THE MODEL ENGINEER

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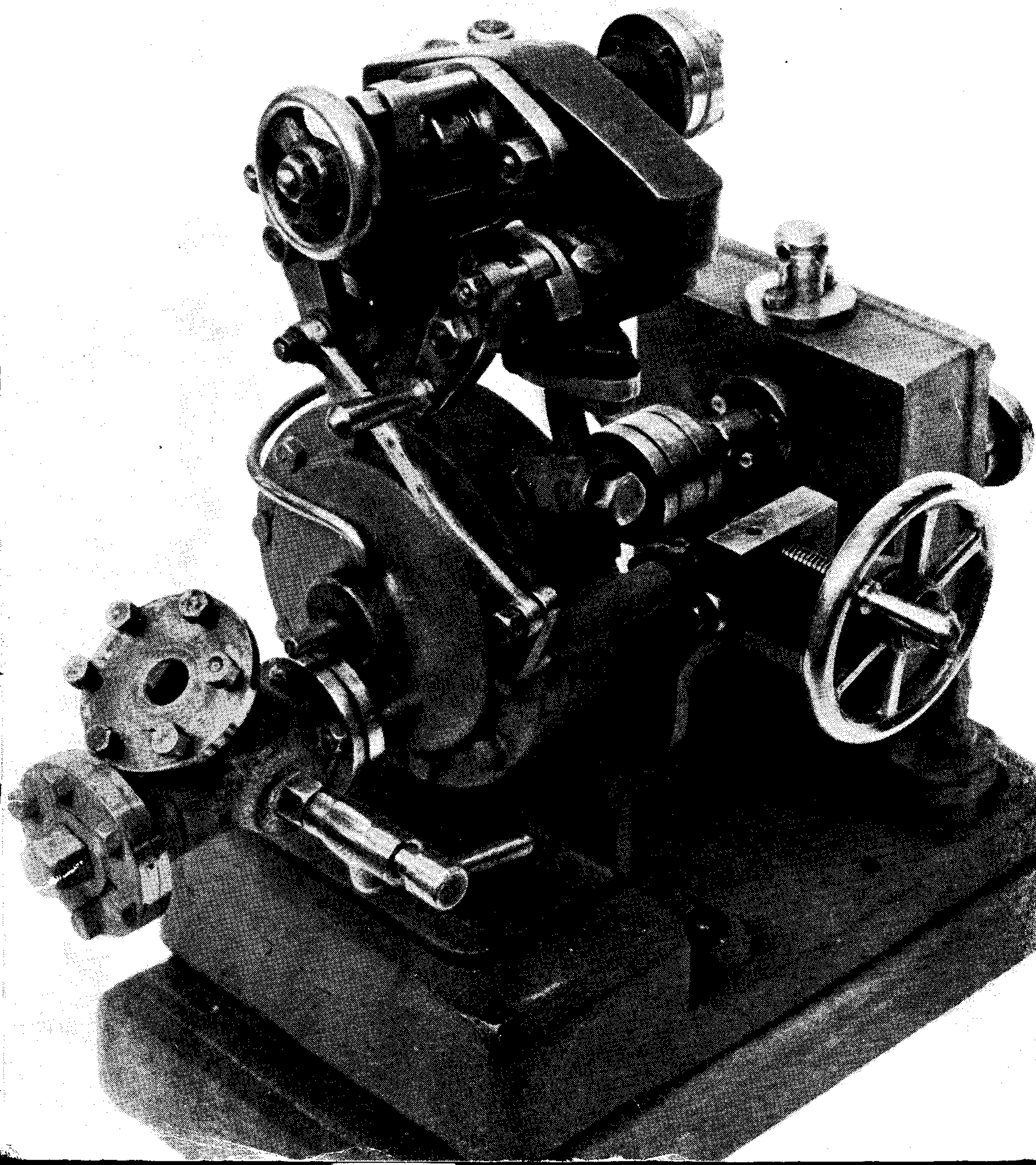


The MODEL ENGINEER

PERCIVAL MARSHALL & CO. LTD. 23, GREAT QUEEN ST., LONDON, W.C.2

28TH DECEMBER 1950 VOL. 103 NO. 2588

SMOKE RINGS

An "M.E." Record

● WITH THE publication of the current issue of THE MODEL ENGINEER, we have created a record!

Before reading further, just see if you can spot it.

For the first time in the history of our 103 volumes, we have exceeded 1,000 editorial pages in a single half-yearly volume of 26 issues! Added to this figure, we published extra pages in one of our Exhibition numbers and a 4-page art supplement; also, with this issue, there is an 8-page index to the present volume, making the grand total of well over the thousand pages.

At present-day prices of technical literature, we feel justified in claiming that the 26 copies, costing 19s. 6d., represent real value for money.

To those readers who find some difficulty in securing a copy of THE MODEL ENGINEER regularly every week, we would suggest they send £2 2s. to our publishing department, to be sure of their copy being posted to them every week for a whole year.

Start the New Year well, by being an "M.E." subscriber.

The December 7th Cover

● THE COLOURED cover on our issue for December 7th found much favour with our readers, as we knew it would. We have some copies of the cover alone, and would be pleased to send one to anyone writing in for it; but the supply is extremely limited, so early application to the Editor of THE MODEL ENGINEER, 23, Great Queen Street, London, W.C.2. is desirable.

The picture can easily be trimmed for framing and hanging up in the workshop, den or living-room, as a pleasing little memento of an era that is rapidly passing into history. And if, by chance, a question is raised as to the suitability of such a picture for the living-room, we would remark that we have found many less attractive subjects decorating the walls of living-rooms!

A Society at Long Eaton

● WE LEARN from Mr. Allan E. Leeson that a society has been founded at Long Eaton, Notts. A number of enthusiasts recently met together at The Youth House, Long Eaton, and decided to go ahead with the scheme; a Chairman, Secretary and Treasurer were elected, and the intention is to cater for all the various branches of model engineering. An endeavour is being made to find suitable workshop accommodation. In the meantime, anyone in the district who would be interested in joining this new society is invited to get into touch with Mr. Leeson, who is the hon. secretary; his address is 23, Netherfield Road, Long Eaton, Notts.

We wish every success to the venture and we hope to hear news of it, from time to time, in the future.

Unsubstantiated Criticisms

● WE SOMETIMES receive letters from readers who deplore the lack of originality displayed in the vast majority of models that are built; the writers seem to think that a modeller who is content merely to copy full-size practice, rather than to seek and apply new ideas of his own, is a stick-in-the-mud who, by his own showing, does nothing to ensure that our great hobby progresses, literally. The inference is that this stick-in-the mud attitude is something to be regarded with dissatisfaction, if not with contempt.

This idea has been more or less prevalent since the early days of our hobby, and we feel that it indicates a lack of understanding of the aims and objects of the very large majority of model engineers. We are not all inventors, and do not pretend to be; we are quite content to follow full-size practice, as a general rule, and apply our *creative* instincts to the pleasurable purpose of reproducing full-size objects as we see them, and to leave the question of technical improvements to the fully-trained technical professional.

It is strange, too, that when one of our fraternity does venture to apply his own ideas to modifying some detail with the object of obtaining improvement in the functions of that detail—and there have been many ingenious cases of this kind of thing—the critics have usually sought to condemn him, on the grounds that he appears to fancy himself as being a cut above the professional engineer!

Model engineering is not an inventors' paradise, and we hope that it never will be. But we deny that model engineers, as a body, lack enterprise; witness the development of such things as miniature steam locomotives and petrol engines during the last thirty or forty years. These are but two of the major branches of our hobby, and nobody can deny the progress they can show; but in many less spectacular, though equally important matters, the model engineer has applied his inherent talent to introducing improved methods towards attaining his ideals, and he will continue to do so.

There is one more thing to add; we notice that very few, if any, of the critics can produce practical examples to justify their criticisms; full-size practice is born of experience and shows us what to do if we want the best results.

The S.R. Pacifics

● THE RECENT remarks by "L.B.S.C." concerning these much-debated locomotives have brought in several long letters, some of which add to "L.B.S.C.'s" catalogue of their shortcomings, while others disagree with all that has been said.

Our space is still severely limited, and we cannot spare any for what would merely become a ding-dong discussion that could not, in the end, have much point to it. We must say, however, that our own observation and experience with these engines in traffic justify all that "L.B.S.C." has written; on the other hand, we have plenty of irrefutable evidence which belies the condemnations. There can be no doubt whatever that with a good crew, a Bulleid Pacific in *good* condition is capable of absolutely first-class work. The real point, however, is: What is the official assessment of the quality of performance given by the two classes of these engines? We do not know, and we are not likely to; but that there is some cause for dissatisfaction seems clear from the fact that the last engine of the final batch has not yet been completed, and is reported to be undergoing considerable alterations. The modifications being made have not yet been officially announced, and until they are, we refrain from making any comment on them. But there must be something about these engines, that is not all that it ought to be, because we cannot believe that the alterations would have been deemed desirable if the engines were giving absolute satisfaction to all concerned with their operation.

Any type of steam locomotive can, on occasions, perform truly prodigious feats of haulage or unaccustomed speed, and the Bulleid Pacifics are no exception in this respect; but there is little doubt that the average quality of the performance of the Bulleid Pacifics, reckoned over a normal period of time, falls short of reasonable requirements. That the modifications being made in No. 34110 have been suggested with a view to improving the general performance seems to be a justifiable assumption.

Bad Business

● AN OVERSEAS reader who is in business as a manufacturer and supplier of castings and materials for model engineers, and does a considerable trade, has drawn our attention to a matter which we regard as being of some importance. He writes:—

"I receive a goodly number of letters pertaining to model engineering and model engine building. Invariably, the letters complain about the slowness of British firms in filling orders. Customers cite instances of waiting three, four and even five months for a simple set of castings; they complain about shortages and about inferior goods in some instances.

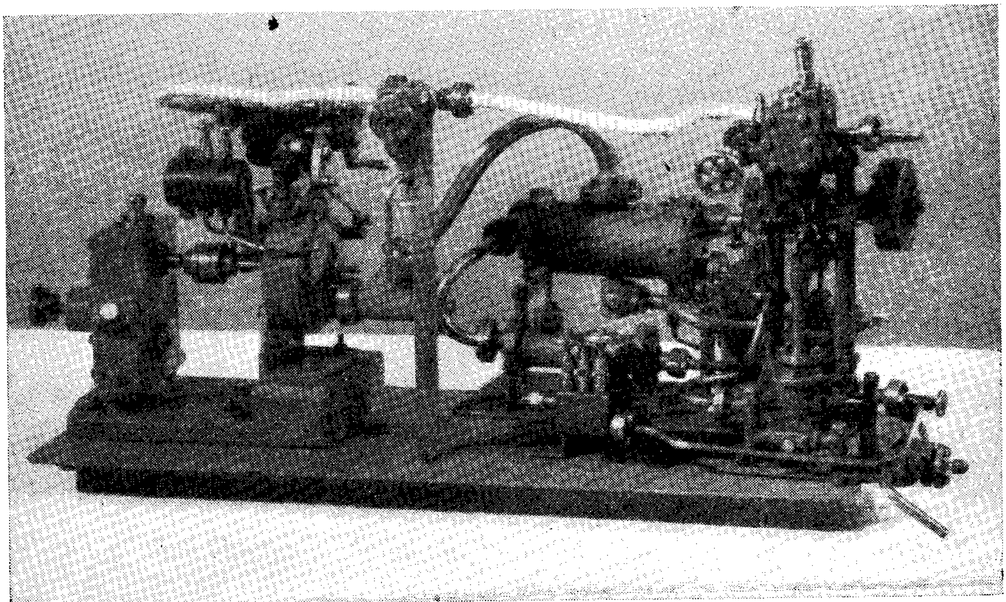
"As an example, I have a set of castings here before me that was ordered by a U.S. customer from a British source. The order required four months to fill, it is short one of the locomotive cylinders, very inferior castings in general and 'just plain poor merchandise from every standpoint'."

This is a heavy stricture, and one that we feel should never have had to be made. It is doing no good to our British reputation and can quite easily do irreparable damage to the British manufacturer's prestige abroad. We know that there are many difficulties to harass those who endeavour to cater for our hobby, and the various controls and official allocations of raw materials do nothing to mitigate the extenuating circumstances. On the other hand, we rather feel that there may be one or two suppliers in this country who succumb to the temptation to blame, entirely, the prevailing state of affairs for any shortcomings which may cause customers to complain. The overseas customer is not in a position to return faulty material or readily to take steps to secure satisfaction; therefore, all possible care should be taken to avoid causing him disappointment.

A Model Marine Steam Turbine and Condenser

by T. W. Geary

FOR many years I have experimented with model steam turbines of all types. I have found it very interesting work and often wondered that more readers have not taken up this branch of model engineering. To hear the humming of a model turbine under steam is sweet music to me. I have made them up in various sizes with rotors



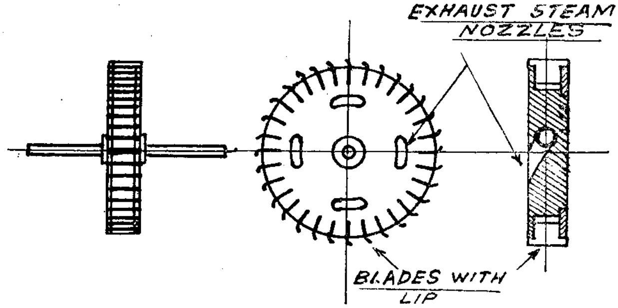
Back view of model marine turbine and condenser, showing feed-water heater, control valves and pump

from $\frac{5}{8}$ in. to 5 in. diameter and find the smaller ones give the best results. I have a small compound turbine with rotors $\frac{5}{8}$ in. and $\frac{3}{4}$ in. diameter running at 40 lb. sq. in. and about 25,000 r.p.m. I have put pressure with my finger on the spindle and it still kept revving at a good speed. I used to build my rotors up by turning a hub and then sweating blades in slots cut round the hub, but now I build them up from sheet brass, then turn up a hub with flange, and screw same to rotor. The blades are cut and bent to shape as shown in sketch and this type of rotor gives excellent results.

The turbine described herewith with sketches is a radial flow type, having two steam nozzles 1/32 in. bore at the throat, the rotor being $1\frac{3}{4}$ in. diameter with 30 blades. These blades are sweated in slots cut in two sides of rotor and the blades have a slight lip at the top. The exhaust steam passes down through the middle of rotor, and the outlet is on one side, on the Hero principle. The turbine casing and front cover was turned from solid brass. The main stop-valve is built into the header carrying the nozzle valves. These are of the plug cock type, being asbestos packed. There is a radial plate fixed above handles, with two stop pins. The handle is extended to work between these stops to on and off.

The main stop-valve has a bridge-piece screwed for valve spindle to work up and down in same. The hand wheel is made of steel, $\frac{3}{4}$ in. diameter. The header is machined from a casting from my own pattern. One of the nozzle valves is controlled from a hand wheel and lever attached to valve, the other one is operated by hand. A lubricator is fitted by gravity feed to main bearings of turbine, which are ball-races for $\frac{1}{8}$-in. spindle. The feed is controlled by two small screw-down valves. The gearbox and cover is a casting in aluminium ; the bedplate is also cast in the same metal, all from my own patterns. The gear wheels are of brass, four-to-one. The driving shaft is $\frac{3}{16}$ in. diameter and a flexible coupling is fitted between turbine and gearbox ; a drain cock is fitted on the exhaust outlet.

The turbine is now connected to a surface condenser as shown in the photographs, and the exhaust steam pipe is $\frac{3}{8}$ in. diameter. The condenser has about 15 brass tubes, 5/32 in. diameter, and fitted with an air extractor operated by the exhaust steam from the engine driving pumps, then the steam passes on to feedwater heater and finally to air pump. The auxiliary engine attached to pumps has a cylinder $\frac{7}{16}$ in. bore × $\frac{1}{2}$ in. stroke; the connecting-rod is fixed to end of arm carrying pump-rods. The eccentric is attached to rocker arm working the slide-valve, this also operates the lever attached to mechanical lubricator secured to side of supports. The three pumps are attached to an arm giving a direct drive with the piston-rod. The circulating pump is $\frac{1}{4}$ in. bore, the feedwater pump 5/32 in. bore and the air pump $\frac{3}{8}$ in. bore, all with a common stroke of $\frac{1}{2}$ in. Ball valves are fitted to both circulating and feedwater pumps; the air pump valves are of the flat disc type made in brass, and pumps to hotwell. The condensates from hotwell was returned to feed pump through a two-way cock.

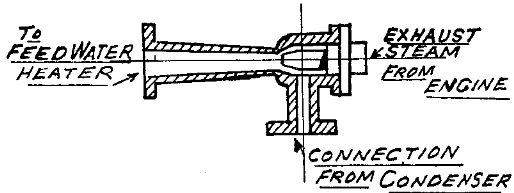


Rotor of radial flow turbine

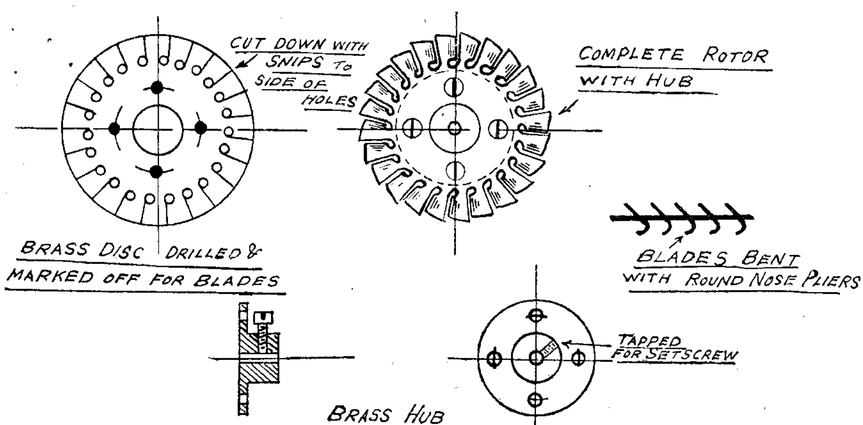
A sketch is shown herewith of the layout of engine. The feedwater is pumped to a header attached to the feedwater heater, and the header is fitted with a stop-valve, bypass valve and relief valve; there is also fitted between the exhaust pipe from the engine and the air extractor an oil separator. The steam pipes are lagged with asbestos and a steam separator is fitted between the steam pipes with a drain cock.

Now perhaps some readers might like to try their hand at building a model turbine after reading the above. A simple one can be made quite easily.

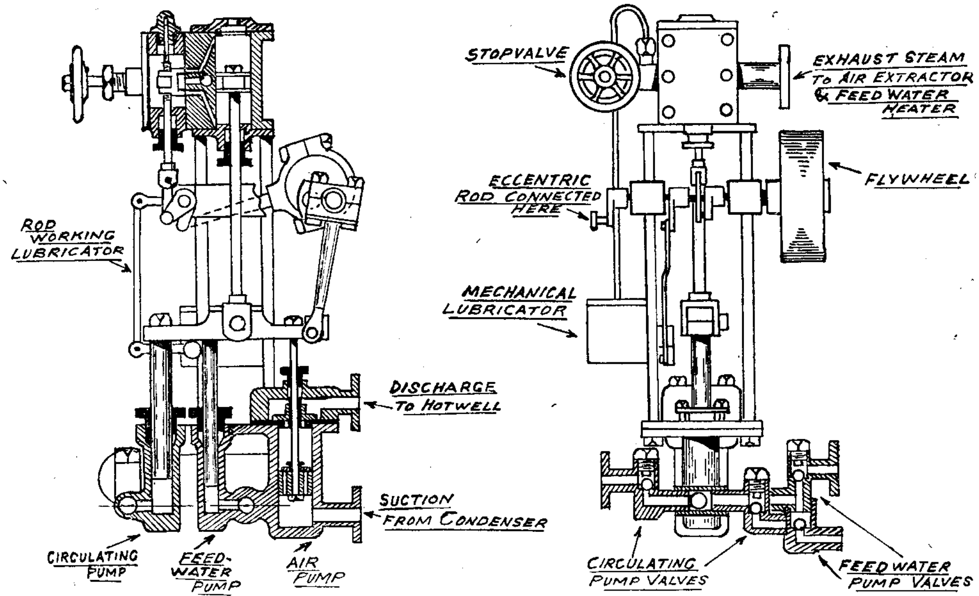
Make up a rotor about $1\frac{3}{4}$ in. diameter as I have described earlier in this article and use an empty Nugget blacking tin or any tin about the same size for the casing. Punch or drill two holes in the centre, one each side of the tin, then cut two short lengths of brass tube and solder them into the holes for the bearings. Place the rotor on a spindle, a piece of silver-steel about 3/32 in. diameter will do, and secure rotor to same by a set-screw; also, put two distance-pieces of brass tube each side of the rotor. This is to keep rotor in position in the casing, allowing a little play each end. Now make and fix steam nozzle to side of lid at an angle of about 30 deg.; the jet should be close up to the rotor, allowing about 1/32 in. clearance. Be careful that the jet does not foul the rotor. The jet can be made from a piece of small-bore tube, but the best results are obtained by drilling and expanding. The drill can be about 1/32 in. diameter and a slight taper with a suitable reamer should be made at the outlet end of jet. The exhaust can be a piece of $\frac{3}{16}$ in. diameter pipe soldered in the bottom of tin, the steam pipe can be $\frac{1}{8}$ in. diameter. A piece of angle-brass or sheet-brass bent to right-angle is soldered to side of tin for a bracket



Air extractor



Rotor for impulse turbines, made from sheet brass

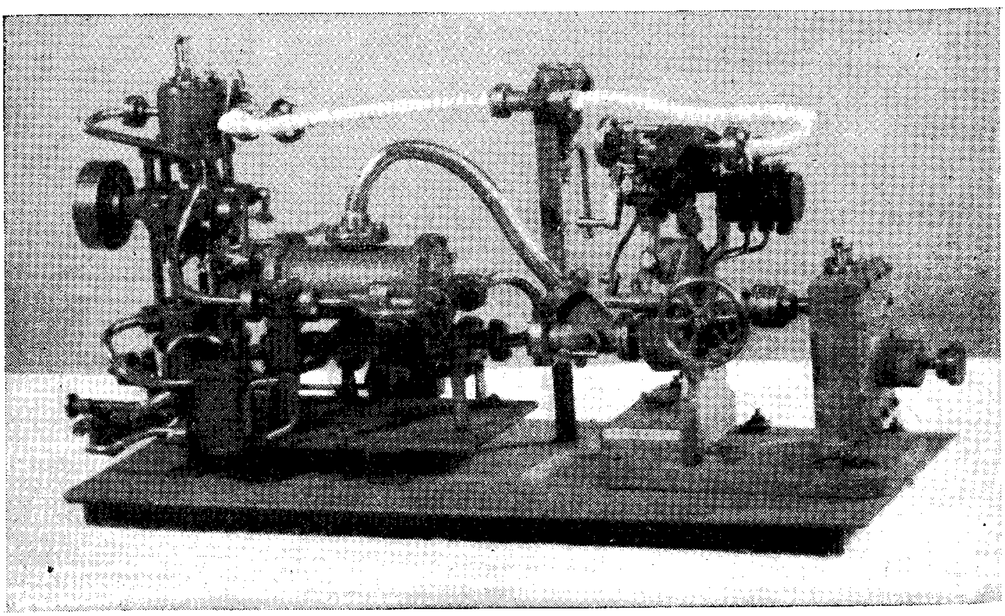


General layout of condenser steam-driven pumps

to screw down to a baseplate. A reduction gear should be fitted and this can be made up of two clock wheels giving a ratio of about 4 : 1. A small piece of stout sheet brass should be bent to form bracket to act as a bearing for gear wheels.

If any reader should think of making this simple type turbine, I feel sure he will not be disappointed with the results of his efforts.

I hope the photographs, including the one reproduced on the cover of this issue, and sketches of my turbine and condenser will give readers a good idea of the general arrangements of the set and encourage them to have a go at building a model turbine for a change from the piston engine.



Front view of model marine turbine and condenser, showing handwheel controlling nozzle, hotwell and air injector

Portable and Other Engines

by Andrew Todd

I WAS much interested in B.C.J.'s article on "The Passing of the Portable Engine." My employment takes me all over Wales and the English bordering counties and during my travels I come across lots of interesting engines. I don't get time to stop and examine them for long. The following information as to the location of a number of engines may interest some readers, and if anyone is able to visit them and give us some details about them, it would give much pleasure to many of us.

Monmouthshire

Ten miles from Monmouth at the village of Sling, near Coleford, are the engineering works of Fred Watkins. I have been to these works recently for material, and they contain some of the biggest portable and semi-portable engines, I have seen. A walk round this yard would be a most interesting and instructive event in the life of a model engineer interested in steam engines.

Herefordshire

About four miles from Bromyard on the left of the road to Stourport-on-Severn, near Saltmarsh Castle, is a small sawmill. There is a portable steam engine used for sawing wood; from the road the flywheel can be seen turning. It was working 18 months ago, and, as far as I can find out, is still working.

To the right of the road from Hay to Whitney on Wye (the Toll Road) about midway between the two villages, can be seen a pair of chimneys above the surrounding wall. Whether they belong to a pair of ploughing engines or to steam rollers I cannot say.

Breconshire

About 500 yd. from the policeman on point duty in Brecon on the right of the road to Abergavenny, is a pub called, I think, "The Blue Boar." Turn right for 100 yd. down the side of the pub, cross the bridge over the canal, turn right for 100 yd. past the gasworks, and across the canal is a contractor's yard with about a dozen steam traction engines and rollers.

Montgomeryshire. Route A492.

Llanidloes, from centre of town take the Newtown road to island. About 200 yd. beyond island on the left is a piece of land belonging to the Llanidloes gas undertaking. Lying derelict at present on this ground is one of the smallest portable engines I have seen; it was made by Ransomes, of Ipswich. The smokebox is badly corroded and so is the ashpan. The boiler fittings are missing. This engine was running in an emergency about four years ago. I hope to get more details of this engine shortly.

On the same road between Newtown and Welshpool, at Abermule, were two steam rollers parked alongside a garage; they were, I believe, being cut up for scrap. Within about two miles of this spot on the left side of road could be seen a pair of chimneys rising above the hedge round a farm, and I believe they belong to a pair of ploughing engines.

I recently saw an Aveling and Porter roller with the wheels off it for repairs at the Cambrian Foundry in Newtown, the casings round the differential gears being removed leaving the planet pinions exposed.

Cheshire

Proceed from Whitchurch to Red Lion Hotel at Malpas (about five miles), turn left at hotel and about two miles along the lane is a contractor's yard with five Fowler traction engines, fitted with horizontal winding drums under the boilers. I have been told that these engines were built in 1918 for service in Russia, but did not leave this country.

Merionethshire

About two miles from Dolgelly on the left of the road to Welshpool stands a large Fowler [?] steam roller. It looks handsome though dirty. In Dolgelly is an engineering shop where I saw an A. and P. roller having its boiler re-tubed, and its wheels re-bushed.

Anglesey

A number of people have told me about a farmer who collects and repairs old traction and ploughing engines near Holyhead, and I have been told that he has some fine old engines. If this should catch his eye I hope he will tell us about them.

Caernarvonshire

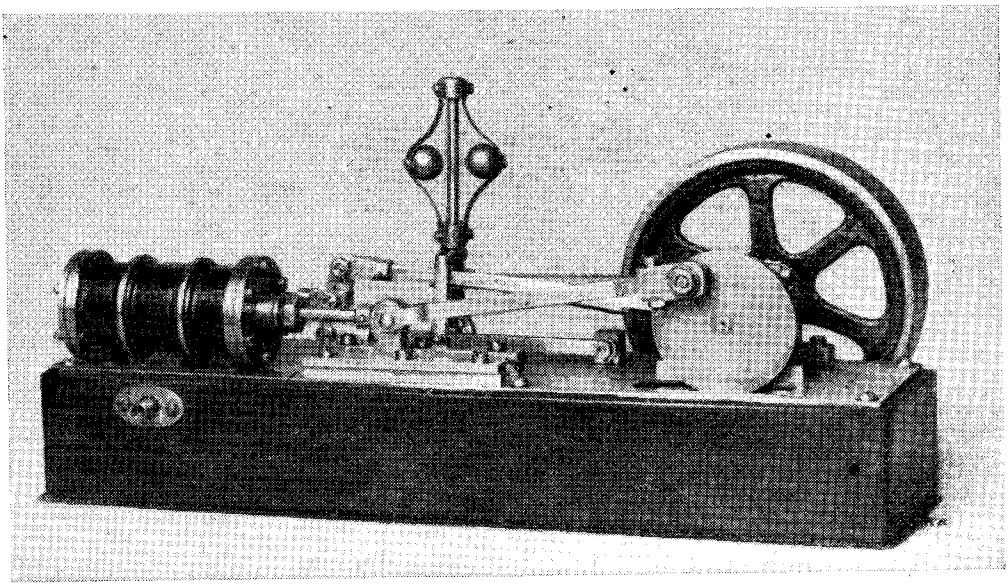
A few weeks ago, I left Portmadoc by the toll road for Festiniog. About 100 yd. beyond the toll gates is a lane running up to some derelect-looking property. This is the engine shed of the Festiniog Railway. Peering through cracks in the galvanised sheeting over the windows, I had a dim view of a 0-4-0 saddle-tank locomotive and a 0-4-0-0-4-0 Fairlie tank engine, both of them being narrow gauge engines. Travelling from Bangor to Bethesda and thence via Tregarth to Llanberis, a narrow gauge engine can often be seen taking trucks of slate to Bangor.

Going into Llanberis, a very old, but clean locomotive can often be seen running down the side of Llyn Peris towards Port Dinorwic on the Menai Straits. Between the two lakes Llyn Padarn and Llyn Peris, is a causeway, at the end of which are the workshops of the slate quarries. Working on the mountainside can be seen dozens of steam and diesel narrow-gauge locomotives. There is a standard-gauge locomotive with a wood-lagged boiler and cylinders which is 100 years old, in a shed by itself, where it is kept as a museum-piece. I would love to have the time to make drawings of it. Llanberis of course is the start of the mountain railway climbing Snowdon.

A Lone Hand Looks Back
or
The Urge to Make Something

by B. Jefferies

TODAY we have jet planes that can circle the earth in a day or two, motor cars that can rival or exceed the speed of an express train, speed boats that can splutter across a large lake in a few minutes, and other examples of speed and more speed. Are we any happier than our grandparents were in the late 'nineties when a bicycle was the fastest vehicle on the road?



As a lover of the steam engine and a lone hand model maker of very modest attainments, I do not think we are. Every advance in mechanical progress seems just a nine days' wonder in anticipation of the next advance.

Today we *hear* more than we *see* in connection with machinery. Petrol and diesel engines are totally enclosed; their exhaust is an unrhythmical bark. The steam turbine and the electric motor emit an irritating hum; we cannot see what is going on within them. Most factories now are motorised, and very few people, other than the employees, ever see the ingenious machines that turn out the vast variety of machine-made products of industry. The steam locomotive is now almost the only prime mover that permits the onlooker to see what it is doing and how it is doing it, and at the same time is pleasing to hear.

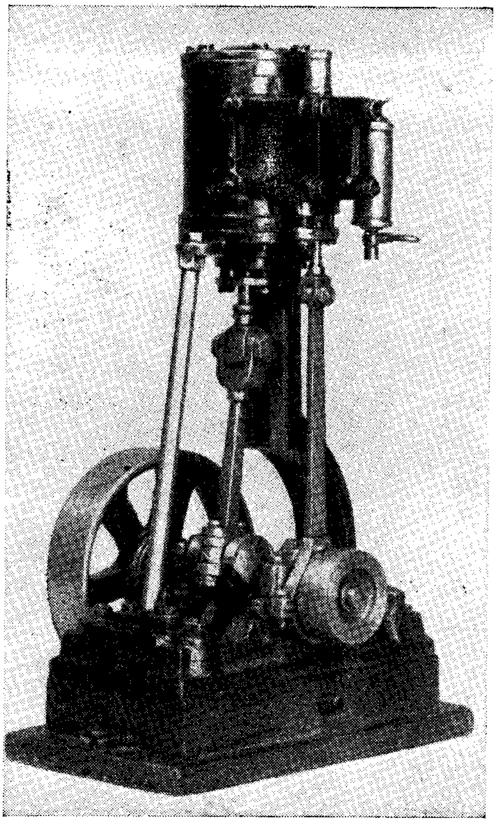
Compare these with the days preceding the use of the internal combustion engine. Every factory had its power plant—boiler and mill engine driving overhead shafting with fast and loose pulleys on each machine. The steam roller, traction engine, portable engine driving threshing machine, etc., the steam engine of the roundabouts, with the little one turning the organ, at the Fair, and that fascinating steam fire-engine with its gleaming brass and copper—all these had visible mechanism, working smoothly, quietly, rhythmically, pleasing to watch and not displeasing to the ear.

I know the change has to do with economy, saving of man-power and increased production, but it seems that the price we have paid for them is, to the mechanically- and musically-minded at least, a loss of beauty of movement and sound.

In my childhood days, in the late 1880's, an occasional visit to my grandparents took me past a spade works where an old-fashioned tilt hammer was used to fashion the spades. The sound of it—1.2; 1.2; 1.2—was music to me, and I peered in at the doorway as far as my limited gift of cheek would allow me to do so. Later on the tilt hammer was replaced by a steam hammer, but the sound of it bothered me, for the taps were all singles and as lacking in music as some jazz tap, tap, tap tunes compared with the waltz, march or minuet.

Another episode, recalled by memory, relates to a schoolfellow who sat near to me in class. His mechanical urge prompted him to play with a bit of wire bent to form a crank, another wire for the connecting-rod, and an india-rubber for flywheel. Held lightly between thumb and finger and rotated, he had, at any rate, three working essentials of a steam engine.

But he also had a real steam engine—a pot boiler heated by a spirit lamp, with oscillating engine mounted on top. I went to his house one day and saw it working. It was a red-letter day for me. There was an engine like it in a shop window in town, priced 3s. (it would be marked nearer £3 today). Often did I linger outside that shop and gaze longingly at the engine until the window went misty from my breath. But 3s. was a lot of money. Pocket-money was very scanty, my parents' pockets were shallow, and I had no rich soft-hearted uncle, so the engine remained for some other purchaser.



In those far-off days, I gleaned a little information about engines from *The Boys' Own Paper*, and at the age of 11 or 12, I made my first engine. It was of wood, wire and tin. My father had built a coal-shed with elm boards 1 in. thick. The cylinder was a bit of an elm board bored with a ¾-in. carpenter's centre-bit and lined with a tube of tin. The cylinder covers were of wood, as was also the piston, grooved and packed with cotton. Piston-rod, crankshaft, connecting-rod, eccentric-rod and strap were of wire from an old umbrella. The eccentric sheave, slide-valve, flywheel and bearings were of wood, and carpenter's wood screws held the parts together. The valve face was of tin with ports poked in. And the engine worked all right by human breath, but I had no boiler for it.

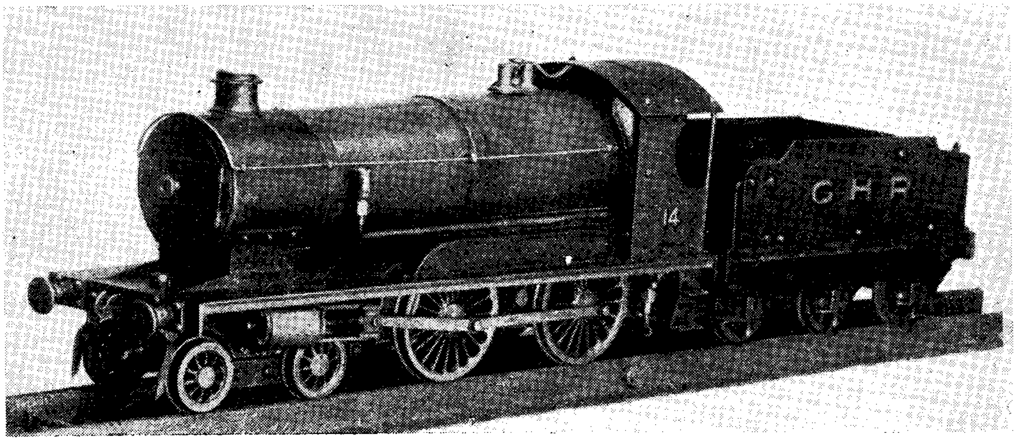
I had little encouragement at home. My parents called it tinkering, so my attempts at engineering had to be surreptitious. We had no gas laid on, and, of course, no electricity; so, except for a spirit lamp for making a quick cup of tea, the coal fire was the only means of heating the soldering iron when I attempted to make a boiler from a coffee tin.

One evening, when my parents were busy entertaining a visitor, I made a coal fire on the floor of the shed to heat the soldering iron. Afterwards, I put out the fire, as I thought, and swept up the cinders tidily. But the draught under the shed door apparently fanned the smouldering embers, for at 4 o'clock next morning my mother burst into my bedroom with: "Get up quick, you've set the shed on fire." And my conscience detected a distinct accent on "you've." But alas, it was so, for the red glow on the window blind confirmed her words. We had no tap water and had to depend on a well which had recently been sunk at the back of the house, so it was "All hands to the well," until, with the help of neighbours, the fire was got under control. A good stock of coal was burnt in addition to brooms, brushes, garden tool handles and other such oddments as had found lodgings in the shed.

That finished my engineering for a time, and being apprenticed to the teaching profession I found other occupation for my time and energies. But my liking for engines was not dead. I belonged to a library connected with the Working Men's Institute, and once when I asked for a book entitled *How to Manage a Steam Engine* the librarian stared hard at me and scratched his head. I guess he wondered how that fitted in with a teacher's studies. It was not until I had qualified, and married and become a father, that I turned my attention seriously to making something. In fact, it was carpentering and cabinet-making that absorbed my energies as a householder with furniture to make or buy. This included a child's cot, a dressing table, wash stand and a chest of drawers for the spare bedroom, all utility, and of pine or yellow deal which could be bought cheaply. Then came a bookcase, china cabinet, bureau and music cabinet of oak, followed by an overmantel and music seat of walnut. At that time, before the first World War, teachers' salaries were by no means exorbitant; but neither was the cost of timber, even hard wood, and the construction of one's own furniture was indeed a pleasure.

These articles were chiefly built in the kitchen, but after a change of residence I was able to build a small workshop in which I have spent many happy hours making various items.

The urge for model engineering was revived partly by my commencing to take in THE MODEL ENGINEER and partly through my acquaintance with a Mr. Newth, who kept a model shop. The 1914 war had just started, and when I first visited his shop his language about the enemy was unprintable. That, perhaps, was natural, for "Made in Germany" was stamped on many model engines which rivalled the goods he had for sale. His business was by no means flourishing, for at that time the rising generation were turning their thoughts to motor cars and petrol engines. But I could not imagine anyone with a greater affection for the steam engine; his enthusiasm was infectious and he would talk for



hours about them and his experiences as an engineer.

At about that time, I bought the castings, partly machined, of a plain lathe and rigged it up on a wooden stand with treadle drive. Later, I bought the parts of a sensitive drilling machine which I built and attached to the lathe stand so that the treadle would drive either machine.

My energies were first concentrated on stationary engines. A horizontal, 1 in. bore and $1\frac{1}{2}$ in. stroke, castings for which I bought from Mr. Newth. Link-motion is provided, although the engine is not reversing. The governor is arranged to raise the link and notch up the engine instead of controlling a throttle-valve. A massive bedplate with bearings 1 in. long forms the basis of another horizontal. Castings were bought for the cylinder, $1\frac{1}{2}$ in. by $1\frac{1}{2}$ in. The crankshaft is $\frac{1}{2}$ in. in diameter with balanced crank equally substantial. A pump is fitted for feeding the boiler.

The vertical engine was built from castings with cylinder $1\frac{1}{2}$ in. by $1\frac{1}{4}$ in. They were for a double-standard engine, but I prefer the single-standard design with steel column, as illustrated in Henry Greenly's book, *Model Engineering*, so I adapted the castings to that design. The flywheel designed did not suit my taste; it had curved spokes like that of a gas engine, so I used a smaller wheel and, in order to increase its weight, I did what most model engineers would consider very unusual: I bent a strip of iron bar, 1 in. by $\frac{1}{4}$ in., into a ring, soldered it on, turned it, and the joint is hardly noticeable.

I think I can trace turning my attention to locomotive construction to three things: Henry Greenly's book *Model Locomotives*, a crankshaft for $2\frac{1}{2}$-in. gauge, with eccentric sheaves turned from the solid, given to me by Mr. Newth, and last, but by no means least, to "L.B.S.C." instructions in THE MODEL ENGINEER.

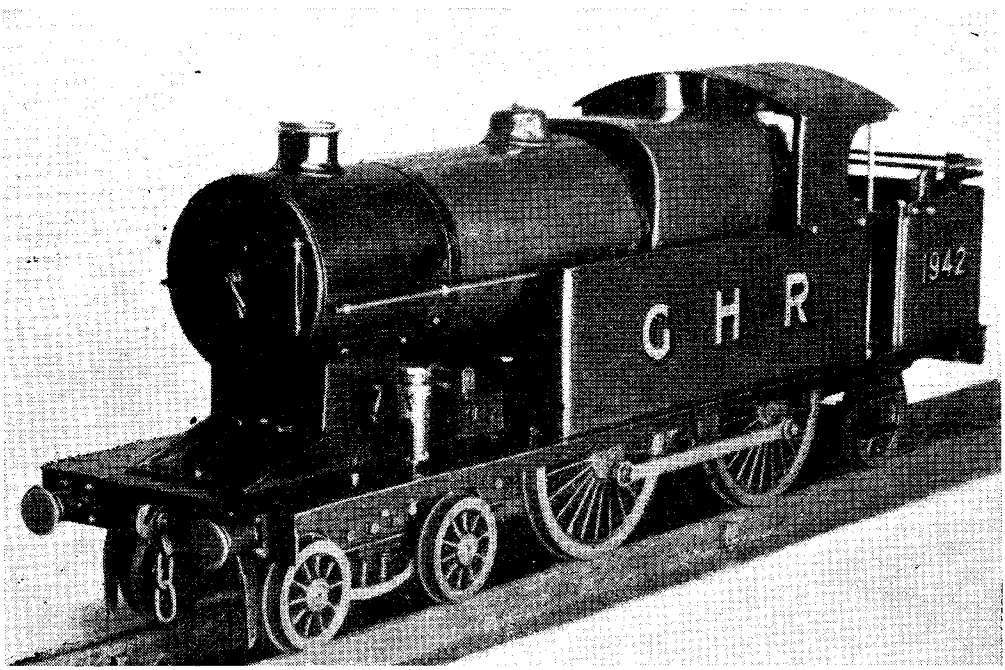
My first attempt was a 4-4-0 tender engine, $\frac{1}{2}$-in. scale, which I built for 3-in. gauge in order to get a wider firebox. I used the crankshaft referred to above and adapted it for the wider gauge by sawing carefully midway between the pairs of eccentric sheaves and inserting a short tube as spacer. It was then soldered and cleaned up, and the turning effort has not yet wrenched it apart, and never will.

Unlike many model engineers, I have not worked methodically to blueprints. I know it is the correct way and saves numerous mistakes; but making mistakes is part of the urge to make something, and one can learn very much from them which is never forgotten. My guidance was chiefly in the pages of Greenly's book which describes a variety of designs and methods from which one can choose and become, in a sense, one's own designer.

My second locomotive began with two nice clean strips of steel, $2\frac{1}{2}$ in. by 3/32 in., obtained from a scrap yard which I sometimes visited, and my target was a $3\frac{1}{2}$-in. gauge tank engine based on Greenly's $1\frac{1}{2}$-in. scale locomotive shown on page 214-215 of his book. I wished to build a tank engine so that I could lift it as one unit instead of having to connect engine to tender after placing on track. The design referred to always appealed to me as nicely proportioned and compact. It seems, however, to be quite out of date, having been superseded by locomotives with the 4-6-2 wheel arrangement.

"L.B.S.C." was at the time describing *Dairymaid* with inside cylinders and Walschaerts valve gear. I knew very little about that gear, for I much preferred Stephenson's; but "L.B.S.C.'s" instructions were so clear that I decided to use it instead of Joy's as in Greenly's book. My only regret with regard to an inside-cylinder locomotive is that the motion, so carefully made and attractive to see working, is almost entirely out of sight.

The side tanks are arranged to contain water and communicate with a small tank in the bunker, from which water supplies a hand pump and also a mechanical pump worked off the rear coupled



axle, and both pumps feed the boiler through the same clack on the backhead.

As I have only a short length of track, the mechanical pump needs some help from the hand pump. But I have found a method of making it do its whack by the very unorthodox one of raising the rear of the engine slightly so that the wheels slip nicely and the pump pumps.

Neither locomotive is outstandingly successful, and I suspect that if "L.B.S.C." examined them he would find that I had not strictly followed the "words and music." The stationary engines, however, have not that shortcoming, and, although I have many years behind me, I still marvel at the rate at which a steam engine can work on only a few pounds of steam, when one considers that the cylinder is filled and emptied at each stroke and the steam turns its direction of flow each time.

I have made several boilers for the stationary engines. The one at present in use is a vertical tubular of copper with 12 tubes, $\frac{3}{4}$ in. diameter. It measures 8 in. by 18 in., and is built for coal-firing. However I use a gas-ring for convenience.

I recognise that this is an age of speed and that many people, particularly the younger generation, would not be satisfied unless the engine hummed or buzzed and the motion was a mere blur. But I am not built that way. When I see a tiny motor-car careering round the track at 50 or 60 miles per hour I find myself thinking, not so much of the speed of the car, but of the rapidity of the electrical, chemical and mechanical operations taking place within the tiny motor engine, all in perfect obedience to the laws of Nature which, as "L.B.S.C." so frequently reminds us, cannot be scaled, and, as a prominent preacher tells us of the love of God, will not let us go, will not let us down, and will not let us off. In fact, the model engineer, like the full-sized one, knows that if anything goes wrong in what he has put together it is not due to lapses on the part of the forces of Nature which he has harnessed, but the fault is to be found in his own work.

I do not feel alone in my attitude to high speed, for I notice that at MODEL ENGINEER Exhibitions the models shown working sedately or gracefully by compressed air always draw a crowd of interested onlookers fascinated by what I call the poetry of motion. That section of the Science Museum in London is, I think, a perennial attraction to old and young, and I anticipate that it will continue so as long as the child in youth and grown up likes to see the wheels go round.

My last effort at model making was a free-lance model of that old veteran, *Agenoria*, built for sentimental reasons and already described in THE MODEL ENGINEER.

I am very conscious of the fact that my work is not of the standard that would satisfy an expert engineer. Friends who see my models may say "What a fine job"; if they know nothing about engineering that may be natural. If a real engineer said the same I should take it as a mark of his kind regard for me and desire to encourage me. Should I, or any other lone hand, ever be tempted to develop a swollen head when contemplating his work, a visit to the London, or any provincial, exhibition would provide a certain cure. For there, pride would receive a nasty bump as it fell, and its place would quickly be taken by admiration for the work of experts and a strong desire to emulate their achievements.

My grateful thanks are due to THE MODEL ENGINEER for help during many years, to "M.E." Exhibitions for inspiration, and to Mr. Ralph Sanders F.R.S.A., A.R.P.S., whose expert photography enabled me to illustrate this article.

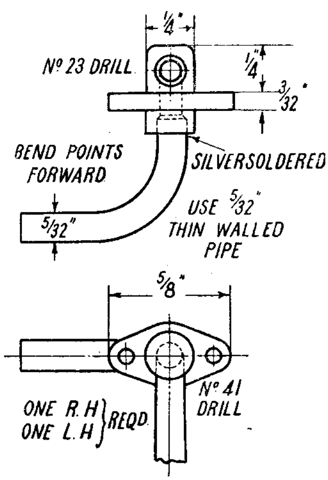
"PAMELA" by "L.B.S.C."

A $3\frac{1}{2}$-in. Gauge Rebuild of a Southern Pacific

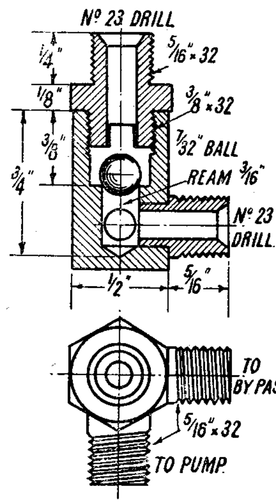
MORE correspondence has recently come to hand from new readers, regarding the merits and demerits of small pop safety valves; so once again may I repeat for their especial benefit, that I don't advise fitting pop safety valves on any boiler where they would not be much above high water level. Every time they pop off, away goes the water; and as all builders of locomotives described in these notes know full well, my boilers will blow off at the slightest provocation, and the driver would therefore receive a series of non-stop shower-baths. Also, as you must have water in the boiler before it can be blown out, the pump and injector would have to work non-union hours, and much extra coal would be consumed in boiling up the extra water. Personally, only one of my fleet of locomotives retains pop safety-valves, and that is *Annabel*, the big Mallet. As they are high enough above water level, to neutralise the water-lifting antic, we don't get any free washes. Great Western engines don't carry pop safety-valves on their taper boiler barrels for precisely the same reason; and as *Pamela's* are not only on the taper barrel, but set forward—in addition to which, they have to be partly sunk in the boiler, in order to get adequate length of spring without being far too tall—I am specifying simple plain valves. A section of one of these was shown along with the illustrations of the backhead adornments.

To make the valve, chuck a piece of $\frac{5}{8}$-in. hexagon bronze rod in the three-jaw; or alternatively, if our approved advertisers supply castings, hold the casting by the hexagon. Face off the end, and turn down $\frac{5}{16}$ in length to $\frac{3}{8}$ in. diameter, screwing $\frac{3}{8}$ in. $\times$ 26. If rod is used, part off at $\frac{7}{16}$ in. from the shoulder. Reverse in chuck, holding in a bush tapped to suit. Centre the end, drill right through with No. 23 drill, open out and bottom to $\frac{3}{8}$ in. depth with 9/32-in. drill and D-bit, tap the top part $\frac{5}{16}$ in. $\times$ 32 or 40, and poke a 5/32-in. parallel reamer through the remnants of the No. 23 hole. Turn the outside as shown, which gives it the appearance of a Ross valve, and face off the end, to bring the valve body to the height specified.

The cup and spindle are in one piece, made from $\frac{3}{16}$-in. round rod. Chuck in three-jaw, and turn down $\frac{1}{2}$ in. length to 3/32 in. diameter, leaving a slight radius at the bottom. Part off at 3/32 in. from the shoulder. Reverse in chuck, make a slight mark with a centre-drill, just enough to allow the point of a $\frac{3}{16}$-in. drill to start; then make a countersink with the $\frac{3}{16}$-in. drill, to the full diameter of the flange. The nipple is made from $\frac{5}{16}$-in. round rod held in three-jaw. Face the end, centre, and drill No. 40 for about $\frac{5}{16}$ in. depth. Open out to $\frac{3}{16}$ in. depth with $\frac{3}{16}$ in. drill. Screw a full $\frac{1}{4}$ in. of the outside with same pitch of thread as the tapped body of valve, and part off at $\frac{1}{4}$ in. from the end. File a nick each side of the nipple as shown in the plan view; seat a $\frac{3}{16}$-in. rustless steel ball on the reamed hole, and assemble as shown, using a spring wound up from 22-gauge tinned steel wire, wound around a 3/32-in. mandrel. Don't forget to touch each end of the spring on a fast-running emery wheel, so that the end coils are squared off, otherwise the valve will be what the



Top feed fitting



Auxiliary clack or check valve

kiddies call a "dribbler," that is, it won't shut down tight. The spring should just start to compress as the nipple enters the tapped hole. I always set my safety-valves by a full-sized steam gauge; I rigged up a small brass air tank with connections for safety-valves, gauges, and air pump. The valve is screwed into a tapped bush in the tank, or into an adapter, if the valve won't fit the bush; the big gauge connected up, air pumped in to the desired pressure, and the nipple of the safety-valve adjusted so that the valve blows off at that pressure. I also check off every small gauge against the big one, by connecting both to the tank at once. If the pressures shown on the gauges do not tally, I simply adjust the needle of the small one, on its spindle, until both gauges read the same, at the working pressure. As long as the small gauge registers correctly at working pressure, it doesn't matter much if it emulates Ananias, more or less, at other points on the scale!

Snifting Valve

This is a very simple gadget, and is made from $\frac{3}{8}$-in. round bronze or gunmetal rod held in the three-jaw. Face the end, turn down $\frac{1}{8}$ in. length to $\frac{1}{4}$ in. diameter, and part off at $\frac{7}{16}$ in. from the shoulder. Reverse in chuck, and machine the inside part exactly as described for the backhead clackbox. Please note, although the drawing of the snifting valve is correct, a wrong dimension was inadvertently inserted; the hole at the bottom is reamed $\frac{1}{8}$ in. as drawn, and not 5/32 in. as wrongly dimensioned. This is obvious, as $\frac{1}{8}$ in. is the correct size of seating for a 5/32-in. ball. Incidentally, it is a wonder I was able to do any writing and drawing at all that week, having one of my very rare spells of being "off colour"; but the best locomotive ever put on rails, won't carry on with 100 per cent. efficiency indefinitely, and my old boss used to call me a locomotive in human form! However, like Sophie Tuckshop of radio fame, "I'm all right now."

After fitting the ball, make a cap for the top exactly as described for the one at the top of the valve box on the eccentric-driven pump. Drill a $\frac{1}{4}$-in. hole in the bottom of the smokebox, in line with the blast pipe, and about 1 in. from the front end; push the projection on the bottom of the snifting valve, into the hole, from inside the smokebox. The small pipe silver-soldered into the wet header of the superheater, is connected to the top of the snifting valve by a $\frac{1}{4}$-in. × 40 union nut and cone. When the engine is coasting with the regulator shut, the pumping action of the cylinder sucks air in through the snifting valve; and as this air has to pass through the superheater elements, it not only prevents their overheating, but the air itself is heated, and prevents the cylinders cooling off.

Top Feed Fitting

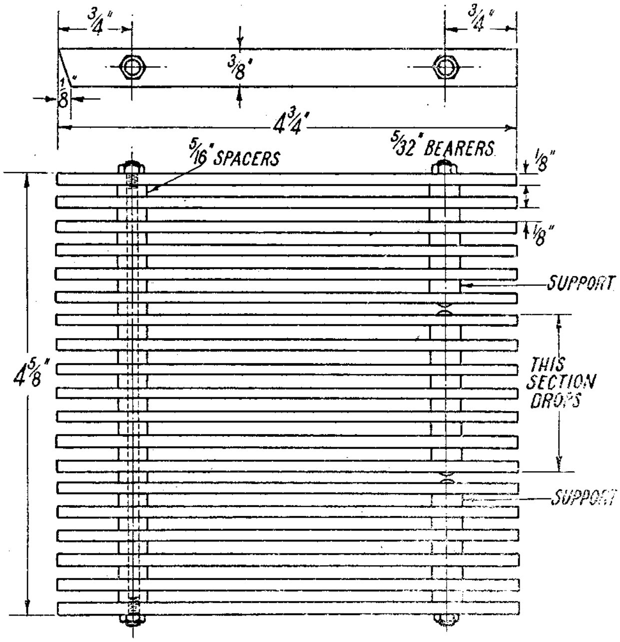
Before erecting the boiler, put in the top-feed connections and the auxiliary clack for the pump feed. The injector need not have an extra clack, if the delivery clack on the end of the injector itself is a relation to Mrs. Caesar; but one may be fitted if desired. One advantage is that the injector may be taken off, should it be necessary, whilst the engine is in steam. The top-feed fittings are very simple, and are the same as fitted to the engine which hauled the *Astral Belle* in the ghost story. You've been wondering what Sir Roy saw on the nameboard over the cornice of the last coach, haven't you? Well, now you know!

To make the fittings, chuck a piece of $\frac{5}{8}$-in. round brass rod in three-jaw; face the end, and turn down $\frac{1}{4}$ in. length to $\frac{1}{4}$ in. diameter. Round off the sharp edge for the sake of appearance and part off at $\frac{1}{4}$ in. from the shoulder. Reverse in chuck, and turn down 5/32 in. of the end to $\frac{1}{4}$ in. diameter. Centre, and drill $\frac{3}{8}$ in. full depth with No. 30 drill; open out to $\frac{1}{8}$ in. depth with No. 23 drill. File the flanges oval, as shown. Fit a bend to each, made from thin-walled copper tube of 5/32 in. outside diameter. Drill a No. 23 hole in the side of the top part, as shown. Make a centre-pop at each side of the dome bush, about $\frac{1}{4}$ in. away and drill a $\frac{1}{4}$ in. hole each side, putting the top-feed fittings temporarily in position. Put the boiler in its approximate place on the frames, and measure with a bit of soft lead or copper wire, from the hole in the top-feed fitting, to a little below frame level, running the wire close to the boiler. Cut two pieces of 5/32-in. thin-walled copper tube to the indicated lengths, and fit them to the holes in the top-feed fittings. Adjust the bends so that you have one right and one left-hand fitting, then silver-solder both bends and pipes at one heat. Don't bother about putting the screws in yet, as the union nuts and cones have yet to be fitted, before the assemblies are fixed to the boiler.

Auxiliary Clackboxes

The auxiliary clack for the pump on *Doris* had a pad attached, for screwing to the frame; but the fitting is so light that the pipes can do all the supporting needed. The fitting is made from a $\frac{7}{8}$ in. length of $\frac{1}{2}$ in. round bronze or gunmetal rod. Chuck in three-jaw, face, centre, and drill a hole $\frac{3}{4}$ in. depth with No. 14 drill; then open out, bottom, ream, tap, and fit a ball and union cap exactly as described for the eccentric-driven pump. At $\frac{3}{16}$-in. from the bottom, drill two $\frac{3}{16}$ in. holes at right-angles, and fit a $\frac{5}{16}$-in. × 32 union screw in each of them, as shown in the plan view, silver-soldering both at the same heat. An auxiliary clack for the injector is made by ditto-repeatoing the whole process, except that one union screw only is needed at the bottom.

Put the boiler in place again, with one of the top-feed fittings temporarily in position. Hold the auxiliary clack inside the frame, with the upper union screw just showing, so that you can easily put the nut on later, when the job is finished. Note how long the pipe from the top feed fitting will need to be, to meet the union screw. Remove the pipe, cut them both to the same length, as the one on the other side will naturally be the same; fit a $\frac{5}{16}$-in. × 32 union nut and cone to each one. Silver-solder the cones, clean up the pipes, and the two top-feed fittings can then be permanently fitted. Attach the flanges by two 3/32-in. or 7-B.A. brass screws, run through No. 41 holes in the flanges, into tapped holes in the boiler shell; and as they



Details of the grate

need nineteen pieces of $\frac{1}{8}$ in. × $\frac{3}{8}$ in. mild-steel, $4\frac{3}{4}$ in. long, bevelled off at one end as shown. Drill two No. 20 holes at $\frac{3}{4}$ in. from each end, in one of the bars, and use it as a jig to drill the others. The spacers are $\frac{1}{8}$-in. slices parted off a $\frac{5}{16}$-in. rod which has been drilled No. 20. The supports, or brackets, by which the grate is held in position in the ash-pan, are 2 in. lengths of the same material used for the firebox. The bearers are made from 5/32-in. rod, same as for the cast grate.

To assemble, thread all the bevelled ends on the long bearer, putting spacers in the gaps between the first five bars. In the next gap, put one of the supports, letting it hang down; then eight more spacers, a support in the next gap, then four more spacers, and finally the nut. As with the cast grate, when the nuts are tight on the ends of the bearer, the bars must be free to move. At the squared ends of the bars, first put a short bearer, nutted at the end; put a spacer in the first four gaps, then a support, and after threading the bearer through the next bar, rivet over the end of the bearer as shown. Repeat operation, at the other end of the grate, which will leave seven loose bars in the middle. These are assembled on a short plain bearer, with a spacer in each gap, and the ends of the bearer are tightly riveted over.

will probably never have to come out again during the lifetime of the engine, sweat them over, same as the stays. Put some liquid flux around each, with a bead of solder; if a good hot soldering bit won't sweat the solder through, assist it with the flame of a small blowlamp played on the fitting at the same time, but be careful not to damage the regulator valve. Well wash off all traces of the flux.

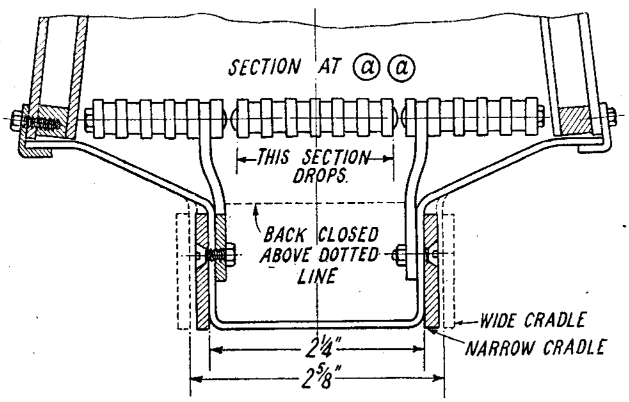
Grate

It is quite possible that our approved and enterprising advertisers will supply castings for the grate, and if so, I recommend their use, as a lot of work in cutting, drilling and assembling the firebars will be saved. Owing to the two side members of the trailing frame, or firebox cradle, passing below the grate, it cannot easily be made entirely removable; so we make the grate in three pieces, and arrange for the centre part to drop in the ashpan hopper. If castings are used, it will only be necessary to drill a No. 20 hole through the web connecting the bars at the bevelled end, and to thread the three sections on to a piece of 5/32-in. round steel, rustless for preference, as it stands the heat better. Screw the rod at each end just enough to allow the nuts to be screwed home tightly, whilst allowing sufficient freedom of movement, to let the centre part drop easily.

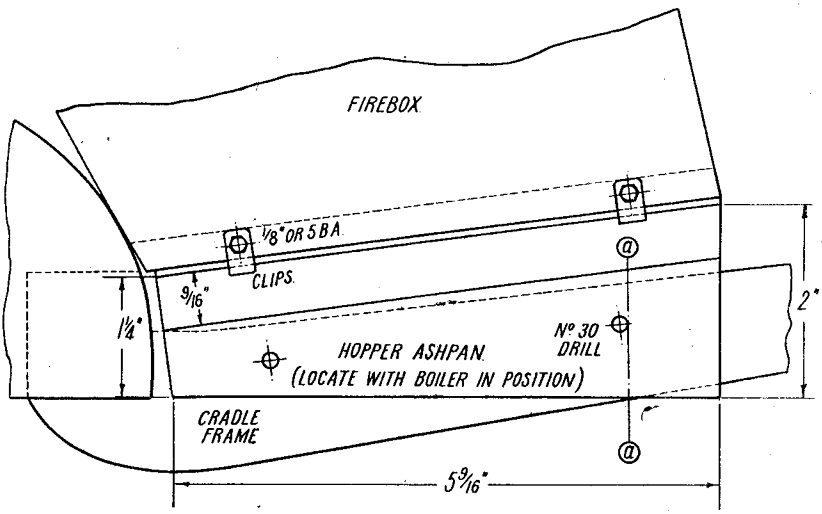
If the grate is built up, it will

Ashpan

There is one advantage in using a firebox cradle of the type fitted to *Pamela*, instead of the usual pattern outside the wheels, inasmuch as it renders the fitting of the ashpan, and the attachment of the boiler, a fairly simple job. The full-size "spam cans" have a weird and wonderful arrangement, in keeping with the rest of the engine, but I have shown a simple hopper, which can be bent up from a single sheet. It is shown laid out in the flat; and all you have to do, is



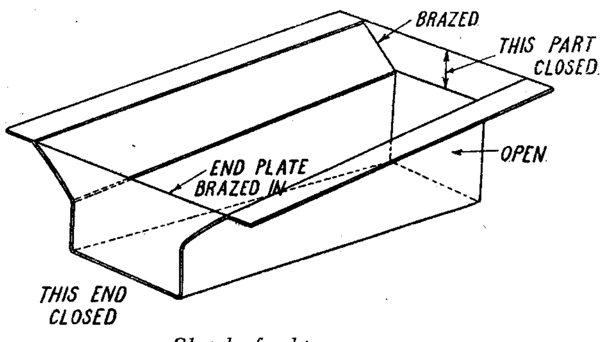
Section of ashpan and grate



How to erect grate and ashpan

to mark it out on a piece of 16-gauge sheet steel, and bend on the dotted lines. My Diacro bending brake would do the lot in a matter of minutes only. For the benefit of beginners, and other inexperienced sheet-metal workers, I have shown it very fully, and included a perspective view. Curly doesn't claim to be a sketch-artist, but I fancy you'll see exactly how the doings should appear after what my one-and-only niece would have called the "bendification process" in her schoolgirl days.

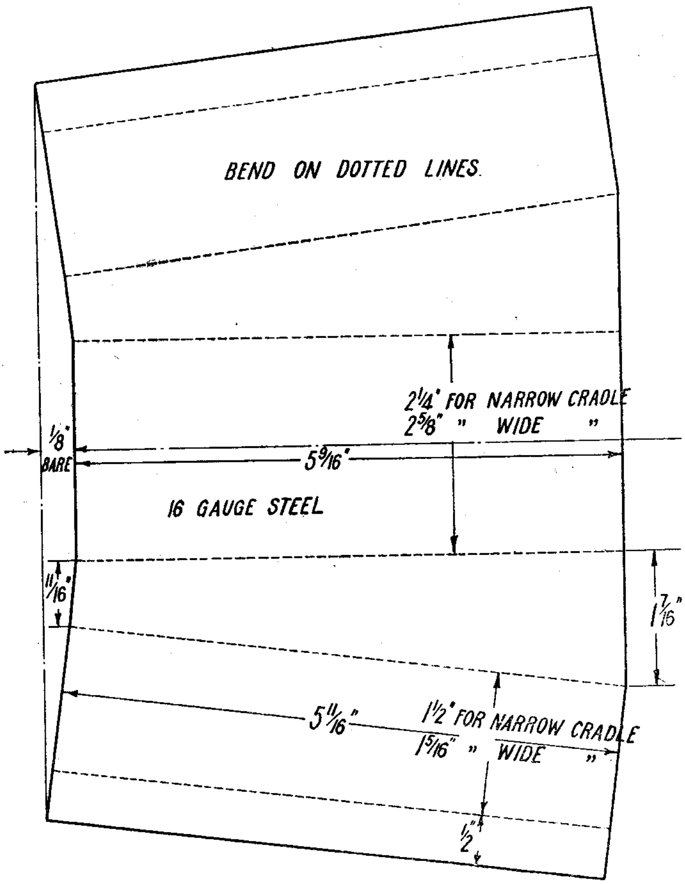
In the original frame drawings, I gave two different widths of cradle; one, 2⅝ in. between frames, for normal curves, and a narrower one, 2¼ in. between frames, which allowed the pony truck more freedom for sharper curves. The



Sketch of ashpan

drawing of the ashpan shows alternative measurements for either width; for the wider frame dimension, you add the difference to the bottom of the hopper, and subtract it from the side "wings." Note that in addition to the front end of the ashpan being entirely closed in, the upper part of the back is closed also; this has nothing to do with the regulation of draught, but is merely for strength. The boiler is pretty heavy, and if no support is provided, to keep the side "wings" at correct angle, the weight of the firebox would cause them to droop a bit. The attachment of these end pieces, is very simple. After bending the ashpan to shape, and trying it in place between the side members of the cradle (it should just slide in nicely, without being loose) stand the ashpan, front end down, on a piece of 16-gauge sheet steel, a little bigger than the overall size of the end of the ashpan. Apply some wet flux, and braze it with brass wire—a one-pint lamp will do this job easily—or else Sifbronze it. Quench in water, then simply file off the superfluous metal, flush with the end of the ashpan. Stand the back end likewise, on a strip of metal just wide enough to reach to the top of the vertical sides of the hopper, shown by the dotted line in the cross section; braze that likewise, and trim up as above.

Drill two No. 30 holes in each side of the cradle frame, in approximately the positions shown; the exact location doesn't matter, as long as both sides are alike. Put the aspan in its approximate position, then put the boiler on temporarily, with the bottom of the throatplate level with the top of that part of the cradle frame which is attached to the main frame; see erection view. Adjust position of ashpan until the side flanges are tight up against the foundation ring. Check off the level of boiler at smokebox end; the bottom of the smokebox should be level with the top of frames. When O.K., drill holes through the sides of the ashpan, using those in the cradle frames as guide, and secure with countersunk screws and nuts, as shown, in the cross-section. That settles the location and fixing of the ashpan. Next, we have to instal the grate. The bottom of the firebars should be level with the tops of the flanges of the ashpan, on which the foundation ring rests. Put the grate in position, bending the supports as shown, so that they fit tightly between the sides of the ashpan; they can also be moved backward or forward, so that they come opposite the bolt holes, the same bolts then holding the whole issue. If desired, separate bolts may be used. However, try the boiler on again, to make certain the firebox fits over the grate; and when it does, the supports can be fixed to the ashpan "for keeps," as shown. Make certain the centre part is free to drop down; we shall make provision for



Ashpan "in the flat"

keeping it up when running, after the boiler is fixed and connected up.

How to Erect Boiler

Little remains to be done, to fit the boiler to the chassis, as the back end is now correctly located by the ashpan, and the rest only requires to be set level and fixed. Put the smokebox saddle in place between the frames, the front edge of it being $\frac{1}{2}$ in. behind the front edge of the cylinder castings. Put the boiler in place, with the smokebox on the saddle, and the firebox on the ashpan flanges; the bottom of the smokebox should be level with top of frames. The saddle is then attached to the frames by four $\frac{1}{8}$-in. or 5-B.A. countersunk screws at each side, going through the clearing holes in the frame, into tapped holes in the saddle. At the firebox end, the attachment is by four clips made from 16-gauge steel, screwed to the bottom edge of the firebox by $\frac{1}{8}$-in. or 5-B.A. screws, tapped into the foundation ring as shown. The end of the clips are bent up into close contact with the underside of the ashpan flanges; the illustrations are self-explanatory. The smokebox is attached to the saddle by four or six 8-B.A. or 3/32-in. screws, round or hexagon headed as desired, put through clearing holes in the flanges of the smokebox saddle at each side, into tapped holes in the smokebox shell. The clearing holes may be drilled before the boiler is erected. Another small job to be done, before the boiler is put on "for keeps," is to connect up the auxiliary clack to the eccentric-driven pump. All this entails is a short piece of 5/32-in. thin-walled copper pipe with $\frac{1}{16}$ in. $\times$ 32 union nuts and cones at each end. Get the length of pipe from the actual job. Simply hold the fitting close to the frame, same as you did when ascertaining the length of the top feed pipes; measure the distance from the top or delivery union of the pump, to the union on the auxiliary clack which is pointing toward the centre-line of the engine, and cut your pipe to that length. When the pipe is fitted, it will hold the auxiliary clack in position; then, when the boiler is erected, all you have to do is to couple up the union nut on the top-feed pipe, to the top of the auxiliary clack, and Bob's your uncle. The by-pass pipe can be connected up later, when the injector is fitted, and the rest of the plumber's job undertaken. The blastpipe nozzle will have needed removal, to get the smokebox over the blastpipe; so replace this, and couple up the blower union on the side of it, to its fellow-conspirator on the tube-plate, by a piece of $\frac{1}{8}$-in. of 5/32-in. tube with union nuts and nipples on both ends.

Great Central Fade-Out

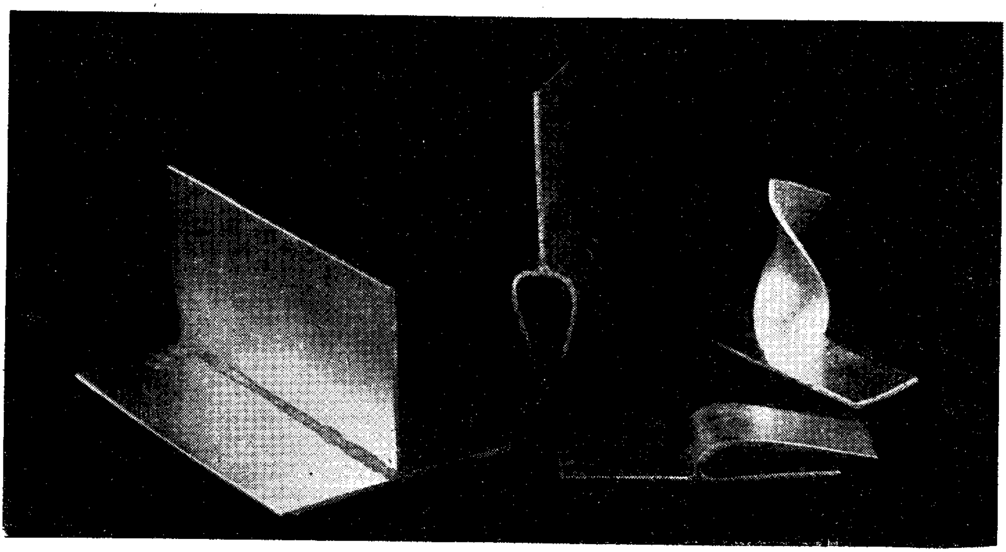
At the moment of writing, only one engine of the once-numerous 4-6-0 type engines on the former Great Central Railway exists; she is No. 61482, *Immingham*, by no means one of the newest. This comes as a shock to those of us who were admirers of G.C.R. locomotives; but economy is a relentless force, these days!

Notes on the Flame Brazing of Aluminium

by Cyril Wadsworth

ONE of the easiest and cleanest metals to work, in the model engineering field, is aluminium, and I am sure that far greater use would have been made of this metal in the past, if an easy method of soldering it had been available. Within the last five years or so, a new technique known as "Flame Brazing" has been developed for aluminium and its alloys the materials for which are now freely available, materials and flux specify that oxy-acetylene flames give the best results, I have produced perfect joints using oxy-acetylene, oxy-coal gas and simple air-coal gas flames, and have no doubt that equally good joints could be produced using a small paraffin blow lamp. Thus the method is available to anyone with normal brazing equipment.

The brazing rod has a lower melting point than



and as no description of this method has been previously published in THE MODEL ENGINEER, to my knowledge, I would like to pass on my own experiences in its use for the benefit of any of the readers who, like myself, have needed at some time to stick pieces of aluminium together.

It all started when a number of small aluminium cabinets for electrical meters were required. The obvious method of production was to press the cabinets out from sheet stock, but since only three or four were needed, the cost of tooling would have been prohibitive. The only solution thus appeared to be either welding, for which we had neither the necessary equipment nor knowledge, or riveting which gave a satisfactory, though rather unsightly joint. At this stage, reference to the flame brazing technique was found in one of the technical journals, and further enquiry produced a pamphlet on the subject and a supply of the brazing material and flux. A few joints were tried using this material, the results of which were really remarkable. In fact, provided that a few simple rules were adhered to, the method was no more difficult than silver-soldering or brazing with normal brazing materials. Furthermore, whilst the manufacturers of the brazing

the parts to be joined and is a 10 per cent. silicon, 90 per cent. aluminium alloy with a melting point approximately 75 deg. C. below that of pure aluminium. It is available in rod form of various diameters down to $\frac{1}{16}$ in. and is ordered as 10 *per cent. silicon aluminium alloy rod.* The flux is *aluminium brazing flux* and is hygroscopic, hence the tin must be kept tightly closed when not in use.

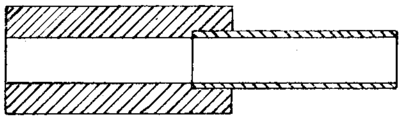
The actual brazing technique is quite simple provided that the few rules previously mentioned are adhered to, and these are as follows :—

(1) The section of the parts to be joined must be approximately the same, otherwise, due to the extremely small difference in the melting points of the pure metal and the brazing material, a light section would tend to melt before a heavier section had reached the correct brazing temperature. The sections illustrate the meaning quite clearly.

In the first sketch, the light walled tube would melt before a satisfactory joint had been made. Where it is unavoidable that one section to be joined is heavier than the other, then the heating must be confined as much as possible to that section.

(2) In the case of commercially pure aluminium sheet, or freshly machined pure aluminium rod or tube, no removal of the normal surface shine or oxide film is necessary, provided the metal is clean and free from grease or other contamination. Aluminium alloys, or castings, however, required the surface layer of oxide to be removed mechanically by vigorous cleaning with a piece of steel wool, file or wire brush.

(3) Rather more clearance is necessary in the joint than is usual with normal silver-soldering



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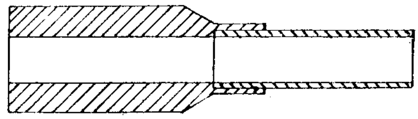


CORRECT

methods ; press fits and close joints are not conducive to complete penetration of the brazing material and flux.

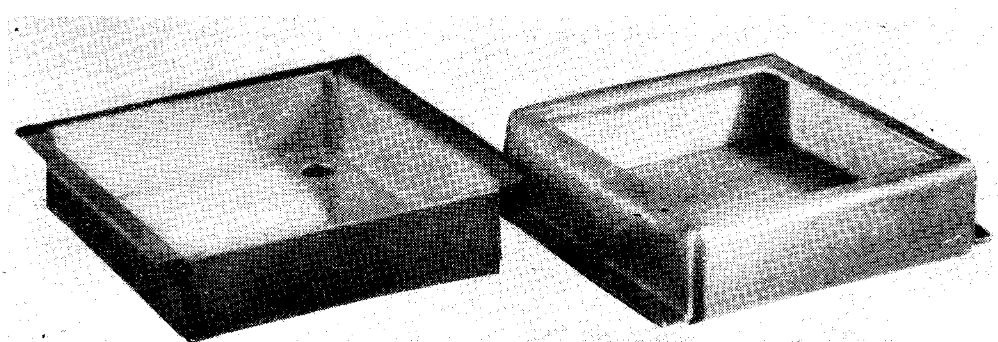
(4) On long joints or seams, adequate support of the parts is necessary, otherwise sagging will occur.

Assuming that we are now in a position to proceed with the actual job, the method is quite straightforward. The joint and a small amount of the surrounding metal is heated with the blowpipe flame and the end of a stick of brazing material is heated in the flame and dipped into the tin of flux, a small quantity of which will adhere to the end of the rod. This small quantity of flux is then touched on to the joint to check the temperature. If the correct temperature has been attained, the flux will melt into the joint and begin to flow rapidly along the joint. *Do not* melt off any brazing rod into the joint until the flux has started to flow freely, as indicated. When the flux is flowing, melt off a small amount of the brazing rod into the joint and push it along the line of the joint with the blowpipe flame, keeping the flame a little behind the forward end of the molten metal. Add more metal from the brazing rod as necessary, and between each addition, dip the rod in the tin of flux. In this fashion work your way right around the whole line of the joint, when capillary attraction coupled to the driving action of the flame which is moved close to the surface of the molten metal, will give complete penetration of the brazing material and a sound fillet of metal on each side of the joint. An equal fillet is not produced on each side, the one on the brazing side being larger than the one on the other side. Use a reducing flame on the blowpipe and keep the flame moving, or brushing over the surface of the joint, since if the flame is allowed to remain stationary on a part of the joint for too long, and too long may be only a few seconds, the localised heat may melt a hole in the parent metal, thus ruining the whole job. After allowing the job to cool down, remove the residual flux deposits by washing off with hot water, and if necessary scrubbing with a small brush of the nail brush type.

The first photograph shows a typical joint made in the above fashion with a number of test-pieces which have been deliberately maltreated to show the strength of the joint produced. In my opinion, the joint is stronger than the parent metal ; the test pieces having first been gripped in the vice, were deformed by means of a large pair of pliers, and in no case did destruction of the joint occur.

The second photograph shows one of the meter cabinets, fabricated from aluminium sheet. The finished article, after spraying, is externally indistinguishable from a single-piece pressed job.

Without going too deeply into the matter, the above method appears to have a great number of applications in the model engineering world, to mention only a few, fabricated bodies of model cars, and miscellaneous applications in the small i.c. engine field. No doubt the reader will have his own suggestions to make as to the uses of this method for his particular project, and I feel that my own scope has been greatly extended by the acquisition of aluminium flame brazing technique.



IN THE WORKSHOP

by "Duplex"

No. 79—Micrometer Stands

THE ordinary workshop micrometer is commonly used in two ways: either it is held in the hand and applied to work that is mounted in the lathe or gripped in the vice, or small parts such as screws are measured by holding the micrometer, as well as the work, with the fingers of one hand and employing the other hand to turn the adjusting thimble. The latter, three-purpose method is quite generally used and with practice gives good results; nevertheless, the hands work more efficiently and have a better sense of touch when relieved of muscular strain, and when, at most, performing a single delicate operation with either hand.

It is therefore an advantage to have the micrometer supported, when gauging small parts, so that the hands are employed solely in lightly holding the work and adjusting the micrometer. The bench pattern micrometer, illustrated in Fig. 1, is intended for this purpose, and to give stability it is formed with a heavy, cast base. This instrument is, however, too heavy and cumbersome for convenient handling when measuring work mounted in the lathe.

To enable the micrometer both to be applied to parts mounted in machine tools and to be used to the best advantage on the bench, a form of stand is usually employed that allows the micrometer to be quickly clamped in place or removed for handling.

The Starrett micrometer stand, shown in Fig. 2, is made to serve this double purpose, and a single bolt and wing-nut is fitted both for clamping the micrometer and for locking the pivot joint which allows the instrument to be tilted to a convenient angle for reading the scale. A further advantage of using a stand of this kind is that there is then no need to lay the micrometer on the bench or on the lathe bed where it is liable to suffer damage; instead, the instrument is always kept mounted in its holder, which stands either on the bench or on the lathe tool stand.

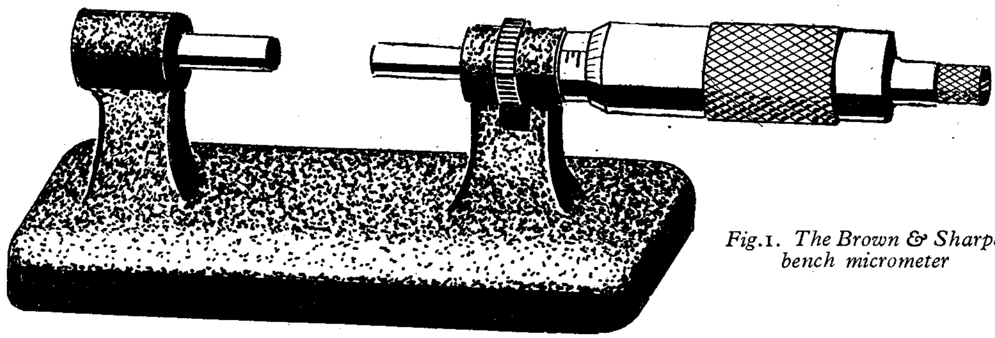


Fig. 1. The Brown & Sharpe bench micrometer

Making a Micrometer Stand

As a result of making enquiries of tool-merchants, it appears that micrometer stands are no longer obtainable in this country. Recently, a second micrometer stand was required in order to save the inconvenience of having to use a single stand to serve two or more micrometers. It was decided, therefore, to make a simple form of this appliance that could easily be built from scrap material and yet would do all that was needed. As it was found that a single position of the clamp was sufficient to enable the micrometer to be easily read, a fixed form of clamp was employed which did not permit of angular adjustment. To keep the front of the stand free from obstructions, the two screws actuating the clamp were placed at the back of the holder. The finished stand is shown in Figs 3 and 4, and the component parts are illustrated in Fig. 5 and in the accompanying working drawings.

The Base (*A*)

This was made from a discarded iron casting originally intended for the jockey pulley of a drilling machine.

The precise dimensions of this part are, of course, unimportant, as long as the casting or other material used is heavy enough to ensure a stable mounting for, say, a 2 in. micrometer.

The casting is first gripped in the chuck for facing the upper surface and boring and tapping the central hole; at the same time, the recess is turned to a good finish with a round-nosed tool.

Next, the work is reversed in the chuck for facing the underside, and, to give greater stability, the rim is machined to stand higher than the central portion of the casting. To finish the

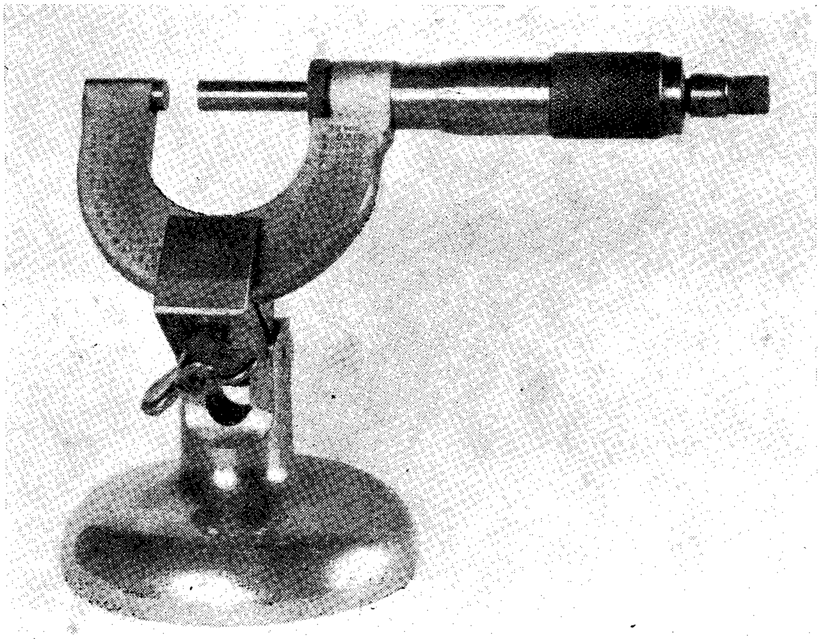


Fig. 2. The Starrett micrometer stand

machining, the casting is mounted on a threaded stub mandrel with its upper surface outwards so that the periphery can be turned and the bevelled edge formed. If a tungsten carbide tool is used for the turning operations, the work can be run at moderately high speed, using the direct drive to the mandrel; in this way, a smooth machined surface should be obtained, which will lessen the rather laborious work of polishing. The polishing operation is started by removing all tool marks with a discarded, smooth file applied to the revolving work, for

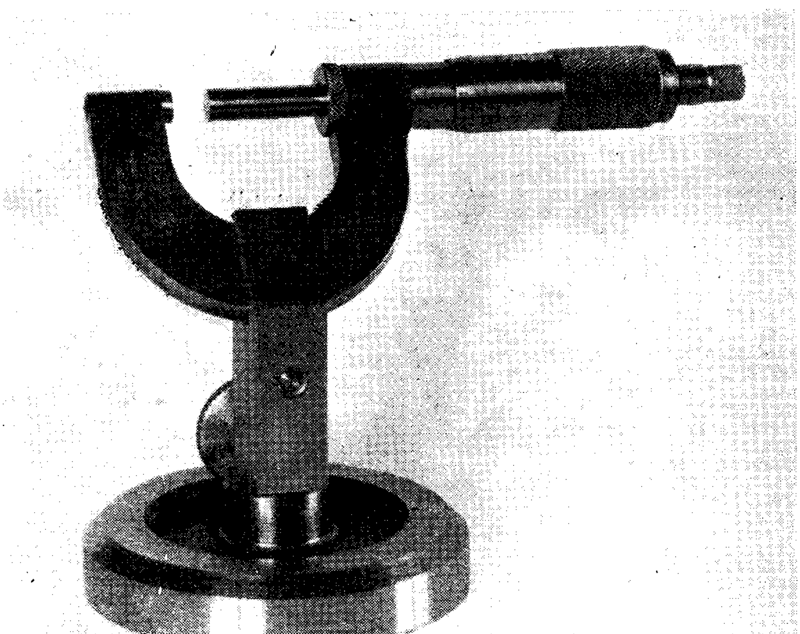


Fig. 3. Front view of the micrometer stand

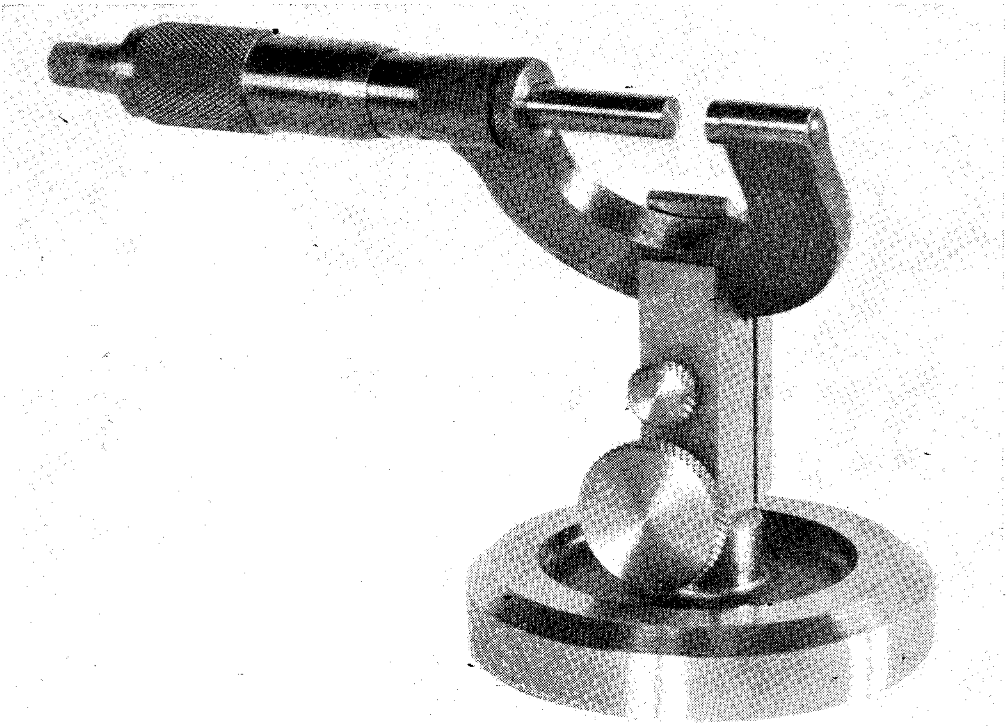


Fig. 4. The micrometer stand seen from behind

if a serviceable file is used it is almost sure to be blunted, particularly where the casting is of hard material. The next step is to cover the file with a strip of coarse abrasive cloth and to continue the polishing, using, meanwhile, plenty of thin oil and applying firm pressure, until all file marks have been eliminated. The final polish is given by using a finer grade of abrasive, but oil must still be applied or a glazed appearance will result which looks rather unsightly. Before removing the work from the lathe, all oil is cleaned off with petrol or lighter fluid in order to

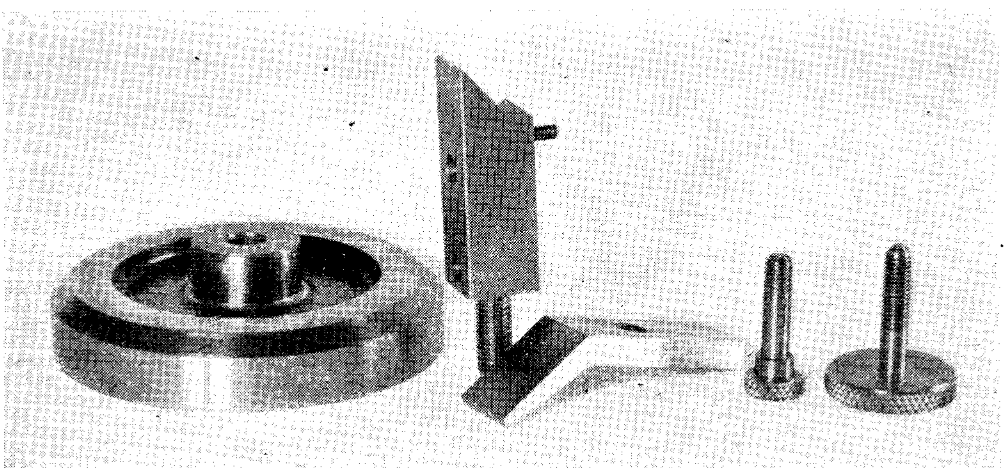


Fig. 5. The stand components, left to right: (A)—the base; (B)—the body; (C)—the clamp arm; (D)—the pivot and clamp-screws

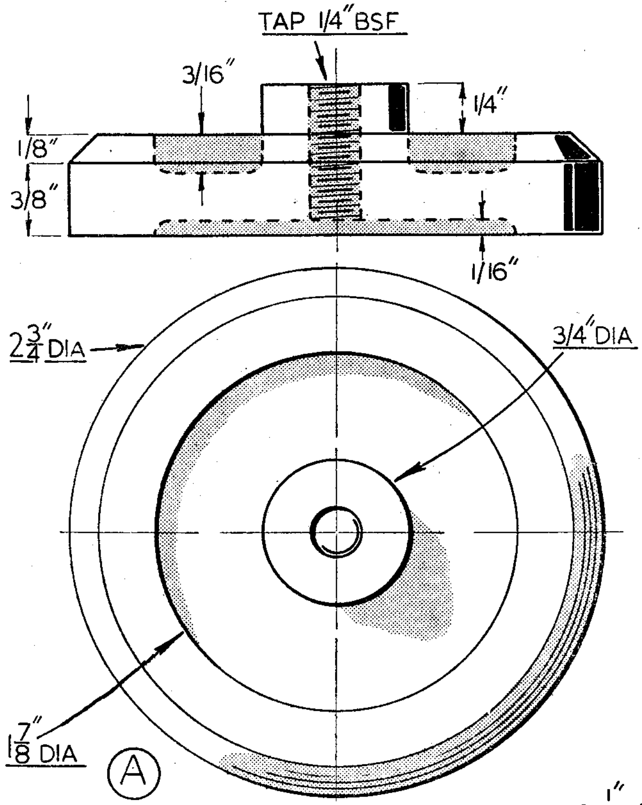


Fig. 6. The cast-iron base

prepare the central recess for painting. The paint is applied with a small brush while the casting is revolving at a moderate speed; moreover, if the work is kept turning for a time, a quick-drying paint will be able to set, and paint runs will in this way be avoided. Optical ebony black gives a pleasing, matt finish, but if glossy cellulose enamel is used, the surface, when dry, should be treated with liquid metal polish in order to subdue the highly glazed finish.

The Body (*B*)

This part is made from a short length of ½ in. square mild-steel, threaded at its lower end to screw into the base casting. On making a trial setting with the Starrett stand, it was found that the micrometer could be read most conveniently when mounted at an angle of some 45 deg.; the upper end of the body was therefore machined to this angle in the shaping machine, but this face can quite well be either milled or filed to shape. Should the micrometer be mounted to lie more nearly horizontal, the clamping face on the body will be shorter and, moreover, a heavy micrometer would then be more liable to overbalance. The step on which the bow of the micrometer rests must, of course, be made shallower than the thickness of the bow to enable the micrometer to be securely clamped. A short length of stiff, petrol lighter spring is housed in a hole drilled in the body above the pivot screw, so as to open the clamp and free the micrometer when the clamp screw is slackened.

The Clamp Arm (*C*)

The clamp itself works on the principle of the ordinary toolmaker's clamp, but it is rather less efficient, as the actual clamping surface lies at an angle to the actuating screws; nevertheless, a 2-in. micrometer is held quite firmly with only

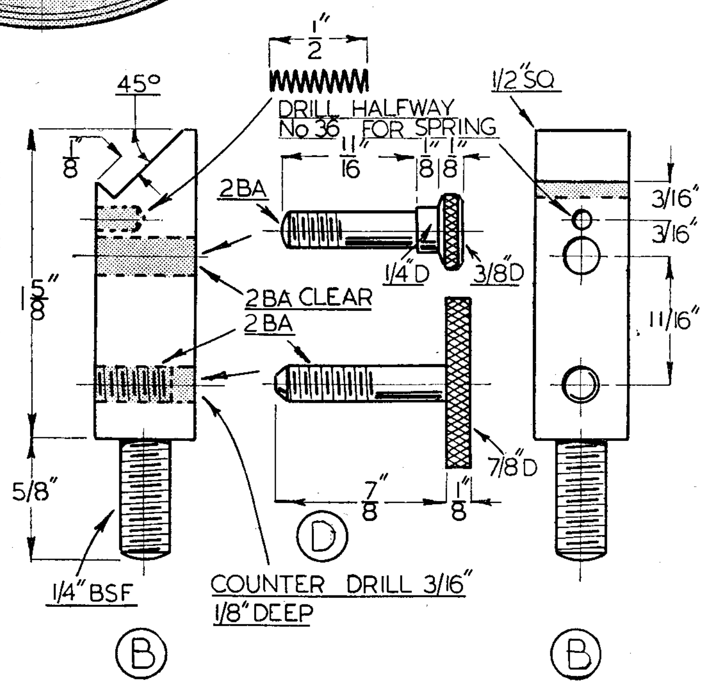


Fig. 7. The stand body and clamping-screws

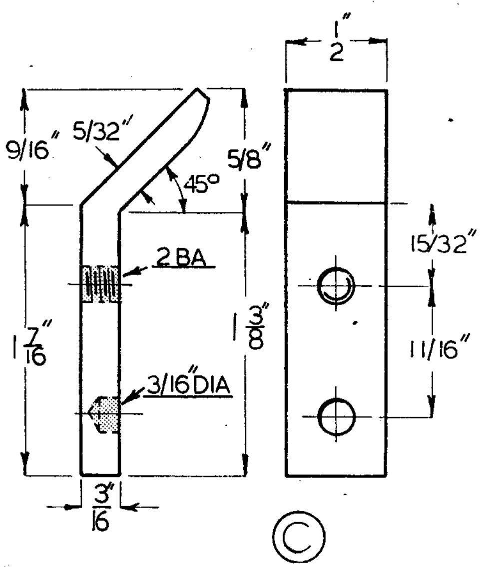


Fig. 8. *The clamp arm*

moderate tightening of the clamp-screw. The clamp arm is cut to shape with hacksaw and file, and it will be noticed that the clamping surface is made slightly curved towards its tip to allow for the rocking movement imparted when the clamp is tightened ; for the same reason, the hole to receive the small pivot screw is threaded for less than the full thickness of the material.

The recess in which the lower clamp-screw engages is deeply drilled with a centre drill in order to afford a good bearing, and so check any tendency for the clamp arm to rise when the clamping pressure is applied. When drilling the clamp arm, it is best to secure it in position on the body with a toolmaker's clamp ; the body will then serve as a drilling jig for accurately locating the holes.

The Actuating Screws (*D*)

When mounting a micrometer in the stand, the pivot screw is tightened until the clamp is closed on the bow, with the lower limb of the arm lying approximately parallel with the body. The pivot screw acts, therefore, merely as a setting screw, and its head is made small to give a neat appearance. Next, the clamp-screw is tightened until the micrometer is found to be firmly held. However, if there is any difficulty in obtaining a good grip, a different setting of the pivot screw should be tried to alter slightly the angle at which the two clamping surfaces meet. To get satisfactory clamping with only moderate finger pressure, the knurled head of the clamping-screw is made of large diameter. When the clamp has been set, it is only necessary to give the clamping-screw a partial turn in order to remove or reclamp the micrometer.

As shown in the drawings, the body is drilled for a short distance to the clearing size of the shank of the clamp-screw ; in this way, as is usual in instrument work, a better appearance is obtained, as the threads on the clamp-screw are then hidden.

For the Bookshelf

Watchmakers' and Clockmakers' Encyclopaedic Dictionary, by Donald de Carle, F.B.H.I. (London : N.A.G. Press Ltd., 226, Latymer Court, W.6.) 280 pages, size 5¼ in. by 8¼ in. 3,000 definitions. 1,100 illustrations. Price 30s. net.

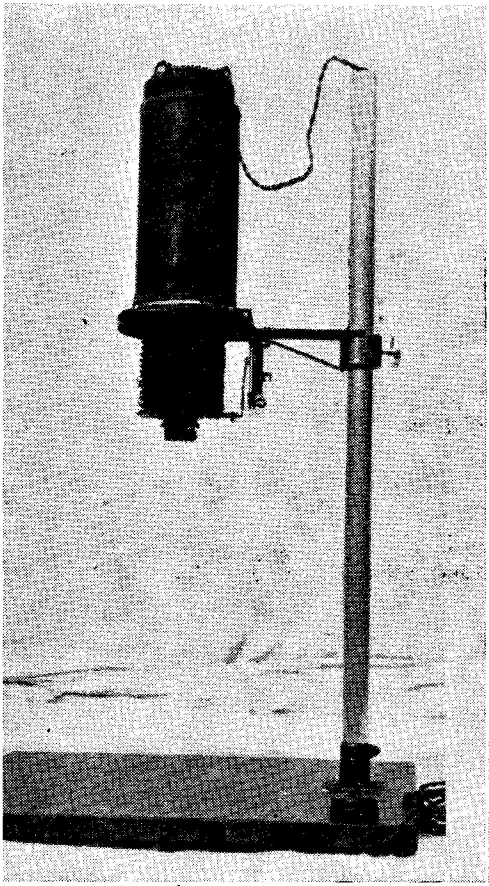
Many hundreds of "M.E." readers are at least interested in horological subjects, and this is a book which should appeal directly to them, even to those who are not, necessarily, practical horologists. The principal contents consist, of course, of a glossary of general terms associated with watches and clocks as well as allied subjects ; but interspersed in the text will be found many tables and descriptive paragraphs dealing with specific branches of the horologist's craft. Particularly useful are such lists as : watch parts in six languates ; cronograph parts, in two languages ; days of the week and months of the year in fifteen languates ; standard time zones and zone times ; temperature conversion tables ; arrangements of chimes, and many workshop hints. There is also a section devoted to woods for clock cases, arranged in tabular form and incorporating such information as : the name of the wood, where it is grown, other names and a general description ; nearly seventy different woods are included.

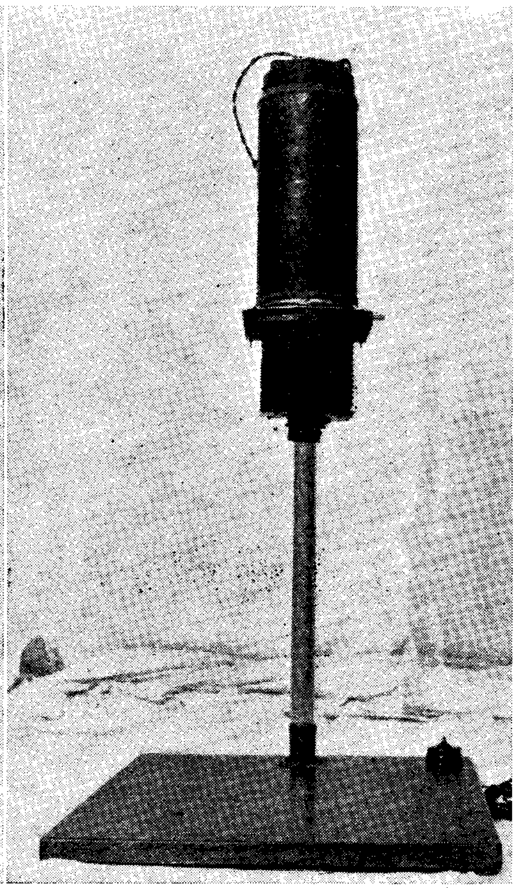
The illustrations consist of line-drawings, diagrams and sketches, clearly drawn and well reproduced. We doubt if there has been previously produced a book in which so much horological information has been collected together so lucidly and concisely within so small a compass ; this book may well become the standard horological reference-book for very many years to come.

A 3¼ in. × 2¼ in. Vertical Enlarger

by A. Macdiarmid

CONSIDERATION of ways and means made it abundantly clear that the only method of acquiring a much needed enlarger was to make one. As spare time was short, like cash, and since the enlarger was urgently required, the job





had to be " quickie." At the same time a reasonable standard of appearance and finish was considered essential, both for the efficiency of the enlarger and my own satisfaction. These usually contradictory requirements, for me at least, were reconciled by using bits and pieces from a dismantled bombsight computer whenever they filled the bill, and such is the wealth of material in these instruments that one can usually find something suitable for the job in hand.

My policy was not to economise unduly on essentials, so the job was designed round a Wray f4.5 lens of 4¼ in. focal length and a 4½ in. double plano-convex condenser unit in a mount. In case anyone else might be as ignorant of the main principles of enlarger design as I was when I started on this job, let me say at this stage that the maximum size of negative with which the enlarger has to deal should determine the focal length of the lens. The focal length should be not less than the diagonal of the negative, and the diameter of the condensers should be equal to the focal length of the lens. Although my own camera is a 2¼ in. × 2¼ in. Ikonta, I had in mind the anticipated needs of friends with larger ones when I fixed the maximum capacity of the enlarger at 3¼ in. × 2¼ in., hence, the $4\frac{1}{4}$ in. lens. The use of a long focus lens cuts down the maximum magnification available. However, a 12 in. × 12 in. image is available from my $2\frac{1}{4}$ in. × $2\frac{1}{4}$ in. negatives, and, should anything in the nature of a giant enlargement ever be required, it will be seen from the photographs that the whole lantern assembly can be swung 180 deg. round the column and the picture projected on to the floor.

The enlarger is built upon a hardwood easel 22 in. × 18 in. × $\frac{3}{4}$ in., 22 in. being the front to back dimension. Rising from the baseboard is the column, a 34 in. length of $1\frac{1}{4}$ in. o.d. aluminium tube. Although this has proved quite satisfactory, I am inclined to think that steel would have been a better material for the purpose, and the aluminium tube will possibly be replaced at some convenient future date. The column is mounted on the easel by means of a fabricated base. For this, a 2-in. length of brass tube, left behind after a visit from the plumbers, was bored out on the lathe till the column would just slide in. A piece of $\frac{1}{8}$-in. brass plate $2\frac{1}{2}$ in. × $2\frac{3}{4}$ in. was then drilled and bored to a force fit on one end of the brass tube and the two sweated together. The other end of the brass tube had four hacksaw slits cut in it, $1\frac{1}{8}$ in. long. The base was secured to the easel with four countersunk woodscrews, the column inserted in the brass tube and a Jubilee hose clip tightened up over the hacksaw slits. A satisfactorily rigid structure was the result.

The next part to be tackled was the sliding arm for the column. In commercial enlargers this is usually a casting, but after much head scratching and searching of the junk box the following arrangement was schemed out. A $1\frac{1}{2}$-in. offcut of 2 in. diameter mild-steel bar was chucked in the lathe and after facing both ends it was centred, drilled and bored to an easy sliding fit on the column. It was then drilled and tapped $\frac{1}{4}$ in. × 40 at right-angles to the bore to receive a piece of correspondingly screwed rod fitted at one end with an aluminium handwheel. This formed the clamping screw. The collar carries an arm which was shaped from a piece of 3/32-in. × 6-in. × $2\frac{3}{4}$-in. steel plate (surplus from "Tich's" main frames). A semi-circular piece of $\frac{7}{8}$ in. radius was milled on the lathe out of one end and fitted with an equal clearance round the column before being fixed with three 7-B.A. cheese-headed bolts into tapped holes in the top of the collar. A stiffening-piece of aluminium was bolted to the bottom of the collar and the underside of the arm, as shown in the photograph.

For the lamphouse, a piece of sheet aluminium was formed into a cylinder $9\frac{1}{4}$ in. long, with an internal diameter which was a tight push fit over the condenser mount. Incidentally, I found that the rain pipe down the side of the house made a useful former for the preliminary shaping of the cylinder. The edges of the cylinder were riveted to a strip of aluminium placed inside the bore, after binding the cylinder with string to keep the edges together. The lowest rivet was located just above the top of the condenser mount so that the end of the cylinder which pushed over the condenser had a certain amount of spring in it. This provides the necessary grip while making it easy to withdraw the condenser for cleaning. Finally, a length of black adhesive tape was stuck inside the cylinder along the seam to make it light tight. The top of the lamphouse was improvised from the cylindrical gyroscope casing taken from the bombsight computer. By a stroke of good fortune the diameter of this casing was slightly greater than the internal diameter of the lamphouse cylinder, so the casing was put in the lathe and parted off at 2 in. from the end, an operation which gave rise to some truly apalling noises and remarks about wakening the children. The parted-off piece was then turned down for $\frac{1}{2}$ in. till it was a nice push fit into the cylinder. The end cap of the gyroscope casing was drilled and tapped to take an ordinary bayonet fixing electric light lampholder and refitted to the top of the parted-off piece of casing. The lamphouse is mounted on the negative platform and raised $\frac{1}{4}$ in. from it by means of spacers in order to leave the gap into which the glass negative carrier slides. In view of the weight which the negative platform has to bear, it was made from a piece of $\frac{1}{4}$-in. dural, 6 in. × 6 in. A $3\frac{1}{4}$ in. × $2\frac{1}{4}$ in. aperture was cut in this directly under the centre of the condenser. One end of the negative platform is bolted to the arm of the sliding collar and the other end shaped to a curve concentric with that of the lamphouse cylinder. The bellows are leather with a 6 in. extension and are fixed to the underside of the negative platform with Bostik adhesive, which is rather messy stuff to work with, but extremely efficient. The lower end of the bellows was fixed with Bostik also to the lens plate, which is a piece of 3/32-in. dural sheet drilled and bored to fit the flange of the lens. Incidentally, lenses of different focal lengths to suit various negative sizes may be screwed into the flange if desired, but that is a refinement which will come later.

There now remained the question of the focussing mechanism. Various rack and pinion ideas were tried but none proved smooth enough to justify adoption, so recourse was had once more to the bombsight computer. This time a worm and nut mechanism driven by bevel gears was chosen and bolted to the underside of the arm of the sliding collar. The nut has a travel of $2\frac{1}{2}$ in. along the worm, which gives a sufficient range of focus for the lens. One end of an aluminium arm was bolted to the nut, and the other end, bent at right-angles, was bolted to the lens plate. The length of this arm is such that when the nut is at the top of the worm the distance from the negative to the lens plate is $3\frac{3}{4}$ in.

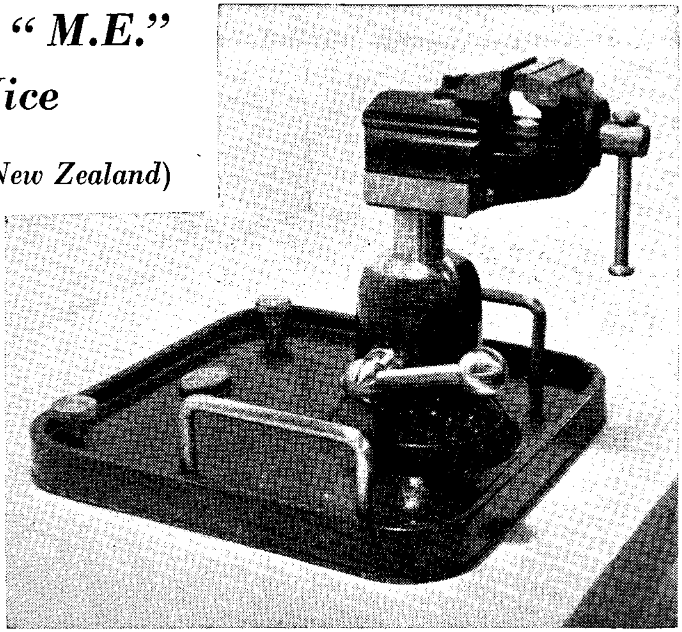
The wiring of the lamp was taken down the inside of the column and along the underside of the easel. The on-off switch is mounted in the top right-hand corner of the easel, which is mounted on six rubber feet to provide the necessary clearance for the wiring. The rubber feet are stoppers from penicillin bottles, kindly supplied by a doctor friend, and they are ideal for such a purpose.

For finishing I gave the easel two coats of rosewood stain. The resulting shade is such that hardly any visible image is formed on the easel, which I find very useful, as it makes it easy to see just how much of the picture is contained on

(*Continued on page* 1000)

An Adapted "M.E." Universal Vice

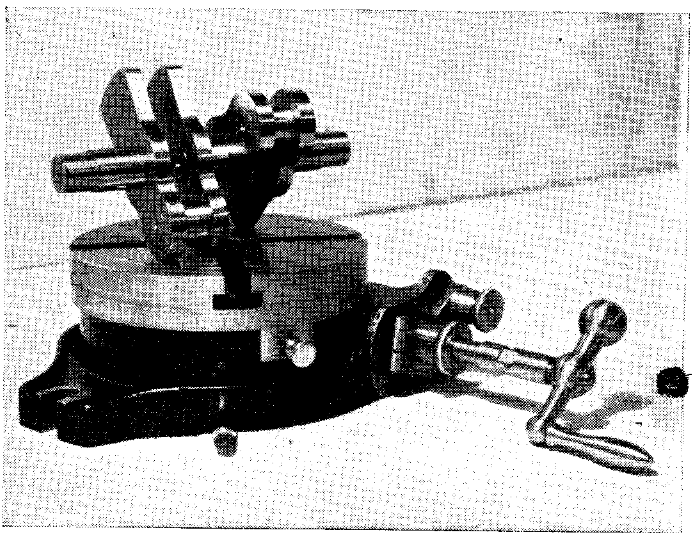
by J. O. S. Miller (New Zealand)



The vice mounted on base as a self-contained bench unit

SOME months past you published some excellent articles on the making of a small swivelling base vice. Just before this appeared I had purchased a watchmaker's vice for use in model work and your article provided a most practical and useful method of mounting it. In consequence, I trust readers will be interested in the photograph of the finished job and approve of the modifications made to suit my purpose.

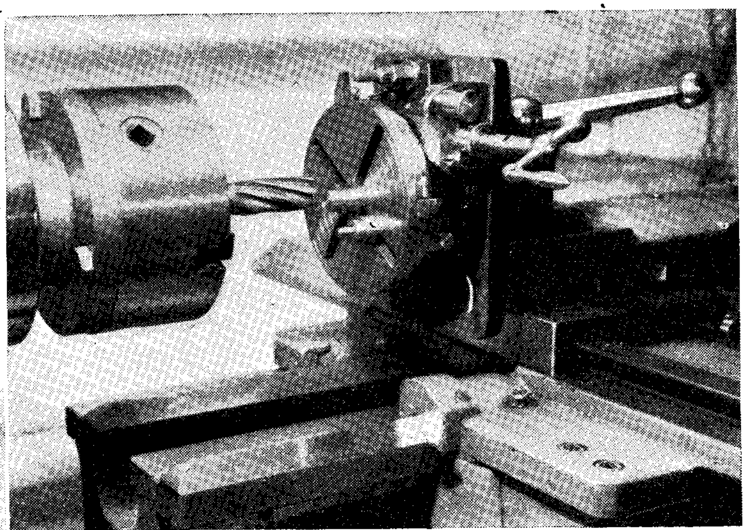
The idea was to have a portable unit, yet one that would sit securely and be free from vibration when filing. Patterns were made to obtain castings with plenty of weight in the right places, and the ball, etc., scaled up to $1\frac{5}{8}$ in. diameter with a 1 in. diameter neck. The base provides a tray for files and small tools and has a sheet of rubber glued on to ensure steadiness and grip on the bench. The knurled knobs operate countersunk-headed screws which are countersunk into the base casting. They have rubber buttons glued to the heads and protrude on adjustment through the base, to remove shake or rock. Few benches are really flat and one or other of the screws usually require adjustment. The handles facilitate the placing of the vice in the most suitable place and in good light. It will sit absolutely solid and steady on any bench and is vibration-free when filing.



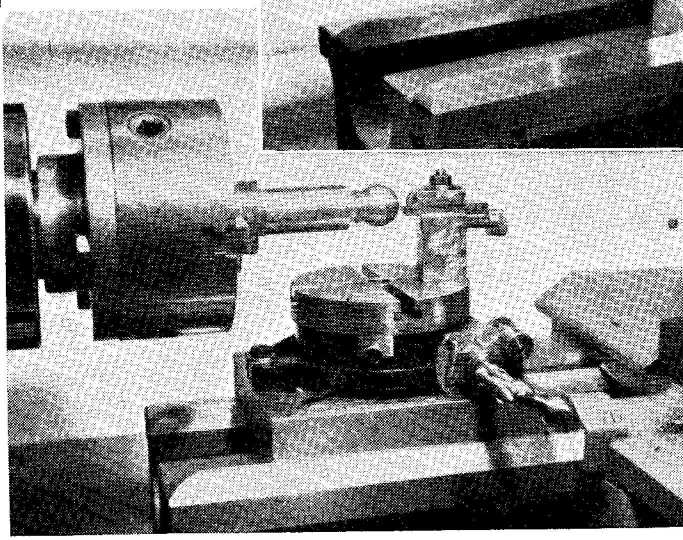
The rotary milling table, showing also two-throw crankshaft for $\frac{3}{4}$-in. scale locomotive

The ball turning was made easy by the use of another recently finished job—the 4 in. rotary milling table shown in the photographs and used on a "Harrison" lathe. This appliance, set up on a specially made angle-plate for the toolpost, makes the milling of crank-webs, coupling-rod ends, etc., very easy—the adjustable stops are used for such work. The crankshaft webs for my $\frac{3}{4}$-in. scale "Princess Royal" were milled in this way and are shown in one of the photographs.

The table itself was first thought out by a club member, George Martin Jnr., who prepared suitable drawings scaled down from a full-sized table and supplied all data for gear cutting, etc. His father, another member of our Timaru club, made beautiful patterns, and several members secured castings from



Right—The rotary table, mounted on angle-plate for lathe milling operation



Left—How the ball for the swivelling vice was turned, using the rotary table as a ball-turning attachment

them. I found the making of this table a most interesting job, as it involved some careful turning and gear cutting; also, toolmaking to produce the gashing cutter hob required to make the worm-wheel. The table is graduated 360 deg., the worm is single-start with disengaging movement, and the worm-wheel has 60 teeth. The collar on the feed shaft has 72 divisions (= 5 minutes). An ingenious locking device locks the table securely by vertical pull-down motion.

A Vertical Enlarger

(*Continued from page* 998)

the printing paper. All bright parts, except the column, handwheel and sliding collar were painted with Johnson's Dead Black, a quick-drying cellulose flat paint, obtainable from most photographic dealers.

The negatives are sandwiched between two sheets of optically flat glass, obtained from an astrograph, and hinged along one side with transparent adhesive tape. Suitable masks for different sized negatives were cut from black paper.

The light source is a 100-watt lamp internally sprayed white. With this and the f4.5 lens at full aperture, a bright image is formed, which makes for easy and accurate focussing and helps to prevent eye-strain. Even after prolonged use, there is no excessive heating of the lamphouse and the negatives remain perfectly cool.

The equipment used for this job was a Myford M.L.7 lathe and a ¼-in. drilling machine, plus the usual assortment of taps, dies and handtools.

The final touch was supplied by my wife who made the dust cover, which is a most essential item if spotty prints are to be avoided.

Novices' Corner

Using Jenny Calipers and the Marking Gauge

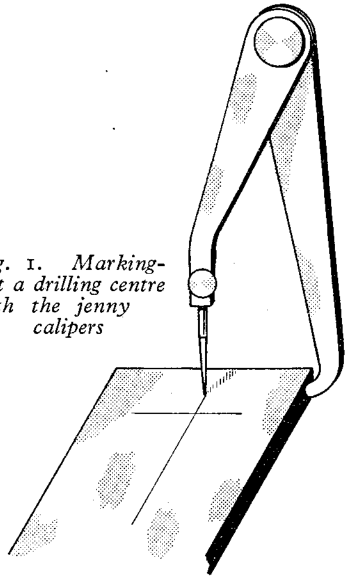


Fig. 1. Marking-out a drilling centre with the jenny calipers

JENNY calipers provide a quick and easy means of marking-out dimension lines with a high degree of accuracy. Take, for example, the piece of work shown in Fig. 1 ; here, a drilling centre on a batch of parts has to be located from the edges of the work.

Once the calipers have been set, all similar dimensions are scribed and then, after the calipers have been reset to the second dimension, the marking-out of all the parts is completed ready for centre-punching and drilling.

For the reason given later, jenny calipers are made with a so-called firm or plain joint, as opposed to the spring form of joint with which other varieties of calipers are commonly fitted.

As illustrated in Fig. 2, the pointed scribing leg is made in two forms ; either its end is merely brought to a point and sharpened, or the leg is fitted with a detachable scriber held in place by a clamping-screw. To give good service, the pointed tip of the scribing leg must be kept sharp. The solid form is sharpened by first opening the calipers until the legs lie in a straight line, and then rubbing the tip to and fro on an oilstone with a rotary motion so as to sharpen the point evenly on all sides. Since the rubbing strokes are made with the point leading, it is best to use a hard variety of oilstone in order to avoid scoring the stone's surface. The detachable form of scriber leg is, of course, much easier to manipulate on the stone, and this pattern has the further advantage that it can be adjusted to mate exactly with the guide leg to make good any shortening resulting from ordinary wear.

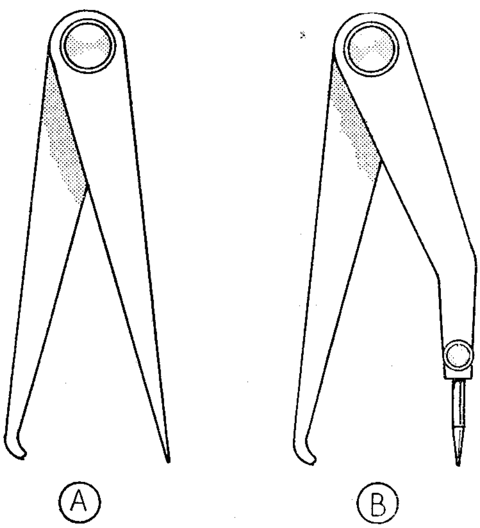


Fig. 2. Two forms of jenny calipers— "A"—with solid scribing leg ; "B"—with detachable scriber

As represented in Fig. 3, the usual method of setting the calipers is to place the scriber point in the rule graduation corresponding with the required dimension, and, while the point is retained in this position by firm, downward pressure, the guide leg is pressed so that it closes on the end of the rule. To obtain an accurate setting in this way, it is essential in the first place that the end of the rule should be in good condition and not damaged by wear or misuse; secondly, the caliper joint must work firmly and smoothly, but without springing.

To test for springing, set the calipers as described, and while the rule is still in position hold it against the light ; if light can then be seen between the tip of the guide leg and the end of the rule, it means that, after being set, the calipers have sprung open by this amount. The remedy, here, is to dismantle the joint for cleaning and oiling and then to adjust the setting of the joint-screw until the calipers work properly.

It was stated earlier that jenny calipers are furnished with the ordinary form of firm joint ; if, however, a spring joint were fitted, it would mean manipulating the adjusting screw until the scriber leg were judged to lie exactly in the rule graduation.

A visual error in making the setting might then quite easily result ; whereas, when applying the method described for the firm joint calipers, the guide leg is pressed firmly inwards as far as it will go and no control by the eye is called for.

The work is prepared for marking-out by painting its surface with a thin film of marking

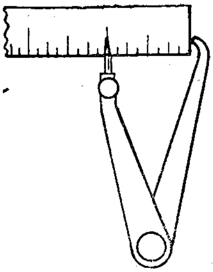


Fig. 3. Method of setting the calipers

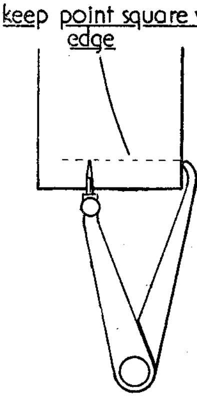


Fig. 4. The calipers must be square with the work

fluid, such as Talbot Blue which is obtainable from the tool-merchant. The guide leg of the calipers is applied to the edge of the work, and a line is drawn by pressing lightly on the scribing point. The object of marking-out is to trace a line that cuts through the dry marking fluid and lightly scratches the surface of the underlying metal; if, however, an attempt is made to cut a groove in the metal with the scriber leg, it is quite possible that the setting of the calipers will be affected, and, in any case, the use of unnecessary force may easily lead to inaccurate work.

Throughout the scribing operation, as well as when setting the calipers, the two legs must be kept lined truly square with the edge of the work, as illustrated in Fig. 4; otherwise, the line will not be scribed at the correct distance from the guiding edge. Furthermore, the tip of the guide leg must be kept level with the work surface or, again, errors will be introduced. The latter form of faulty handling can be avoided by using the type of jenny calipers manufactured by Messrs. Moore and Wright; these, as shown in Fig. 5, have a step formed on the guide leg which serves to keep the leg level with the work.

The Marking Gauge

The ordinary marking gauge, or scratch gauge, used by carpenters will no doubt be familiar to readers, but a tool of this sort will, at times, be found useful for marking-out metal work, particularly sheet material. Recently we had to mark-out a quantity of sheet metal, and the width of the settings required was rather more than the jenny calipers could manage.

It was decided, therefore, to make a gauge for this purpose, and the finished tool is shown in Figs. 6 and 7. It will be seen that the bar carrying the scribing point slides in a body furnished with guide surfaces and having a clamping device for securing the bar after it has been set. For the scriber, a hard gramophone needle is used, as this can readily be replaced when blunted.

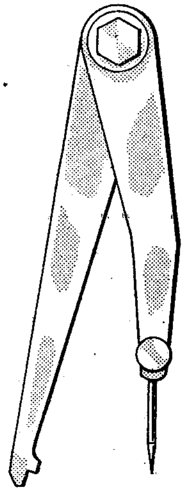


Fig. 5. Moore & Wright calipers with stepped guide leg

The needle is clamped in position by means of an axial screw and, for the sake of neatness, this end of the bar is enclosed by a removable cap. A draw-cotter and nut is used to clamp the bar in the body. The guide surfaces at the lower edge of the body serve to keep the tool square with the work, and, at the same time, the step provided supports the body at a uniform height above the work surface. In use, the scriber is set at the required distance from the guide face with the aid of a rule, and the needle is also given a slight trailing action so that it does not tend to dig into the material. The gauge is very easy to use, as the body is well supported, and it is only necessary to press the guide face inwards, while sliding the tool along the edge of the material with the scriber kept in light contact with the work.

Reference to the photographs will show how

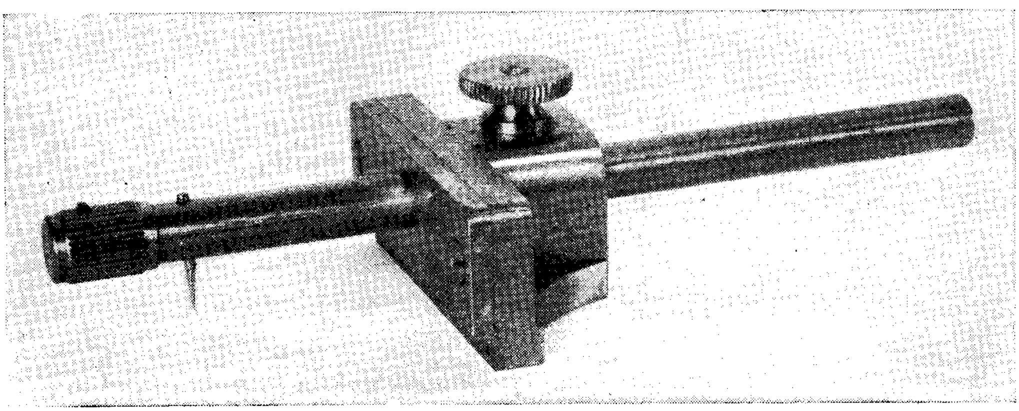


Fig. 6. The finished marking gauge

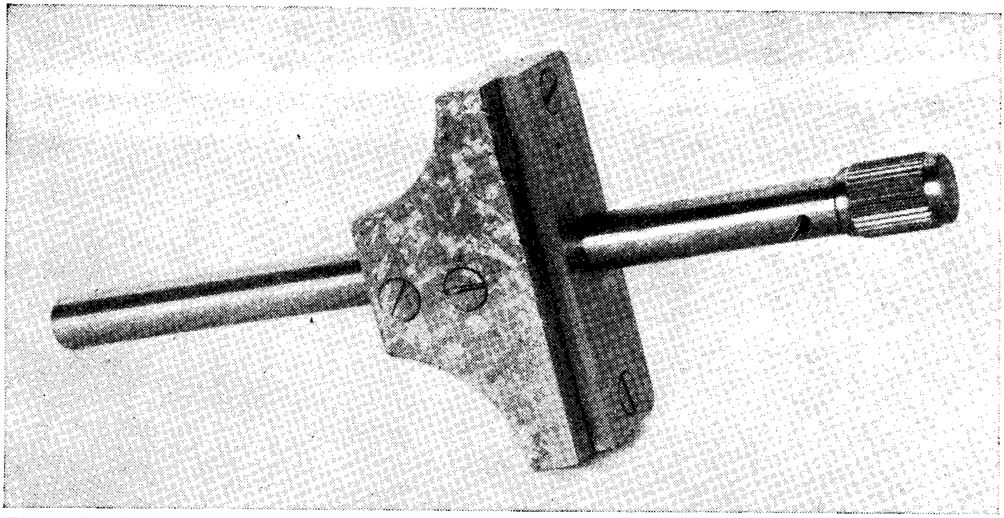


Fig. 7. Under side of the gauge, showing the guide surfaces

the parts of the gauge are assembled, and the working drawings, Fig. 8, give the dimensions of the various components.

The base portion of the body (*A*) consists of a short length of steel angle, and to it is secured the guide strip and the block for clamping the bar (*C*).

It is best to use a length of silver-steel for making the bar, as this material is straight, and s formed accurately to size; a good sliding fit should therefore be obtained if the hole in the body is finished with a reamer. The general construction is quite straightforward, and no difficulty will be found in fitting the components of the body together if the holes to receive the screws are drilled and tapped while the parts are secured in position by means of a toolmaker's clamp. However, the fitting of the cotter (*B*), which serves to clamp the bar, requires some care, and its drilling centre must be accurately marked-out in accordance with the drawing. As will be seen, a curved slot, $\frac{1}{16}$ in. deep, is machined in the side of the cotter, so that when the clamp-nut is tightened the bar is gripped firmly. The cotter itself must be in place in the body while the hole to receive the bar is drilled and reamed to size. To fix the cotter in place during this operation, it is made a tight press fit in the body; afterwards, it is reduced in diameter, to afford a close working fit, by careful treatment with a strip of abrasive cloth while the part is rotated at high speed in the drilling machine.

The removal of the cotter from the body, when the machining is finished, will be easier if, in the first instance, the cotter is made from a piece of rod long enough to be gripped in the vice. Next, the cotter is cut off to length and then mounted in the lathe chuck for machining and threading the end to receive the clamp-nut. Although the cap illustrated, which fits over the binding screw securing the scriber needle, is in no way essential for the working of the tool, it nevertheless adds greatly to the appearance of the finished marking gauge.

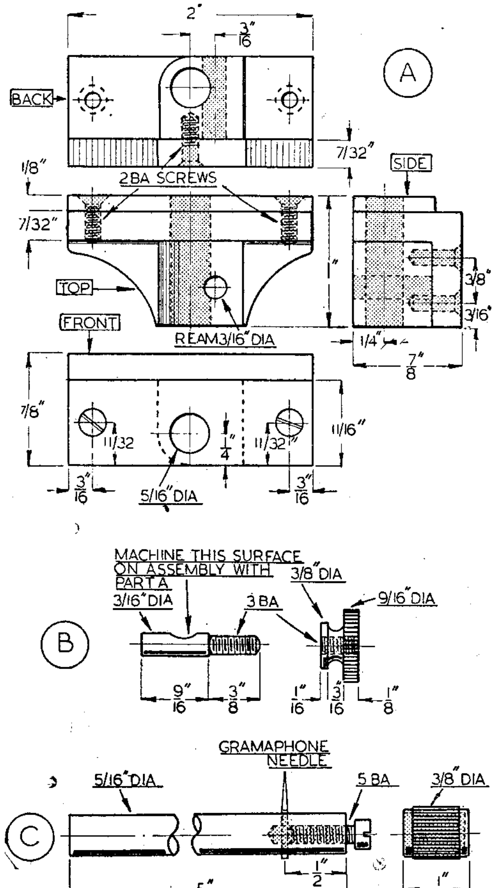


Fig. 8. Parts of the marking gauge. "A"—the body; "B"—the locking cotter; "C"—the bar with its scriber and cap

Improvements and Innovations

No. 13—Quartet

by "1121"

WE once saw a film consisting of four short stories by a famous author, and each story had a moral which we were left to draw for ourselves. We give here four other short stories, which we do not anticipate will ever be made into a film, but which, nevertheless, also contain morals which we will leave to readers to work out without further comment from us. We will merely state that each one has a distinct bearing on some aspect of the question of safety which we have discussed in one or other of our previous articles on this subject.

Story No. 1

Once upon a time, we were invited to take the society's engine to run at a local club exhibition. When we got there we found that another S.M.E.E. member had turned up with his engine, which was put on to run first. We were asked to drive this engine while the owner went to tea. While we were driving, a local club member came up and asked if he could take over for a bit. Well, we said as tactfully as possible that we would rather he asked the owner's permission first. When the owner came back from tea the local club member approached him and was allowed to have a drive. After a period of quite blameless driving the local club member drove the engine over the end of the track on to the floor some 2 ft. 6 in. below. We hasten to assure readers that it was a pure accident and could have happened to anybody; but we wonder what success we would have had in trying to convince the owner of this if *we* had put the local club member on to drive and whether we would have been left in charge of the engine again.

Story No. 2

Once upon a time, A Man We Know went to watch the running on a 7¼-in. gauge track at a local exhibition. After some time the driver, who was also the owner of the engine, got fed up with driving, and, looking round at the assembled multitude, asked if anyone would like to take over. Up spoke a schoolboy, of no more than fourteen, to the effect that anyone could drive these things—there was nothing to it, and was thereupon installed in the driving seat, and set off down the track at great velocity with a heavy load of children. Approaching to within 10 ft. of the end of the track, with the regulator still wide open, he showed no signs of pulling up, and the owner dived at the engine in an attempt to stop the train. This was quite unsuccessful, of course, and the engine hit the dead-end (bolted down good and solid) and scattered the passengers in divers directions. When they had all landed, mostly buttered side downwards, The Man We Know assisted in the ensuing scene of great activity getting them carted off to the first-aid department.

Story No. 3

Once upon a time, the S.M.E.E. track was in operation at an exhibition, staffed by its usual personnel, supplemented by sundry other people who are regularly co-opted to help at the bigger shows. Among the latter was one whom we have always assumed should know what's what and be a fit person to take charge of an engine with safety. We put him on to drive a Very Simple Engine, whose feed-pump is more than ample for keeping up the water-level. Shortly afterwards some difficulty was encountered in getting the injector to perform, which was tracked down to the water-hose between engine and tender having become disconnected. This was put right, and we expressed surprise at the injector's being needed at all on such a Very Simple Engine, and we stayed within calling distance in case any further trouble should occur. Some time later we were hurriedly summoned because the hose was again slipping off every time the injector was turned on, and the water was no longer visible in the gauge. Water has got down to the bottom nut with the best drivers on occasions, of course, but we did not waste time expressing further surprise at its having happened with such a Very Simple Engine. The safety-valve was blowing off hard, there was a very big fire in the box, and the blower was turned full on, although it is not normally necessary to use it at all, this engine being a very free steamer. We turned it off and despatched the driver to raise the front end of the engine up on a lump of wood to keep the crown of the firebox covered while we fiddled with the hose connection. We were extremely alarmed to find still no water showing in the glass. This called for immediate and drastic action, so we whipped the engine off the track and dropped the fire. As an experiment we then rolled the engine right back on to her drag-beam, so that she was standing quite vertical, and still no water appeared in the glass, showing that the boiler had been allowed to run absolutely bone dry before assistance was called.

Story No. 4

Once upon a time, an engine with a Very Old Boiler was produced as usual for running at an exhibition. On putting air pressure into the boiler to raise steam we found that the pressure-gauge was not working. Following our usual rule we did not allow the engine to be steamed, and obtained and fitted a new pressure gauge. We applied our usual water-test to the Very Old Boiler with the object of checking the new gauge for accuracy. At a pressure of 80 lb. per sq. in. a loud "click" was heard, and the cab side was seen to move outwards from the firebox by about ⅛ in. Further examination revealed a bulge in the firebox wrapper where the last of a row of stays had parted.

PRACTICAL LETTERS

Battery Charger Circuit

DEAR SIR,—I was very interested to read Query Number 9871 and your reply. I immediately made one or two calculations on the problem, but cannot vouch for any real accuracy in the results, as there was no indication of the type of instrument used in making the stated measurements. A technically-minded electrical engineer will know that great care has to be exercised in the selection of instruments for measuring rectified a.c. parameters. I have not given the calculations, as they would take up too much room, but have indicated the assumptions made. The calculated figures should be accurate within 10 per cent., I think.

Assume 12-volt battery resistance = $\frac{1}{2}$ ohm.

Assume a.c. current equal to d.c. current (depends on instruments used).

Assume rectifier efficiency = 80 per cent.

Assume 6-ampere charging current.

Rheostat watts = 31.

Rheostat resistance = 0.87 ohms.

Using Newton's Law of Cooling. New working temperature of transformer equals 2.2 times rated temperature.

If the calculation is repeated for a 6-volt battery, the rheostat must dissipate 88 watts and have a resistance of 2.45 ohms.

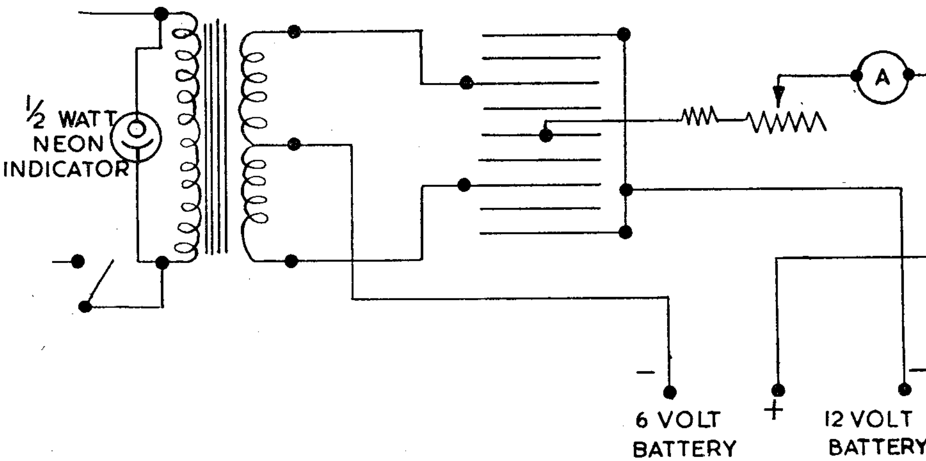
I consider that the correspondent will soon ruin his transformer at the rate he is working it, and that he would be well advised to charge at the rated current of the transformer. The life of his rectifier will also suffer because it must be remembered that the resistance of rectifiers falls with rise of temperature. The rheostat is obviously not capable of dissipating the heat generated. The efficiency is also very low when charging a 6-volt battery, since he is putting into it 36 "watts" and losing 88 watts in the rheostat!

A far better plan when charging a 6-volt battery would be to use the transformer centre tap as the negative and the centre positive on the rectifier as the positive. The charging current could be 8 amperes, making the transformer rating normal, but the rectifier could not stand it. The rheostat would have to be in the battery circuit.

A better circuit incorporating the above is shown below.

Yours faithfully,

Quarry Bank. BASIL C. R. BURFORD.



The Ladder of Success

DEAR SIR,—Your recent Smoke Ring (entitled "The Ladder of Success)" has prompted me to write to you.

Although I cannot claim any great success, it was through THE MODEL ENGINEER that I decided to be apprenticed to the M.E.T. Loco. Works, Neasdon, in 1900.

My hobby has always been steam models, stationary and marine. My model of the *Royal Eagle*, exhibited at the "M.E." exhibition 1946, was awarded a "highly commended."

I can say that THE MODEL ENGINEER has often helped me in the course of my work, especially during the last war, gadgets being required in a shadow factory, experimental dept.

I have now retired after 50 years, and live in an M.T.B. built by Samuel Whites, of Cowes, 1945 (under licence by Vospers Ltd.).

Should any reader wish to take measurements, etc., of her for a model (I believe she was the fastest type of her day) I should be pleased to make an appointment for them to look her over.

I will close by saying, how very much I have enjoyed reading THE MODEL ENGINEER and wish you much success in the future.

Yours faithfully,

Shoreham-by-Sea. MORRIS HARRIS