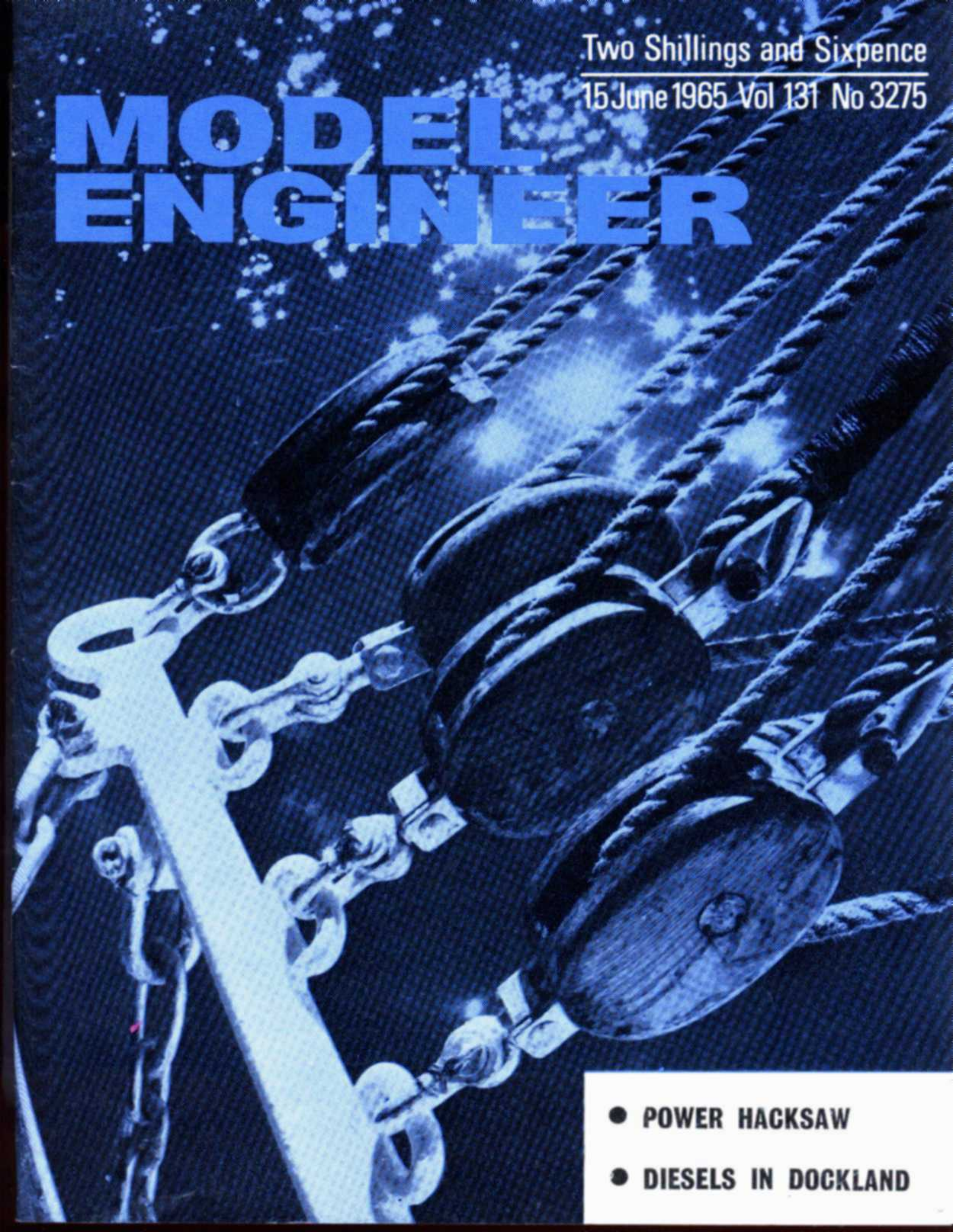
Two Shillings and Sixpence
15 June 1965 Vol 131 No 3275

MODEL ENGINEER



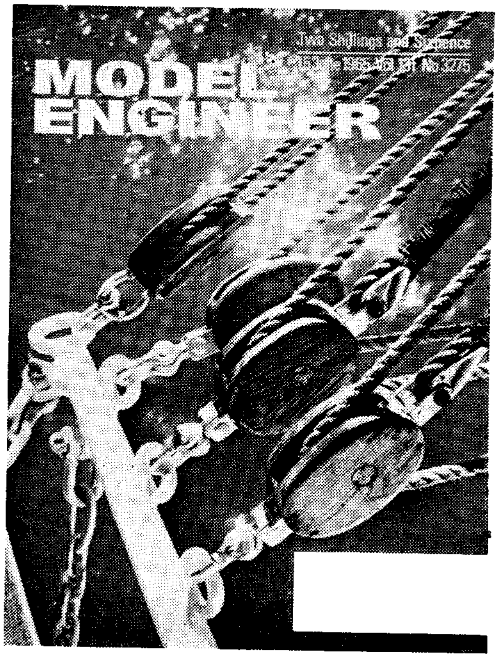
- POWER HACKSAW
- DIESELS IN DOCKLAND

MODEL ENGINEER

Incorporating Mechanics and English Mechanics and Ships and Ship Models

15 June 1965 Volume 131 Number 3275

Contents



Cover picture

Our fine cover picture, captured by staff photographer Brian Western when he went on board the SORLANDET *during the Tall Ships Race, has a salty touch to it—appropriate in this issue in which Joseph Martin writes of the 200th anniversary of Nelson's great ship, and Oliver Smith takes us one more step forward in modelling Scott's* DISCOVERY

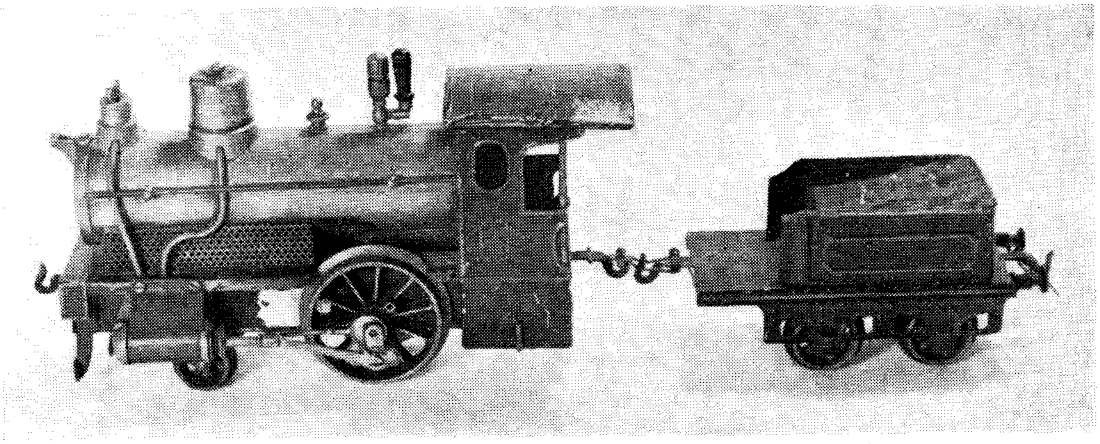
July 1 issue

Many people have dreamed of converting an i.c. engine to steam operation. Mr Kyrle Willans, engineering son of an engineer, describes an invention of his father which has possibilities for the experimenter

Braywick House, Braywick Road, Maidenhead, Berks. Maidenhead 21254

(Advertisement, Plans, Subscription, Circulation, Back Numbers and Accounts Departments are at 19 Noel Street, London W1. GER 8811)

Subscription 70s. (U.S.A. and Canada $10) post free



SMOKE RINGS

A commentary by VULCAN

Ambitious layout

MR E. PHILLS-WALKER, the Harbour Master of Kingston, Ontario, is currently engaged on laying an ambitious 1,500 ft live-steam track with motive power supplied by four locomotives.

Its unusual gauge, 8 in., was determined by the first engine he acquired, an 0-6-2 tank of 1875 vintage. Then, on a visit to Britain when I had the pleasure of meeting him, Mr Phipps-Walker bought his second 8 in. gauge engine, a 4-4-0, from the York SME. A 4-6-0 chassis came from a perusal of ME small ads, and the fourth, a *Midge*, he built himself. I imagine he is the only person in the world with four 8 in. gauge engines.

Mr Phipps-Walker is a member of an enthusiastic group of live-steamers who have just established a model railway club in Kingston. Eleven people turned up for the first meeting; twenty-five came to the second.

Restoring a locomotive

One of the tasks that this lively club has set itself is the restoration of an antique CPR 4-6-0 which they bought for $4,500. The engine was built in 1910 at the Kingston Locomotive Works, the largest in Canada.

The intention is to have the engine ready for display outside the City Hall in July 1967 when Canada will celebrate its first 100 years as a Dominion.

Mr Phipps-Walker is looking for a complete set of MEs from No 1. If anyone has such a set I will be glad to pass on his name and address. A good price will be paid.

If a full set is not forthcoming, he would consider No 1 to No 2588 (1898-1950).

Another toy train

A FEW years ago Alan M. Keel of Aston Clinton, in Buckinghamshire, acquired a toy engine similar to the one I wrote about on May 1. Like the Salvationists of Seattle, he too is mystified about the manufacture.

There are strong similarities between Mr Keel's engine and the one in America, but the Buckinghamshire one seems of later date.

Mr Keel's has the regulator combined with the reversing gear which acts with a single eccentric and reverses the ports. It has the further refinement that reverse can be operated from the track. Exhaust steam passes into the chimney. The smokebox door bears interlaced letters that look like " GnB " and one cab side carries the figures 1/48.

Another correspondent (see Postbag) has already identified the Seattle engine and the probability is that Mr Keel's is of the same lineage.

Questionnaire

THE analysis of the replies received to the Questionnaire have proved very heartening for they show that readers are well pleased with the present formula of the magazine.

There were one or two surprises, one of them being that requests for articles about Model Locomotives was only fractionally above the demand for Inventors and Inventions, Engineers and Their Work, Mechanical Curiosities and Museum Models. What was remarkable, too, was that features on full-size engines were almost as welcome as articles about models.

We would like to thank our many friends all over the world who responded to the Questionnaire. We appreciated the kind thoughts of many who added a few tit-bits of supplementary information for our guidance.

STA schooner named

THE topsail schooner now being built for the Sail Training Association will be known as *Sir Winston Churchill*. The name was adopted at the recent annual meeting of the association held at Westminster.

The vessel will be launched in November and will make her first voyage from Portsmouth on 13 March, 1966. Her commander will be Capt. Glyn Griffiths of the King Edward VII Nautical College, London, and she will have a permanent adult crew of five, including the master. Accommodation for 36 trainees will be provided and in addition three volunteer duty mates will be carried.

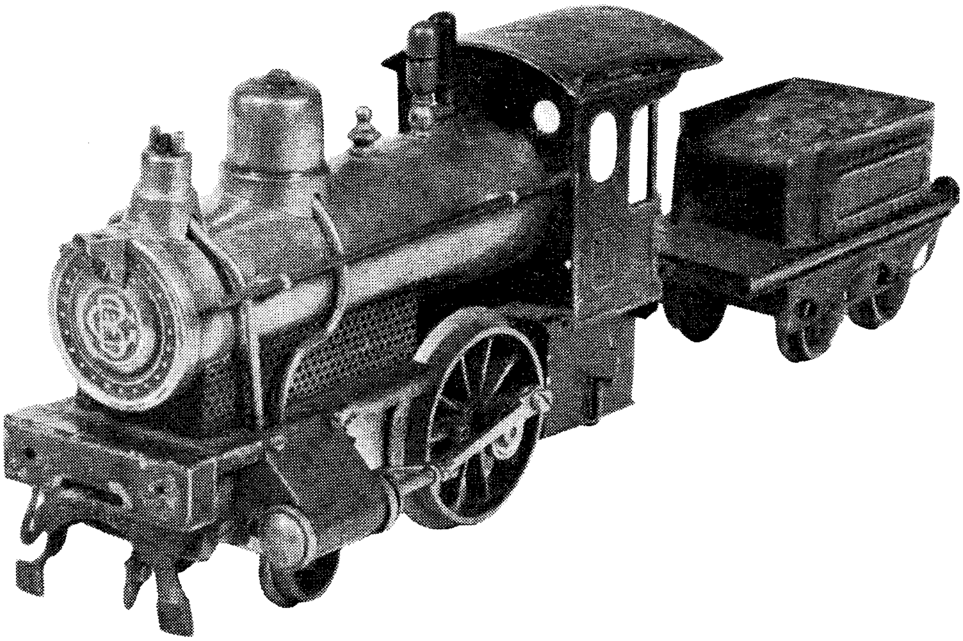
Philip Kershaw, our maritime correspondent, tells me that *Sir Winston Churchill* may take part in the Tall Ships race from Falmouth. The route will be across the North Sea to the Skaw, on the north coast of Jutland, and from there she and other vessels will cruise to Copenhagen for the centenary celebrations of the founding of the Royal Danish Yacht Club.

HMS *Serapis*

YOU may remember that on March 15, I wrote of HMS *Serapis*, the converted troopship in which the future King Edward VII travelled to India ninety years ago. She left Brindisi escorted by the frigates *Hercules* and *Pallas*, and with the Royal Yacht *Osborne* in attendance.

I was inspired to write of her by a painting at the Lowndes Lodge Gallery in London. The painting was by G. Meares, an official marine artist of whom I would like to know more. It was reproduced here—though not, of course, in colour with the flags and pennants gay against the sky.

Soon afterwards I received a kind letter from the Press Officer to the Queen. I now hear from a director of the Lowndes Lodge Gallery that the picture has been bought for Her Majesty. It should give her much pleasure.



Left and right: Two views of Mr Keel's toy steam engine, that bears similarities to the one given to the Seattle Salvationists

Triple effort

THREE public-spirited Danish preservation societies have co-ordinated their efforts to provide what must be a unique passenger transport system. Road, rail and sea are involved in an ambitious triple-service set-up.

The s.s. *Skjelskor,* operated by the Danish Veteran Ship Club, has regular sailings that connect with a train service between Maribo and Bandholm which is run by Danish Veteran Railway Club, and Maribo is linked with Saxkekbing by a double-decker bus owned by the Maribo Tourist Association.

The steamship was only acquired after a great deal of hard work by Mr M. H. Spies, a graduate in law at Copenhagen University and founder of the DVCS, which was inaugurated in 1963.

When sufficient enthusiasts had been found to form the Club the purchase of the vessel ran into difficulties. Denmark, at the time, was facing a financial crisis and the *Skjelskor* was already at the breaker's yard.

Use of publicity

But the Club made use of almost every publicity device to arouse interest and finally its efforts were crowned with success. The old steamship was bought, restored and put into regular passenger service.

The railway operated by the DVRC has several steam locomotives and a number of wagons and coaches. Two of the engines are over 80 years old. The KJGE was built in 1878 and the FAXE in 1879. The youngest one, now over 60, was built by the Vulcan Co. at Maribo in 1901.

Early coaches

Rolling stock dates from some of the earliest days of the line, then known as the East Zealand Railway Company, and it gives a good idea of the primitive conditions that was the lot of travellers of that period.

In connection with the rail trip, passengers may visit the largest park in Denmark, which is at Knuthenborg.

The double-decker bus, run by the Maribo Tourist Association, may be known to British readers of ME. It was originally in regular service in the Brighton area until it was acquired by the Association in the Spring of 1964.

On its way to Denmark it travelled through a number of European cities and the enterprising Danes made use of this to advertise the Veteran Triangle, by which slogan the triple preservation societies' passenger services are known.

Power hacksaw from pieces of scrap

"Just fix the work in the correct position under the blade" . . . J. V. Murton devises an interesting and useful tool in Johannesburg

MY small power saw is the result of many changes and alterations. The original was begun about three years ago as a copy, in principle, of the saw found in the average factory workshop, except that it was made as a bench machine.

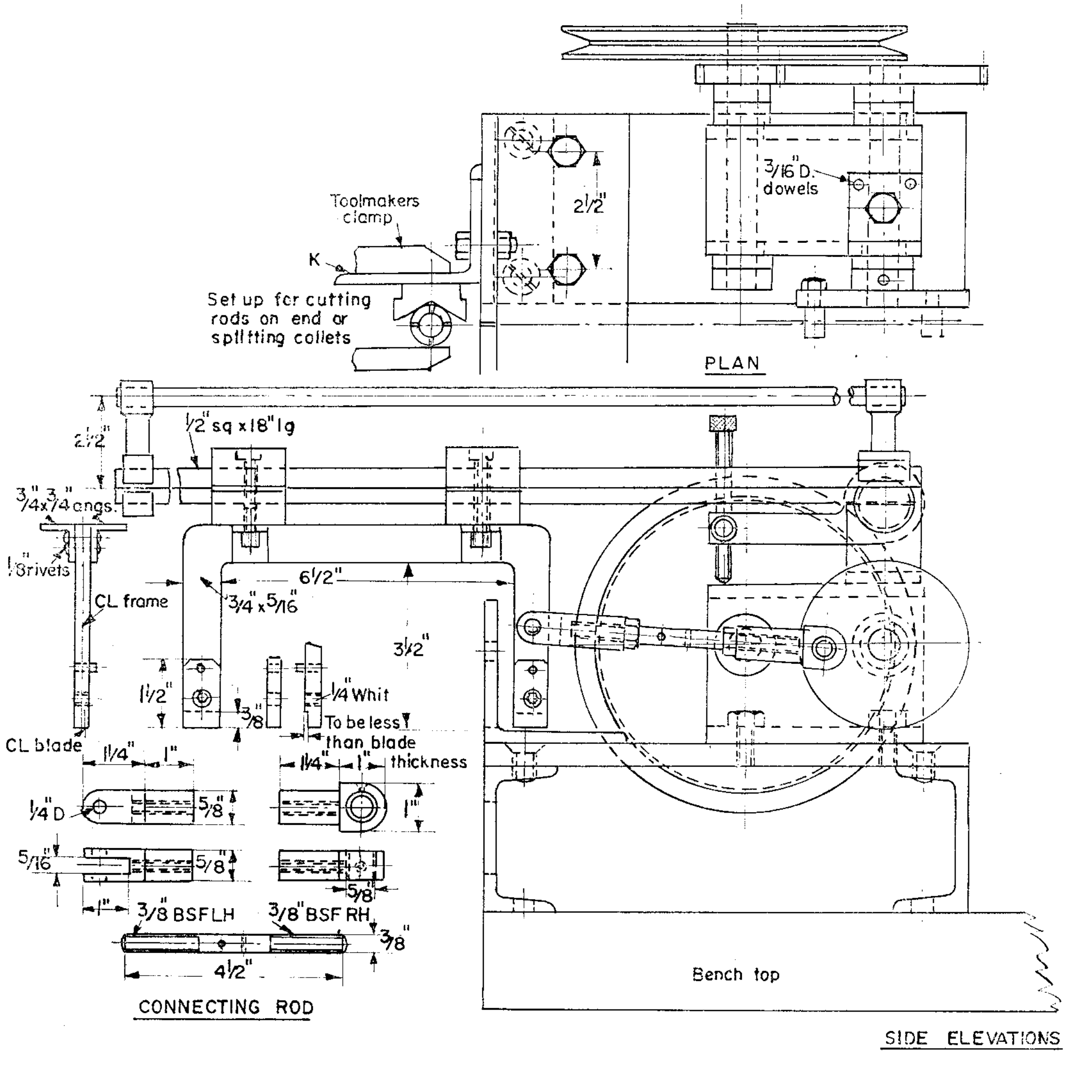
When I wanted to cut a piece of metal, there was always something in the way to make it difficult to hold. It seemed to me that instead of dealing with any shape of scrap material it was limited to the cutting of bars of round or square stock. When I wanted such material it was usually for a one-off job, and so the machine was not much used.

Then some miscellaneous scrap came my way, quite large structural plate, thick bar and off-cuts 3 in. round. The flat plate was particularly welcome, and I realised that I could not let a $\frac{1}{4}$ h.p. motor stand idle while I battled with big pieces in the bench vice.

I scrapped the baseplate (20 in. × $4\frac{1}{2}$ in. × $\frac{3}{8}$ in.) and cut a new plate from flat bar 10 in. × 4 in. × $\frac{3}{8}$ in. My idea was to break away from a horizontal base carrying a small machine vice and to have a short horizontal one which would provide a vertical face to which I could set up any work within its capacity as one would set up work on the faceplate of a lathe, with the advantage that as this face was stationary any C-clamps or toolmakers' clamps could be employed.

I placed the machine on the edge of the bench so that I could get the most use from it. It is driven from a countershaft at the back of the bench (if a motor is to be incorporated provision must be made for it). As the countershaft drives other machines, I remove the belt when the saw is not in use. The machine stands up out of the way and there is nothing to prevent free movement around the bench.

I made the whole from scrap except for the guide bar, for which I bought 18 in. of precision-ground $\frac{1}{2}$ in. square bar from Spear and Jackson of Sheffield. A box carrying the gears and shafts is bolted to the baseplate by two $\frac{3}{8}$ in. set screws. Two structural angle off-cuts $3\frac{1}{2}$ in. × 3 in. × $4\frac{1}{2}$ in. long are arranged in the form of a box and



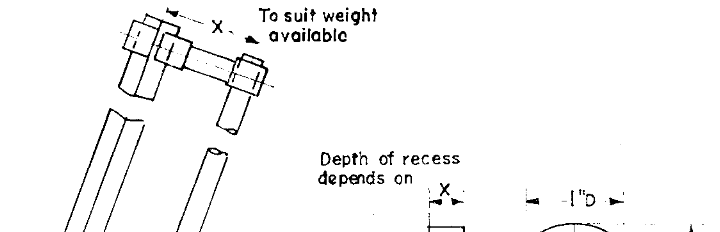
heavily welded along the outside of the toes. When you are ordering, stress the importance of having the weld built up so that it will machine to a sharp corner.

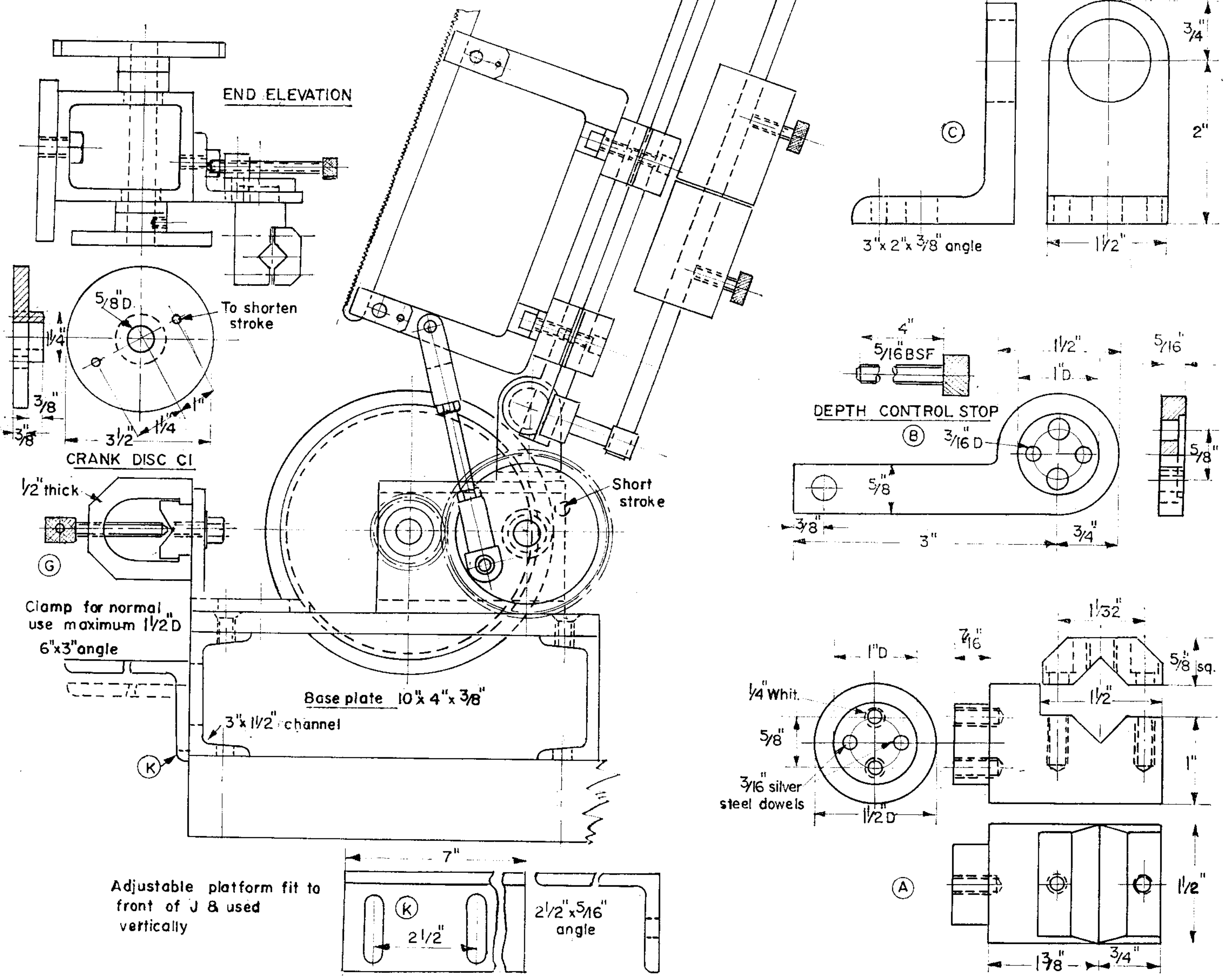
The gears are 16 d.p. Wheel and pinion have 70 and 24 teeth. The box is bushed with phosphor bronze, and the shafts are $\frac{5}{8}$ in. dia. I turned the belt pulley from a $3\frac{1}{2}$ h.p. motor cycle flywheel, machined it all over, and grooved it for an M-belt.

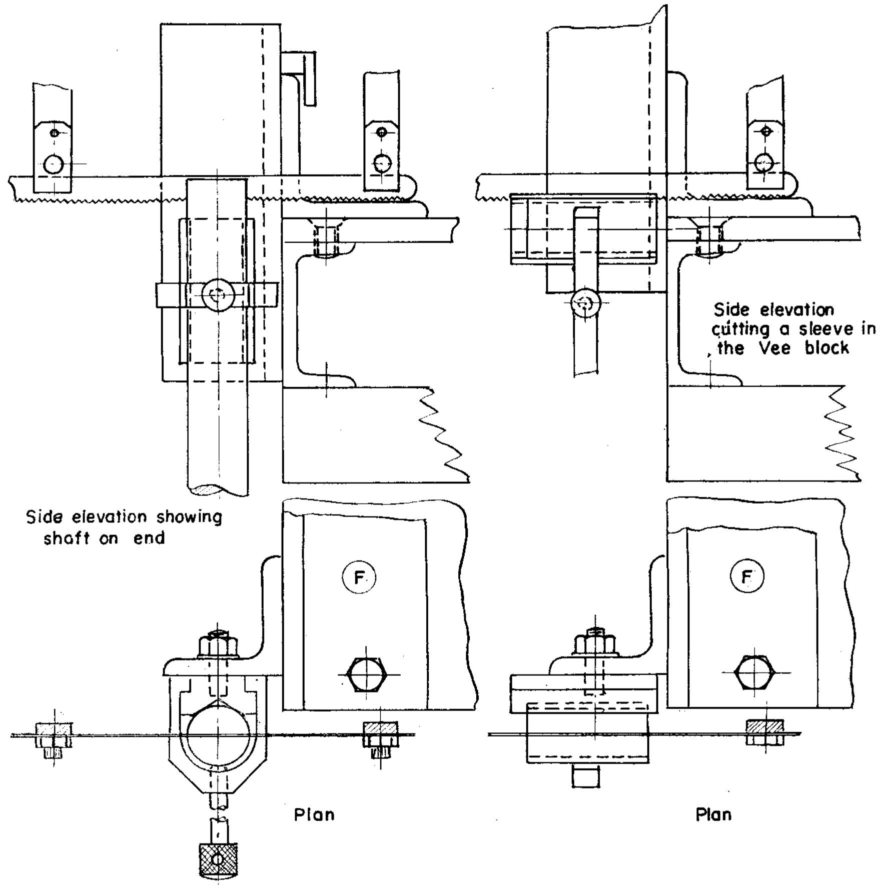
On the top of the box at the back is an assembly marked on the drawing *A*, *B* and *C*. This unit should be made carefully and assembled without any shake. It incorporates the pivot for the $\frac{1}{2}$ in. square guide bar on the one side of the angle *C* and an arm and depth stop on the other side. I can use the depth stop to control the saw blade by unscrewing it as the saw is working, or I can set it by locknut to a predetermined position just below the finish of the cut.

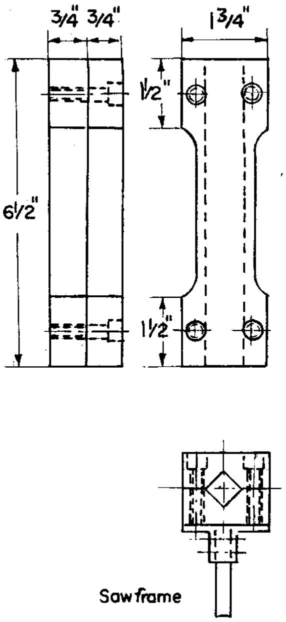
The slides will hold anything round from $\frac{1}{16}$ in. to $1\frac{1}{2}$ in. The edge of the V-block should be about $\frac{1}{8}$ in. from the blade; for larger round stock, I shall eventually try old cycle-chain on the principle of a pipe vice. I think that it would be much safer than a C-clamp. While I made the slides from some $1\frac{3}{4}$ in. dia. phosphor-bronze bar that I had on hand, a long slide of cast-iron might be much better. The temptation on designing such a slide would be to have cast flanges along the sides and bolts through, but the width shown ($1\frac{3}{4}$ in.) sometimes gets in the way and so it would be well to keep at or within that limit.

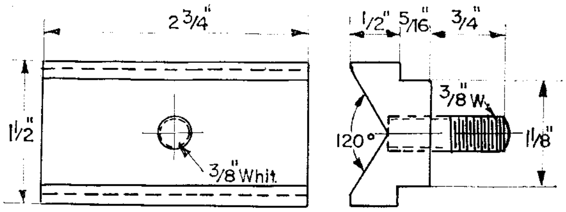
We do not tension the blade as is usually done. A little step is formed in each leg of the frame and the blade is clipped into it. Nor is the blade broken before use. Clip it at one end of the frame, with about three-quarters of the hole showing at the other end, and insert a punch to lever it before it is tightened. You then have a full 6 in. of cutting edge, and have done away with several unwanted



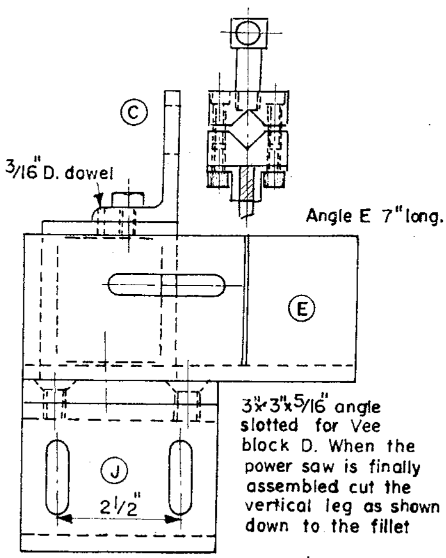








VEE BLOCK (D)



bits and pieces. What I am aiming at is a labour-saving device, not an exhibition piece—accuracy and efficiency rather than good looks. The blade is always in one plane and if the crank end is lowered $\frac{1}{16}$ in. it may give relief on the backward stroke.

Another useful feature is an adjustable connecting rod made with right-hand and left-hand threads which can be adjusted to give clearance where it is required. Channels 3 in. × 1½ in. and 4 in. long support the baseplate, and the back of the channel at the edge of the bench is a working face. This will carry an angle platform to extend under the blade. The small machine vice may be set on it at any angle and will be found extremely useful with the height adjusted to suit.

To be continued

Continued from June 1

Calculating the braking distance

by B. G. Hughes

THE amount of brake application required to stop the train at the desired position is soon learned. As a general guide, the train should be brought under control with a first application, followed by a second to bring it to rest. The brake should be released as the train comes to a halt so that the stop is smooth, and may be applied again if the train has to be held on a gradient. With the brake which I have described, the application can be made gradual and the full force is still available after several partial applications or releases.

To calculate the size of brake cylinder we take account of several factors: the normal working vacuum, the reduction in the volume of the reservoir when the brake is applied, the leverage of the brake rigging, the weight of the normal load, and the proportion of the load to be braked.

The full-size practice is to apply a force to the brake blocks equal to about 80 per cent of the empty weight of the vehicle. With models, the weight of the load carried is so great compared with the empty weight of the truck, and the tracks are so often greasy, that I have found a figure of about 40 per cent of the loaded weight a sounder basis. Taking my driving truck as an example, the weight with driver is about 200 lb. As 40 per cent of this is 80 lb., and the rigging has a 4 to 1 ratio, a pull of 20 lb. is required from the brake cylinder. The cylinder is $4\frac{1}{4}$ in. diameter with an area of just over 14 sq. in., which gives an effective area of 10 sq. in. at 70 per cent efficiency. To find the pull exerted by the brake cylinder, we must know the final pressure. While it can be measured with a vacuum gauge once the cylinder is made and fitted, it can also be calculated beforehand:

$$\text{Final pressure} = \text{Initial pressure} \times \frac{\text{Initial volume of reservoir}}{\text{Final volume of reservoir}}$$

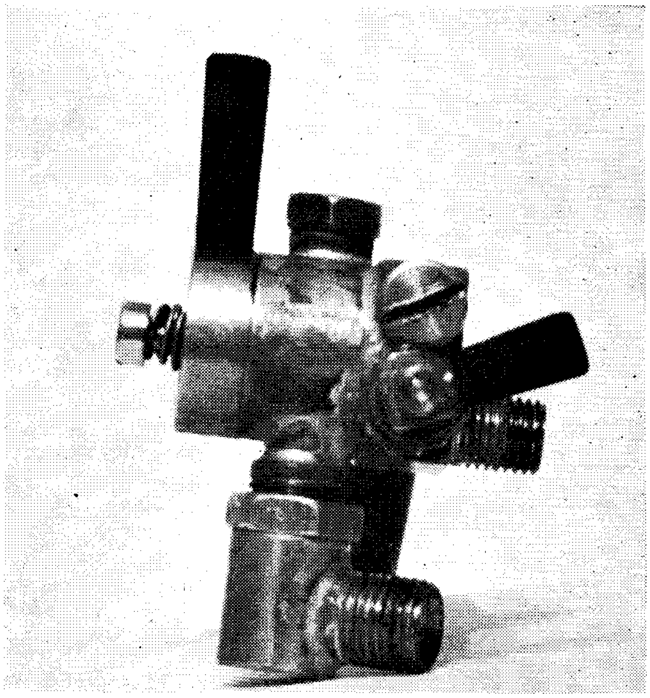
where pressures are measured in p.s.i., on the absolute scale.

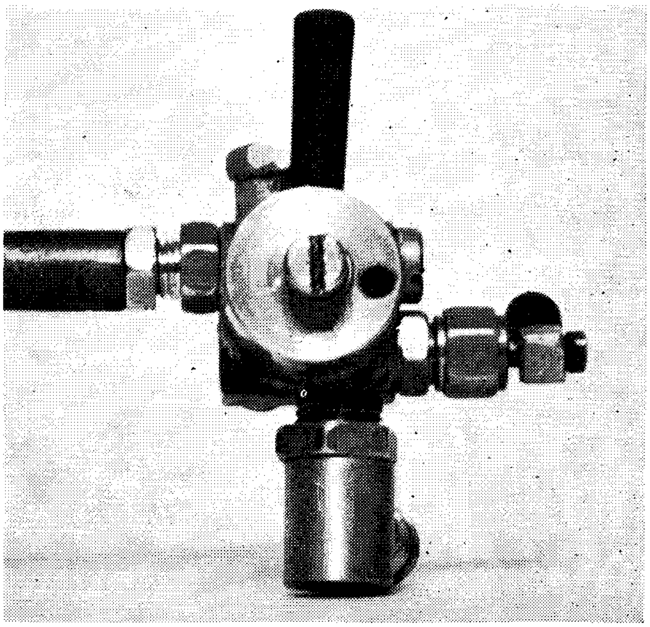
In the example quoted, the normal train pipe vacuum is 10 in. mercury, which is equal to 10 p.s.i. absolute, and the calculation is:

$$\text{Final pressure} = 10 \text{ p.s.i.} \times \frac{19.5 \text{ cu. in.}}{15.0 \text{ cu. in.}}$$

= 13 p.s.i. absolute

= 4 in. mercury vacuum, or 2 p.s.i. available from the atmosphere.





Two views of the combined brake valve and ejector

With this pressure and an effective area of 10 sq. in., the required 20 lb. pull is achieved.

In the picture of the underside of the driving truck the supplementary reservoir originally fitted can be seen. When it was connected to the brake cylinder, the vacuum in the reservoir did not fall so much, giving a greater brake force:

$$\text{Final pressure} = 10 \text{ p.s.i.} \times \frac{(19.5 + 20.5 \text{ cu. in.})}{(15.0 + 20.5 \text{ cu. in.})}$$

= 11.25 p.s.i. absolute

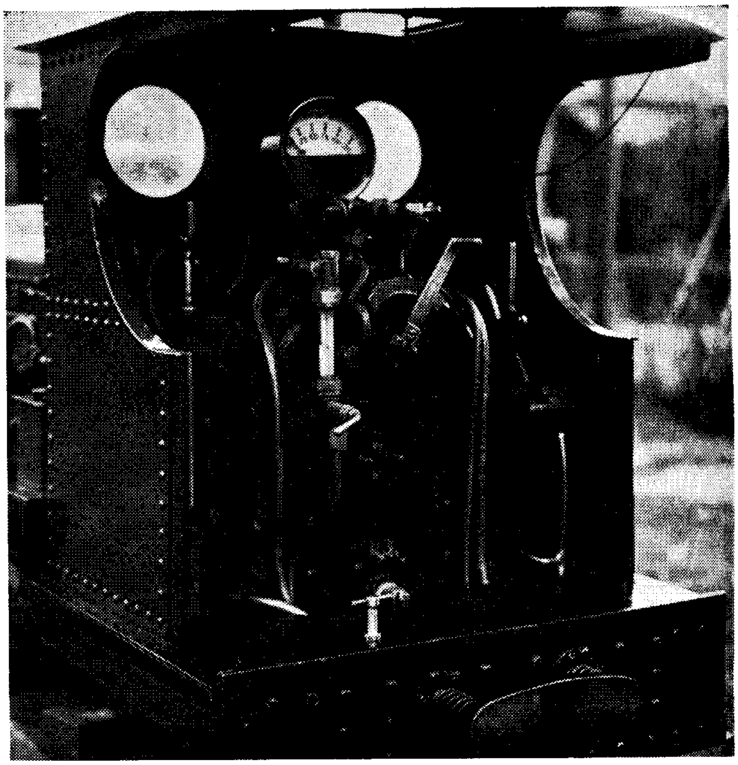
= $7\frac{1}{2}$ in. mercury vacuum or 3.75 p.s.i. available from the atmosphere.

An effective area of 10 sq. in. gives a pull of 37.5 lb. at the cylinder, and with the 4 to 1 rigging we have a total force of 140 lb. at the brake blocks, or 70 per cent of the loaded weight of the vehicle. While this provides very good braking in ideal rail conditions, it is too fierce in normal conditions and causes the wheels to lock.

Just as an alteration to the reservoir volume brings about a change in the available pressure, so does an alteration to the piston stroke. It is for this reason that we must fit some means of adjustment to the brake rigging to take up brake-block wear. At an extreme, overtravel of the piston can cause the pressure above it to equal the pressure below, so that the brake becomes ineffective.

While I am thinking mainly of train brakes, the same principles can be applied to those on the locomotive. Fitting automatic brakes to the engine would also serve as a form of insurance in the event of a breakaway.

My figures derive from simple experiment and calculation and are offered as a guide rather than scientific argument.



Brake valve of this $2\frac{1}{2}$ in. gauge Hunslett saddle tank is to the right of the reversing lever

NAVAL PINNACE OF THE 1913 PERIOD

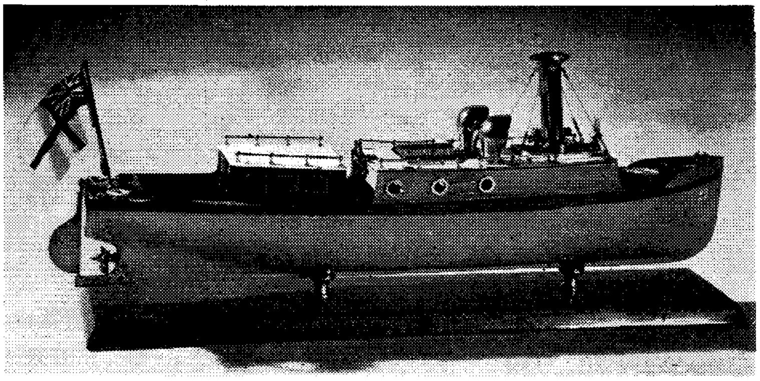
As a boy of thirteen in Europe with my parents, I admired the little steam naval pinnaces of the period and was determined some day to make a model. I made one—47 years later.

Despite a lifetime as a professional design engineer, I seem to be a complete duffer as a model craftsman. In fact, I have difficulty in drilling a straight hole through soft butter! Nevertheless, I have always loved model locomotives and ships and have built several, though I have never had the temerity to expose them to the critical eyes of British model engineers who seem, without exception, superb craftsmen whether their age be ten or ninety.

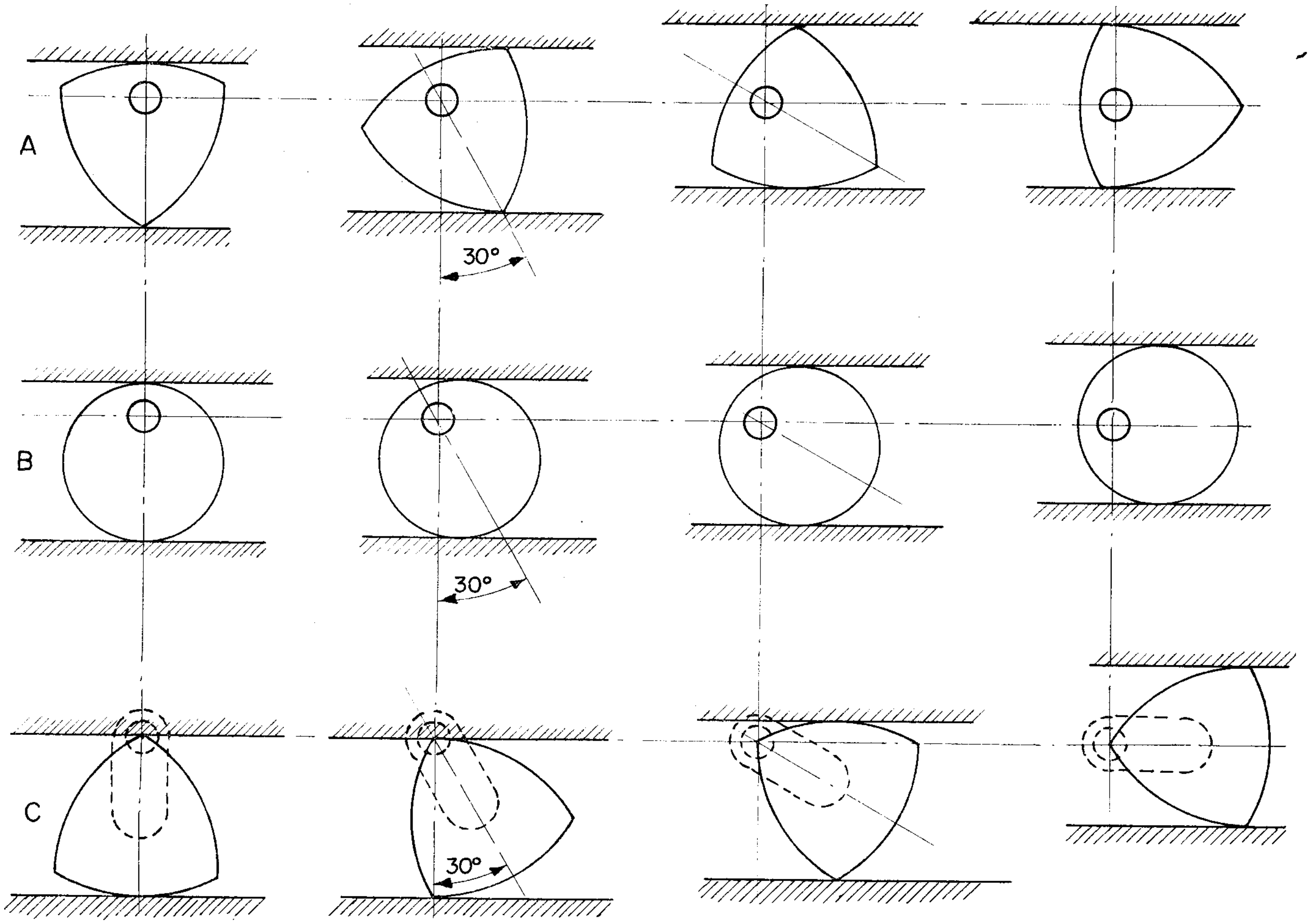
The little craft shown in the picture is 12 in. long and follows the plans of E. W. Hobbs. I carved the hull from a block of Philippine mahogany, excellent wood for any form of carving, while I was on a winter holiday in the West Indies. Exacto gouges were perfect for hollowing out the interior. For the decks I obtained some teak veneer about 1/64 in. thick and mixed some lamp black and shellac to represent pitch between the planks.

Unfortunately the power plant is not steam but a W & H HO. gauge electric motor. A steam plant in so small a model was beyond my skill. Besides, no one could put a proper steam plant in so small a ship—or so I thought.

Continued on page 435



Lyndon W. Burch of Boston, the distinguished American inventor, keeps a pledge which he made to himself nearly half a century ago when he visited the Old World



LAUBEREAU'S ENGINE

by Geoffrey K. King

MR H. E. RENDALL has my hearty agreement in what he says about the danger of using air compressed to 150 p.s.i. in an old beam engine. This figure is often quoted, but I wonder if it is really correct.

I also agree about the probable advantage which Laubereau obtained in his engine by providing a dwell at each end of the displacer stroke, using a triangular cam. But the arrangement shown in the drawing accompanying the letter (Postbag, April 1) is completely wrong and would not attain this result at all. In fact, it would be inferior to an ordinary eccentric.

My 1872 edition of Deschanel's book on Heat has two very good woodcuts of Laubereau's engine. One of them, evidently drawn from an early photograph, very clearly shows the correct arrangement of the cam in which the apex of the triangle coincides with the centre of the shaft, which is in two parts with the cam supported between them by two arms similar to crank webs. This is a well-known method of obtaining, with an equilateral triangular cam which has curved sides, a motion in which there is a complete dwell for 30 deg. on each side of top and bottom centre.

On my drawing I have shown the action from bottom centre to half stroke, in *A* for the cam as shown, in *B* with a circular cam of the same throw, and in *C* as actually used in Laubereau's engine, clearly showing that the cam in *A* would in 30 deg. movement displace the follower a greater distance than a circular eccentric of the same throw, while *C* would not move the follower at all for a movement of 30 deg. on either side of the dead centre. *C* has a longer stroke than either *A* or *B*, but only because I have made the cam of the same size in all three and it has greater eccentricity in *C*. The mechanics of this type of cam is worth remembering for aplication to other machinery.

I am very doubtful indeed about the addition of the two valves. The other woodcut in Deschanel shows a section through the displacer and power cylinders with the cylinders connected directly to the cold end of the displacer cylinder, as always with the original Stirling engines. The Stirlings embodied a regenerator as an essential part of their economy, and so a pipe and valves would very considerably negative its effect. Even here, where the only regenerative effect is in the space between the displacer and the walls, the circulation of hot air through the power cylinder could only lead to loss of heat in an engine follow-

Continued on page 446

Engineering drawing

Continued from June 1

by P. W. Jukes

Cross-hatchings and outlines

IN order to draw sectional views correctly, so that they can be clearly interpreted, we must work strictly to the rules or conventions which are used by the majority of engineers.

Cross hatching is done by drawing thin, equally-spaced lines at 45 deg. to the edge of the drawing sheet, unless the shape of the section is such that 45 deg. lines would be parallel or perpendicular with the outline, in which case another angle is chosen (see Fig. 30).

Assemblies: Adjacent parts are cross-hatched in different directions or with different spacing to emphasise them (see Fig. 31).

Outlines: Everything which is seen when looking on the cut face must be shown (see Figs. 32 and 33).

Standard Parts: Many machine parts such as cotters, nuts and bolts, have no internal detail and are more easily recognised by their external shape. Where the cutting plane passes through such parts *lengthways,* they are shown by external views and not in section (Fig. 34). When the cutting plane passes *lengthways* through a rib, spoke, gear tooth or similar thin part, the part is not sectioned. To do

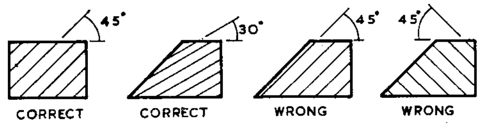


FIG. 30

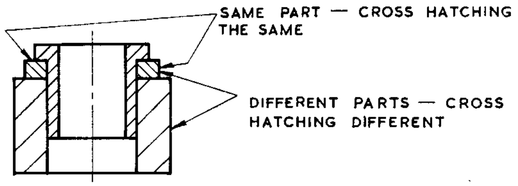


FIG. 31

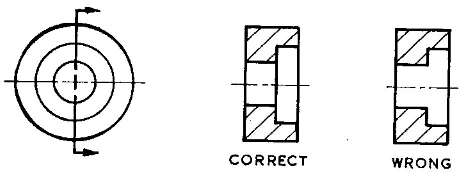


FIG. 32

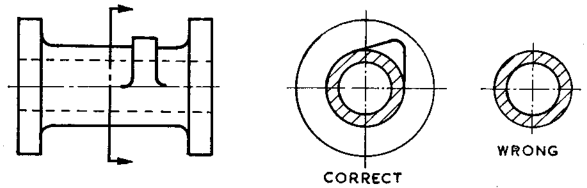
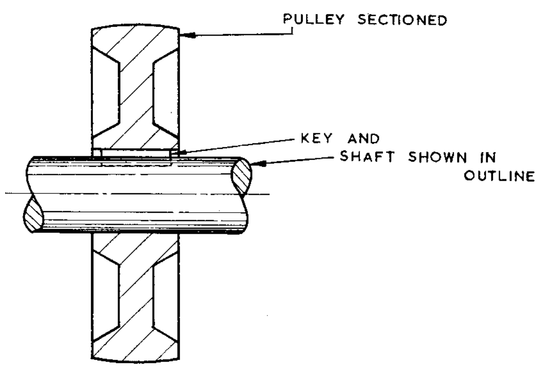


FIG. 33



SECTION THROUGH PULLEY AND SHAFT

FIG. 34

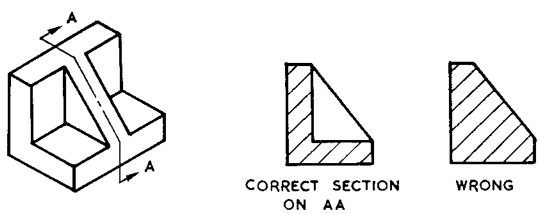
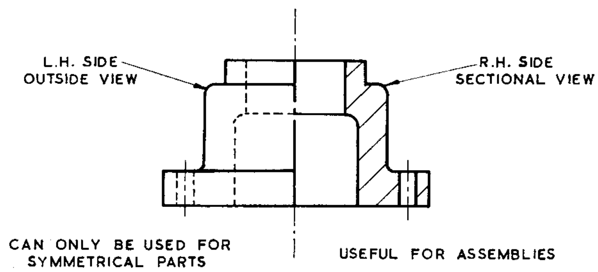


FIG. 35



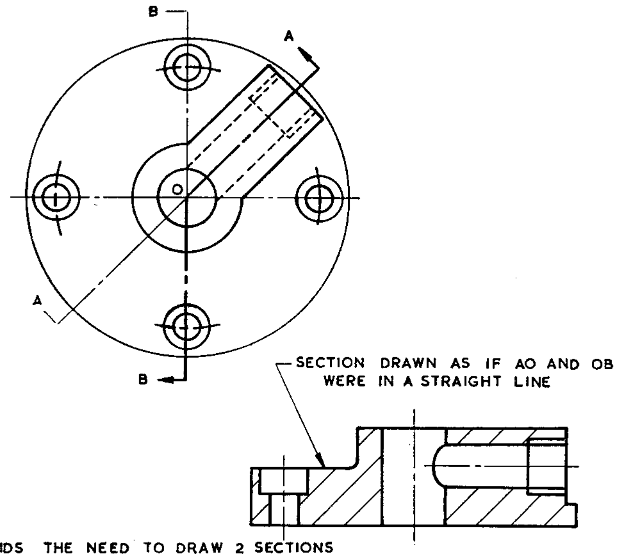
HALF SECTION

FIG. 36

so might give a false impression of thickness (Fig. 35). When the cutting plane passes *across* these parts, they are sectioned in the normal way.

Half sections, Sections in more than one plane, Revolved and Removed sections are used when the normal sectional view is inadequate or when it is unnecessary to draw the complete sectional view. Figs. 36, 37, 38 and 39 show how they are used.

To be continued



SECTION IN 2 PLANES FIG. 37

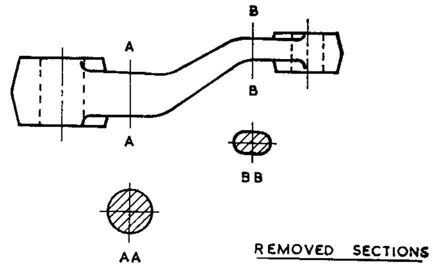


FIG. 38

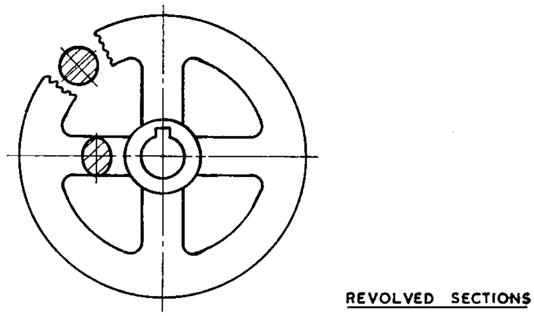


FIG. 39

NAVAL PINNACE . . .

Continued from page 432

The deck houses are of mahogany with removable tops and the after one has seats and tables. The fiddley grating aft of the funnel is made of old No. 80 drills, and the funnel is properly hinged to fold back when it is stowed aboard the mother ship.

I made the flare at the bottom of the smokestack from a Woolworth lipstick holder. It is surprising how many parts for a model ship or locomotive can be found at these low-cost chain stores: jewels for signal lights, steam domes, chains, and so forth. For a few pennies, you can get a selection that is worth its weight in gold when you are making a model ship or railway part. My advice is that you use imagination and lay in a good stock, especially at the cheap jewellery sections. (I assume that "dime stores" are the same in Britain as in North America).

The ventilators were a problem. I finally made a wood form and with my dentist's help produced a mould to cast two out of low melting-point alloy, of the sort used to pour into pipes so that they will bend easily. They were then put into a copper plating bath until about 0.015 in. of metal was built up. While the low temperature alloy was still inside, the ventilators were buffed to a high polish. Then the alloy was melted out in hot bacon grease and a brass flange was turned on the lathe for the base.

I carved the steering wheel out of one piece, embellished it with a brass wire ring around the rim, and stuck the head of an escutcheon pin to each spoke handle. The wheel operates the rudder by deck cables and pulleys.

The painting presented a colour problem for an American, as my memory of 47 years ago was not sufficient for me to know what colour scheme was used. I wrote to ME and to my surprise and delight I received a most courteous and complete reply. It seems that Rear Admiral C. M. Blackman was asked to supply the details, which told of several painting schemes depending upon the location, the rank of officer and so forth. I chose the all-grey and put on twelve coats, each well rubbed with pumice. The final finish looked and felt well-nigh perfect, and I thought that even my perfectionist British cousins could not but admire this part of my model.

In fact I was quite pleased with myself and my model until one day about two years ago. I was in the Royal Service Museum in London and chanced to see Captain Isard's 12 in. model pinnace complete with a two-cylinder reversing engine and proper tubular boiler! Needless to say, my balloon of egotism was soon deflated. ■

Pinnace, formerly a fully-rigged small vessel used as a tender to a larger one. In the British Navy a pinnace is a boat provided with sails and oars; it is bigger than a cutter and smaller than a launch, and is rowed by ten to sixteen men. Steam pinnaces are carried by nearly all large ships, especially in the Royal Navy.—*From a description at the time when the author was a boy.*

NOVICE'S WORKSHOP

Continued from June 1

DRILLS and DRILLING

by Duplex

DRILLING holes is one of the earliest of workshop practices dating back into the mists of time, but it is only of comparatively recent date that the drill itself has undergone much development, the progress being stimulated by the improvement in drilling machines and the need for tools capable of working at high speed.

Types of drill. Those originally used by craftsmen were of spear-point form, their manufacture being within the capabilities of the operator himself. They were knocked up in the blacksmith's forge, filed to shape, and then subjected to a hardening and tempering process. Such drills were incapable of producing accurate holes or even of drilling quickly, and so it is not surprising that by the early part of the nineteenth century, when the great industrial expansion began, efforts were made to manufacture drills that would produce accurate holes speedily.

These developments resulted in the straight-fluted form, sometimes to be found today and eminently suitable for drilling sheet brass and similar metals since it does not tend to grab when breaking through.

The straight-fluted drill does not readily clear itself of swarf, and it became necessary to develop a drill that would do so at the higher speeds then being demanded. Thus the twist drill was evolved, having first been manufactured in carbon steel then later in high-speed steel to cater for the increase in cutting speed.

With the variety in materials now in use it has been found that, for some classes of work, the normal spiral is not the most advantageous. For this reason drills are made with either a faster spiral for aluminium alloys and the like, or a slower spiral for dealing with brass and its alloys. The variations in form referred to are illustrated in Fig. 2.

You will see an additional type of drill in the illustration. This is the stub drill, so called because of its stubby character. It is a useful tool, about half the length of a normal or jobber's drill with resulting increase in rigidity. For this reason it will give excellent service when used in hand drills, either electric or hand-driven.

A word should perhaps be said about the materials or steels from which drills are made. Carbon steel is used for cheaper drills which, if carefully used, will give reasonable service; but they easily overheat and lose their hardness if run at too high a speed. Their life between grinds for sharpening is much shorter than that of drills made from high-speed steel.

As might be expected, there is a big difference in the cost of the two materials, consequently a high-speed twist drill is the more expensive. Nevertheless, if much drilling is contemplated the extra cost of high-speed drills will be found to be well worth while.

Centre drills. As you will see in Fig. 3, this tool is two drills in one; a small diameter pilot drill and a larger drill, really a 60 deg. countersinking cutter. They were originally developed for machinists who needed a rapid means of forming accurately the female centres for mounting work to be turned in the lathe.

Although the beginner is unlikely to need them for their original purpose, he may well find one or more invaluable when picking up the centres for holes at the start of a drilling operation in one or other of the column-mounted electric hand drill devices now on the market.

It will be noticed that centre drills are made double-ended; this is an advantage since, in the event of breakage, the opposite end can be brought into use.

At one time the number of different sized centre drills presented anomolies, but this matter has now been regul-

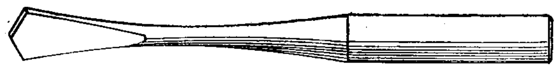


Fig. 1: Spearpoint drill

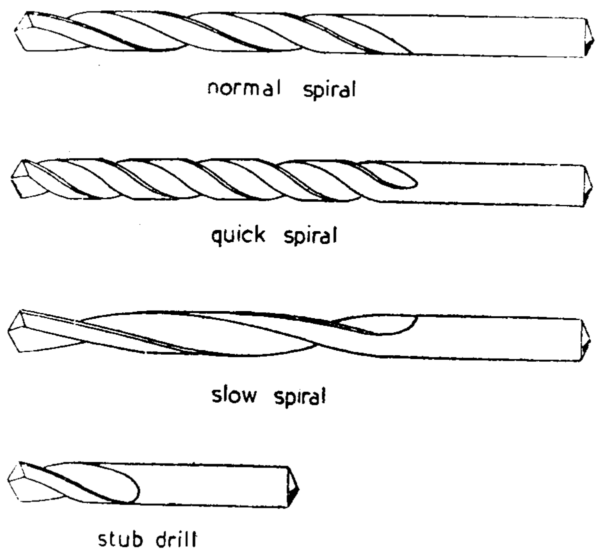


Fig. 2: Forms of twist drill

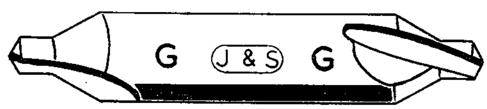


Fig. 3: Centre drill

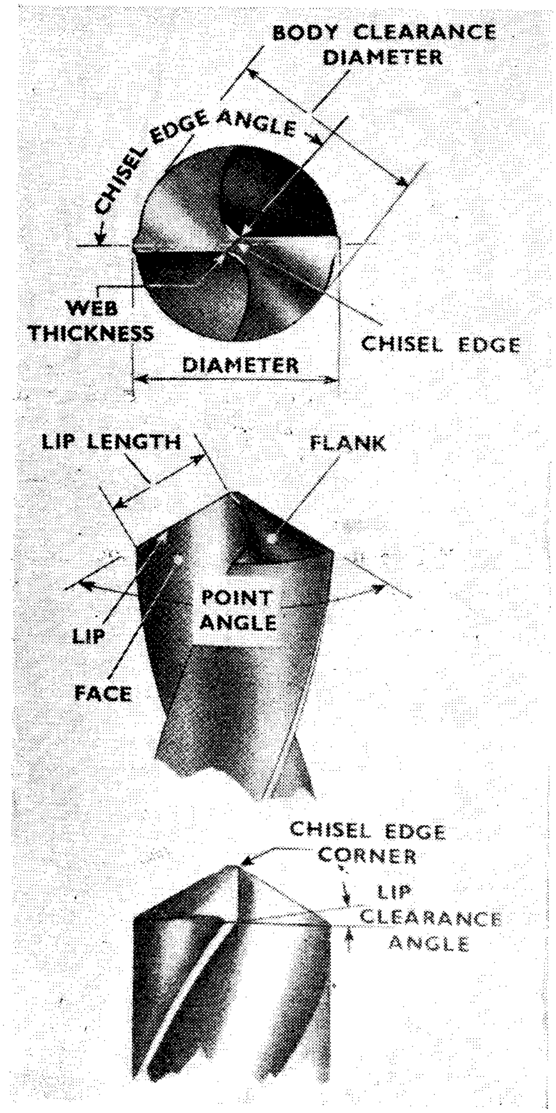


Fig. 4: Components of the twist drill point (Courtesy of the English Steel Corporation)

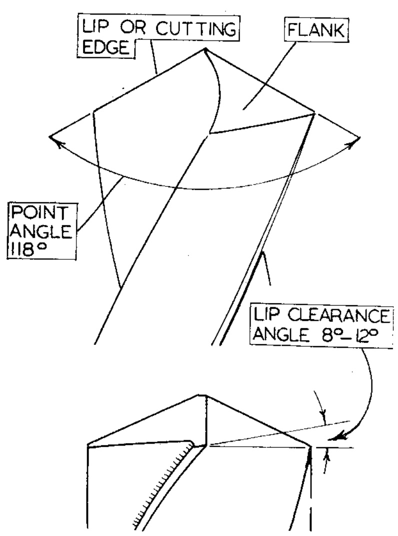


Fig. 4a: Drill Point

arised and centre drills now being made are those given in the accompanying table.

Size	Body Diameter inches	Drill Point Dia. inches
BS 1	1/8 in.	3/64 in.
BS 2	3/16 in.	1/16 in.
BS 3	1/4 in.	3/32 in.
BS 4	5/16 in.	1/8 in.
BS 5	7/16 in.	3/16 in.
BS 6	5/8 in.	1/4 in.
BS 7	3/4 in.	5/16 in.

Drill sizes. There are four series of drills obtainable in the average tool shop. The first of these, the inch-fractional series, provides drills from 1/64 in. dia. to 1 in. dia. in increments of 0.015 in. or 1/64 in. The second series, the Numbers, lists drills from 0.0135 in. dia., that is from a No. 80 to a No. 1 drill of 0.228 in dia.

The third series, the Letter size, starts at the letter A (0.234 in. dia.) and finishes at letter Z (0.413 in. dia.). In addition there are also obtainable, though obviously not at all toolshops, a range of fractional-millimetre drills starting at 0.35 mm. or 0.0138 in. dia. and proceeding to 25.00 mm. or 0.9842 in. dia. by very close increments.

Space does not permit of dilating further on this matter, but sufficient has been said to indicate the closeness of the dimensional increments. Those who require more information are referred to the booklet *Screw Threads and Twist Drills* published by Percival Marshall and Co., where details of available drills are given together with tables showing the various sizes.

Drill point. The components of the twist drill point are given in the illustration Fig. 4. Standard jobber's drills have an included angle at the point of 118 deg. and a lip or cutting edge clearance of some 8 to 10 deg., but both these figures are sometimes varied when drilling difficult materials or when considerations of speed in production make this action desirable.

An examination of the components of the drill point inevitably leads to the question, "How are these angles to be maintained during the resharpening process and what will be the effect on the work if they are not maintained?"

The answer is that without a point grinding machine or an attachment for the purpose it is idle to pretend that absolute accuracy can be achieved, as any reputable manufacturer of drills will confirm.

However, the newcomer need not be deterred from trying to sharpen his drills without a jig or fixture since, to answer the second part of the question, the result for the most part will be an oversize hole, not always a disaster.

The difficulty of free-hand grinding is to keep the angle of the two cutting edges equal. If the angles are not the same, one cutting edge or lip will be longer than the other. The work of cutting will then be done by one lip only, and an oversize hole will result. The results of having produced an oversize hole are not necessarily catastrophic to the newcomer, and so he need not be deterred from using free-hand methods to sharpen his drills, a matter we shall be returning to later.

But to return to the drill point itself. Examination will show that behind the lips of the drill there are two surfaces, known as flanks. The intersection of these flanks forms a chisel edge which must be kept sharp if the drill is to cut freely. It will also be noticed that a land is formed on the

Continued on page 446

Continued from June 1

POWER FROM THE SUN

After a solar-heat model had been devised at the University of Wisconsin, Allen J. Organ of Toronto University improved the concept in detail. Using heat which costs nothing, such a machine would be a boon to hot countries with little money. Meanwhile the model runs, as we learn from this third and final instalment, "on samples of British and Canadian sunshine"

I BECAME acquainted with the modern resurrected line of Stirling engines when I had to determine the efficiency of the power unit of a small electric generator, a 150-watt portable set. The combined Stirling engine-alternator unit, redesigned in 1947, was made as one of a pre-production batch of similar sets which were discontinued when a further break-through in design made them obsolete.

The engine itself bore little external resemblance to the classical Stirling machines, as can be seen from Fig. 9 where its appearance is further disguised by some of the testing apparatus. The unit was mounted in a tubular carrying-frame which also acted as a compressed air storage tank for the starting. A centrifugal fan on the generator shaft provided air for the cooling of the 'cold space' heat exchanger and also supplied air to the combustion chamber around the cylinder head. The internal configuration was

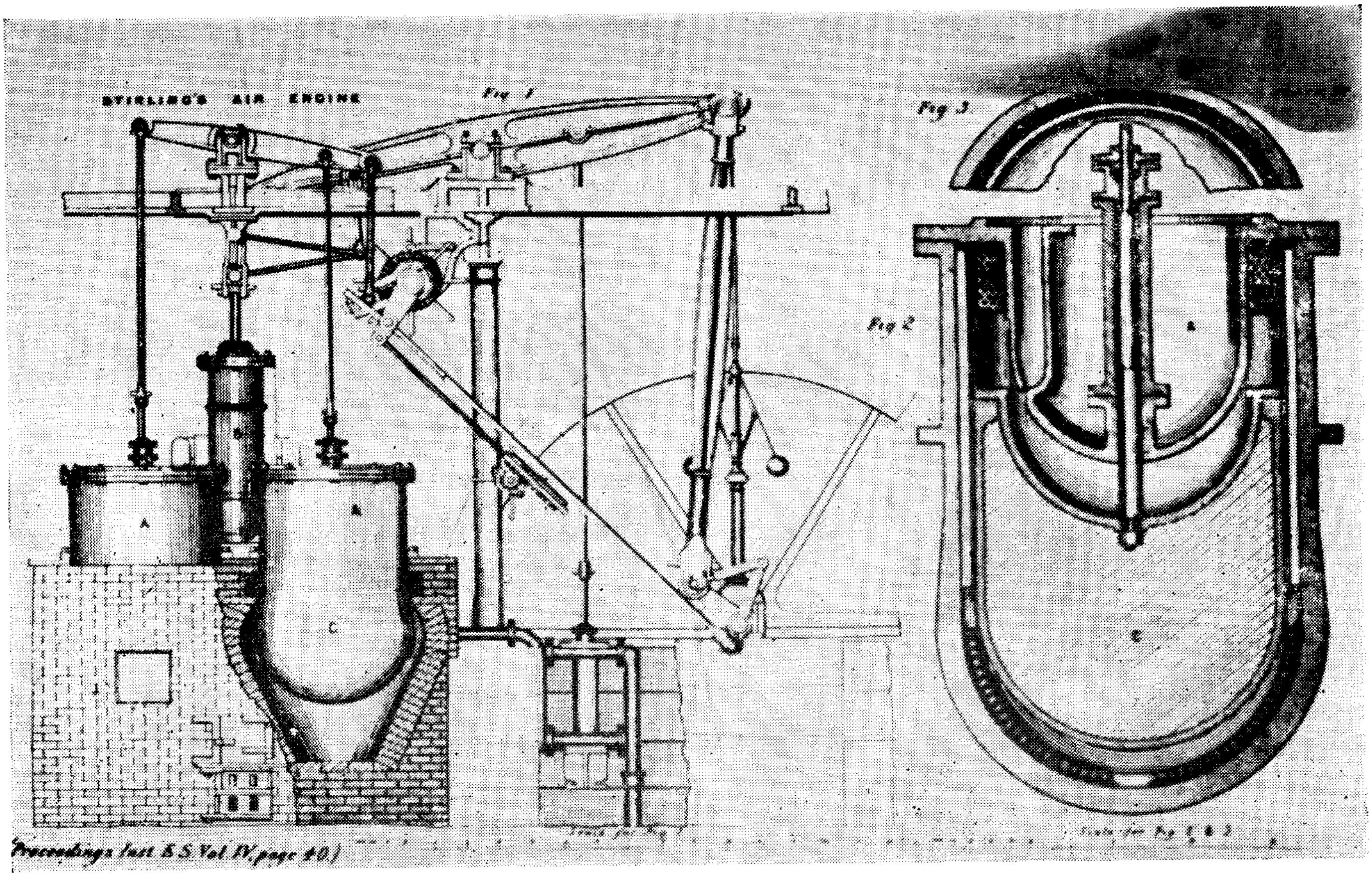
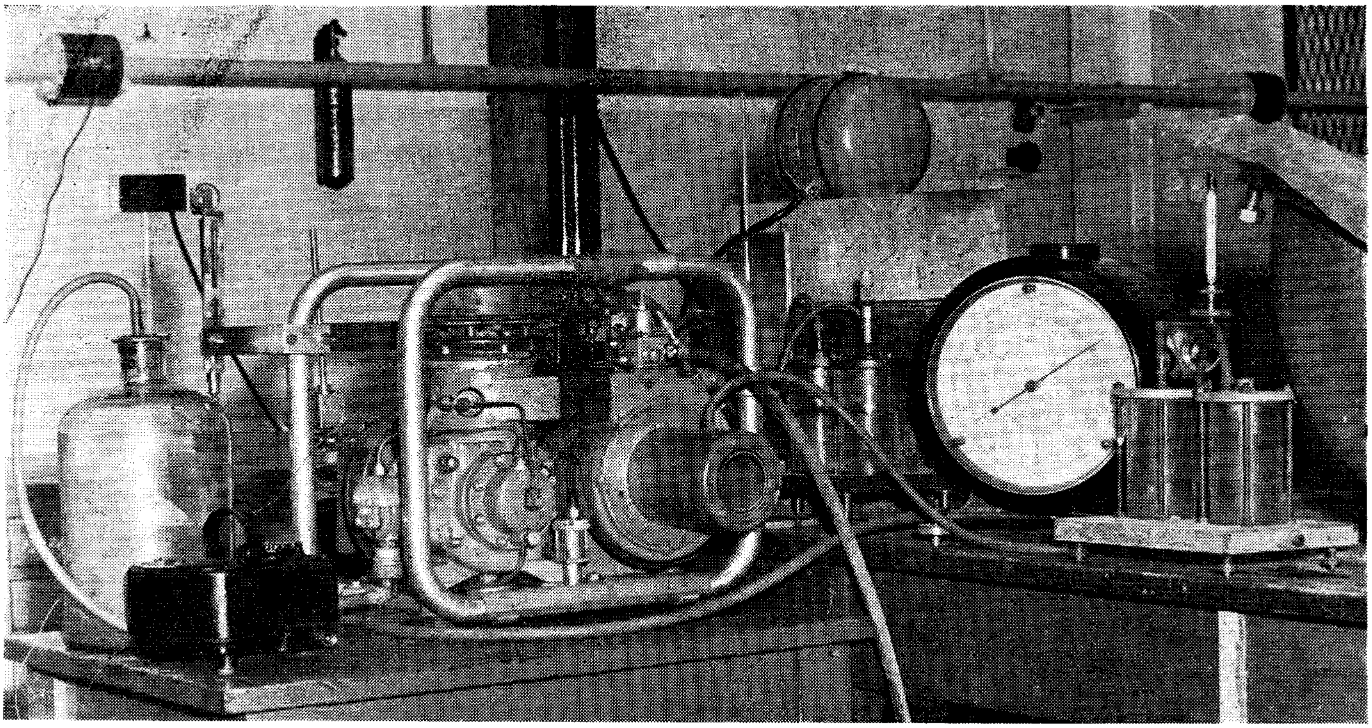
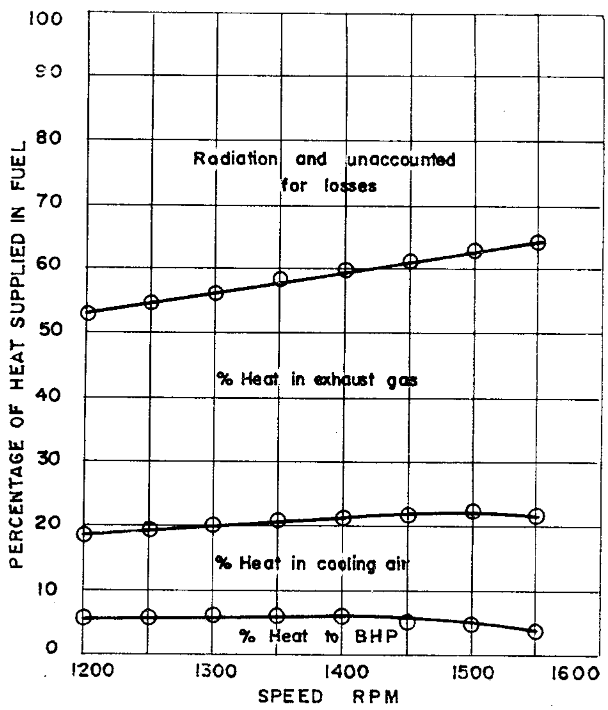


Fig. 8



Above: Fig. 9

Below: Fig. 10



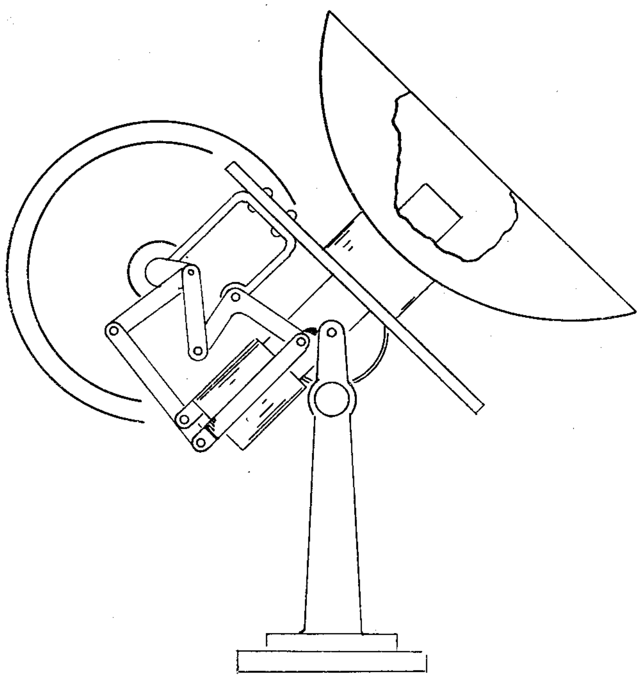
the now-familiar coaxial arrangement with both pistons running in the same cylinder. As in Stirling's recommendations of 1845, the system was pressurized (to 14 atmospheres) and had an efficient regenerator.

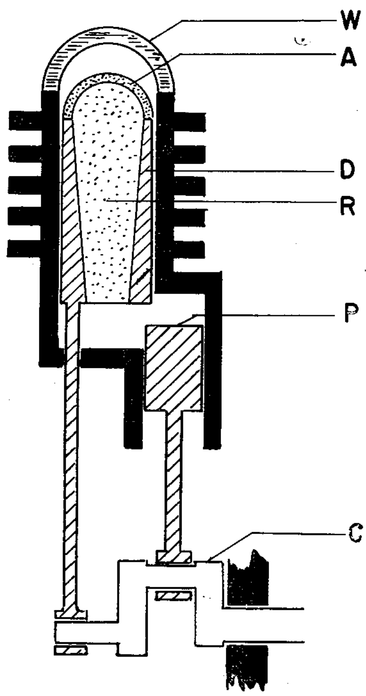
The most revealing single piece of information gained from the tests is the heat balance shown in Fig. 10. It will be seen that a rather disappointing 5.5 per cent was the maximum brake thermal efficiency attained. This is attributable to a variety of factors, all of which have been overcome in later designs. The use of hydrogen or helium as the working fluid, the incorporation of an exhaust heat exchanger to reduce the excessive 78 per cent exhaust and radiation loss—these and many other refinements have made 40 per cent thermal efficiency easily obtainable.

In efficiency the Stirling compares favourably even with the diesel. It is silent, it can be almost perfectly balanced, hence eliminating vibration, and its lubricating oil is never in contact with products of combustion, so that it is almost everlasting. Furthermore, although its power-to-weight ratio is poor compared with that of the petrol engine, a single-cylinder Stirling has a uniformity of torque output which is better than that of a four-cylinder diesel.

It will be seen that the modernised Stirling engine has many advantages, one or more of which will probably make it popular again. A property shared by few other power converters is its indifference to the nature of the heat source. Although petrol, kerosene and so forth, are more convenient, there is no reason why wood, peat or even dried straw could not be used. While the Stirling engine is unlikely to displace the internal combustion machine in the western world, there are still vast areas where the price of petroleum is prohibitive. This makes the simple, wood or straw-burning Stirling engine a highly attractive proposition as a light and portable source of power.

Nor are conventional fuels the only suitable source of heat. Concentrated sunlight is a possibility. Apart from its purely romantic attraction it has certain undisputed advantages—ultimate cleanliness and freedom from running cost. The immeasurable benefits to be derived from an economically sized solar energy converter have inspired many engineers in the past, including the prolific John Ericsson who in 1872 built the first solar motor of which records exist. Between this date and 1883, he made about nine experimental solar engines, some using steam cycles and some

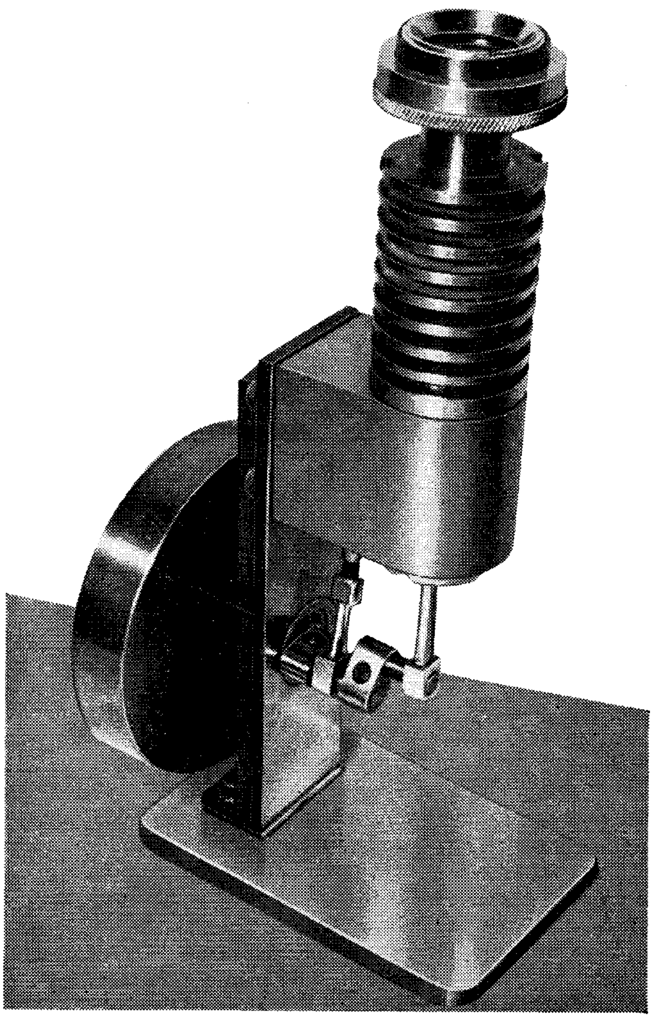




Left: Fig. 11

Right: Fig. 12

Below: Fig. 13



air. Fig. 11 shows one which would appear to have operated on Stirling's original principle, the only difference being that a parabolic reflector concentrated the sunlight to heat the appropriate end of the cylinder.

There are serious disadvantages to this method. Before the engine can do work, heat has to be transferred through the metal end of the cylinder to the working fluid. Of the total radiation received on the cylinder head from the reflector, some would be re-radiated and some lost by convection and stray conduction; and relatively little would be transferred to the air taking part in the cycle.

In 1960, Dr T. Finkelstein of the University of Wisconsin proposed a method whereby each of these difficulties might be overcome. To prove the principle he built a model engine which he ran with electricity. As I felt that the concept could be improved in detail, a slightly modified model was tried. It now has about ten hours of running time to its credit, operating on samples of both British and Canadian sunshine.

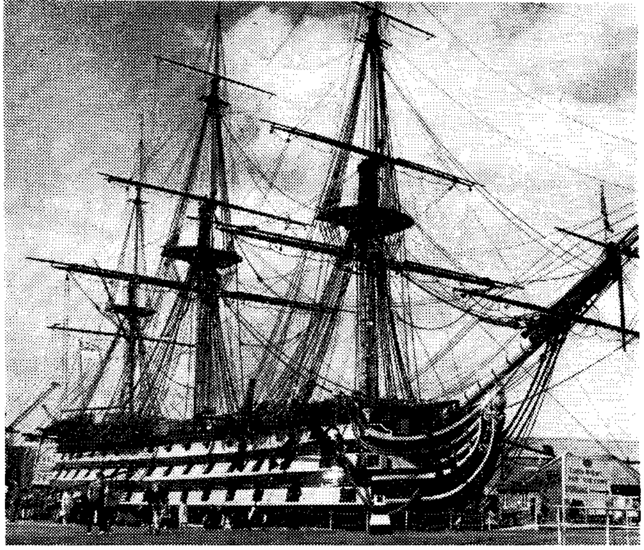
Fig. 12, which illustrates the principle, will be recognised as a simple extension of the basic Stirling engine layout in Fig. 3c. Previously concentrated sunlight is beamed through the transparent quartz window *W* onto the stainless steel mesh absorber *A* which rises to a very high temperature. The displacer *D* is hollow and is packed with fine copper wire to act as a regenerator *R*. Cooling fins on the outside of the cylinder dissipate waste heat.

The machine works exactly after the manner of the conventional Stirling engine. As the displacer rises and falls, the air trapped within the system is passed back and forth through the regenerator and heated absorber. Occupying the hot and cold spaces of the engine alternately it attains high and low pressures. The pressure changes are communicated directly to the power piston *P* which is connected to the crank *C* with a suitable phase displacement from *D*.

With the quartz window arrangement, the concentrated

Continued on page 443

How they built the VICTORY



Continued from June 1

by Joseph Martin

MASTER SHIPWRIGHT LOCKE was waiting with his mould-boards when the stage-wagon from London to Rochester stopped outside the gates of Chatham Dockyard one day in June of 1759. Here at last were the plans of the new ship. Thomas Slade and his draughtsmen had worked on them for six months, and now the time had come for the dockyard people to translate them into solid timber, beginning with the chalking-out of every part at full-size on the floor of the great mould-loft.

The drawings revealed the new First Rate as an improved version of the *Royal George*, that ill-fated vessel which was to sink in three minutes with " eight hundred of the brave " at ten o'clock on the morning of 29 August, 1782. Her length from figurehead to taffrail would be 226 ft 6in.: her extreme breadth would be 51 ft 10 in.: and her hull would be over 2 ft thick. All this massiveness would be held

Nelson was sailing paper boats . . .

together by copper bolts six inches long and two inches in diameter.

Chatham was going to be even busier that at present. The Navy Board issued its formal Order on July 7, exactly three weeks after the plans had been approved, and on July 23 the keel was laid in the Old Single Dock, later known as No. 2, opposite the clock and bell turret and not far from the Admiral Superintendent's Office. It was a bright, warm Monday morning.

The Admiralty wanted the ship to be afloat in less than three years, by 31 March, 1762. Meanwhile Chatham had two ninety-gun three-deckers and two seventy-fours to complete, as well as having to carry out all the refitting and repairing which fell to a great dockyard in time of war. Over two thousand men were already working from first light on Monday to dusk on Saturday, with an overtime arrangement which kept half the number busy on Sunday and through part of every night. The dockyard bell announced the normal end of a working-day: afterwards the men on " double tides " and " nights " toiled in the light of cressets and links for another three or five hours.

At the outset 150 hands worked on the huge vessel designed by the Senior Surveyor, who would later be honoured with a well-earned title. They gave her the general form which she could take, bolting the frame and floor timbers in place, fixing the stem and stern pieces—the stempost was a single oak-tree—and lifting the ribs and beams and brackets into position, until Chatham could see what a giant work was rising in the Old Single Dock.

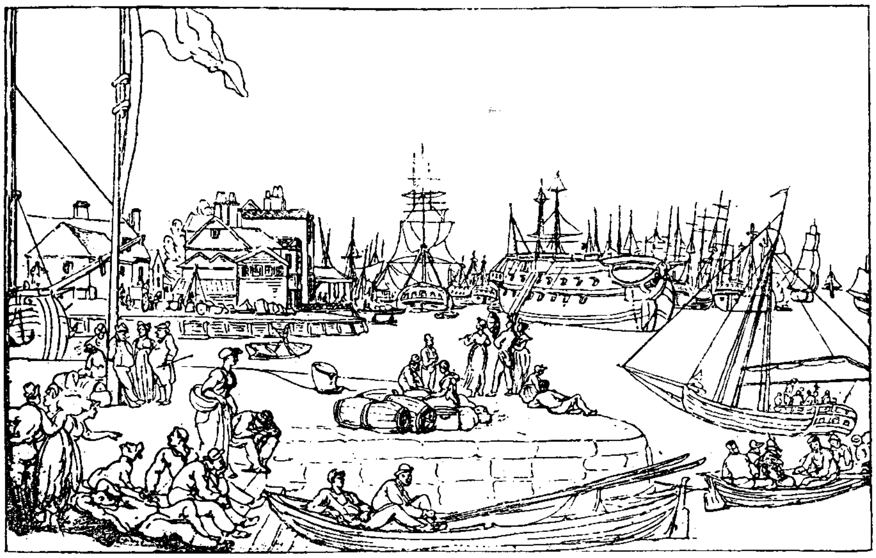
After a while the pressure eased. The special First Rate had been laid down in the " Wonderful Year " of Quiberon Bay, the capture of Quebec and the victory at Minden; and now with redoubtable Boscawen and Hawke (Cornishmen both, like Peller) glorious on the seas, Britons had no need to lie awake o'nights. In any event, the ship had to " stand in frame " so as to season.

Soon afterwards the Admiralty instructed the Navy Board " to cause the name appointed by my Lords to be so registered in the List of His Majesty's Navy." Everyone had been able to guess what it would be. For a lifetime or more, seven names had headed every Navy List: *Royal Sovereign, Britannia, Royal William, Royal Anne, Royal George, London* and *Victory*. In 1760 six of them were already borne by First Rates. The seventh had been unused since the storm in 1744 which swallowed up Admiral Balchen's *Victory*.

Slade's ship was the seventh to bear that name. The first had sailed to meet the Armada, like the *Ark Royal* and *Vanguard,* whose names recur illustriously in naval history. It was rather odd that this vacancy should be waiting in the Navy List just when Horace Walpole wrote: " We are forced to ask every morning what victory there is for fear of missing one." Walpole made this cheerful comment in October 1759. On October 28 the new ship at Chatham received a name which was admirably fitting for that time and would be equally apt for another October nearly half a century hence.

By the Spring of 1762, the date originally set for her completion, she was little more than an outline with the bottom planked over. The date had been put forward for two years. In the meantime £12,000 had been added to the £141,000 spent on the first steps so that further materials

When the special First Rate was floated at Chatham two centuries ago this year, the future hero of Trafalgar was a small boy in Norfolk. Joseph Martin continues the story of the events which led to the order for her launching on " the next Spring tide "



could be prepared and allowed to season. The emphasis placed on seasoning should be noted by ship modellers. It may also interest them that most of the wood in the *Victory* came from trees that were more than a hundred years old.

When the March of 1764 arrived about four-fifths of the work had been done, at a cost of nearly £50,000. Since the end of the Seven Years' War—that great free-for-all which involved countries as far apart as Saxony and Canada—the building of new vessels had been less urgent than the repairing of those which were afloat. Nearly a third of all repairs came the way of Chatham.

At the end of May, after the time had been extended for another six months, the Lords of Admiralty inspected the *Victory* and ordered alterations which would put her completion still further forward. The French then added to the delay by making trouble over the fisheries of Newfoundland, so that the ships in reserve had to be made ready for sea. While men sweated in the saw-pits, a second alarm of more startling concern to Chatham alerted everyone employed there. The Admiralty had wind of a plot for the destruction of the dockyards by fire. Guards were doubled; all vessels on the Medway were carefully watched; ships' boats and Jacob's ladders were hauled out of reach at night: twenty-two armed sentries were posted; Marines were brought in; and special checks were made on all visitors, with a constant escort for strangers. The precautions at Chatham in 1764 were, in short, as thorough as those which I once encountered at a great naval establishment in the United States where I walked with an armed escort although the visit had been arranged.

Every night from sunset to sunrise sentries with loaded firelocks on their shoulders paced the dock where HMS *Victory* lay. They had to reply whenever a warder struck his bell in one of the look-out towers—a system similar to the one used today on railcars, where the driver responds at intervals to a bell signal so that he is known to be awake and well.

With all these excellent measures, there was no Jack the Painter at Chatham in 1764. At length the Commissioner reported the *Victory* to be ready for launching. The date was 23 April, 1765, St. George's Day and Shakespeare's. A week later the Commissioner opened the orders for her launching at the next spring tides.

The *Victory* which the Admiralty and Navy Board admired on 7 May, 1765 was different in some ways from the ship which the Society for Nautical Research has preserved at Portsmouth, saving her for the coming generations much as the USS Constitution was saved during the same period (with the help of pennies from American school children, some of whom may be reading these lines). Between 1800 and 1803 the *Victory* was rebuilt and given a closed stem, such as we see in Dr D. Nepean Longridge's model at the Science Museum, in place of the original open stem with two galleries. Nine years after Trafalgar, and two years after her sea-going service had ended, her old square bearhead bulkhead was removed and a built-up round bow fitted in its stead. It apparently did not occur to anyone that posterity would prefer to see her precisely as she had been at Trafalgar.

She was, of course, very much a veteran of battle by 1805, forty-six years after the Order arrived at Chatham. She had flown the flag of Keppel and Kempenfelt (the Admiral lost in the *Royal George*) and of Hood and Howe. As she was busy in the War of Independence, it is pleasant to record that her compliment at Trafalgar included twenty-two Americans.

Afterwards, in 1809, she was to take most of Sir John Moore's troops after his burial at Corunna—a battle which we used to remember through Charles Wolfe's poem. She was on active service again during the last war, as the headquarters of Admiral Sir William Janes, and the Luftwaffe paid her the tribute of its attention.

Many went aboard her last month to see the Bicentenary Exhibition, which included models. If only a film would bring her alive for us in replica so that we might have a vivid idea of how she looked at sea, with her canvas spread! She would be even taller than the 200 ft monument which rose in the heart of London: a column with two octagonal lanterns from the *Victory* at its base, and its top a bronze capital made from the guns of the *Royal George* and surmounted by the figure of a sailor, sculptured by Edward Hodges Bailey of Bristol.

But in 1765, when the *Victory* was launched, the boy known as Horace at Burnham Thorpe in Norfolk—a small frail boy, later to be absorbed in Shakespeare and in the poetry and prose of his own time—was sailing little paper boats, never dreaming of what destiny had prepared for him.

To be continued

HOT-AIR ENGINES . . .

Continued from page 440

light does not appear as high temperature heat (to use loose terminology) until it is actually inside the engine. Quartz, while an excellent transmitter of the useful light wavelengths, is a poor conductor of heat. The energy is therefore trapped inside the engine by the so-called greenhouse effect. For a given amount of solar input, a high percentage conversion to work is therefore possible.

The engine, without parabolic mirror, is shown in Fig. 13, where the displacer and power piston drives are visible. To reduce friction, flexible elements replaced the more usual gudgeon pin arrangement, and the shafts ran in miniature ball bearings. The no-load speed of the engine with a 24 in. parabolic reflector varied (according to the intensity of the sunlight) between 200 and 600 r.p.m., but the efficiency measurements are unreliable and misleading owing to the disproportionate friction losses associated with the miniature construction. It is thought, that a full-sized version of, say, 1 h.p. nominal output could be capable of an overall conversion efficiency (including mirror) of about 15-20 per cent. It might well, on this account, be a valuable method, if not the only one, of providing power in those parts of the world which are better endowed with sunlight than with financial resources.

In thermodynamics, reference is made to an idealised 'reversible cycle' of which the Carnot is an example. The implication is that, if Q units of heat applied to an engine produce W units of shaft work, W units of work put back in at the shaft can be expected to give back exactly Q units of heat. Thus, the reversibility or otherwise of a cycle is the criterion of its 'thermodynamic perfection.' As an example, consider the highly imperfect steam cycle. It is obvious that the complex processes of steam generation, expansion, condensation and boiler return-feed cannot be reversed and brought back to their initial states by our driving the flywheel backwards with external power. Hence, the steam cycle is irreversible and thermodynamically 'imperfect.'

The Stirling engine, however, satisfies very closely a law which states that, if heat is supplied to a heat engine only at a fixed upper temperature, and if the waste heat is rejected only at a fixed lower temperature, the engine has an efficiency equal to that of a completely reversible engine operating between the same temperature limits. In practice, this would nearly always imply that the engine was also fully reversible. I have already pointed out that the function of the regenerator in a Stirling engine is to store, for later use in the cycle, all heat which would otherwise have to be rejected at some temperature between the upper and lower limits. It will be seen, then, that if a regenerator is highly efficient, a condition is approached where most of the heat exchange takes place only in the actual constant-temperature heater and cooler of the engine. A comparison should be made here with the internal combustion engine which rejects heat continuously to the cooling jacket at all points of the working stroke.

In theory the Stirling engine therefore appears to satisfy the condition for physical reversibility. In practice, it certainly does. By rotating the crankshaft at running speed with the fuel supply shut off, we can make the cylinder head attain a very high temperature. The engine is then acting as a heat pump. When we reverse the crankshaft rotation, the cylinder head becomes so cold that 'frost' appears on it. In other words, the machine is now acting as a refrigerator.

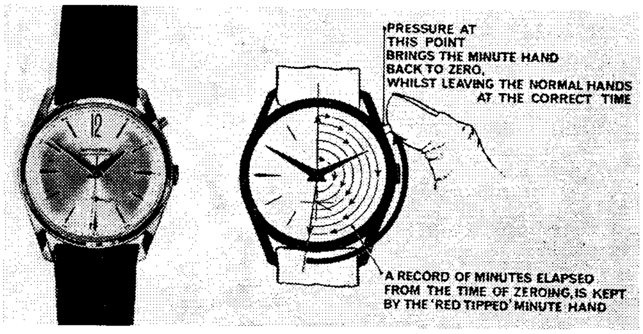
Refrigerating machines working on this 'reversed Stirling cycle' are not merely an academic novelty. Detail modifications to the basic layout have produced refrigerators of very high 'efficiency' (more correctly 'coefficient of performance'). They are already being produced commercially and are widely used for producing liquid air which literally drips from the cylinder head of the electrically-driven Stirling.

This by no means exhausts the list of applications of the modern hot-air engine. Commercial prospects for the machine are difficult to assess. It is easy enough to establish a radically novel piece of apparatus in fields where no alternative exists. It is less easy to displace established power sources which are only marginally inferior but have undergone long stages of technical development. Time will show whether the silent motor-mower and outboard-engine are sufficiently in demand at their slightly elevated cost for manufacture to begin on a modern, cheap, mass-production basis.

Neither is the Stirling engine limited to small-power application. I believe that untold benefits would be reaped by replacing with Stirling engine units such offensive pieces of equipment as the diesel engines which power mobile compressors for road maintainance work. The fumes, and much of the noise, would automatically be eliminated.

And the possibility of engine-power without noise and fumes has existed since 1816. ▣

Around the TRADE



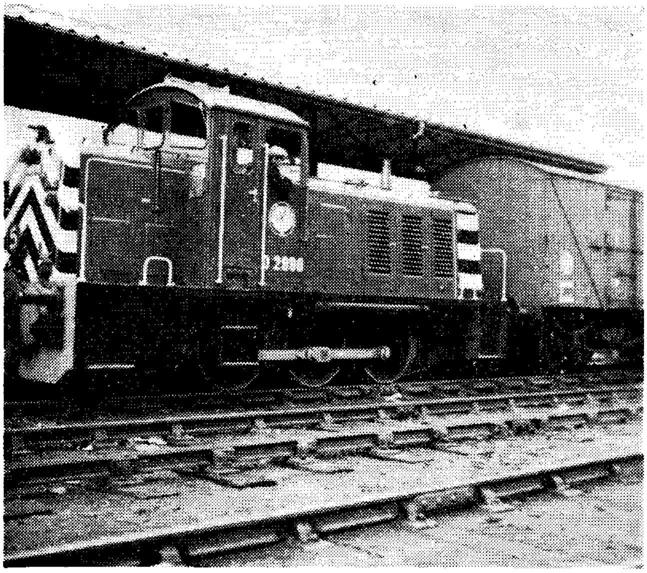
THE new Inventic elapse-recorder watch, though primarily designed for such uses as registering parking meter time or periods of play at sports meetings, has an application in model engineer activities.

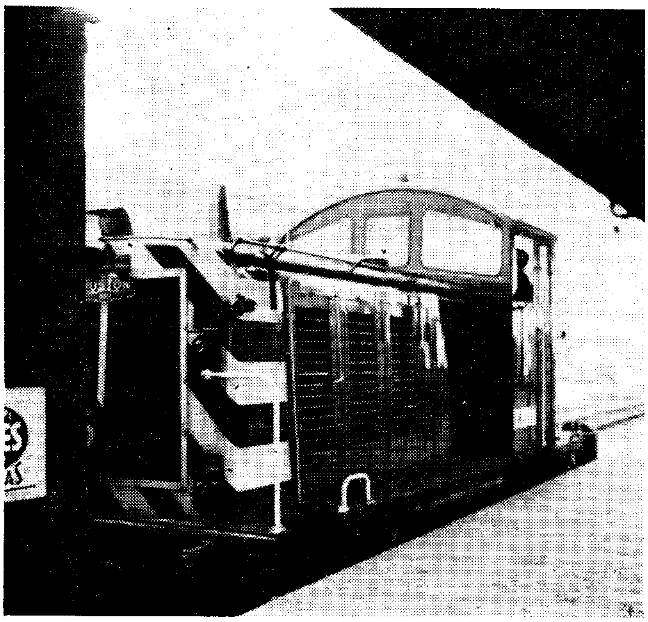
Elapsed time is recorded by an additional sweep minute hand which is set to zero by depressing a tiny plunger. This feature has uses for the starter at regattas, or similar club events, and also for a track marshall at a locomotive efficiency trial.

The Inventic watch is Swiss made with a shock-protected pin-lever movement and it has a hard gilt case with a chromium back.

Price is £4 10s. and it is obtainable from Louis Newmark, 143-149 Great Portland Street, London, W1, or branches at Croydon, New Addington and Reigate.

We found it a good timekeeper.





The new diesel shunting locomotives at work in Southampton Docks

DIESELS IN

THE diesel-electric era has arrived in Southampton Docks. Steam power has almost completely gone. A recent visit showed that modernisation is well under way in the dock rail system.

Freight trains, on arrival, are normally broken down into a number of shunts. Each shunt may consist of several wagons which may have to be re-shunted several times before they reach the shed or ship to which they are destined. Similarly, wagons which have been loaded from the ships are mustered in a marshalling yard from which a train is eventually made up ready for despatch.

Shunting duties are carried out by about eighteen locomotives which are almost constantly in use. Until recently, the bulk of the work was handled by steam-powered engines of about 47 tons and capable of negotiating the tight curves which predominate in the Old Docks. The steam force consisted of a number of British and ex-United States Army tank engines, all of 0-6-0 wheel arrangement. The U.S.

By John Brooker

engines are regarded as the finest steam shunting locomotives in Britain.

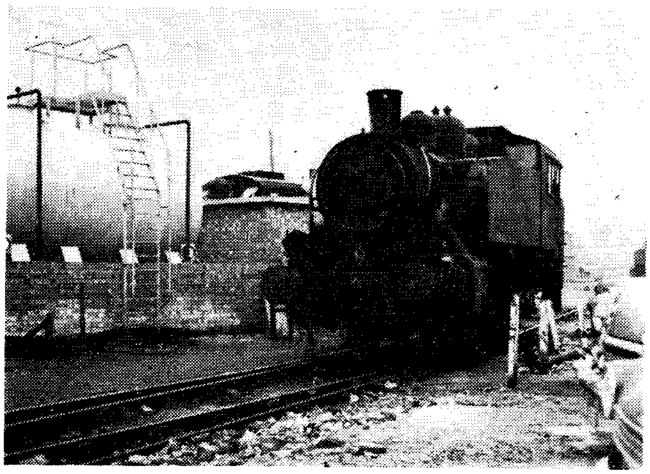
The few remaining steam locomotives work in conjunction with Ruston and Hornsby diesel-electrics of 275 h.p. The steam locomotives, now about twenty years old, look neglected (outwardly at any rate) but seem to wear an air of disdain as they work alongside their colourful successors which, by the time this is in print, may have ousted the last of them from the metals.

I therefore accepted with pleasure the opportunity of spending a period on the footplate of one of the last steam locomotives to be employed on miscellaneous shunting in the Old Docks. To witness the efficient co-operation between the shunter, driver and the fireman gained my admiration, for their actions were as one man.

The deft movements of the driver when operating regulator, brake or reversing lever, with hardly any impression of contact when buffers met, was time-earned skill indeed. This spell of duty was full of variety and we worked so many shunts that I soon lost count. I watched the relaying of hand signals from the shunter alongside the moving wagons to the driver, the apparent ease of connecting and disconnecting the heavy couplings and the changing of points.

Each operation was perfected with great skill: and it seemed with the definite enjoyment of a job well done. The locomotive handled easily, and the fire needed very little attention, efficient working power being available at any boiler pressure between about 50-200 p.s.i. This allowed the fireman to relay orders to the driver when the shunter was working on that side of the engine and left only the boiler feed water to be attended to from time to time.

DOCKLAND



A surviving steam engine at the time the author was there

After leaving this locomotive I made a short but interesting tour of the workshops, which handle engine repairs on the British Railway vessels in addition to the smaller locomotive repair jobs. I then boarded one of the new diesel-electrics.

All outward appearances of cleanliness and efficiency conveyed to me through the colourful and immaculate livery were reflected in the driving cab. Dual controls are a special feature and so a driver and fireman are carried for safety reasons, particularly as all shunting locomotives work without fixed signals. A second pair of eyes is an essential to the driver when operating in the confined workings of the dock area where the tracks cross road after road with many blind sections.

Compact and simplicity

These diesels are also equipped with an inter-communication radio system to facilitate operations. The comfort and almost all-round vision combined with simplicity of control greatly impressed me—quite different from the steam locomotives with their open cabs, so often shared with adverse elements, and rather poor vision offered through the small spectacle plates.

The duty assigned to this locomotive was the collection of empty banana vans which were to be strawed and tared in readiness for an incoming vessel.

The empty vans were first shunted alongside a small platform where their floor boards were covered with clean straw, then they were carefully drawn on to a weighbridge where each van was weighed separately to obtain the tare. I was told that only a 7 lb. margin was allowed, which ensures that when the vans are loaded and re-weighed, the consignees will receive the correct weight of bananas, as far as is practicable. This duty is a boring one, but all locomotives and enginemen are worked on a rota system which allows for variation in hours and duties performed.

During a short spell between shunts, the offer of a drop of "the enginemen's best friend" was most welcome. In the nearby lobby I was soon engaged in locomotive chat and it was pleasing to note that an extremely happy atmosphere prevailed. The "old steamers" figured prominently in the conversation and the older enginemen's love of steam was made apparent.

The time came for me to leave this fascinating section of Southampton's dockland. As I made my way past the engine sheds, I came upon one of the latest auxiliaries operated by British Railways—the automatic push-button-controlled steam boiler heater van, which is completely self-contained and can be connected to passenger stock, such as an outgoing boat train, during the winter months. This is progress indeed.

I would like to express sincere thanks to the Chief Docks Manager in Southampton and to members of his staff whose co-operation and assistance made this article possible. ▣

Portable elevated track

on ammunition boxes in Germany

I NEEDED an elevated portable 3½ in. gauge track for a garden fête organised by our regiment stationed in Germany. I made one from 1 in. × ¼ in. flat steel with tubular spreaders laid on an elevator road bed made of ammunition boxes! The track was secured by steel wires passed over a spreader and pegged into the ground at 6 ft intervals

Unfortunately the weather was most unkind, but nevertheless 230 passengers were carried during the afternoon and the railway proved to be a great attraction.

It was the first time that either locomotive or driver had experienced protracted steaming, and so many lessons were learned. The engine performed magnificently and astounded most people by its power (which *I* knew to be less than its maximum because the exhaust beats were not as even as they should have been). The load was also limited by a severe gradient and an absolute minimum radius on the curves. The track was oval, two 30 ft. dia. half-circles separated by 25 ft straights.

I have now made three injectors, each one a little more accurately than the last—but none of them work! For the last one I made new reamers and replaced the delivery pipe

and check valves—straight as possible. I now see that the drawings of the *Ivy Hall* injector are slightly different from that in the *Live Steam Book*. The injector simply squirts water from the overflow and will empty the tender in quite a short time!

I have painted the engine with a dead flat black undercoat—the effect is to make it look like a real worker. The trouble is that the paint is not very durable, particularly on the brass parts. I understand that black all over is standard livery for BR mixed-traffic locomotives. Should buffer beams be red?

I have just received a set of drawings from your plans department for *Caribou,* which seems to me to be a good design from the point of view of both construction and operation. However, as Martin Evans pointed out at the commencement of the serial, much detail is left to the builder to devise. The photographs are not quite as discernable as I need them (admittedly because of my inexperience)—can you include a few drawings for some of the details? One point that springs to mind immediately is the apparent " nothingness " between the cab floor and the top of the bar frames, and the apparent difference in level between the cab and tender floors.

E. R. ADDINGTON (Lieut.)

[Martin Evans writes: *The cab of* CARIBOU *is mounted on the firebox, and not on the mainframes or running boards—as in British practice—so that there may appear to be considerable " daylight " beneath the rear of the cab.*

The weight of the cab is taken mainly upon a strong angle which is screwed to the backhead.

It is probable that the injector described for IVY HALL *is a somewhat later design than that shown in the "Live Steam Book."*

Lieut. Addington is right about the livery of BR mixed-traffic engines—black with vermilion buffers.—EDITOR.]

LAUBEREAU'S ENGINE

Continued from page 433

ing the closed cycle of Stirling. I am convinced that these valves must have been a guess by the person who made the drawing.

My picture of Laubereau's engine includes a curved pipe very similar to the one shown, connecting the top of the displacer with the bottom of the power cylinder, but without a valve and with no connection to the lower end of the displacer cylinder at all. In any event the engine could not possibly even work with the valves as shown unless they were mechanically operated, as hot air coming in by one valve could pass straight out by the other one round to the cold end.

Mr Rendall's experience with the Heinrici surely points to inefficient insulation between the hot and cold ends of the displacer cylinder, a common fault in such engines.

I always read with interest everything that Mr Rendall writes. As he appears to be really interested in this subject, I wonder if he is acquainted with the hot-air engine developed by Phillips of Holland during and just after the last war? If he is not, I should be pleased to let him have some interesting information.

GEOFFREY K. KING.

ACKNOWLEDGEMENTS

The writer wishes to express his thanks for permission to publish the following illustrations:
The Institution of Civil Engineers, Fig. 8. Dr. T. Finkelstein, Atomics International, California, U.S.A., Figs 5, 6, 7. The Editor, Battelle Technical Review, Fig. 4.

NOVICE'S WORKSHOP *Continued from page* 437

body of the drill itself, and that behind this land the drill is reduced in diameter to provide clearance and lessen friction.

The land is normally hard wearing, but in adverse circumstances, as when drilling unsuitable or abrasive materials, it may become worn with the result that, when again used for normal drilling processes, the holes produced will be undersize and the drill itself may even jam in the hole, the more particularly if it is deep.

The moral of this is that one's best drills should not be used for rough work or abrasive materials. If they do get used in this way and become worn in the process the only remedy is to buy replacements.

To be continued

Continued from June 1

Special reversing gear for tarmacadam

W. J. Hughes on the Aveling centenary

FOLLOWING the success of the 1873 design, which had the cone-shaped front rolls, the smokebox itself was extended to take the bearings of the vertical spindle attached to the front axle. Then came the design shown in Fig. 10, with parallel rolls of smaller diameter at the front, carried in a stirrup fixed to the vertical spindle.

The spindle still passes through the extended smokebox itself, and as in the 1873 engine there is a separate chain-drum and chain at each end of the steerage spindle. Apart from the front end, and the steerage which I have just mentioned, the engine looks very much like a modern roller, even to the side-plates which enclose the motion. As catalogues of the time explain, the sign plates were intended so that the driver could "avoid frightening horses," and were not designed particularly for the aesthetic effect.

A disadvantage of the small front rolls was a loss of weight at the front end, and the next step was the one seen in Fig. 11. A heavy casting forms the bearing for the vertical spindle and is bolted to the top of the smokebox, incorporating the chimney base. Thus any practicable diameter (and weight) of front rolls could be used, with a more substantial stirrup to carry them. This stirrup and the spindle bearing also added, of course, to the front-end weight.

Once more there is a separate steerage chain at each side, and now the flywheel spokes are sheeted over, again for the benefit of the horses. The particular engine shown in Fig. 11 is a tandem compound, a design soon superseded by the side-by-side compound, with valves overhead. But at this stage the compound was still not very popular, and single-cylinder engines were greatly in the majority.

By the early 1890s, design had more or less crystallized, with the steerage

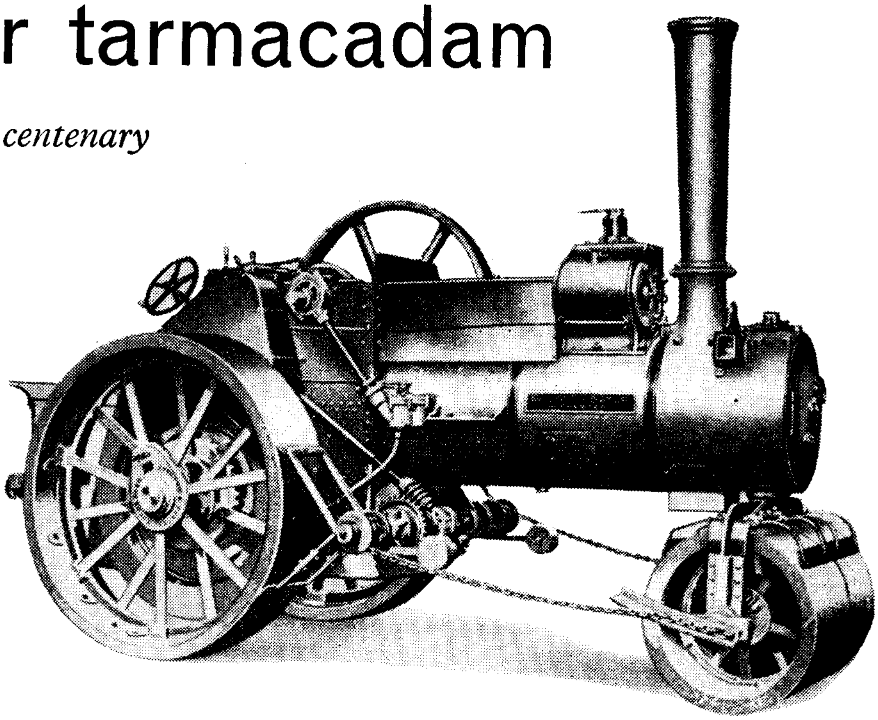
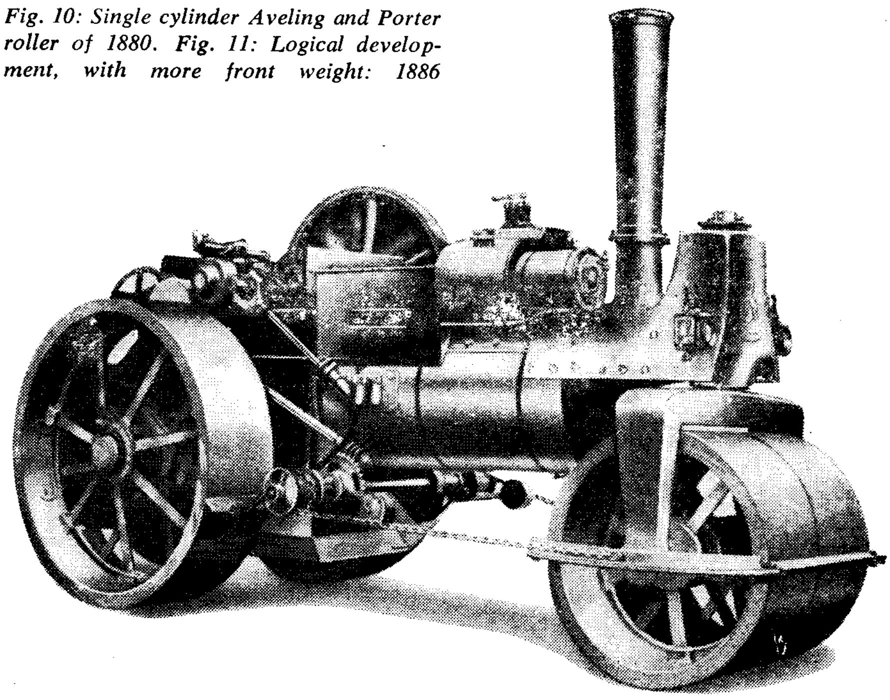


Fig. 10: Single cylinder Aveling and Porter roller of 1880. Fig. 11: Logical development, with more front weight: 1886



of the normal single chain-drum type. A strong feature of Aveling and Porter engines was that the bearings for the crankshaft and second and third shafts were all carried in one massive casting. Bolted strongly to the hornplates, these brackets gave great rigidity to the crankbox.

Aveling and Porter were still exporting many engines, and a single-cylinder steam roller was sent out in 1894 to Mr Churchill Oastler of 48 Exchange Avenue, New York. It was a convertible: a traction engine which could be changed into a steam roller. The hind wheels were exchanged for rolls, and the fore-carriage was dismounted and replaced with a saddle bolted to the smokebox front to carry the front rolls in the usual stirrup. Thus a contractor could have a dual machine at a comparatively small cost.

These convertibles proved very popular; the first of them on record was produced as early as 1871 (Aveling's No. 616), and they were built for sixty years. Another popular line was the tandem roller. The first, built in 1902, weighed four tons, and was soon followed by a complete range in weights from four to 15 tons, and with both single and compound cylinders. While the whole arrangement (Fig. 12) was very similar to the conventional machine, the rear rolls were smaller and ran side-by-side, like the front ones. They were carried by steel brackets fitted to the firebox end of the boiler. The brackets also held the bearings for the countershafts and crankshaft. All-gear drive was used. For the front rolls, the usual flat-faced saddle bracket was replaced by a hollow cylindrical casting which housed the independent upright shaft attached to the steering fork by a horizontal pin which allowed the fork to pivot sideways.

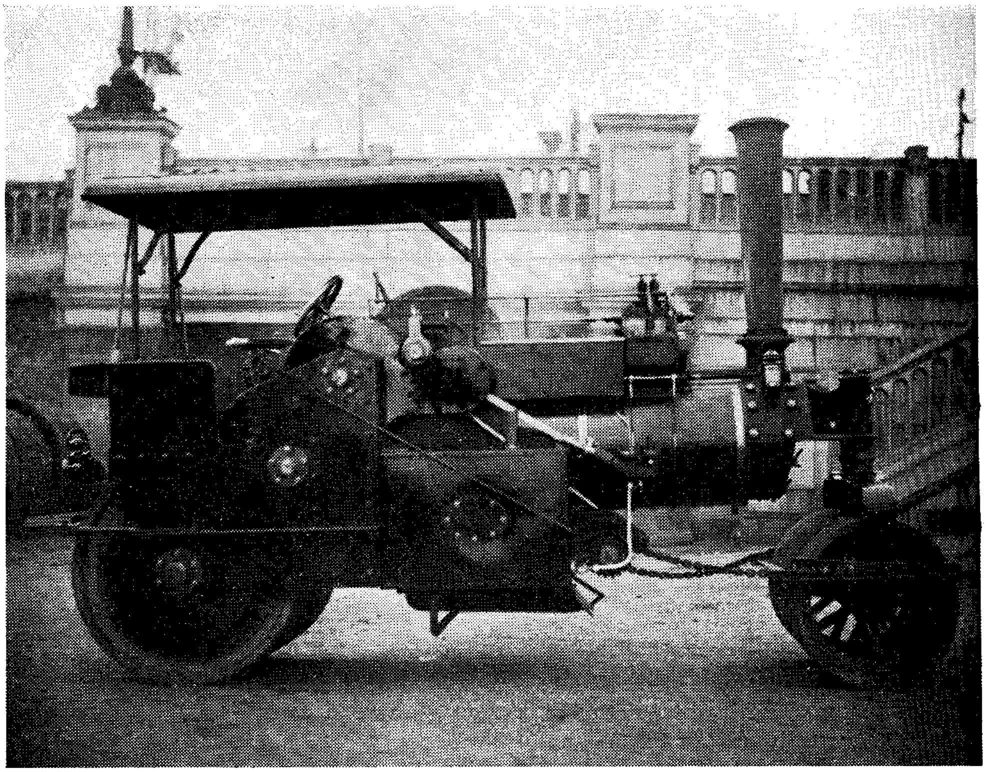
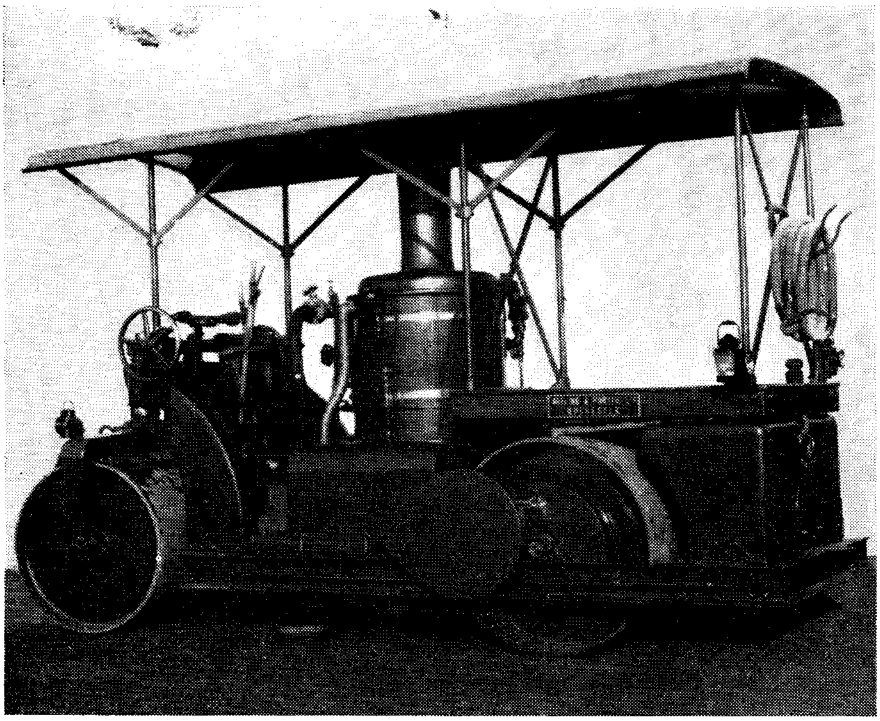


Fig. 12: Four-ton tandem roller of early twentieth century. Fig. 13: Type O, with double cylinder engine and steam steering



An interesting variation on the tandem theme was the MLD. This had two high-pressure cylinders, 6½ in. bore by 7 in. stroke, mounted vertically on the right-hand hornplate, with the crankshaft on a level with the axle of the rear rolls. A bevel pinion on the crankshaft drove a bevel gear-ring bolted to the end face of the driving-roll—an arrangement somewhat similar to that of a Shay locomotive. The reversing-gear was of special design to allow for the quick action called for by new kinds of tarmacadam.

The engine developed 41 b.h.p. at 257 r.p.m. Its maximum speed was 5½ m.p.h., and it weighed seven tons empty. The mechanism was totally enclosed, and a large water tank was slung from the left-hand hornplate, where it helped to balance the weight of the cylinders and motion. At least one of these machines still exists, in Somerset.

From 1921 the original range of tandems was superseded by a new range—the N, O and P (Fig. 13). The main frame was low-slung, of channel section steel, with a vertical multi-tubular boiler centrally mounted. A cast steel sub-frame carried the two high-pressure cylinders and motion. Piston-valves were mounted above the cylinders, again with a special quick-reverse arrangement for the rolling of hot and plastic bituminous carpeting or tarmacadam. A small three-cylinder radial engine could be fitted as an extra for power-operated steering.

Aveling-Barford merger

Throughout this period the conventional type of roller was produced, of course, in large numbers and in various weights. In 1934, Aveling and Porter amalgamated with the old-established Barford and Perkins to become Aveling-Barford Ltd. The new company moved to the works which it still occupies at Grantham.

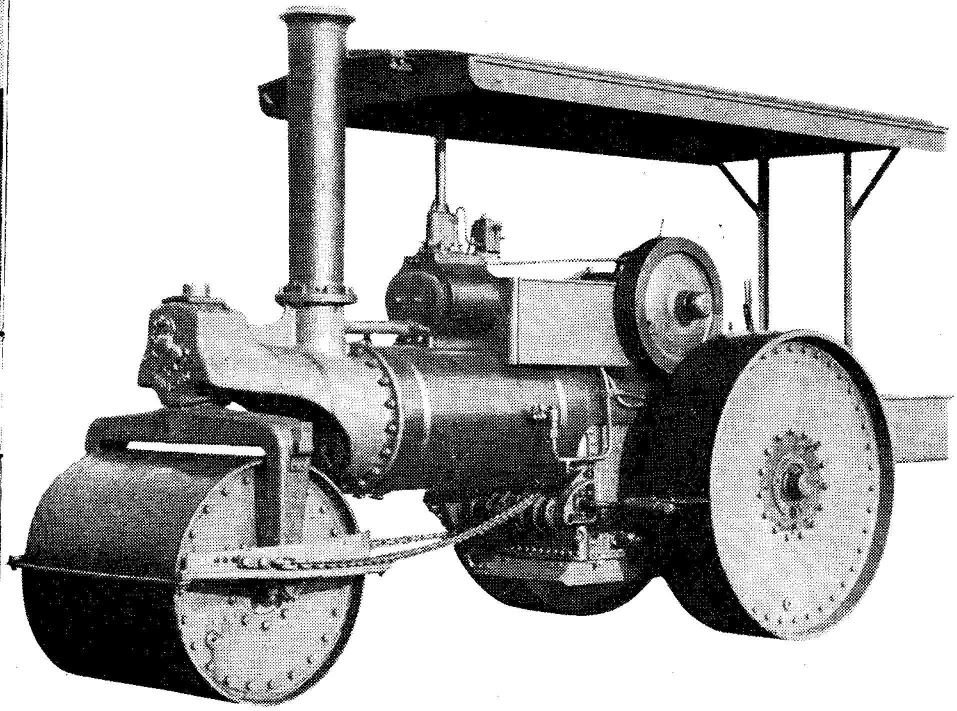


Fig. 14: Type T single-cylinder roller of 1939

A new range of steam rollers was introduced in 1937, at first without water ballast for the rolls and later with it. They were in three sizes, R, T and W. R was offered as a single-cylinder machine only, but T and W could have single or compound cylinders. Their weights in working order, with water ballast, were (single cylinder) 7 ton 6 cwt for R, 9 ton 9 cwt for T and 11 ton 12 cwt for W, with compound T at 9 ton 13 cwt, and compound W at 11 ton 17 cwt.

After the last war a redeveloped version of this range was produced; it included all the pre-war types except the compound T, which was discontinued. More than 400 of these post-war machines were turned out; most of them went to the India Stores Department and to the Crown Agents, but a number found their way on to the home market. Figs 14 and 15 show the T single and the T compound. The other sizes were very similar in appearance. ▣

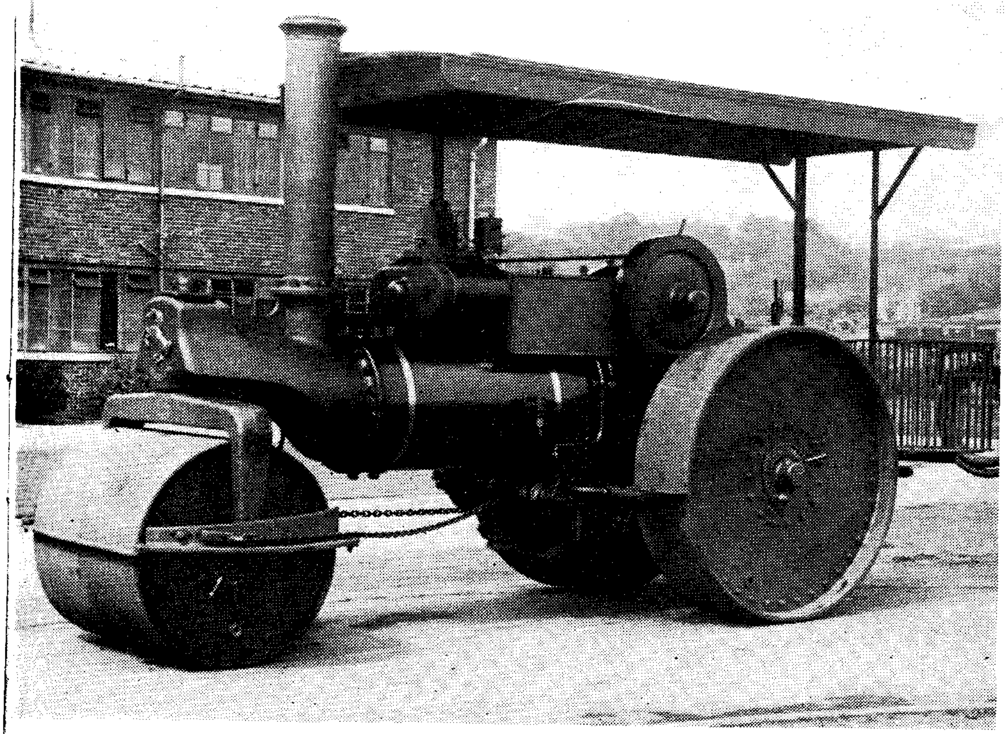
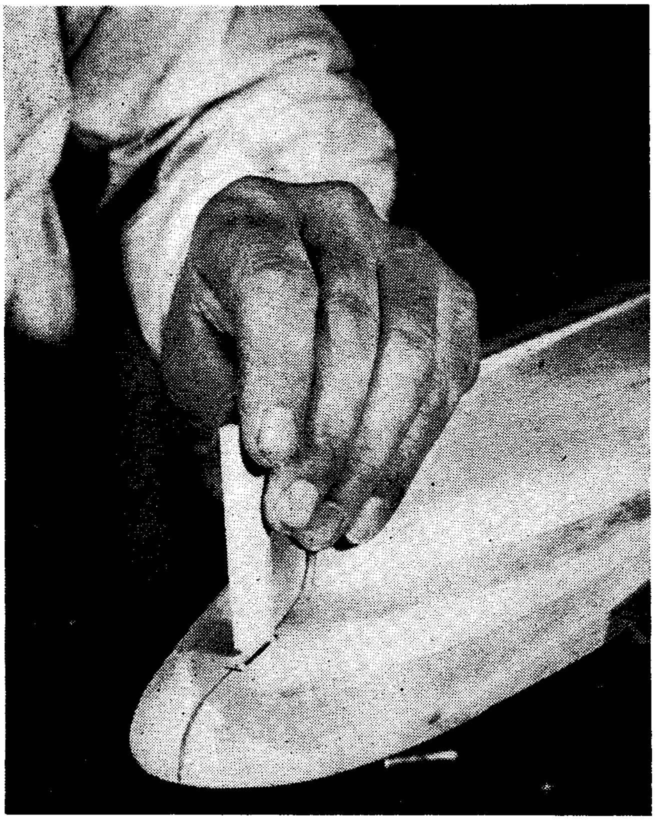


Fig. 15: T compound roller, fitted with tender for wood-firing

The author is indebted to Aveling-Barford, Ltd., for information, and for the figures 12, 13, 14 and 15, and to Mr Alan Duke for information.

WORKING ON



Now that I have told you something of the interesting features embodied in the design and working of the rudder, propeller and tail shaft, we can return to the construction of our model a little more enlightened about the tasks which we are soon to undertake.

The first thing that you must do is to shape the inside of the hull. With the careful use of a gouge and a piece of medium sandpaper, remove the unwanted material to leave the sides of the hull $\frac{1}{4}$ in. thick. When you remember that the walls of Captain Scott's ship were over 24 in. thick, you will see that our model is running close to scale here. The bow can be left more solid, again in accord with the full-size ship, but I recommend this more as a safety precaution, in case some are tempted to remove too much and break right through, rather than for the strengthening of the bow against hard knocks.

If you prefer to be a little more meticulous over the thickness of your hull, you should make some templates similar to those which we used for the outside. The main difference between the two is, of course, that the outer templates take a concave form while the inner ones will be convexed, less the amount allowed for the thickness of the hull.

Stern tube

When you are gouging the wood from the bow, keep about $\frac{1}{2}$ in. in from the edge of the top board. This will prevent you from obtaining a clean unbroken curve with the main section of the hull because the corners will still remain from the piece of wood that we cut from the centre before the pieces were assembled. But at this stage of the construction the appearance is of little consequence, and we leave the corners for practical reasons. At the stern no wood is removed from the top board—only those layers beneath it. We keep these four corners so that the work can still be positioned over the piece which we removed from the centre. I found that this was still the simplest way to hold the hull while it was upside down for working on.

As soon as you have tidied up the inside of your hull, you now begin to consider installing the stern tube. For this you will require a piece of $\frac{3}{16}$ in. o.d. $\times$ 22 s.w.g. brass or copper tube to the finished length of about $3\frac{3}{4}$ in. The length is not a critical dimension, but you must make sure that you will have enough of the tube inside the hull to give you easy access to the stern gland. Check the length of the hole through the hull before you cut your tube.

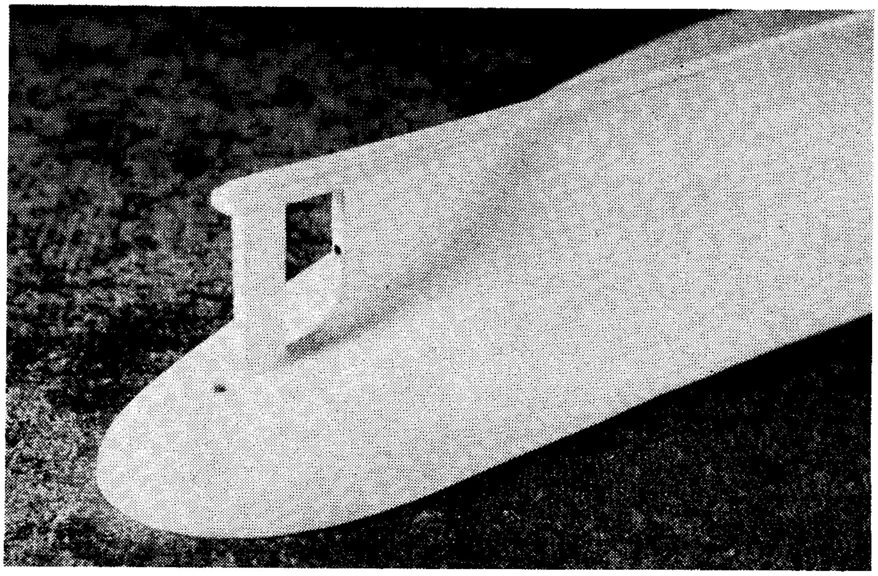
A quick study of the drawing will show you that the stern tube and gland are very straightforward to make. First, cut your piece of tube to the required length, allowing

Above: Fitting the stern post and Left: Drilling the hole for the rudder post

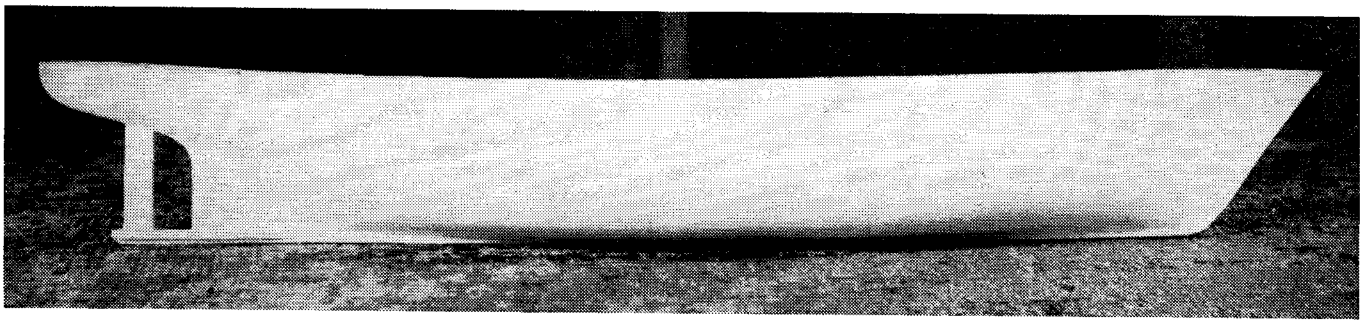
THE HULL

Continued from June 1

by Oliver Smith

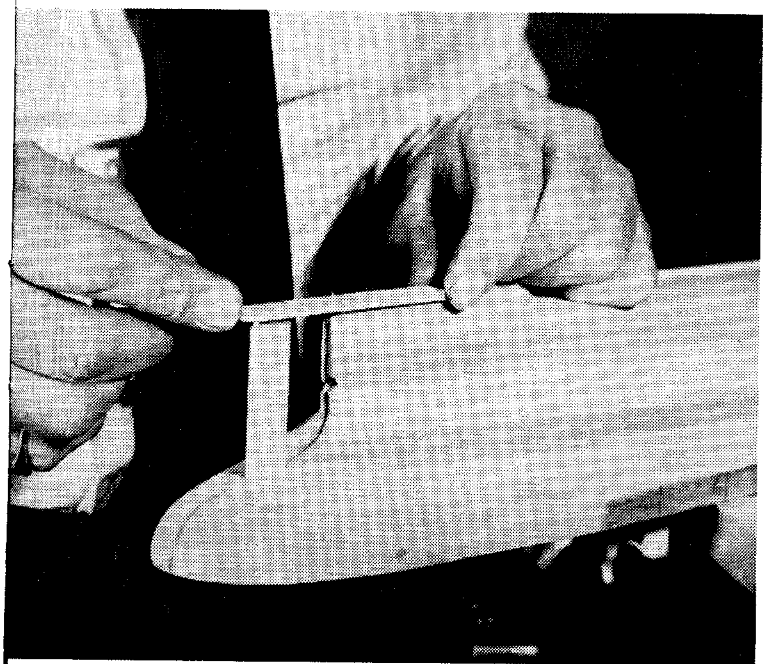


Ready for the next stage



Below: Adding the strengthening to the keel and stern post

General view of the hull taking shape

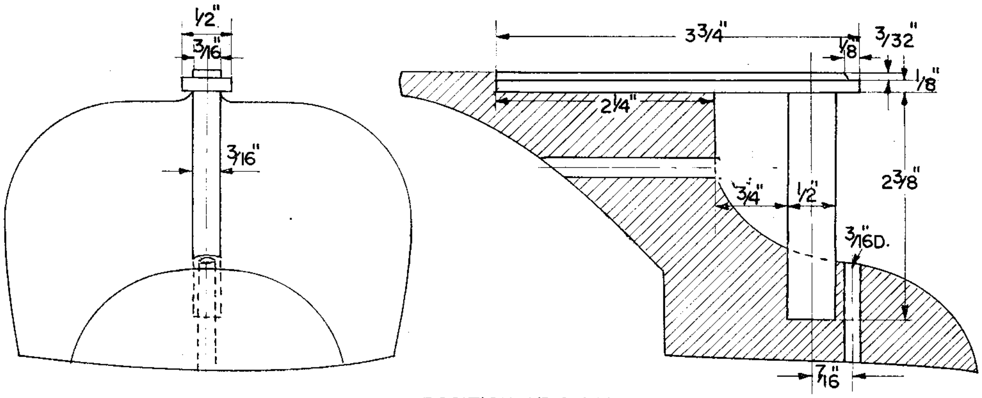


a little extra for squaring up the ends with a smooth file or in the lathe. Then take a piece of ¼ in. o.d. × 21 s.w.g. brass tube and cut off a small length which will measure 5/16 in. long after the ends have been trued up. This is slid over one end of the stern tube and silver soldered. Another way of making this part, for those who have a lathe, is to turn the tube and gland from a piece of ¼ in. dia. solid rod.

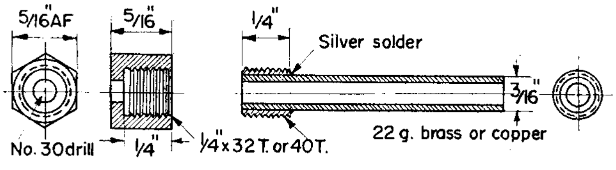
Whichever method you choose, the next step is to thread the piece of ¼ in. dia. of the stern tube. The pitch can be either 32 or 40 t.p.i. It does not matter which so long as you have a set of taps the same as the die.

Open up the die as much as the holders will allow for the first cut. To make absolutely sure, remove the two outer adjusting screws from the holder and turn the remaining centre one in as far as it will go between the split in the die. After you have run the die down the work to cut the first impression of the thread, replace the two screws and adjust the die very slightly for the second cut. Sometimes there is a tendency for the taps in the set to cut a little oversize. If you have any doubt about your taps, I advise you not to remove any more metal from the thread on the stern tube until you have made the gland nut.

If you fabricate your stern tube, as I did, hold the work



POSITION OF STERN POST



STERN TUBE AND GLAND

low in the vice when you start to cut the thread. You must remember that heating the work for silver soldering will soften the copper; and if you try to cut the full depth of thread soon after this operation with the work high in the vice, you may find yourself twisting the soft copper tube. Providing that you follow my instructions you should not run into any difficulties as I have already tried out the method.

The gland nut is made from a piece of 5/16 in. A/F hexagon brass rod. To make it properly with the minimum of fuss you will require the use of a lathe. If you lack this facility, you can make the nut with the help of a small bench drill, taking every care that the hole is exactly in the centre of the work. I will describe the sequence of events for use on the lathe and leave those who will be using a drill to adapt them to suit their circumstances.

First the piece of material is gripped in the three-jaw chuck and the end of the rod is faced across with the cutting tool set at centre height. Next move the tailstock into position, complete with the drill chuck and a small centre drill and work the drill about 1/8 in. into the rod, sufficient to give a No. 30 drill a good start. Replace the drill with the No. 30 and take it about 7/16 in. into the hexagon rod. Then change the drill for a 7/32 in. and open up the hole to the depth of 1/4 in. To be finished correctly, the bottom of the hole should be at right angles to the side, and so if you have a D-bit run it in just enough to remove the taper left by the end of the drill. The work is now ready to receive its thread, of the pitch which you cut on the stern tube.

Grip the tap in the tailstock chuck so that the thread is square in the nut, and gently press it into the work, which is turned by hand. After the hole has been tapped saw or part off the nut from the rest of the rod and clean it up, ready for fitting on to the stern tube.

The completed part can now be fitted into the hull. This is a simple operation. All you have to do is to insert the stern tube into the hole which you drilled when you began to shape the hull. It should be a tight press fit, the tube finishing flush with the end of the deadwood. Should your tube slide in easily, coat it with Araldite to make sure that it stays put and to keep water from seeping in.

We now move to the outside of the hull to make and fit the stern post and complete the after part of the keel. The stern post will take very little making. It is a plain piece of wood 2 3/8 in. × 1/2 in. × 7/16 in. If you want to have it of the same material as was used on the *Discovery* it will be of oak. But as there is little possibility that anyone will be able to identify the wood which you used once the model has been painted, I will leave you with the choice. For my own model I used one of the jelatong off-cuts from the hull, making sure of course that the grain ran vertically up the post.

The next thing to do is to mark off the position of the stern post under the counter, and at the same time the position of the rudder post. Both are shown on the drawing. Then move up to the keel and measure 2 1/4 in. forward from the deadwood and make a mark. From the mark measure down 7/32 in. and draw a line parallel to the keel back to the deadwood. Remove this section carefully with your chisel.

You will require a small chisel to cut the slot into which the stern post has to fit. Try not to enlarge the top of the hole when you are getting near the required depth. The stern post is fitted correctly when its foot is level with the cut-off in the keel.

Remove the stern post temporarily and drill a 3/16 in. hole for the rudder post. Because of the proximity of this hole to the slot, do not try making them in the reverse order or you will find yourself running into trouble.

To complete this part of the hull two small strips of wood are required to represent the continuation and strengthening of the keel. One piece of wood measures 3 3/4 in. × 1/2 in. × 1/8 in. and the other one 3 5/8 in. × 3/16 in. × 3/32 in. When you have these cut to size you can begin assembling.

First, glue the head of the stern post and push it firmly into its slot. Then coat the foot and the cutaway in the hull with the same mixture and lay the 1/2in. × 1/8 in. strip down to bridge the two. Take two brass pin nails and drive one through into the hull and the other down into the post. They will hold the strip firmly in place while the glue sets. Their heads are covered by the remaining piece of wood, glued in position to create the illusion of an unbroken keel.

When the glue has set, taper the forward end of the 1/2 in. × 1/8 in. strip for about 3/4 in. of its length so that it merges into the hull. Clean the work generally with a piece of fine sandpaper.

To be continued

Markers for free-running craft

Continued from June 1

Given fine weather, this summer should be a memorably happy one for model power-boat men. Newcomers taking part in events, as well as the interested spectators at the pondside, will be helped by the explanation of British practice offered here by J. A. King, secretary of the Model Power Boat Association. He has particularly in mind the friends of the MPBA on the Continent, where competitions have just been held for the ME and Whitbread trophies

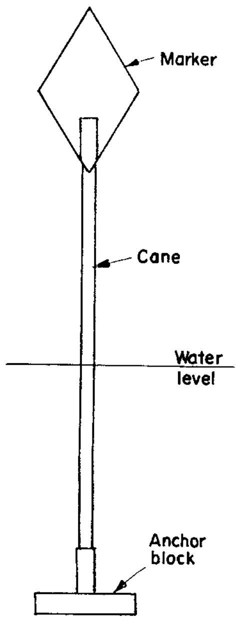


Fig. 1

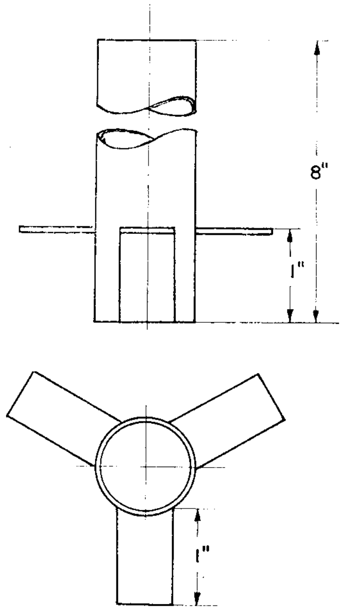


Fig. 2b

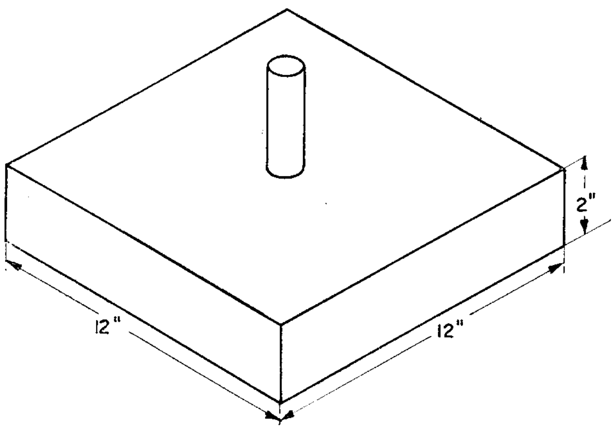


Fig. 2a

MARKERS for targets in steering competitions and other events for free-running craft are usually of the flag type and are either staked in the lake bottom or fixed in a removable stand—the commonest practice. A typical marker, as my sketch shows, consists of three parts—the flag, the post and the stand.

The post should be a good quality bamboo of about $\frac{1}{2}$ in. dia. and long enough to give at least 24 in. clearance between the water level and the flag. Bamboo is used because it reduces the damage if boats collide with it, and because the flexible cane will stay straight and last longer than other materials.

You will see the anchor block in 2A. It is cast in the same frames as the block which I described earlier, with the difference that in place of the hook a tube is fitted in the centre to carry the stake. The tube, which should have an internal size to suit the cores to be used, has six sawcuts made in one end and the flanges bent up as shown. It should be placed in the centre of the mould when about 1 in. of concrete has been poured. The remaining concrete is poured around it. Take care that the tube is square with the base before the concrete sets.

Usually the flag is of metal. The shape is not defined in MPBA rules. Some clubs have all their flags the same shape with pairs coloured alike, and others have three pairs with each pair a different shape. Common shapes are circles, ellipses and diamonds. The sizes which I suggest are a circle of 9 in. dia., an ellipse 12 in. $\times$ 6 in. and a diamond 12 in. on the longest diagonal, with 8 in. sides.

A tube is sweated to the back of the flag to take the cane. If aluminium is used for the flag, two saddles are riveted to it. Do not forget to close the top end of the tube, or to fit a stop, so that the flag will not slide down.

The markers which I have described will be suitable for most purposes. They are based on those already in use by clubs of the MPBA. ▣

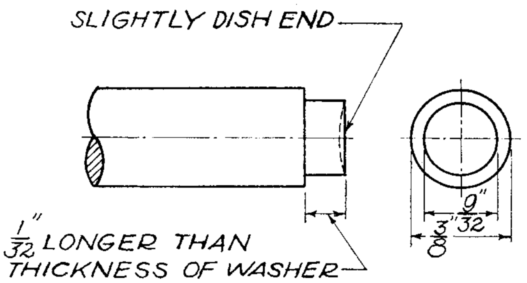


FIG. 1

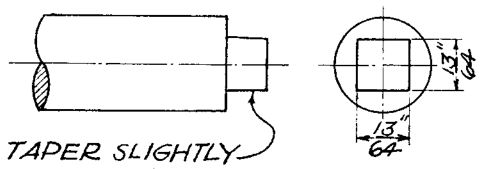


FIG. 2

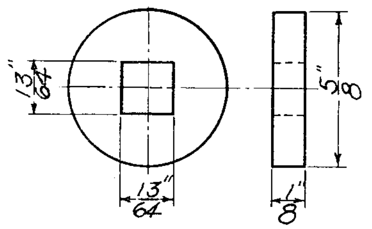


FIG. 3

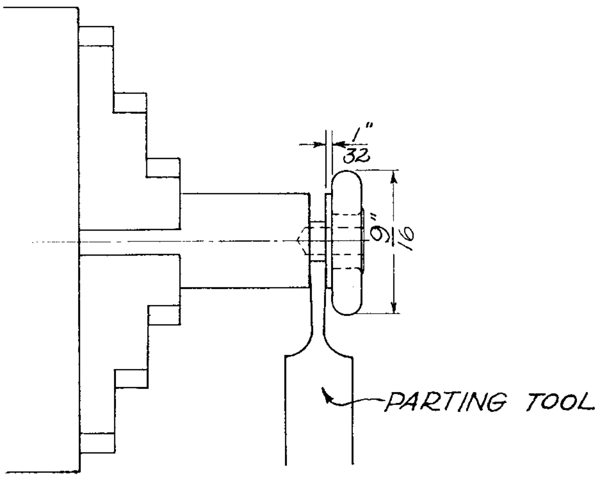


FIG. 4

Felix W. Howe has his own method of making

FIBRE HAND WHEELS

THIS locomotive valve hand-wheel design was the result of a search for a foolproof method of attaching a fibre wheel, with its low heat conductivity, solidly and permanently to the valve stem.

I began by chucking a bit of $\frac{3}{8}$ in. dia. brass or dural rod in the lathe and turning it to the dimensions shown in Fig. 1. The bar was next clamped in the vice and the cylindrical portion filed square and slightly tapered to 13/64 in. (Fig. 2). Then the wheel proper was selected from an assortment of red fibre faucet washers, and set up in the vice. The centre hole was squared out with a file to a snug fit on the end of the square filed on the bar (Fig. 3). A good light drive fit is wanted between these parts. The square on the end of the bar was driven into the hole in the washer by placing it on a bench block having the right size hole. It must project through the washer about 0.025 in. I tightened the bar in the vice with the fibre washer uppermost and carefully riveted the projecting metal over at the corners and edges to hold the two solidly in place. With the bar in the lathe, I faced off the excess rivet, centredrilled and drilled $\frac{1}{4}$ in. deep (No. 36 if the hand-wheel is to be used on a 5/32 in. dia. valve spindle). The outside edge was turned to $\frac{9}{16}$ in. dia., rounded over with a file or sharp hand tool and then polished with fine abrasive cloth. I parted-off in the lathe leaving a $\frac{1}{32}$ in. thick disc of metal attached to the hand sheet as shown in Fig. 4. I filed the hole in the centrepiece 7/64 in. square with a slight taper to fit a corresponding taper on the threaded valve stem. After being driven on tightly, a little riveting held the two firmly together. Care must be used here to protect the threads and to prevent bending the stem. A piece of thin copper sheet bent around it when clamped lightly in the vice will do the trick.

I have never had one of these hand-wheels come loose, and the combination of the red fibre and polished brass centre looks well on the locomotive backhead. ■

FOR YOUR BOOKSHELF

MACHINE TOOLS AND THEIR MAKERS

Tools For The Job *by L. T. C. Rolt (Batsford) 42s.*

CHARLES CHURCHILL AND CO. LTD celebrate their one-hundredth birthday this year. To mark the occasion L. T. C. Rolt, well known to us as the biographer of Telford, Stephenson, Brunel and Watt, was commissioned to write a short definitive history of machine tools and their makers. The result, *Tools For The Job* (Batsford, 42s.) is probably the most comprehensive book of its kind and certainly the most interesting. It has a value for the layman as well as for the experienced engineer.

The two chapters on the development of machine tools in USA illustrate the crucially important role that men like Eli Whitney, Samuel Colt and Frederick Howe played in the genesis of present-day mass-production techniques. Without the metal-cutting, boring, grinding and polishing machines, which these men helped to design and incorporate into the factory workshop, the production of the standardised interchangeable component, such as the bicycle chain or automobile layshaft gear, would not have been possible. The mass-produced motor car, aircraft, typewriter, sewing machine and repeater rifle would have remained pipe dreams.

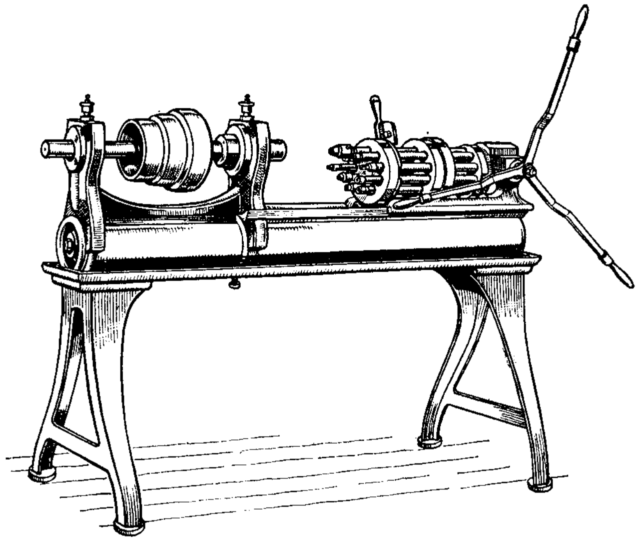
Whitney's business, other than his work on the cotton-gin, was with guns, where the great need of the frontiersman was for a firearm which did not have to be returned to a gunsmith every time a new lock or barrel was required. A visitor to the Whitney Armoury in its early days describes what, with modifications, became known as the " American System ":

" The several parts of the muskets were, under this system, carried along through the various processes of manufacture, in lots of some hundreds or thousands of each. In their various stages of progress, they were made to undergo successive operations by machinery, which not only vastly abridged the labour, but at the same time so fixed and determined their form and dimensions as to make comparatively little skill necessary in the manual operations.

" Such were the construction and arrangement of this machinery that it could be worked by persons of little or no experience, and yet it performed the work with so much precision that when, in the later stages of the process the several parts of the musket came to be put together, they were as readily adapted to each other as if each had been made for its respective fellow. . . .

" It will be readily seen that under such an arrangement any person of ordinary capacity would soon acquire sufficient dexterity to perform a branch of the work. Indeed, so easy did Mr Whitney find it to instruct new and inexperienced workmen that he uniformly preferred to do so, rather than to attempt to combat the prejudices of those who had learned the business under a difficult system."

In the space of one lifetime, from before the American Revolution, when the export of English tools and skills connected with the colonial iron industry was forbidden, to the early years of the nineteenth century, when America began exporting her tools to England, a revolution came about in technology as significant to society as the more publicised political upheavals of the same period. It would not be an overstatement to say that Britain owes her decline as the workshop of the world to the ingenuity and drive of the many American inventors and industrialists who were prepared to forsake old prejudices and feelings (including the cut-and-dried distinction between the businessman,



tradesman and technician and the members of the learned professions) for the new material success and gain that the machines would bring in the form of higher wages and the use of unskilled, highly mobile emigrant labour. New ideas were eagerly sought and speedily exploited, and many inventions originally conceived in Europe were first successfully developed on a large scale in America, as some still are today.

Charles Churchill, the son of a Connecticut engineer, and one of the ambassadors of the new American technology, paid his first visit to England in 1861. He was to instal special machines for braiding crinoline frames, but to assist his friend Hiram Maxim (who liked the ME Exhibition) with the production problems of the machine-gun, he also imported some metal-cutting machine-tools. Such was the interest which these machines aroused that a company was founded for the importation of the tools to Britain and another was later established to manufacture them there.

Detailed attention is given to Maudslay, Clement, Fox, Roberts and Whitworth, to the many pioneers of drives, gears and gear-cutting machines on both sides of the Atlantic, to the precision-grinding machine and its influence, and to modern developments in metal-cutting, automated tooling and so forth. There are many fine line drawings and photographs, including a number reproduced from journals such as *The American Machinist*, *The Engineer* and *Journal of the Royal Society of Arts*. The need of the early American industrialist in the prevailing social and economic circumstances, to build the skill into the machine and to furnish manufactured components of the highest quality, often in mammoth quantities, is reflected through successive chapters of the book to the point where even an electronic tape control of limited but astounding capabilities in integrated in a complex process.

The chapter on the twentieth century will, I dare say, have to be revised in the not-too-distant future. D.K.M.

MODEL PUMPS

Continued from June 1

FROM BRIDLE TO MAIN BEARING

by Edgar T. Westbury

THE two bridles (part No. 4) can best be made from bronze or gunmetal castings, in the form of a near-triangular frame of T-section, with bosses at the apex and base. They can be cast from a simple pattern, provided that the inner sides of the frame are tapered both ways to give ample draft for easy removal from the mould. The little machining required should be done carefully, to maintain exact alignment of the piston and tail rods.

First the edges of the frame should be trimmed by filing, so that they will rest either way up on a flat surface without rocking. The centres of the bosses can then be marked out accurately, symmetrical with the frame sides. After centre-punching the bosses deeply, centre-drill by resting each end in turn on the back centre, while running the drill in the chuck. If a short, stiff drill is used to take the tapping holes through the bosses, there will be no tendency to deviation from the axis. The tap should be applied in the same way, for the first hole only. A screwed stub mandrel is then made and the bridle is screwed on to it for tapping the second hole, and for facing both bosses to the overall length of 4 in. With this method the alignment of the holes can be checked, and the truth of the threads assured.

We may now drill the cross-hole in the upper boss by setting the bridle up on the lathe faceplate and clamping it in position by a strap across the opening of the frame. At the same setting we can machine one face of the hole $\frac{1}{16}$ in. back from the frame edge and deal with the other side in the same way after reversing the casting on the faceplate. If the cross-hole is made in the drilling machine, the faces will need attention with a spot facing cutter. The hole is finished to size with a reamer or D-bit.

We make the piston and tail rods (part No. 15) from $\frac{1}{4}$ in. mild steel rod, chucked accurately, preferably in a collet chuck, for screwcutting the ends $\frac{1}{4}$in. × 26 t.p.i. For the piston rod we turn down to 9/64 in. for a length of $\frac{1}{2}$ in. and thread 4BA with a tailstock die holder. Some may prefer to use silver steel, but it has no practical advantages for this purpose, and to cut clean threads on it is much more difficult with dies or a single-point tool. The rods should fit closely in the threads of the bridle bosses. When they are screwed in to the specified depth, the assembly should be truly in line, as checked by our running it in the lathe with one end truly chucked. I have not considered fitted lock-nuts on the rods; should any length adjustment be needed, one or both of the rods may be cross-pinned when correctly set.

The cylinder castings (part No. 5) should have plain cores through their entire length, and the pattern should therefore be provided with core prints about $\frac{3}{8}$ in. dia. at both ends. No machining allowance is necessary on the outside, except for the edges of the top and bottom flanges. It would be difficult to machine the part immediately under the top flange, because of the side projection, but the rest of the outside, including the centre band, may be trimmed with a file to remove rough spots or flashes.

Most of the internal machining can be carried out by chucking the casting by the bottom flange. As the piston must produce a watertight seal in this type of pump, the circular and parallel accuracy of the cylinder bore is highly important. After boring as accurately as possible to within one or two thou of finished size we finish the working surface by lapping with a mild abrasive, such as brick dust or pumice powder, on lead or copper. The mouth of the cylinder, down to below the level of the discharge outlet, is opened out to $\frac{7}{8}$ in. dia., and if a level is provided to lead into the smaller bore, as shown, it will ease the entry of the packed piston on assembly.

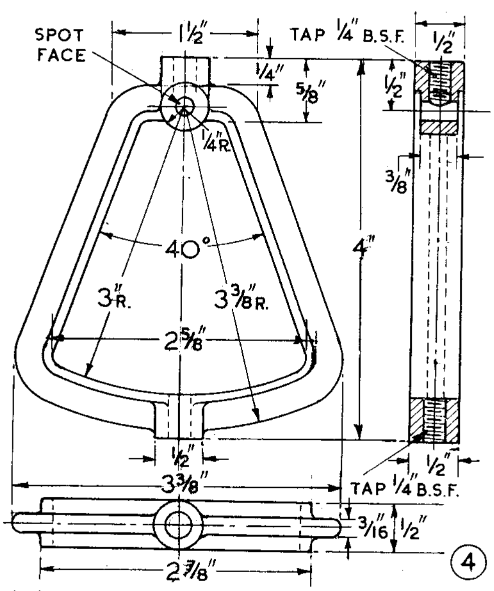
We may use a stub mandrel to mount the cylinder in the reverse position, for facing and counterboring the bottom end and for turning the outside of the flange. To drill the discharge passage, and face its flange, we mount the casting on an angle plate, by a bolt through its centre, and set it up on the lathe faceplate. The flange faces on the two cylinders should be the same distance from the bore centre, so that when they are mounted on the baseplate a straightedge laid across the two flanges will make contact with them throughout their full width. Both the depth and diameter of the counterbores in the cylinder bases should be machined to fit the inlet valve plates.

Two methods

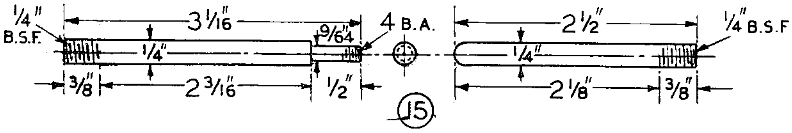
In machining the cylinder covers (part No. 6) we have a choice of two methods. If we set up the casting with the underside outwards for machining the register spigot and the inner and outer faces of the flange, and for centring and drilling the hole, we must then make sure that when the casting is reversed for working on the top side it is set up concentric with the hole and is also true on the face. The best way is to make a split ring chuck, which is faced and bored in position to fit the cover spigot. Both the facing and counterboring of the gland recess can then be carried out with positive accuracy. The other method consists of dealing with the top side operations first, and then turning a stub mandrel with a pilot, to locate in both the centre hole and the counterbore, for facing the underside and turning both the register and the edge of the flange.

We can carry out the essential operations of drilling, turning and facing the gland (part No. 7) at one setting by holding the flange in the four-jaw chuck. For the less exacting operation of facing the top surface, the self-centring chuck may be used. I find it extremely convenient when a number of flanged parts, including pipe connections and valve covers, have to be made, to cast a stick of metal of the same shape as the flanges, so that the parts can be machined and parted off at one setting. The stud holes in the gland are marked out and drilled, after which we use the part as a jig for spotting the tapping holes in the cylinder cover. To guard against any discrepancy in the location of the holes, the mating parts should be marked so that they can be assembled in correct relation to each other.

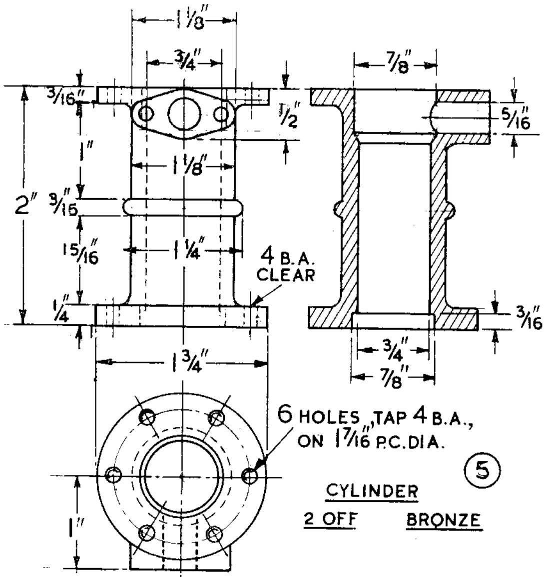
In a similar way we can use the six clearance holes in each cover to spot the tapping holes in the top cylinder flange. I make certain of locating such holes symmetrically, and on a true pitch circle, by indexing the lathe mandrel and using a simple drilling spindle in the tool post, while the part is set up in the lathe for machining. The fittings have been the subject of articles in ME, and are also described in *Lathe Accessories* and *Milling in the Lathe*. They are well worth making. For those who object to setting up a rotary spindle attachment for a small operation, a simple and fairly accurate method is to make a special centre punch from round silver steel with a truly machined point, and to mount it axially in the tool post in a bored holder, which is then traversed up close to the work, and at the correct cross



BRIDLE 2 OFF BRONZE

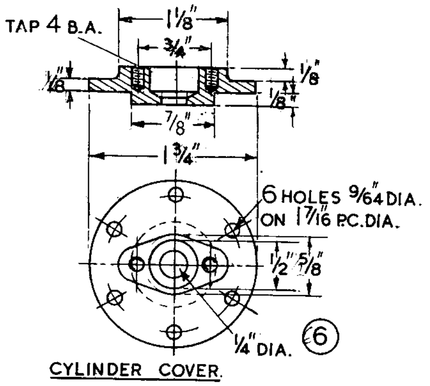


PISTON ROD 2 OFF EACH M.S. TAIL ROD

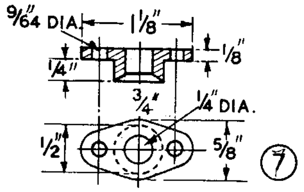


CYLINDER 2 OFF BRONZE

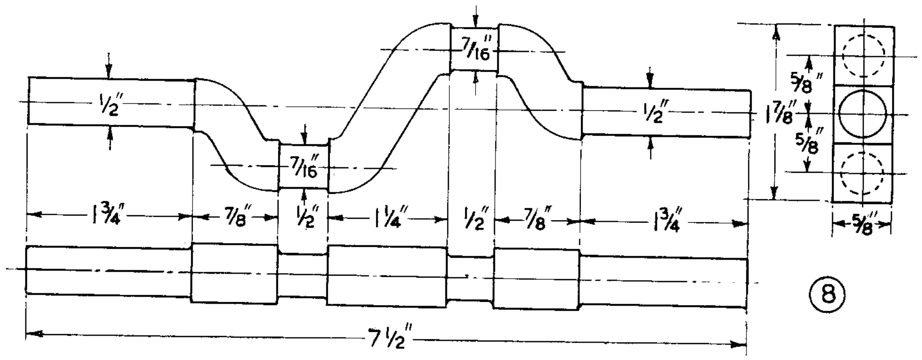
CRANKSHAFT



CYLINDER COVER 2 OFF BRONZE



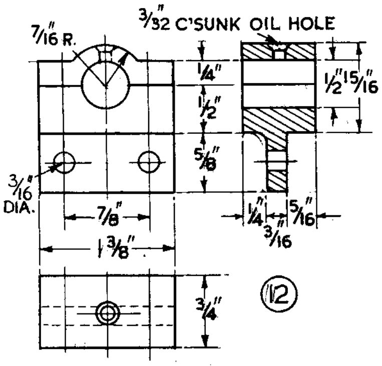
GLAND 2 OFF BRONZE



CRANKSHAFT 1 OFF M.S.

radius for the specified pitch circle. After the lathe mandrel has been indexed in each position, a light tap on the end of the punch will produce an accurately located pop or indentation for starting the hole in the drilling machine.

The base flange of the cylinder must of course be marked out and drilled separately. It cannot well be used to spot the tapping holes in the base, because direct access of the drill from the top cannot be obtained. Apart from working by exact measurement, or dead reckoning, as navigators say, our best method is to clamp the cylinders down on the base



MAIN BEARING
2 OFF BRONZE

in correct position, not forgetting to line up the discharge flanges, and mark the holes through with a bent scriber.

One of the biggest operations, though not necessarily the most difficult, in making the pump is the production of the crankshaft (part No. 8). In the full-size pump, the crankshaft was made by the forge-bending of a round bar. This was undoubtedly the most convenient method at the time and was employed for many cranks, including those of stationary and traction engines. Nothwithstanding the lack of dies or other aids to accuracy, the blacksmiths of the period could make neat cranks which required very little machining on the journals. The same methods could equally well be used for the model, given the necessary forging skill; but as the blacksmith's art seems to be almost extinct nowadays, I have thought it best to arrange for the crankshaft to be cut from solid rectangular steel bar, with the webs left with square corners or rounded later by filing.

The section of bar required is $1\frac{3}{8}$ in. × $\frac{5}{8}$ in., and slightly over $7\frac{1}{2}$ in. long to allow of trimming the ends. It is first marked out on both ends for main and throw centres, which are then deeply centre-drilled. Most of the unwanted metal around the crankpins can be cut away by sawing and drilling, but of course the ends must be left for the time being with the throw centres intact. The bar is then set up on each of these centres for turning the crankpin journals. The operation is simpler than usual because of the splayed crank webs, which give plenty of clearance for the turning tool, in comparison with the restricted space between the more familiar parallel webs. In this shaft the webs are inclined at 60 deg. to the axis, with well rounded corners where they join the journals.

After finishing the crankpins smooth and parallel, with a small fillet or internal radius in each corner, we cut away the surplus metal in the vicinity of the main journals and again mount the shaft between centres for turning these to size. To stiffen the shaft against the tendency to deflect under cutting pressure, two steel plates about $1\frac{1}{2}$ in. wide × $3\frac{1}{2}$ in. long, and not less than $\frac{3}{16}$ in. thick, may be clamped on the sides of the webs by bolts in the gaps adjacent to the crankpins. As in the previous operations, the journals must be finished to a smooth surface, and dimensional accuracy is important because of the need to fit the bearings and driving pulley.

The detail drawing of the main bearing (part No. 12) shows it made in one piece. It is not necessary, as a practical measure, to split the bearing and fit studs for holding down the top half. But this would be in comformity with the full-size pump, and would also be necessary if the clearance had to be adjusted to take up wear. If a split bearing is used, the clearing and tapping holes in the two halves should be drilled, and the joint faces bedded together, before the final boring. Otherwise, the solid bearing may be held in the four-jaw chuck, inner face outwards, for boring and facing. A witness facing cut can also be taken on the lower flange extension, as far as is permissible without fouling of the underside corners. This will help towards the squareness of the surface when we are milling or filing it to fit against the facing on the outer side of the standard.

To be continued

AROUND THE TRADE

Bottle gas torch

THE Supa Nova blowtorch, recently reviewed in our columns, is a useful appliance in the home workshop.

With a temperature in the region of 1600 deg. C, and a flame size of three inches, a variety of brazing and hard-soldering tasks are within its possibilities.

A standard lighter refill gives sufficient bottled gas—butane or propane—for $1\frac{1}{2}$ hours of strong flame usage, or $2\frac{1}{4}$ hours with a low flame. For longer periods of work the burner can be connected to larger bottles.

Readers in the North will be interested to hear that this useful blowtorch may be had from Robert Menzies and Co., of 58 Gibson Street, Hillhead, Glasgow, W.2.

DRAWINGS FOR HIGHLANDER

A FURTHER sheet for *Highlander,* the $7\frac{1}{4}$ in gauge LMS 4-6-0 locomotive now being described by Martin Evans, may now be obtained from the Plans Department, 19-20 Noel Street, London, W.1.

LO.39/Sheet 4, shows the engine erecting stand, driving and coupled wheels, driving and coupled axles, assembly of buffer beam, further frame stretchers, hornstays and spring plates. Price 5s. 6d.

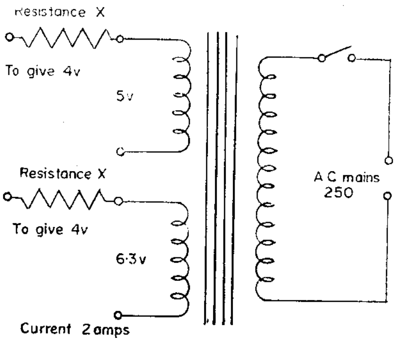
CORRECTION

In the article dealing with piston-valve cylinders, line 17, on page 365, the amount undersize should have read " 0.001 to 0.002." *Line 32 should have read:* " $\frac{1}{4}$ *in. (approximately) to* 0.0005 *in. over the nominal.*" *Page 364, second column, line 10 should have read,—* " *generally* $\frac{3}{8}$ *in. or* $\frac{5}{16}$ *in.*"—

READERS' QUERIES

DO NOT FORGET THE QUERY COUPON ON THE LAST PAGE

- ★ Queries must be within the scope of this journal and only one subject should be included in each letter.
- ★ Valuation of models or advice on selling cannot be undertaken.
- ★ Readers must send a stamped addressed envelope with each query and enclose a current query coupon from the last page of the issue.
- ★ Replies published are extracts from fuller answers sent through the post.
- ★ Mark envelopes "Query," Model Engineer, Braywick House, Maidenhead.



Reducing voltage

I have a transformer which gives an output of 6.3 v. and 5 v.

I want to reduce the voltage (output) in each to 4 volts 2 amps. It must be done without my having to alter the secondary winding in any way. I want to use a resistance (X).

What value resistance will be required, and what will be the gauge of resistance wire needed?

The load at the reduced voltage will be constant; not more than one piece of apparatus will be operated.
—A.H.R., Bargoed, Wales.

▲ *The main concern is the current taken by the apparatus; the voltage is incidental. For the 5 v. secondary a resistance of 2.5 is the value; for the 6.3, about 3.1 ohms. As the output in amps of the secondaries is not known, nor the regulation of the transformer, you should make the check with an ammeter in circuit, and adjust the resistances for a current of 2 amps, through the item being used. A suitable wire would be 20 s.w.g. nickel-chrome resistance, $2\frac{1}{4}$ yards for the 5 volts and 3.25 for the 6.3 volts.*

Thetford Town

I am building a 2 in. scale Burrell SRL from drawings supplied by Dick Simmonds and have become stuck on a problem regarding the governor.

The control of the valve is shown to be by three balls fixed to 3/16 in. x 3/64 in. spring steel strips which are also *rigidly* fixed at top and bottom. I cannot imagine how the set-up can give the 7/32 in. total vertical movement required to open the valve fully.—J.H.C., Uxbridge, Middlesex.

▲ *Ronald H. Clarke who made the drawing replies:*

The governor on my drawing is a scale replica of a standard Pickering instrument used almost exclusively on traction engines in later years. Each flat spring is rigidly fixed top and bottom. Being of spring steel, it can move horizontally at speed, thus moving the inner spindle sleeve, and on it the valve, to suit. I suggest that you study a full sized instrument at any rally.

Boiler

Some time ago I wrote to you about the copper thickness for my *Doris* boiler. You were able to reassure me that 0.080 in. copper would be suitable for the firebox inner wrapper. I would like to know if 0.080 in. would be suitable for the front plate and rear plate of the inner firebox.

A further point of concern to me is the sealing of the firebox stays. Kennions recommend the use of their Silcop material and claim that this obviates nutting. In 1949 LBSC condemned the use of Silcop on the ground of brittleness, I would like to use Kennions method in order to avoid any soft solder.

Is there any design defect in this boiler? When *Doris* was being described in 1948-9, LBSC claimed that the "piston ring" connecting the boiler barrel to the throatplate was merely for location purposes and that he himself omitted it. I intended to omit this ring myself, but on browsing through my back numbers I find LBSC in 1953 defending some of his boiler designs and claiming this "piston ring" as an essential feature of his boilers of this type.

In passing I would mention that *Doris* was begun in 1949 during my apprenticeship as a toolmaker. The tender and chassis less cylinders were completed in 1950. Four years ago my employers, who are leading motor manufacturers, decided to build a minor factory in Liverpool (minor by comparison—we have 3,500 employees here) and I was installed as Works Manager. In the course of moving home all the bits and pieces came to light and I resolved to finish the job as soon as circumstances allowed. Now I have only the boiler to complete.

The bulk of my day is spent on labour problems, and I often think when I am in my own workshop that I would need every union card going to keep out of trouble.—J.H.H., Halewood, Liverpool.

▲ *Copper sheet* 0.080 *in. thick could safely be used for the firebox tubeplate and firebox backplate. For tubeplates we recommend slightly thicker material. The thinner material should be stayed a little closer.*

Our opinion of Silcop is that it is inferior to the best-grade silver solder. It may suffice in expert hands, but it tends to be brittle, while the best silver solder makes a safe lasting joint.

It is an advantage if all the stays can be run over with silver solder. They should still be threaded in both plates and nutted on the inside of the firebox. It never pays to take any chances in boiler work.

As you may have difficulty in silver soldering inside the firebox, you can try a different method of assembly—putting in the firebox backplate after *the sidestays have been put in and silver soldered over. The firebox backplate is silver soldered, and finally the backhead and the end stays between the backhead and the firebox backplate are fitted.*

We do not know of any design error in this boiler. The "piston ring" construction is very strong and is recommended to all boiler-makers except the highly experienced.

Can you help?

How about Marine engines?

Where can I get a general arrangement drawing of any triple or quadruple exmarine engine of the heroic period—say, 1910-15?

I vaguely remember two books with plates published in about 1900, Seaton's *Marine Engineering* and Lineham's *Mechanical Engineering*, but I have not been able to get a copy of either.

The interests of elderly modellers seem entirely concentrated on locomotives.—C.S., Shoreham-by-Sea, Sussex.

Fairground photographs

I am very keen on collecting photographs of the old steam engines and any kind of ride, and I would be very pleased if you could put me in touch with any one who could help me with my collection.—E.W., Bedminster.

Rival powers

I would be most obliged if you can help me.

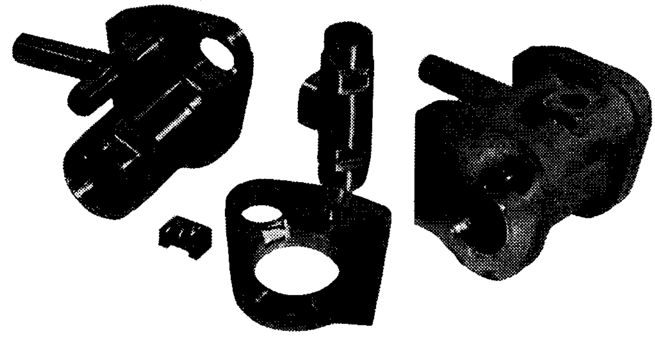
I have a friend who has a coloured print of a country scene with a period car (full of toffs) passing a level crossing. (I think the car is a green Bentley). There is a large Crampton locomotive tearing along beside an avenue of trees, with its whistle blowing and driver and fireman waving frantically for the car to get out of the way.

Does anyone know where this may be obtained? It is the best picture I have ever seen of the rival powers. Thanks for a great magazine.—R.M., Perth.

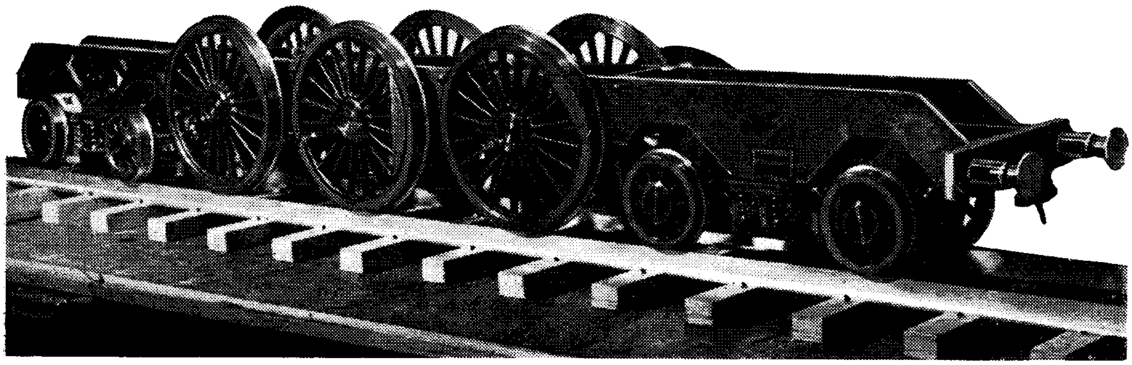
Brass locomotives

I have in my possession two early brass locomotives, $3\frac{1}{2}$ in. gauge, named *Farringdon* and *Rover*. The first-named is a 2-2-2 locomotive and is complete, less cylinders and whatever was fitted on the footplate; the other has only the boiler complete and is thought to be a 2-2-0 or an 0-2-2. Can any reader throw any light on these locomotives and supply details of the missing parts so that they can be completed?—W.J.M., Chester.

Postbag



The Editor welcomes letters for these columns. A PM Book Voucher for 10s. 6d. will be given for each picture printed. Letters may be condensed or edited



Top: Phosphor-bronze piston valve cylinders. Left: Chassis complete

German Hudson

Sir,—For the past year and a half I have held a subscription to MODEL ENGINEER, and all fourteen days I wait for the next number with more interest. I am beginning to build the model of the German Hudson locomotive (gauge 110 mm. or $4\frac{5}{16}$ in.). Unfortunately, in Germany the industry for modellers is not so specialised as in England. Some castings and fittings such as water gauges, I must buy in England. I esteem the good quality of the material.

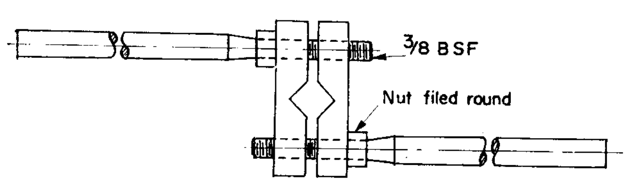
As I could find no suitable castings for the cylinder blocks, I made the blocks from material bought in the metal-shops here. The piston and piston valve cylinders are from phosphor-bronze and the flanges from brass plates. The steam and exhaust ports are cut, drilled and filed and the exhaust ports are connected with a T-pipe from copper. All the parts are silver-soldered. It was not difficult work.

The bore is 40 mm. (1 37/64 in.) and the stroke 60 mm. ($2\frac{3}{8}$ in.).

Feldblumenweg, Germany. FRANZ GROSSE-HOLTFORT.

Tap wrench

Sir,—Referring to Mr Collier's letter and sketch showing a simple tap wrench, I attach a sketch of one I made in 1917. It was done by hand without the use of machine tools. It is very simple and can be adjusted by twiddling both handles, the operator's hands then being already in a position to use the wrench.



I may say that this wrench is in daily use by myself and my African technicians who are always highly amused at the dating of my various tools. I once overheard one say to his companion, having borrowed my pocket knife, that the "bwana" must have had this knife for twenty years without sharpening it.

But it was a knife, bearing a well-known trade name, obviously produced for the so-called "native trade," and no amount of honing would have given it an edge.

Malawi. T. GIBBARD.

Baker valve gear

Sir,—In his article on the above topic in MODEL ENGINEER (February 1) Mr K. N. Harris refers to the difference in centres between the two upper pin holes in the gear connecting rod and those in the radius links. The reason for this difference is given in the *Railway Gazette*, 11 February 1944, page 134.

Here it is explained that the set-back of the gear connecting rod in itself is not sufficient to give equal movement of the valve each side of mid-position, and that the inequality of centres referred to above permits this feature of symmetry to be achieved.

In the *Railway Gazette* of 11 June 1943, page 587, is another good article describing this interesting gear. There are two drawings of its application to American locomotives which show clearly that the motion is inclined, with the foot of the gear connecting rod well above the cylinder centre line, thus disagreeing with what Mr Harris shows as the "normal form" in his diagram on page 99.

University of Western Australia. R. S. MINCHIN, (*Senior Lecturer in Mechanical Engineering*)

Diesel interest

SIR,—In the May 15 issue of ME (page 355) you show a photograph of a most interesting diesel shunting locomotive. I was disappointed at the small amount of space describing this model, as I believe there is a growing interest in these types.

Could Mr Dobson be persuaded to give more details especially regarding the engine and transmission? I am building almost an identical model in $3\frac{1}{2}$ in. gauge with E.T.W.'s *Sealion* engine as the prime mover.

Catford, London SE6. F. H. GRAY.

Time thread

SIR,—Mr Armstrong is using a steam-hammer to crack a nut! Has he not tried putting the tailstock barrel up against the die, or making a tailstock die-holder?

If I want a thread to run really true, I set up the change-wheels and cut a rough form with any old V-shaped tool, and then finish with the die. This is much quicker than finding, turning and drilling a screwed bush. How do you get the bolt-end to run really true? If you don't do this, the last state is worse than the first.

Orpington, Kent. HAYDN D. SMITH.

Loss to tourists

SIR,—In the issue of February 1 you printed a picture of a Canadian side-wheel steamboat, the *Sovereign,* believed to be of Montreal.

Now from an old American tourist book, I send you a photograph of a much bigger vessel, in fact a little liner, of the same class. She is *Pilgrim,* of Fall River Line, USA, and seems to be about 1896.

Pilgrim is of great interest. Note that the huge old "flitch beam" (iron and wood combined) connecting rod has gone and is replaced by a double rod of carbon or nickel steel. You can see the keys in the little-end with a glass. There seems to be a two-toned hooter behind the engine, and the lights over the decks are Edison filament bulbs and not arcs.

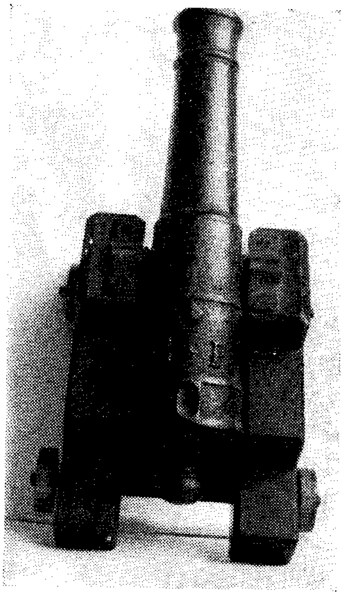
It is a great loss to world tourists that these superb old American river-liners have gone; they had accommodation far superior to that of the day boats.

Mill Hill, London NW7. H. H. NICHOLLS.

Standby! Fire!!

SIR,—As an old artilleryman of the 1914-18 war I was most interested in a model cannon which had been relegated to a local scrap-yard, and I determined to find something of its past history. Correspondence with the Rotunda Artillery Museum at Woolwich revealed that it was indeed an historic piece.

It is cast-iron, has a smooth bore, measures 14 in. long, 3 in. thick at the breech end and has a crown, broad arrow and the initials GP cast in near the touch-hole.



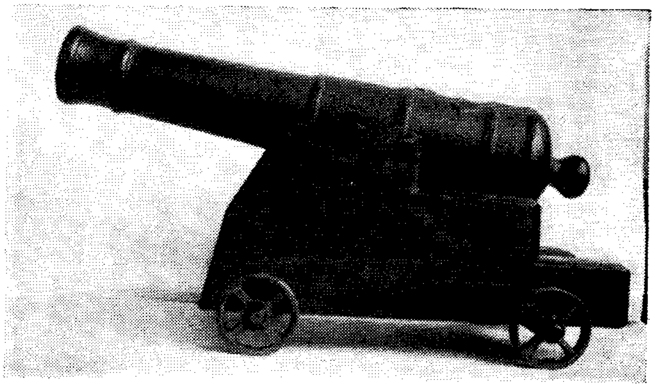
Historic 24-pounder of the Napoleonic era

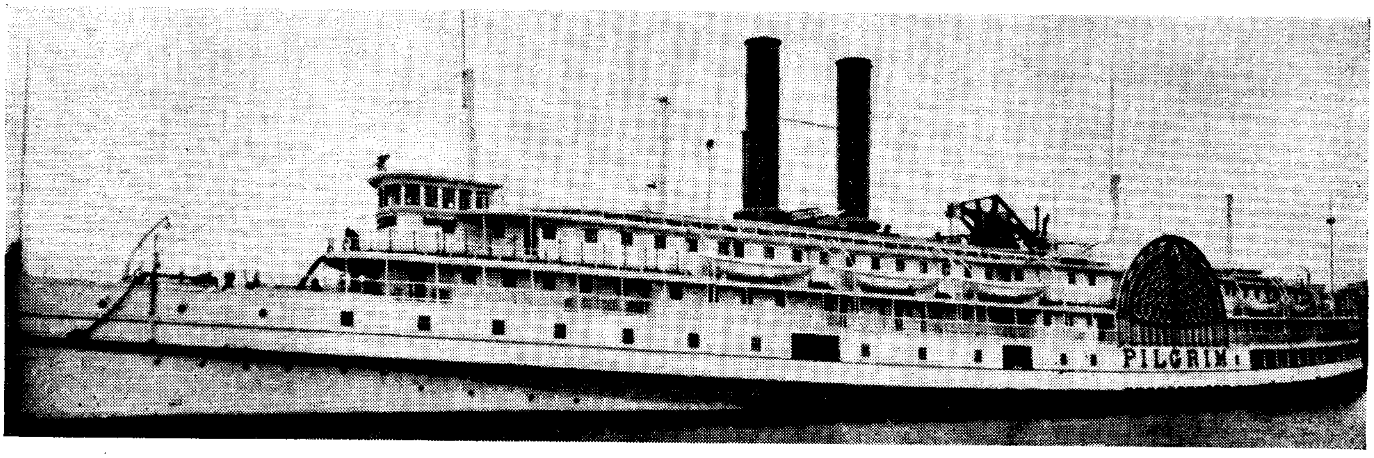
According to the authority quoted above, it represents a 24-pounder used by George Potter in his experiments about 1790-1800.

The Napoleonic era was a time of feverish activity in naval and army circles and the aiming of cannon in fog or darkness was being studied by several people of whom G.P. was one.

A dial sight attached to the gun platform, and an auxiliary sighting point gave one solution. In fact an Mk 7 dial sight was used successfully in World War I.

Wigan. J. L. WATERHOUSE





River liner of the USA

She was at Dunkirk

SIR,—Vulcan says in Smoke Rings that the old steam boat *Consul* is the last surviving paddler in service. I hasten to say that the old *Sandown* owned by British Railways is still running between Portsmouth and Ryde, Isle of Wight.

On Good Friday, my wife, daughter and I went over to Ryde in this old paddle steamer, which was making her first trip this season. She was freshly painted and appeared to be in good shape.

Below decks, she carries the plaque between decks commemorating her services as a mine-sweeper and troop carrier during the world wars. She has a triple-expansion engine and it still thrilled me, as when I was a boy many years ago, to stand at the engine-room door and watch the three big cranks come up and over. The cylinders are at an angle of about 45 deg. below the crankshaft which passes out at deck-level to the paddle sponsons.

With good wishes to the staff and for the future of ME.

Warsash, JAMES D. PETTITT.
Hampshire.

[*The* SANDOWN *was at Dunkirk*.—EDITOR.]

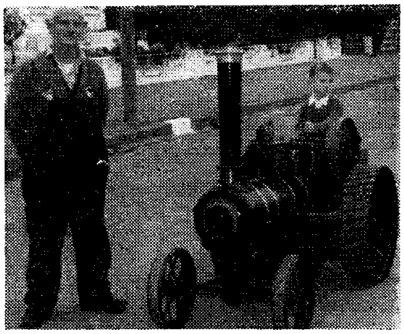
Friend in Medicine Hat

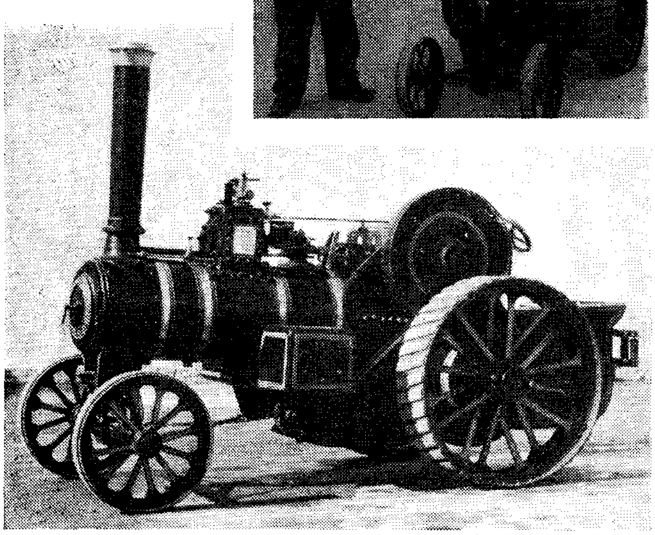
SIR,—May I thank Mr D. A. Lefever, of Medicine Hat, in Alberta for his letter on melting of aluminium? I have received through MODEL ENGINEER Flux Foseco, which I am using with great success.

It is a pity that the distance is so great between us, or I would take the weekend off and go and shake Mr Lefever's hand. I hope that other readers also find MODEL ENGINEER of great value and full of instructive reading matter. I am always looking forward to the next issue.

Virginia, G. M. DE LANGE.
South Africa.

Mr Rainey's model Burrell has phenomenal powers of haulage





Toy locomotives

SIR,—The toy steam locomotive and tender illustrated in the May 1 issue is one made by Georges Carette of Nuremburg, Germany, before and right after World War I.

I have four of these engines. Two are as pictured, save that the headlight is higher. One has oscillating cylinders and the fourth one has slide valves and a reversing link outside. The example you illustrated has slide valves driven by an eccentric behind the crank. This slide valve business is unusual in toys, for the bigger makers (Marklin and Bing) used piston valves.

The cars with my sets are different from those in Seattle, which look as though they might be hand painted. Mine are lithographed and carry Carette's trademark in place of the class making, I or II.

This is not surprising, for in collecting these old German trains, it is rare to find any two items identical. So much hand work went into their production that variations were not expensive and were evidently made to suit various dealers and markets. For instance, the cowcatcher shown in your pictures was put on for the American market, although the European buffers were retained.

I would be happy to engage in further correspondence with anyone interested in old toy trains.

Philadelphia. JAMES MACFARLANE.

We are grateful to Mr Macfarlane for his detailed reply to Vulcan's Smoke Ring. We will be delighted to forward correspondence.—EDITOR.

Powerful model

SIR,—My photographs are of a model three-speed single-cylinder Burrell traction engine which I made. It has springs fore and aft, and runs on 150 p.s.i. It is to one-third scale, complete with front tank, and weighs 15 cwt. empty.

The $10\frac{3}{4}$ in. dia. boiler incorporates a barrel and firebox of $\frac{1}{4}$ in. plate, hornplates, tubeplates, and throatplates of $\frac{5}{16}$ in. plate. All rivets are $\frac{1}{2}$ in. The stays consist of two $\frac{3}{4}$ in. longitudinal ones, and two 1 in. stay tubes. There are nineteen 1 in. tubes. The firebox and crown stays are all $\frac{3}{4}$ in.

The boiler holds eight gallons of water, and the tender and front tank hold four gallons each. The tube-expanders, stay-taps and all jigs and formers for front and back wheels, front and back tubeplates, backhead plate and tender, had to be made. For instance, the jib for forming the throatplate took five hours to make, while making the throatplate itself took only two hours.

The crankshaft is cut out of $5\frac{1}{4}$ in. shafting. The cylinder is fabricated out of steel, there being seven parts in all, welded together, with a cast-iron sleeve, which is steam jacketed. It has a 3 in. bore and a 4 in. stroke.

The wheels were a big job, the back wheels weighing 128 lb. each. The boiler feed is by a small steam pump and injector. It has a water lift that works, and a free drum complete with 50 yards of wire rope. The only castings on the model, are the cylinder sleeve and the flywheel.

The engine runs really well when notched back, and has pulled a five-seater Chevrolet car, plus two trailers loaded with children, in top gear.

All jigs and parts were made by myself in my workshop.

Ashburton, H. W. S. RAINEY.
New Zealand.

Savages Limited

Sir,—Some time ago I read the book review by W.J.H. of the booklet *Savages Ltd,* by R. H. Clarke, and after reading the first paragraph I began to wonder what manner of review it was. An earlier review in another publication made it adequately clear to the would-be purchaser that *Savages Ltd* was a reprint of the original *Century of Engineering* and that the company, Savages Ltd, regretted having to charge 7s. 6d. to cover increased charges. Why W.J.H. had to begin his review in such a manner, I am at loss to know.

He took R. H. Clarke to task over Fig. 14 and the reference to "The disc form of crank being used with a large flywheel for steady running." But the original by R. H. Clarke and the same paragraph as written by W.J.H. are vastly different. Fig. 14 shows one of the smaller horizontals, and as the statement on disc cranks follows the words "30 n.h.p. (cylinder 18 in. x 36 in)" which is logical, I feel that W.J.H. confuses the issue.

The parting-shot by W.J.H. after taking Clarke to task over the lack of dimensions in Fig. 36, is: "We do not have to be purists for them to be annoying." If we are to be annoyed by these things in *Savages Ltd* we should be equally annoyed by the undimensioned drawing of the Burrell-single-crank compound cylinder on p.169 of W. J. Hughes' book *A Century of Traction Engines* because it does not show the slight rearwards inclination from vertical of the cylinder. This too is a minor point, but not sufficient for us to get annoyed about.

I feel, Sir, that W.J.H. showed some bigotry towards the works of R. H. Clarke, which do not reflect favourably on the reviewer or reviewed, and I trust that future reviews will not be in this vein.

New Plymouth,
New Zealand.

I. G. Reid.

Send news and notices to the CLUBMAN, Braywick House, Braywick Road, Maidenhead, Berks.

CLUB NEWS

Merseyside progress

I hear from Mr M. S. Jackson, secretary of the Merseyside Live Steamers, that there is still plenty of interest in the Liverpool area. The club has over 400 feet of multi-gauge track (2½ in., 3½ in. and 5 in. gauge) and also in course of construction 100 feet of portable track for 3½ in. and 5 in. gauges. A small clubhouse, with water and electricity laid on, is available for members' use.

Readers interested in the society are invited to get in touch with Mr Jackson, whose address is 40 Yew Tree Road, Huyton, Liverpool.

Harrow and Wembley

This well-known society is making a visit to the Witney & West Oxfordshire Club's fine track at Blenheim Park on August 15. Phil Hains reports that the Harrow club track is in good shape for the season, and two members of the society recently distinguished themselves by winning first and third places respectively in the "Q" Class National Championships for Radio-Controlled Yachts. They were Mr E. Terrett and Mr C. R. Jeffries.

Regattas

June 20 MPBA. 3-point Regatta, Witton Lakes, Birmingham. RC, SR, SP.
June 23 Harrow & Wembley SME. Pondside meeting, Rushgrove Park, Rushgrove Avenue, NW9. 7.30 p.m.
June 27 Southern Counties Steering Championships. St Albans.
June 27 South London EPBC. RC Regatta, Brockwell Park. 11 a.m.
July 4 Thames Shiplovers. Regatta at the Round Pond, Kensington.
July 4 Southern Counties Steering Championships. Blackheath.
July 4 Blackheath MPBC. SR Regatta. Prince of Wales Pond. 11 a.m.
July 4 Wicksteed MYPBC. SR, SP Regattas. Wicksteed Park, Kettering. 10.30 a.m.
July 4 Maidstone Cygnets. RC Regatta. Mote Park, Maidstone.
July 10-11 MYA Open Championship. 6-metre class yachts, Fleetwood.
July 11 Southampton & District SME. Regatta. SR, SP, Ornamental Pond, Southampton Common.
July 11 Bromley MPBC. RC, SR Regattas. Whitehall Rec., Southlands Road, 10.30 a.m.
July 11 Southern Counties Steering Championships. Bromley or Southampton.
July 18 Southern Counties Steering Championships. Vacuumatic, Dovercourt.
July 24-25 MYA Open Championship. "M" class yachts. Hove.
August 8-15 MYA Open Championship. "A" class yachts. Fleetwood.
September 5 Thames Shiplovers' & Ship Model Society. Hove Rally. The Lagoon, Hove, Sussex.

Club Diary

Dates must be sent at least four weeks before the event

June 17 Harlington Locomotive Society. Club night, High Street, Harlington. 8 p.m.
June 18 City of Leeds SMEE. Erecting track at St George's, Harrogate. Transport from Temple Newsam, 7 p.m.
June 19 City of Leeds SMEE. Operating track at St George's House, Harrogate. 2 p.m.
June 19 Harlington Locomotive Society. Portable track events 2 p.m.: Ponds House for Spastics, Chalfont St Giles, Colham Manor Primary School, Hillingdon. Hanwell Carnival.
June 19 City of Bradford M.E.S. Portable track at Hepworth and Grandage's Gala. Addi Street, Dudley Hill.
June 20 Worcester & District SME. Public running day at the track, Diglis, Worcester.
June 21 Leicester S.M.E. Meeting at the Museum, New Walk, Leicester. 7.30 p.m.
June 24 Harlington Locomotive Society. Club night, High Street, Harlington. 8 p.m.
June 26 Harrow & Wembley SME. Track meeting, BR Sports Ground, Headstone Lane, Harrow. 9.45 a.m.
June 26 Harlington Locomotive Society. Portable track event, Fielding Junior School, Ealing. 2 p.m.
June 26 City of Bradford MES. Portable track at Calverley Church Gala, Woodhall Hills.
June 27 Harlington Locomotive Society. Extra public open day, High Street, Harlington. 2 p.m.
July 4 Lancashire Traction Engine Club. Talk "Fodens, 1930 onwards." Horseshoe Inn, Croft, Warrington, Lancs.
July 7 Harrow & Wembley S.M.E. Committee meeting, Heathfield School, College Road, Harrow. 7.45 p.m.
July 7 City of Bradford MES. Talk on marine matters by Mr V. Briggs. Eccleshill Community Centre. 7.30 p.m.
July 12 Leicester SME. Meeting, the Museum, New Walk, Leicester. 7.30 p.m.
July 12 Clyde Shiplovers' and Model Makers' Society. Meeting at Missions to Seamen Hall, 4, York Street, Glasgow, C2. 7.30 p.m.
July 14 Harrow & Wembley SME. Track meeting, BR Sports Ground, Headstone Lane, Harrow. 7.15 p.m.
July 18 Worcester & Dist SME. Public running day. Track, Diglis, Worcester.
July 18 Harrow & Wembley SME. Pondside meeting, Rushgrove Park, Rushgrove Avenue, NW9. 9.45 a.m.
July 24-25 Kegworth Carnival Traction Engine Rally, and exhibition of models. Hallstone Meadows, Kegworth, Derbys.
July 24 Leicester SME. Public running day. Abbey Park track. 2.30 p.m.
July 25 Harrow & Wembley SME. Track meeting, BR Sports Ground, Headstone Lane, Harrow. 7.45 p.m.
July 26 Leicester SME. Meeting at the Museum, New Walk, Leicester. 7.30 p.m.
July 28 Harrow & Wembley SME. General Section meeting, Heathfield School, College Road, Harrow. 7.45 p.m.

Traction engine rallies

June 19 Andover Rally. Finkley Manor Farm, Andover, 12.00.
June 19 Traction Engine Rally. Hunts County Show, Huntingdon.
June 19-20 Traction Engine Rally. St Eval, Wadebridge, Cornwall.
June 26-27 Traction Engine Rally. Stamford, Lincs.
June 26-27 Traction Engine Rally. Chartridge, Chesham, Bucks.
July 3-4 North of England Steam Traction Engine Society. Traction Engine Rally and display of model engines. Mill House Farm, Black Fell, Birtley, Co. Durham. 11 a.m.
July 18-19 North Staffs & Cheshire Traction Engine Club. Rally at Bellamour Hall, Colton, Rugeley, Staffs.
July 24 Somerset Traction Engine Club. Ashcross Thornfalcon, near Taunton.
July 24-25 Kegworth Carnival Traction Engine Rally, and Exhibition of Models. Hallstone Meadows, Kegworth, Derbys.
September 4-5 Masham Town Hall Association Rally at Masham, Ripon, Yorks.
September 11-12 North Staffs & Cheshire Traction Engine Club. Rally at Hunts Bank Farm, Jadesons Corner, Wistaston, Crewe.