Model Engineer

THE MAGAZINE FOR THE MECHANICALLY MINDED

YARMOUTH STEAM DRIFTER

Young Cliff lives on in the model

ALSO INSIDE:

- CAVAN AND LEITRIM RAILWAY
- POLISH SHIP BATORY

1/3 15 MARCH 1962 VOL. 126 NO 3166

15 Mar. 1962 Vol. 126 No 3166

Model Engineer

Incorporating Mechanics (Home Mechanics and English Mechanics) and Ships and Ship Models

19-20 Noel Street, London, W1

Contents

Published every Thursday

Subscription 78*s*. (*USA and Canada* $11.50), *post free*.

Cover picture

Mr D. S. Paterson's YOUNG CLIFF, *a model of a Yarmouth steam drifter. Another article by the constructor appears on pages* 326-8

Next week

We have learnt from the series of articles by Mr E. T. Westbury how important magnets can be in everyday life. Now he tells us something about their manufacture

Smoke Rings A weekly commentary by VULCAN

THE Hydrographic Service of the Port of London Authority brought up a first-class mystery when its survey team investigated an irregularity between Nos 4 and 5 Sea Reach Buoys in the Thames.

To the Wreck Raising Service fell the task of lifting whatever was there. The remains of a wooden sailing ship came up first. Experts assessed its date as about 1820.

But from the same site, salvage engineers brought up an old bronze cannon on which was engraved the date 1636. The most likely explanation of the great difference in times, says the PLA in its magazine, is that a much older vessel was wrecked at the same spot.

Inscriptions

The cannon has proved of great historic interest. On the rim at the breech a Latin inscription records that it was made by Johannes de Guindertal at Havre de Grace, now known, of course, as Le Havre.

The breech is adorned with the sign of an anchor, the date, and the name Cardinal de Richelieu. Richelieu was Grand Admiral of France from 1624 to 1642.

France and Navarre were united in 1274; a cartouche on the gun bears the arms of the two States. A French royal crown and the collars of two French Orders of Chivalry—the Order of St Esprit and the Order of St Michel—surround the design. A French crown and the letter L, the Royal Cipher of Louis XIII, decorate the barrel near the muzzle.

The *PLA Monthly* says that the cannon fired a 9 lb. shot from a 4½ in. dia. bore. Inspection revealed that the bore was formed in the casting and not made after the cannon was cast.

The Port of London Authority

has presented the gun to the Tower Armouries, the historical arsenal of the nation, where it can be examined among exhibits of a similar nature and period.

One wonders what other treasures still rest on the bed of London's river.

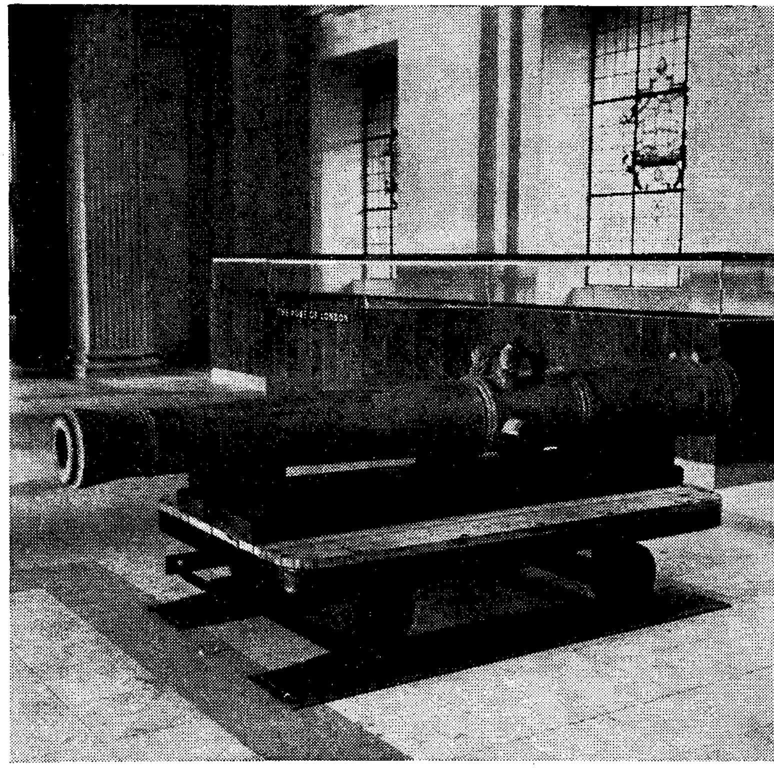
Gone with the wind

ONE of the buildings that suffered badly in the terrible gale which swept Sheffield recently was the factory of Charles Portass,

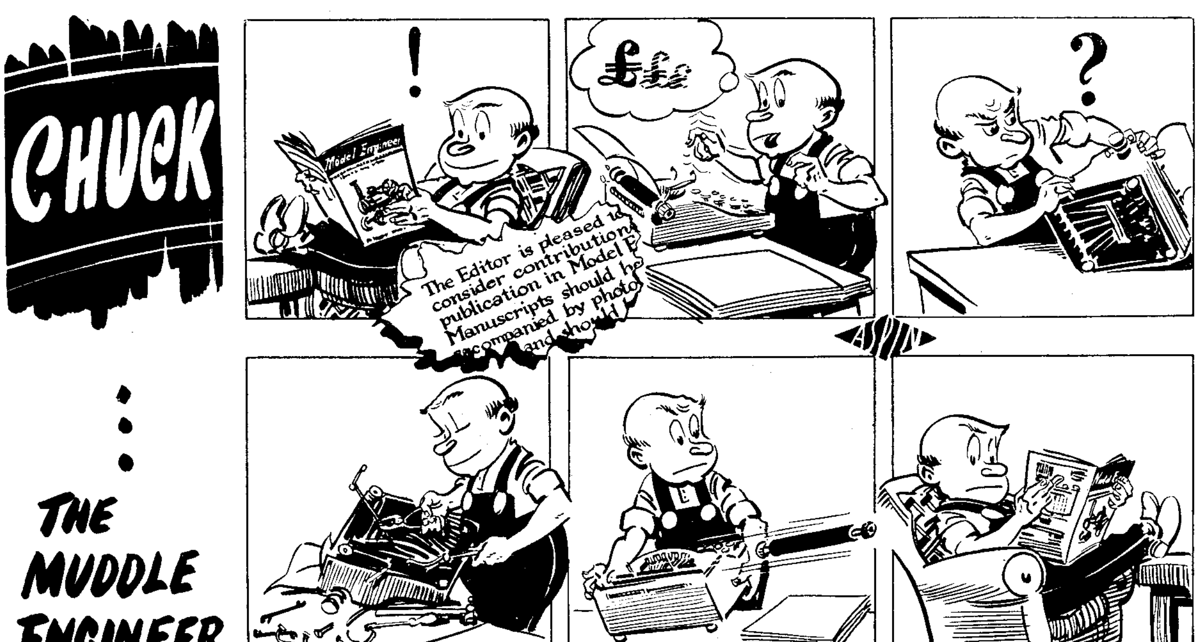
A wall was torn down, the roof was blown off, and a great deal of machinery and stores was damaged by the heavy snow which followed in the wake of the hurricane-force winds. Falling slates and debris caused further havoc, and many of the finished lathes and other machines awaiting delivery were knocked about.

At the time of writing the factory is still being patched up. Work has been slow because of the shortage of building materials and labour, despite the drafting of supplies and workmen into the city.

A further severe blow was the loss of many records, whipped from the building by the savage gale. This has brought commercial difficulties, for when the damaged lathes are restored will come the task of trying to sort out the consignees. It would help the firm if anyone who has an outstanding order with Charles Portass would write and explain the nature of the transaction.



Over 300 *years ago this bronze cannon was cast for one of the ships in Grand Admiral Richelieu's French fleet. It was salvaged from the Thames Estuary recently by the Port of London Authority*



Some Irish engines ran better backwards

This meant moving the cowcatchers to the other end. CAITLIN M. DEANE also reveals the unassailable logic with which a standard main-line gauge was determined

DURING a sentimental journey to my home-town of Mohill last September, I took some photographs of an old Irish narrow-gauge locomotive at Dromod, where the 3 ft 6 in. Cavan and Leitrim Railway joined the 5 ft 6 in. Dublin-Sligo line of the Coras Iompair Eireann (formerly the GSWR).

At this point passengers and goods were transferred to the three-trains-a-day service for Mohill and all stations to Ballinamore, where the line branched west to Arigna and east to Belturbet.

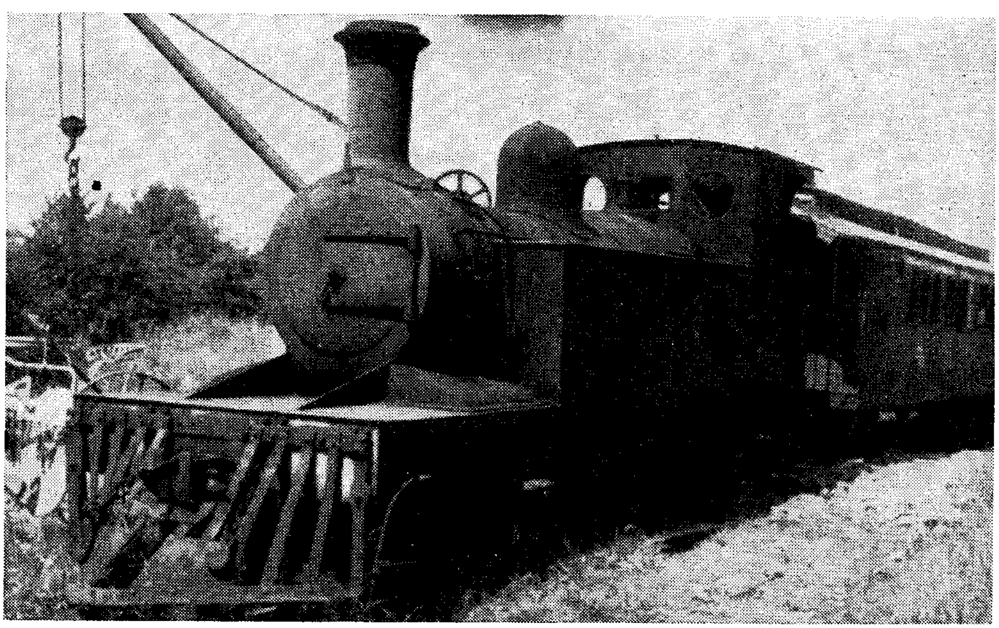
The iron and coal mines at Arigna provided the bulk of the mineral traffic and were the primary reason for the building of the railway. Ballinamore gained importance from having a small locomotive repair shop. Belturbet is the junction with the former GNR of Ireland, and Dromod, besides being the junction with the GSWR, is the beginning of the last lap on my home run.

Engine No 2, in a very faded smoke-begrimed vestigial green, was one of eight 4-4-0 tank engines built by Robert Stephenson and Company in 1884 (serial numbers 2612 to 2619). This would make the engine's serial number 2613—logically at any rate, but logic has a different meaning in Ireland.

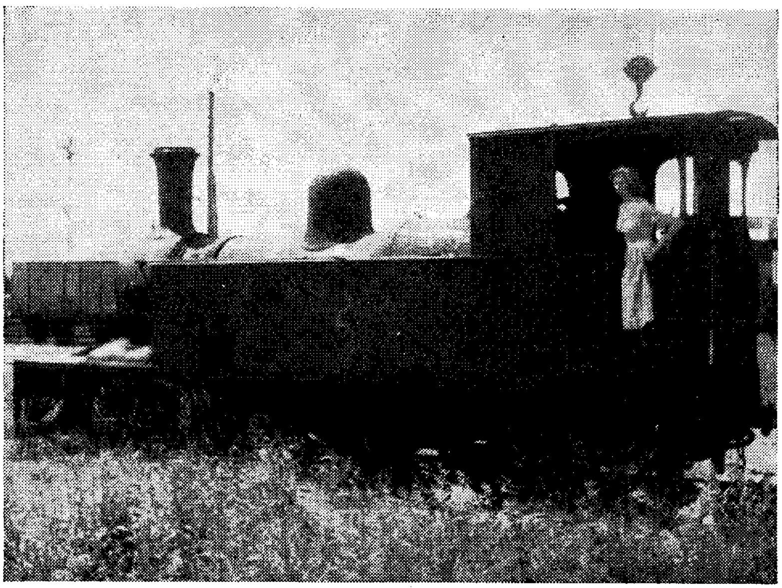
No 2 was originally named *Kathleen*, the English equivalent of my name. Its outside cylinders are 14 in. bore × 20 in. stroke. The coupled wheels are 3 ft 6 in. dia. and the bogie wheels 2 ft 1 in. The bogie wheelbase is 5 ft and the total wheelbase 5 ft plus 5 ft 9 in. plus 6 ft. A boiler about 3 ft 6 in. dia. × 8 ft 6 in. long has 124 tubes of $1\frac{7}{8}$ in. dia. Working pressure is 150 p.s.i. The grate is almost 4 ft 6 in. × 1 ft 6 in. The side tanks hold about 550 gallons of water and what would appear to be about two tons of coal.

The photo shows the engine from the port quarter. The cow-catcher gives it a distinctly American air and the wagon-top firebox enhances this effect. A clerestory carriage completes the picture.

A single buffer-coupling adorns the centre of the buffer beam, and



Locomotive No 2 of the Cavan and Leitrim seen from the port quarter additional safety chains can also be seen. Cow-catchers were fitted only to the front of the C and LR locomotives as they were never run in reverse. Cow-catchers were supposed to be necessary as the line was unfenced, but an old driver assures me that he never once had any steaks from them. His favourite method of speeding an obstreperous beast was to open the cylinder cocks while his mate accompanied him on the whistle. The animals usually howled back, once they had retreated to a safe distance. Apparently they were not worried so much by the blast of steam, as by the small stones that it threw up from the ballast.



Caitlin M. Deane looks wistfully from the cab

When the pictures were taken, the line had been closed for about fifteen months and most of it had been ripped up and sold for scrap. The station buildings are now used as houses.

My pictures also show a crane, and some standard gauge (5 ft 3 in.) CIE goods wagons. The engine is standing in what used to be the transfer sidings, with the 3 ft 6 in. gauge on one side and the 5 ft 3 in. gauge on the other. The crane stands between the two, and despite my efforts at woman-handling it seems determined to be in the picture.

At the rear of the cab is a low double door about 18 in. wide providing a gangway on to the train and used in cleaning fires as the firebox was rather long. An auxiliary coal tender might have been very useful during the war when wood and peat were extensively used on the Irish railways; I do not know if the doors were actually used for this purpose.

The only way to fill the coal bunkers is through a small trapdoor in the top inside the "office," as the enginemen affectionately referred to the cab. The trapdoors are only about 1 ft square, and coaling must have been a tedious and costly business even in the days of cheap labour.

It is peculiar that most of these narrow-gauge locomotives have side bunkers awkwardly situated and often of very inadequate capacity, although the wheel arrangements of these and other narrow-gauge engines would have allowed of a generous rear bunker. Even the largest engine on the line, an 0-6-4 tank, hardly had room for a rear bunker and most of it was in the cab.

The enginemen who had been used to driving 4-4-0 engines had a deep distrust of the 0-6-4 and persisted in driving it the obvious way, as a 4-6-0—in reverse. The belief gradually spread that the engine ran better this way. And so, with typical Irish logic the cowcatcher was transferred to the rear buffer beam and the engine ran for the rest of its days as a forward-control 4-6-0.

One of the 4-4-0 engines was originally fitted with an extra cab, reversing lever, regulator and brake at the front end, with casings over the wheels, and with condensing gear. All these "improvements" were required by "Red Flag" laws enforced when part of the railway ran on the public roads. The engine must have looked hideous.

The stretch of line which ran on the roads was, of course, a tramway. It had some alarming aspects. While roads tend to wind, railways are more or less straight. The result was that on one stretch the railway would be on the right of the road, and a few yards farther would be on the left. A motorist travelling towards an oncoming train, and imagining it to be on the track on the opposite side of the road, would find himself very much on the wrong side shortly afterwards.

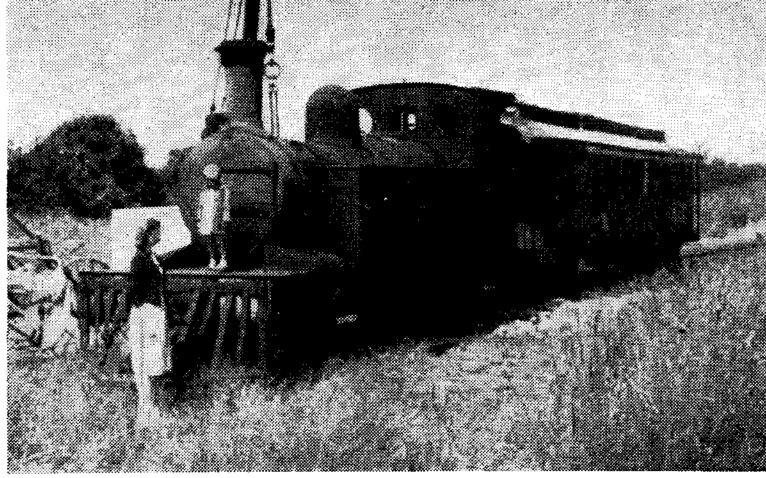
A situation of this kind led to the conviction of an engine driver under the Road Traffic Act for not sounding his "audible warning instrument." The offence is believed to be unique in law.

The carriage, which rather resembled a single-deck tram with end platforms and longitudinal seats, was in a much battered condition. I could see that it had been divided into first class, third class and guard's van. In the centre was the first class compart-

To Irish enginemen this was the Office ment, which held about eight passengers and was entered from the third class or the van. The coach rode on two bogies which had diamond bar frames and four wheels about 20 in. dia.

Some wit had daubed the words "To be kept as a souvenir" in the dust that coated No 2. Whether this was wishful thinking I do not know.

Although the engine had been looted by vandals and souvenir hunters, it was in regular service until just over a year ago, and could probably be put into good running order with a little care and goodwill. It is an excellent specimen and a worthwhile acquisition for anyone with a 3 ft 6 in. gauge railway, if the CIE has not already sold it.



There are times, of course, when even a little girl may make herself sooty

The narrow-gauge companies were fairly consistent in adopting 3 ft 6 in. as their standard, and all credit for this must go to the locomotive builders. But many main line companies, actual and proposed, wanted to lay broad gauge lines varying from 4 ft to 6 ft. The government appointed an eminent Irishman to decide on a common standard gauge for all Irish main lines. Realising that to recommend the standard of any particular company would immediately antagonise all the others and very likely lead to revolutions, he solved the problem in a typically Irish way by finding the sum of the various gauges and dividing this figure by the number of railway companies. The resulting figure of 5 ft 3 in. was accepted as fair by the companies and with infinite relief by the government. ■

QUARTERING WITHOUT CURSING

SEVERAL designs for quartering wheels have been published in MODEL ENGINEER. My own design arose from the building of *Britannia*.

My device is simple and quick to make and easy to use. During the pressing-on the builder can test his accuracy as often as he wishes without any bother of setting up.

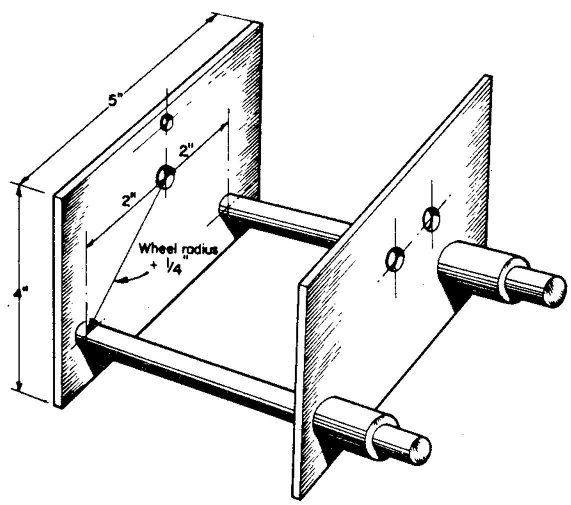
The device has an end-plate to which two guides are fixed and on which the wheels rest. There is a drilled hole to receive one crankpin and a moving end-plate to slide on the guides. The moving plate has a crankpin hole at right-angles to the first plate. Do the work while one wheel is still off its axle. With the wheel resting on the guides, mark off the wheel centre on the end-plate and drill a hole the size of the axle. Using the jig that was made to locate the crankpin holes in the wheels, drill in the plate a hole large enough to take the largest crankpin of the set. Bushes can then be made up to suit the smaller pins.

The sliding plate is similarly made, but with the crankpin hole at right-angles to the one in the fixed plate. Drill on the side of the centreline determined by the crank which is to lead.

For *Britannia's* wheels I took two pieces of $\frac{1}{8}$ in. m.s. plate, each 4 in. × 5 in., and bolted them together. After squaring one side and end, I scribed a centreline and a line 2 in. each side of it. The wheel centre was positioned so that the bottom of the wheel was $\frac{1}{8}$ in. clear of the bottom of the plate.

The guides are of $\frac{1}{2}$ in. b.m.s. To get their centres, take the radius of the wheel over the flange plus $\frac{1}{4}$ in. ($2\frac{7}{16}$ in. + $\frac{1}{4}$ in.) and scribe it on the plate, bisecting the outer centres. Drill $\frac{3}{8}$ in. at these points through the plates. Separate the plates and open out the $\frac{3}{8}$ in. holes of one of them to $\frac{1}{2}$ in. Make the guides from two pieces of $\frac{1}{2}$ in. b.m.s., 7 in. long. Reduce one end of each for $\frac{1}{2}$ in. to $\frac{3}{8}$ in. dia., and screw $\frac{3}{8}$ in. BSF. Put one through each of the $\frac{3}{8}$ in. holes and nut the other side.

Drop the plate with the $\frac{1}{2}$ in. holes in it over the guides and bring the two plates together; place the wheel on the guides, and mark the wheel centre through the axle hole.



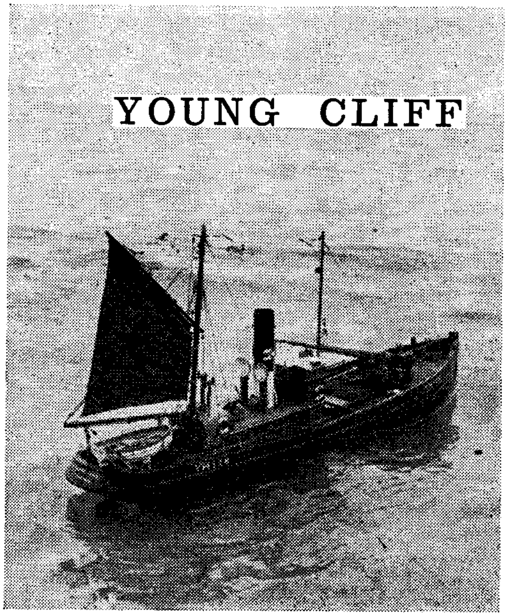
Through both plates drill a hole the size of the axle. Separate the plates, and in the fixed one place the crankpin in the vertical plane and drill through, enlarging it to take the largest crankpin.

Drill the sliding plate in the same way, but place the jig in the horizontal plane. The $\frac{1}{2}$ in. holes in this plate must be opened out to $\frac{5}{8}$ in., ready to receive the thimbles.

To make the thimbles, chuck a piece of round b.m.s. or brass; face, centre, drill and ream $\frac{1}{2}$ in.; reduce $\frac{3}{16}$ in. of one end to $\frac{5}{8}$ in. dia. to suit the $\frac{5}{8}$ in. holes in the plate; and part off 1 in. from the shoulder. Make two, and rivet them into the sliding plate. Pass the reamer through again, and the job is done.

To use the device, push the second wheel of a pair on to its axle in its approximate position, put the pair of wheels on the guides, and engage the crankpin of one wheel in the hole in the fixed plate. Bring up the sliding plate and adjust the second wheel. JOHN E. PERRY.

Continued from March 1, page 264



No one can miss the steam capstan

When the stern of the drifter pointed to the rushing clouds, the whirr would shake the deck from end to end. D. S. PATERSON also writes of the nets, real and modelled

RIGHT alongside the tabernacle is the steam capstan which is used to bring in the warp and to unload. As ¾ in. scale is a reasonable size, I decided that it would be fun to make the capstan work and drive it from a little oscillating engine below deck.

My sketch shows the general principle. The point to note is that the barrel part only is made to turn. It was formed by silver soldering the principal chocks to a piece of brass tube on which were also fixed the gear and ratchet wheels. The intermediate chocks were filed and bent up from little scraps of brass, and were soft soldered into position. Silver solder and soft solder prevent the parts from coming adrift in the heat and provide a secure base upon which the small intermediate chocks can be sweated.

The tube core of the barrel revolves about a fixed centre spindle screwed into the engine framing and a solid brass block representing the engine casing at the top.

As it is almost too late for anyone to go and have a good look at a steam capstan, a few detail photographs may be helpful to those who are interested in building a steam or sailing drifter. Almost without exception, the capstan which I used was the EH/HI made by Elliot and Garrood of Beccles. Over 6,000 capstans, in more than 20 different varieties, were supplied by this firm—happily, still very much in existence—to the fishing fleets of the world. The EH/HI had either a deep cast iron base or a shallow base, and either a small or large geared whipping pulley for unloading.

As can be seen in the photograph the two cylinders (of 3¾ in. bore × 4½ in. stroke) are on top of the barrel. They are supplied with steam through a hollow core. The exhaust steam is led to the waste pipe on the fore side of the funnel, which also takes exhaust steam from the donkey engine and safety valve.

Sometimes, instead of there being the usual chocks, the barrel was filled in solid with wood strips, as seen in the photograph of the *Romany Rose* of Yarmouth. The pull on the barrel was 49¾ cwt, and the winding speed was 3½ fathoms a minute at 100 r.p.m. and 14 fathoms a minute at 400 r.p.m. The barrel ran in a clockwise direction, and the ring under the cylinders operated the drain cocks.

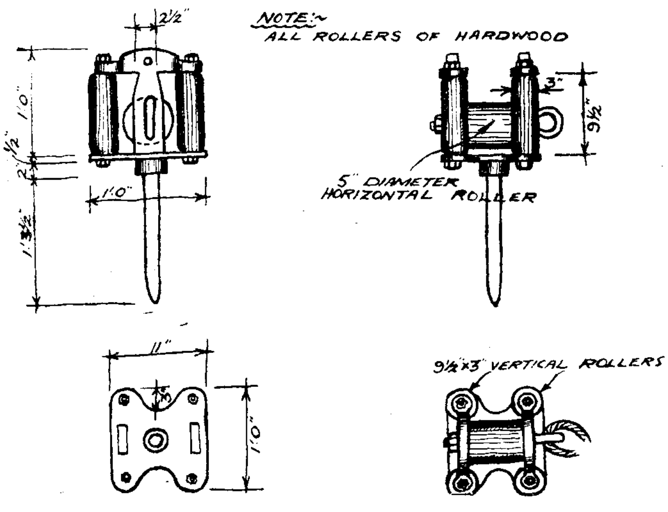
On the model the whipping drum is dummy, and the gear train casing is filed up out of one piece of brass and is sweated on. The hinged lid was just a piece of copper shim, and the little operating handwheel was made from a brass nail with a circular head filed into a cross. A copper wire ring sweated on formed the rim.

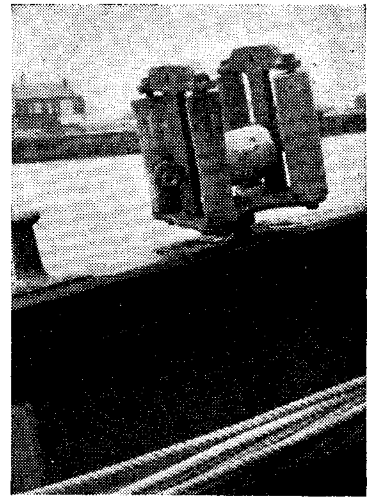
It is well worth while to take some trouble over the capstan as it is a very prominent and important feature on a drifter; the boiler seems to make enough steam to run both engine and capstan together, if necessary. The lubricator and tap to control the steam supply are in a convenient position in the net hold.

Of course, the winding speed which I have mentioned relates to a given and constant set of conditions. In bad weather the drone of the capstan was no longer regular. As the bow lifted skyward and the warp drew taut, it slowed down until its *beat, beat, beat* almost stopped. A second or two later the stern would point to the rushing clouds and the *whir-r-r-r* would shake the deck from end to end.

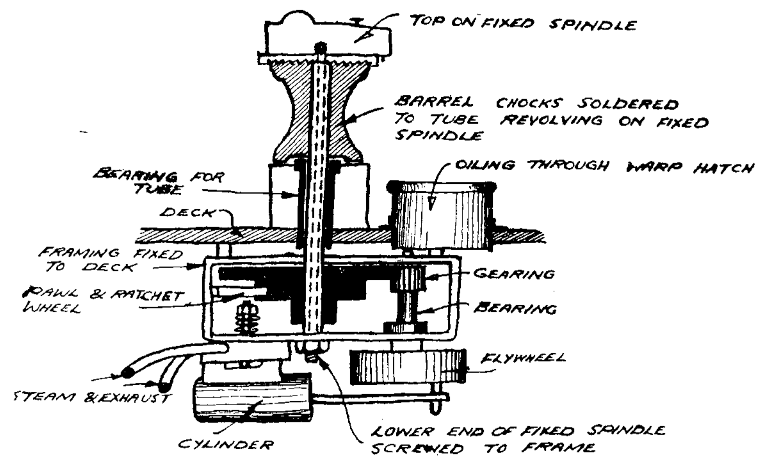
Immediately abaft the capstan is the warp hatch with a portable roller that slips into a pair of stanchions. On some drifters this hatch is on the fore side of the capstan. The top is always trimmed with convex iron, and when the capstan is out of use a sheet metal cover, which can be secured by a locking bar, is placed over the opening.

The main net hold is trimmed with a coaming 1 ft high × 2½ in. wide and has slots at each end on both sides to take the roller stanchions, sometimes with provision for fixing the roller centrally when the nets are brought up and stacked on each side of the hold between the coaming and the rail. The hold of a drifter is open immediately below the hatch. On each side of this space are three or four compartments or bins, the fronts of which can be adjusted to any height from the floor up. The round scuttles of about 15 in. dia. on the side deck, between the coaming and the rail, communicate and are arranged to prevent the catch from shifting about from side to side of the boat in a seaway. Fish are so slippery



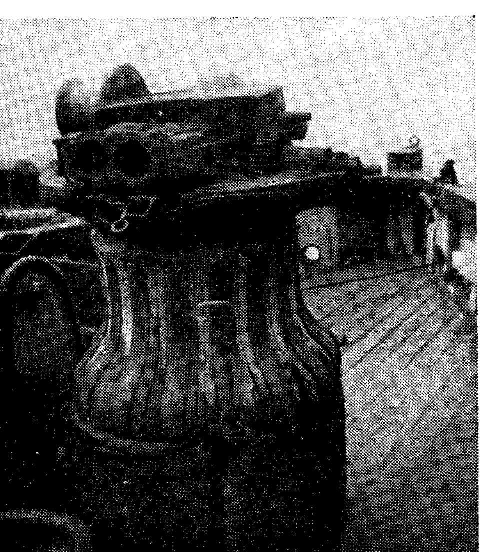


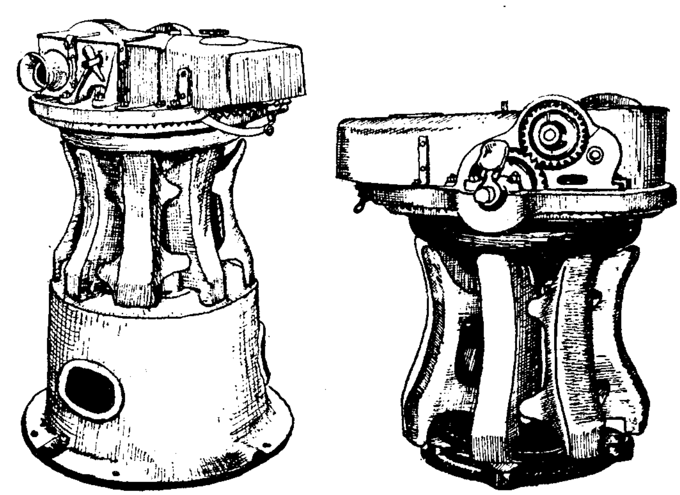
Above: *Molgogga. Plan of base and plan on top. The photograph of the molgogga shows the capping rising to the stern*

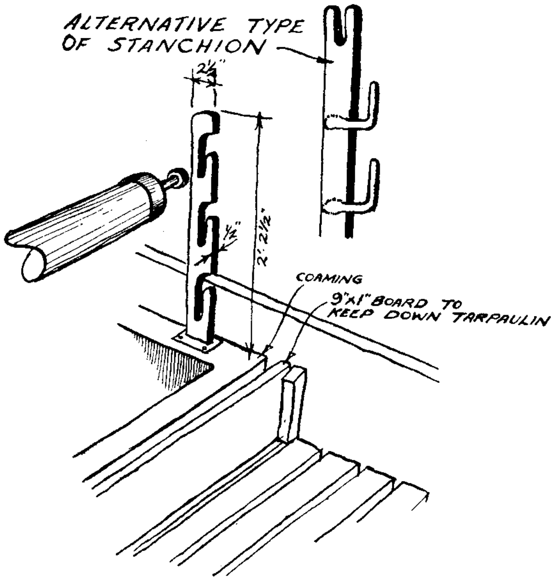


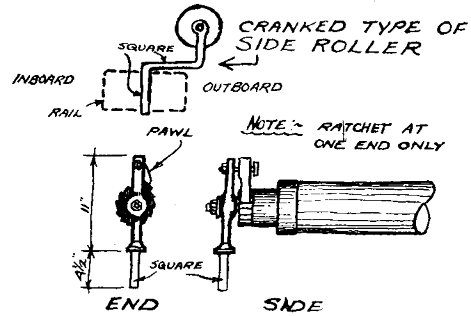
Right: Principle of the steam capstan

Below: Here, with part of the casing removed, is the steam capstan of the ROMANY ROSE. *Note the sockets for the molgogga in the covering board. In the foreground the warp roller stanchions and hatch are seen. Below, right: EH/HI capstan. Deep base (left) and ordinary*









Net hold roller (left) and side roller (above). Bottom of page: Construction of the wheelhouse

that if the boat takes a roll they immediately slide, one over the other, to the side that is down, thus helping the seas to capsize her

When the nets are brought in over the side, the fish are shaken or scudded out on to the side deck with the scuttles and the nets flaked down in the central section under the hatch. After all the nets are in, they are pulled up and stacked on each side, any remaining fish are picked out—and the central space thus becomes open for the fish to be shovelled up into the baskets and unloaded. It is then that the deck looks a mass of gear, but by the time that the drifter is ready to shoot her nets all is order once again—with the nets down in hold, the cork line aft, and the strops for attaching the warp and " buffs " neatly stacked ready to hand. You will see, therefore, that the presentation of the gear on a model will depend upon what stage of the proceedings is to be depicted.

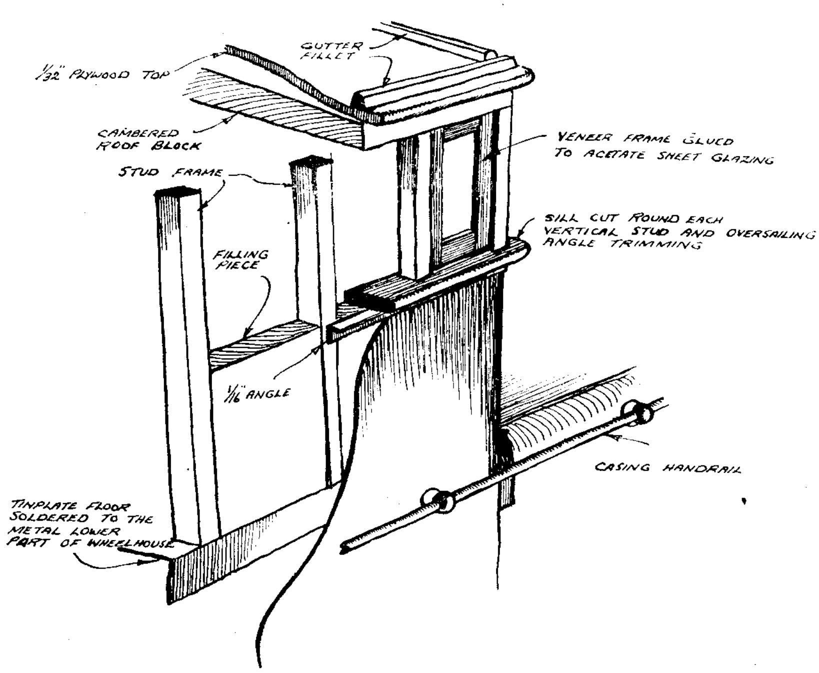
On the model, the nets are indicated by an old nylon mesh stocking folded down and finished with a short length of cork line. It is then all fixed with a couple of pieces of thin wire to a gauge sheet that fits into the rebate of the coaming. This method allows the whole lot to be easily lifted off and at the same time lets through the air to the fire. To get the correct colour, I simply boiled the net in some cutch and water. I always have a bit of cutch at hand for tanning my cotton shrimp trawls, and as this is the material used for the drift nets the colour was assured! Cutch comes from the bark of a tree in Borneo and is readily obtained at any fishing port.

The net hold is trimmed off fore and aft with the thwartship board, a portable pound board trimmed with convex iron on top and fitted with various battens holding the 9 in. × 1 in. boards on each side of the coaming to keep the tarpaulin down when the nets are covered; they also hold the bank boards, which extend from the coamings to the rail on the bulwark to form a continuous sloping surface, from hold to rail, for use in mackerel drifting.

I made the net rollers 4 in. dia. and the side roller 5 in. dia. centrally—with a slight camber to 4 in. at the ends. One end has a ratchet and pawl to stop it from running back, as is shown in the sketch. The solid side roller is going out of use now, and a larger diameter spline type of roller is more frequently to be seen.

The net hold is divided off towards the after end, and a separate compartment called the aft well is formed on the after side of this division. In the model it is indicated by a division extending to the depth of the coaming only and covered with hatch boards. The grips of the boards were made by forming a semi-circular depression by a ball-shaped drill, with thin wire for handles filed off flat on top.

★ *To be continued on March 29*



Facing operations

A BETTER job is made by facing material in a lathe instead of with a file. The work is easier and faster; the finished end is flat; and the material is square at end and sides. You can use the independent chuck to hold angle sections and T-sections. A round-nosed tool, at centre height, can be employed to face them.

The material should be cut over-length with a hacksaw. It is advisable to begin to face it near the centre, and to bring the tool toward you with the cross slide feed. You will then avoid chopping at the start of the cut and

By GEOMETER

save the tool from damage. Chopping is at a maximum when facing is started at the outside edges of the material.

If the hacksaw cut has gone askew, and a start is made to face the material at its outside edges, care must be taken to bring the tool to the edge at the top of the slope. Then the tool can be advanced for a normal cut. It is easy to make a mistake here. With a deep cut, the edge of the material chops heavily on to the tool. A very deep cut can break the edge.

To avoid this hazard, start to face the material at the centre. If the cut becomes heavy, as facing proceeds, the tool is drawn back by the top-slide, to reduce depth of cut for the remainder of that traverse. For the next one, the original cut is picked up again. The saddle should be locked to the bed; or it can be held by engaging the leadscrew nut.

Two angle sections can be set up in the independent chuck, as at *A*, with two of their flanges together, and a piece of packing on the other flanges. It should be placed slightly behind the ends of the angle sections, so that it is not faced by the tool. A T-section can be held the same way in the independent chuck, without packing.

When the end of each angle section has been faced, the two pieces can be reversed in the chuck for facing their opposite ends. If there is a stop in the lathe spindle, they can be pushed up to it. Then they will be faced to the same length. Without a stop, they can be clamped, at the ends still to be faced, until they have been rechucked.

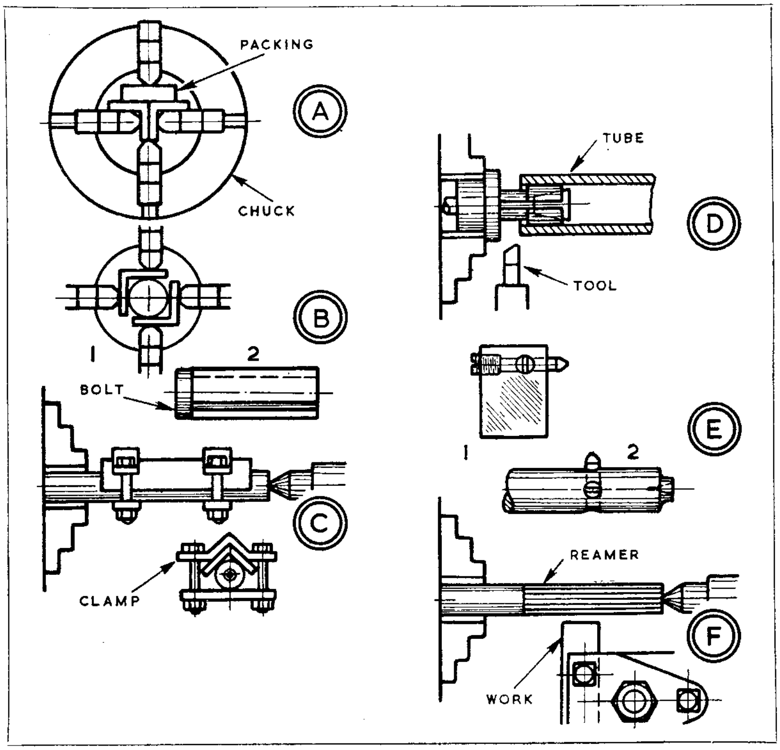
Another way to set up angle sections is as at *B*1, where two pieces are placed up to a rod and gripped by opposite jaws of the chuck. When a bolt is used instead of a rod, its head locates the angle sections, *B*2, so that they are faced to length at the second chucking. The head of the bolt should be turned circular, making the shoulder slightly less than the thickness of the angle sections. Then they are gripped firmly by the chuck jaws. The bolt can also be faced to overall length to serve as a gauge when there are several angle sections to be faced to the same length.

Long angle sections can be faced, one at a time, as at *C*, on a mandrel. This can be centred for support from the tailstock, although the end of a round bar can be run in the fixed steady. As shown, two clamps can be fitted on an angle section, so that its ends can be faced with left-hand and right-hand tools. Alternatively, one end of the angle section can be held in the chuck. Only one clamp is needed; but the angle section must be reversed to face the opposite end.

A tube can be faced by mounting it on wood plugs which should be tapered to force tightly into the ends. Another way to set it up is as at *D*, on a mandrel which is expanded with a taper plug and a drawbolt. The free end of a long tube is supported by the fixed steady.

Many facing operations can be performed by rotating a tool instead of the material, which is clamped to a slide or on an angle plate. A facing tool for the independent chuck is as at *E*1; a round bit in a steel block, held by a clamping screw and kept up by a backing screw.

For finishing work with a radius, a fly-cutter can be used in a bar, as at *E*2; or a reamer which is the size can be employed, as at *F*. ▣



FOR THE SCHOOLS *Concluded from March 1, page 267*

Complete and all square

K. C. HART takes the young engineer through the last stages of making a hand tapping jig

For many this will be the first time that they have needed to bore a 1½ in. hole 1½ in. long. Contrary to what they may suppose, a large hole is sometimes easier to make than a small one. As the size grows, there is more room for a sturdier tool, more room for the chips to escape, and more opportunity to view the progress: one can even get a small paintbrush with coolant inside.

It is, however, more or less necessary to have a ½ in. drill to ease the entry of the boring tool, and so the work should be drilled, say, 3/16 in. right through, and then ½ in. before boring begins.

When a small boring tool has been traversed for only a short distance, chips soon begin to wrap themselves around the tool shank. It is, therefore, as well to arrange some sort of stop for the lathe saddle and to bore in for, say, ½ in. depth only, opening out the diameter to about ⅞ in.

Then attack the next half inch; and so on. Afterwards a more substantial boring tool can be used and passed right through each time. An ordinary rule will give good indications of the progress, and may be used until the hole is within about 1/32 in. of the final size. The round column itself will then form a gauge, although it is highly convenient to have a small piece of 1½ in. dia. round stock about 0.010 in. under size. More liberal cuts can be taken until this enters, leaving only a few thou of an inch to be found for a good fit to the actual component.

Although the block is ultimately split for the clamping action, and the split will allow for a certain amount of slackness in the bore, it is not wise to rely upon the split as compensation for errors much in excess of about 0.005 in. oversize. But it should not be difficult to keep within this amount. The slitting of the block is best left until the locking or clamping bolt hole has been drilled and threaded. All the remaining holes are easily located from the arms, details of which are given in the lower part of Fig. 9.

When the stock for the arms has been prepared, faced to length and cleaned up, it may be slit to form the underside taper. For this kind of slitting I mount the stock on the cross slide with the slitting line, and the piece to be cut off, overhanging the left side so that it can be passed underneath a slitting saw from the rear, against the rotation of the saw. The scribed cutting line can be lined up with the saw by holding a steel rule against the side of the saw and adjusting the work until the line thereon agrees with the rule edge.

In marking out the positions for the holes, the clamping bolt hole should be left until later. Holes need be marked only on one arm. They can be clamped together afterwards and the holes drilled through both at once.

The two holes shown as 3/16 in. should be drilled tapping size for No 2 BA threads: 5/32 in. will give 75 per cent thread, which is quite sufficient and easier to tap. The four holes marked ¼ in. dia. should first be drilled tapping size for ¼ in. BSF, for which a No 4 drill gives a theoretical 85 per cent thread.

Separate the arms. In what will be the right-hand one, mark the hole for the clamping bolt. Drill this at first 17/64 in. Although all these holes will ultimately be opened out with larger drills, it helps the later operations if both sides are lightly countersunk just enough to remove drilling burrs.

Lay the arms aside, and deal with the table and table seating. In Fig. 10 both are shown as they would be seen from their upper or normal sides. Assuming that both have been brought to length and cleaned up, we have only to mark and drill the three holes in the table seating piece for the table fixing. Drill No 4 at first.

Transferring the No 2 BA holes from the arms to the table seating is best done by laying the seating upside down on a flat surface, placing an arm upside-down at each side and—after making sure that the front of the seating piece is flush with the narrow or tapered ends of the arms—clamping the whole together and spotting through.

When you are transferring the eight fixing screw holes and the clamp screw hole from the arms to the block, it is as well not to assume that if the top of the block is level the arms will be at right-angles to the 1½ in. column hole or column. From the nature of the side fixing, too, you will realise that undue slackness in the clearing holes in the arms may allow the table to tilt downwards with the load—a circumstance which is just possible with a drilling machine, although it is highly unlikely on a tapping device. I have shown ¼ in. holes for the ¼ in. screws; if they have to be persuaded to pass through, so much the better.

Further precautions can be taken to anticipate any remaining slackness. Place the arms, with the table seating piece fixed between, upside-down on a flat surface and insert the column clamp block between, at the rear. Level the block and see that the back is flush with the arm ends. Clamp in place. First drill through only one diametrically opposite hole a side—preferably the rear and upper two holes. Thread the block, open out the two arm holes (one in each arm) to ¼ in., and fix with one screw a side.

Now drill and tap the clamping bolt hole. Drill 17/64 in. (through the hole in the right-hand arm) to a depth of 1⅞ in. in the block, or a total of 2 in. including the thickness of the arm. Open the hole out to

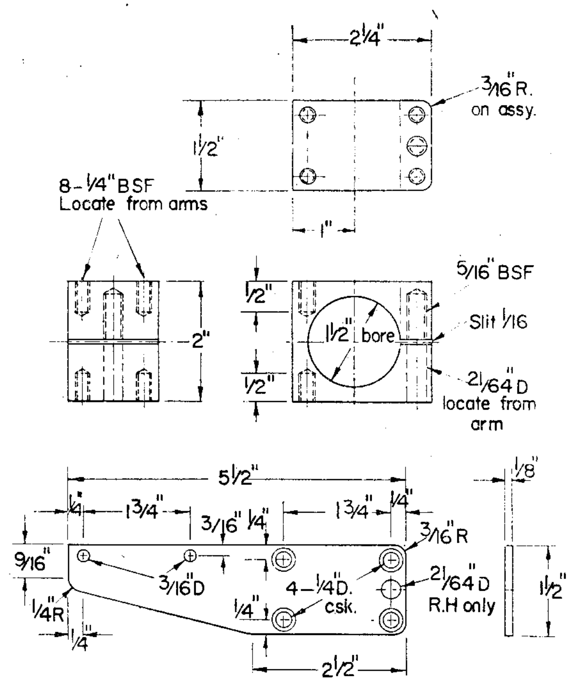


Fig. 9: Worktable clamp block (top) and the arms or bracket pieces. First drill all holes tapping size for transferring

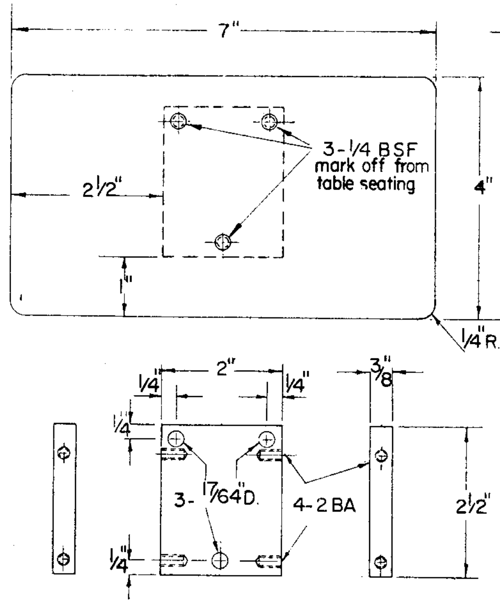


Fig. 10: Worktable (top) and table seating. Position for the seating is shown in broken outline. Locate the 2 BA holes from the arms

21/64 in., to a depth which just passes the centreline of the block so that, after slitting, no thread is left in this half. Thread $\frac{5}{16}$ in. BSF.

The block can now be sawn or slit by hand. If you have a 4 in. slitting saw, you will find it simple to mount the block on the cross slide with its centreline at about lathe centre height, and to feed it straight on to the saw. After the cutting or slitting, remove all sharp corners inside and outside, and clean out any dust from the threaded hole.

If the table is now stood the normal way up and the column inserted and locked, squareness tests can be made. It is here that we can anticipate a possible slackness in the arm-to-block fixing screws by simply biasing the arms with an upward tilt relative to the round column by, say, an estimated half to one degree. Then tighten the two fixing screws and deal with the remaining six. On the final assembly, with all eight screws fairly tight, load the table by leaning upon it; this will make it settle down with all the screws resisting further movement.

If the 7 in. length of 4 in. × ¼ in. stock for the table happens to be arched, the tapped holes can be "borrowed" to fasten it to the lathe faceplate. To take a light facing cut over it afterwards it is a simple and pleasant task. The small corner radii can be filed by hand, as the table is difficult to mount on the cross slide for forming them. ■

This short serial began on January 18 (page 72). Other instalments were published on February 1 (138), February 15 (202) and March 1 (266).

LOCOMOTIVE NEWS

Two other engines are to be preserved. One is LNER J21 0-6-0 65099, which was a T. W. Worsdell engine built in 1886 for service on the North Eastern Railway. Most of this class were originally built as two-cylinder Worsdell von-Borries' compounds. Altogether 201 of them were constructed and all but the final thirty were compounds. Later they were converted to two-cylinder simple engines. Eventually a number were fitted with superheaters and piston valves, although later the superheaters were removed. There is no indication yet of where No 65099 will be kept.

The other locomotive to join the rank of BTC preserved engines is No 68633, the little Great Eastern 0-6-0T of the LNER J69 class. She has been restored to GER livery and given her original number of 87.

This means that of the 27 locomotives added to the BTC preservation list last year, six have already been saved. These are ex-GWR Castle class 4-6-0 No 4073 *Caerphilly Castle* housed at the Science Museum; ex-LSWR T9 class 4-4-0 No 30120; ex-Southern Railway King Arthur class 4-6-0 No 30777 *Sir Lamiel*; ex-NER C class 0-6-0, BR number 65099; ex-Great Eastern Railway 0-6-0T, BR number 68633; and ex-GCR Director 4-4-0 506 *Butler Henderson.*

THESE days we are quite accustimed to reading that locomotives built in the late 1930s and early 1940s are being scrapped, but I do not think there were many of us who thought the B1 4-6-0s would start to go in 1962. However, this is so, for 61085 has recently been withdrawn.

The B1s were first introduced by Thompson in 1942, although construction continued for some years after Nationalisation. By the time construction finished there were 410 in service. Actually, 61085 is not the first of the class to go for 61051 was wrecked completely after the Witham smash of 1951. R.O.

She had to have Churchward's cylinders

Continued from March 1, page 274

I CUT the axleboxes for the main horns from phosphor bronze bar and provided with keeps and oil pads recess, two-pin fitting, and with a screwed-in eye bolt for the jaws of the spring buckles, connected with a shouldered pin and split pin.

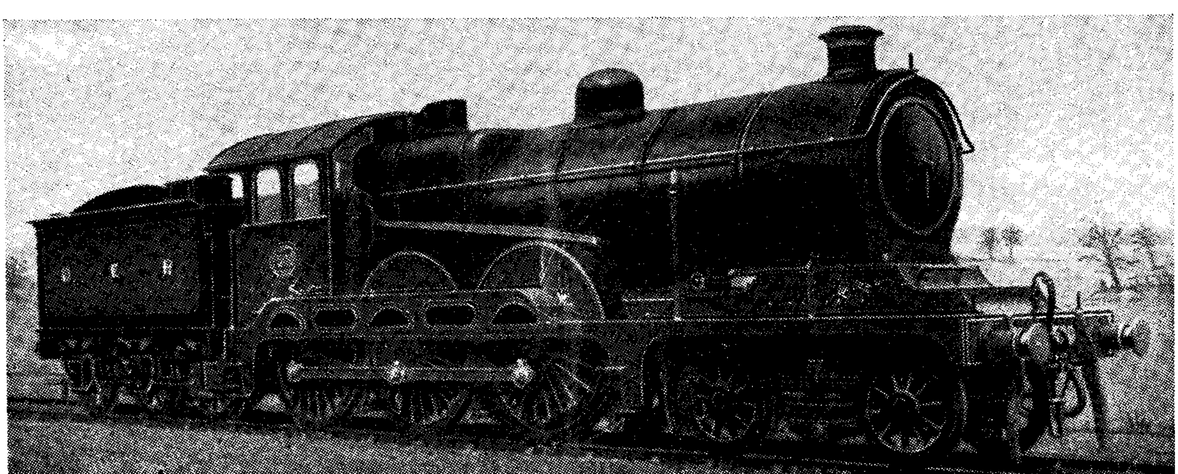
The springs were made from 1/32 in. × 5/16 in. polished steel strips with rounded edges. I machined the buckles from mild steel bar. There were 12 plates to each spring. To get the required working movement, I had to punch nine of the plates with 1/8 in. dia. holes in the length of plate up to the overlap of the next. The top plate and the two short bottom plates were left unpunched. A No 50 drill was used to make holes on the centre line of all leaves for a pin which goes through in the buckle and is lightly countersunk. On assembly, the buckle was filed out so that as the short bottom plate was lightly tapped in, all the plates were made tight. Then a steel pin was riveted in. I tried the springs by bouncing an old 10 lb. flogging hammer head.

While I was busy on the springs I cut some long h.t. 6 BA bolts to length. Twelve of these were wanted for the set. I drilled a piece of 7/32 in. steel rod a tight fit for the bolts. Twelve slices, well bevelled on one side, were parted off and tapped down under the head of the bolts with the bevelled part outwards. These would then set on the springs to give a free movement. The full-size engine had shock absorbers on the underneath of the spring hangers to take the first shock off the spring itself. The rubber pads are enclosed in a steel case made square, oval or round. I made mine round—they were easier to machine. Each box contains two 1/8 in. hard rubber washers with a steel one between and under. A thicker steel washer rests on the spring bolt lock nuts.

At the end of 1911 the GER turned out the first of their 4-6-0 express engines. They were the heaviest express engines which the GER built and were known as the 1500 class. I worked on the first five.

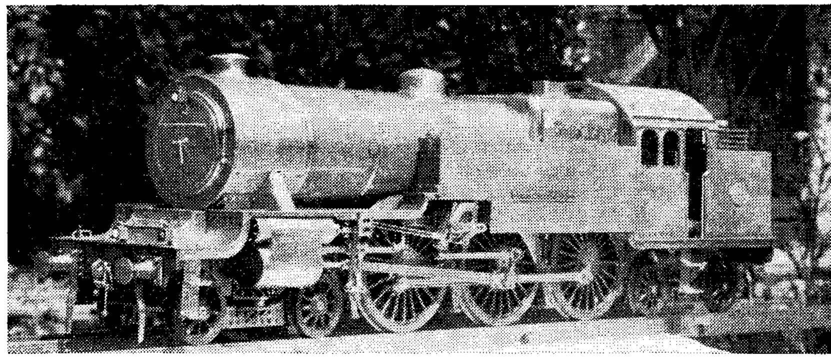
G. J. Churchward of the GWR in 1906 had redesigned the cylinders of his express engines. He had greatly increased the efficiency of the engines by using piston valves instead of slide valves, and had placed the steam inlet ports at the ends of the cylinders, thereby enabling the steam to make a quicker inlet and—what was more important to fast running—a quicker exhaust getaway. The cylinders on 1500 were of this design and the top link drivers spoke well of them. *Princess Amelia* had to have them. As no castings like these were on the market, I had to make patterns and get the cylinders cast in gunmetal. The machining of bores for the cylinders and valves was carried out in the usual way.

The valve liners were made single to go in each end of the valve box, and a recess spigot was counterbored in each end for the liner to be pressed down. When the studs and covers were on, they were locked in position. I produced two home-made Woodruff cutters. By inserting the smallest one in the liner barrel bore and the largest in the cylinder bore to the required distance, with the dial indicator on the lathe, I was able to break through



No 1500 *superheater express engine of the Great Eastern Railway. As F. Moore painted her, she was a thing of beauty—predominantly blue, with red lining*

J. F. BANYARD tells how he modelled, in $3\frac{1}{2}$ in. gauge, a tank which he first saw as an apprentice fifty years ago. The model received an award at the last Model Engineer Exhibition



ust enough to get in a $\frac{3}{8}$ in. slot × $\frac{1}{8}$ in. wide cutter, which gave me the equivalent of the holes which you would drill by the approved methods. I measured the position on the separate liners, slotted them with the arbor set-up, machined them until I had a $\frac{3}{8}$ in. slot inside, and very lightly pressed them home. They were phosphor bronze. I made the valves of stainless steel.

Then there was the machining of all the covers and the endless business of drilling, tapping and studding the four cylinders, the pistons and rods, the valve spindles and the 16 phosphor bronze locking nuts. The exhaust pipe system was quite a headache for a time.

The four slide bars and crossheads had to be GER.

Making the slide bars

I cut the slide bars from carbon chrome alloy steel. This alloy, also known as gauge steel, is lovely to work with and is also much better for resisting rust. Except for the crossheads, which were cut from b.m.s. bar, the whole of the motion, including the coupling and connecting rods, were made of it. The slide bars have the staggered series of oil holes as on the works drawings.

The oilbox on the top of the crosshead feeds oil on to the tops of the bars. Circular oilways were cut in the white metalled top slipper. The oil spreads all round these and drops onto the bottom whitemetalled slipper with its circular oilways. A small hole was drilled through bottom slipper over the oil recess in the small end of the connecting rods to oil the gudgeon pin.

On the side of the crosshead was a small oilbox which fed direct to the small end to ensure that oil was on the gudgeon pin—there is no such thing as a wrist pin on a steam engine!

I found the steel crossheads a long job; a number of machining, hacksawing, drilling and filing operations had to be done to make them conform to GER drawings. However, they were finally completed, even to the recess on the top of the crossheads in front of the oilbox, which was there merely to save a $\frac{1}{4}$ in. depth of metal in the castings.

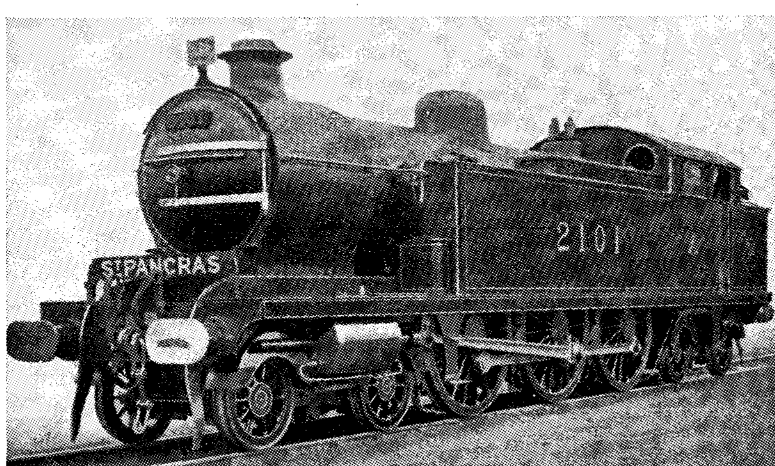
Flat cotters were fitted to the crossheads and the piston rods.

The inside connecting rods are GER pattern; the big ends have two bolts and flat cotters.

On the middle axle the eccentrics for mechanical feed water pump were fitted. The sheeves, straps and rod were according to the drawings. While I was on the inside work, I made the brake gear. I added the left- and right-hand screwed turnbuckles and locknuts. On the brake block hangers are solid round bosses forged so that there is a wide bearing surface for the hanger pin and at the bottom for the crossbeam ends. The hangers were cut out of thicker material to allow for turning the bosses.

The connecting rods for the inside cylinders are of the correct GER pattern, made with two bolts and flat cotter. I made the rods and big-end straps, clamped them in the machine vice, and drilled the two bolt holes and the three $\frac{1}{16}$ in. dia. holes for the cotters. A silver steel drift from $\frac{1}{4}$ in. dia. rod I cut to $\frac{1}{16}$ in. thick × $\frac{1}{8}$ in. wide, with rounded edges. It was hardened and let down to dark straw, and the slots were drifted out from both sides to the middle and then smoothed out with a flat needle file; both edges were ground round so that the round edges of the slots would not be damaged.

Pieces of phosphor bronze were cut to size and grooves were milled in them to fit in the straps. A piece of $\frac{1}{4}$ in. thick b.m.s. plate, the width of the straps, was cut out and the two half bosses were inserted in it and held in the four-jaw, with the plate



Superheater tank engine of the Midland Railway (London, Tilbury and Southend section) designed by R. H. Whitelegg and built by the Beyer, Peacock company. The board close to the front of the chimney reads: "LTS Section" resting firmly back on the first steps of the outside jaws; thus holding the brasses dead square with the bore. The diameter of the crankpin circle having been scribed on the face of the brasses on the centre line of the halves, they were set up and bored for crankpin diameter. After both sets had been bored in the jig, they were replaced in their straps. The back halves had a piece of $\frac{1}{16}$ in. thick steel plate sweated on, as a cotter plate to save the heavy flat steel cotter from the grooves which it would make on the back brass when it was driven up.

I made a stub mandrel. The assembled straps and brasses, held tight by the cotter, I machined both sides. The circular bosses were machined on; they were to hold the large area of big ends from rubbing on the crank webs. The rods were drilled and reamed for the gudgeon pins. All the connecting and coupling rods were made from gauge steel. I provided the coupling rods with phosphor bronze bushes and the outside connecting rod bushes with a retaining hexagon set screw, as on the full-size engine; all were fluted. Hexagon-headed oilbox caps were a push fit in all the oil holes on the rods.

Coupling rods

The coupling rods were drilled from a simple jig. The axleboxes in their hornblocks were wedged in the running position. Short pieces of rod were then machined a push fit in each box on one side of the engine and a spigot was turned about $\frac{1}{4}$ in. along, the size of the wheel crankpin. With a strip of b.m.s. $\frac{1}{8}$ in. × 1 in. I made the drilling jig. Using a large magnifying glass, I scribed the centres of the wheelbase, on the strips of steel and drilling the size of the crankpin to suit. I could then offer the jig on the spigots in the axleboxes and proceed to drill the rods for the bushes. With a six-coupled engine knuckle joints are cut in the coupling rod material and a tight stub of rod is bored and fitted before the drilling begins.

I placed the jig on the crankpin centre lines marked off on the flat material and clamped it down on the drilling machine table. To locate the holes, I used a short piece of silver steel, held in the chuck. I located the hole in the jig, and with a Slocombe centre drill and a drop of cutting oil I carefully cut the full size of the centre. I finished with an ordinary drill. Then I made a stub of metal a tight tap fit in the jig and the hole, reset for the next hole, and repeated the process. I removed the jig and opened out all the holes to the size for the bushes with a pilot drill—a sure way of making a satisfactory job.

When you have completed all the drilling you can, if you wish, put some temporary plain pieces of bushing in and assemble your wheels in the axleboxes and frames. Try your rods on and you should be very gratified with the results. You can then do all the machining and filing to complete the sets of rods.

As I wanted to see as much as possible of the Walschaerts gear, I adopted the GNR design for the basic mounting of the expansion link and lifting arms of the reversing or weigh shaft. I drew out the position of the bracket and bolting holes. The reversing shaft, which in this gear is almost the width of the engine, was cut to length and mounted in the frame holes, and a bracket was machined for the bearings for the shaft and lifting arms as well as the outside bearing of the expansion link trunnion.

Brackets began as a piece of 1 in. square b.m.s. Eventually after drilling, milling and sawing they looked like steel castings. Between them I milled a channel section bar to carry the motion bracket for the slide bars. The lifting arms on the reversing shaft, of $\frac{1}{4}$ in. dia. stainless steel, were drilled and reamered $\frac{3}{16}$ in. dia., and the shaft ends were shouldered down $\frac{3}{16}$ in. dia. and threaded for 4 BA collar nuts. I finally pinned the arms, after setting both sides parallel with each other.

Expansion links

I made the links to the GNR pattern as this was the one which I liked best. As the outside plates carry the trunnion pins, I made a jig plate of one of these for drilling the two bolt holes at the top and bottom of the expansion links for the final assembly. The holes in the jig were drilled $\frac{1}{16}$ in. dia. After all had been drilled with the pieces of plate clamped down together in each set of three pieces, the slots for the expansion link die blocks were cut and filed out.

Each set of links was then assembled. With a home-made reamer of silver steel turned to 67 thou the holes were opened out for the 10 BA stainless steel bolts. I made them a good fit in these holes. The outside trunnion plates were $\frac{1}{16}$ in. thick and the trunnions were machined for them a press fit.

Then the four distance pieces were cut and drilled, giving the clearance for the jaws of the radius rods, which pass through the expansion links with the lifting link slot and die block behind. I filed up the whole assembly of each link, and that was another job done.

And now for a story . . .

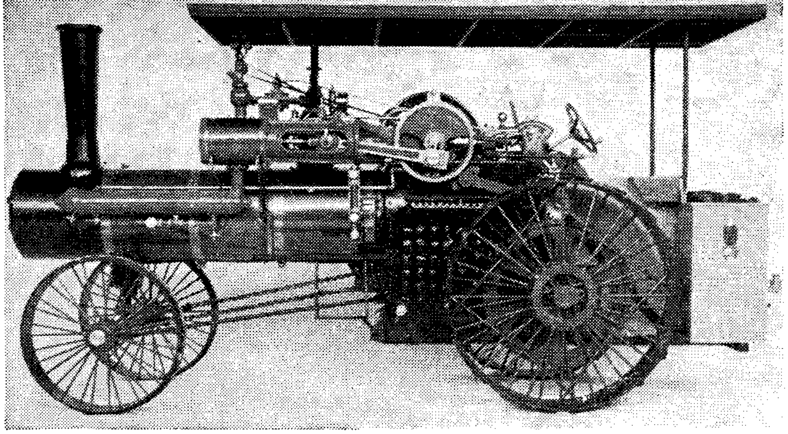
In my third year as an apprentice I was working one day on the bench which fitted up the slide valves, buckles and intermediate spindles. When the chargehand said: "Jim, they are taking pictures of the Royal Claud Hamilton engine out on the weighbridge. Nip out and have a look, and don't let anyone see you." Every year two new Clauds were chosen as Royal engines; with the red lining out was a white line, making, red, white and blue. I was naturally eager to see the Royal Claud. Leaving the shop, I hurried through the big archway between the main offices through which the finished engines went out to the front roads, and nipped round the corner to the weighbridge. There the engine was in all the glory of polished brasswork and the lovely blue of the old GER. Very few of you that read this ever saw a Claud as it was on that day in 1907.

Unfortunately for me, another lover of the beautiful engines was standing against the office wall—Mr Perry, assistant foreman in the fitting shop. He said: "What are you doing here away from your work, my boy?" I told him that I had come to see the Royal engine and that I had worked on her and was proud of her. He asked: "Do you go to evening classes at the GER Mechanics' Institute?" I told him that I did. "Give me your work's check, my boy, and you can go there for the rest of the day and see all the engine photographs."

This meant that I would be a shilling short in my wages on Friday, and a shilling was a good deal to parents with a growing lad to feed and clothe. But next day Mr Perry, a very kindly man at heart, came to my bench at the finishing time, and slipped a brown paper parcel in my hand, with a pass-out note to the gatekeeper. "Something for you, son."

On the road home I quickly undid the parcel. Inside were six copies of *The Locomotive Magazine*, a kind gesture from a man who had to keep the strict discipline of those days.

★ *To be continued on March* 29

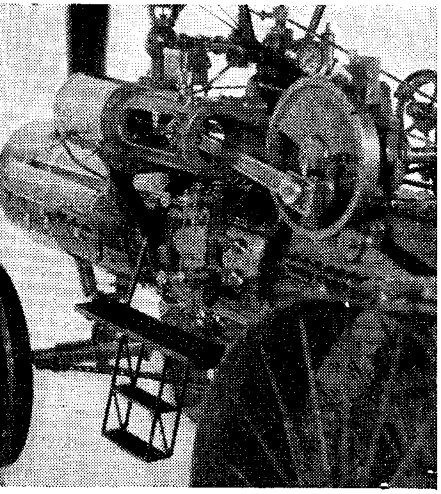


These pictures are of a 2 in. scale Case tractor made for an American reader by Charles Arnold of Junction City, Oregon, a professional modeller.

The tractor has all the operating features of the full-sized engine, including geared water pump, injector, oil pump, working governor, differential, large feedwater heater, and Woolf reverse, a type of Hackworth gear. It is usually steamed on charcoal. Working at 90 p.s.i., it amazes the uninitiated with its power.

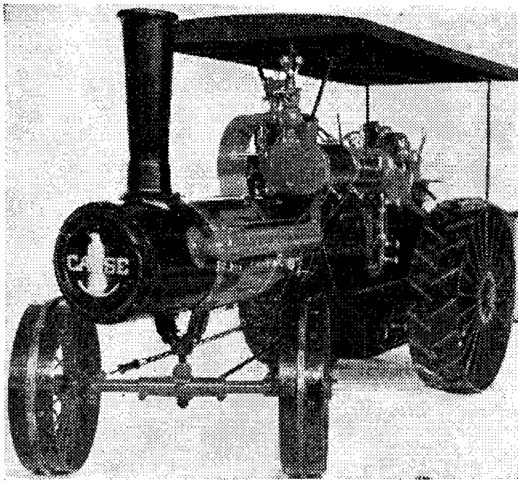
MODELLED IN OREGON

All the characteristics of the American Case are present in the traction engine photographed by W. B. HENRY of Virginia

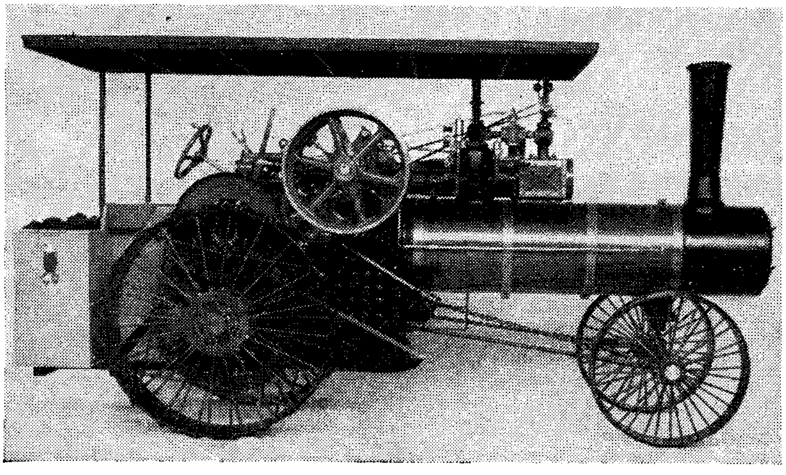


Bore and stroke are 1¾ in. and 1⅞ in., and the governor is set for about 350 r.p.m. Although the 12 in. and 8 in. wheels are spindly in appearance, are very strong; and they are faithfully dimensioned from the big engine. The rear wheels are sprung and radiused on parallel arms. The boiler is all copper, with 18½ in. tubes and 2¼ in. superheater flues.

Of the several design differences between the typically American Case and the popular Enginsh engines the use of a side crank with a heavy cast frame-crosshead is probably the most notable. It is hard to beat for simplicity and stiffness, and it permits the front end of the frame to be hung out from the boiler in such a way as to alleviate longitudinal stresses caused by temperature differentials.



Because the American engines of the later period were seldom used for road haulage, only one locked-in drive gear was provided. A flywheel clutch was used for disengagement.

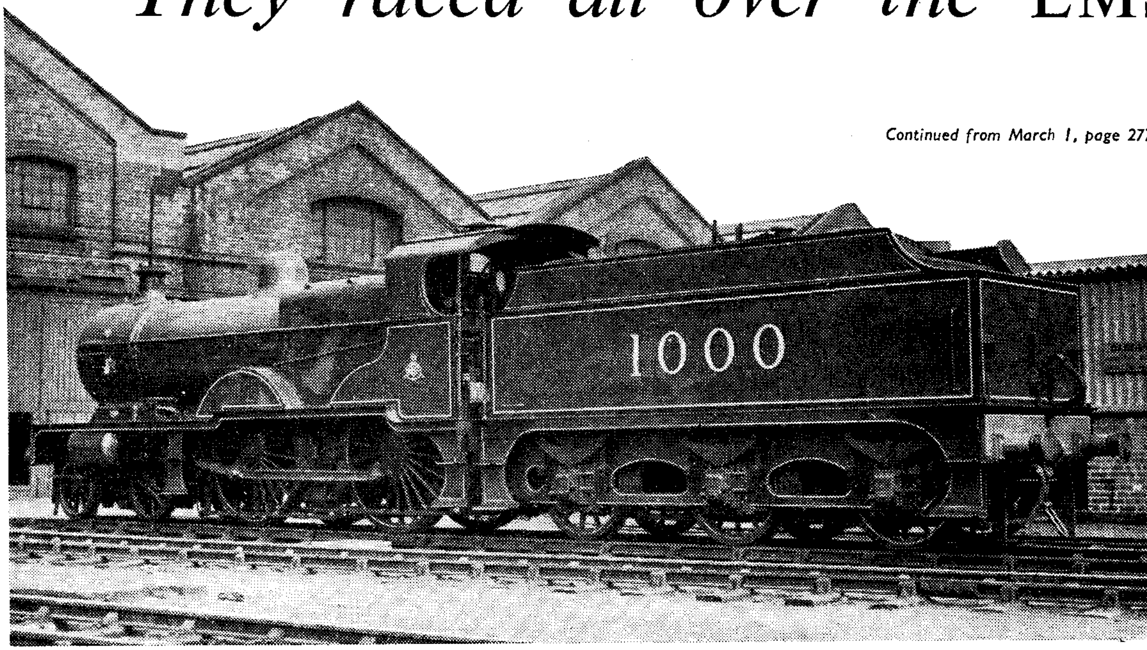


Manufacturers claimed that radial valve gear gave faster opening and closing of the valves, and, therefore, greater economy. Perhaps with only one wear point in the Woolf gear (the sliding block, which was easily replaced), unskilled operators found it easier to maintain free of slack than the Stephenson linkage.

One might generalise that the English manufacturers gave more attention to efficiency, perhaps at the expense of complexity and initial cost. Certainly there were many more compound engines in England than America. The American engines seem, by comparison, to emphasise simplicity and ease of maintenance. ▣

They raced all over the LMS

Continued from March 1, page 277



Photographs by Brian Western

DAY-IN, day-out, during the Thirties the Compounds raced all over the LMS section. Up in Scotland they were doing magnificent work—no wonder the Scots loved them! The Scots always appreciated a really good machine. They are reserved folk at first, but once something has shown its worth they are the most generous of all in their praise.

Even when the more powerful Royal Scots, Patriots, Jubilees and Black Fives got into their stride the compounds would compete favourably on the same schedules. But train loads were slowly increasing and, as was only to be expected, the compounds gradually lost the main links. But, oh, how they worked the other duties!

It was not until the war that they really felt the pinch. During those dark days they became sadly neglected and run down. They needed just a little more maintenance than a simple engine, and in war-time the extra time could not be spared. Their reputation took some knocks.

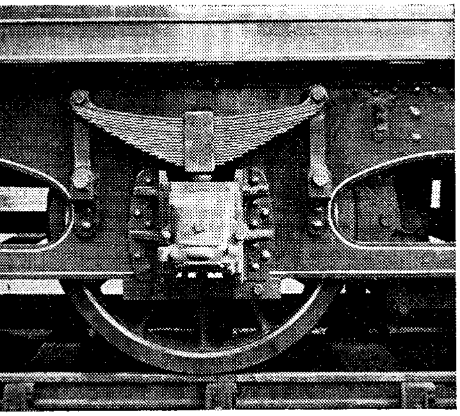
Once the war had ended they were better maintained and once again began to do excellent work. But their days were numbered. It may surprise some of you to learn that it was as long ago as 1948 that the first of them was scrapped. The first of the Johnson engines to go was 41002, and the first of Deeley's was 41018. Three were cut-up in 1948, nine in 1949, and four in 1950.

Surprisingly, four of the original engines remained until 1951 when together with another fifteen, 41000, 41001 and 41003 were withdrawn and all were scrapped except 41000, which was stored at Crewe, awaiting preservation.

In 1952 the last of the Johnson engines 41004 was scrapped, with another nine Deeley engines. By now only two of the engines built in pre-grouping days remained, 41009 and 41025. Both of them had gone by the end of 1953, with twenty-one of the LMS-built engines. The first of the post-grouping engines to go was 41046. Heavy scrapping continued. Twenty in 1954, 35 in 1955, 23 in 1956 and 33 in 1957. One of them was 41098, the engine which had its cranks setting altered to 120 deg. in the early Thirties, to determine whether the balancing would be better at high speed—an experiment which created a peculiar beat with every third pulse missing.

Only 63 of the class were left; by 1959 the figure was down to 29 and by 1961 to two. Last August 41168, the last of the line, was cut-up. The Crimson-Ramblers were dead . . . almost.

In 1959 old 41000, which had been salted away nearly eight years before, was overhauled for preservation. She was restored to Midland livery, but instead of being placed in a Museum



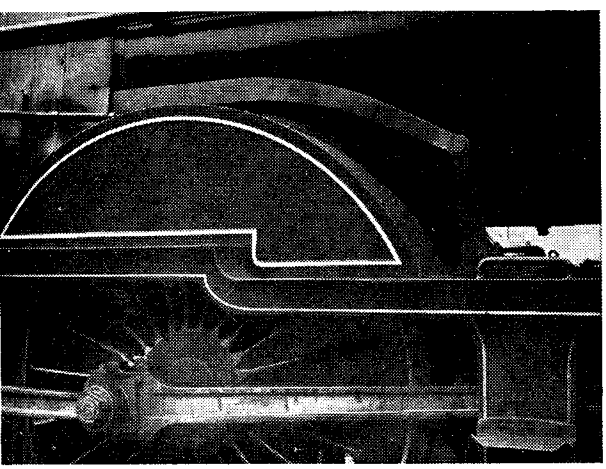
outside low-pressure cylinders of 21 in. bore and 26 in. stroke and one inside high-pressure cylinder of 19 in. × 26 in. Their coupled wheels were 6 ft 9 in., and the bogie wheels 3 ft 6½ in. Tapering from 4 ft 9⅛ in. dia. at the firebox to 4 ft 7⅝ in. at the front, the boiler was pitched 8 ft 6 in. above the rails and had a barrel length of 11 ft 11 in. The firebox was 9 ft long. Within the boiler were 21 flues of 5⅛ in. dia. and 146 tubes of 1¾ in. The superheater contained 21 elements of 1½ in. dia. As the heating surface was 1,169 sq. ft for the tubes and 147.3 sq. ft for the firebox, the total evaporative heating surface was 1,316.3 sq. ft. The superheater provided tractive effort at 85 per cent, boiler pressure was 22,649 lb.

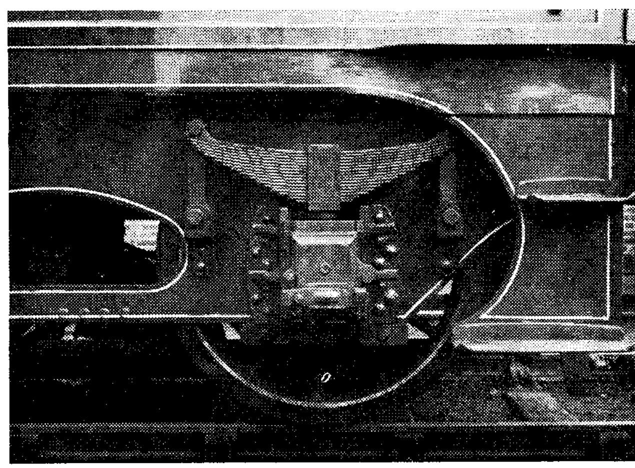
When the engines first appeared they were painted Midland crimson lake, banded in black with a thin yellow line to each side of the black, The buffer beams were vermilion and had the letters *MR* on them in gold-shaded blue. Later the engines received black wheels, and the name of the shed and the number were given also on the buffer beam.

After the grouping, painting had not become standard. Some engines had the number in large Midland figures on the tender and some had it on the cab side. In 1927 the new Compound 1112 was painted crimson lake but without a lining to the boiler bands. On the cab side it carried the LMS crest; on the driving wheel splashers was the building plate.

The following year the standard was set: the old Midland crimson and lining for all first-class passenger engines, including the Compounds. The engine number appeared on the cab-side and the initials LMS on the tender side.

After the war, says ROBIN ORCHARD, the Compounds continued to run well. But they had reached their last phase, and today only one of them remains





was kept in working condition for hauling railway enthusiasts' specials. Her first duty was the SLS special from Birmingham to Doncaster and York on 30 August 1959. Since then she has run many such trips; I hope that she will continue to work for many years. During her 49 years in ordinary service she covered 1¾ million miles.

Returning the engine to her original condition would have been too costly, but it was possible to make her as she had been after the 1914 rebuilding. She carries the number 1000 and the livery of that period.

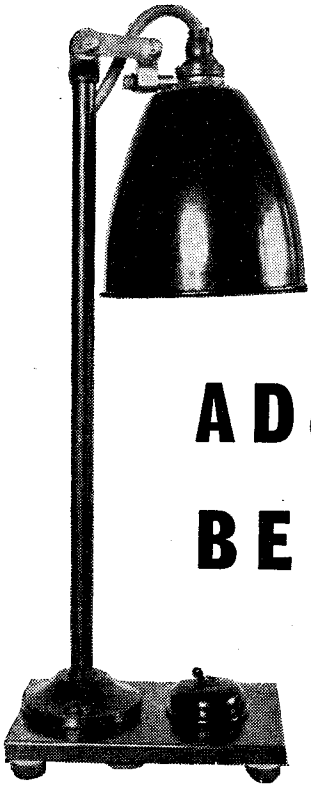
The LMS-built engines had two 290.7 sq. ft, which gave a combined total heating surface of 1,607.7. The grate area was 28.4 sq. ft and the boiler pressure 200 p.s.i.

The engine weighed 61 tons 14 cwt, of which 22 tons 10 cwt was borne by the bogie, 20 tons 15 cwt by the driving wheels and 20 tons 9 cwt by the trailing coupled wheels. Running on six 4 ft 3 in. wheels, the tender carried 5½ tons of coal and 3,500 gallons of water. It weighed 42 tons 14 cwt: 14 tons 8 cwt on the leading axle, 13 tons 19 cwt on the centre axle, and 14 tons 7 cwt on the rear axle. The total weight of engine and tender was 104 tons 8 cwt. Total

Basically, this remained the standard livery until the war, when most of the class assumed a sombre black cloak. During nationalisation the engines ran in black, some with lining and some without. Probably the last engine of the LMS to retain its LMS livery was Compound 40934 which had it till 1949, nine years after it had ceased to be used.

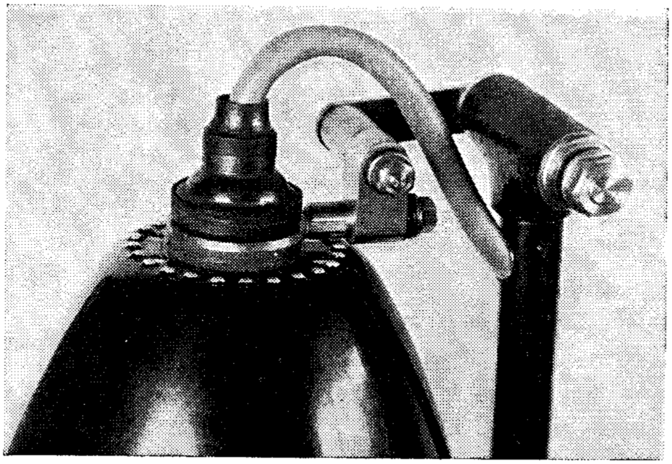
On March 29 I shall be writing of the Great Central Railway Directors.

I should like to acknowledge the help given to me by the Press officer of the Midland Region, the works manager of Derby Works, and the Midland photographic library.



N. F. HALLOWS makes a handy unit to light some of the machines in his workshop. This is the first of two articles

ADJUSTABLE BENCH LAMP



My lamp stand was made for lighting some of the machines on one of the workshop benches. They included two drilling machines and two grinders, as well as the bench vice.

The other machines are equipped with self-contained lighting systems. A further use for the small standard lamp is as a spotlight for photographic work, with a photo-flood bulb. As bulbs of this high wattage cause considerable heating and have a comparatively short life, they should not be switched on longer than is necessary to check the lighting effect and afterwards to make the exposure. The fitting of a more open type of shade than the one illustrated will largely overcome the heating problem.

For the main parts of the lamp I used standard electrical fittings and materials, found in the boxes where I store such things. The pillar upright was made from a 18 in. length of $\frac{5}{8}$ in. dia. electrical conduit tubing, threaded 18 t.p.i. at either end to take standard fittings.

Your local electrician who supplies the conduit should be able to do the threading; otherwise, if you do not have the appropriate die, you can readily screwcut the thread in the lathe.

The footing for attaching the pillar to the baseboard is the centrally-tapped, domed lid of a standard, circular junction box. At the upper end of the conduit a commercial T-piece is screwed in place to carry a cross-bolt for mounting the adjustable lamp head.

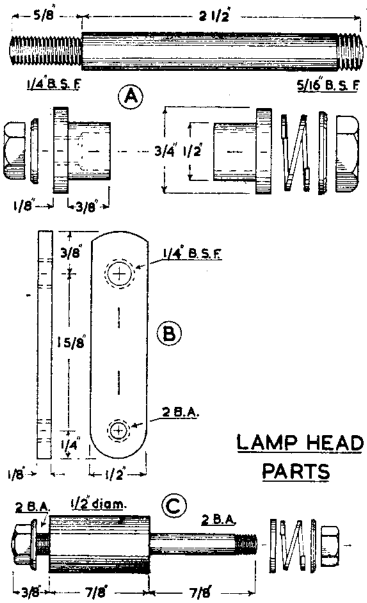
As the T-piece was only a rough casting, I mounted it on a stub-mandrel for gripping in the lathe chuck, so that the head of the T could be faced at either end and its overall length reduced to 2 in. The adjustable head, shown assembled in the illustrations, provides for swinging the lamp from side to side as well as for tilting it upwards. While the range of height adjustment is somewhat limited, it can be substantially increased by slightly modifying one of the components.

The head is attached to the T-piece of the tubular upright by the cross-bolt, *A*, which is furnished with an adapter at either end to fit the bore of the T-piece. In addition, a double-coil spring washer provides frictional control of the height adjustment. The nut compressing the spring washer can be locked by being screwed firmly home on the threaded end of the bolt or by being secured with a $\frac{5}{16}$ in. BSF lock-nut after the necessary adjustment has been made. At its other end the cross-bolt is shouldered down and threaded $\frac{1}{4}$ in. BSF for attaching the link member, *B*, and securing the adapter. A greater range of height adjustment can be obtained by increasing the length of the link.

I threaded the link $\frac{1}{4}$ in. BSF for the cross-bolt with its lock-nut, and 2 BA at the other end to receive the trunnion bolt, *C*. By securing the components together in this way and fitting lock-nuts, the parts are made proof against unscrewing when the position of the lamp is adjusted.

The trunnion bolt was machined from $\frac{1}{2}$ in. dia. mild-steel rod, shouldered down and threaded 2 BA to screw into the link and carry the locking nut. At its other end the bolt was also shouldered and threaded 2 BA for mounting the trunnion block, *D*. Frictional control was again provided by a double-coil spring washer, compressed by a nut when it was screwed home against the end of the thread.

This entails careful fitting; gradually increase the length of the thread with the die, until the required degree of friction has been obtained. If the



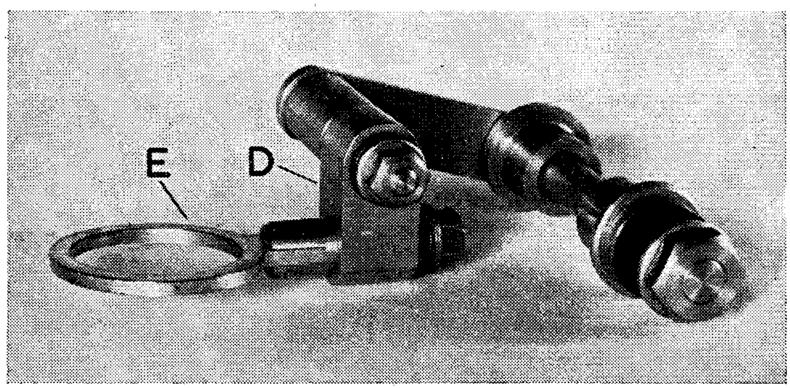
threading has been carried too far, you can make a correction by fitting thinner washers or by facing back the abutment shoulder on the bolt.

A short length of $\frac{1}{2}$ in. square mild steel was used for making the trunnion block, *D*. As shown in the drawing, it was drilled $\frac{3}{16}$ in. dia. in two planes at right angles to one another to receive the trunnion bolt at one end and the shank of the lamp-holder ring at the other. To finish the part, both ends were rounded off to a $\frac{1}{4}$ in. radius.

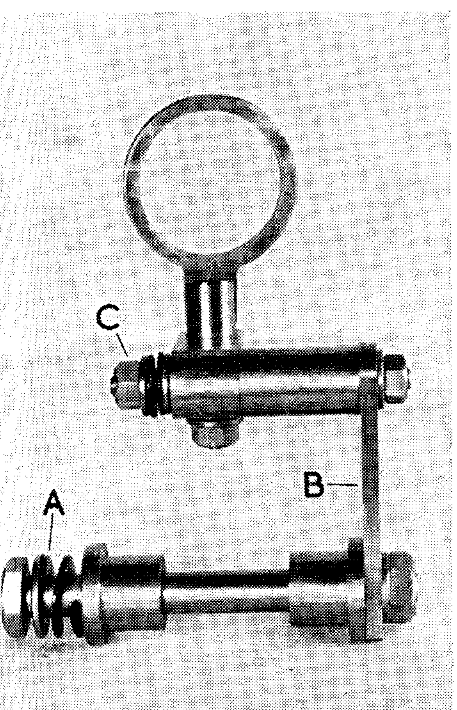
The lamp-holder ring, *E*, is of built-up construction, with the shank of the bolt part threaded 2 BA and and follow it by boring the part to the finished diameter of 1$\frac{1}{16}$ in. By taking these precautions, the working parts of the chuck will be kept clean and its face will not be damaged by the boring tool.

An alternative way of machining the ring is to mark it out on a rectangular piece of material for gripping in the four-jaw chuck. The centre mark should be drilled so that you can set it to run truly by using the wobbler, engaged with the tailstock centre.

After employing this set-up for machining the bore, file the ring to shape. The finished components are



Right: D *is the trunnion block and* E *is the lamp-holder ring*



Head assembly. A *is the cross-bolt,* B *the link, and* C *the trunnion bolt*

furnished with a double-coil spring washer and compression nut.

Grip a length of $\frac{3}{8}$ in. round mild steel at centre height in the lathe toolpost, and machine the slot in the bolt head with a fly-cutter or circular milling cutter, mounted on an arbor between the lathe centres. Measure with the micrometer the thickness of the material to be used for making the ring portion, and machine the slot 1 thou in. less in width when it is checked with a taper gauge. This will ensure a secure fixing when the parts are finally pressed together in the vice, cross-pinning will not be necessary. Cut off the bolt to length, and grip the head in the chuck for machining the shank with a series of light cuts. Finally, thread the end with the tailstock die holder.

Mild-steel sheet, 3/32 in. thick, is used for making the lamp ring. After marking out the work, I sawed and filed it to shape on its outer contour. This allowed the blank to be gripped and centred in the self-centring chuck for machining the bore.

To prevent chips entering the chuck, pack the bore with a piece of rag or cotton wool. Bed the work on a piece of thick card and press it against the chuck face with the tailstock centre while the jaws are tightened.

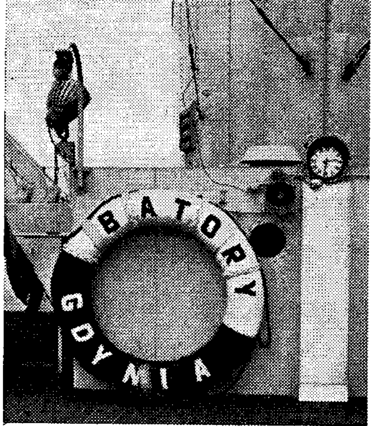
Drill a $\frac{1}{2}$ in. dia. hole in the work next assembled and the complete head, with the lamp bulb and shade in place, is mounted on the pillar to check that there is sufficient frictional control to hold the lamp stationary in all positions.

Before the wiring is carried out the foot of the pillar can be fixed to a hardwood baseboard, which is afterwards french polished. The baseboard should be large enough to overcome any tendency for the lamp to be tipped over. In addition, rubber buttons are fitted at the four corners of the under surface.

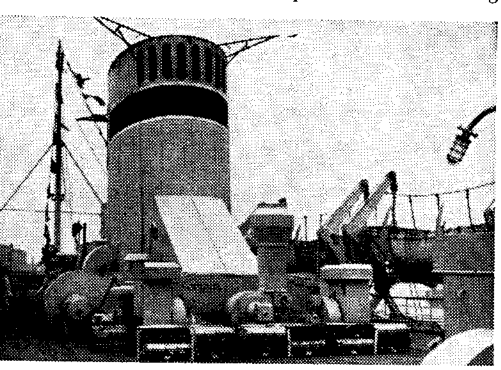
A 1 in. dia. hole is bored in the baseboard beneath the footing for the passage of the wiring leads, which you take through the tubular column by drilling a hole towards its upper end. For convenient working, a tumbler switch is let into a 2 in. dia. hole bored in the baseboard and is fastened in place with a cross-strap. The lamp is supplied from the mains by a flex connector; the plug part carrying the pins is fixed to the baseboard with a single screw. This part of the connector is packed up with a strip of card to allow the socket part to be engaged.

For the sake of safety in handling, the shrouded socket should always be connected to the mains.

★ *To be continued on March 29*



*Top: Passengers like to pose for their photographs in front of this outsize lifebuoy on the games deck. Above: In white on red—*POL*, Polish Ocean Lines Below: Looking aft. Buoyant apparatus is seen in foregrourd. The fans on the ventilators improve air-conditioning*



AFLOAT ON THE THAMES

LINER FROM POLAND

By OLIVER SMITH

In the introduction of this series I mentioned that the motor vessel *Batory* was at Tilbury on December 23, embarking passengers for a Christmas cruise. Within seven weeks, she was back in the Thames and making her way further up river to Greenwich.

M.v. *Batory*, 14,287 tons, was built in 1936 for the Polish Ocean Lines, together with her sister ship *Pilsudshi*. Their careers as luxury liners, intended for comfort rather than speed, were fated to be short.

Soon after the outbreak of war they were in action with British forces in Norwegian waters. In the April of 1940 they were engaged in the landing of troops into Norway, and a month later were evacuating them. This campaign, short though it was, accounted for the sinking of *Batory's* sister ship.

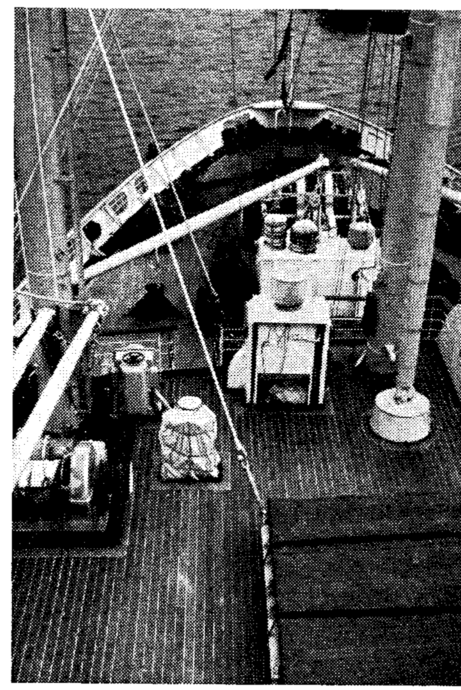
In June 1940 *Batory* took part in the historic evacuation of British forces from France to England.

The next memorable date listed in her log with the Allied forces was in October 1942 when she was engaged in the landing of troops in North Africa. In July 1943 she helped to land troops in Sicily. When the Allies launched their main offensive into Europe in 1944, she once again played her part, this time in taking troops to Southern France.

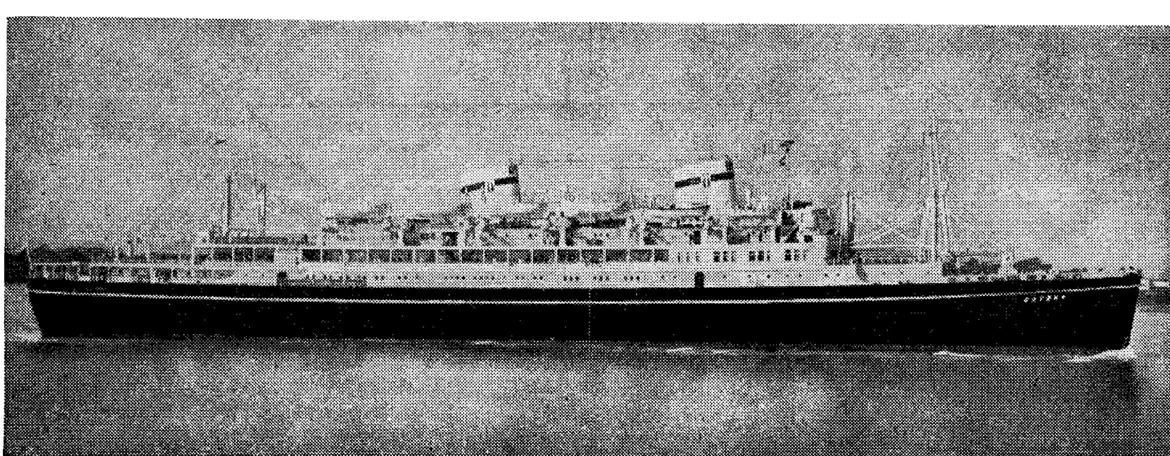
With the war over, *Batory* returned to her native shores in July of 1945, shed the wartime austerity of a troopship, returned to the elegance of a luxury liner.

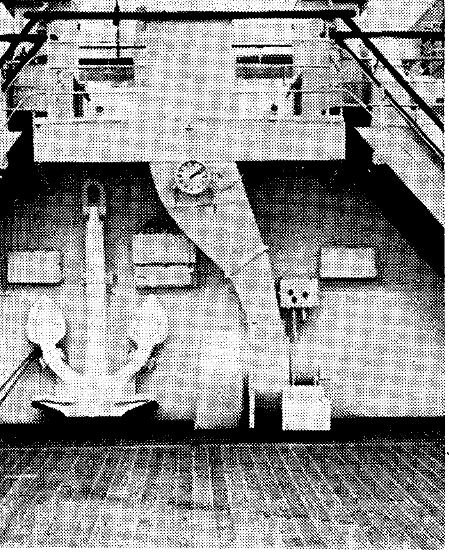
Her normal scheduled run, extending from May to November, is from Gdynia to Montreal, with Copenhagen, Southampton, Leningrad and Helsinki, as ports of call on certain voyages. For the European visiting the Middle West cities such as Detroit and Chicago this North Atlantic route is easier than the route by way of New York.

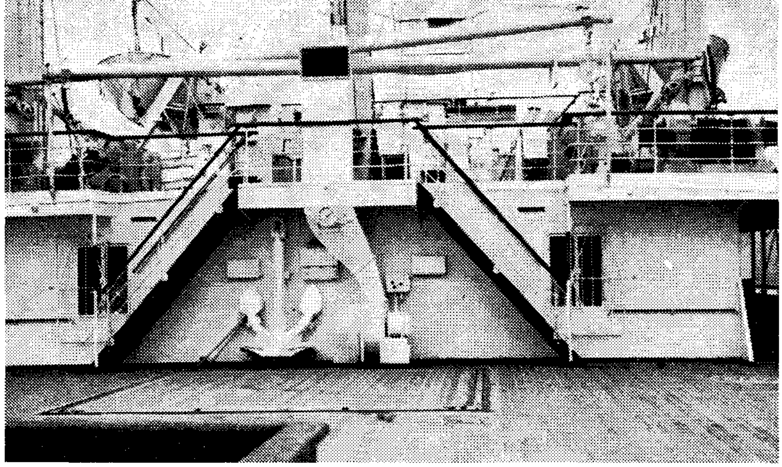
At the end of the season *Batory* works two or three short cruises before entering dry dock for her annual refit. The special Christmas



View from the bridge. Near the derrick post and winch (left) is the control gear with a wheel as for car steering







Left: Spare anchor and a ventilator with motor. The ladders lead to the boat deck, seen in more detail above. In the foreground is the games deck

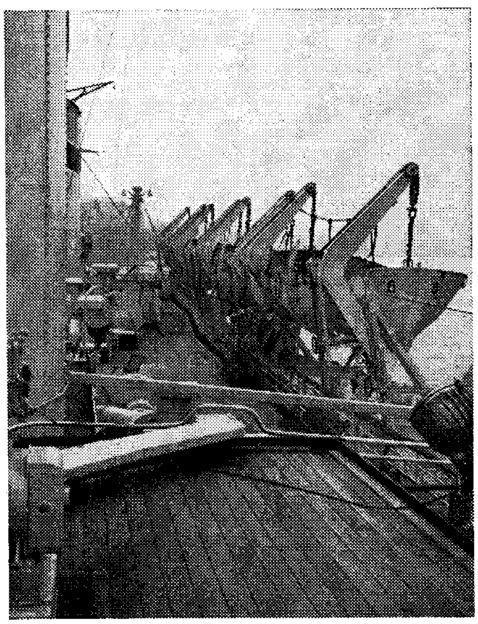
cruise last year embarked passengers at Copenhagen from the Continent and at Tilbury from the United Kingdom. They spent Christmas Day at sea and Boxing Day in Tangier, their first port of call. Then they visited Casablanca, Las Palmas, Madeira and Malaya before returning home to Southampton or Copenhagen.

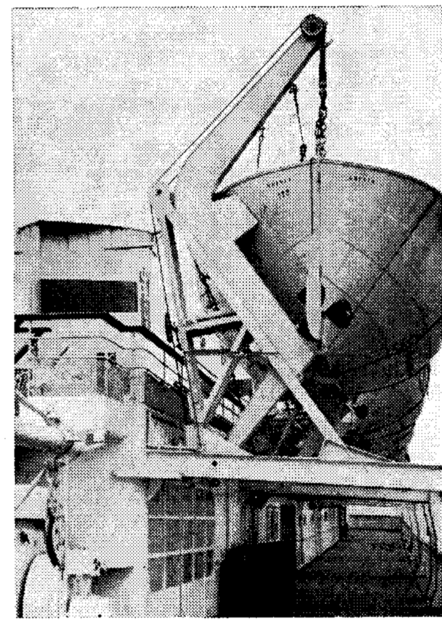
All the passengers on the second cruise, which brought *Batory* up the Thames to Greenwich, were Poles enjoying a late holiday. They spent three days seeing the sights of London and then went to Amsterdam for a similar tour before returning home.

Batory is a twin-screw ship with two nine-cylinder two-stroke Sulzer engines developing 6,250 b.h.p. each at 130 r.p.m. They give the ship a service speed of 18 knots. Her length is 152 metres, her breadth 21.57 and her draught 7.54. Seven decks provide the accommodation and recreation for 800 passengers. The largest part of the cabin accommodation is allocated to tourist section, with 257 cabins. There are 28 first class and four de-luxe.

Since the ship was built, the major modification in her appearance has been the fitting and repositioning of the lifeboat davits. There are twelve aluminium lifeboats; some are equipped with radios.

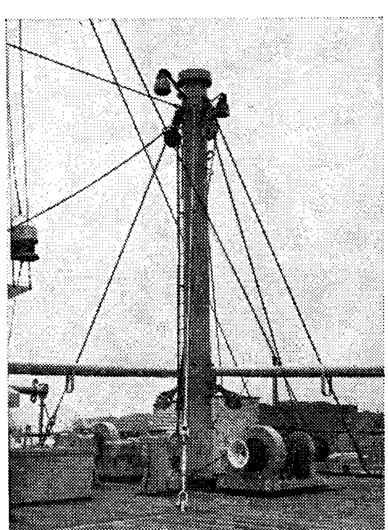
Batory takes her name from a Polish King of the sixteenth century. ■

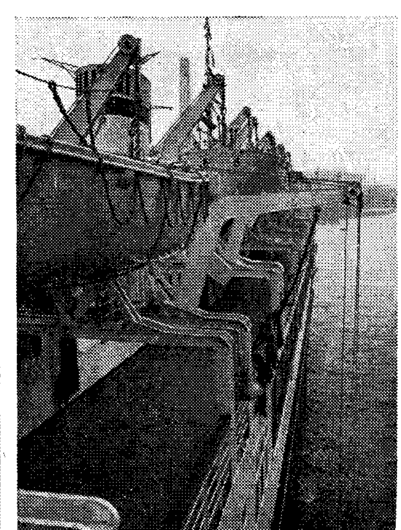




Looking aft on the port side. The lifeboats are of aluminium. Right: Looking forward on the starboard

Below left: Derrick post with winches at after end of the games deck, port side. Right: Davit out; port, looking aft





Index

There was a printing error in the title page of the ME index for volume No 125. Corrected pages have now been printed; they were included in the February 22 issue for home subscribers and in the March 8 issue for others. If you are a subscriber and have not received the corrected title page, or if you ordered an index and received the incorrect one, please write to PM Sales Department.

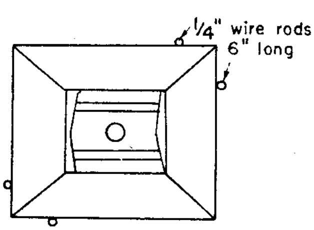
 Continued from March 1, page 270

No grass in the attic

While the track lies idle, ARTHUR W. SMITH finds plenty to do

AFTER fixing all the top boards in place I found that, by using my long levelling rule, it was simple to find the high and low spots on the whole layout. To my agreeable surprise, there was very little difference.

Fortunately, the low spots were so slight as to make no difference and the high ones were quite easy to rectify by removing the two top boards and planing away the wood on the stringers until it was right. In any event, all the top boards had to come off because I decided finally that a certain amount of super-elevation would be desirable. I reduced the height of the inside stringer by $\frac{1}{8}$ in. Before screwing the top boards back on again, I gave



them a coat of paint underneath, as well as painting the top edges of the stringers. The whole structure, to my delight, was as solid as a wall. Unless the weather damages it, it should last for years.

I gave the top boards one coat of paint on the top before laying the rails, to preserve the wood under the rails where water lodges after rain. Following LBSC's method, I laid the outside rail first as a guide for the others, and put down about eight yards. Then I laid the other two rails, to see how they looked and to check the gauges and the level by running the driver's car on it.

The trial was a great disappointment. Being springless, the car derailed all over the place. I thought at first that it might have warped, but a check proved the warping to be unimportant. I realised that the super-elevation must be at fault.

After further checking I found that where the top boards butted against one another there was a considerable difference in level between the outer rail and the position between joints, so that at most of these points my two-axle car was running on two opposite wheels only. Obviously, I had to make the top boards level or put springs on the car. As the engine and tender were both sprung, I was not afraid of serious trouble with them from this humpy track, but rather than have any trouble at all I re-levelled the top boards by taking out the super-elevation.

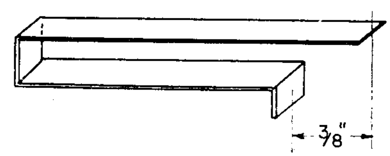
Worth doing

This meant pulling up all the rails I had so painstakingly laid and shaving $\frac{1}{8}$ in. off the outer stringers after removing all the top boards. I went ahead and did it, and am I glad! Once more I enlisted the aid of the carpenter, and between us we levelled the whole track.

I began to realise that the number of screws needed on work like this was very high, and that screwing them in would just about cripple me. And so I threw them overboard in favour of brass nails. I used No 14 $\times$ 1 in., with a fairly large round head which gripped the rail base very firmly and were easy to knock in. They were easily pulled out with a pair of side-cutting pliers. I put them about 6 in. apart on both sides of the rail except at the joints, where I used four—two together opposite one another, an inch on either side. I used the same arrangement at the rail-board joints, where they butt, to help hold down the wood in case it had any funny ideas about warping.

For the rail joints themselves (each rail was 6 ft long) I did not use fishplates; I simply clamped them tight. A toolmaker's cramp and two small pieces of $\frac{1}{4}$ in. round rod were placed on either side of the web and tightened up well. Then the nails were driven in and the cramp was removed.

Before laying the outer rail, I made a templet out of a piece of $\frac{1}{2}$ in. board 6 in. wide and about 5 ft long, with the outer rail radius cut out on one edge, to mark out the curvature of the outer rail on the top board, as a rough guide. The curvature of the

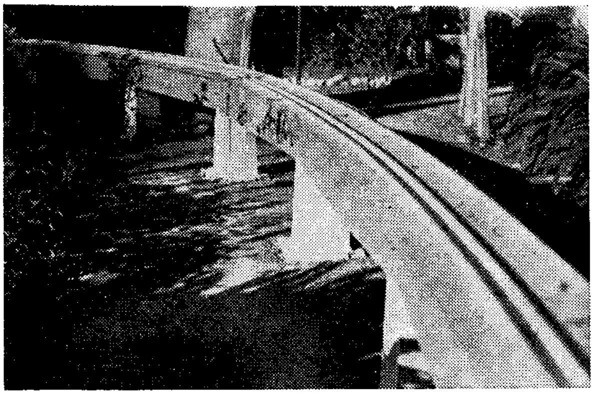


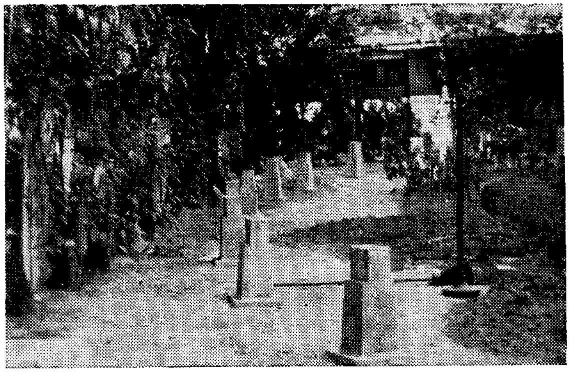
rails on the boards between pivots I decided by eye, as the curve at these two points was very small.

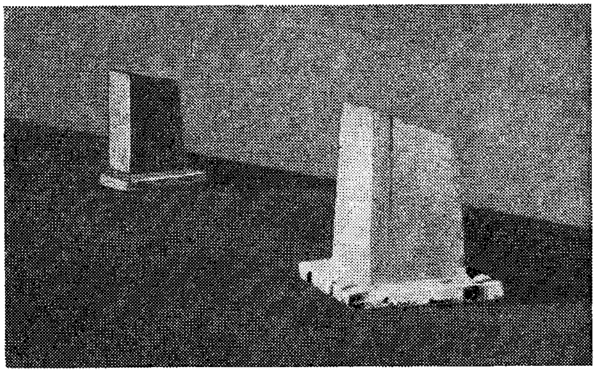
The other two rails were then laid, first the 5 in. gauge and then the $3\frac{1}{2}$ in. I used as gauges short lengths of 1 in. $\times$ 1 in. wood, one $5\frac{1}{16}$ in. long and the other $3\frac{9}{16}$ in., and slid them along as the nails were driven in, with the help of my brother-in-law and his wife, who had just arrived in Lisbon for a short holiday My brother-in-law did most of the painting, and we finished the job just in time for my annual holiday. Before we left, I again tried the driver's car on the track. It still derailed, and so I fitted it with springs. They immediately cured the trouble.

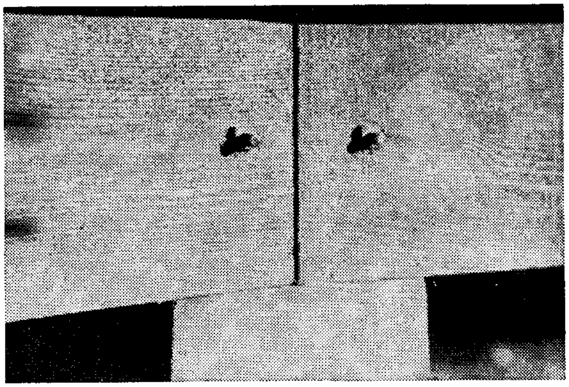
Upon our return from the seaside some weeks later, I found the whole structure unchanged, in spite of the fierce summer sun. Owing to the difference in temperature from day to night, I expected that at least there would be some slight movement of the pillars at their bases, but there was not the slightest sign of this anywhere. Nor has the layout been affected by the wet and cold winter. I shall replace all the rail joint nails by screws eventually.

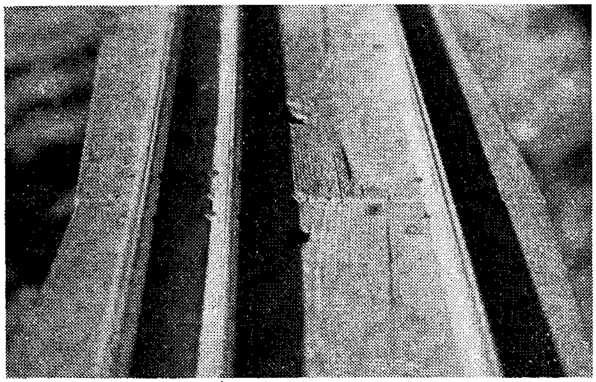
There only remained the running of the engine under steam. I took the

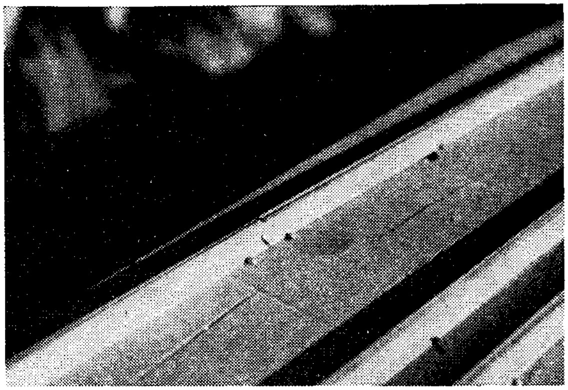












Top: Towards the swing. Centre: Pillar close-up. Above: Fastening at the joints in the top board

Top: Pillars in position; not lined up. Centre: Stringer fastening. Above: One of the joints

precaution of trying the engine alone on the track by pushing it along by hand. To be quite sure that all the wheels were in contact with the rails everywhere, I placed a small strip of tin (a tobacco tin seal again) on the rail ahead of the engine. As each wheel passed over, the tin strip was firmly held.

Now I listen with delight to the snappy note from the blast pipe as my *Iris* makes little of the 13 in. difference in level, and to the clickety-clack of the joints as she goes over them. At first I was a bit scared to go too fast in case the engine derailed, but she seems to stick to the rails like a leech. Little by little, as I get more confidence, I shall increase the speed.

After a few runs I noticed that in a few places the engine and car leaned over slightly either to one side or the other, owing to small inequalities in level. I found that there were a few differences here and there which could be eliminated by packing the rail up with thin wooden strips. On one section I removed the outer nails after slightly raising the inner ones and inserted the wooden strip of the same width as the rail base and 1/32 in. thick. I used a taper gauge marked off in 1/32s, a gauge which I made when I was a student apprentice in the English Electric Company's works at Preston thirty-seven years ago. By slipping the gauge under the low end of the level laid on the track, I could easily see how many 1/32s were needed to level the rails. I checked the track all round at about 12 in. intervals.

Each check mark was written in chalk on the top board. Of course, it rained heavily that night and all my figures were washed out. I had all the work to do again, but this time I used a white crayon pencil belonging to my young daughter.

We have recently planted new grass where the path was and the track now is; there can be little work or running for at least two months until the grass has firmly established itself. But I have plenty to do; time is no object to us model engineers. There are passenger cars to make, and the work can be done in my attic workshop where there is no grass. In the cold weather I can wear fur-lined boots, a Christmas present from my wife, God bless her, who realises that warm feet mean a warm body. ▣

STEAMTOWN, USA

By Robert W. Adams, Superintendent of the Monadnock, Steamtown and Northern Railway.

EDWARD BOWNESS' "Steam Dies Hard in the United States" on January 11, provided excellent coverage of our operation during the past summer.

However, there are several points in the article which we feel should be corrected and clarified. Mr F. Nelson Blount, president and owner of the Monadnock, Steamtown and Northern Railroad and the narrow-gauge Edaville Railroad, already has more than forty steam locomotives in his possession. Most of them will be given by him to the State of New Hampshire for permanent preservation, and public display under cover, as soon as suitable museum buildings can be erected to house them. It is expected that construction will start this year in the Keene area of New Hampshire. The museum will be known as "Steamtown, USA."

In addition to locomotives, many other steam exhibits, including steam fire engines, steam tractors, and steam-driven autos, will be displayed. The museum itself will be built and operated by the State of New Hampshire.

Mr Blount will operate a section of standard gauge railroad with steam-powered passenger trains. Some of the better locomotives now in his collection will be reserved for operational purposes, but all will eventually become the property of the state for guaranteed permanent preservation.

The area at Bellows Falls, which Mr Bowness mentions as having only a snowplough and coach as evidence of a railroad display at the time that he was there, is the base of the operating railroad. Last summer, except for several locomotives under cover in the enginehouse here, all equipment was at Bradford in New Hampshire where we conducted operations over the Claremont and Concord Railway. It is our hope this year to be able to operate from Bellows Falls, providing that the necessary approval for the transfer of the existing line between here and Keene can be obtained in time for some summer working. We could not obtain it last year and were compelled to transfer our activities to Bradford.

The 4-4-0 tank locomotive pictured on page 37 was on display at "Pleasure Island," an amusement park in Wakefield, Mass, in company with a number of other locomotives. It belongs, with other equipment from Ireland, to Mr Edgar T. Mead, who brought it to the United States. All the other railroad equipment at this park was owned by Mr Blount.

Late in December 1961 all standard gauge equipment at the park was moved to Bellows Falls. Several of the locomotives we hope to operate soon. The rest will be restored and painted for display in the museum of Steamtown, USA. At present we have ten locomotives and 20 cars at our Bellows Falls site.

The narrow-gauge East Broad Top Railroad in Pennsylvania is owned and managed by Mr Nick Kovalchick of that state.

In addition to having United States, Canadian and other North American locomotives, Mr Blount hopes to get some English locomotives for display in the Steamtown museum.

Once the museum has been established, we will offer MODEL ENGINEER, with American magazines, so that visitors here will be aware of its excellent coverage. ▣

IRISH JIG

Body ex ½ in. square stock × 1¾ in. long drilled through No 27 to clear 4 BA and followed by No 12 for 1¼ in. to clear 3/16 in. dia. 22 s.w.g. spring.

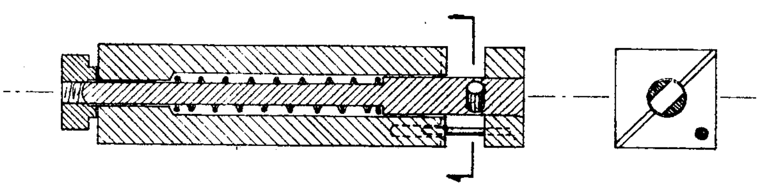
Spindle ex 3/16 in. round stock, relieved and part tapped 4 BA, cross-drilled No 45. Head ex ½ in. square stock × 3/16 in., force fit on spindle, swaged. Locating pin 16 s.w.g. Shallow groove filed diagonally on body face, to locate drills at 45 deg.

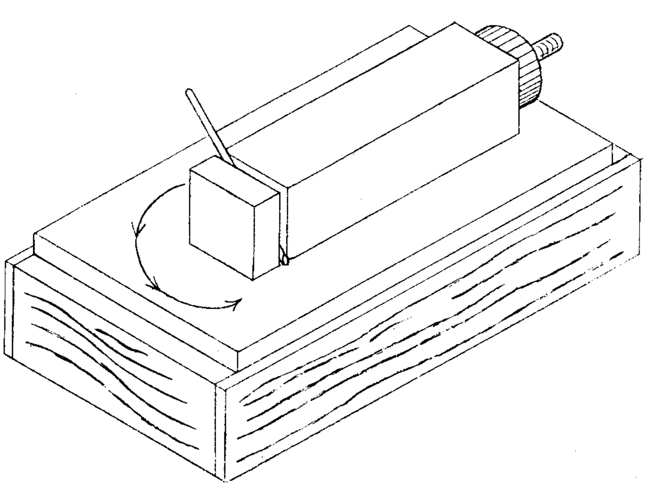
Drill fixed on holder, barely to protrude, and ground in place on fine oilstone.

MANY years ago I made a jig to instructions in either ME or *English Mechanics*; I cannot now trace the source.

The jig produces a 90 deg. point, but 120 deg. may be obtained by varying the design to use hexagonal instead of square stock for the body and head.

J. J. CARROLL.

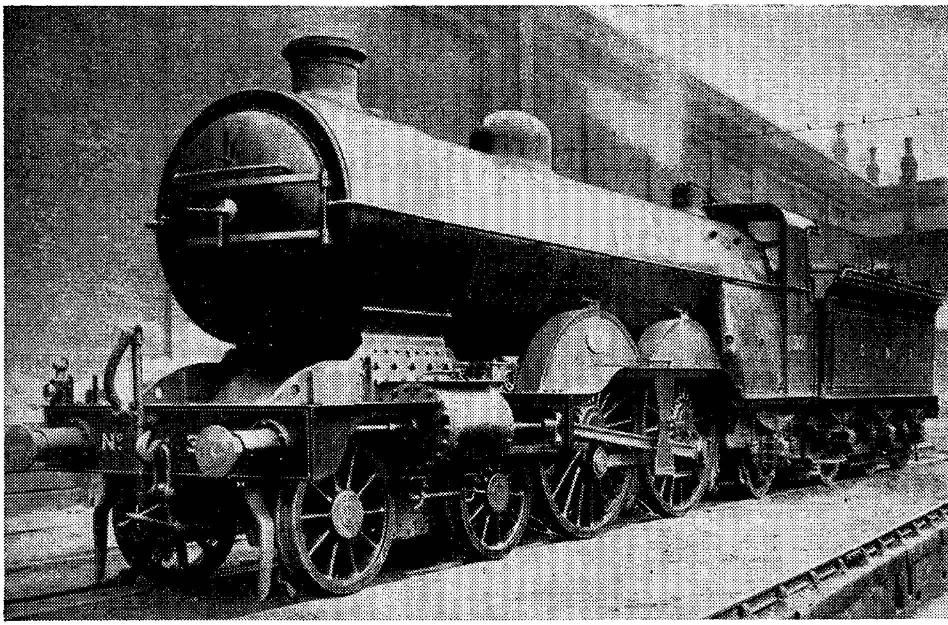




RAILWAY LIVERIES—5

BRITAIN'S GREAT NORTHERN

MARTIN EVANS writes of the colour schemes which were adopted from 1866 under four famous loco engineers



Up to 1923, the Great Northern Railway was one of the largest and most important railways in Britain, its main lines running from Kings Cross to north of Doncaster.

The railway was very well served by four distinguished locomotive engineers, Archibald Sturrock, Patrick Stirling, H. A. Ivatt and, finally, H. N. (later Sir Nigel) Gresley. Unlike many other railways, the Great Northern always favoured a green livery for its locomotives.

During the Sturrock regime (1850-1866) there would seem to have been considerable variation in the locomotive colour schemes. However, the main body colour was a bright grass green with black smokebox, buffer heads, springs, and chimney. The outsides of frames were dark red. Wheels were green. The tender sides were broken up into three panels and the lining was white on each side of a black line with " concave " corners. On tank engines there was generally a large brass oval number plate with the words *Great Northern Railway* around the outside. A small works plate adorned the cab sides.

Tender engines usually had an oblong number plate placed on the sides of the boiler barrel.

Under Patrick Stirling (1866-1895) the body colour was a light grass green and the wheels were painted the same colour. Outsides of frames, including the tender frames, were painted " chocolate-maroon " (a darkish red-brown). Outside the lined panel on the tender, the colour used was a dark green. Cab and tender beading were painted black, and the cab had a thin white line between the black and the green. There was black and white lining on all boiler bands, as well as on the tender sides and back. The underframes were lined in vermilion and the upper edge of the footplate edging had an additional white line.

All axle ends were black, and spokes and crank bosses had a black lining. Bogie splashers were green, edged with black and lined white. The buffer beams and the insides of the frames were vermilion and the outside ends of the beams chocolate-maroon.

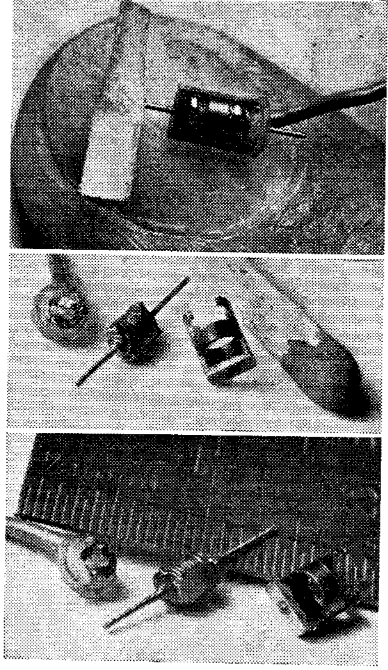
Polished brass-work included the safety-valve covers, whistles, injectors and pipework, the beading around driving wheel splashers, and the works plates.

Lettering was in gold shaded crimson to the right and black on lower edges. It was about 7½ in. high in Sans Serif. (Eric Gill, whose Sans Serif is widely used, lived from 1882 to 1940.) The numbering was carried out in a similar manner on the cab side; where the number consisted of a single digit, the letters *No* appeared before the number. On the front buffer beam, the letters *No* were painted on the left of the coupling, while the numerals appeared on the right. Buffer stocks were chocolate-maroon with a single vermilion line around the beading. Altogether it was a highly elaborate livery!

Under the Ivatt and Gresley regimes, the colour scheme remained much the same, though most observers seem to agree that the green used as the main colour became a little darker than in Stirling days and that the polished brass beading and safety-valve covers soon disappeared.

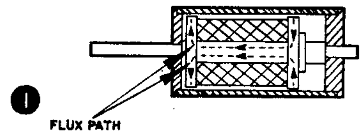
Main-line coaching stock was in natural teak, lined in gold on the raised beadings and varnished. Coach lettering was gold, shaded black. Carriage trucks, horse-boxes and similar stock, were painted a light yellowish brown. Coach roofs were white, as were the wheel rims. The centres were brown.

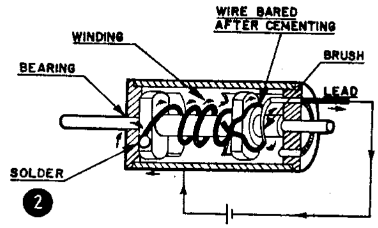
Goods stock was generally maroon-chocolate with black ironwork and *GN* in very large white letters. *Load 10 tons* appeared in small letters on the extreme bottom left, and the number of the vehicles on the right. There was also an oblong plate on the solebar, generally near the middle. ▣

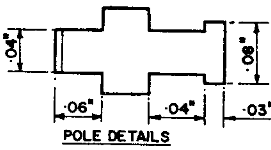


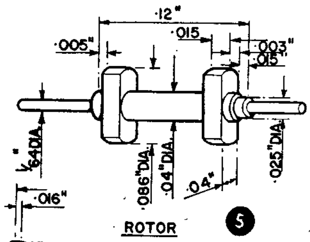
Tiny electric motor

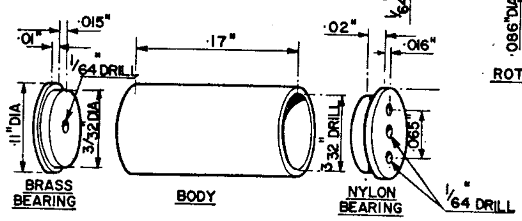
J. E. Mack has enjoyed making this unit from unlikely odds-and-ends











MY small electric motor, though it has so far not been used in a model, has given me great fun and satisfaction. It is minute, but it is simple, robust and economical, and is made from an old nail, a brass screw, an odd bit of nylon and about a foot of wire.

Through the impulse principle the motor receives a short pull every half revolution. Fig. 1 shows the magnetic circuit, and Fig. 2 illustrates the brush and the commutator—which is simply the bared end of the coil. The motor is energised automatically whenever this bared end makes contact with the brush. The single coil (which is wound directly on the shaft) and the simple magnetic circuit and the commutator are the features which have enabled the motor to be reduced to such a small size.

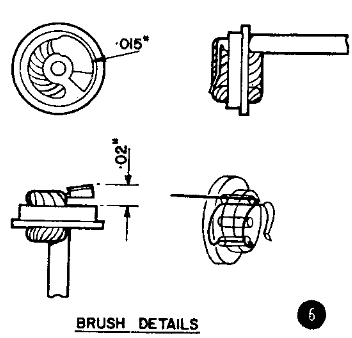
Parts are produced in such a sequence that one part may be made to fit the previous one and so be the correct relative size, which is the important feature. By using this amateur technique of manufacture, no precision measuring instruments or gauges of any sort were needed.

Making the body

First, the body was drilled 3/32 in. dia. After turning the o.d. to leave a conveniently thin wall, and facing and parting off, I removed the internal burrs by spinning it on the drill with the fingers. The brass bearing was next faced and drilled 1/64 in. dia.

To provide concentricity on such a small diameter, the tip of the drill was supported as close to the work-face as possible by the back of a lathe tool held in the toolpost. At first the drill was slightly deflected. As it was advanced, the tool was gradually withdrawn so that the drill cut a concentric dimple. This is the only way in which I can prevent small drills from running off.

The spigot was turned a snug fit in one end of the body (which was marked). After parting off, the burr was removed by running the bearing up and down the drill. The bearing was then soldered into the body: solder paint provided a simple and clean job.



The bearing

I made the nylon bearing similarly, but this time the spigot was rather a tight fit in the body. In addition two 1/64 in. dial holes were drilled for the brush wire, by holding the drill in a pin chuck and the bearing under the thumb-nail. The radial spacing of these holes is much more critical than the angular spacing, as the bare brush wire must not make contact with either the body or the rotor spigot. While I used nylon, almost any reasonably rigid and tough plastic would do.

The poles were filed on the body with a fine Swiss tool. I removed the burrs by spinning the work again on the 3/32 in. drill. The proportions of the poles are not important, but the motor looks better and is easier to time if they are symmetrical.

While I turned the original rotor in the lathe, there is no reason why the bobbin cheeks should not be made separately and soldered on to 1/64 in. shafting. The o.d. was turned to between 0.005 in. and 0.010 in. smaller than the bore of the body. This controls the magnetic gap, which is one of the few critical features. Theoretically, the wider the gap the faster the motor, but in practice the motor runs at about the same speed, taking more current and so tending

● *Continued on page* 348

READERS' QUERIES

DO NOT FORGET THE QUERY COUPON ON THE LAST PAGE OF THIS ISSUE

- **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 envelope "Query," Model Engineer, 19-20 Noel Street, London W1.**

Seal pistons

On assembling the Seal engine, I noticed that the pistons came above the liners by 1/32 in., and according to the drawing measurement this is apparently correct. Is the 1/32 in. recess in the combustion head to take the piston ? If it is, what top clearance is required ?

MODEL ENGINEER of 17 August 1947 mentioned a built-in flywheel magneto. Could you refer me to any article which deals with this, and any suppliers of the parts ?—J.W.A., Rotherham, Yorkshire.

▲ *The projection of the pistons in this engine, 1/32 in. above the level of the cylinder block face at t.d.c. is quite correct. The clearance in the combustion head when the engine is assembled should be only just sufficient to avoid any possibility of fouling the pistons when the engine is running. This is a necessary feature for a reasonably high compression, but the engine will run satisfactorily if greater clearance is allowed.*

A description of a magneto which can be applied to the Seal engine in place of the standard flywheel was described in ME of 20 *July* 1961.

Portable gramophone

I have a good portable gramophone and a 14-32 v. lighting set, and I want to convert the gramophone into a radiogram or electrical reproducer for LP records.

What parts will I need, and what alteration must I make on the gramophone ?—M.M.C., Poyntzpass, Co. Down.

▲ *You do not state what type of portable gramophone you wish to convert. If it is driven by a clockwork motor and has a contemporary reproducer, it would be very difficult to convert to play modern records.*

All modern record-players have electric drive with provision for changing the speed of the turntable to suit different types of record, and also for special electrical pick-ups and amplifiers for reproducing the sound. Some of these parts might be obtainable separately from dealers in electronic supplies, but their adaptation to an existing gramophone would probably be more expensive than buying a complete modern instrument.

Most gramophone motors are designed to operate on alternating current of 50 *cycles frequency, and would not work on direct current supply.*

Power generator

I have a small Service generator which is marked −LT+ and −HT+ at either end. The commutator at the LT end is of large segments with fairly large brushes to the commutator at the HT end of very fine segments with brushes only 1/16 in. gauge.

I would like to know if I could use it as a generator to make light. If so, what would be the approximate voltage ? I have been a reader of ME since it was fourpence a copy, and, I still enjoy it.—R.W.S., Liversedge, Yorkshire.

▲ *Many types of motor generators were used in the Services. Most of them were equipped with a nameplate giving the input and output volts and amps, and in the absence of this information the only way to find the output would be by a test. With a standard test instrument, such as an Avometer, the characteristics of each of the windings can be found.*

Maid of Kent

I am building *Maid of Kent* with outside cylinders and Stephenson link motion. This is my first attempt at locomotive modelling, and up to now everything has gone well.

I have now come to the valve gear and this rather puzzles me, as according to my drawings the eccentric sheaves have 7/16 in. throw, while there is only about 3/8 in. space for movement of the valve in the steam chest. Could you explain this ? Is there some lost movement in the motion ?—E.L.F., East Huntspill, Somerset.

▲ *As your engine has locomotive expansion links, it is quite correct that the total travel of the eccentrics is more than the full gear valve travel. It is only with launch-type links that twice the eccentric throw is equal to the full gear valve travel.*

South Bend

I have bought a second-hand South Bend lathe and the change wheel chart is missing. I have the following change wheels (each has a key way in which fits the leadscrew and the shaft under the tumbler reverse which rotates at headstock speed): 16, 24, 32 two off, 36, 40, 44, 46, 48, 52, 54, 56, 60, 80 two off, and also a 72 coupled to 18 and a 54 coupled to an 18 which do not have a key way and fit on two bushes on the gear quadrant. I require to cut some metric threads and cannot calculate which wheels to use.

I think I need some bushes to fit on the gear quadrant with a key on them to couple the other change wheels together.

Years ago I had a Drummond lathe with a leadscrew of 8 t.p.i., the same as this South Bend. All the wheels fitted anywhere, but I had a 63-tooth wheel for metric threads.

What is the pin for on the front of the tailstock ?—W.S., West Hallam, Derbyshire.

▲ MODEL ENGINEER *has no exact particulars of the set of change wheels required for the South Bend lathe. Although the leadscrew has the same pitch as most English lathes in a similar class, and the gear ratios would, therefore, be the same for the various thread pitches, English lathes usually have change wheels beginning from* 20 *and going up in increments of* 5, *and so the charts for these lathes would not be appropriate.*

To cut metric threads accurately, you would need a wheel having 127 *teeth, to enable you to obtain a ratio of* 2.54, *necessary for conversion from inches to centimetres. The 63-tooth wheel used on the Drummond lathe gave an approximately accurate metric thread which was generally satisfactory for practical purposes.*

The pin on the front of the tailstock of this lathe is presumably intended to be used for lubricating purposes, a small quantity of oil being kept for this, in a hole where the pin is fitted, and can be picked up on the pin, and applied to the back centre.

Showman's engine

I have bought a drawing of a 2 in. showman's road locomotive. I have a piece of copper plate of 12 gauge and on the drawing all the copper work of boiler, firebox and so forth is $\frac{1}{8}$ in. thick sheet copper. I intend to make only the boiler barrel out of the 12 gauge. Will it be thick enough ?

The test pressure of the finished boiler is 200 p.s.i. and the working pressure is 150 p.s.i.—M.H., Elsecar, Yorkshire.

▲ *It is difficult to say definitely whether the copper plate of 12 gauge would be suitable for the construction of the boiler barrel, and the question could only be settled properly by subjecting the boiler to a hydraulic test.*

The working pressure of 150 p.s.i. is rather high for a traction engine boiler, and satisfactory results would probably be obtainable with considerably lower pressure.

Nearly all model boilers are designed with a very high margin of safety, and some reduction of the thickness of the boiler is usually practicable. If no sign of collapse or distortion is shown on the hydraulic test, it can generally be taken for granted that it is safe to steam the boiler at about 60 per cent of the test pressure.

Can You Help ?

Readers who can offer information to those whose queries appear below are invited to write c/o Model Engineer. Letters will be forwarded.

Drawings for Belle steamer

I have been trying to get drawings of the hull, superstructure, engines, and boiler for one of the Belle Steamers and the *Crested Eagle* which used to ply the English south-east coastal resorts before the war. Could you recommend any drawings of a similar boat, three or four feet in length with a good draught and beam, and suitable for steam propulsion and radio control ?

I must congratulate ME on its very interesting articles in its pages. I enjoy reading every page and am surprised at the number of different types of steam engine and so forth.—R.S.H., Sudbury, Suffolk.

▲ MODEL ENGINEER *secured a limited number of drawings from the General Steam Navigation Company but they were not sufficient to provide hull lines. It is proving very difficult to get information on these craft.*

Model in Maroon

As I have not seen any detailed specifications for painting the Martin Evans *Jubilee*, I wonder if you can help ? Has this locomotive ever been painted in LMS maroon ? If it has, what are the details ?—P.S., Huddersfield, Yorkshire.

TINY ELECTRIC MOTOR

Continued from page 346

to overheat. The gap should be as small as is reasonably practical and consistent with the total eccentricities and bearing clearances.

The integral shafts were turned in short stages of about 0.05 in. long, with the output shaft furthest from the chuck; I used the brass bearings as a ring-gauge. In guessing the size of the brush-end shaft, I erred on the plus side, so that the nylon bearing, afterwards needed opening up to fit. This was done by turning a separate tapered shaft and running the bearing up as it spun in an electric drill.

Rotor end-float should be reduced below the 0.0015 in. or so of the original, as this will help the ultimate setting-up of the brush. The technique is simply to press in the nylon bearing, measure the inside length, and make the rotor a bit shorter.

Flats were made on the bobbin cheeks with a smooth Swiss file moved axially along the rotor and pressed into the fleshy part of one finger. This method is simpler than it sounds and there is no other way. The whole bobbin was deburred with a penknife, to ensure that the winding insulation was not pierced. For further protection I gave the bobbin two coats of shellac varnish.

Winding the coil was greatly simplified by holding the rotor to a shaft (by Sellotape), which could be bent into a handle and turned evenly. The end of the 0.005 in. dia. enamelled wire was bored and tinned and the tinned length cut back to about 1/32 in. long. One flattened cheek at the output shaft end of the bobbin was also carefully cleaned with a razor blade and tinned, with care not to tin the blade, or overheat the whole rotor and so melt the shellac. The tinned end of the wire was then soldered to the rotor and the winding was begun.

When the bobbin was almost full (with enough room for at least two or three more turns) the wire was taken outside the cheek at the brush end and wound round the collar and back into the coil again. After one more turn, it was taken outside the other pole and back again for one further turn. Several more turns were then made haphazardly. I finished up round the shaft to maintain the tension.

Applying varnish

The coil was then cemented. I applied shellac varnish with a small paintbrush and allowed it to dry for a day. A further application was made to make sure that the loose end would be retained at high speeds. When the varnish had set, the haphazard turns were removed, leaving at least one full turn for mechanical strength after the wire returned from outside the cheek.

I then adjusted the commutator wire to follow closely the cheeks and the collar, by manipulating with a pin. The insulation was scraped off the commutator with a razor blade.

I made the brush by flattening one strand of 7/.0048 in. plastic-covered wire. A few experiments were required to find how many strands, twisted and tinned to form a stiff wire, would follow the looped path and hold firmly in the nylon bearing. All but one were cut short and all were twisted and tinned.

After inserting the wire in a large loop and carefully pulling the single strand until the ends of the others were flush with the inside face of the bearing, I tightened the brush end towards the free. The free end was finally secured by the plastic covering, which was worked up to press on the bearing. Thus the single strand was firmly held. It was folded and bent into an arc of rather smaller radius than was needed, and was unfolded to stick out of the bearing as a hook. This was flattened by squeezing it between two flat pieces of steel.

After having been trimmed with scissors, the brush was folded back against the face of the bearing. The tinning was removed to reveal bare copper and the tip was bent a bit.

The motor was assembled with the timing adjusted so that the rotor poles were pulled to the stator poles, until the circuit was interrupted just before they were coincident. To provide a load and to start the motor a crude $\frac{1}{2}$ in. dia. propeller was carved out of a match and pressed on to the output shaft. The bearings were lubricated with thin oil.

To prevent the burning out of the brush or the coil, the battery was not connected until the motor was spinning. One-and-a-half volts turned the propeller with a firm buzz, at which speed the slipstream could be easily felt. Three volts made the motor howl, but arcing soon sooted up the brush and commutator and caused the unit to overheat. The consumption at $1\frac{1}{2}$ v. is 0.3 amp. ▣

POSTBAG

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

BLUNT TRUTH

SIR,—We were recently warned in your columns not to go on wasting time with the file Grandad found in the hen-house (though it could make an excellent scraper?), and the last thing that I would do is to question such unimpeachably sound advice.

But, loath as I am to say it, several British files purchased over the last few years have gone blunt inordinately soon, whereas some foreign ones bought many years before the war at prices which today would seem ridiculous, are still cutting well. In my experience, files of about 1930 were more variable, but the good ones were magnificent; those of 30 years later are more consistent, but tend to be second-class. Is my experience typical? If so, what is the explanation?

Little Melton, Norwich. J. R. C. MOORE.

MURIEL

SIR,—Thank you for the excellent article entitled "Heywood's Little Engines" on February 8. It included much which was new to me, and was most interesting.

All that was lacking was photographs of Heywood's engines; you may care to use the seasonable picture of *Muriel* on the January cover of the Journal of the Ravenglass and Eskdale RPS.

DOUGLAS FERREIRA.
General Manager,
Ravenglass and Eskdale RPS.

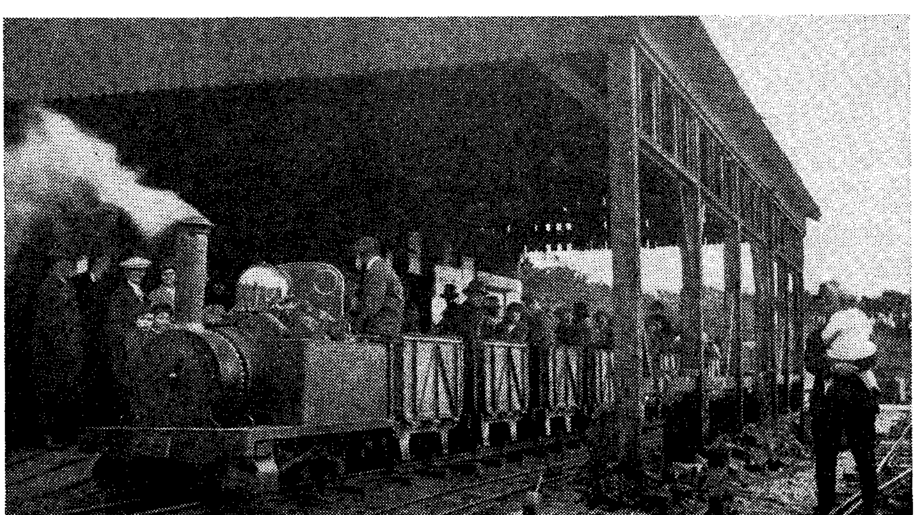
COVENTRY LINE

SIR,—As a Coventrian I was greatly interested to see a photograph of the gun for the battleship *Queen Elizabeth*.

The place shown is where the line crosses the Stoney Stanton Road, well within the boundary of the city of Coventry. In days gone by the road presumably led directly to the village of Stoney Stanton which is in Leicestershire. The road immediately beyond the bridge assumes the name of Bell Green Road and leads to the suburb of that name a mile or so onwards.

The railway is known as the Coventry avoiding line and runs from Humber Road Junction (on the Coventry-Rugby section) to Three Spires Junction (on the Coventry-Nuneaton section). It was constructed in the 1914-18 war principally to serve factories on the northern perimeter of the city. A branch to the Ordnance Works where the gun was built joins the line at Ordnance Sidings about a mile from the bridge. The line is still in use fairly regularly for freight traffic and is, in fact, scheduled for electrification under the modernisation programme.

Cash's Lane is named for J. and J. Cash Limited, a noted local ribbon weaving company which had a factory there.



MURIEL *in the snow; from the Journal of the Ravenglass and Eskdale Railway PS. Left: Bank Holiday in the 1920s, and a special leaves Old Ravenglass station hauled by Heywood's* ELLA. *This 0-6-0 of 1881 was broken up after about another three years, in 1926*

A tramway route to Bell Green ran along the Stoney Stanton Road and passed under the bridge in the photograph. It was opened at a later date than the Bedworth route.

The Coventry tramway system suffered heavy damage from enemy action in the autumn of 1940 and had to be abandoned in favour of motor bus transport.

May I say how much I enjoy reading your magazine and in particular the articles on railway subjects?

Coventry. ALAN T. REID.

STEAM PLOUGHING

SIR,—I have just finished building a 1½ in. scale ploughing engine.

It was made from drawings for a 2 in. scale model. I scaled them down to 1½ in. to make the construction easier.

The engine is 33 in. long, 18 in. to the top of the chimney, and 12 in. wide. Its front wheels are 6¾ in. and its rear wheels 9 in. The cylinder bore is 1⅛ in. and the working pressure 60 p.s.i.

I find anthracite the best fuel. The engine will maintain pressure comfortably while she is towing a truck with my wife and son aboard as well as myself.

The colour is all black, with the crankshaft, the second and third shafts and the inside of tender and hub caps in red. The lining is yellow.

I would like to state how very helpful MODEL ENGINEER was during the building when I had any queries, etc.

Ongar, Essex. N. T. ELLIS.

PIONEER

SIR,—I was interested in Vulcan's comments on radio pioneers. While I was at Hackney Technical Institute, London, in the years from 1927 to 1934, I assisted a fellow student, A. E. Boardman, in the construction of parts for his scanning disc television receiver, which ultimately produced a picture about the size of a postage stamp.

I also recollect going with fellow members of the SMEE somewhere about 1932, to what is now the Brimsdown works of the AEI Limited, to see a demonstration of a CR tube television set receiving the BBC experimental transmissions made after the close of normal sound broadcasting.

An early scanning disc receiver made commercially was shown in a Bristol shop window during the 25th anniversary of BBC television last year.

It was at Hackney Technical School that I was first introduced to ME.

Bath, Somerset. J. E. MORRIS.

FIREMAN'S SIDE

SIR,—Many thanks for your articles by Martin Evans; his drawings and text are excellent.

I believe, however, that he has the reverse lever on the fireman's side of *Firefly*.

Brazotectic, mentioned in a query, is a product of British Oxygen Gases Limited.

Best wishes to the continued success of ME.

Redruth, Cornwall. AUSTIN HEYDEN.

[*Martin Evans writes: The reverse lever of* FIREFLY *was put on the left-hand side as it is easier to operate there in a model of ¾ in. scale. If it is put in its "correct" position, the driver's fingers will tend to foul the cab side.*—EDITOR.]

VACUUM

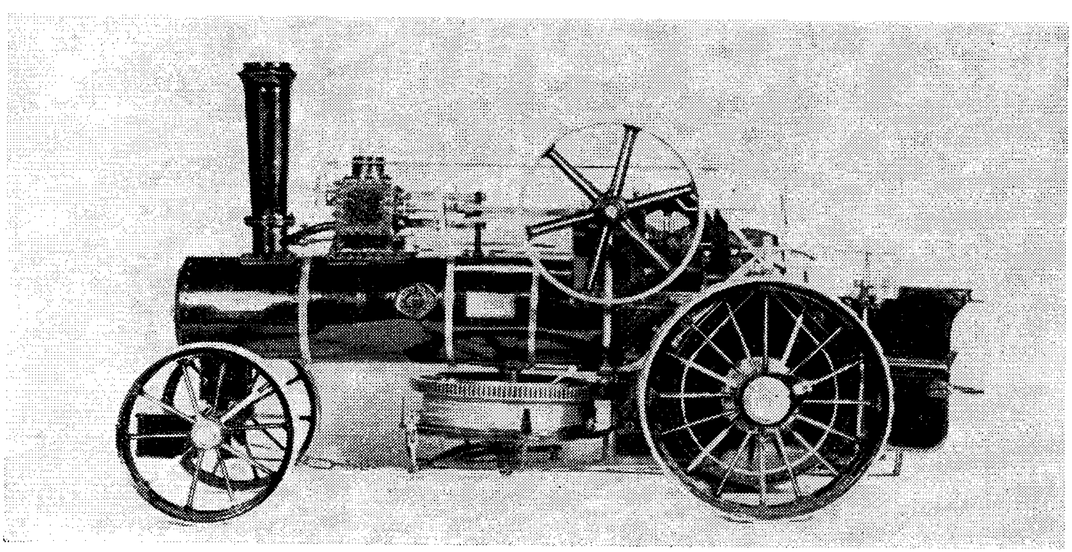
SIR,—I cannot allow Mr D. Proudlock's statement [Postbag, February 8] to pass unchallenged. Mr Proudlock says: "The air pump merely removes the small amount of air present in all systems, and, of course, the condensate."

The vacuum will neither be created nor maintained if an air pump is not running or started with the engine. For theoretical and practical proof I would refer him to Dalton's Law of partial pressures: "Each constituent of a gas mixture exerts that pressure which it would exert if it alone occupied the containing vessel at the same temperature."

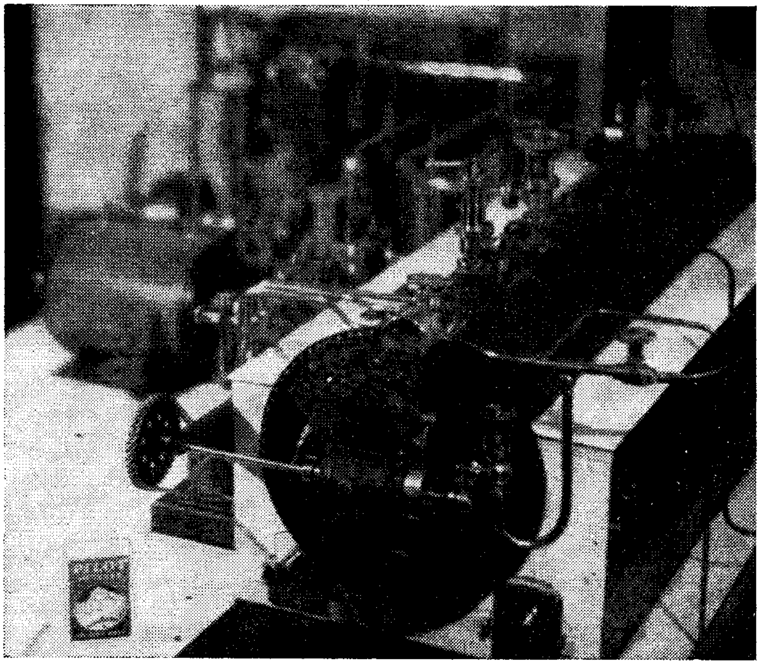
Total condenser pressure equals the sum of partial air pressure and partial steam pressure.

Thus, we have a condenser containing air at atmospheric pressure and when steam passes in and condenses, we do not have a vacuum, but a pressure slightly above atmospheric—atmospheric plus partial air pressure. This assumes that there is no increase in atmospheric pressure through the heating effect of the steam on the air.

Unless the air pump or ejector is used, the condenser pressure will rise as there is no other means of escape. In other words, the air pump or ejector is as necessary to a vacuum



Ploughing engine model by a reader in Essex



This coal-fired Cornish boiler was made at 1 in. scale by a reader in Yorkshire

as the condenser is, because steam can create a vacuum only by itself condensing in the complete absence of air.

Shirley, Southampton. M. Ross.

STRESS FORMULA

Sir,—The formula for the circumferential stress, given by Mr Proudlock, is incorrect. For *4* read *2* in the denominator.

This would make the test stress 3,550 and not 1,775 p.s.i., and would give a safety factor of only 1.21 on the figure of 4,300 for the ultimate stress at 400 deg. F.

Considering that a safety factor of 2 is taken as a minimum in the aircraft industry, and that this is based on first-class workmanship done to rigid specification and control, I think that Mr Innes would be well advised to stand clear of his boiler, particularly as the joints will probably be weaker than the parent plate.

J. Hansbury.
Lecturer-in-Charge,
Day Release Classes.
Technical Institute,
Wallsend-on-Tyne.

Martin Evans writes:

In the first place, the tensile strength of copper is generally taken as 25,000 lb. In the second place, the ROB ROY *boiler could not possibly reach such a high temperature as 400 deg. F. A more likely figure is about 300 deg. F.*

The accepted formula is as follows:

Factor of safety

$$= \frac{S \times P \times R \times C \times T \times 2}{D \times WP}$$

where

S = 25,000 *for copper.*
P = *plate thickness in inches.*
R = *riveting allowance—*
$\frac{1}{2}$ *for single riveting.*
$\frac{3}{4}$ *for double riveting.*
$\frac{7}{8}$ *for silvered joints.*
C = *corrosion allowance:*
Steel—$\frac{3}{4}$.
Copper—9/10.
T = *temperature allowance, say,* 8/10.
D = *diameter of band in inches.*
WP = *working pressure in p.s.i.*

For ROB ROY:

$$F\ of\ S = \frac{25{,}000 \times \frac{1}{16} \times \frac{7}{8} \times 9/10 \times 8/10 \times 2}{3\frac{1}{4} \times 80}$$

$$= 7 \text{ approx.}$$

CHANGE WHEELS

Sir,—A friend of mine who had a Drummond 4 in. roundbed wanted to cut a certain pitch, but could not do it with his wheels. He borrowed the second half of my train. All he had to do was drill the wheels I lent him.

I should strongly advise W.T. to get a set of wheels running up in fives.

Wilmington, Kent. H. B. Packman.

[*Mr Packman kindly encloses, for W.T., a change wheel table from* Practical Lessons in Metal Turning and Screw Cutting (*Percival Marshall; eighth edition*). *Another table has been sent by F. Featherstone of Rochester, Kent.*—Editor.]

CORNISH BOILER

Sir,—A.M. of Swinton, Yorkshire, seeks advice on a suitable boiler to steam his 1 in. scale beam engine.

The difficulty of obtaining adequate natural draught in a small boiler applies no more to a model Cornish boiler than to any other. Usually some kind of artificial draught is required. Why then must A.M. use a centre-flue boiler which bears little likeness to the real thing? If a decent draught can be induced through the tubes of a Scotch boiler, then why cannot it be induced through the spacious flues of a Cornish one? I have noticed at exhibitions, and in the pages of your excellent magazine, many good model engines spoilt by unsuitable boilers.

I have recently completed a coal-fired model Cornish boiler to 1 in. scale. It is made of 5 in. inside diameter copper tube $\frac{1}{8}$ in. thick, with the end plates of slightly thicker material. The shell is 5 in. × 20 in. and is properly set in asbestos-lined steel flues, giving three pass gas travel. An induced draught fan, electrically driven, supplies the draught for starting. A 2 in. i.d. copper chimney takes the engine exhaust and the auxiliary blower. The boiler holds about a gallon of water. Steam is raised in ten minutes to 60 p.s.i.

The boiler will evaporate $7\frac{1}{2}$ lb. of water to a pound of coal from and at 212 deg. F. It steams a vertical high-speed engine of $1\frac{3}{8}$ in. bore × $1\frac{3}{8}$ in. stroke at 400 r.p.m. driving a 6 v. motorcycle dynamo enclosed in a dummy case. In addition, it supplies steam to a Weir feed pump, $\frac{5}{8}$ in. bore × $1\frac{3}{8}$ in. stroke, and to a $\frac{1}{2}$ in. bore × $\frac{1}{2}$ in. stroke engine driving an automatic stoker (Whiteheads'). It steams all this plant and will still blow off. The grate is $2\frac{1}{2}$ in. wide × 5 in. long, and with hand firing will burn anything from anthracite to nutty slack. Stoker coal is sieved to $\frac{1}{4}$ in.

I hope that this information will assist A.M. I strongly recommend him to make the real thing. If he gets in touch with me, I will arrange for him to see my plant or will give him more details.

Halifax, Yorkshire. L. Q. Mitchell.