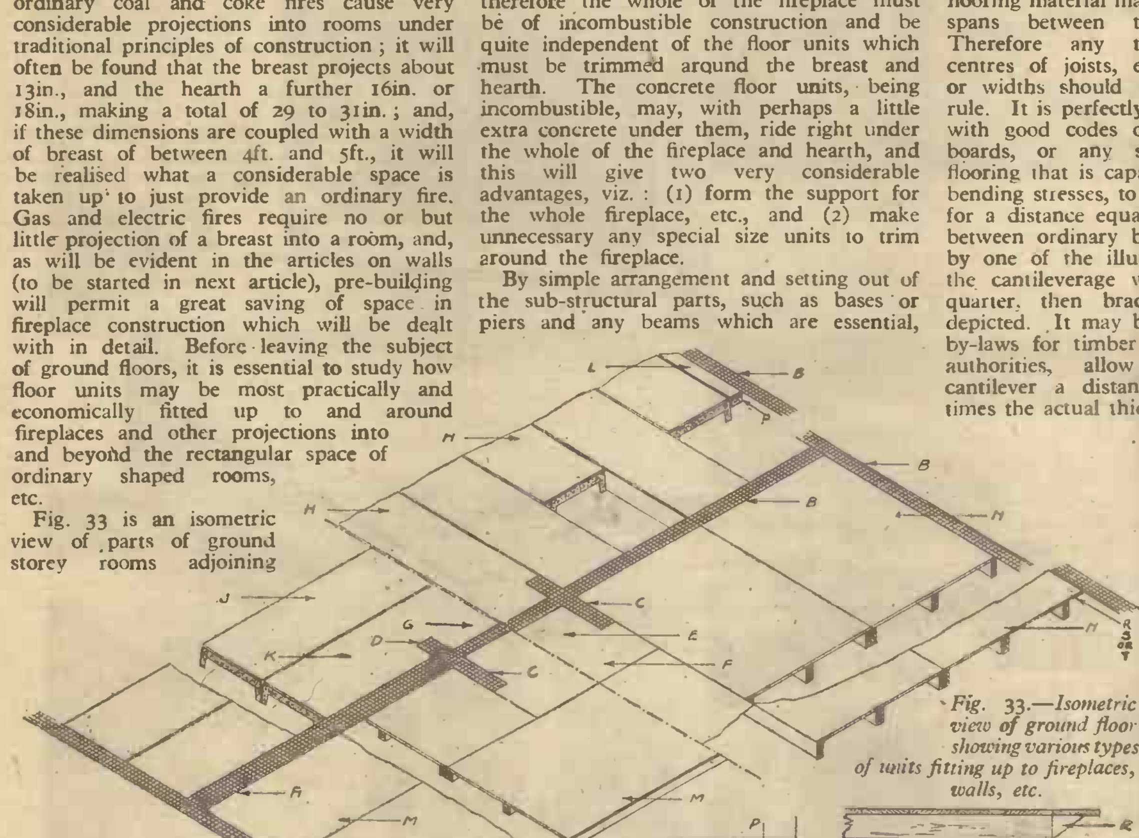


Fig. 33.—Isometric view of ground floor showing various types of units fitting up to fireplaces, walls, etc.

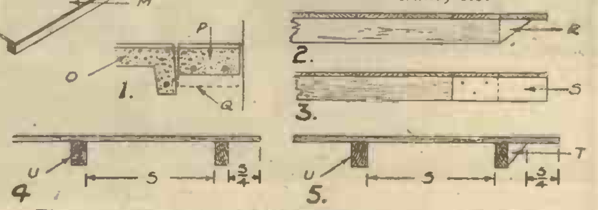


Fig. 34.—*Methods of making-up standard dimensioned units with fillers.*

A—Party wall. B—Partition wall. C—Fireplace jamb. D—Jamb and gas fireplace. E—Back hearth. F—Front hearth. G—Hearth formed by floor unit. H—Pre-cast concrete floor unit with its length at right angles to wall containing fireplace. J—Unit as H but with its length parallel to fireplace. K—Unit extending under and supporting part of fireplace construction. L—Concrete filler as 1 (Fig. 34). M—Floor unit with timber framework, with length parallel to wall containing fireplace. N—Floor unit as M but with its length in other direction. 1.—Reinforced concrete filler. O—Standard pre-cast R.C. unit. P—Filler. Q—Depth of filler to suit its span. 2.—Method of increasing width of unit by means of a timber bracket fixed to ends of joists or bearers. R—Bracket. 3.—Bracket nailed to side of joist or bearer. S—Bracket. 4.—Showing how floorboards may cantilever over joists or bearers. S—Span. U—Joist or bearer. 5.—Another method of cantilevering boards. S—Span. T—Bracket. U—Joist or bearer.

Flooring Materials

Protection during transport and handling is a subject which may be given attention before the various materials are explained. There is an impression, very well founded, that ordinary building materials are not always handled with sufficient care, and in consequence many are damaged. It is therefore reasonable to conclude that architects and builders may feel a little apprehensive about proper care being taken with the many pre-built units which will have to be subjected to various handlings, transport conditions, and erection operations before they are in positions where there is no danger of them being damaged. I am sure that engineers and manufacturers on their part, and architects and builders in their interests, will conform to a good code

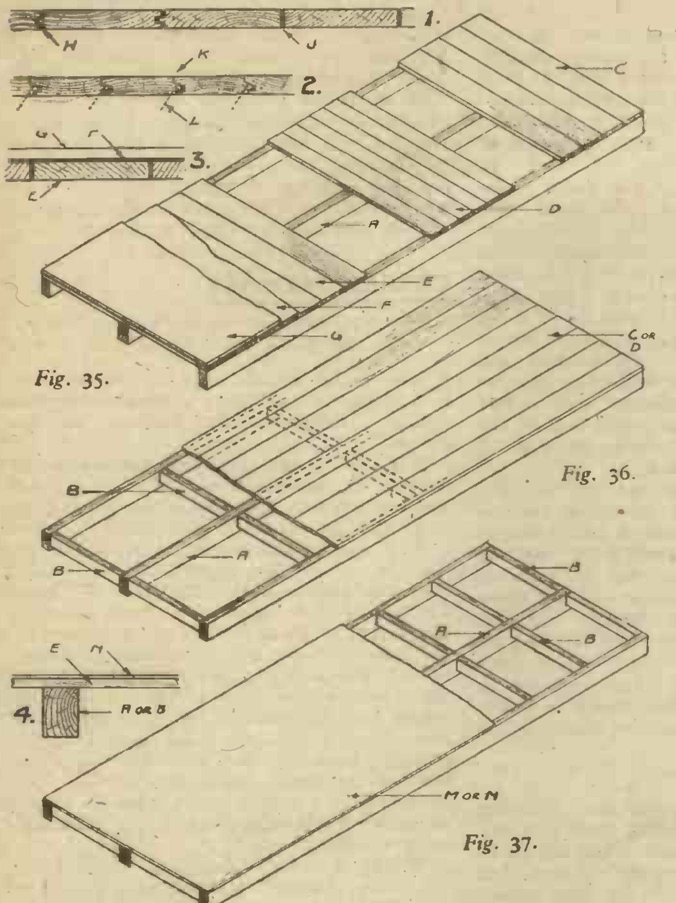


Fig. 35.—Pre-built timber framed floor unit with softwood, hardwood strip, and coloured asphalt floorings. Fig. 36.—Pre-built timber-framed floor unit with flooring boards running in direction of length of unit. Fig. 37.—Pre-built timber-framed floor unit with plywood or other sheet flooring.

1—Plain edged and tongued and grooved flooring. 2—Splay rebated tongued and grooved for secret nailing flooring. 3—Sub-flooring for sheet floorings. 4—Hardboard flooring as sub-flooring.

A—Main longitudinal joist or bearer. B—Cross bearers. C—Ordinary softwood flooring. D—Hardwood strip flooring. E—Sub-flooring. F—Felt-underlay. G—Coloured asphalt flooring. H—Tongued and grooved joist. J—Plain edge joint. K—Splay rebated tongued and grooved for secret nailing joint. L—Nail. M—Plywood. N—Hardboard on sub-flooring.

of handling and transport technique to ensure a minimisation of risk of damage. It will be manifest that the transport and handling of about 40 tons of materials, etc., comprised in a pre-built house is totally different and more economical than having to cope with about 125 tons of traditional materials. This fact alone will permit a good margin for the expenditure of sufficient money to allow for proper crating and protection. Another factor is that the probable enormous volume of business that will accrue through house building will cause manufacturers and transport interests to insist on vehicles having specially and simply designed bodies with cradles and mechanical lifting appliances to allow for speedy and careful operation of the units during loading, transport and unloading. Once the units are on site, the erection, machinery, builders' staff and operatives can be relied upon to conduct the various operations in a satisfactory manner to prevent damage. After all is analysed, crating materials and protecting sheets will be cheap after the war, will be usable many times, and it takes but very little extra time or expense to exercise care than to adopt slovenly methods.

Ordinary Softwood Floorings

These are commonly of two types, viz.: (1) plain edged or (2) tongued and grooved, the latter, although being the slightly more expensive initially, is recommended for reasons which will be explained. The softwood used is that known as deal, or, more technically, as redwood, and is obtained in nominal widths before planing, in widths known as *narrow widths* of 3 to 4½in. and *batten widths* of 5 to 7in. The narrower the board, the greater is the percentage of waste due to planing and greater is the labour in laying it; 4½ to 5in. widths are recommended for good quality work. The normal thicknesses suitable for domestic floorings are ¾, ⅞ and 1in., which finish about ⅝, ¾ and ⅞in. The thickness to use is governed by good rules and also by the excellent L.C.C. by-laws for timber construction. One of the practical rules of these by-laws is: *The clear span of floor-boards shall not exceed 24 times their actual thickness.*

This means that floorings which finish ⅝, ¾ and ⅞in. thick may span in clear between joists or bearers 15, 18 and 21in. respectively, which are reasonable spans in rather sharp contrast to the old 14 and 16in. centres specified for joists which usually carried 1in. nominal thickness floorings. *B.S.S. 1018, Part I, 1942—Timber in Building Construction: Floors give the following useful data* (which the writer assisted in framing):

Floor-boards.—For the purpose of determining the required thickness (actual thickness) of floor-boards, the imposed loading shall be taken as not less than 200lb. per sq. ft. of the horizontal area covered, provided that where floor-boards are grooved and tongued the imposed loading may be taken as being not less than twice that given in the table of loading for joists. The thickness shall in no case be less than ⅝in.

Fastening. Floor-boards.—(A.) (1) Floor-boards, other than grooved and tongued, up to and including 7in. wide shall be fastened with two nails or screws at each intersection with a joist not less than ½in. nor more than ¾in. from the edges of the boards; (2) Floor-boards, other than grooved and tongued, over 7in. wide, shall be fastened with three nails or screws at each intersection with a joist, the outer nails being not less than ½in. nor more than ¾in. from the edges of the boards; (3) Tongued and grooved floor-boards shall be fastened with two nails or screws at each intersection with a joist; (4) Tongued and grooved flooring of not greater width than 4in. on face may be fastened by one nail or screw at each intersection with a joist; the nails or screws shall have a length not less than twice the thickness of the flooring.

(B.) Nails shall have a length not less than

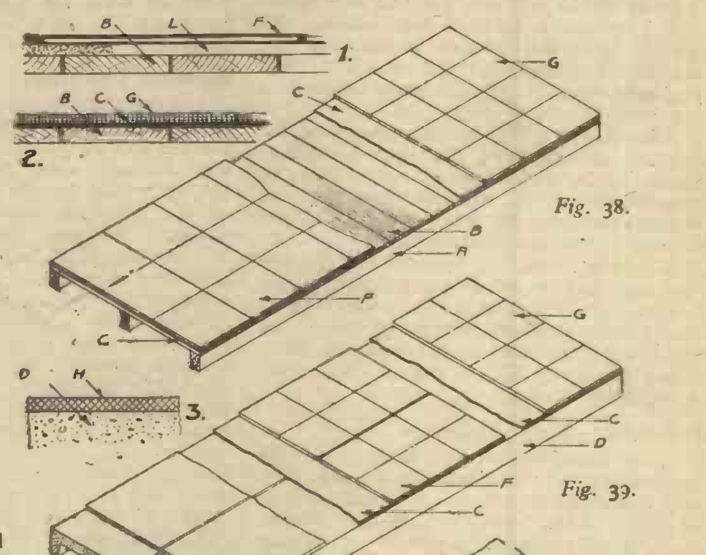


Fig. 38.—Pre-built timber-framed floor unit with rubber on asbestos-cement and cork floorings. Fig. 39.—Pre-cast concrete units with coloured asphalt, rubber on asbestos-cement and cork floorings. Fig. 40.—Cast-in-situ concrete floor with various types of floorings.

1—Detail of rubber on asbestos-cement floorings on wood sub-flooring. 2—Detail of cork flooring on wood sub-flooring. 3—Coloured asphalt flooring direct on pre-cast concrete units. 4—Detail of rubber on asbestos-cement floorings on concrete sub-floor.

A—Timber-framed unit. B—Sub-flooring. C—Felt-underlay. D—Pre-cast concrete units. E—Cast-in-situ concrete sub-floor. F—Rubber on asbestos-cement flooring tiles for fixing on wood sub-flooring. G—Cork flooring tiles. H—Coloured asphalt flooring. J—Rubber key on tiles fixed and covered sub-floor. K—Bedding compound. L—Mastic.

2½ times the thickness of the boards (see (A.) (4)).

(C.) Where screws are used their size small be not less than that known as "No. 8" and of a length not less than twice the thickness of the floor-boards.

Leaflet No. 22 of *Forest Products Research Laboratory—Economy in Timber* is another authority which helps to show that flooring boards are now considered with greater care. The following is an extract:

MINIMUM THICKNESSES FOR FLOOR-BOARDS

Type of Flooring	Tongued and Grooved			Square-edged
Joist spacing centre to centre	Floor loading (lb./sq. ft.)			All loadings to 200 lb./sq. ft.
	*40	†80	100	
in. 12	in. 5/8	in. 5/8	in. 5/8	in. 3/4
16	5/8	23/32	25/32	1
24	3/4	31/32	1 1/16	1 19/32

* Normal for domestic work.

† See following note regarding using twice the normal floor loading for tongued and grooved boards.

The above table gives the minimum thicknesses of floor-boards for various floor loads and spacings of joists. Flooring may be subjected to point loading and for the purpose of design 200lb./sq. ft. is assumed for square-edged boards. If the flooring is tongued and grooved the imposed point loading should be taken not less than twice that given in the table of floor loading. In no case must the thickness be less than ⅝in. An allowance for wear and tear of 3/16in. has been made in the thicknesses inserted in the table.

The thicknesses given are appropriate for flooring timbers having a bending strength of 800lb./sq. in. and a modulus of elasticity of 1,300,000lb./sq. in., such as Scots pine or Baltic redwood. All thicknesses are to the nearest 1/32in. for finished flooring.

It will be noted that tongued and grooved floorings may be much thinner than square edged, and the saving in this respect will be found to compensate wholly or partly the extra cost of tongued and grooved over plain edged floorings. Fig. 35 depicts these types of common floorings.

Hardwood Strip Floorings

These floorings are of many kinds of hardwoods and semi-hardwoods, and even softwoods may be employed. They may be of Columbian pine, Canadian birch, Canadian maple, white American oak, Indian gurjun, Australian jarrah, pitch pine, Tasmanian oak, Burma pyinkado, Burma teak, and various softwoods. Their side joints are almost invariably splay rebated tongued and grooved for secret nailing as Fig. 35. Their widths are usually narrow, with 2¼in. to 3¼in. faces, and their nominal thickness varies from 1in. down to ¾in. This type of flooring is much more expensive than ordinary kinds in cost of wood, losses due to planing and edge work and in laying and finishing off; but the flooring is excellent in appearance and seldom needs any flooring covering except rugs.

Direction of flooring boards is worth considering. Although floor units should fit tightly together, it is right to allow that little shrinkages and movements may occur, and consequently some designers may prefer longitudinal joints in the panelled units to coincide with the longitudinal or side joints of flooring boards; in this case the latter could be laid as Fig. 36; but it will be noted that cross bearers must be used.

Coloured Asphalt Floorings

These floorings, on timber framework, are becoming very popular and are obtainable in red, grey and green colours—white, black or multi-coloured marble chippings may be added and the surface machine-rubbed to produce a terrazzo effect. Asphalt floorings are inodorous, fairly resilient, and pleasant to walk on, waterproof and easily cleaned. They may be laid on a sound, firm and even wood sub-flooring with a felt underlay tacked down to the flooring so that any movement of the timber will not affect the asphalt. In pre-built construction it may be advisable to "key" the asphalt down to the sub-flooring by using a large mesh wire netting or other suitable fabric stapled down through the felt to the sub-flooring. The flooring is rather expensive in initial cost, but has many advantages—and when all is considered there is only about 60 Y.S. in the whole ground-floor area of a small house, and considerably less in the kitchen and bathroom where this type of flooring may be only used, and the additional cost is not a great percentage of the whole cost of the house. The flooring is shown by Fig. 35 and is laid about ⅝in. thick.

Coloured Asphalt Floorings (*on concrete*) are similar to those last described, but are laid as follows: For cast-in-situ concrete floors, a felt underlay between the concrete and asphalt is necessary so that any cracking or movement in the concrete will not cause damage or cracks in the asphalt. See Fig. 40. For pre-cast concrete units, as Fig. 39, no felt underlay is necessary as these types of units may usually be relied upon not to crack or affect the asphalt which is firmly keyed to the fairly rough surface of the concrete.

Plywood Floorings

Floorings of plywood are now receiving particular attention regarding their practical use for floorings. Plywood, when compared with ordinary wood floorings, is thin, but has, as a rule, greater strength than timber of the same thickness to resist bending stresses. Although plywood, which should be of the resin-bonded type, is often advocated as best laid on an ordinary wood sub-flooring which is thick enough to carry all loads, there is a modern tendency to use sufficiently thick plywood to span by itself between bearers at reasonable distances apart. In my opinion it is safe for it to span up to 32 times its thickness and this means that ⅜in. plywood may have a clear span of 12in., and the egg-box method of framing, as described in the last article, being useful for this class of flooring. Fig. 37 shows the plywood without a sub-flooring.

Super-hardboard floorings, although not having the "figure" of plywood, may be used, but as super-hardboards are only made ⅛in. and 3/16in. thick it is impracticable to use them except on a sub-flooring. See Fig. 37.

Rubber on Asbestos-cement Floorings

These floorings consist of tiles having an asbestos-cement core with the exposed surface covered with rubber of any one or mixture of a wide range of colours. The tiles are rigid and may be laid on a wood sub-flooring as Fig. 38, or on a concrete sub-floor as Figs. 39 and 40. When laid on wood, tiles with plain under-surfaces are used, but when to be used on concrete the under-surfaces are keyed as shown by the details. A wood sub-flooring must be firm, level and painted with a red lead priming, and the tiles are fixed with a mastic compound. Concrete floors must be dry, and if very uneven in level or surface they should be corrected by screeding with cement and sand; the tiles are bedded down to a special compound about ⅛in. thick. The tiles are made in such sizes as 12in., 9in. and 6in. square.

Cork Floorings

Floorings of cork are made in ¼in., ⅜in., 9/16in. and other thicknesses, and in a variety of sizes, and may be laid on wood or concrete. Wood sub-flooring should be dry, firm and perfectly even. Concrete sub-floors should be screeded, and if in contact with earth the screeding should be waterproofed or otherwise the floor made damp-resisting. A felt underlay is laid on wood sub-flooring, and the tiles are fixed by invisible nailing. A special mastic is used for bedding the tiles down to the screeding on the concrete, see Figs. 38, 39 and 40.

(*To be continued.*)

CORRESPONDENCE

We publish below an interesting letter from a reader, together with Mr. Boughton's reply.

SIR,—Being connected with the building trade I was rather interested in your article "Engineer-built Houses of the Future."

It seems to me that most houses of the future are designed to suit our *average* climate, whereas they should be designed to withstand the strongest gale likely to blow.

What householder sitting by his fire listening to a 60-80 miles an hour gale does not feel thankful that he has a good 125 tons of solid weight about him, including the weight of slates or tiles on the roof?

I have seen the iron framework of a *very modern* garage of the Nissen type blown over on its side by the force of the wind. What would have happened if the light corrugated iron covering had been fixed on? It would probably have been blown miles away. I also know of an enemy bomb which would have devastated a whole street of modern houses do only superficial damage to our old-stone-built tenement houses.

Within a stone's throw of where I live are some so-called engineer-built houses—a wooden framework covered with steel plates on the outside, and a paper or fibre composition board on the inside, and so "sound proof" that one can hear the people talking in the adjoining house quite easily.

The roof garden shown on your drawings is rather a novel idea, but what a receptacle for snow. I wondered if *all* the melting snow would find its way down the soil pipe?

Regarding the jerry-built houses which followed the Great War, who was to blame for them? None but the people themselves, who will buy anything provided it is a few pounds or pence cheaper than the other article, and disregarding whether it is made in Britain, Germany or Japan. The result of this was that the honest builder could not compete with the jerry builder and was forced out of the market.

WM. B. POLSON (Edinburgh).

W. B. P. (Edinburgh) raises many interesting matters which are indicated in the following answers and comments.

Most of the subjects raised are well-merited if considered as related to the standards and conditions of building in vogue during the period between the last and this war, and connected with those principles of the old masters of building which were followed so conservatively, and so sheep-like by architects and builders.

After the last war building underwent certain changes, many good and many bad; the worst forms of jerry-building came into being; many new and excellent materials came on to the market; there was long-wanted betterment of bylaws; and, what is of extreme importance, scientific research was applied to building, one of the greatest pre-war, and what will be the greatest post-war, industries in this country.

W.B.P.'s preference for 125 tons of solid weight of the ordinary type of house, with its brickwork and slated or tiled roof, when there is a 60-80 m.p.h. gale, is quite understandable if based on pre-war ideas. But, if driving rain is coupled with the gale the solid brickwork is soon made wet, and, as is well known, roofing tiles which are imperfectly nailed may be stripped by a heavy gale. And, the way the ordinary pitched roof was designed and constructed, particularly in connection with the joints, by jerry-builders, certainly gives little confidence to those, like me, who understand mechanics of structures. The engineer-designed and built house, although very considerably lighter in weight than a brick-built house, can be, and will be, much stronger than the latter. Strength is not always ensured by the use of heavy materials; there are many materials, quite apart from the metals, which are stronger than brickwork, and lend themselves to the best principles of design to resist forces and to meet artistic requirements.

It is a fallacy to think that pre-built housing means the use of steel framework, and metal generally; engineer-built houses will be found to consist of the best of many kinds of materials chosen carefully to permit of a well-balanced manufacturing system and distribution of labour, and the use of machines.

As to houses being blown down by bombing, I quite agree that certain types of pre-war brick-built houses were easily devastated, and that stone-built houses stood up to the trouble much better. "Whole streets of modern houses" is taken to mean the pre-war jerry-built houses of the rectangular plan and box-like construction.

As will be demonstrated in a future article on "Engineer-built Houses," the whole principle of the structural design of such houses calls for much improvement which will certainly be incorporated in the engineer-houses. The old "back-addition" type of house built before the last war stood up to bombing, etc., much better than the "pre-war houses," for the simple reason that the "back-addition" acted as an excellent buttress to the main building.

W. P. B.'s notion is wrong that post-war engineer-built houses will consist of a wood framework covered externally with steel plates, and "paper or fibre composition boards" internally "which are so sound-proof" that people in adjoining houses can be heard talking quite easily. Construction of engineer-built houses will incorporate modern principles of sound and temperature insulation.

The comments about the combined pitched and flat roof, shown in the first article, being a receptacle for snow, and the doubts as to its disposal when melted, raises a few interesting matters. Even if the "large pocket" on the roof was filled with snow, and a heavy thaw set in, the gutter and rain-pipe would take the water if they are of reasonable size.

As to your remarks about the decadence of the British craftsman, it is a fact that modern pressure and competition have done much to make it impossible to devote sufficient time to work, which in bygone days was the pride of British craftsmen in building.

Finally, I may mention something that most people overlook when praising the virtues of brick-built houses; bricks are only an advancement of the old sun-baked mud hut; bricks are only scientifically mixed mud, etc., shaped usually by machinery and baked in kilns. It was only about 75 years or so ago that builders dug the clay, etc., from housing sites and made their own bricks on the site.

R. V. BOUGHTON.

A Word to Inventors

Notes on the Conditions Necessary for Success

By E. WILLIAMSON

THERE are few fables that die so slowly as the one that to make an invention is to make a fortune. Even the story of the golden London pavements did not have such longevity. Perhaps one or two occasional outstanding examples give the fable a new lease of life, and yet these examples are exceptions to the imagined rule. A study of these examples shows the salient conditions necessary for success. These may be summarised as follows: a financial backing for the industrial and commercial development of the invention; a sound and shrewd handling of that development; and finally, the invention must supply an incipient or prevailing demand.

Financial Backing

It is so little realised that there is many a slip 'twixt the invention and the invoice. An inventor may find it difficult to solve the problem on which he is working, and he may not find it easy to finance his initial experiments and the taking out of his patents. But when he has proved practical feasibility and obtained adequate patent protection, his real difficulties begin. He must then find the money to finance the large-scale testing and the design and purchase of tools and machinery for commercial production. This means that he must not only find someone with money to spare, but he must instil into such a person that absolutely essential faith and enthusiasm which has carried him through the initial stages. The inventor must not only be akin to a technical genius, but he must have also the enthusiasm of the pioneer and the power to impart it to others. Without this quality he will never be able to gather round him the hard-boiled men of money.

Sound Development

During the early commercial development it is vital to success for someone to be in control who knows all the difficulties and pitfalls of commercial life. Very, very few inventors have this knowledge: in fact, the large majority of them have temperaments which are at variance with commercial shrewdness and ability. A sound commercial partner is as necessary to an inventor as an experienced manager is to a professional boxer. Furthermore, if it is hoped or intended to develop the invention on a large scale, it is essential to have, in addition to a sound commercial control, a wide and expert knowledge of technical production, salesmanship, and purchasing.

Supplying the Want

The crucial question now is, where and how can the free-lance inventor find and obtain adequate finance, sound commercial experience, and technical production ability? It is fairly obvious that these are to be found only in the large industrial concerns which are an outstanding feature of modern industry. The free-lance inventor is very much at a disadvantage when competing with such concerns as Imperial Chemical Industries, Morris Motors, Electrical and Musical Industries, to name only a few. Development and invention in these concerns are the result of team work: the firms have large staffs of chemists, engineers, mathematicians and physicists. Experience and information are pooled, and controlled by one or two master minds.

There are few activities other than oratory in Hyde Park, which show so few results for the energy expended, as the hawking of inventions. And yet it goes on. Some large concerns have one or more men whose sole job it is to consider inventions submitted by outside inventors. One large concern in America has submitted to it about 8,500 inventions annually. And over a period of four years, out of a total of 35,000 inventions submitted, only 26 have been taken up—.07 per cent.

The reason for this paucity of results is clear when one considers the manner in which the large concern works. It is always striving to improve its products and always trying to solve new problems. Its engineers are in the front line of advance and know the difficulties ahead. *The free-lance inventor, if he must succeed, must be also in the front line and must also know of the difficulties.* Furthermore, it must be realised that large-scale development is not haphazard: it is carefully controlled with an eye on the future. The engineer of a motor firm must at the same time act as mother to last year's model, wet nurse to this year's, and midwife to next year's. Plans are laid ahead for several years. How then can the free-lance inventor hope to have his own infant adopted? He is really in a dilemma of which he is ignorant: unless his own invention is in the same line of development and follows the same path as that of the large concern, it will not be adopted; and if it is in the same line, it will not be adopted because it is competitive —with one crucial exception. It must be realised that his own pet invention will be submitted to those very engineers who are working in competition with him. Unless it follows their own ideas, they will cast it aside: they will not overthrow their own long-laid plans for a line which is strange to them. They will not damp their own enthusiasm in their own ideas and expend new energy and rouse new enthusiasm in an idea which is at variance with their own. On the other hand, if the invention submitted is on the same lines as their own, they will view it with a certain amount of jealousy. And here comes the crucial exception: the invention will be adopted *only if it is protected by a patent having an earlier date.* The free-lance inventor, in fact, must be in front of the front line. To the writer's knowledge the few inventions which have been adopted by large industrial concerns are those on which the inventor has an earlier patent date, or those which, in a competitor's hands, would be a considerable nuisance.

In one case, in the early days of the wireless boom, it happened that a French inventor had patent applications covering a new form of loudspeaker, and which were just a little earlier than those of a large concern which was marketing that form of loudspeaker. The French inventor had had the genius to look ahead as far as a whole team of experts, and he was rewarded with several thousand pounds as the purchase price of his patents.

Toy Manufacture: Principles and Practice

Another Selection of Mechanical Toys and Details of Operation

(*Continued from page 347, July issue*)

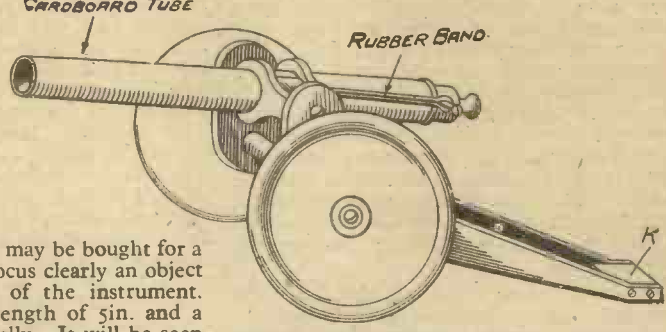


Fig. 115.—The finished model gun, made chiefly from a cardboard postal tube and cotton reels.

A Kaleidoscope

APART from the changing beauties of the kaleidoscope, which so please the eye, this instrument may be made to render a real service to those who are interested in the evolution of conventional designs for various decorative purposes.

The instrument to be described is convenient for that purpose, because once a suitable design has shown itself it can be retained in view for as long as is necessary for the operator to copy it on paper.

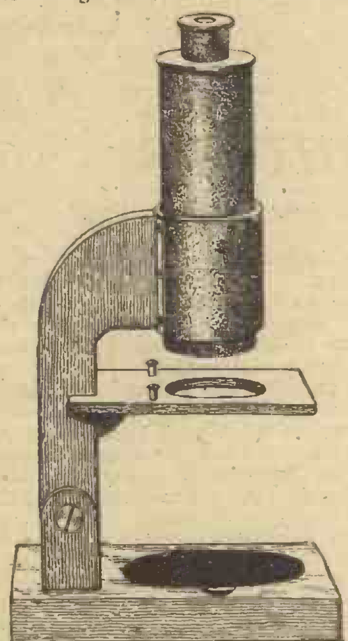
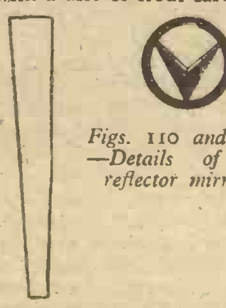


Fig. 108.—A side view of the finished kaleidoscope.

It will be seen that the instrument is built on the lines of a microscope, with a jointed limb, thus enabling it to be used upright or at any desirable angle. (See Fig. 108.)

The Tube.—This may be made of paper pasted and rolled round a ruler to the requisite thickness. Fig. 109 shows the tube in sectional view. The bottom is left open, and the top closed with a disc of stout cardboard perforated with a central hole, in which is fitted the smaller tube that carries the eyepiece with its lens. The latter may be bought for a few pence, and should focus clearly an object placed upon the stage of the instrument. The tube may have a length of 5in. and a diameter of 1¼in. internally. It will be seen that a small hole is made in the disc covering the eyepiece, and that the lens is placed immediately below it, being held in place with a cardboard ring. The whole inside of the tube should be blackened. French polish diluted with methylated spirit, to which some lampblack has been added, makes a good dull black that dries quickly.

Fig. 109.—Sectional view of the tube.



Figs. 110 and 111.—Details of the reflector mirrors.

The Reflectors.—These are tapering strips of plain plate-glass, say ⅛in. wide at the small end and of a width at the large end which will just fit the tube when the two strips are set at an angle of 60 deg. with each other (see Figs. 110 and 111). These strips should be blackened on one side, for which purpose the mixture mentioned above would serve.

This makes a better reflecting surface than that of a silvered mirror for the purpose in view, because the reflections are from the front surface of the glass.

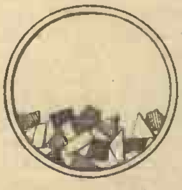


Fig. 112.—The container.

Figs. 113 and 114.—Designs obtained by the use of opaque objects.

Fix the glass strips securely in the tube, which may best be done with cork wedges glued in place.

The Stand.—This, it will be seen, is built of wood, and its construction will be clear from Fig. 108. The base should be hollowed, and fitted with a slab of lead to give stability to the stand. The two short uprights are mortised into it. The limb, cut from ½in. stuff, will give the distance apart to fix the uprights.

The stage may be ¼in. thick, and should have a hole of the same diameter as the tube. Two small brass screws should be fixed as shown, and should stand up high enough to permit the container (shown in Fig. 112) to pass under their heads.

The head of the limb carries a short paper tube, through which the main tube can slide friction-tight.

Covering the Tubes.—Both tubes can be covered with grained black leather cloth, which gives them a nice finish. Also, the short tube may be lined with fine cloth, which is best applied when making the tube, using the main tube as a mandrel.

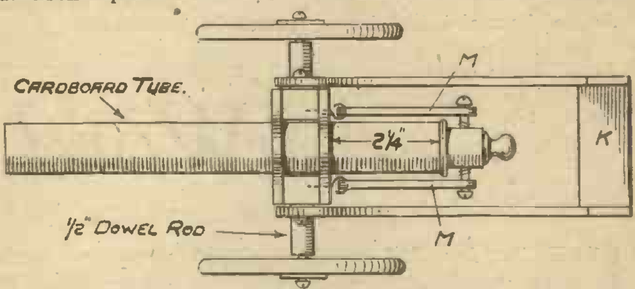


Fig. 117.—Plan view. The gun is worked by two elastic bands, as shown.

The short tube is joined to the limb with a strip of brass sheet bent to the curve of the former. It should first be screwed to the limb and then to the tube. The thickness of the short tube must be sufficient to give a good hold for the screws.

The upper surface of the base is recessed to hold a disc of opal glass, one side of which should be blackened, so that a white or black background may be had as desired.

The Container.—This consists of a disc of clear glass, as shown in Fig. 112, to which is attached a rim of cardboard, and is easily rotated with the finger until an attractive design appears.

Figs. 113 and 114 show designs obtained by the use of opaque objects.

A Toy Gun

All that is required to make this toy gun is a piece of cardboard postal tube, some cotton

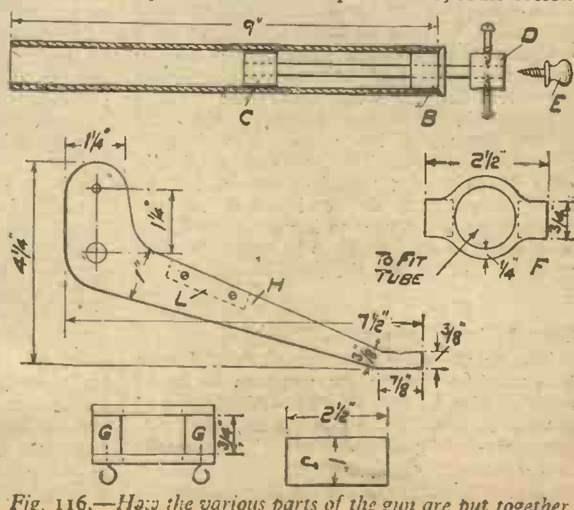


Fig. 116.—How the various parts of the gun are put together.

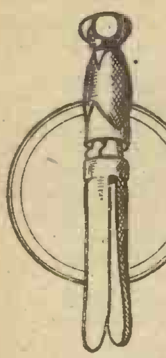


Fig. 118.—*Marking off the peg for the toy.*

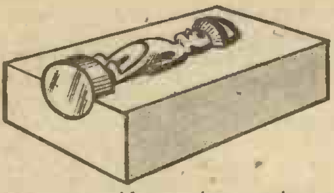


Fig. 119.—*After cutting out, the toy is embedded in plaster, as shown.*

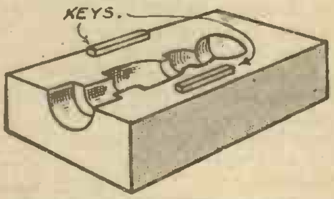


Fig. 120.—*Two keys must be cut, as shown here.*

reels, pieces of dowel rod, and odd bits of fretwood. To provide the power for firing rubber bands are used, while the ammunition may consist of small indiarubber balls.

First of all, obtain three empty cotton reels and saw an end off one, as indicated at B, Fig. 116. Now obtain a cardboard postal tube, into the end of which the body of the cotton reel just fits, as shown at B, Fig. 116. The plunger rod is a piece of dowel rod, 5½in. long, which should be an easy fit in the hole in the cotton reel. If it fits too tightly, rub it well with glasspaper. The part C consists of the body of another cotton reel, both ends being sawn off. The part D is a similar piece of another cotton reel. These parts are glued on to the ends of the rod after passing it through the part B, which is then glued into the end of the gun tube. Into the part D screw two screws opposite each other, as shown, and then screw a small wooden drawer knob into the end of the plunger rod.

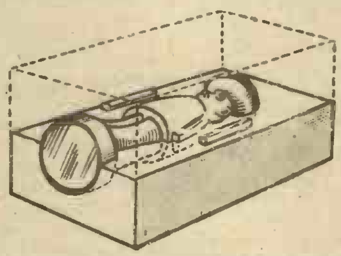


Fig. 121.—*Increasing the height of the box.*

The Trunnion Block.—The next part to make is the trunnion block (F). Cut two pieces of ordinary fretwood to the shape shown, with a hole in the middle of each a good fit to the gun tube. Between the ends of each piece glue two blocks of wood (GG), and, when the glue has set hard, screw in two little hooks, as shown. Slip the trunnion block on the tube and glue it in place, 2½in. from the rear end of the tube.

For the trail, cut two pieces of fretwood to the shape and sizes given at H. Make two holes in each, the top one for the pivot screw and the bottom one to fit a piece of ⅛in. dowel rod, which forms the axle. This is 4½in. long. Cut a piece of wood (J), and screw it between the ends of the trail, as shown at K, Fig. 117. Another piece (L), also 2½in. wide, is screwed in place in the position indicated.

Assembling the Gun.—Now fix the gun tube and trunnion in position by means of a screw through each side of the trail. Push the axle through the holes in the trail and glue it in place. Obtain two wooden wheels, about 4½in. in diameter, and fix these to the ends of the axles with round-headed screws, placing a washer under the head of each screw before screwing them in.

Lastly, obtain two strong rubber bands, about 2in. long, and loop them over the hooks and screws, as shown at MM, Fig. 117. The finished toy, with the exception of the rubber bands, can be given a coating of grey enamel.

To work the gun simply put a small rubber ball down the gun tube, pull the knob back and then let go. Plenty of amusement can be had by shooting at toy wooden soldiers.

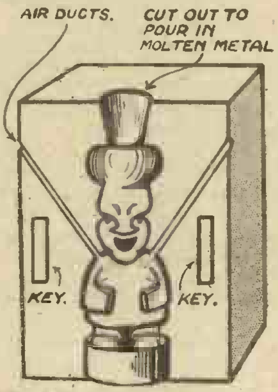


Fig. 122.—*Making the casts into moulds.*


Fig. 124.—*The "finished" obedient watch-dog.*

Casting Lead Toys

Most pegs look alike to the untrained eye. But it is a mistake to believe pegs are all the same quality, size, or shape. Some are good to work with and others are useless. Experience will teach you which to use.

Take a peg in your left hand and the penknife in your right, and you are ready. You will note that the legs of the peg offer a good grip, and the spring eases the strain for your hand.

In Fig. 118 is shown how to mark off the peg for your toy. From the various illustrations you can pick out the style of toy you fancy and start with the penknife to make one for yourself. In an hour or so you should be able to make the top half of a clothes-peg into a figure similar to those illustrated. You will soon find this is a very interesting occupation. It is full of fun.

The Mould.—Perhaps you desire more than one of a kind. Do not recarve. There is a much quicker method. Make a little box and fill it with plaster of paris. Grease your toy and embed it half-way in, as shown in Fig. 119. Allow this to set hard. When it has properly set, carve out two "keys," as shown in Fig. 120. Now grease the whole of the surface of the plaster of paris and what is still exposed of the toy. Increase the height of the box sides, as shown in Fig. 121. Then mix up a fresh supply of plaster of paris, pour in flush to the top of the box, and allow to set hard.

The next stage is to make these casts into moulds. In Fig. 122 you will see what to carve away to achieve this object.

To prepare the moulds ready for use the insides should be well smoked over the flame of a candle.

Now stand these moulds upright on a thick piece of blotting-paper. A metal clip should hold both halves of the mould together. You are now ready to start casting replicas of your original toy.

The Metal Required.—In a special ladle you now melt down a quantity of type metal, lead, or pewter. The type metal may be easiest to obtain. Any printer will sell you a quantity of old type for a few coppers per pound. Pewter is more difficult to obtain. There may be old pewter teapot or sugar basin which has come to rest in the lumber-room. Old lead pipes or pieces of lead may be available and could be used.

Plaster of paris can be bought from most chemists, but is much cheaper if bought from a plasterer.

When the metal you are melting is hot enough you pour gently into the mould. (See Fig. 123.) The metal will set quickly, but great care must be taken in handling the casts and the moulds, as they will have become very hot.

You can turn out dozens of replicas in this way. Always keep the inside of your moulds well smoked and you will get good, clean casts.

When the casts are cold you can snap off

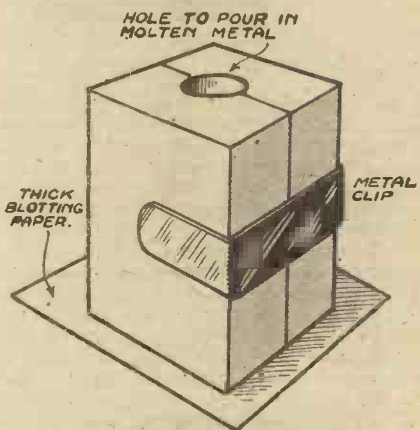


Fig. 123.—*The mould ready for use.*

the surplus metal and finish off with a small file. Practice will make you perfect in casting.

Mis-shapes can always be remelted. Never throw cold metal into the molten metal, as it will cause the metal to "fly."

The Obedient Watch-dog

This amusing toy consists of a china watch-dog housed in a small wooden kennel that stands on the table. Directly you call, snap your fingers, or whistle, he will pop out from his kennel to see what it is all about.

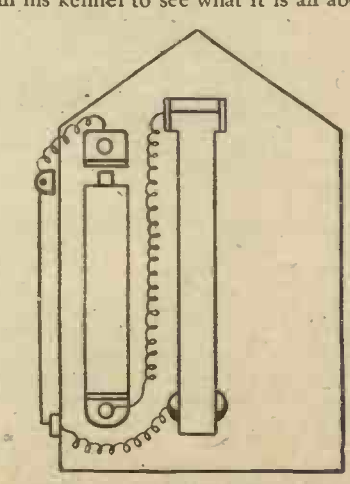
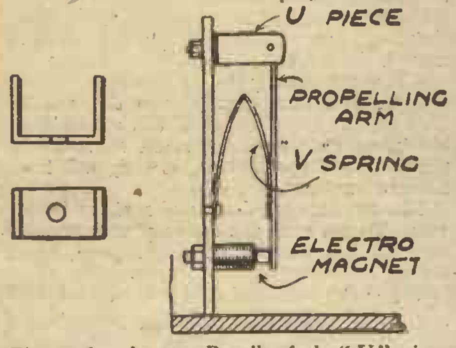


Fig. 125.—*The propelling strip.*

The toy (see Fig. 124) is quite easy to make, and is controlled by the vibration your voice sets up when you shout.

Behind the dog, fixed to the back of the kennel, is a hinged strip of metal which, under the action of a spring, will propel him outside. In the ordinary way this metal strip is held back by a small electro-magnet energised from a pocket-lamp battery. The circuit is completed through a "sensitive" contact made by another metal strip, suspended outside the kennel in such a way that it rests lightly against a metal stud. The vibrations set up by the voice cause this strip to dither, thus momentarily upsetting the contact, de-energising the electro-magnet, and releasing the propelling strip.



Figs. 126 and 127.—Details of the "U"-piece, and how the "V"-spring is fitted.

The Dog.—The first thing to do is to buy the toy dog so that the kennel can be made to fit him. A little china dog, a fierce-looking bull terrier for preference, is best; but one of the celluloid variety will do quite well if a small hole is made in it, and the body filled with shot to give it the necessary weight. If it is too light or too heavy it will not jump out as enthusiastically as it should.

The kennel can be made any convenient size, but somewhere about 4in. long by 3in. wide by 3½in. high overall is generally suitable. Cut the sides out of three-ply, and make an opening in the front sufficiently wide to allow the dog to move in and out quite easily. A slanting roof overhanging the sides a little looks best. The floor must be made long enough to extend in front of the kennel for an extra 3in., making a smooth platform.

After preparing the various pieces for the kennel, the mechanism must be fitted before they are assembled. First comes the propelling strip. This is made from 26 S.W.G. mild steel, ½in. wide by about 2½in. long. In cutting this strip, two narrow supporting ears must be left at the top, as shown in Fig. 125, or alternatively, a 1/16in. pin, arranged to project 1/16in. beyond each side, can afterwards be sweated on the extreme end.

The Mechanism.—Obtain a small electro-magnet of the type used in electric bells, and mount it centrally on to the backboard of the kennel so that it will come parallel with the floor and about ¾in. above it. Measure the distance the electro-magnet projects from the board and then bend up a "U"-shaped piece from thin ½in. strip brass (see Fig. 127) the distance between the arms being ½in. clear, and the length of them ¼in. over that of the measurement taken. Drill ⅛in. clearance holes ⅛in. from the end of each arm of the "U," and another in the centre of the base. The fitment can then be bolted near the top of the backboard, and the ears on the propelling strip sprung into the two holes. The strip should now hang parallel with the board and make good contact with the face of the electro-magnet, projecting a little beyond it.

A piece of medium strength clockspring, bent into a "V," is fitted between the board and the propelling strip so that it tends to push the latter away (see Fig. 127), and will send the dog outside at the double. The spring can be fixed in position with a round-headed screw at either edge if you do not feel inclined to try punching a hole through it.

The Contact Strip.—This is made from ½in. 26 S.W.G. brass, as shown in Fig. 128, and is mounted in exactly the same way as the propelling strip on one side of the kennel—outside (see Fig. 129). To the end of the strip is bent over at right angles to project about ¼in., the edge being carefully levelled off with a file. A small contact stud of the type used in radio work is bolted in place so that when the wooden side is in its proper vertical position the edge of the suspended contact strip rests very lightly against it. The setting of this contact strip must be really accurate, so obviously the position of the holes in the "U"-piece which carries it must be marked with care.

Only a 1½-volt battery is needed, so one of the cylindrical pocket-torch variety is the most convenient thing to use. To make replacement easy, it is best to hold the battery in position with two brass angle brackets, one arranged to make contact with the base, and the other with the brass cap at the top. It can be mounted outside the kennel on the backboard or tucked away in a corner inside.

The Sides and Floor.—These can now be fixed together, but the roof must be left until the wiring has been completed. Connect one end of the electro-magnet winding to its own mounting, so that it makes a contact of the iron core, and run the other to the contact stud on the side piece. One battery connection runs to the "U"-piece holding the contact strip, and the other to the "U"-piece holding the propelling strip.

Now the roof can be put on and the gadget tried out. The dog is pushed back into the kennel until the propelling strip touches the electro-magnet. If all the connections are in order and the "V"-spring is not too strong, the strip will stick there directly it touches. Now give a shout, and the dog should come popping out. If he doesn't, it is probably because the contact strip is bearing too heavily against the stud, and to obviate this try bending it a little.

Until you get the hang of it, you will perhaps find it difficult to make the dog stay in. The operation has to be carried out gingerly, like setting a mouse-trap, because the release is, of course, very delicate. It has to be, to work from voice vibration. Try holding the contact strip in position until you feel the magnet is gripping the propelling strip, and then letting go very carefully. In time you may get poor contact through a film of oxide covering the stud. It can easily be scraped away by pressing the contact strip down and rubbing it to and fro.

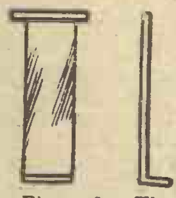


Fig. 128.—The contact strip.

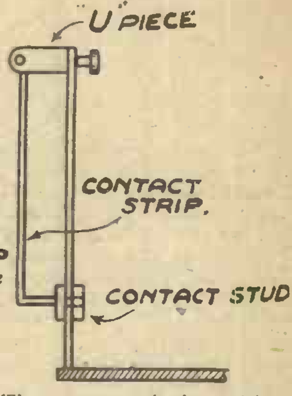


Fig. 129.—The contact strip in position.

Once you get used to him, you will find the little dog a very reliable little fellow, always ready for action. But don't keep him in the kennel for long at a time, otherwise you will run the battery down.

In the concluding article of this series, which will appear in the September issue, the interesting subject of bead making will be discussed, and complete constructional details given for making a xylophone, a diving doll and a fine model electric locomotive.

(*To be continued*)

School of Tank Technology

Officer students being instructed in the effect of projectiles on German tank armour at a school of tank technology. Courses are provided on the engineering side of tank construction and design for officers attached to administrative departments dealing with armoured fighting vehicles, for civilians dealing with such vehicles, and for officers of the Royal Armoured Corps.

Photographing Items of Historical Interest

Useful Hints on the Choice of Subjects in Collecting Information

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

A famous landmark on the Derbyshire Moors—The Toad's Mouth Rock.

ON looking through a friend's collection of photographs recently I came across one of a weird looking tower, or rather the remains of a tower, and when I appealed to him for information with which to satisfy my curiosity I was surprised to learn that he knew very little about its history. He knew that it was the scene of some sort of a "scrap" between two chieftains of a couple of neighbouring clans but who they were and why they fought he did not know.

This friend is a very keen amateur, and certainly goes out of his way to keep very full details of exposures, stops used, value of the light, and other points which may be useful to him for taking similar subjects, or when adding data to his entries for exhibitions and competitions. I was therefore taken aback somewhat when he could not supply interesting data for his friends when they were looking through his albums.

Holiday Subjects

On my holidays, and at other times when I have my camera with me, and happen to come across something historical and therefore of "general" interest, I invariably make a point to gather as much information about it as is possible, even to the extent of enquiring of some of the local people; failing this I endeavour to get something out of a guide book. It is not enough for me to just take a picture, and not to know what I am taking.

This type of subject never fails to create a certain amount of interest amongst friends who, one usually finds, get rather bored when looking at collections of landscapes, beach scenes and the other items so common in most amateur books of "What I have done with my camera." I can therefore recommend it, not only on this score, but also from the point of view of a future lantern lecture to the members of your club, especially if that happens to be a photographic or literary society.

Most of our towns, and a surprisingly large number of our small villages in Great Britain, have something which is treasured on account of its historical value, but it is a true saying "that Londoners know far less of their city than its visitors do," and I have found that this applies equally to those who dwell in other places.

Amateur photographers will soon have ample proof of this when they start using their films on this very absorbing section of camera work. Here is an example of a recent experience. On visiting that charming and interesting Roman city of Chester, I enquired of a policeman where I could find King Charles's tower? "On the walls," was the reply, and then he told me in reply to a second question which way to go but he had to think twice. The tower was eventually found and a note taken of the details mentioned on the plaque; but when I asked two other individuals later on in the day what historical interest was attached to the tower, neither could give me a definite reply.

A church that was buried in the sand for over 300 years, and restored in 1863. Note the crooked spire.

The plan to adopt when on holiday is to gather as much knowledge beforehand of the district and places which you have in mind to visit; such a procedure will save you considerable time, especially if you make a point of going straight to the spot without allowing other interests to attract too much attention.

Assistance of Guides

It is better to visit a cathedral or old castle as early in the day as you can, as you are more likely to get the assistance of a guide, possibly to yourself or to a small group of only three or four persons, and he will be very willing to answer your inquisitive inquiries, because he will recognise the deeper interest and will point out items which might be missed when the party consists of, say, 20 persons. Tell him that you wish to take some photographs and again you will find he can assist you by suggesting best positions and even giving some advice as regards exposure; certainly he can give you some authentic notes which you should quickly scribble in your diary. The exposure for interiors is apt to be puzzling at first, but make a point of recording whatever times you give, as this will help you very considerably on future occasions.

Chepstow is only a small town but it is full of "history," and a dozen shots can give you twelve good records. The castle is well looked after by H.M. Office of Works, and there is a very capable guide who will show you not only the big items, such as the Martens Tower, banqueting hall and the largest walnut tree in England, but also small details and their historical significance.

Some readers may have visited that wonderful old village, West Wickham, the main street of which some enterprising Americans desired to purchase and to re-erect in the States; fortunately the National Trust were able to acquire it and so it still stands intact for us amateurs who are near enough to visit it on a Saturday afternoon.

Off the Beaten Track

IN a small village off the beaten track there is what remains of an ancient well; it is known locally as the Virtuous Well because of the medicinal properties of the water. To-day it is forgotten, but three or four hundred years ago many large pilgrimages were made to it by ailing persons.

In a Cathedral City in the West of England there is a very fine specimen of a Jacobean house, built early in the seventeenth century, and kept in splendid condition by the Corporation; while in an adjoining city one can photograph a most delightful old Posting Inn of the genuine old style, complete with gallery around the courtyard.

In a small town in Cornwall there is an

old-fashioned inn which, in the years that have passed, was much frequented by artists, and on the walls can be seen some of the work of their hands. Many of these pictures were left in lieu of payment for board and lodging, or for refreshment "put on the slate."

There is a famous manor house which was built in 1567 and occupied up to a few weeks ago when a bomb from an enemy 'plane finished every window, and made it too draughty to live in until these can be repaired. This house wants finding as it stands at least five miles from any town.

Old bridges and gateways are to be found in many districts and will quite frequently help the amateur photographer to get not only an historical record, but something of a distinctly pictorial character.

Old abbey ruins, mills, cottages, tombs with effigies, forts, ancient monuments, monolithic stones, caves and similar objects abound everywhere so that the camerist has not to go far to find the necessary material for a really good collection of items which will prove full of interest to all.

Useful Hints

THERE are two pieces of advice which I would most strongly urge readers to follow when starting this class of work. Firstly, if you are only staying a short time in the district which you are exploring you will find it profitable to take a developing tank and some Johnson's Fine Grain or Superfine Grain Developer with you, and develop each spool as soon as you can for the purpose of testing the working of your camera and also your exposure calculations; this I consider is important because where you have a variety of subjects, such as this class of work offers, it is practically impossible to standardise exposure unless you have a very reliable exposure meter; and, if you have made a mistake you may have the opportunity of revisiting the spot.

Secondly, keep that notebook up to date; do not rely on your memory, it can play tricks, especially with dates and names, and even if you leave the entry till the evening you might make a mistake of a 100 years when entering the record.

There is much to be gained by adopting this type of subject as a branch of your hobby; you will learn a lot about interiors and "close-ups" and the value of good, bad and indifferent lighting; all of which will help you in your general work and in any particular subject in which you may be specialising. Further, you will also be adding extra interest to your holiday seeing that you will have more information about the places visited to impart to your friends.

Aero-engine Carburation

The Construction and Operation of Carburettors

By T. E. G. BOWDEN

THE function of the carburettor is to provide the engine with an explosive mixture of air and petrol which is passed to the appropriate cylinders via the induction pipes. Owing to the large number of cylinders that occur in modern high-powered aero-engines (anything up to 24), the carburettor has to operate under extremely arduous conditions and requires precision engineering so that it may fulfil the requirements. Amongst the many problems encountered at the present time are the difficulties brought about by violent acceleration, inverted flight, ice formation and high altitude flying.

The fuel-air mixture varies for different conditions of flight and have to be catered for in the design of a carburettor. A list of varying mixtures is as follows:

1. Slow running (rich mixture).
2. Cruising (weak mixture).
3. Take-off and maximum output (extremely rich mixture).
4. Climbing and high output (rich mixture).

Fuel-air Mixtures

For the first case and also when starting the engine, a rich mixture is definitely required. To obtain a suitable mixture for starting it is usual to install a priming pump in the petrol system by means of which petrol is forced into the induction pipes, the carburettor being assisted (see Petrol Systems for Aircraft—December, 1942, "Practical Mechanics").

For economy reasons aero-engines should run at certain definite revolutions and at the same time use the weakest mixture of fuel-air that is possible. The ratio between the fuel and air for cruising conditions is usually greater than 1 : 15. It has been found that engines will function efficiently utilising extremely weak mixtures by advancing the ignition timing.

A very rich mixture is required for the actual period of taking-off, i.e., the period in which the aircraft starts from rest until it becomes airborne. Detonation is reduced by supplying a high quantity of petrol which cools the cylinder walls. Maximum output is usually limited to a definite period of time and must not be exceeded, otherwise the engine will suffer damage. An extremely rich mixture is used, similar to that used for take-off purposes.

For climbing and high power (not maximum) a fairly rich mixture is used, being an average between cruising and take-off requirements.

Construction

A simple carburettor is illustrated in Fig. 1. The main details are illustrated

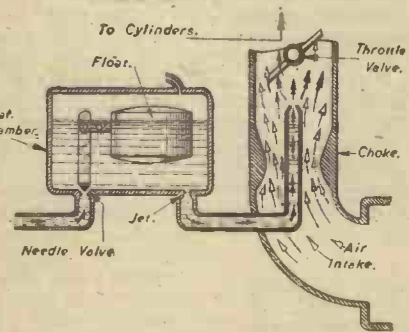


Fig. 1.—Sectional view of a simple carburettor.

diagrammatically. The first essential is the float chamber which regulates the supply of petrol. In the float chamber a float constructed of cork or metal is pivoted as shown and connected to a needle valve. The fuel enters at the inlet shown and passes to the jet. The function of the float is to ensure that a constant level of petrol is maintained, otherwise the engine may be starved or flooded. As the level of the liquid rises so does the float, and by doing so closes the needle valve, preventing the entry of any petrol. When the level drops the valve opens and allows a further supply to enter.

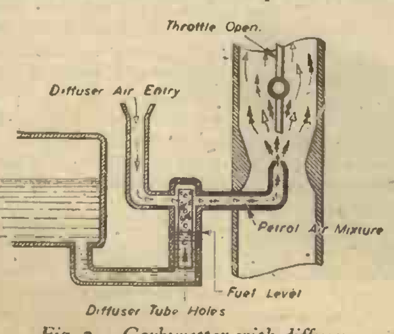


Fig. 2.—Carburettor with diffuser.

The diameter of the jet tube decides the amount of petrol capable of being passed to the engine, and as the liquid level in the tube and float chamber is the same, it is usually made to finish at a slightly higher level to prevent overflowing.

The choke tube acts in a similar manner to a venturi, i.e., due to the air flowing from the air-intake through the reduced area, a reduction in pressure is caused owing to the increase in velocity at this point. In consequence, as shown, petrol is sucked out of the jet tube and mixes with the air, forming a combustible mixture which then passes to the appropriate cylinders.

To control the amount of fuel-air mixture being supplied to the engine a throttle valve is fitted. This usually takes the form of a butterfly valve connected by means of rods and levers to the throttle control in the pilot's cockpit. By varying the position of the valve the passage-way is restricted or increased according to whether less or more power is required.

Carburettors may be either of the up or down draught types. The up-draught design is illustrated in Fig. 1, and for the other type the air enters from above the engine and passes down to the carburettor. Both are used in present-day power units, the down-draught method reduces the possibility of sand or earth being sucked into the induction system as the air-inlet is usually situated on top of the engine, away from the ground.

Diffuser

A development of the simple carburettor is the fitting of a diffuser jet. As shown in Fig. 2, the petrol is emulsified before passing out of the jet to the choke portion of the air inlet. The air is drawn from the small diameter pipe due to the reduction in pressure in the choke, and mixes with the petrol so that the mixture is atomised completely by the time it enters the induction system. The restriction at the base of the diffuser jet controls the amount of petrol passing from the float chamber.

In order to cope with varying engine revolutions and reductions in pressure, the diffuser in actual practice is arranged so that the greater the suction, the greater the amount of air allowed to enter via the small diameter inlet. This prevents the mixture from being too rich at high speeds as is the case in normal simple carburettors.

Accelerator

If the throttle is suddenly opened to obtain greater power, there is a lag between the actual operation and the required result. This is because the air passing through the intake is increased in volume, but the fuel supply is not increased at the same time due to inertia. In consequence, a weak mixture is supplied momentarily, and this period is termed a "flat spot." The power output drops just at the moment when an increase is required.

To overcome this difficulty an accelerator-pump is incorporated in all modern carburettors fitted to high-powered aero-engines. The supply of fuel is temporarily increased in order that the "flat spot" may be eliminated. The pump usually consists of a plunger fitted in a cylinder. As the throttle lever is moved, so the piston forces petrol into the jet.

An additional refinement is the fitting of a "delayed-action pump" as well as the "accelerater pump." The function of this additional pump is to continue the supply of petrol after the throttle has been moved and the accelerator pump has ceased to force any further fuel into the choke. The pump is so designed that a supply lasting approximately three seconds is obtained, thus increasing the engine's output during the period of time between the moving of the throttle lever by the pilot and the required supply of fuel being available through the normal way.

Slow-running Jet

With the throttle lever in the fully closed position it is usual to allow the engine to receive a sufficient amount of fuel so that it is just turning over at a low rate of revolutions.

The method by which the supply of petrol-air mixture is supplied is as follows. A special tube is fitted which connects the normal supply system to a point on the casing opposite to the butterfly valve. This valve is positioned so that a slight reduction in pressure is obtained adjacent to the slow-running feed pipe, and consequently fuel is drawn out and through a hole drilled in the butterfly valve, then passing to the induction system.

A second hole is drilled in the casing which picks up with the first slow-running feed pipe, and when the throttle is slightly opened the butterfly valve alters in position, allowing a further quantity of fuel to be delivered. The normal delivery jet will also come into operation at this setting, together with the diffuser. In the case of a simple carburettor, no additional slow-running jets are fitted, the fuel being drawn out of the main jet by the venturi effect caused by the butterfly valve being kept slightly open.

Slow-running Cut-out

Due to the fact that the pilot's throttle lever is already in the fully closed position, it is plain that there must be some other means of stopping the engine. The obvious solution is to switch off the ignition system, but this is not effective in certain types of engines. Even with no sparks being supplied in the cylinders, the mixture may easily be fired by the incandescent carbon deposits on the cylinder heads, etc. Irregular firing is the result, with a possibility of damage or strain to the engine.

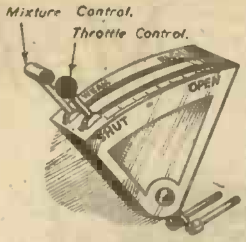


Fig. 3.—Throttle and mixture control.

The device commonly used is the incorporation of a small rod, which, when the cut-out lever is operated by the pilot, closes the slow-running feed duct thus cutting off the supply of fuel. As no combustible mixture is being supplied to the cylinders, the engine will naturally cease to function.

Power Jet

An additional supply of fuel is required for full throttle conditions as the diffuser tends to maintain the air-petrol mixture at a constant proportion. When the throttle lever is opened fully a valve known as the "power jet valve" is opened. This valve is fitted adjacent to the normal supply tube and is connected direct to the float chamber, so that when it is opened an additional supply of fuel is allowed to enter the induction system owing to the fact that there are now two sources of supply.

For taking-off purposes when an extremely rich mixture is required, in many carburettors an additional jet is fitted which comes into operation only when maximum take-off power is required.

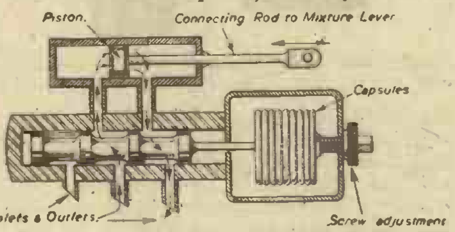


Fig. 4.—Automatic mixture control.

Pressure Balance

To ensure that the air pressure is the same in the float chamber and the air-intake, a pipe connecting them both together is always incorporated. This balancing of pressure is essential in order to maintain a steady supply of fuel. Due to the slipstream from the propeller it is possible for the pressure in the air-intake to be lower than that in the float chamber. By fitting a balance pipe the pressure is kept equal in both components and a normal mixture strength delivered.

Mixture Control

Owing to the fact that the air density gradually falls as height is gained, the petrol-air mixture supplied to the cylinders varies according to the altitude at which the aircraft is being flown. The reason for this is that the same amount of petrol is sucked out of the jet at all heights (at a constant forward velocity) and at the same time the weight of air passing through the carburettor is reduced. Consequently the ratio of petrol to air will vary accordingly.

To overcome this difficulty a mixture control is usually incorporated in all modern carburettors by means of which the mixture is prevented from becoming too rich. By connecting the diffuser to the pressure balance tube and fitting a valve, the pressure around the actual diffuser may be increased as the air in the balance pipe is at a higher pressure. When the valve is opened and the pressure increased, the amount of petrol passed out of the jet will be reduced, thus weakening the mixture. The valve may be connected, via the usual type of linkage, to a lever adjacent to the throttle control on the pilot's cockpit. As shown in Fig. 3, the control housing is usually engraved with the words *weak* and *rich*.

An alternative method of hand control is the incorporating of a valve in the carburettor between the jet and the float chamber. By varying the opening the amount of fuel passing through may be cut down or increased, according to the altitude being flown at. This valve is operated as previously, i.e., by a lever in the pilot's cockpit.

Automatic Control

A development of the hand-operated type of control which must be constantly altered by the pilot, is the automatic mixture control. The responsibility of providing the correct mixture is taken away from the pilot, thus relieving him of one of his many duties. A mixture control, similar to the type first described, is fitted, but is operated by means of a rod connected to a piston, which in turn is moved by means of oil pressure admitted to one side or the other of the piston. A chamber in which sealed metal capsules are fitted, controls the operating mechanism. As in a barometer, the capsules expand or contract according to the air pressure and this movement uncovers certain holes thus allowing the oil to flow to the piston and alter the setting of the mixture-control valve (see Fig. 4).

In order to provide the pilot with a means of obtaining either a rich mixture or a weak mixture, the automatic control is linked to a mixture lever. When this control is moved an alternative set of oil entrance holes are utilised, thus causing the mixture to be varied. Oil from the lubrication system is used, as in the case of automatic boost controls.

Aerobatics

Aircraft carburettors have to function correctly during the usual manœuvres that aerobatic aircraft perform. Special precautions have to be taken so that supply of fuel will not be interrupted. In the case of loops, the action of centrifugal force will maintain the fuel supply, but if a stalled loop is made the engine may cut out due to the alteration in level of the petrol in the float chamber.

For prolonged inverted flying special tanks have been fitted which give a gravity supply of petrol during inverted flight. The pilot has to switch on the fuel cock for the tank which is so situated that it is above the float chamber when the aircraft is in the inverted position. Other devices incorporating specially designed float chambers and valves have been developed. Air vents have to be watched, otherwise petrol will spill out if cocks or non-return valves are not fitted.

Blueprints by Airgraph

By permission of the G.P.O., blueprints are now being sent by airgraph in two ways to Dunlop factories in India, South Africa and Canada. The drawings may be made on the airgraph form itself, 8½in. by 10¾in., reduced to a tiny film, smaller than a postage stamp, for transport by aeroplane and then enlarged on arrival to half their original size.

Alternatively the original machinery drawing is reduced by the Fort Dunlop photographer, Mr. Francis Hart, to airgraph letter size, sent off by airgraph and brought up to normal size on receipt. The latter process is an application of Mr. Hart's idea for the civilian pigeon post from Fort Dunlop which was adopted by the Services.

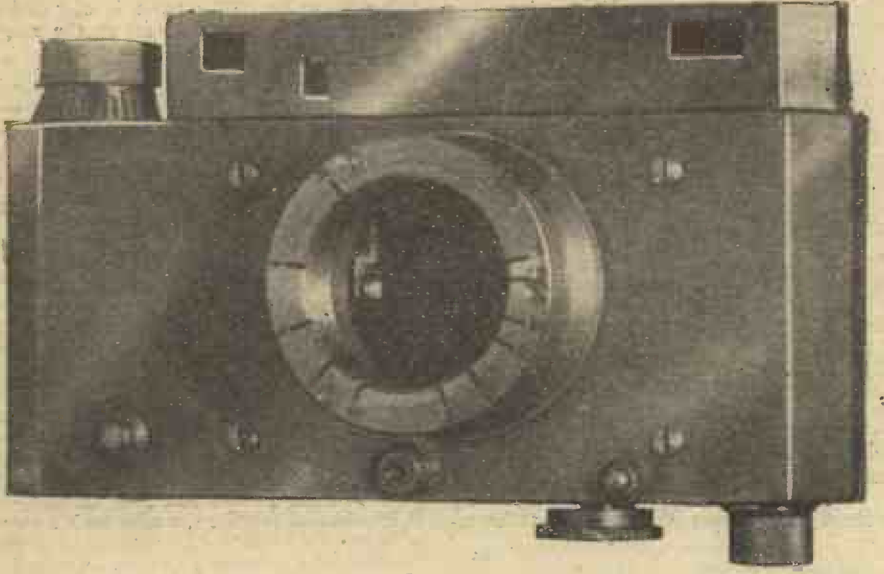
They go in about one-third of the time taken by boat and the risk of loss is almost negligible.

Making a Min

Constructional Details of a H

By F. A. C

TO attempt the construction of a miniature camera might seem highly ambitious, but with a knowledge of what is required, and a fair amount of skill, the job can be tackled successfully. The design of this particular camera arose because of a number of reasons. The owner of a



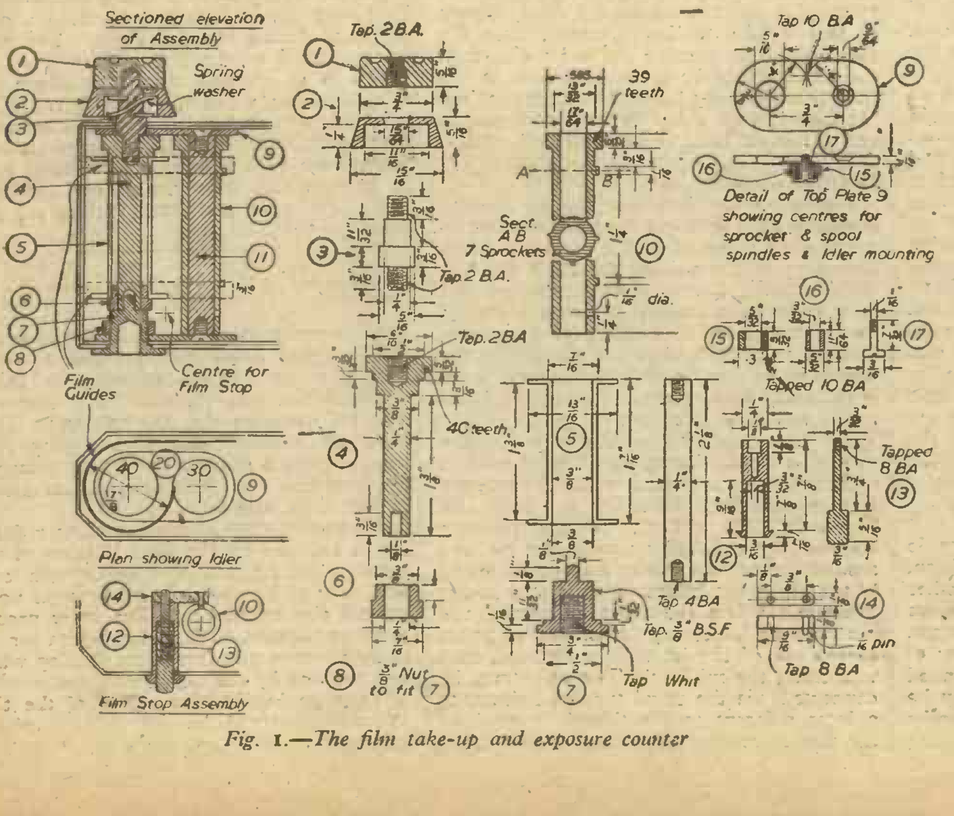
Front view of the finished camera. The range-finder roller is visible through the lens opening.

"Foth Derby" camera, which has a 5cm. lens and uses V.P. film giving 16 exposures on one loading, wanted to cut off 6 exposures from the film before the rest had been used. The successful achievement of this and the consequent resticking of the film to the paper packing in the dark, demands considerable manual dexterity. Ciné film in a cassette is much more suitable, also the larger capacity of one loading is an advantage. It was not possible to convert the existing camera—the case is too small—so a new case was designed. Then arose the problem of counting the exposures and fitting a coupled range finder. The accompanying drawings and text indicate how these jobs were done, and though in this particular instance the camera is built round the lens, shutter and view finder of a "Foth Derby," the principles involved can be applied to any short focus lens, and any form of shutter, focal plane or between lens. With this in view, not only are the constructional details given, but the principles involved are dealt with.

General Description : The Camera, Lens, and Film Mounting

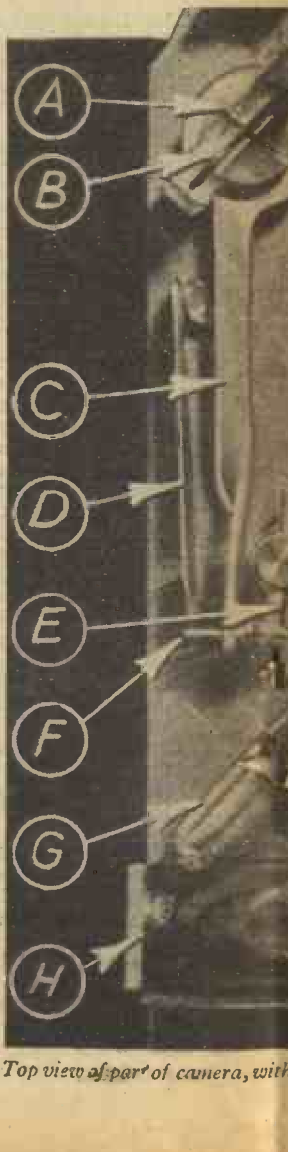
The cassette is mounted between the pivot (21) and the rewind knob assembly (18, 19, 20) (Figs. 2 and 3). The film passes behind the shutter, under the sprockets (10) and on to the film spool (5), as shown in Figs. 1 and 2. The film is kept flat against the shutter opening by a piece of black velvet glued into the back of the case. The two guides (18) round the film spool prevent the film from springing and relocking in the sprockets. The film spool (5) is free on the take-up spindle (4), being held in position by the spool push (6) which is a push fit on the spindle. It is necessary for the spool to be free, because the constant length of one exposure, covering seven perforations on the film, is being wound on to a spool, the diameter of which is increasing as more film is taken up. The film is drawn out of the cassette by the sprockets, and the spool is merely a take-up. This means that while the knob, counter and spindle are moving a constant distance, almost one revolution, the spool is moving a gradually decreasing fraction of one revolution.

One exposure fits the circumference of the sprocket, and the film stop assembly (12, 13, 14) uses this fact to ensure that not more than one exposure is wound on at a time. The film stop also acts as a brake on the spring of the wound film, which tends to unwind from the spool. The film cannot be wound on until the pin (13) is pressed. This disengages the pinion on the link (14) from a hole in the sprocket, which permits the knob to be turned. Immediately the knob begins to turn the finger is taken off the pin, and upon completing one revolution the spring



1. *Winder knob.*
2. *Exposure indicator.* (*40 divs.*)
3. *Knob spindle.*
4. *Take-up spindle, 40 teeth.*
5. *Take-up spool.*
6. *Spool bush.*
7. *Pivot and tripod bush.*
8. *3/8 B.S.F. nut.*
9. *Top and bottom plates.*
10. *Film sprocket, 7 sprockets, 39 teeth.*
11. *Sprocket spindle.*
12. *Film stop barrel.*
13. *Film stop pin.*
14. *Film stop link.*
15. *Idler, 20 teeth.*
16. *Idler bush.*
17. *Idler fixing screw.*
18. *Film guides.*

Fig. 1.—The film take-up and exposure counter



Top view of part of camera, with

niature Camera

ligh-class Pocket Camera

COSSOM

inside the barrel returns the pins into the hole and locks the sprocket. When rewinding the film into the cassette, the pin is disengaged until all the film has left the spool.

The sprocket is driven from the winder knob spindle by means of an idler (15). This is necessary, because each spindle must revolve in the same direction.

The counting of the exposures is done by these gears. The size of exposure in this particular camera permits of 40 being made from one standard loading. The exposure indicator (2) is graduated into 40 divisions, and numbered in 10's. There is a corresponding number of teeth cut in the top of the take-up spindle (4). The top of the sprocket (10) is turned to 39/40's of the diameter of the take-up spindle, .585in., and has 39 teeth. These two are linked by an idler having 20 teeth. Because of this, for every complete revolution of the sprocket (one exposure) the exposure indicator, revolving with the knob and take-up spindle, does 39/40's of a revolution, leaving one division each time, and so indicating the number of exposures made. The graduated exposure indicator is free on the knob spindle (3), being held in position by a flat spring washer which rests on the shoulder of the spindle. This is to enable the indicator to be reset at zero on reloading.

...ange-finder case removed.

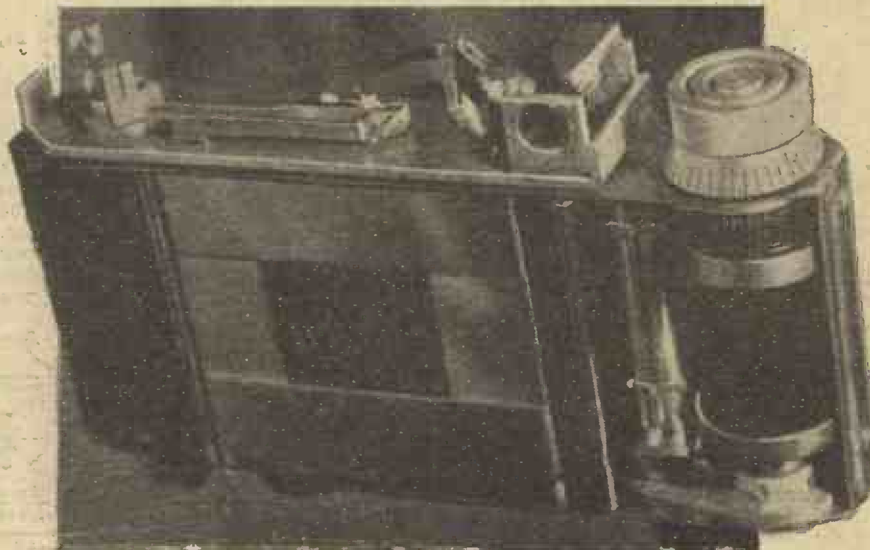
The lens is mounted so that the front face of the lens ring is the focal length of the lens, in this case 5cm. from the film plane of the shutter. The view finder is mounted on the base plate (30) inside the range finder cover, as shown in Fig. 4. The holes in the case, marked A and B (Fig. 2), are for the shutter release button and the catch release respectively.

The View and Range Finders

These are mounted on the base plate 30, and covered by a casing that is independent of the main case. The view finder of the original "Foth Derby" was mounted as near to the centre of the lens as possible, whilst leaving room for the largest convenient base for the range finder. Actually a base of 50mm. was chosen, because this was a convenient figure for working out the angles of movement for the mirrors and also because the view finder was still not much farther away from the lens centre than if it had been centrally above. There is no need to stick to metric measurements for the range finder, but they were used in this case for convenience of calculations, and also because the "Foth Derby" is a Continental job, all the measurements in the re-made camera were metric and have been converted for this article.

The ranging is done by correlating two images and linking this correlation with the forward movement of the lens. In any method of correlating two images by reflection there can be no depth of focus, i.e., the ranging is extremely critical and is concerned with planes having no depth of thickness. For example: When a lens is focused to determine distance, according to the aperture used in the lens so there is either a relatively small depth of focus with a large aperture and a large depth with a small aperture. Consequently, for camera ranging over small distances, generally from round about 3ft. to 6oft., the focusing lens system on this scale requires extreme precision and is far more difficult to apply than the system of correlated images.

A reflected image is in focus for all depth to the same degree as the eyes, because there is no interposed lens, and the eyes do all the focusing, or, in other words, the selection of the object to be looked at. The simple experiment of holding up two pencils, one an inch or so behind the other, but slightly to the right, and looking at the front pencil with one eye closed, will demonstrate the extreme accuracy of the focusing mechanism of the eye: the rear pencil will not be in focus.



Three-quarter view, showing general assembly from the rear.

Accurate Focusing

The reflection of an image at 42in., as shown in Fig. 7, shows how this extreme accuracy of focusing is utilised in the reflected image ranging. Though there is an infinite number of light rays from the object along the direct line of sight and along the reflection, the lines on the diagram from that object represent the light ray from one single spot. And in practice it is this single line that is used for ranging.

There are three general systems of correlating two images. One, the superimposition of one upon the other. This system is outside the scope of the amateur mechanic, and will not be dealt with. Two, the dissolving of one into the other by having clear vertical areas on the fixed image through which the direct sight is taken, and by superimposing

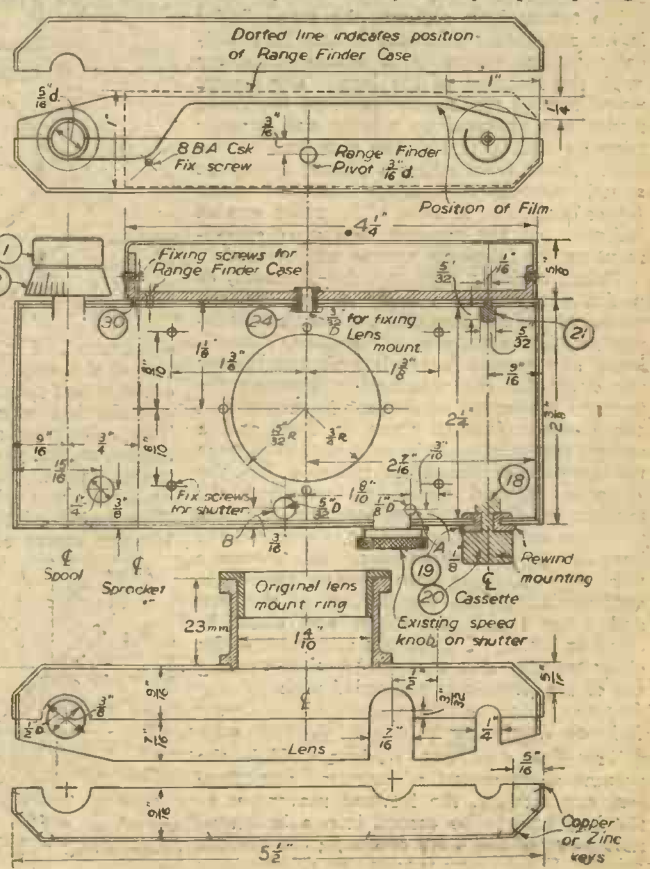


Fig. 2.—Details of camera case.

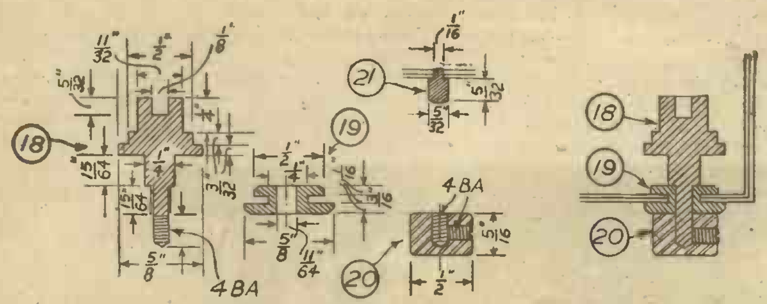


Fig. 3.—Details of cassette mounting: 18, spindle; 19, collar; 20, knob; 21, pivot.

the reflected image on it. In practice this works out to be a vertically divided image and has drawbacks, in that since the moving mirror moves in a horizontal plane, the vertical lines which actually differentiate distance remain undivided, and the combined real and reflected images become a pictorial approximation rather than a precise optical composition.

The third system, that of a horizontally divided image, is the one used in this instance. As previously stated, when the mirror turns in a horizontal plane, the vertical lines differentiate distances, and this principle is applied in the following manner. By looking through the peep hole the bottom half of the real image is seen by looking under the fixed mirror, while the top half is reflected from the mirrors. A range finder of this type is extremely critical in registering distance, and the following test will demonstrate this. Point the finder to one stile of a door from an angle of about 45 deg., and turn the mirror until the vertical line of one edge coincides both in the real and reflected images. Then, without altering the setting, look at the other edge of the same stile, and it will be seen that these two lines do not agree. This means that though the difference in distance between the two edges is only about 2in., it is registered by the range finder.

No matter how accurate the range finder is for registering distance, it can be practically useless unless it is linked accurately with the focusing of the lens. The author noted that in commercial cameras the range finder was operated by a lever and a roller running on the rim of the rear unit of the lens. Apart from taking a camera apart, the actual method of linking lens and range finder could not be seen. The roller was an indicator of the method, and after experimenting the following system was evolved.

Before deciding anything, the possibility of a direct relationship between the forward movement of the lens and the turning movement of the mirror was investigated. Accordingly two graphs were drawn; one giving the curve for the relationship between the forward movement of the lens in inches and the distance focused upon in feet, and a second curve showing the relationship between the distance of the object reflected (i.e., the distance focused upon in feet) and the tangent of the angle enclosed by the line from the object to the moving mirror and the base line of the range finder. The inference was that if these two curves agreed in characteristics then the linking of the lens and range finder was direct and could be done by levers. The results showed that the characteristics did agree, and the working out of the levers was proceeded with.

Mirror Angles

The first fact was obvious. With the present arrangement of mirrors, one fixed and one moving, the forward movement of the lens had to be turned into a backward movement of the lever operating the moving mirror. Fig. 6 shows the position of the mirror when ranging on infinity—the assumption being that the base (the distance between the mirrors) was short enough for the lines of sight to be parallel, and to correlate the two images both mirrors were set at 45 deg. Next the angle through which the mirror must be turned to correlate the images when focused upon the nearest distance, 3½ft., was determined. Fig. 7 illustrates the determination of this angle. The angle of movement is equal to half the difference between the angles of reflection when set at infinity and 3½ft. The calculation shows how the angle was arrived at, and gave an angle of movement of 1 deg. 42min. Next the length of movement on lever 4 was calculated as shown in Fig. 8. The length of the lever was made 50mm. between centre of pivot and point of application of the movement. Because of the shortness of this movement it was assumed for convenience of calculation that it was at right angles to the base, though, of course, it is part of a circle. The result was that x, the distance of rearward movement necessary, was 1.48mm. Finally, the relationship between the forward movement of the lens and the backward movement of lever 4 was considered. This determined the relationship of the operating levers. Careful measurement showed that the lens movement was 2.8mm. This was extremely fortunate, because it gave a ratio of 2 : 1, which meant that the lever lengths must have that same ratio. Fig. 9 shows the layout of the levers to obtain the backward movement of 1.4mm. Levers C and D are the reduction levers, levers A B being the operator from the tube on the lens cell.

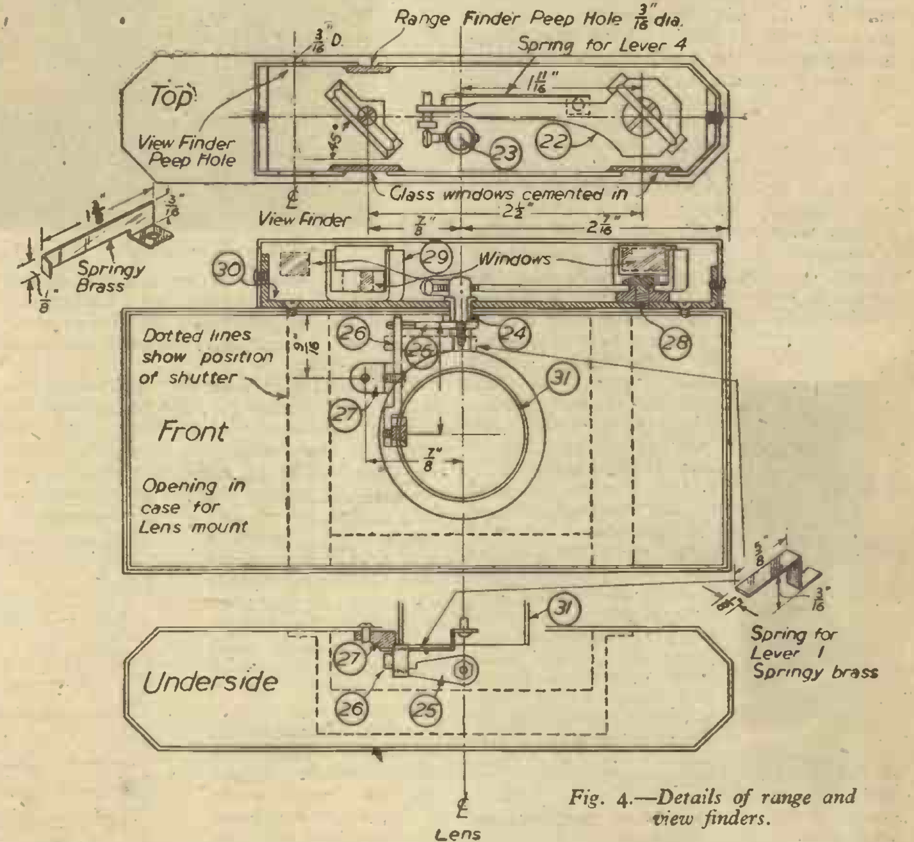


Fig. 4.—Details of range and view finders.

Because of the impossibility of making this assembly dead accurate, two adjusting screws are incorporated: the screw 23 (Nos. 4 and 5) which is lever 3, and the screw on lever 4 (22). The method of setting is as follows. The lens is set to infinity, and the screw on lever 4 is turned until the split images agree. Note that the screw driver slot is at the end and not on the head of the screw. Then the lens is set to 3½ft., and if the images do not then agree the screw (23) is adjusted until they do. It will probably be necessary to repeat this operation until the correct combination is found.

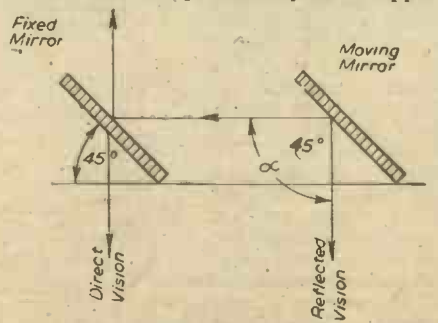


Fig. 6.—Mirrors reflecting an object at infinity.

Construction and Assembly: The Case.

The best method for making the case is to use gilding metal and hard solder all the joints. Unfortunately only brass was obtainable and, because of the distortion arising when the brass is heated for hard soldering, the joints were soft soldered. The relatively weak construction by this method was improved by soldering in "feathers" or "keys" in the joints where necessary and by using the following procedure. This

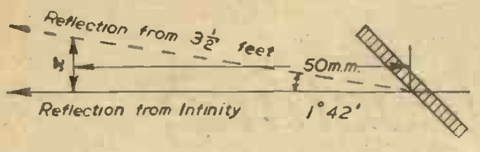


Fig. 8.—How to determine the length of movement on lever 4 :

$$\frac{x}{50} = \tan 1^\circ 42'$$

$$\frac{x}{50} = .0297$$

$$x = 1.48mm.$$

method may be unorthodox, but three cases have been made in this manner, all giving excellent strength and accuracy of fit.

For the front and back of the case prepare two strips of 22 S.W.G. brass $6\frac{3}{4}$in. x $2\frac{1}{2}$in. Working from the centre line on each piece, set out the folding lines. Score about half-way through the thickness on these lines and fold to shape. A template of the inside size and shape facilitates this operation. For the top and bottom prepare two strips of the same material 5 7/16in. x $1\frac{1}{4}$in. Mark out and cut the corners to 45 deg. as indicated on Fig 2. Then prepare a block of hardwood $4\frac{3}{4}$in. x 2 5-16in. x $1\frac{1}{4}$in. The accuracy of the case depends upon this block, so make sure that the edges are square to the face. Place the back and front of the case on each side of the block and lightly wire together with two binding wires. Tap the top and bottom into position, making sure that they are tight against the block and that the back and front project an even amount both top and bottom. There will be a gap of 1/16in. at the ends, between the back and front pieces. Soft solder the joints, ignoring the gap at the ends. Clean off the top and bottom overlap with a file and very lightly chamfer the edges. With a piercing saw cut the slots for the keys where indicated on the drawing. Make these cuts about 3/32in. deep and note which way they slope. They are practically useless if sloped the wrong way. For the keys use copper or zinc of a thickness that will push into the slot, and solder in position. These metals will give the necessary strengthening to the joint and have the advantage that the bit of the triangle that juts into the case can be removed with a "wood" chisel when the case is sawn through. After soldering, file these keys down flush with the surface.

Whilst the case is still round the block do all the marking out. Scribe a line 9/16in. from both the back and the front for the depth of these two sections. On the front mark the centres for the lens hole, shutter mounting screws, film stop, cable release and button release. These last two are marked B and A respectively in Fig. 2. On the top mark a centre on each scribed line for the winder knob and cassette pivot, squaring these lines round the case for the centres for the tripod bush and rewind knob on the bottom. Also square the centre line of the lens across the top. This is the line from which the range finder assembly is set out. Now that the marking out is done, with a fine hack-saw, saw down between the scribed lines in the top and bottom and remove from the block. Don't saw unnecessarily deep into the block because it will be required again. File down to the lines and finish on a sheet of emery cloth laid on a flat surface, ensuring that the point is a fit. It is useful to have a second block of wood, this time $4\frac{3}{4}$in. x 2 5/16in. x $\frac{1}{2}$in., which can be slipped into each half of the case so that they can be held safely and securely in the vice.

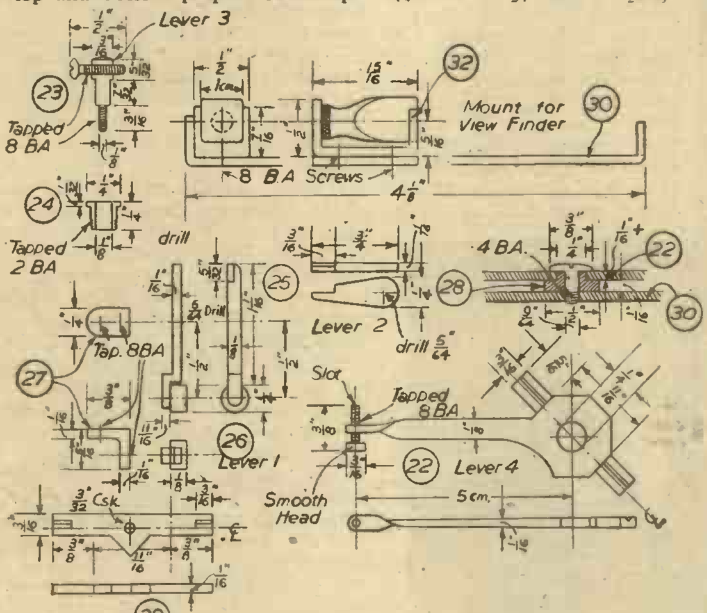


Fig. 5.—Fittings for range and view finders.

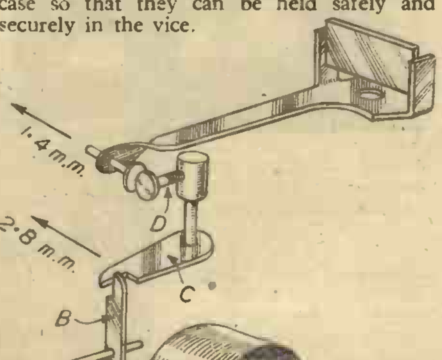


Fig. 9.—Correlation of lens and lever movements. The lever reduction of the forward movement of the lens, 2.8mm., to the backward movement of the mirror lever: 1.4mm.

Inside Lining

Before fitting the inside lining of the front the hole in the outer case for the tripod bush must be bored. The tripod bush is also the fixing for the film take up and counter assembly, and because of this the nut inside tightens the bush into the lining and not the case, so that the back can be removed for loading. To do this the bush is shouldered and the hole in the case is $\frac{1}{8}$in. larger than the hole in the lining. To bore the $\frac{1}{2}$in. hole for the bush, plane down and chamfer the end of the block, so that it will fit into the case, and reassemble the back and front on the block.

Having bored this hole only, proceed with the lining. Prepare two strips of 26 S.W.G. brass 5 7/16in. x 15/16in., mark out and cut to shape as on the drawing. Also two pieces for the ends, $2\frac{1}{4}$in. x 7/16in. Solder into position and clean up so that the back is a gentle push fit.

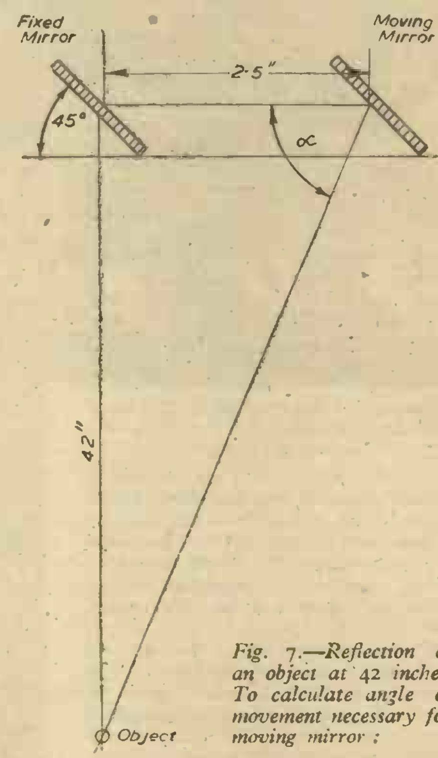


Fig. 7.—Reflection of an object at 42 inches. To calculate angle of movement necessary for moving mirror :

$$\text{Angle of movement} = \frac{90^\circ - a}{2}$$

Distance between mirrors = 2.5"

Distance from object = 42"

$$\frac{42}{2.5} = \tan a$$

$$16.8 = \tan a = \tan 86^\circ 36'$$

$$\frac{90^\circ - 86^\circ 36'}{2} = 1^\circ 42' = \textit{Angle of movement}$$

Making the Slots

Reduce the width of the wooden block so that it is again a push fit into the front of the case and reassemble. Bore the remaining holes, for the winder knob, cassette pivot, rewind knob and shutter speed knob on the centres all ready marked, but remark the centre for the tripod bush from the original centre line and bore a hole of the smaller diameter. Remove the front from the back and the block and pierce out the slots in the lining where necessary for the entry of the knobs, etc., and finish with a smooth file. Replace the front on the block and bore the holes on the front face. If the hole for the lens is not bored out use a piercing saw and finish with a smooth half-round file.

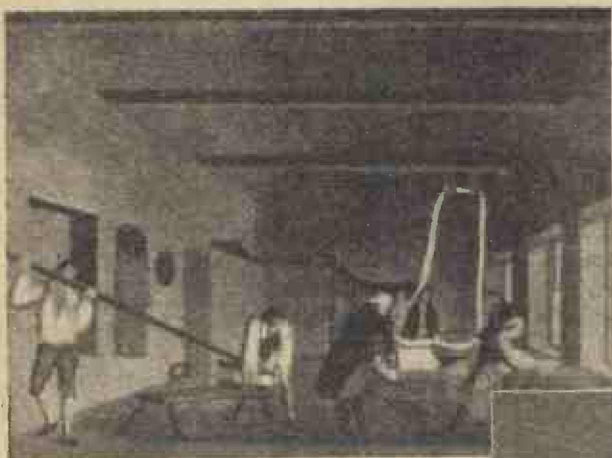
(To be continued.)

The Story of Chemical Discovery

The Science of Bleaching

Chemistry's Aid to an Indispensable Industry

BLEACHING must surely constitute one of the oldest arts of mankind. Even before bleaching became a recognised process, the whitening effects of the sun's rays on the bones of dead animals and on various other natural objects must have been universally recognised in sunny climes. And because animal bones slowly whitened on continual exposure to the sunshine, it was clearly only an imitatory act on the part of early man to put out clothes, garments and other fabrics in the strong sunshine so that they, too, would gradually whiten in precisely the same way as the animal bones.



An eighteenth century method of pressing and finishing of bleached fabric. (From a contemporary print.)

So, in the remote ages, the art of bleaching must have originated. For thousands of years it remained purely an art before it ultimately became an industrial science in consequence of the discovery of certain chemical principles which underlie the bleaching action.

Cloth dressers and bleachers were known as "fullers" in ancient times. References are found in the Bible (II Kings, xviii, 17) to the "fuller's field," in which fabrics were laid to whiten in the sun, and from the tone of the biblical narrative it would seem that, even at that early date, the art of the fuller or bleacher was even then an ancient one.

Manchester Bleachers

In England, organised bleaching appears to have originated around Manchester probably in the thirteenth century. There was certainly a bleaching mill on the banks of the Irk, a Manchester river, in 1525, which was owned by one Lord de la Warre, a Lord of the Manor of Manchester. There was another large bleach field at Southwark, to the south of London, in 1677, and, later on, there were bleach fields in Scotland.

The "whitsters" or the "crofters," as the English bleachers came to be called, did a fairly steady trade, despite the appalling slowness of their methods. In the seventeenth century the Dutch (and, to a lesser extent, the Belgians) enjoyed a world reputation for their skill at bleaching. To Holland the finest fabrics were invariably sent when they required whitening, and although, at a later date, the Irish were successful in setting up an opposing industry, using practically the same methods as the Dutch, the latter nation maintained its reputed supremacy in the bleaching art.

Bit by bit the bleaching industry extended itself in Britain. Many areas, particularly in Lancashire, practised the art. Bleachers' "crofts" became everywhere known. The stealing of cloth from them was made a capital offence in our country, and the whole practice of bleaching became very strictly regulated by law.

The early methods of bleaching in England comprised two very simple processes, viz., "bucking" and "crofting." "Bucking" consisted in boiling the fabric in a lye made from the ashes of certain plants which were rich in alkali carbonates, whilst "crofting" consisted merely of spreading the cloth on the "crofts," these latter comprising small, enclosed grass fields, the cloth, in this manner, being adequately exposed to the action of the sun's rays.

Charles Tennant, the pioneer of chlorine bleaching in Britain.

Bleaching in those days was an affair of repeated "buckings" and "croftings." Frequently this combined process was repeated from ten to sixteen times, the strength of the bucking lye gradually being increased up to the middle bucking, and then decreased with successive buckings.

Buttermilk Bleaching

Sometimes (at later dates) the cloth, after bucking, was steeped in sour milk for a week, and afterwards put out on the bleaching crofts. Buttermilk came to be used for this purpose and, afterwards, vitriol (sulphuric acid), although there was considerable opposition to the use of the latter substance.

The bleachers in England noticed that if lime were added to the bucking lyes, the latter became caustic, and were consequently more effective as scouring agents. Here, however, Parliament stepped in and made it a criminal offence for bleachers to use lime in any of their processes, in view of its supposed injurious effect upon the fabrics. In Ireland, the use of lime in bleaching was actually made the subject of the death penalty.

It was, indeed, only in the early part of the nineteenth century that the embargo upon lime as a bleaching agent was removed in Britain. Even as late as 1815 a bleacher named Barklie was prosecuted for a transgression of the strict English law prohibiting the employment of lime in bleaching processes.

Chemically considered, the mechanism of all the early bleaching processes was very straightforward. The process of mild alkali boiling or "bucking" merely served to extract some of the more soluble portions of the colouring matter from the fabric. Subsequent "crofting," or exposure on the grass to the sun for several weeks at a time, gave the necessary opportunity for the less extractable colouring matters to become oxidised away to colourless and more soluble products, which were removed from the cloth during the next "bucking" operation or during its final washing. The whitening action, in all such instances, was clearly a photo-chemical one, the oxidising effect of air, moisture, together with traces of ozone and hydrogen peroxide which the fabric

"Kiers," or chemical vats, in a modern bleaching works.

encountered as it lay on the bleaching croft being greatly accentuated by the powerful ultra-violet rays inherent in the sunlight.

Little as the early bleachers understood the real significance of the process which they worked, they made continuous attempts to speed it up, for, as time went on and as the great cotton industry of Lancashire developed itself, the period of several months which was required for the adequate bleaching of fabrics became intolerably long.

We have already seen that the English law had set itself resolutely against the chemical advancement of the bleaching process. The efficiency of lime in the bleaching of linen had first been scientifically demonstrated by a Dr. James Ferguson, of Belfast, in 1770. In that year the Linen Board, a trade association in Northern Ireland, actually awarded Ferguson the sum of £300 for his lime process of bleaching, but the process was unable to be applied in consequence of the stupid English law prohibiting the employment of lime in any form.

It would seem, however, that this out-of-date legal prohibition, like all similar restrictions, was everywhere evaded. Manchester crofters, if existing records are anything to go by, invariably used lime in their bleaching vats, and so, too, did many of the Scotch bleachers. Lime was cheap; suitable "pot-ashes" cost about four guineas per cwt. Lime was more effective than the pot-ashes, and, used cautiously, it did no harm to the cloth. Consequently, law or no law, the prevalency of lime bleaching increased.

Lime, however, is by no means a direct bleaching agent. It only acted by making the "bucking" lye more caustic and thereby in serving to dissolve out more of the colouring matter than ordinary plant or pot-ashes were capable of doing. So that, despite the advent of lime in the bleaching trade, the "whitsters" were still as dependent as ever upon an increasing acreage of their "crofts."

The Coming of Chlorine

In the last half of the eighteenth century scientific chemistry began to take a firm foundation. Among the many noted chemical experimenters of the period was Charles William Scheele, the Swedish apothecary, who took to the making of new experimental discoveries in chemistry as a distraction from the compounding of pills.

Now, one of Scheele's discoveries, as every chemical student knows, was the gas *chlorine*, which he obtained by heating hydrochloric acid with manganese dioxide. Scheele found that chlorine was a corrosive gas of a sharp, penetrating character, a gas which was enormously chemically reactive, and one which it was impossible to breathe, even in small amounts, for any length of time, owing to its strong inflammatory action on the bronchial passages and the lungs.

It was Scheele who noted the remarkable property which chlorine possesses in destroying vegetable colours. That was in 1784. He found that the gas turned blue litmus paper white, and that it similarly bleached all flowers which were exposed to its influence for only a short time. He also showed that colours thus bleached could not be restored; but Scheele's mind worked in anything but industrial channels, and that was about as far as he went with his chlorine discovery.

The next chapter in the story of chlorine and its bleaching action is laid in France, in which country another scientific investigator, Claude Louis Berthollet (1748-1822) repeated Scheele's initial experiments.

Berthollet, indeed, may be claimed as the patron saint of present-day bleaching, for it was he who first conceived the idea of applying the principle of chlorine for the much-desired speeding up of the bleaching industry. Owing to its corrosiveness and its generally unpleasant nature, chlorine gas was clearly unsuited for industrial usage in bleaching. Berthollet sought around for some satisfactory guise in which to present the gas to the industry. He brought out his famous "Eau de Javelle," which is a solution made by absorbing chlorine gas in caustic potash solution. This he applied to commercial bleaching with some success in his own country, but the "Eau" was by no means an ideal substance for that purpose. It was too expensive, and its action was too uncertain. Moreover, it often tended to ruin the cloth owing to the presence of the caustic alkali.

It seems that Berthollet communicated the chlorine gas bleaching process to James Watt,

Laboratory apparatus for the preparation of chlorine gas from hydrochloric acid and manganese dioxide.

the so-called steam engine "inventor." Watt passed on the information to one McGregor, of Glasgow, who used it in his works.

Independently of Watt, Thomas Henry, of Manchester, used chlorine for bleaching and, in 1788, exhibited in Manchester samples of chlorine-bleached calicos. It seemed, therefore, that, despite the corrosiveness of chlorine gas, the latter would have to be used for quick bleaching if the Berthollet "Eau de Javelle" were not taken up in its place.

Bleaching Powder

It was Dr. T. Henry, of Manchester, who made the first atetempts to absorb the chlorine gas by lime, but it was to Charles Tennant, a Glasgow chemist, who invented and patented (in 1798) a new combination of lime and chlorine which subsequently became known as "bleaching powder" or "chloride of lime." According to Tennant's patent, the chlorine gas was passed through water in which lime was suspended. The lime absorbed and combined with the chlorine, giving rise to a new and powerful bleaching liquor which was superior to any chlorine-containing liquid which had previously been prepared.

Tennant's first patent was contested and rendered legally invalid by the activities of a certain group of Lancashire bleachers, but, in the following year, he circumvented their designs and took out a new patent for the same or, at least, for a similar discovery which comprised the absorption of chlorine gas by *dry* slaked lime.

By virtue of this 1799 patent of Tennant's, chloride of lime or bleaching powder was evolved and made widely known. In 1799, at the St. Rollox works, Glasgow, Charles Tennant commenced the commercial manufacture of bleaching powder for the bleaching industry. Within a year he had manufactured 52 tons of the material at a price of £140 per ton. For many years Tennant's was the largest bleaching powder works, despite the fact that many bleachers preferred to make their own bleach liquor by absorbing chlorine gas in milk of lime. Nevertheless, the introduction of "chemic," as chlorine bleach solutions came to be called, into the bleaching industry speeded up the bleaching process from an affair of months to a matter of hours. The bleaching trade, thanks to the direct impact of chemistry upon it, was now well able to cope with all the growing demands which were being placed on it.

From that time up to the present chlorine bleach solutions of one type or another have been the mainstay of the bleaching industry. Methods of bleaching wool by sulphur dioxide gas, methods of utilising other oxidising agents, such as potassium permanganate, for bleaching purposes, have been discovered and introduced since that date, but in the main the modern benefits of bleaching have accrued chiefly through the universal employment of the chlorinated "chemic" throughout the industry.

A typical modern bleaching process consists in boiling the material with "chemic" in specially designed vessels called "kiers" and, afterwards, in "souring" them by immersing them in dilute acid. Finally, the material is thoroughly well washed and dried.

So far as its chemistry goes, the bleaching action is fairly simple.

Hypochlorite

When chlorine gas is absorbed by lime it forms, among other things, a compound

Natural bleaching in modern times. Household fabrics being laid on grass to be whitened by the photo-chemical action of the sun's rays.

known as calcium hypochlorite. This substance is soluble in water, and when it comes into contact with an acid, such as dilute hydrochloric acid, free chlorine gas is evolved.

Cloth fabric which has been saturated with bleaching powder solution is fully charged with calcium hypochlorite. On being "soured," or exposed to weak acid, chlorine gas is liberated in the fabric. Now, chlorine has an exceedingly strong affinity for hydrogen. Hence, the chlorine which has been liberated in the fabric combines with the hydrogen present in the water (H_2O) to form hydrochloric acid, viz.:—

$$2\,H_2O + 2\,Cl_2 = 4\,HCl + 2\,O$$

(Water) (Chlorine) (Hydrochloric acid) (Oxygen)

The oxygen which is liberated from the water in the above reaction is in a condition of chemical super-activity, which condition we term the "nascent" state. Nobody knows what exactly this so-called "nascent" state consists of, but that fact, of course, is, for us, beside the point. All we are concerned with here is the fact that, being liberated in its "nascent" condition, the oxygen immediately oxidises the colouring matter of the fabric to colourless substances which are subsequently washed out of the cloth along with the residues of bleach liquor, "chemic" and other substances.

Hence it is that by the theoretically roundabout method of employing chlorine to liberate active oxygen, the modern bleaching processes, as originated towards the end of the eighteenth century by Berthollet, Charles Tennant and others, bring about within the space of a few hours the result which, with the older processes of "croft" bleaching, took weeks and even months to effect.

Chemistry, therefore, did not merely aid the bleaching operation. It revolutionised it and established it upon a basis of permanent efficiency.

Nowadays, of course, it is not only cloth and other textile fabrics which undergo the bleaching process. The technique of bleaching is applied in one way or another to a whole host of different commodities. Flour, sugar and other foodstuffs, wood, paper, fur, skins and numerous other materials are all subjected at times to chemical decolourising treatments of one sort or another, many of which treatments are based upon the fundamental principle of oxygen bleaching. The list of such substances is a large one, and it grows year by year, for with the advances of our modern civilisation we seem to aspire more and more to absolute whiteness as a standard of purity in many of our materials, and it is in consequence of the efficiency of our present-day quick bleaching methods that such standards are not only possible but, also, readily attainable.

THE MONTH IN THE WORLD OF

Science and Invention

Walls to Warm Houses

INVISIBLE heat from the walls of post-war houses is being planned by Britain's electrical industry. One form of invisible heating consists of electrical heating elements embedded in plastic boarding, which can be produced as oak, mahogany, or walnut. The elements can even be woven in special wallpaper. Used as panelling, the system will provide even heating throughout the whole of any room.

Largest Service Telephone Exchange

WHAT is probably the largest Service telephone exchange in the world, handling sometimes 2,000 calls an hour, is operated entirely by W.A.A.F.s., who maintain the links between R.A.F. units in all parts of Britain.

In a peak period one operator may pass 200 calls in an hour. The operators are almost "touch telephonists," and can plug-in without a second's hesitation. To ease eye strain, the switchboard is lit by artificial daylight lamps.

Aeroplane to Carry 'Planes

AIRCRAFT engineers in the United States have designed an aircraft to carry 'planes. The new machine is to be propelled by a unique combination of engines, helium gas, and a system of air tunnels. This single-wing 'plane would have a flying deck big enough for 12 fighters to take off, and it would carry enough helium gas to lift 36 tons, and with its engines turning the propellers it would be capable of lifting 70 tons. If the 'plane did not carry such a heavy load it would not need helium to lift it, but it would use gas to utilise the craft as a 'plane 'carrier. The machine was designed to adapt the lighter-than-air principle without the bulk of the lighter-than-air craft. Wind tunnels would create a semi-vacuum for increasing lifting power.

Steel Lifeboats

THE Ministry of War Transport recently issued orders concerning the use of safety devices on board merchant ships.

From August 10th all ships will be required to carry as standard equipment much-improved life-rafts, wireless transmitters, bilge pumps, emergency clothes, scientific rations and safety lights. All tankers will be equipped with steel lifeboats to reduce fire risk.

New A.A. Gun

IT was disclosed recently by the chief of the U.S. Army Ordnance Technical Division that America has a new 4.7in. anti-aircraft gun that fires shells 60,000ft., which is higher than the ceiling of the highest flying aircraft.

Metallurgical Research in Sweden

IT is reported that a committee has recently submitted to the Swedish Government a proposal for the establishment of a new institute for iron and steel research, to be called the Metallographical Institute, which will be a central institution for close co-operation with the iron and steel works. The present Metallographical Institute in Stockholm will be incorporated. A building is to be erected at a cost of 1,200,000 kr. (£70,000), and equipment is to cost 500,000 kr. (£30,000), the State paying for the former and industry for the latter.

A new appliance for fire guards, known as a wheelbarrow pump, is now in production. It is a petrol-driven unit, of far greater power than a stirrup pump, and in the illustration the crew of a pump are seen wheeling their appliance along.

U.S. Army's Amphibious Lorry

THE U.S. Army have a new 2½-ton land-sea lorry which can travel along the ground, or take to the water just as well, fully laden with troops.

World's Longest Ropeway

WHAT is reported to be the longest ropeway so far constructed in the world has recently been completed in Northern Sweden. It belongs to the Boliden Mining Company and is intended for the transport of ore from remote inland mines to the company's smelting works. It has a length of 96 kilometres (60 miles) and a transport capacity of 9,000 tons/kilometres. The line is equipped with eight loading stations and two unloading stations. When the ropeway is working at full capacity there will be 1,600 cars in operation.

Shipbuilding in Chicago

THE first of a new design of naval patrol vessel, the first ocean-going patrol craft ever built in Chicago, was recently launched by the Pullman-Standard Car Manufacturing Co. About 180ft. in length, it will be equipped for anti-submarine warfare. The boats are constructed in 14 sections, which are moved from the plant to the launching ways four miles away.

Britain's New Flying Boat

LARGE flying boats capable of carrying 200 passengers on post-war business and pleasure trips are being constructed by Saunders-Roe, Ltd., for the Air Ministry. The new aircraft are primarily intended for transport work, but are capable of conversion to civilian use after the war. The craft will carry 23 tons of petrol for a range of 4,000 miles. The maximum number of passengers, 200, could be accommodated on a short journey—for example, from Britain to the Mediterranean. Big machines were being produced for civilian purposes before the war.

THE WORLD OF MODELS

By "MOTILUS"

The Use of Technical Models and Their Value in the Post-war World

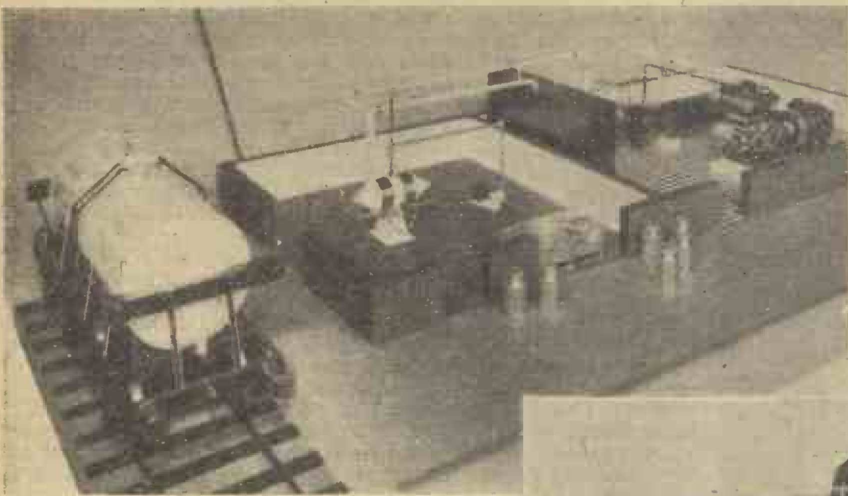


Fig. 1.—Model of a modern milk pasteurising plant, built to a scale of ½in. to one foot.

THE use of fully detailed models dates back to the Middle Ages, when the models of famous ships of those historical periods were made and stored in special museums for records and reference purposes. Very often they were found more useful and comprehensive than drawings, especially in the days when a knowledge of making and reading drawings accurately was limited to very few people.

This system of models for records has persisted, and in modern times has been brought to a high standard of perfection, and model makers—amateur and professional—are called on from time to time to make most intricate and complicated models of pieces of special machinery or plant.

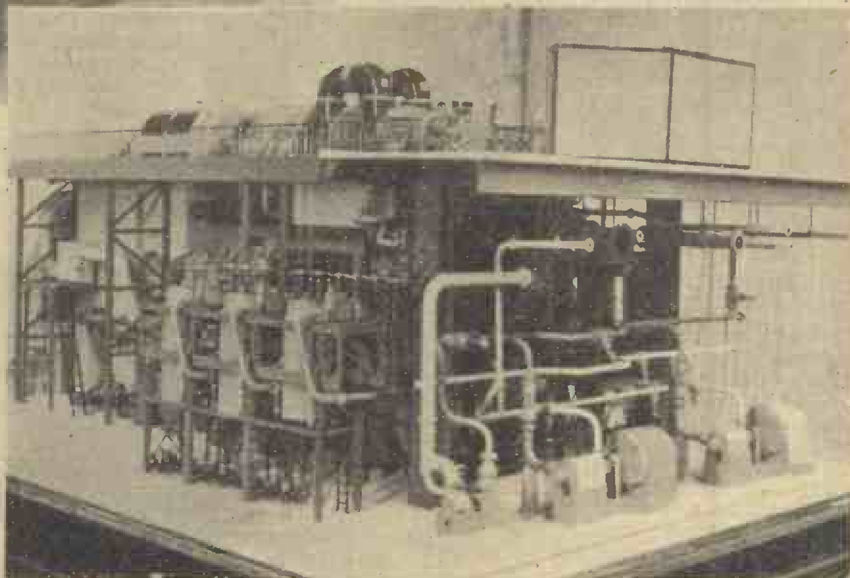


Fig. 2.—A fine model of a 30,000 kilowatt turbo-alternator set viewed from the steam end of the installation.

Model Pasteurising Plant

One such model which comes immediately to my mind is that of a modern milk pasteurising plant, made to the special order of the United Dairies. A general view of the model plant is shown in Fig. 1. It is to the scale of ½in. to 1ft. — which gives opportunity for a fair amount of interesting detail to be shown, and each part of the model is remarkably true to life. The pasteurising plant is shown, composed of the spiral heat exchanger in one compartment, and the wooden brine tank, motor, condenser and evaporator tanks in the other, interconnected by various thicknesses and lengths of stainless steel piping.

On the track is shown a United Dairies glass-lined tank, which receives the pasteurised milk for transit.

Model Turbo-alternator Set

Scale models of this quality can be applied with advantage to practically every branch of industry and transport, and in more recent times a very fine reproduction has been made by Bassett-Lowke, Ltd., of a turbo-alternator set at a modern power station. Several illustrations are given in this article of this model 30,000-kilowatt turbo-alternator set, which is complete with condensing and five-stage heating plant. It has been specially constructed for instructional and record purposes, and is probably one of the most intricate pieces of modelling ever produced by this well-known firm.

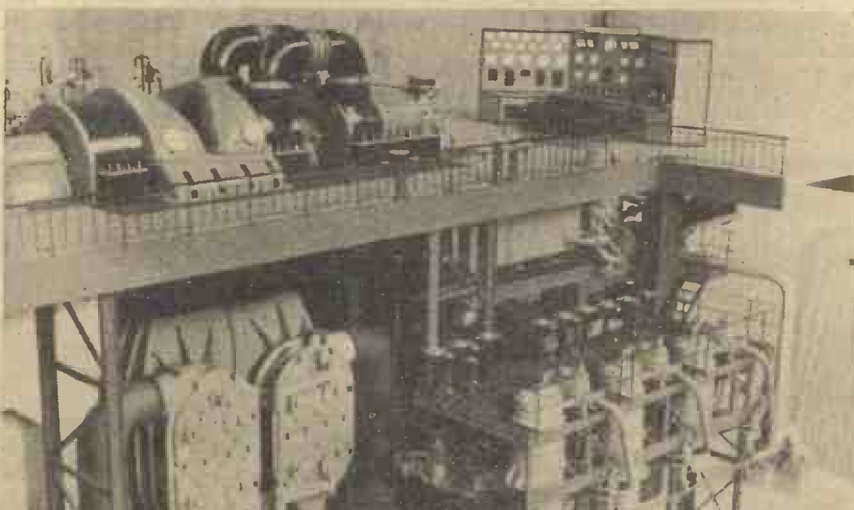


Fig. 3.—The water system showing the large pipes—left foreground—which admit circulating water to the condenser.

This model is made to the scale of ½in to the foot (1/24th actual size), and it is interesting to learn from the photographs of the model how the actual turbo-alternator works.

Steam is admitted from the boiler plant (which is not modelled) to the unit at 650 pounds per square inch, a total temperature of 910 deg. Fahrenheit. (Fig. 2.)

It passes through the piping (seen on the right) from the main stop valve to the throttle valve, and into the high-pressure turbine. When it has done its work in the high-pressure turbine it passes through the overhead pipes and also the inter-connecting pipes situated below the engine-room floor level to the low-pressure turbines. The steam in these has opposing directions of flow, the reason for this being to balance the end thrust at the low-pressure end. The total exhaust is brought to a common point of entrance to the condenser.

Now for the water system—the steam is condensed by circulating water admitted to the condenser through the pipes seen on the bottom left of the illustration (Fig. 3).

The air is withdrawn from the condenser by two banks of extraction pipes and distributed to the various ejectors. The condensed steam is extracted from the base of the condenser through special de-aerating pots, by means of one of the two 100% pumps shown on the model in Fig. 4 (in front of the condenser), and is passed to the boiler feed pumps through two stages of feed heating in direct contact with bled steam from the turbines.

Fig. 5.—Richard Derry, aged four, with his ¾in. scale Burrell traction engine.

At this point the condensate is about 220 deg. F. and becomes the boiler feed water, being handled by the main boiler feed pumps. From here the feed water is now pumped through three stages of feed heating in surface type feed heaters shown on the left-hand side of the model, looking from the steam end towards the alternator end (Fig. 3), and reaches a final feed temperature of about 375 deg. F.

The electrical energy is taken from the alternator through protective equipment housed in the main foundation block at the extreme end of the machine (away from the steam end), and passes to the station switch gear and bus bars from which the supply is controlled to feed into the grid system (Fig. 4). The current is generated at 11,000 volts, the continuous maximum output of each unit being 30,000 kilowatts, equal to about 40,000 horse-power, and the model shows one of four turbo-alternator sets in this generating station serving the grid system.

The alternator is cooled by air in a continuous closed circuit, the air being blown through the windings by two fans and returned to the fan suction through a cooler which is connected with the main condenser cooling water system.

The alternator exciter is air cooled on a shunt off the main air-cooling system, the air being filtered through a viscous type filter shown on a sub-platform at the alternator end, in Fig. 2. It is necessary to filter this air because of the carbon dust entering from the brush gear.

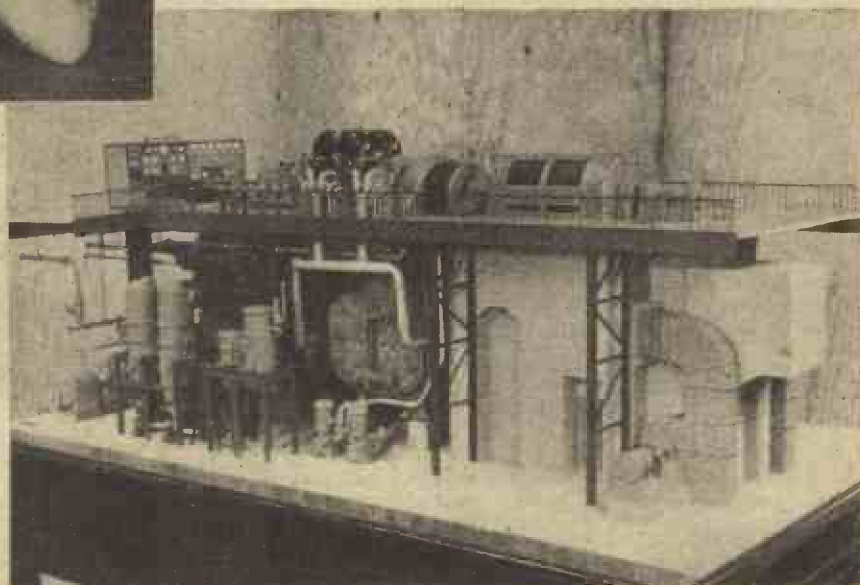


Fig. 4.—The turbo-alternator set as viewed from the alternator end. The control panels are clearly visible in the top left-hand corner.

As to the oil system, the complete turbo-alternator set is automatically lubricated from a central system with a direct driven pump, and the reservoir tank, shown just below the engine-room floor level at the steam end left-hand side (Fig. 2), is of sufficient capacity to allow the oil to slow down and pass through settling trays and strainers to ensure complete de-aeration.

Think how much more compact and comprehensive a model is than all these words! The fact that the whole intricate system can be viewed in the space of 4ft. 6in. x 2ft. 6in. makes it, in a way, more attractive than the original.

The Young Idea

From models that are used by the experts, I turn to the photograph (Fig. 5) recently sent me by Mr. Cyril Derry, chairman of Bassett-Lowke, Ltd., of his young son Richard, who is beginning to manifest a decided interest in models. This picture shows him oiling up his model ¾in. scale Burrell traction engine, which his father gave him for his fourth birthday, and as he grows in years he will come to learn more of its finer points, for it is a model which even the most critical engineer can appreciate. Evidently Richard believes in starting young!

A 36in. flying model monoplane made from a kit of parts by Mr. H. A. Rowley, of Leeds. Note the large extending under-carriage to prevent damage on landing.

A model of a German armoured car to a scale of 1in. to 1ft. The model is cut out of solid Obeecha wood, and the turret is arranged to revolve.

Our Busy Inventors

By "Dynamo"

Fish Bones Strengthened

FOR a considerable period the bones of vertebrate animals have been made to contribute raw material in the button and fancy goods industry. And there have been repeated attempts to use fish bones for ornamental purposes but without success. The reason given is that this is owing to the fact that these bones are inherently fragile. Consequently, articles formed from them have to be handled with extreme care.

Similarly, in the preparation of fish bones for scientific purposes and preservation in collections, their brittle character has always hampered osteologists. So, from the point of view of the museum, as well as that of decoration, some special method of treatment is a desideratum.

An inventor now claims that this weakness in fish bones can be overcome. After a preliminary treatment in which the bones are thoroughly cleaned and soaked in a disinfectant and dried, he incorporates in them a non-drying oil, a non-drying fat and a wax.

It is imperative that the substance to be incorporated be allowed to soak into the pores of the fish bones to an extent which depends on the properties of the particular type of fish bones used. And it is essential that the pores are subsequently sealed up, in order to cause the non-drying oils, etc. to be permanently retained within the tissue of the fish bones.

Aerial Mine

AMONG existing anti-aircraft shells there is one which contains a parachute mine. This is embodied in a projectile or parent-shell fired with the object of producing an aerial mine or defence curtain.

An improved shell of this type hails from Chicago, and a patent in this country has been applied for the invention.

This anti-aircraft shell contains a parachute mine constructed to form the forward one of two sections of the shell which, during its flight, are adapted at a predetermined altitude to be automatically separated.

The explosion of the charge embodied in the mine is controlled before and after the automatic separation. And the charge is detonated by a firing device, including a slidable primer. This primer is actuated by a percussion plunger, and is associated with means whereby it is held in a rear operative position during the flight of the shell, in an inoperative position during the opening of the shell, and is again rendered operative only after the shell sections are separated and the mine is suspended from the parachute.

Charing in Comfort

IT was Jerome K. Jerome, I believe, who remarked that, when he read a medical dictionary, he imagined that he was afflicted with all the physical ills to which flesh is heir, with the exception of housemaid's knee. This inflammation of the knee-cap—the besetting disease of the noble army of charladies—has been guarded against by the use of a kneeling mat.

An application recently accepted by the British Patent Office relates to an improved combined mop and brush. This utensil can be so manipulated as to enable the cleaner of offices and other apartments to perform his or her work without going down on the knees.

The information on this page is specially supplied to "Practical Mechanics" by Messrs. Hughes & Young, Patent Agents, of 7, Stone Buildings, Lincoln's Inn, London, W.C.2, who will be pleased to send free to readers mentioning this paper a copy of their handbook, "How to Patent an Invention."

Parachute Knapsack

IN the ideal parachute equipment, obviously weight and bulk are reduced to a minimum. Of course, efficiency must not be sacrificed and it is also desirable not to interfere with the comfort of the parachutist. A further necessary feature is the provision of emergency requisites, for example, in the event of a forced landing in desert or other districts where local assistance may not be rapidly available.

A new invention, for which a patent in this country has been applied, is a back pad for parachute harness adapted to serve as a container for one or more articles for use after landing. The pad includes side portions which form, in conjunction with the body of the pad, a waistcoat. These side portions can be rolled or folded when the device is not required to function as a garment. Then the rolled or folded parts serve as padding extending along the side margins of the back pad.

No glamour here—but real hard work with the "Back Room" girls. A W.A.A.F., A.C.W.2, of Gravesend, who was taught her job by the R.A.F., acetylene welding at a maintenance unit in the Southern part of England.

Luggage On Wheels

WHILE the traveller naturally reduces his impedimenta to a minimum, he is usually handicapped with the burden of some baggage.

Many years ago an inventor devised a circular portmanteau. As a consequence the railway passenger could wheel his luggage to the station.

The latest thing for facilitating the carrying of parcels and other hand luggage is an appliance of the kind which has a shaft with a handle at one end and is at the other end provided with a wheel or wheels. It is, therefore, fitted to run along the ground while the shaft, held in the manner of a walking stick, possesses means for supporting luggage.

An improved invention of this type is characterised by the fact that the luggage - supporting arrangement consists of a hook in front of the stick. There is also beneath the hook a cross-piece forming a back-rest for the suspended luggage. This prevents it from swinging round the stick.

The appliance can be taken into a bus, tramcar or train without causing inconvenience when the passenger is seated. The luggage is then so placed as not to prevent the shaft being held close to one's body. At the same time no rigid projection in front is likely to cause obstruction to other persons.

A basket, bag, etc., can quickly be hung on the hook and removed therefrom with equal ease. As already stated, the cross-piece keeps the luggage in its place.

Advertising By Steam

AN interesting advertisement display apparatus has been submitted to the British Patent Office. The invention consists of a representation of a teapot, a tea cup, a tobacco pipe or a cigarette to be exhibited presumably in a shop window or over a shop. Included is a self-contained apparatus comprising a small steam-raising boiler, preferably heated by electricity. This lends reality by causing steam to issue from a jet or opening corresponding with the spout of the teapot, etc.

In the case of a cigarette or pipe the verisimilitude could be enhanced by controlling the emission of the steam in such a manner that it may be issued in a series of puffs.

QUERIES and ENQUIRIES

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

Miniature Rifle Range

COULD you please advise me on the following matter?

I am building a new landscape target for use in an indoor 15 yds. range with .22 long ammunition. Our present target is of sand, which requires constant attention, and I propose modelling a target in clay on which coloured sawdust would be sprinkled.

Would you be good enough to tell me if ordinary clay kept moist by periodical watering would serve my purpose or could you give me a formula for keeping it in a plastic state? The target will be made in three sections to provide for snap-shooting figures as per sketch.—J. H. Powell (Sutton Coldfield).

THERE is no ordinary material which has better bullet-stopping properties than sand which has been carefully screened and freed from coarse stones. Clay, of course, may be used also, but it is not as effective as sand in this respect. Exposed to the air clay dries, and then tends to fall to powder. You can, of course, prevent this from happening by periodically moistening the clay with water, but the process will be a troublesome one. If you could mix a small percentage of glycerine (say, 5 per cent.) with the water which you used for watering the clay, it would remain wet for longer periods; but, in this instance, there would be a tendency for mould growths to appear. An alternative is to dissolve 10 parts of calcium chloride in 90 parts of water, and to use this solution for moistening the clay.

Fire-lighters

I AM interested in the manufacture of cake fire-lighters using sawdust as a base. I have tried mixing this with nitrate of soda and paraffin, using glue as a binder, then compressing the whole into cakes, but this method is not very suitable, as the cakes do not set hard enough, nor are they as inflammable as I would like.

I would be very grateful for any suggestions you could give me on this subject.—V. Hayton (Bradford).

WE agree that your present method of compounding your fire-lighters will not be conducive to the best results. In your case the trouble is due to the presence of glue and sodium nitrate, both of which contain water and are not particularly inflammable. We would advise you to cut out these ingredients, and to use a pitch or a pitch-oil mixture as the binder. With suitable trials you will not find it difficult to alight on a good formula for fire-lighter manufacture, using as the ingredients sawdust and crude naphthalene or creosote residue (obtainable from any tar works), together with a little pitch to act as a binder.

Alternatively, you can employ the following formula, which is simple and effective:

Rosin or pitch, 10 parts; sawdust, 10 parts; creosote, or naphthalene residue, 2 parts (this ingredient is optional). Melt the ingredients, stir well, and cast into convenient blocks or shapes. No compression is needed provided that not too much creosote or naphthalene residue is used.

Do not use paraffin for fire-lighters. We believe that such a use is at present illegal; also, the oil is too volatile for such a use, and it would evaporate from the fire-lighters on storage. Also, never use glue, gelatine, waterglass or chemical salts, since they all usually contain water, which inhibits the inflammability of the composition.

Bronzing Metals

PLEASE could you tell me how to get a bronze finish on some radiogram parts, and what chemicals to use for both steel and aluminium?—G. T. Harris (Herts).

THE bronze-type finish to which you refer usually consists of an applied coating of lacquer, and we think that if you are able to purchase a small quantity of this bronze lacquer from your nearest paint stores you will make a satisfactory job of the parts you mention.

There is no simple and satisfactory way of bronzing steel by chemical methods alone. Any such method depends upon the copper plating of the steel and the subsequent treatment of the copper-plated steel with a very dilute bath of ammonium or sodium sulphide.

In the case of aluminium, however, this metal may be coloured various shades of brown by immersion in the following bath:

5 to 10 grams potassium permanganate, 2 to 4 ccs. nitric acid, 5 to 7 grams copper nitrate.

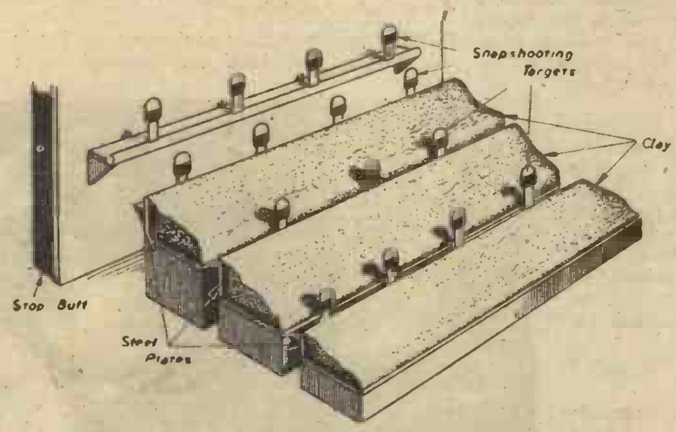
This bath must be used at a temperature of 80 deg. C. Aluminium parts, when placed in the bath, turn light-brown within about five minutes. They become deep brown within 10–15 minutes, and almost jet black in about half an hour. The actual shade of colouring and speed of colouring depends upon the precise composition of the bath. The parts must, of course, be perfectly clean and grease-free, and the chemical bath *must* be at the required temperature of 80 deg. C.

Overhead Cables

A FRIEND of mine has a shop on a main road which is connected to a 230A.C. lighting and power circuit; he also has a bungalow about 150 yds. away. Can you please let me know the size of cable (overhead) to use to extend each of these lines from the shop to the bungalow, lighting 5 amps, power 10 amps?

I have several 6 volt D.C. dynamos which I would like to use as motors to drive a small drilling machine, etc. I have a 12 volt 15 amp charger of the vibrating rectifying type, which charges batteries quite well, but it fails to make dynamos run at any speed or power when run as series machines. I am on A.C. 230 v. 50∿. Can you suggest anything?—Sparks (Sheffield).

THE size of your overhead cables to carry 5 amps. and 10 amps. respectively to a distance of 150 yds. on a 230 volt A.C. supply without excessive volt drop should be 7/0.029 and 7/0.044, respectively. You cannot run 12 volt dynamos as motors satisfactorily from a 12-volt rectifier of the vibrating-reed type, but will have to use the rectifier first to charge up an accumulator of sufficient ampere-hour capacity to supply the necessary current the dynamos take when running as motors, and drive them from the battery alone. It would be immaterial whether the dynamos were series or shunt connected, as they would then be running as direct current motors.



Sketch of snap-shooting targets (see reply to J. H. Powell, Sutton Coldfield).

"Crackle" Finish

CAN you please inform me how I can obtain the enamel effect on metal known as cracking or crackle enamel in black or grey? The effect is shown as very small raised ridges running in all directions. Also, can you tell me how articles finished with this enamel may be touched up where it has worn off; do I need a special enamel?—W. Taylor (Mansfield).

MANY of the "crackle" enamel effects are produced by a species of heat-treatment, the enamel being partly baked after being sprayed on to the metal surface. The majority of these crackle lacquers are of secret composition, but they usually contain a metallic soap, such as aluminium stearate, which is responsible for the "crackle" effect simply by its action in breaking up the continuity of the paint layer and partially destroying it.

You can make a crackle lacquer by adding to an ordinary cellulose lacquer about 15 per cent. of a strong solution of aluminium stearate in ethyl or butyl acetate. These materials may normally be obtained from Messrs. A. Boak Roberts & Co., Ltd., Stratford, London, E.5, although there is some doubt as to whether you will be able to obtain them now.

Usually, objects painted with this lacquer are warmed after the lacquer has reached the tacky stage, the object being to aid the destructive effect of the aluminium stearate on the lacquer.

We are afraid that you will not be able to purchase this crackle lacquer ready made.

If you are unable to obtain the above materials or lacquer, we suggest that, in order to touch up the worn places of articles finished with a crackle lacquer you paint these places with ordinary lacquer, approximately matching in shade, and that you afterwards apply very cautiously a little paint-stripper to the newly-lacquered areas, subsequently heating the article. The destruction of the lacquer which will result should, with careful management, give a fairly effective crackle effect. Any proprietary paint-stripping composition will serve for this purpose.

Cold-cream Soap

WHAT is the chief difference between an ordinary toilet soap and a "cold-cream" toilet soap? The latter type of soap appears to have been discontinued by manufacturers for the duration of the war, and I was wondering how the soaps differed from each other. Is there any special process required in the manufacture of "cold-cream" toilet soap?—W. E. Savidge (Cleveleys).

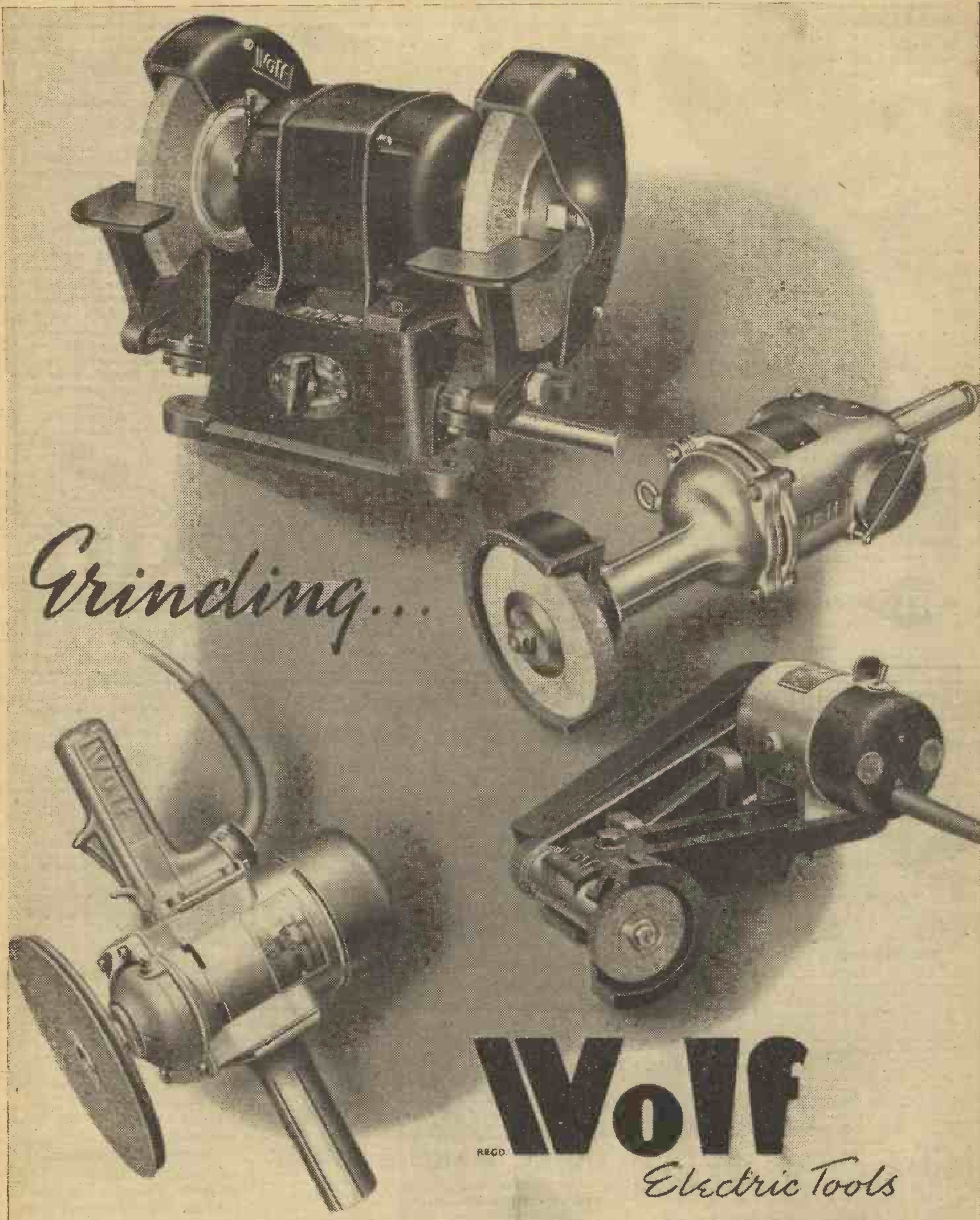
FUNDAMENTALLY, there is no difference whatever between any of the various present-day toilet soaps. Despite the fact that many people imagine that "cucumber" soaps are made from raw cucumbers and that "coal tar" soaps are produced direct from coal tar, such is not the case. Nor, again, are the various "cold cream" soaps produced from cold cream. All that these various names refer to is the distinctive perfuming of the soap. Hence, a "cold cream" soap, owing to its perfuming, is considered to have an odour reminiscent of cold cream, just as much as a violet-scented soap is supposed to smell of violets. But, chemically, there is little or no difference between the soap bases. It is all a matter of colouring, perfuming—and advertising.

Running a Car on Calor Gas

I WONDER if you could give me any information about using calor gas for running a Standard 9 h.p. side valve engine on the road. I have tried using a small jet direct into the air intake of the down draught carburetter (it is a 1936 model), and while this will start it and keep it running, the engine does not pick up, and lacks power. When I increase the pressure, it cuts right out; the pressure is 25lbs. to the sq. in.—S. T. Jones (Leominster).

YOUR query, and the experiments which you describe, are most interesting, but, at the present time, we are afraid that you will find yourself very much a lone hand in the trials which you are making in the direction of gas fuel for a Standard 9 h.p. engine. We do not know of any firm which is able to supply any device or fitting which would suit your purpose.

We do not think that the gas pressure which you are using is too high. We have the idea that the cause of the trouble lies in the composition of the gas. That is to say, the gas is not rich enough in combustible material. Or, alternatively, it may be that you are using an ineffective gas-air mixture—either you have too much air or too much gas.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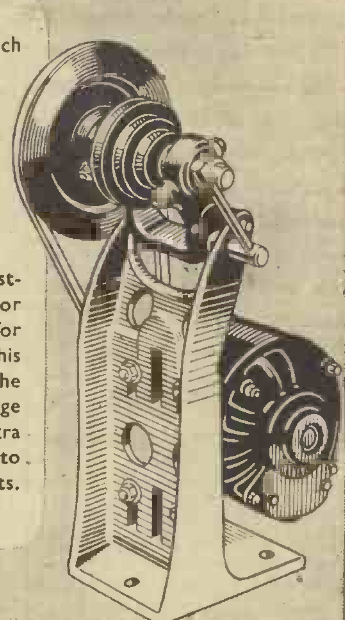

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THE Cyclist

Editor: F. J. CAMM

VOL. XI AUGUST, 1943 No. 258

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

Phone: Temple Bar 4363

Telegrams: Newnes, Rand, London

Comments of the Month By F. J. C.

Lt.-Col. Mervyn O'Gorman on Road Accidents

(*Concluded from page 73, July issue.*)

Street Name Plating and House Numbers

It is certain that every unit of traffic ought uninterruptedly to attend to the traffic in front of him. He ought not to be hunting about for street names. Yet Sir Henry Maybury assured me that all his powers of suasion had proved vain in his attempts over three years to induce urban authorities to put up the five name plates that are essential for every T street junction. Until that work is well and clearly done and standardised, the attention of all the traffic will not be centred on the traffic. Accidents are dominantly at intersections. So are unfindable street names. (I'd like to put the plates on the top of the beacon poles instead of the yellow blobs.) Name plates cost little. If we had the Scottish law of non-feasance we could compel their erection. In my opinion research would prove their contribution to safe traffic flow, but opinion alone is clearly unavailing.

Lay-bys for Bus Stops and Parking Places

The London and Home Counties Traffic Committee told us after several years of sittings that "the number of street accidents is intimately related to the extent of traffic congestions." Any bus which stops in mid-stream holds up a line of vehicles, in other words it builds up the preliminary to congestion. We could utilise many of the gaps made by bombs in the lines of houses, as lay-bys, partly for bus stops and partly as small parking places and as taxi ranks. Such parks, small, but well spread about, are far better than the large congestion making car parks.

We know that the slow circulation of crawling taxis and cars standing in the streets accents congestion. We know it means waste of road value. We know it increases the total time of every journey afoot or awheel, and that clearly increases the amount of exposure of everyone to the risk of accidents. No planner seems to propose this simple remedy, he is too busy with vistas. Set a Traffic Research committee on it and see what they say.

Slow Traffic

Nothing can move, however slowly, but it has some speed—so that to accuse "speed" is as wise as accusing *boots or tyres*. You might think there are no accidents when the vehicles have *no* speed—i.e., if they did not move. The facts are otherwise. A good number of killing accidents occur every year in which the only vehicle involved is stationary—in London alone the latest yearly record was 10 killed—from 10 to 20 times that number are hurt.

Take the slowest traffic. In the same year where the approach of the vehicle was slower than walking speed, the number killed was actually greater than when the speed of approach was over 20 m.p.h. There were 208 at walking speed as against 45 at all the speeds higher than 20 m.p.h. in London. That is not as strange as it sounds, because the overwhelming majority of traffic movement is very slow. The average is only 10 m.p.h. and so much of it is slower.

One very bigoted person accuses me of saying that the faster the vehicles go the safer you are—but to ordinary folks it indicates how very gravely congestion multiplies accidents.

I have myself seen a young man turn out of the crowd on the pavement and dash his head into the side of a stationary van. In Aldwych I have seen a woman walk into a taxi that was crawling at 5 m.p.h. and it was pitiful to see her killed. The fact that there were 208 deaths in a year in such simple circumstances surely warrants investigation and research. I have no quality to forestall the findings of the researchers, but I would ask *inter alia* that their inquiry be directed to the effects of having no regulations designed to instil instinctive habits of safe foreseeable walking and foreseeable driving. I refuse to believe that the great walking public prefer to suffer hundreds of thousands of casualties a year rather than that some reasonable rules should be promulgated, advertised, and after a preliminary period, enforced—that would certainly save many children—besides a habit of foreseeable movement is effortless when all around practice it.

The latest new traffic problem, the erratic behaviour of people due to war nerves, which has pushed up the deaths by 50 per cent., would not, I think, have reared its ugly head, if the instinct and habit I speak of had been there to give poise to the people.

Wanted—A New Racing Policy

In view of the success of the mass-start road races, the crowds they draw, the publicity they give to the sport, and the fact that the police are co-operating, invites the thought that the whole of the rules governing time trials and attempts on records need to be revived in the light of modern trends. Why should time trials be held in a hole and corner fashion, with everything kept secret, the riders sneaking away to the starting place in the morning, and dire penalties inflicted on any who should so much as breathe the fact beforehand that a race is to be held on such and such a day, on such and such a course?

We can understand that in the 'nineties, when the police were unfriendly towards cyclists, and one had only to be seen on a bicycle to run the risk of being charged with riding to the common danger, that such rules were necessary. Many have been the events broken up by the police, who at that time regarded cyclists in the same light as they now regard motorists. But that time has passed. Cyclists are not, by any means, the fastest vehicles on the road. In these days a cyclist must be "inconspicuously attired," which meant according to the rules that he must be dressed in black tights, which fitted him like the skin round a sausage. We do not believe that a cyclist was inconspicuously attired so garbed, even in those days. Everyone to-day who sees a cyclist in black tights knows that he is taking part in a road race—or, if we must adopt the subtle subterfuge, a time trial. The fact is that such trials are not illegal, whether they are designed as a race against the clock or watch, or whether they are in the modern mass-start form. The police are co-operating in a form of road racing which has always been advanced as illegal by the national bodies. We now know that it is not illegal. The main plank in the argument for secrecy, namely, fear of police opposition, has gone, and we therefore advise the R.T.T.C. and the National Cyclist Union to face the facts, and to remodel their views.

A New Body!

As we see it, unless they do so, a new body will spring into existence to control the new sport, and will considerably weaken at least the N.C.U., which is an old-established body. The R.T.T.C., formed out of the old Road Racing Council, is a comparatively new body, which has merely cluttered up the sport with a lot of rules and given rise to the impression that all sport exists to keep the R.T.T.C. in existence instead of the R.T.T.C. being a servant of the sport, and willing to carry out reasonable wishes and anxious to bring its rules into line with the changing times.

Within the R.T.T.C. are many with heads in the sand who still want the sport to go on as it did in the 'nineties. They cannot forget the old Ordinary. We must not forget either that the R.T.T.C. was one of the first to abandon the sport at the outbreak of war. When it saw that the clubs would have none of this it shamefacedly endeavoured to take control again, with doubtful results.

We therefore are in favour of prior publicity being given to all forms of road sport—mass-start, time trials, and attempts on records. The need for secrecy and hole and corner tactics has passed. One objection to prior publicity is that crowds may foregather at the start and hamper the riders. This is a somewhat flimsy argument because in a time trial the riders are started one at a time and usually at minute intervals. In a recent mass-start race a crowd estimated at 3,000 watched the start of a race where the riders all started together. So well organised was the event that there was no interference with the riders, and we fail to see why there should be with the comparative simpler time trials. Let us bring our views up to date and not stupidly regard a cyclist in tights as inconspicuously attired; let us not think that because the winner of a time trial selects a cycling jacket or some accessory that he is a professional; let us not presume that the police are anxious to interfere in time trials in 1943; and let us forget the bad old days of cycling sport which many prefer to regard as the good old days.

Paragrams

Stratford St. Mary, Suffolk.

New Road Record

THE fourth R.R.A. record to be beaten since the war fell to L. E. Copping and J. M. Sloper (North Road C.C.). It was the 100-mile tandem tricycle record, the new figures for which are 4 hrs. 13 mins. 57 secs., a 25 minute beating of the previous best put up by D. F. Nash and H. G. Scutchings (Poly C.C.) 18 years ago.

Fred Willett's New Role

ACTIVE time-trialist and track rider of pre-war days under the colours of the Norwood Paragon C.C., Fred Willett, now a sergeant bomb-aimer in the R.A.F., has taken part in some of the biggest raids over Germany.

Ray Gibbney Missing

PILOT OFFICER RAY GIBBNEY, R.A.F.V.R., expert track enthusiast of the Morpeth C.C., is missing following an operational sortie over enemy territory.

Thom in Rhodesia

WINNER of the Midland Centre (N.C.U.) championship at Donnington Park in 1928, "Bobby" Thom is now serving with the R.A.F. in Rhodesia.

The Fair Sex

APART from having the distinction of being the first woman member of the Wolverhampton Racing Club, Miss Pat Davies is also distributor of the club's magazine.

Wisbech Wheelers

WISBECH Wheelers have held an inter-club event with a newly-formed R.A.F. club in their area. Member Freddy Gilham is a prisoner of war in Italy: Sergeant Chapman is in Japanese hands and William Cousins is with the R.A.F. in Canada.

Consistent Rides

R. H. HERBERT, Eleanor C.C., won four first handicap awards in five consecutive weeks.

R.A.F. Enthusiasm

A FEW weeks ago three members of the Kentish Wheelers found themselves in the R.A.F. and posted to a Midland aerodrome. The Hereford (R.A.F.) C.C. soon came into being and now it is over 40 strong with an increasing membership.

London Road Race

THE first massed-start road race over London roads was won by E. A. Clements, (Wolverhampton Racing Club, in 3 hrs. 16 mins. 53 secs. for 69 miles.

Wessex Road News

TWO of the Wessex Road Club's oldest members are missing: Ewart Warne, who was on the ill-fated H.M.S. *Bramble*, and George Ansell, who was serving with the R.A.F. in the Middle East.

Gane for the Navy

CHAMPION of Norion Road Club for four years and holder of several club records, Leonard Gane has joined the Royal Navy.

Voluntary Registration

ALTHOUGH the scheme is purely voluntary, over 12,000 Portsmouth cyclists have registered their machines with the police as a precaution against theft.

Southampton Course Record

BY clocking 1 hr. 2 mins. 45 secs. in the Southampton Wheelers "25," S. Boulter, Portsmouth North End, put up a new course record. There were 88 entries for the event: the largest of any on the South Coast for two years.

Cornwall's Loss

C. A. STUART, prominent pre-war Cornwall R.T.T.C. official, has been killed in action.

Poloists' New President

THE new president of the Bicycle Polo Association of Great Britain is Albert Lusty of the Midland Cycling and Athletic Club.

Cyclists at Cricket

AN open challenge to play any club in the Kent N.C.U. Centre at cricket has been thrown out by the Sittingbourne C.C.

Clubmen in Germany

C. E. ASHBY, Peterborough C.C., P. L. Child, Kingston Phoenix Road Club, and E. E. Davis, Croydon Road Club, have met at a German prisoner of war camp.

Anglo-American Memorial

THE village church of Cransley, Northamptonshire, is to have a stained glass window with portraits of Winston Churchill and President Roosevelt.

"Frampton" Memorial Service

FOR many years cyclists attended annually a service in Maiden Bradley Church, Bath, to the memory of colleagues who fell in the last war. It was organised by Mr. H. Frampton who subsequently died. Riders from all parts of the West Country still attend the annual gathering which has become known as the "Frampton Memorial Service."

Cycle Traders' Generosity

THE Cycle Trades Red Cross Fund, launched by Sir Harold Bowden some months ago, has reached £10,000.

Killed in Action

FORMER member of Yorkshire Clarion C.C., Pte. Harry Huckle was among those who lost his life in North Africa.

A Pedalling Minister

COMMANDER STEPHEN KING-HALL, M.P., Director of Fuel, has been converted to cycling and cycles extensively on official business.

Willesden Sergeant Missing

SERGEANT PILOT ROBERT WHEELER, Willesden C.C., has been posted missing following air operations in the Middle East.

Son for Tricyclist

COMPETITION 25-mile tricycle record holder, E. A. Fry, Westerly Road Club, has been presented by his wife—also a keen rider—with a son.

Maxfield's New Role

A FORMER British sprint champion, Flying Officer W. W. Maxfield, who is with Coastal Command, was responsible for rescuing 19 Norwegians whose ship had been torpedoed. The survivors were spotted by Maxfield while he was on U-boat patrol.

Sandon Man a Prisoner

AFTER being posted as missing for over 16 months, Jack Suddes, Sandon C.C., is now known to be a prisoner of war in Japanese hands.

Wartime Time Trial Record

TO Eddie Larkin, Yorkshire Road Club and member of the Hemsworth Wheelers, goes the distinction of lowering the first wartime R.T.T.C. record. He clocked 1 hr. 12 mins. 27 secs. for 30 miles beating by 24 secs. the previous best which had stood to the credit of G. Flemming since 1938.

Tricycling Centurion

PETER DUNCAN, of Carnmoney, Ireland, died at the age of 101. He never rode a cycle but for many years—and up to a day or so before his death—was a keen tricyclist. He gave one of his machines to Belfast museum.

Vegetarian in India

TED BRUMMELL, well-known pre-war stalwart of the Vegetarian C. and A.C., is serving with the Forces in India. The former secretary of the Bon Amis C.C. (J. Wrightson) is also in that country.

A Good Price!

DURING Oxford's "Wings for Victory" week a Raleigh cycle realised the record price of £1,500 when sold by auction.

Death of George Logan

LONDON clubmen heard with more than regret of the death of George Logan, brilliant pre-war star of the Vegetarian C. and A.C., who was killed in a road accident in Wales. It will be recalled that while serving on an aircraft carrier Logan was seriously injured when a 'plane wing crushed his head. For a time he suffered from loss of memory and on return to this country—the accident taking place in the Middle East—he was discharged from the Fleet Air Arm and subsequently found work in Wales.

More Rubber

A PROMISING area of rubber-bearing trees, so far untapped, has been found on the Gold Coast.

Ersatz

CLOTH, springs, and jointed wood are being used by the Germans as bicycle tyres.

Cycling Munition Worker

LADY HEATON, wife of Sir Frederick Heaton, chairman of Short Brothers, makers of aircraft, is herself a munition works manager, and travels to and from work by bicycle.

Given to Trust

TWO more houses have been given to the National Trust. They are Sir Isaac Newton's birthplace, Woolsthorpe, near Grantham; and St. John's Jerusalem, Sutton-at-Hone, Kent.

Hostels Not Open

THE youth hostels at Nethybridge and Laggan are not opening this year.

Looking down on the pretty little town and harbour of Killybegs, Donegal Bay, Ireland.

Around the Wheelworld

By ICARUS

Roadfarers' Club—Chairman and Secretary Honoured

THE Roadfarers' Club was formed in July, 1942, with the object of consolidating, without favour to any particular type of road user, all of the varying road interests. Its members include famous motorists, motor-cyclists, cyclists, hikers, and those famous in the administration of the roads. Lord Brabazon of Tara, its president and ex-Minister of Transport, the late Sir Henry Maybury, Sir George Beharrel, Lord Iliffe, Sir J. Cooper Rawson, Mr. A. P. Herbert, M.P., Prince Birabongse, W. J. Bailey, A. J. Ballantyne, Percy Bradley, Bob Carlisle, C. G. Grey, Lord Kenilworth, Major-General Loughborough, Prof. A. M. Low, J. A. Masters, Lieut.-Col. Mervyn O'Gorman, Lieut.-Col. J. A. A. Pickard, G. L. Samuelson, G. Geoffrey Smith, S. M. Vanheems, Major H. R. Watling, H. G. Wells, Sir Harold Bowden, Major Frank H. Bale—these are but a few of the names associated with this already famous organisation. Within the year it has achieved a most important and influential membership.

It is already accepted as a national body, and it has before it a most important task in helping to frame a post-war road policy acceptable by all road users.

The chairman of council, Mr. J. Dudley Daymond, and the secretary, Mr R. A. West, were honoured for their services during the first year at a dinner given by the council at the Clarendon Hotel on Friday, July 9th, with C. A. (Bath Road) Smith in the chair. It was a happy occasion. The first speaker to pay tribute to the two guests of honour was Mr. A. H. Bentley, in the grounds of whose delightful bungalow at Sunbury-on-Thames the rules of the club were framed and the club itself sprang into existence. He said that the most difficult year in the existence of any organisation was the first formative year, and the fact that J. W. Daymond had conducted a large number of council meetings and dinners, that the membership of the club had grown to such gigantic dimensions, and that it had within the short space of a year become an accepted national body, was a tribute to the ability and wise chairmanship of J. Dudley Daymond, who had been able to superimpose on his position as chairman nearly 40 years of experience of committee work in various capacities. It had been a year of hard work for all concerned, but the chairman was the guide who must keep the meeting within the bounds of the agenda, and help to frame its policy.

The secretary, too, had had a difficult time for correspondence is heaviest in the first year.

Mr. E. Coles-Webb paid his tribute to both, and Mr. J. L. Callway and others spoke in similar terms. Mr. E. P. Richford, the treasurer, was congratulated upon the success he has made of his job as treasurer. The annual general meeting of the Roadfarers' Club will shortly be held.

Fewer Children Killed on the Roads

MAY'S record as the most dangerous month for children on the roads was lost this year, when the number of children killed fell to 78.

In May, 1941, the total was 166—more than twice as many—and last year it was 134.

Until now all efforts during the war to secure a reduction in the number of road accidents to children have met with little success. The latest figures, however, show that the number of accidents can not only be reduced, but reduced very substantially.

The extent of the reduction also encourages the hope that, as a result of the popularising of the kerb drill by the Press, the B.B.C., and the combined efforts of the police, schoolteachers, and road-safety workers, the tide of street accidents among children may be on the turn. The kerb drill instructions are: "At the kerb, halt. Eyes right, eyes left. If all clear, quick march."

Accidents to older people show a decrease of 18, and the grand total for the month of 431 deaths among children and adults is the lowest recorded in May for many years. The injured numbered 8,972. Of this total 2,222 were seriously hurt.

National Road Race Championship

THE National Committee of the British League of Racing Cyclists have decided upon a National Road Race Championship in order to find the champion massed-start rider of the country.

The race will be held on Sunday, September 5th, and will be started at 1 p.m. There will be 25 riders, selected by the National Committee from the current best performers up to the time of the meeting, which is on July 25th. The course will be approximately 65 to 70 miles, and up to the moment there are two selections for the venue: (1) Starting at Bridgnorth, and proceeding to Ludlow via Clee Hill, thence to Church Stretton, Much Wenlock, and finishing at Bridgnorth; (2) starting in the Harrogate suburbs, and proceeding to Ripon, Pateley Bridge, Grassington, Coniston, Burnsall, Bolton Abbey, and finishing in the Harrogate area. This is the more severe course of the two.

The race will be run as a means also of providing further funds for the Red Cross and St. John organisation.

Police approval will be asked for, and in the light of this season's races so far held, every co-operation from the authorities in these road races may be expected.

These are the preliminary details of an event which will serve to create a type of rider who would be a well-trained international when competition is once more available on the Continent, for the committee hold that the Park and Circuit races as proposed by the N.C.U. cannot provide the training necessary, and in consequence British riders go out to compete with the Continentals with an inferiority complex to begin with.

A resident in Leeds, who has had 25 years' experience in Continental racing and management, has offered a silk jersey for the winner of the championship, which, like those awarded on the Continent, can be worn by the rider in all his races during the next year.

Wanted—a Slogan

THE Cycle Manufacturers' Union has great pleasure in offering a new bicycle for the best slogan bringing home to cyclists the need for making the 20,000,000 cycle tyres, now regularly in use on our roads, last as long as is safe to the riders.

There are many incidental causes of tyre wear — delayed repairs, kerb-mounting, wheels badly aligned, stones and thorns in the cover, defective valve rubbers, and damage from oil and grease. But the main reason is soft tyres.

Writers of slogans have therefore a wide range to choose from, and for their guidance I may quote one slogan which has already had considerable success: "All Hands to the Pumps!"

Envelopes marked "Slogan" in the top left-hand corners should reach Camden House, 201, Warwick Road, Kenilworth, Warwickshire, not later than the first post on Saturday, July 31st, and I hope that every reader of *The Cyclist* who appreciates the seriousness of the rubber shortage will send in his or her effort.

Road Safety

IN a speech made by Mr. P. J. Noel-Baker, M.P., Joint Parliamentary Secretary to the Minister of Transport, at Preston, recently, on the opening of Road Safety Week, he said:

"No thinking citizen any longer doubts that the problem of road safety must be solved. But it will not be solved without big, perhaps what some will think revolutionary, advances in the planning and construction of our roads.

"It is a common illusion that good roads are a luxury which add perhaps to the comfort and pleasure of existence, but give the nation no economic return.

"In fact, they give an economic return which, if we could measure it, would amount to scores of millions of pounds a year. Consider only one item in the account—the case of traffic congestion in our larger cities. Some years ago I used to travel from Liverpool Street Station, and, to reach it, had to go by bus or taxi past the Bank. I remember often helplessly sitting in the traffic blocks, wondering if I should miss my train, wondering how many other people would do the same, wondering how much that traffic block had cost the nation. Hundreds of engines ticking over for many minutes on end; the long account in petrol, oil, wear and tear; the waste of the wages of hundreds of transport workers many hours a week; the loss on the capital invested in the vehicles which are standing idle; the wasted time of all the passengers that might have been productively employed; all that must go into the sum which we seek to calculate.

"And let us remember that after the war it will be difficult for the nation to meet the bill for imports, and that petrol is a major item in our import account. Can anyone doubt that replanning and reconstruction will pay the nation, if we did nothing else but cut out the traffic blocks and save the waste of materials, vehicles, wages, and time which is involved."

Hume's Bicycle

I MENTIONED in a recent issue that I cast doubt upon the late H. W. Bartleet's claim to have possessed the bicycle upon which Hume won the first bicycle race on pneumatics at the Queen's College Sports, Belfast, in 1889. Accordingly I placed all of the facts before Major H. R. Watling, O.B.E., J.P., Director of the British Cycle and Motor Cycle Manufacturers' Union, Ltd. I thought he was the best individual to approach, since Bartleet's collection of bicycles was presented to Coventry. Major Watling placed my letter before the Town Clerk of Coventry, with the suggestion that the Coventry Corporation invite Mr. Alf Bednell, J.P., who is a practical bicycle manufacturer, to view the alleged Hume's bicycle and advise. In the interests of historical accuracy (and I am sure that Bartleet would have been the first to admit he was wrong) this matter should be settled beyond all cavil.

Cyclorama

By H. W. ELEY

Argyle Tower, Edinburgh Castle.

"A Spot of Fishing"

WHITSUNTIDE was not very kind as regards weather, and I felt sorry for hard-worked munition workers, snatching a very brief holiday from their labours . . . and on Whit Monday, instead of basking in sunshine, being drenched by the torrential storms which were such a feature of the Whit week-end. The Clerk of the Weather might have been a little more considerate, but we must not grumble; holiday-makers did their best to ignore the rain and the sleet, and smilingly got on with their chosen holiday pleasures. Many, taking advantage of the "bringing forward" of the opening day for coarse fishing, spent quiet and happy hours by the side of river or stream or lake. I was one of a happy band which endeavoured to lure perch and roach from a quiet Midland pool . . . and with some measure of success. Angling is one of those pastimes which you either love . . . or hate. You are either born with a fondness for standing by a stretch of water, and watching a float, or you just consider the whole business futile! Well, I know of nothing more appealing, or more restful, than a "spot of fishing"; I like all the business of digging for red worms, procuring "gentles," preparing ground bait, and then the quiet hours by the water . . . the excitement of pulling out a sizable fish . . . the munching of bread and cheese, and the swallowing of ale, as one takes a rest. And now the season is with us again, and my treasured rods in use again, and I look forward to that grand and glorious day when I shall pull out the biggest bream ever caught from that still pool where, by the rushes, one may fish from a punt all day and never see a human soul. But enough . . . or non-anglers will get murderous thoughts!

"Tyre Economy" Exhibition

THE "Tyre Economy" Exhibition, held with such marked success at Berkeley Court, in London, has, I see, been transferred to the provinces, and I hear that it was equally successful in Birmingham, where tyre users attended in goodly numbers and saw examples of tyre abuse, and obtained all manner of hints on how to make tyres last longer, and conserve that precious commodity, rubber, which has aptly been described as the "Nation's No. 1 War Material." After opening at Manchester, the exhibition proceeds to various other provincial centres. This is good work in connection with the war effort, and the cyclist should remember that the care of tyres is a matter for him, as well as for the lorry driver.

The Month of Roses

JUNE is traditionally the "month of roses," and when riding around the outskirts of North London recently I gathered the impression that this was indeed a good year for roses. On the clay ground of Middlesex, roses always do well, and I saw some magnificent blooms in dozens of gardens . . . all the old favourites, Emma Wright, Christine, Lady Hillingdon, Ophelia, Covent Garden, Lady Wavertree, Lady Inchiquin . . . there they were, glorious and colourful, and if the modern rose, in gathering increased beauty of form has lost something of its scent, well, we cannot have everything. And not only in the country and in the suburbs do roses abound . . . I commend all who can to visit the Rose Garden in Regent's Park, where there is a great mass of colour and rich beauty. One June day I sat in the garden for half an hour, and realised anew how rich is Mother London in oases where one may escape from the noise and the bustle, and dwell amid flowers and birds . . . the surroundings so rural that one might well imagine themselves to be a hundred miles from the Metropolis.

Showcards

FREQUENTLY I talk with cycle dealers, and many of them lament the non-existence of showcards and window bills which used to be such a feature of the advertising programmes of cycle and tyre firms before the war. Well, paper and cardboard are other "war materials" which have to be conserved, and I am afraid that we cannot look for a return of the fine advertising material which used to reach dealers with such regularity, and in such generous measure, until the "job" is done. But many dealers are making the best of a bad job, and making their windows as colourful and attractive as possible . . . sometimes with much ingenuity I believe that when the war is over, and there has been time for the production of raw materials, we shall see a tremendous flood of advertising, which, whether we like it or not, must be regarded as having proved itself long ago as a powerful factor in creating sales. And we shall certainly have to create some sales after the war if we are to regain, and retain, our great position in industry. The competition will be fierce—but Britain has great industrial resources, and, what is more, great trading traditions.

Cecil Rhodes

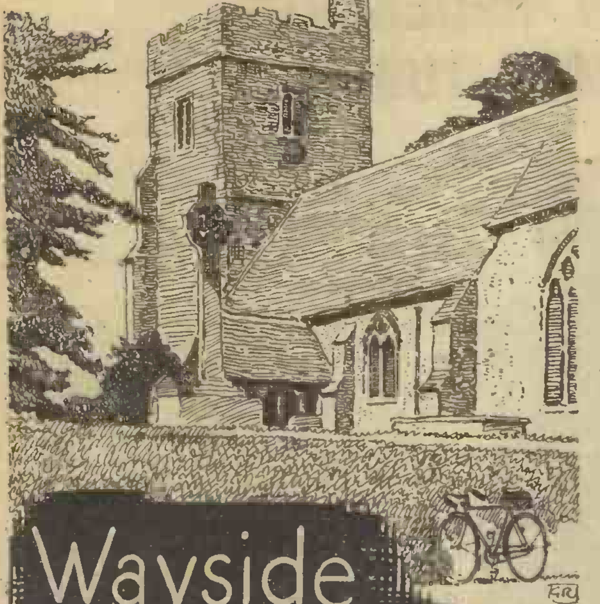
I FOUND myself not long ago in the pleasant town of Bishop's Stortford, in homely Hertfordshire, and of course my memories were chiefly of that remarkable Empire-builder Cecil Rhodes, who was born in the Vicarage in the town in the year 1853. Bishop's Stortford is doubtless proud of her illustrious son, who did so much to encourage the vision of Empire. He accomplished a prodigious amount of work in a short life, and I recall that I have read somewhere that his last words were, "So much to do, so little done." Other men might have considered that they had done a great deal . . . but Rhodes had his own conception of accomplishment! He sleeps in a lonely tomb hewn out of the rock of the Matoppo Hills in his beloved Africa.

Pageant of Nature

AS I write these rambling notes, I look out on to a pleasant lawn, fringed by laurel bushes. A mother thrush is busy, first tugging a worm out of the lawn, then speedily hopping to one of her plump babies, who waits with wide open beak for the dainty her mother has secured. And this process is repeated time and time again . . . baby thrushes, like most young birds, have an amazing appetite, and it takes many worms to satisfy it!

A tawny-billed blackbird, possibly with her own brood somewhere in the bushes, endeavours to rob the thrush of a particularly fine worm . . . and a battle ensues. I feel glad that Tawny-Bill loses and has to retire! The Pageant of Nature is ever set before us . . . if only we have eyes to see, and a heart to understand.

George Logan, who is awaiting his discharge from the Navy.



Wayside Thoughts

BY F. J. URRY

The Easy Way

I WAS out some weeks ago on a lone trail when the rain and wind were splashing the road and disturbing the air, and into that steady deluge I perforce had to pedal to make my way to my destination. On most occasions when I am travelling from town the younger folk pass me easily, even the sloppy riders middle-footing it and standing on the pedals at every tiny rise, but this evening I was the overtaker, sometimes to the surprise of the overtaken, one of whom gathered momentum to ask me how it was I seemed to ride so easily into that gale. There are many answers to that question, but I think the one my inquirer needed was the one so many cyclists would be wise to understand. It is merely this: to acquire the simple ability to ride correctly. And by that I mean the right use of legs and arms when a mixture of the elements are flung in your face. Mainly, I suppose, it is leg-work that tells, for get that action correct and the rest will automatically settle itself. Presuming the saddle position is right, then use the thigh as the beam of power and the lower leg and ankle as the toggles attached. Sit well back on the saddle and let the thigh do the pushing—steady pushing—not the jerky pressure that is so often concerned with the dancing action. Using the lower leg and the ankle as toggles means, in effect, what is generally known as "ankle-action," the lifting of the heel as the pedal reaches its lowest point, and the dropping of the heel as it starts to descend. And, don't forget this, lift the whole of the leg on the upward stroke, for so many folk allow the descending leg to assist the other one to rise. It may sound complicated, but in actual practice it isn't, and after a very short trial the action becomes automatic, simply because it is so much easier to ride correctly.

Poor Stuff

IT seems a pity to me that when the supply situation was such that we could only hope for a limited number of new machines from the factories, the decision was made that such machines should be of a certain quality, and, to be candid, that quality does not reflect the capabilities of the manufacturers. I know the matter is a difficult one, and there are many details with which I am not conversant; and I suppose I shall be told we ought to be thankful to the powers that be for providing the wartime machine. But, because I love cycling, I am sorry the wartime machine is no better than it is, for the simple reason that many thousands of people are returning or being introduced to a type of bicycle which is not the ideal. I should have thought it would have been possible to market a wartime machine in the middle-class range, which surely would have been a far better proposition for the industry and the rider, and would have taken no more, but probably a little less, bulk material. We were told at the beginning of hostilities that quality in bicycles would not suffer, and no doubt the manufacturers made those statements in perfectly good faith, and are now impotent as far as alteration is concerned. If someone says to me seriously: "What is the matter with the wartime machine?" I would like to refer that questioner to the club folk lucky enough to possess a pre-war model, and he will hear the truth as recognised by the cyclist who rides for pleasure as well as convenience. The fact is, the wartime machine is not properly representative of the bicycle as it can, and as it ought to be sold to a public anxious to try out this cycling game: which is why I utter this regret. I know the good machines will return, but many thousands of others don't, and they don't believe you when you tell them.

Well Kept

THE day I was 64 was of typical April inconsistency. It happened to be a day early in Easter week, and as I was in Wales with my family, the occasion was ripe for travelling part of the stretch of road that I had first toured in the company of the Guv'nor 54 years ago. How well I remember that first adventure into the then unknown, and the easy restraints my fond parent imposed on my young enthusiasms. I do not know how many times I have been over that road since 1889, but the journeys must run into dozens—spring, summer, autumn and winter wanderings—until I know every mile of that always charming route. On this occasion I was at Llangollen, and my people said they would meet me at Bala at noon, that I could leave my bicycle there and join them on a train trip up that climbing line that runs to Festiniog. The 24 miles to Bala by the Dee Valley route constitute as beautiful a stretch of A5 (as far as Corwen, Telford's road) as any of the long miles I have travelled, but a westerly gale of cold rain rather interfered with the glory of the ride to Corwen, but thereafter came splashes of sunshine with intermittent showers. Little traffic, much wind, the gold of the gorze and the snowy delight of wild cherry: such was my portion, wedded to a sense of joyful fitness that made me a happy man of 64 springtides, for one does not feel the weight of the years when the practice of cycling has been so constant a pleasure. I met my folk at the station, went with them to celebrate the day with coffee, and then caught that funny little train running into the Arenig hills by stream and moor and lake, often clinging to the mountainside along a rocky shelf, until it emptied us at Trawsffyndd Lake Halt, that lovely place in the hills which the North Wales Power Company has made lovelier by the formation of the fine lake.

In Luck

WE did not know what was waiting for us in that lovely spot where only a café sits by the roadside; but we were lucky. The day was cool and very windy, the hills were misted, and the usual glorious view of Snowdonia was under the weather; but even so there were compensations, for the café gave us hot oxtail for lunch with all the essential trimmings, sweets and cheese and tea, so the birthday celebration was as merry as any other in the land. A walk by the lake shore where the wind found every hole in my raiment, and darkened the waters as it struck, made me thankful for a jersey; and then away to Bala again, where I picked up my bicycle for a wind-borne journey back to Llangollen. I was in no hurry, but that gale took me in hand and bustled me along to the summit of the Boot Pass (the mountain route home) just in time for me to find a primitive bus shelter to save caping-up. For half an hour I smoked contentedly and watched the marvellous panorama of storm cloud come sweeping out of the Arans, trailing grey curtains over the wide valleys to be followed by the fickle sunshine, touching the bracken to bright bronze, and making the thousand shades of green shine in beauty. Then the long checked descent to A5 short of Corwen, where another burst from Pluvius sent me to the tea-table, what time the rain went trampling down the street in splashes, making Corwen a place where only an occasional stone lorry seemed alive. That was my last watery interruption during those 10 lovely miles of lazy wind-borne riding. How I enjoyed them, with the hills clearing in the evening light, and the whole valley lit with the intensity of April that gave to the term "spring-cleaning" a new definition. But O! my beautiful woods. They lie hereabouts on the seared hillsides, a sacrifice to the needs of the times; but will they be replanted, and when? Shall I see those hillsides clothed again?

Our Roads

MANY people are busy on post-war planning, and none more so than the interests concerned with the roads. It is no more than the bare truth to state that unless the public take a little more interest in their property—the King's Highway—they will wake up to find themselves in danger of losing their ancient rights thereon. That is not a fairy tale. Since the advent of transport interests in the road the idea is undoubtedly to use our big trunk highways for purely commercial purposes, and finally to bring about the exclusion of other forms of traffic. In other words, to acquire the public highway for the furtherance of private interests. I know this statement will be categorically denied simply because it is not admitted, for admission by the powerful transport interests would immediately raise public antagonism and probably wreck the schemes for acquiring the ends such interests have in view. Looking at the whole question objectively, I am not at all sure that I blame the big road transport interests for getting ready to take action which may lead to a loss of public privilege in reference to the roads, for if the owners care so little for their property that they jeopardise their rights to the free use of it, they are merely asking for changes which they may not welcome, but which they almost deserve because of their own neglect of this most important question. I find in my own circle of friends that the present vested right in the free public use of all our roads is accepted as an immutable law, and no one, however powerful, can possibly tinker with that. No, the amendments, if they come, will not be by the process of direct action; they will be insinuated little by little, and as each is accepted, possibly with some criticism and grumbling, the next one will be set in train, until a new generation will discover how false we common people were to our guardianship.

Room for Compromise

I HAVE known the road so long and so intimately that nothing can still my interest as long as I am *compos mentis*. I have seen its outline change, its amenities improve, and its rehabilitation under modern conditions; yet its fascination still persists, and the interest in its many types of user still grows. And talking to all sorts and conditions of folk along its miles I cannot believe the fierce antagonisms that flare up now and then mean there is no route to be found for compromise among the too often quarrelling interests. After all, we are Britishers, used to compromise and the decency of adjusting the other fellow's point of view, and since none of us, I presume, want the new conditions which must come to be dictated by a body of civil servants, we surely ought to endeavour to sort out our own troubles and make a respectable job of an agreed approach to the problems that call for solution. I have my own ideas on this wide question, nor have I sought to hide them; and am prepared to listen to the notion of other people possessing other interests. But I am convinced that unless the public take a hand in this matter that so vitally affects their own interests, their voice in the councils to be will be a very feeble one as compared with that of the great minority seeking special privileges. For this matter and its final settlement might easily be vital to the future of cycling interests, the least troublesome to authority—in comparison with its numbers—of any road users. That fact cannot be stressed too often in these days, when cyclists are frequently made the scapegoats in road troubles, for I would point out to you that always it is the cyclist who collides with the car, bus or lorry, never the other way about. Think this question over; it is important now and it will become more so.

Club Notes

Missing in East

SERGT.-PILOT BERT WHEELER, of the Willesden C.C., is reported missing from air operations in the East.

Death of Veteran

JOE ARMSTRONG, who has died at the age of 85, was the oldest cyclist in the north-eastern counties.

Secretary in India

JACK WRIGHTSON, well-known as the former racing secretary of the Bon Amis C.C., is now in India.

Rankin as Secretary

JOHN RANKIN is again time trials secretary of the Barnesbury C.C., as J. Jones has been called up.

Scots Revival

THE Larkhall Roads C.C. has been revived, with Alex. Gilchrist and Tom Hamilton, both leading Lanarkshire cyclists, as members.

Death of Rotherham Wheeler

A. BROOKES, a member of the Rotherham Wheelers and formerly a time trialist, in spite of a crippled leg, has died.

Hendry Wins Cumbrae Event

ALEX. HENDRY, Glasgow Wheelers, won the Clarion massed-start event round the Island of Cumbrae with a time of 2h. 48m. 10s.

Best Girls' "25"

RIDING in the Midland Ladies' open "25," Joy Drage, Eleanor R.C., clocked the fastest girls' "25" of the year, 1h. 7m. 50s.

Hawkes in Navy

R. E. HAWKES, fast Cambridge Town and County C.C. speedman, has joined the Royal Navy.

The Man in the Car

By "NEMO"

TWENTY-TWO miles from home at half-past eight on a dark wet night, with a facing wind and a puncture in the back tyre of the bicycle! What would you have said when the motorist offered you a lift? So did I.

Although a bicycle looks small compared with even a small car, it is not easy to take it on board without removing wheels and scratching paint, but my new friend made light of the matter. Upending my machine with one strong, certain movement, he soon had it firmly wedged in position half in the open boot of his car, with sacking well placed to prevent scratching of either vehicle. As I took my seat beside him in the car, I remarked: "That seemed fairly easy"; and he laughed before replying: "Yes, it *is* easy when you've once found out how to do it."

From my earliest days as a clubman, I had learned to look down on cars and their users, and at one time I should have scorned to accept such a lift. But I could not deny that it was worth it. I had cycled some 80 miles already that day, and there had been a good deal of cold and wetness. The last bit home was going to be the hardest of the lot, and I had reached the stage when I felt no real need of further exercise. Inside the car it was just pleasantly warm, the seat was quite different from a B17, and I could lean back and stretch my legs.

Yes, he said, he was a cyclist himself, and, owning a car for business reasons, he sometimes combined cycling and motoring, and that was why he knew how to fix a bicycle with such speed and confidence.

As we made our way homewards through the darkness at a tranquil 30 m.p.h., I learned that he had been a clubman for many years, knew the surrounding countryside as only a cyclist can, had toured widely, and in road competitions had come to the timekeeper's notice in no uncertain manner. So he really was a cyclist, but he had also done some motoring, and he admitted that there were times when he would sooner be in a car than on a bicycle. "To-night, for example," he said. I agreed with him, and not only from courtesy, for my escape from the task of mending a puncture in the dark and wet, and from a hard ride against the wind, was something to be thankful for.

Thousands of miles of looking where I am going when cycling in the dark made me fix my eyes on the bright patch of road in front of us. My friend was using the single-masked headlight that motorists accepted with such pitiful wailing when the war made it necessary to restrict lighting, but I could see the road and objects on it for many yards ahead. But, of course, I was not driving, and so I asked: "How do you manage with wartime headlights?" And my friend replied: "There's no difficulty whatever, if you know the road, and you concentrate on what you're doing and you're not such a damn fool as to try and go at 40 or 50 miles an hour."

"Do you have any trouble in seeing cyclists without rear-lights?" I then asked.

"None at all," he said. "Because you've got to be all the time looking out for pedestrians, anyhow, and they don't have rearlights, and they do the most idiotic things. However, I've never been near hitting anything in the dark yet, although if you want to be safe you've got to be ready to make up for the different brands of jay-walkers who wander about the roads without bothering what they are doing. It usually takes two to cause an accident, and if you make sure that you're not at fault yourself you have a pretty good chance of keeping out of trouble. Otherwise, anything can happen. The other night I saw two cars that had collided head-on in the middle of a four-track arterial road. Evidently two of the cheerful idiots that drive on the white line."

"Do you find the white line useful?" I asked.

"Oh, yes," he said. "But it can be a danger for the thoughtless driver. The main thing about it is that it enables you to keep on the road, even on a very dark night when the edges are indistinct. If the line is newly painted and the road is reasonably straight you can follow it at any speed the car can make, but what the careless motorists forget is that it doesn't let you see obstructions any better than if it wasn't there at all, and so high speed is just suicidal, or, worse still, murderous. A lot of people seem to have the idea that if you can't see anything ahead the road must be empty, and the white line encourages them to go fast when it's just mad to do so."

"Would you have bought a car if you hadn't needed it for business?" I then asked.

"No; I don't think so," he said. "It's quite nice to use one occasionally for visiting friends who live beyond easy cycling distance, but it's not worth the expense for such odd journeys as that. There's no particular pleasure in motoring itself, but it can be a means to an end. I find driving in the daytime either tedious or irritating, according to the amount of traffic on the road. If there's nobody about it's very dull and mechanical. If you meet more than a few cars they become a nuisance. Before the war, cyclists disliked the heavy motor traffic on main roads, but I think motorists hated it more than they did. When you're cycling the biggest nuisance on the road is the motorist, and when you're motoring the biggest nuisance on the road is the motorist again. Of course, during the war things are different, and I'm spending as much time as I can on my bicycle, to make the most of the empty roads. There's a peace on the road now that will go for ever when the war ends."

"That's quite true," I said. "I like quietness as well; and I've never known anything like we have at present; but it's a bit hard to enjoy it when you remember, now and then, why there are so few people about."

"Yes, I know that," my friend replied, "but I think that in wartime we must forget occasionally or go mad, and I find the bicycle a great help. Riding at a reasonable speed you have to give some attention to the road, but not too much. When I'm walking, I find myself thinking about all sorts of things—such as work—that I don't want to think about. When you're motoring, you've just got to concentrate on the road, but when you're cycling, it's something in between and the mind seems to get its best rest."

"You believe, then, that as a pastime cycling is better than motoring?" I asked with purposeful understatement.

"There's no comparison at all," he said. "In the car you just slump into an easy position that's probably not healthy, you either starve with draughts or suffocate, and you get no exercise at all. When you get out at the far end, you breathe the fresh air and it's marvellous, but somehow you feel lazy and unappreciative of the country you've reached. You've just dumped yourself in another place. On the bicycle you get fresh air all the way (a bit too much at times perhaps), you get long exercise that doesn't half shift the poisons out of your system, and when you get there you do feel you've done something.

"I know what you mean," I said, "but I've sometimes wondered whether a car wouldn't be an easy way out for someone who's not as young as he used to be. Some of the places you like to go to are a long way from home and if you happen to be going to one of them when you're a bit off-colour and it turns out to be a hard day, you may have had more than you want before you get there and you think, over the last few miles, 'If I'd come in a car, I'd be feeling better than I do now, no hard work, just ease and comfort!' I've felt like that more than once."

My friend smiled at this. "So have I," he said, "but it doesn't work out like that. You may cycle to a pretty village or a fine viewpoint and you like it when you get there, but it's really the ride that has given you most of your pleasure. Do the same journey in a car and the place seems quite different. No, what makes the enjoyment of cycling is the fact that it is personal effort. Dodge the work by riding in a car, and you don't get the same effect at all. The country unfolds itself in front of the windscreen as if you were looking at it in the cinema, and when at last the film jams, and the picture doesn't change, you've got to your destination."

"Well, it certainly takes a grip on you," I said, "and even after a lot of tough going that makes you fed-up with cycling for the time, in a few days you are as ready as ever to go for another ride. And you must be right in saying that the cycling counts more than the scenery, because when you come to think of it, in an ordinary winter Sunday's cycling, you ride about a third of the way in darkness, and most of the country you do see is familiar to you. But it's not the same with motoring you say?"

"Not a bit," replied the driver, "you are just a parcel in a van, and though you may be driving yourself, there's nothing in that. Cars are now made so that they can be driven by backward children, and no one of ordinary intelligence can get any kick out of driving —unless he goes in for the dangerous stuff. You can get a lot of interest out of that, no doubt, and nobody would mind if it were only your own life and property that you endangered. As a matter of fact, nobody minds *very* much if you damage somebody else, it's wonderful what motorists can get away with. They are quite the most pampered class. But motoring itself is no pastime for any sane grown-up. Certainly it won't satisfy anyone who's been a cyclist."

We had now entered the suburbs of my home town and my friend had slowed down.

"If you'll drop me at the next corner," I said, "I can walk home in five minutes." Smoothly we came to rest, and got out into the cold, wet wind.

"Thank you very much indeed," I said, when he had lifted down my bicycle and closed up the back of his car. "I'm glad to hear you think there's nothing like cycling, but I must say it's been nice to ride with you to-night. I wish I could always be picked up when things are not going so well."

"Don't you believe it," he said earnestly, "the whole thing is to take the rough with the smooth. Sticking it through the bad times makes you appreciate sunshine and following wind. The harder the fight on the way home, the better it is when you get there. Well, I'll be getting along now, so good-night."

My Point of View

BY "WAYFARER"

St Mary the Virgin. Adderbury (Oxon) "For Strength"

Mixtures

A REFRESHMENT house in the Midlands exhibits the sign: "Café. Antiques." It is to be hoped that the two trades are kept quite separate . . . especially where eggs (if any) are concerned! At a Leicestershire restaurant, where I had lunch the other day when on tour, was displayed a notice like this: "A mixture of butter and margarine is served to customers in this establishment as bread and butter." No objection can be taken to the mixture, but on what is it spread?

Flippancy

THE occasion was the monthly "tea party" at the factory where I toil and spin. Suddenly the chairman (an ardent gardener) said: "I wish it would rain!" (He has since had his wish, as I know from personal experience!) In reply, I murmured: "But not at the week-end. It has been fully established that week-end rain is no good at all to gardeners or farmers." People paused in their consumption of spam, or glitto, or vim, or whatever it was we were eating, and looked at me in amazement. Then they realised that a seriously-spoken dictum was actually a flippancy!

'Prentice Hand

A VERY amateurish article entitled "A Cycling Holiday," recently published in a provincial weekly newspaper, leads off by stating that wartime conditions have "brought the humble bicycle back into fashion." So that's what has happened to the "humble" bicycle, is it? Then the writer, having made the profound discovery that "bicycles require neither petrol nor garage," goes on to ladle out some sound advice, of sorts, to the would-be tourist. We learn that 40-50 miles a day can be done quite comfortably, that an attaché-case, strapped to the back carrier, is *the* way of carrying your luggage, that your bicycle should be "well overhauled" by an expert before starting out, that you should see that your oil-can is full, and that your lamps should be in good order. I hardly think that the 40-50 m.p.d. tourist will need to bother about lamps, especially with lighting-up time lingering in the neighbourhood of midnight, nor is the full oil-can of much importance. As oil-cans have a nasty habit of automatically distributing their contents, and as it is hardly likely they will be needed for their intended purpose during, say, a fortnight's tour, they can quite safely be left at home. I have not carried oil for some 25 years, preferring to rely on garages should lubrication be necessary—on the chain, for example, after rain. A reference to "these days of no sign-posts" indicates the value of the contribution referred to—if the above quotations have failed to achieve that end.

Interval for Tea

THE Boy and I had meandered through exquisite lanes all the afternoon, forgetful of the passage of time, until we came to a stream, swiftly flowing and deep, which effectively cut our route in two, and said "No" to traffic, whether on wheels or feet. We loitered on a flimsy wooden bridge provided for the benefit of pedestrians, with or without bicycles, and pondered over the recollection that this primitive ford was but a dog's bark distant from a great main road. The hand of what-we-call-progress has touched and developed that road, which, in normal days, carries a considerable burden of quick traffic, whilst this water-splash is reckoned among the things that are unchanged and unchanging. As we lingered there, enjoying the liquid gold of the sun, and the green of the trees, and the promise of the fields, an adjacent church told the hours—five of them, though three only, if everybody had their rights and Authority had refrained from "interfering with the clock"! (Or should it be seven?)

"Tea-time!" cried the Boy. . . . "Let's." Thus we made our way out of the lane-maze which had held us, streaked over a main road, and pushed along a roughish secondary road to join a rising highway that would carry us to the distant ridge now within our vision. So, in the fullness of time, we came to a hillside cottage with a roof partly thatched and partly covered with beautifully matured tiles, and, having successfully asked for tea, we stood and gazed at the loveliest of patch-work quilts which was spread out below us. It was a vista at once "grateful and comforting," and ever so inspiring, from which we were called away by the announcement that our tea was ready. Tea in the open before the wasp season is in full swing—what a joy it is! And what a delight to be eating bread and butter (and butter is the word to use!), with home-made jam and home-made cakes! ("This place ain't at war with the Axis," said the Boy, jocularly.) The interval for tea was prolonged whilst we sat there and baked. Thereafter we "got cracking," doing a 26-mile ride home with delight, in the golden splendour of that early summer evening.

Moist-feet Tour

AT the beginning of June last I carried out a week's cycle tour which was "the wettest ever" in my long experience, and which will go down to history (or thereabouts) as a moist-feet holiday. After the glory of the Spring, it was a disappointment to be treated in this scurvy manner, but I determined to make the best of it, and to keep smiling. I suffered no harm. On the other hand, going away with my annual (or biennial) cold, the drastic "cure" of a daily ration of wet feet proved very effective, and I was soon on top of my form. Some of the days were pretty strenuous, the most difficult being that on which my smallest mileage was done—55 miles against a relentless wind. Actually the breezes were unfavourable the whole time until 6 p.m. on the penultimate day, when I turned my back to Rude Boreas, and started for home. Where did I go? First from the Midlands to the east coast, and then plumb through the Midlands on a long round which brought me to Aberystwyth and back to Birmingham. I accounted for 562 miles through scenery and weather just about as diversified as it is possible to obtain in this country.

A "Packet"

SHE was one of those estimable ladies who profess to be able to "read" tea-cups and who can see in the tea-leaves a letter, a big building, a dark man (or woman), and all the rest of it. She sat opposite to me recently at a catering establishment, and, when I passed my cup for a fourth filling, she said: "Ooo! you're going to have a parcel!" How right she was! It had been a golden day, but the evening fell from grace. The sky clouded over, the wind rose, and the rain tumbled down. Enclosed in my cape, I had a hard tussle with the elements and was pretty moist on reaching home three hours after the fortune-teller had been at work. I received my promised parcel all right—but we cyclists call it "a packet"!

Notes of a Highwayman

By LEONARD ELLIS

Love of Rivers

MOST tourists seem to have accepted the doctrine of Ernest Pulbrook, who shows a great love of bridges in his "English Countryside." He says: "There is an allurement about the parapet and an enticement in the seductive call of the waters that are impossible to resist." We hear much of the love of bridges, but remembering that most bridges would not be there if there were no rivers, we must be fair and concede that much of our affection is for the rivers themselves. It is possible that we have used bridges for so long as a convenient place from which to gaze at the waters that we have really forgotten what we stay for. Let us therefore look at rivers for a moment and forget the bridges. Most rivers are attractive. They are cool and enticing in the hot weather; there is a tremendous fascination in their tireless meandering.

Riverside Ruminations

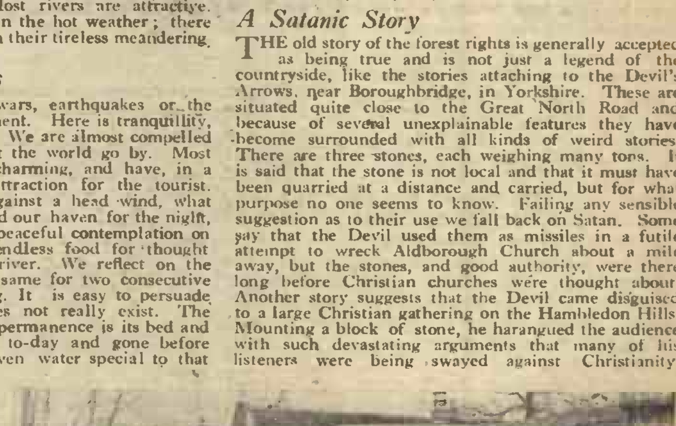
A RIVER cares not for wars, earthquakes or the overthrow of a government. Here is tranquillity, peace, and an object lesson. We are almost compelled to stand for a while and let the world go by. Most of our English rivers are charming, and have, in a differing degree, a great attraction for the tourist. After a hard day's grind against a head wind, what greater solace, having reached our haven for the night, than a pipe and a rest for peaceful contemplation on the river bank. There is endless food for thought in the contemplation of a river. We reflect on the fact that a river is not the same for two consecutive seconds, it is ever changing. It is easy to persuade ourselves that the river does not really exist. The only thing about it with any permanence is its bed and banks. The water is here to-day and gone before to-morrow, and it is not even water special to that river. It is just any spare storm water that is seeking an easy and sure way to the sea. The sea—another intriguing thought. No matter how far inland, we reflect that the water passing in front of our eyes is making for the great open sea, and will reach it eventually no matter how tortuous the route or how long it takes. Another lesson in perseverance.

Rivers and History

THE river reaches the sea only after a most amazing journey through all sorts of country, and touching the focal points of our island history on its course. This again is not an accident, and it would be quite easy to prove that the river was, in fact, mainly responsible for this or that event happening at that spot. A river too wide to be forded must of necessity be bridged, and, therefore, people travelling in opposite directions must meet at the only crossing place. So must armies, therefore many battles occurred near a bridge. Just consider the Warwickshire Avon and try to discover why so many battles were fought along its course. A lovely, peaceful English stream and yet from beginning to end its name suggests strife and bloodshed. It begins at Naseby, where Cromwell defeated Charles, and finishes at Tewkesbury, where Edward was killed and the Lancastrians routed. Battles took place at Edge Hill and Evesham. But enough of tragedy—all rivers are not tragic. Some are enticing throughout their length. Some, like the Windrush in the Cotswolds, appeal by their name alone.

A Satanic Story

THE old story of the forest rights is generally accepted as being true and is not just a legend of the countryside, like the stories attaching to the Devil's Arrows, near Boroughbridge, in Yorkshire. These are situated quite close to the Great North Road and because of several unexplainable features they have become surrounded with all kinds of weird stories. There are three stones, each weighing many tons. It is said that the stone is not local and that it must have been quarried at a distance and carried, but for what purpose no one seems to know. Failing any sensible suggestion as to their use we fall back on Satan. Some say that the Devil used them as missiles in a futile attempt to wreck Aldborough Church about a mile away, but the stones, and good authority, were there long before Christian churches were thought about. Another story suggests that the Devil came disguised to a large Christian gathering on the Hambledon Hills. Mounting a block of stone, he harangued the audience with such devastating arguments that many of his listeners were being swayed against Christianity,



The old bridge over the Windrush, Burford

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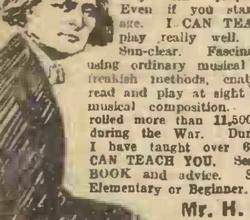

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