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"Sugar"—Rex Tingey's serialised 0-4-0T loco for 2½ in. gauge.

NEXT ISSUE

The Marshall Portable Engine returns.

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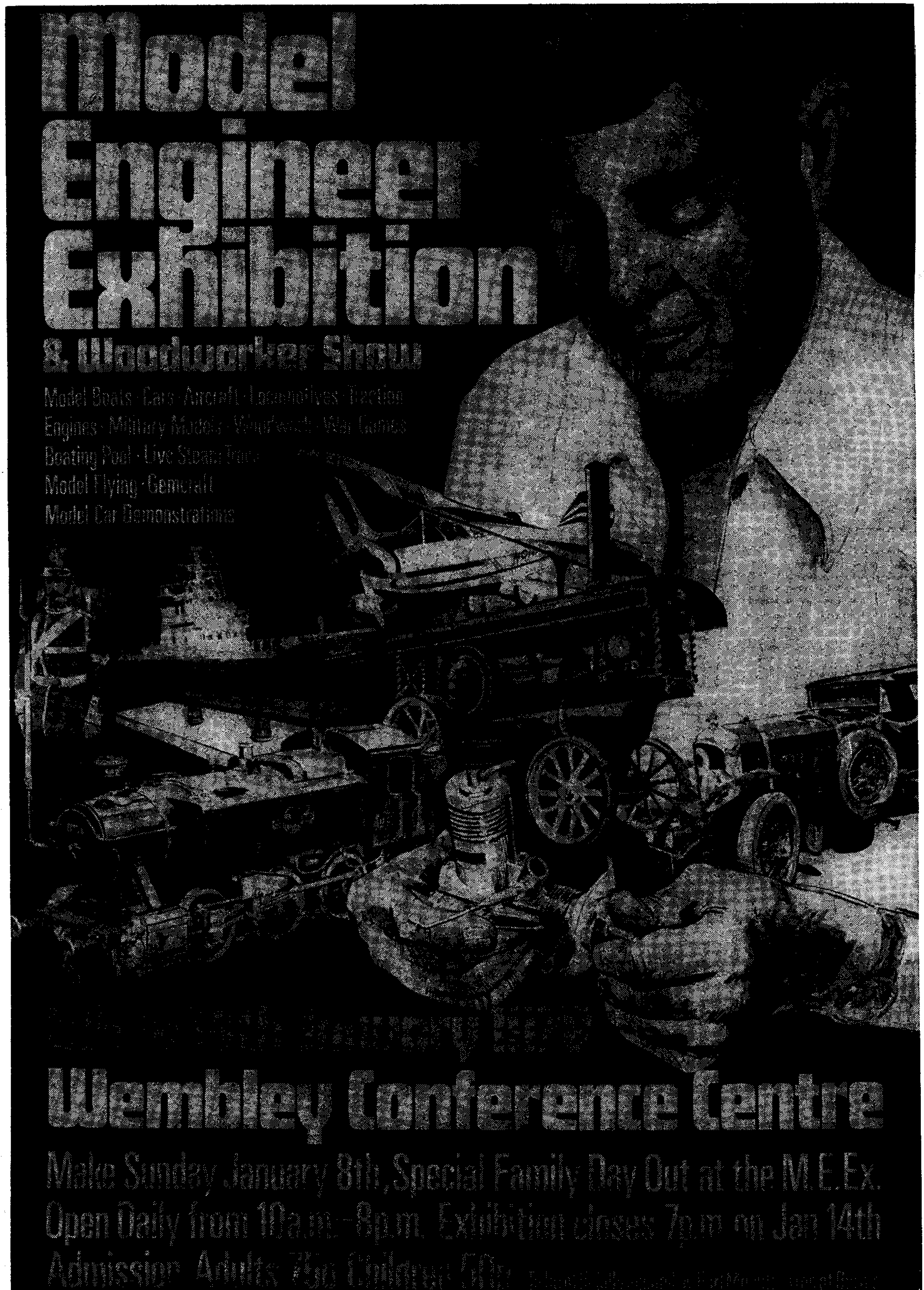
JANUARY 1978



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Engines · Military Models · War Games
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Model Car Demonstrations
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Open Daily from 10a.m.–8p.m. Exhibition closes 7p.m on Jan 14th
Admission Adults 75p Children 50p

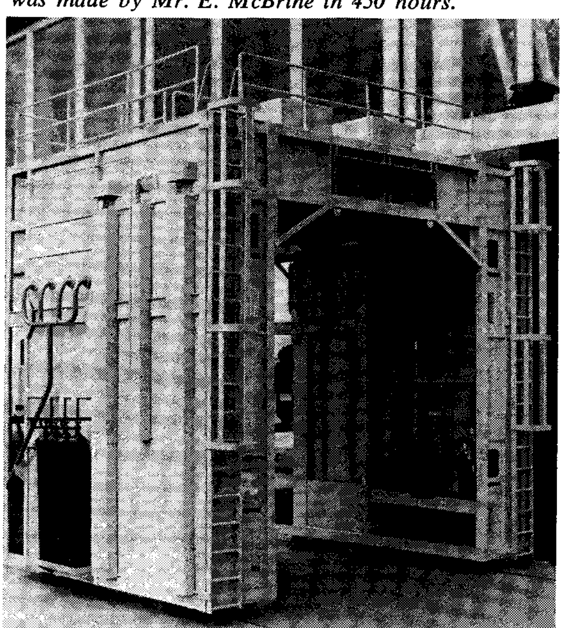
SMOKE RINGS

A Commentary by the Editor

A loco without tears

There must be many people who would like to build a loco but lack either the facilities or confidence to tackle the job from scratch. Time, too, can be a restriction, particularly when the main desire is to be out there on the track. One company which understands these problems is D.I. Developments Ltd. which manufactures special purpose machinery, and with some spare factory floor available decided that it could best put its expertise into the model loco field. After some deliberation the loco selected for the "kit" treatment was *Simplex,* a well-proven design which offers a 5 in. gauge model with sufficient performance to encourage newcomers to venture further. And this is what D.I. Developments wants to do. Initially, *Simplex* will be offered as a kit of finished parts ready for assembly using simple tools. If demand is sufficient, then "de-tuned" kits—semi-finished parts, rough castings, etc.—will be considered. Later, perhaps, there will be additions to the range. Price at present is undecided and must depend upon demand, so those interested should contact John Wood, D.I. Developments Ltd., Grays Lane, Old Town, Moreton-in-Marsh, Gloucestershire GL56 0LS.

This model of a DeVilbiss Travelling Spray Booth was made by Mr. E. McBrine in 450 hours.



Calling car enthusiasts

In this issue can be found Gerald Wingrove's article on his workshop and the photograph showing his model 1924 Hispano Suiza will no doubt generate some complimentary remarks. Those model engineers who up to now have been put off making cars and other road vehicles by the problems of tyres will be interested to know that Mr. Wingrove has written a book on the building of model cars in which full details of how he makes his tyres are included. The book is to be published around Easter 1978.

Railway preservation

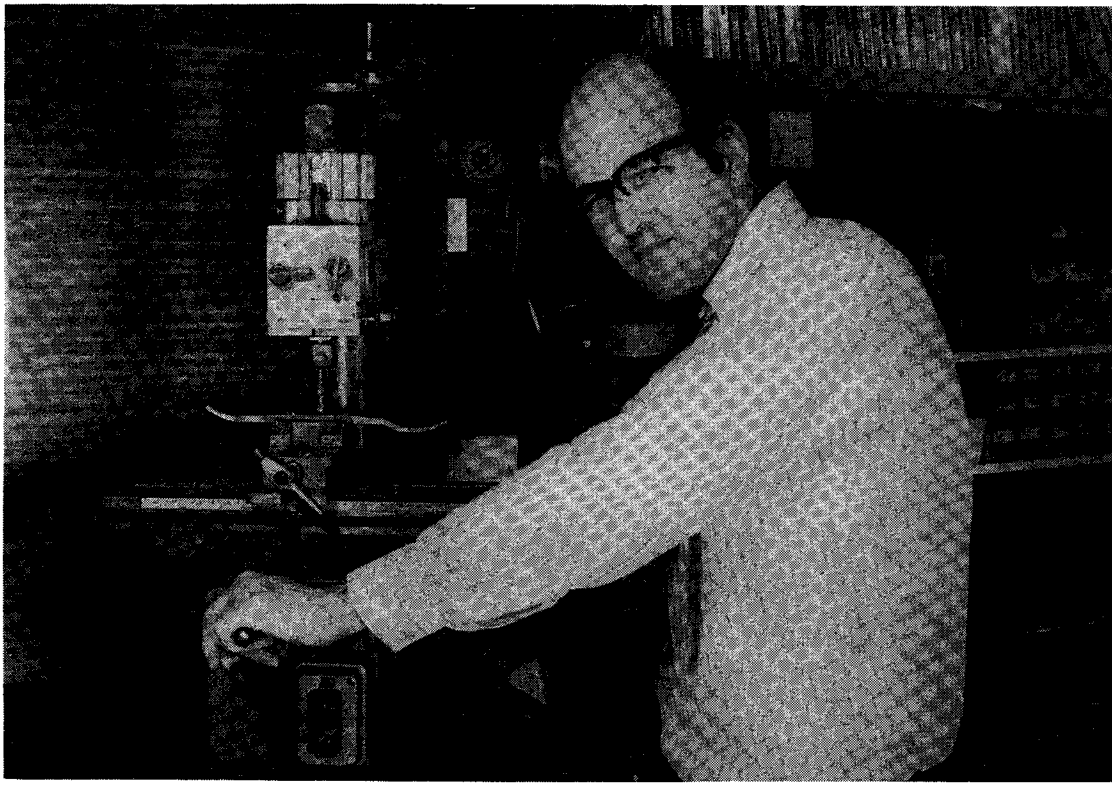
Mr. O. H. Prosser, founder of The Railway Development Association, will be already known to many readers for the series of talks he gave last year on "The History and Future of the Railway Restoration Movement". The success of these lectures has led to another series being started on 9 January. These will discuss how the circumstances affecting the closure of many lines ten to twenty years ago created the situation today of volunteer-assisted revivals on several sections. The lectures will be held on Monday evenings from 18.45 to 20.15 at the Mansbridge Centre, Wellington Street, Gloucester. The fee is £3.50. Contact Mr. W. H. Hawkins, 307 Stroud Road, Gloucester (Tel: 0452-24643). *M.E.* will be publishing an article by Mr. Prosser shortly.

Toy and Hobby Fair

Opening at the National Exhibition Centre, Birmingham, from 14-19 January, the Toy and Hobby Fair will be the biggest yet. Over 400 exhibitors are attending.

North Wales tourist attraction

Don Young writes to tell us that the ex-Dinorwic Slate Quarries "Alice" Class locomotives, built by Hunslet's between 1886 and 1932, are back in business on the Bala Lake Railway in North Wales. *Maid Marian,* one of the class, has been passenger hauling there for several years but on 9 September, this year, celebrates her 75th birthday and to mark the occasion there will be a photographic exhibition, parade of 2 ft. gauge visiting locos, and a models display. If any reader has built an "Alice" class model and wishes to take it along to run on the 5 in. gauge track or simply to show it he will be very welcome. The *Maid Marian* Locomotive Fund's Hon. Sec. is Douglas C. Carrington, 223 Sunnybank Road, Unsworth, Bury, Lancs. BL9 8JU, and the site organiser will be George Barnes, General Manager, Bala Lake Railway, Llanuwchllyn, Clwyd. Either of these two gentlemen will be pleased to offer further information if required.



EFFICIENCY BY DESIGN

Gerald A. Wingrove is a professional model engineer. It shows in the photographs on the following pages. But his new workshop may help any reader to improve his own facilities.

MY WORKSHOP is almost my home, if one counts the hours I spend in it as compared with indoors one would probably say it *is* my home. At any rate I do spend on average about 90 hours a week in there, so when I decided to build a new one I gave considerable thought to the project, and planned every detail before a sod was turned.

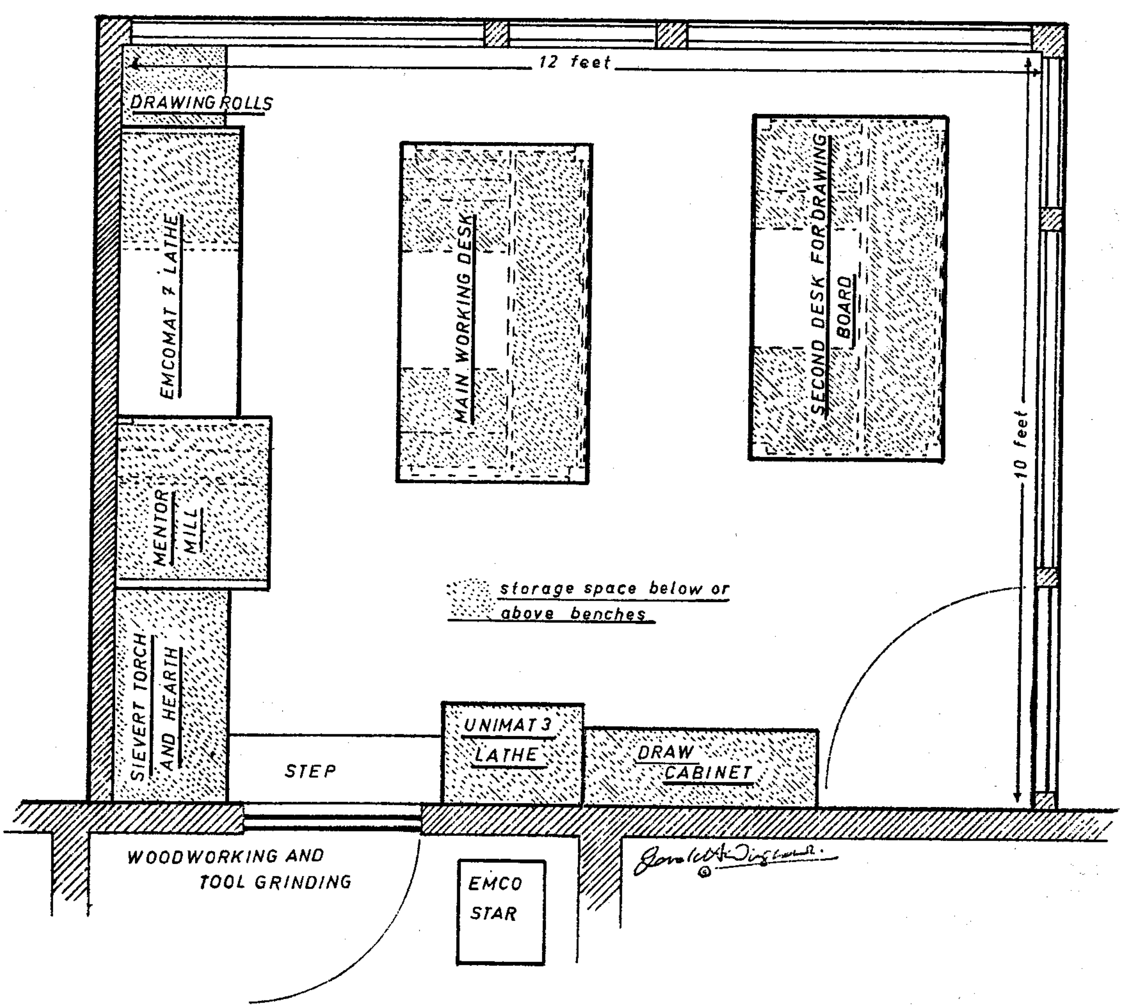
I build models—ship models, aircraft models, car models, windmills, forts, villages, scientific instruments, patterns, prototypes, jewellery, etc. My materials include woods, metals, resins and silicone rubbers, and my tools to work these include power saws, lathes, drills, mills, gas burners and spray equipment.

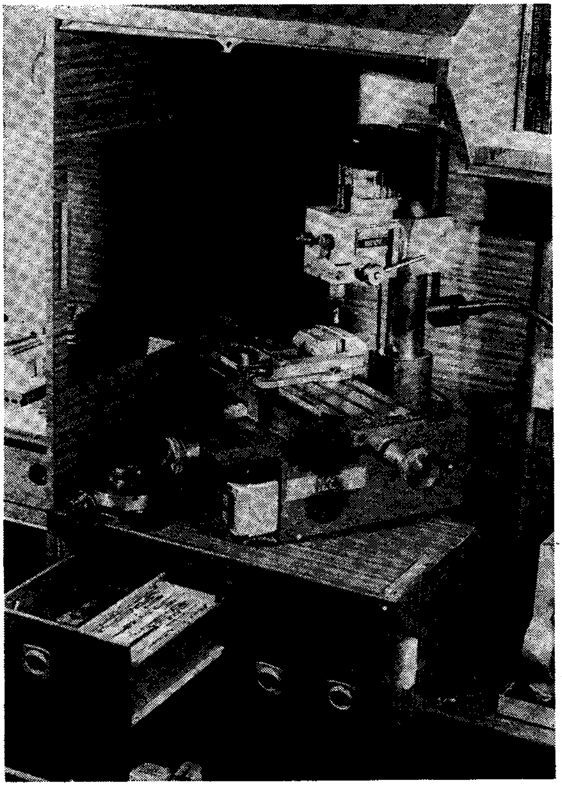
As one may imagine, ten years full-time of this in my old workshop of just 66 square feet, and I was in need of some sort of expansion. My materials and even some of the larger tools were starting to get pushed out into my garage, on the side of which my old workshop had been built. Also the wood and asbestos with which I originally built it were getting a bit frayed at the edges and last winter in particular, I suffered from icy cold draughts in the most unpleasant places.

So the decision was made, 1977 would see my model-making in a new home. I drew up the necessary plans and got them passed by the local council; the size of my new shop would be 120 square feet which was about the maximum I could get in the space available. However, before I could put the foundations down I had to dismantle a 10 ft. by 20 ft. asbestos garage and bodily move the existing workshop about six feet. This was nothing compared to the trouble of finding storage space for twenty years of accumulated "wealth" (or as my wife put it, "rubbish"). Like all good model makers and D.I.Y. experts, I never throw anything away that can be re-used in whole or in part. But with my loft full and a large tent in the garden packed solid, I had bonfire after bonfire, and nearly broke the dustman's back on two occasions with the wealth of "goodies" I had to dispose of, and as I have found on numerous occasions since, everything was irreplaceable. It still brings tears to my eyes to think of all those odd bits of wood and scrap metal gone forever.

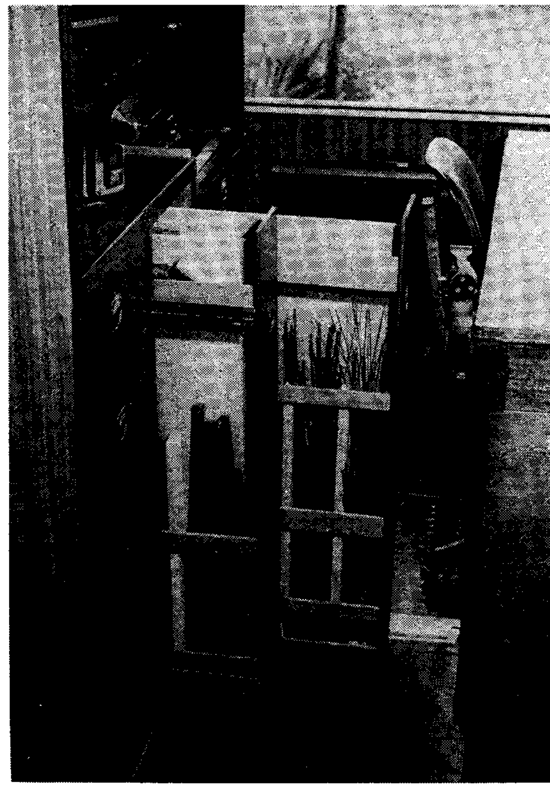
The first considerations in planning the new workplace are comfort and efficiency. If you are going to place yourself in a room for up to fifteen hours a day, for seven days in most weeks, year in year out, these must come first. So the décor was to be wood grain finishes on all surfaces, plenty of light, and a moss green carpet tile floor. So as to make it look more like a study than an engineering factory, all machinery and tools had to be out of sight. To achieve this roller blinds were fitted over the front of the benches holding the "Mentormill" and "Emcomat 7" lathe, and the hand tools were fitted in racks that slide on tracks under the desks. The windows are all double glazed and walls and ceiling fully insulated. The windows are also fitted with venetian blinds to control direct sunlight by day and reflect artificial light at night.

For the efficiency side of my original aim, one





Mentor mill with Encomat 7 head. Note the drawer of accessories and tools.



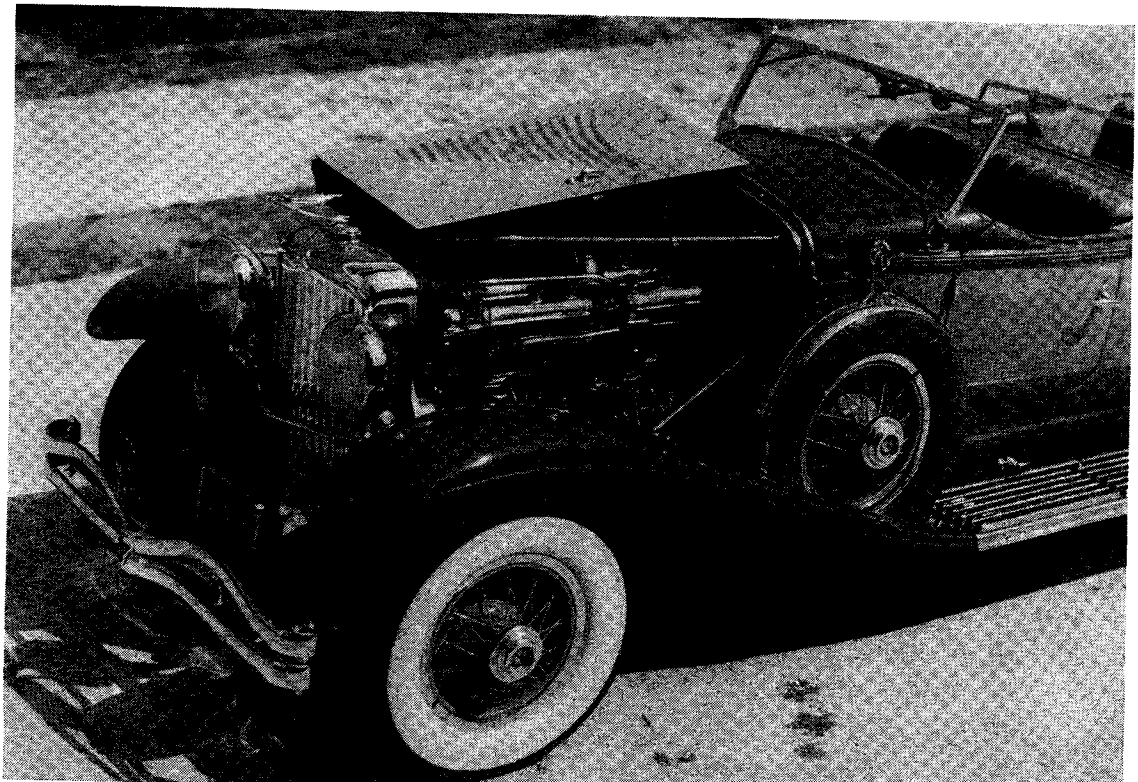
Under the mill are two sliding racks for the storage of rod and bar materials.

needs to consult the plan and some of the photos. Between the main working desk and the Emcomat lathe I have a swivel chair. I purchased two of them for about £5 each from a secondhand shop. From this one seat I can not only work the lathe and work on the desk, but I can also reach all my hand tools, files, drills, taps, lathe tools, abrasive papers, motorised flexible shaft, gas torch, soldering irons, vice, stock of materials, and radio and stereo cassette player.

When one is over the moon, engrossed in capturing the character of one's latest project, the most distracting thing is having to stop and look for the next tool. With this set-up, almost everything is within arm's length of the working area. If one gets into the habit of putting tools, etc. back in their allotted place, which is not such a problem if it is within easy reach, then one can soon learn to find everything blindfolded.

The two free-standing desks or benches were another buy from the secondhand shop. These started as oak office desks with removable legs, and two drawers apiece; each is 30 in. by 54 in. When one sits up to the desks, one's feet and legs take up less than half the depth of the 30 inches, so I recessed the oak legs to take a $\frac{3}{4}$ in. thick veneered chipboard panel on each end, and then glued and screwed another large panel down the centre between these. With a floor piece, shelves and sliding doors fitted to the other side I now had some very useful storage space. Under the existing drawers one each side of the seat position, I have fitted various sliding trays, racks and shelves to add more storage space. Both desks are the same height and positioned so that one can, with a squeeze, get right around both, so that both can be used together to accommodate large models.

My powered equipment is quite comprehensive and has accumulated over about fifteen years. The odd thing is that only quite recently I discovered it all came from the same design team. My first power tool, apart from the ubiquitous electric drill, was a secondhand Selecta Unimat purchased in the late 1950s. This brilliant piece of design work lasted me until quite recently in one or other of its guises. The next, in the early 1960s, was bought new after just one look, this being the Emco Star woodworking machine with its many attachments. This, after about 12 years of exceedingly hard, trouble-free work, is still like a second right arm to me. Because of the dust from working wood and tool grinding which are its main uses to

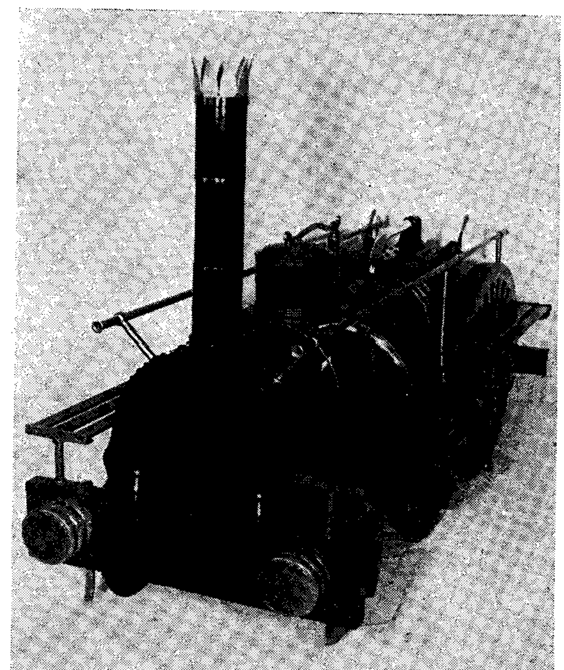


The engine detail of a 1:15 scale 1931 "J" Duesenberg, and a 36 in. high loco in wood, are examples of Mr. Wingrove's skill. The car is in a U.S. private collection.

me, it stands in a small room of its own between my workshop proper and the garage.

In the late 1960s I was called on to produce some very accurate patterns in metal for a well-known toy company with the prospect of several years' work to follow. The pieces were up to about eight inches long with elaborate turning and milling, much too big for my little Unimat. As often happens I was, within a week of the offer, visiting my local tool suppliers for some drills and other knick-knacks, when what should I see standing in the doorway but a new Emcomat 7, and as it turned out, one of the first to come into the country. I placed the order the same day and it has been the backbone of my workshop ever since. If I were to design a machine to do my sort of model work it would look exactly like an Emcomat lathe-cum-mill.

A year or so ago I saw the Mentor mill for the first time and having just about enough room to accommodate it, purchased the bed for fitting my existing Emcomat milling head and column onto it. This saves somewhat on setting-up times in that I do not have to break a set-up on the lathe before I can mill or drill something. Though this is of little importance when using the machines in a



hobby context, it does make for easier and more efficient working when you are building models as a profession.

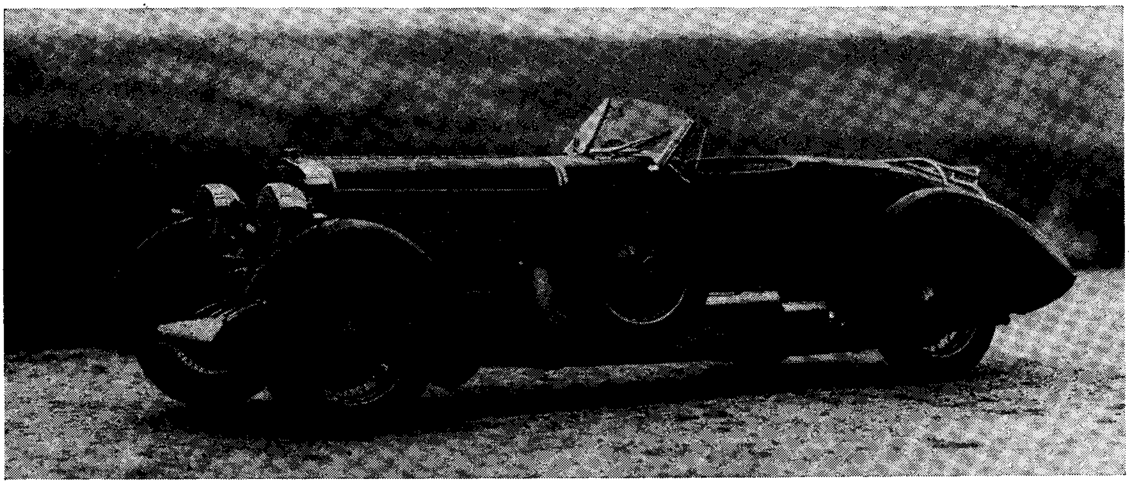
My latest edition to the equipment brings me full circle, for it is the very latest Unimat 3. This has been built into a drawer unit so that when not in use it is out of sight and dust-free. It is for the smaller jobs particularly when the two larger machines are set up for other work, and also for use in illustrating different techniques for a new book I am just starting on how and what you can do on such a versatile precision machine tool as this.

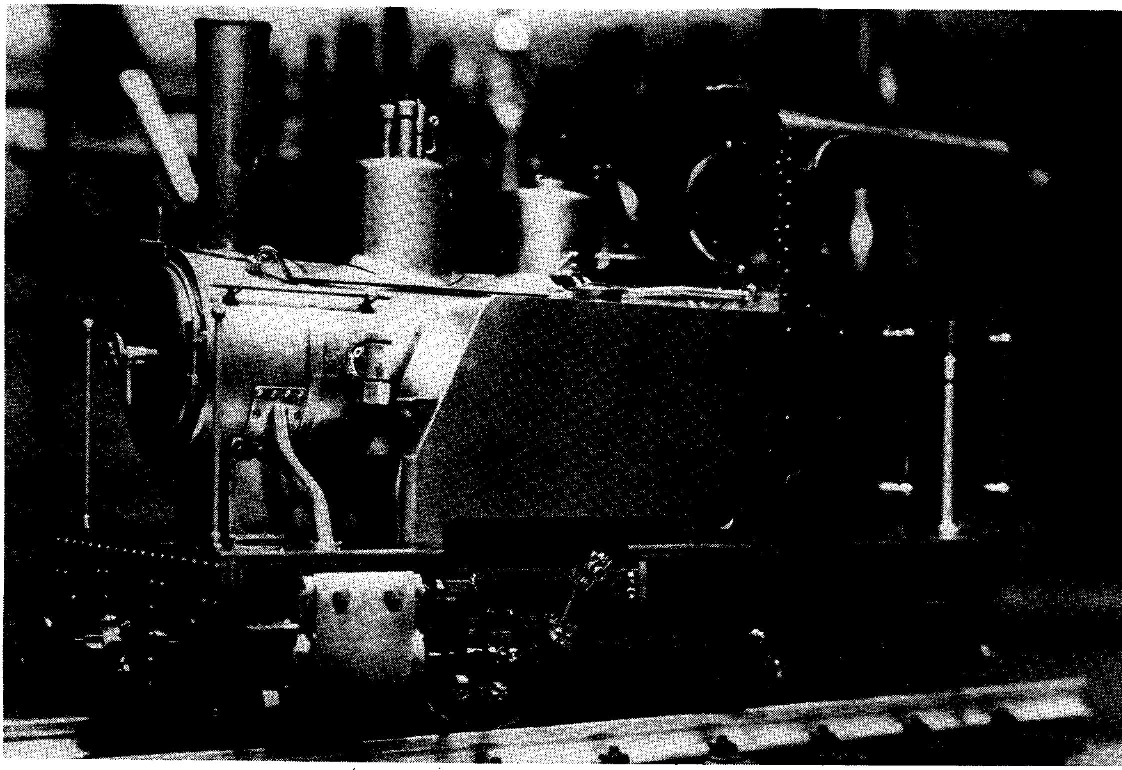
Almost all my metal work is silver soldered and for this I have a large asbestos lined area served by a Sievert torch and propane gas cylinder. For very small quick jobs I also have fitted out under the main desk an Adapto needle flame torch with its own gas supply and air pump. This same bench is also wired for 110 volts to take an American Dremel fretsaw for very fine wood and metal cutting.

The power for all this equipment is cabled under the floor in plastic piping set into the foundations before the building was erected. The two desks and the bench holding lathe and mill are all fitted with illuminated neons to show when they are live, and all can be isolated from a single master switch and fuse box. So there is no chance of leaving a soldering iron on at night hidden under one of the desks, as all the neons are positioned so that they can be seen from the entrance door.

All the desks and benches, etc. were built in my garage in the evenings and weekends of the two months or so before the workshop was actually put up. It is one thing to plan where and how you think things should be and it can be quite another to see if they work in practice. I have now been in residence for about three months and am exceedingly pleased to report that everything has fitted into place and works, and I even have room left to swing the proverbial cat around, if I can find one! So it is well worth while to plan everything out thoroughly on paper before starting such projects.

Right: Mr. Wingrove's daughter shows the compact installation of a Unimat 3.
Below: A model 1924 Hispano Suiza.





A GAUGE 1 STEAM LOCO

Mr. Kenji Nishimura interviews the builder of this Japan-made, coal-fired model

MR. RYUICHI SATO, member of the Nippon Live Steam Club in Japan, whose butane-fired HO-gauge steam locomotive was already introduced in the 21 January 1977 issue of *Model Engineer* magazine, has completed a 0-4-0 Gauge 1 tank engine fired with coal. Despite her cylinder bore of 9 mm. and grate area of 44 mm. by 28 mm., this engine develops power to pull a trailer carrying a man on a level, straight track. The author recently had the occasion to see the builder and ask him about his new work in detail.

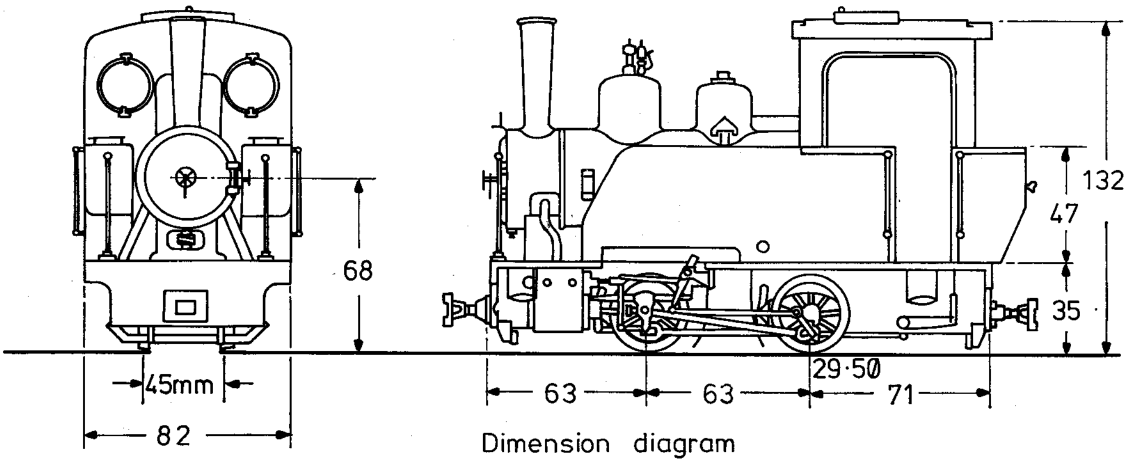
Nishimura: I understand that the prototype is a Japan-made industrial tank engine now operating in an oil refining agent manufacturing firm in Niigata Prefecture on the Japan Sea coast of central Japan. I presume you have selected this prototype taking special note of a number of characteristics which ensure high performances even when it is modellised. If that is the case, what are such characteristics?

Sato: The prototype is a locomotive used on a track of narrow gauge—610 mm. It has a large cab for its size. This means that even in my very small model built to a scale of 1/19, the cab is large enough to install such items as water gauge, pressure gauge and reversing gear in it with relative ease, and this assures an easy operation after all. Also, the fact that the driving wheels are comparatively small in diameter is especially important to obtain a larger tractive effort.

N: I also hear all the parts of your model, except the pressure gauge, screws, etc., are of your own making. Is that true?

S: Yes. Most of the parts commercially available are too large for my small locomotive, and I feared they might affect her appearance. The parts I made are mostly of brass.

N: Now, Mr. Sato, you earlier built a number of HO-gauge live steam engines to explore the possibilities of very small locomotives. May I under-



Dimension diagram

stand, then, that you had a similar purpose in attempting the construction of your new tank engine?

S: Of course you may. My purpose was to examine the possibilities of using coal on a very small engine. The boiler of my new locomotive measures only 37 mm. in diameter and 130 mm. in length, with two fire tubes each 10.4 mm. in inside diameter and 80 mm. in length. The evaporative heating surface totals 114.22 sq. cm. Now that her running performance has been fully confirmed, I can say with confidence that coal can be used effectively even with such a small sized boiler.

N: The grate area is only 44 mm. by 28 mm. With the fire grate being so small, what is the suitable size of each piece of coal burnt? And what is the relationship between coal consumption and the running distance?

S: Each piece measures about 15 mm. cube, or weighs about 3 grams. A total of about 20 grams of coal is enough to run the engine over a distance of approximately 550 metres, or 35 circuits along a circular track 5 metres in diameter. In this case water consumption is about 50 cc.

N: To obtain such fine results, on what respects did you place emphasis in constructing your locomotive?

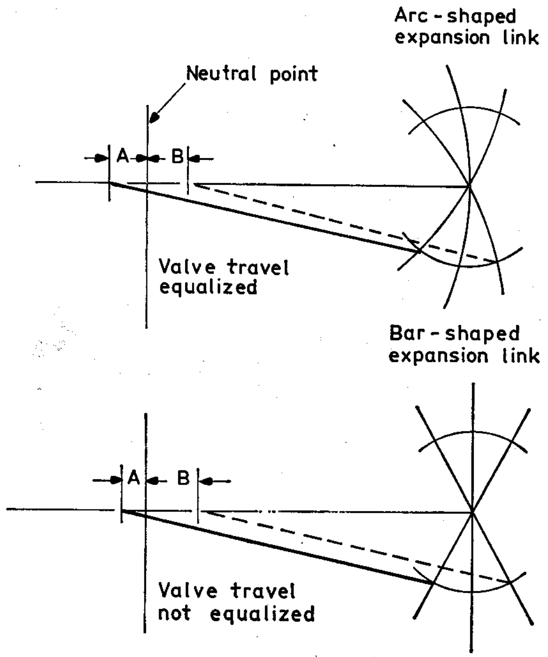
S: I took every possible means to reduce the power needed to move the loco herself. Extreme care was taken to minimise mechanical loss by adopting piston valve (diameter: 4 mm.; travel: 4 mm.; lap: 0.6 mm.; exhaust lap: 0.3 mm.) cylinders and by carefully processing the axles, crank pins, and so on. All this, after all, has served to boost the tractive effort.

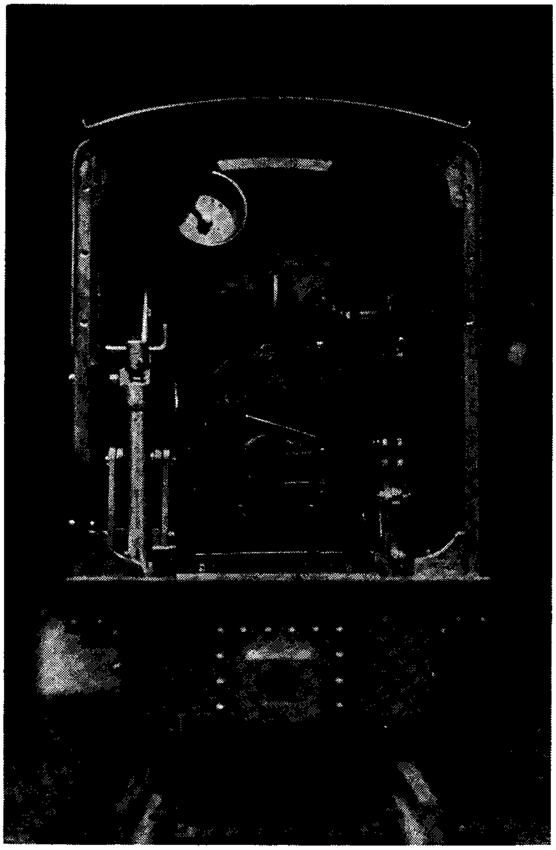
N: What, then, is the tractive effort of your little engine?

S: Believe it or not, my engine pulled a person weighing 70 kilograms on a level and straight-line steel track, using a trailer with bogie trucks having 37 mm. diameter ball-bearing type wheels.

N: Frankly, I find it hard to believe your engine, whose cylinder bore and stroke are only 9 mm. and 14 mm. respectively and which weighs a little more than 2 kilograms in working order, can display such an excellent performance. Could you give me a theoretical explanation?

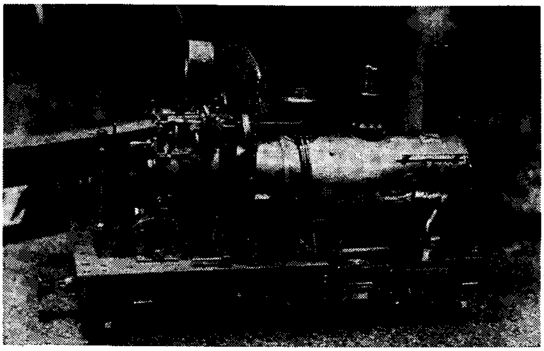
The diminutive locomotive looks even smaller on a ground level track. Mr. Sato is driving.

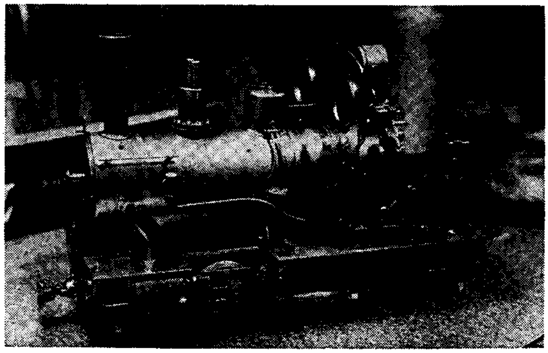


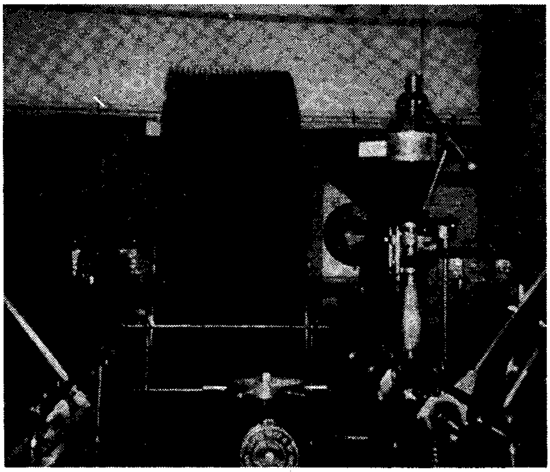


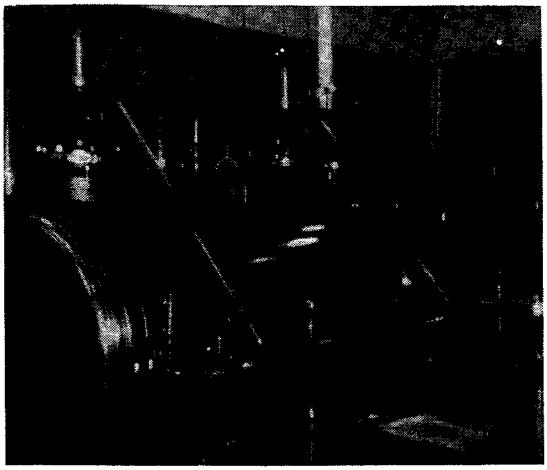
S: The effective steam pressure is 2 kg./cm.^{2} and the driving wheel diameter is 29.5 mm. Putting these values, along with those cylinder dimensions, into the conventional formula for calculation of tractive effort, we obtain the value of 0.769. Multiply this by the mechanical efficiency of 0.8, and we can get 0.615. Since the minimum weight required to move the locomotive on a level track can be known experimentally as 80 grams, we obtain the value of 0.533 by deducting 0.080 from 0.615. This shows that the theoretical tractive effort of my loco is 535 grams when the effective steam pressure in the cylinders is 2 kg./cm.^{2} Meanwhile, the locomotive weight, which is about 2 kilograms, can be regarded as the adhesive weight since she has neither leading wheels nor trailing wheels. Thus we can get the value of 0.4 by multiplying 2 kilograms by 0.2, which is taken up as the friction coefficient between the driving wheel treads and the rails. The value of 0.4 here indicates that it is possible for the locomotive to develop a drawbar pull up to 400 grams without having the driving wheels slip. Since, usually, a model locomotive is capable of pulling a weight 120 to 150 times the value of her tractive effort when a trailer with ball-bearing axles is used, the weight which can be pulled by my tank engine becomes 48 to 60 kilograms. In actual practice, however, we must raise the boiler pressure somewhere between 2.5 and 3 kg./cm.^{2} taking various mechanical losses

Continued on page 37









ALAN HAWORTH DISCUSSES

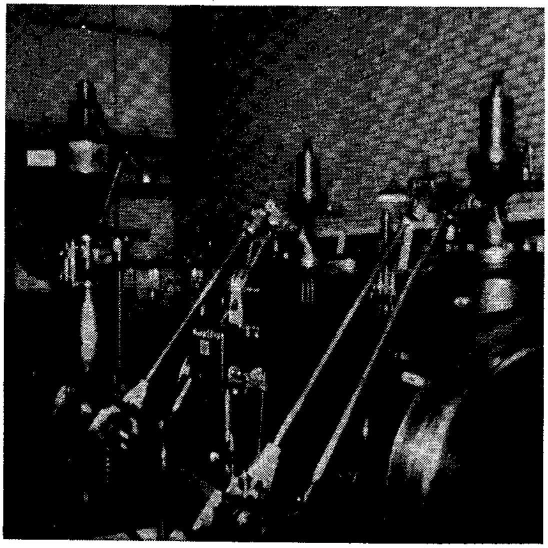
A MODEL CROSS

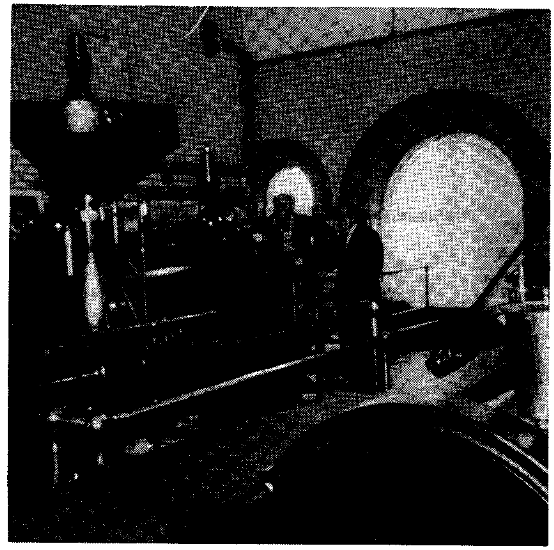
AT THE TURN of the century, a popular prime mover was the drop valve engine. They were much in favour on the continent of Europe. Such valves were not new, and had been in use on early beam engines. In about 1850, Geo. H. Corliss, 1817-1888, the eminent American engineer, invented his now famous "Corliss" valve gear. These, with their high steam economy, automatic load governing, were immediately accepted with enthusiasm by British engine builders. They reigned supreme for more than a century. However, about 1890, it had been proved, by Swiss and German engineers, that the drop, i.e. "poppet" type valve was just as economical in steam. In consequence, they came to be used in British mills.

At first, these engines were constructed with inlet steam and exhaust, all drop valves. This meant that the exhaust valves were situated below and under the cylinder. These valves were therefore very inaccessible and extremely difficult of maintenance. They were eventually replaced by Corliss type, that is, semi-rotary valves. This arrangement resulted in all the valves being above engine room floor level, and thus facilitating maintenance.

The inlet valves of the full-size engine are of necessity of the "double beat" type, that is to say the valve is in equilibrium and no "steam load" is imposed on the valve. For example, a disc valve of 6 in. dia. "single beat" will have a load of some 2700 lb. imposed on its seat, with an admission pressure of 100 p.s.i. A force in excess of 2700 lb. is thus required to lift the valve from its seat. This is rather an excessive force to be accepted by the valve tripping gear. Once the valve has lifted, the pressure, of course, is equalised. However, in the model, a "single beat" valve is shown. This is largely because a "double beat" valve is a trifle complicated to make, and secondly, the area of the valve is small, around $\frac{1}{4}$ sq. in., and the boiler pressure can be kept to a minimum, thereby reducing the imposed "steam load" on the valve. Should the modeller prefer to conform to standard practice and incorporate double beat valves, so much the better. These steam valves are operated by Corliss type tripping gears through valve rods driven from the lay shaft via eccentrics. The lay shaft is driven from the engine crankshaft through bevel gears. It is essential that these gears be mitre, i.e. of equal ratio. The speed of the lay-shaft must be at crankshaft speed.

An unusual feature of the engine is the tail-slide operated vertical "Edwards" type air-condensate extraction pump. It will be appreciated that, in the full-sized engine, the majority of this equipment is below floor level and therefore unseen. For the purposes of the model, however, it is suggested that the flooring between the foundation blocks be omitted. The pump motion is particularly fascinating to see in action. The foundation block should be constructed in wood, and painted in a stone colour. The cylinders are largely self draining. The low pressure cylinder will drain to the





Photographs by courtesy of L. Twinney Esq.

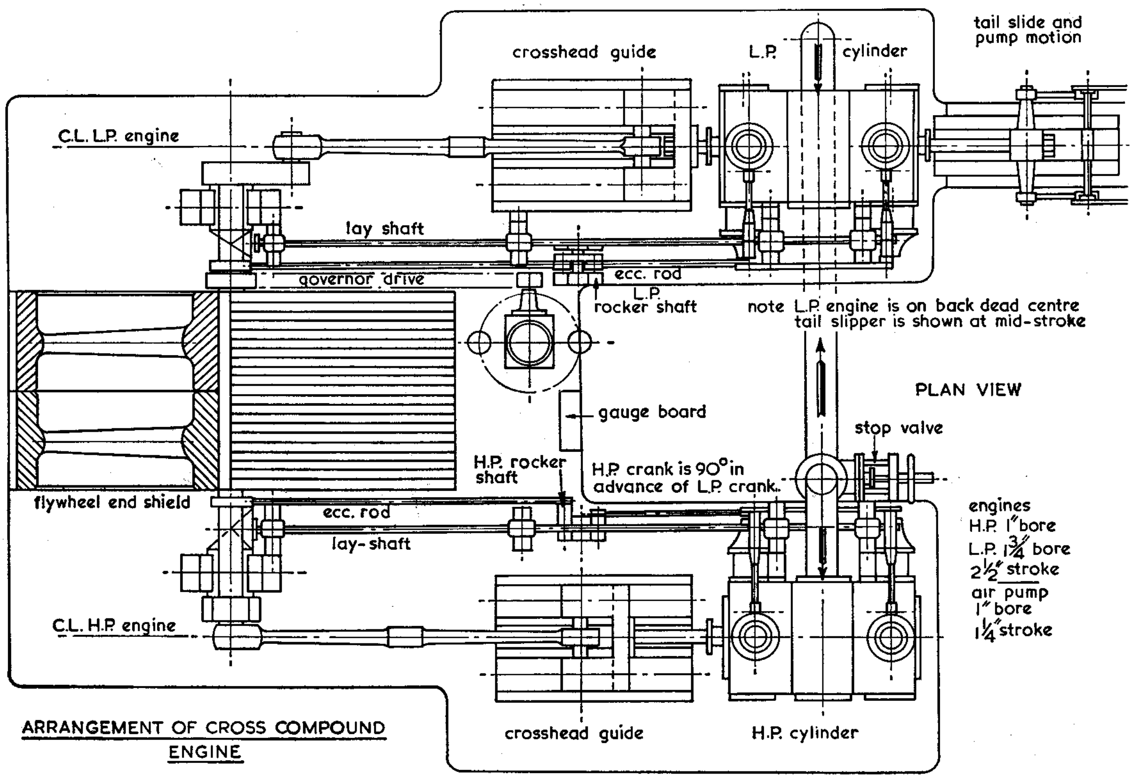
COMPOUND MILL ENGINE

condenser, and the high pressure cylinder will drain to the crossover pipe between the cylinders. It is this pipe which must be drained. This is accomplished by fitting a drain valve at the crossover pipe and another at the feed tank into which it is to drain. When the engine is running, both valves should be shut. When draining is to take place, the valve at the crossover is to be opened for a short period and then closed. The valve at the feed tank is now carefully opened, allowing condensate to drain into the tank. This procedure allows drainage of the pipe without loss of vacuum. Care is required at the tank for the simple reason that "flashing" will occur at the end of the drain pipe. Under no circumstances should the end of the drain pipe be submerged below the water level in the tank. If this is allowed to happen, a series of "cracklings" and "bangings" will be heard from the tank when the drain valve is opened. The contents of the tank is used for boiler feed, and very often a single ram boiler feed pump was situated here and driven from the air-pump crosshead. The feed tank itself is fitted with an overflow at one end and thereby maintains a reasonably constant water level in the feed tank. The overflow is returned to river, stream, dock or canal, from where the condenser injection water came. The contents of the feed tank should be at a temperature of some 80°F.

Frequently, the continental builders, in particular, operated the exhaust valves from cams, rather than eccentrics. This is not recommended for the model. One of their better practices was to place the governor on the lay-shaft and be driven by it. This could be incorporated in the model, to advantage.

The Steam Engine Indicator

It is necessary to know the power being developed by an engine, and this is accomplished by the use of the engine indicator. This is a precision instrument and consists of a small cylinder about 1 in. bore x 3 in. long, containing a piston. Into this cylinder is inserted a small spring, extremely accurate, and calibrated under laboratory conditions. The rating of this spring is to a certain scale, that is, proportional to the pressure being measured. A small piston rod protrudes from this cylinder and includes a small parallel motion, which ends in a "pencil" point. The whole is, of course, an engine cylinder in miniature. The other half of the instrument consists of a drum which can be rotated by a cord against a light spring. The engine crosshead drives an arm or lever, usually called the "pantograph". To this is attached the cord of the drum, which will reproduce the engine stroke to a small scale. When the indicator is attached to the cylinder and the cord is attached to the pantograph, it is obvious that a certain figure will be drawn on the paper attached to the drum. It will also be obvious that the height of this figure represents pressure, and the length



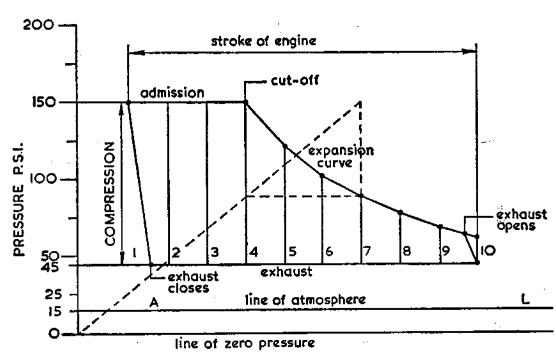
ARRANGEMENT OF CROSS COMPOUND ENGINE

represents stroke. Since the foot-lb. is, or was, the unit of work, it should also be equally obvious that the area of the figure represents the work done, in that particular stroke at least.

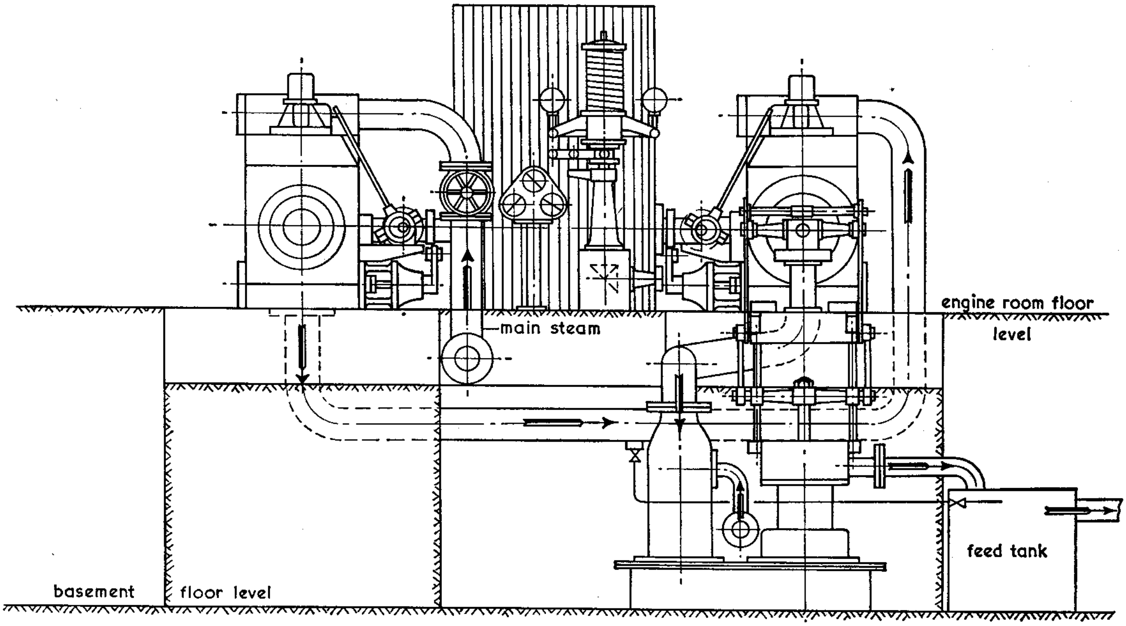
The formula used for calculating the power is given by: P × L.A.N. divided by 33,000 where P = the M.E.P. (mean effective measure). L = Length of stroke in feet, A = Area of piston sq. in., N = Number of working strokes per min. 33,000 = Internationally agreed figure of the number of foot/lb. per horse power.

It is seen that the M.E.P., or average pressure, is required. The diagram clearly shows the actual pressure at any and every point of the stroke. Since the height of the figure represents the pressure, what is needed is the average height of figure. This may be accomplished in two ways, first, the length of the figure is divided into ten or twelve equal divisions, called ordinates. The height of each line is measured to the scale of the spring. These heights are added up and then divided by the number of lines. The resulting figure given is the average height and therefore, the average pressure, or the M.E.P. (Mean Effective Pressure). This is the force acting on the piston during a single stroke.

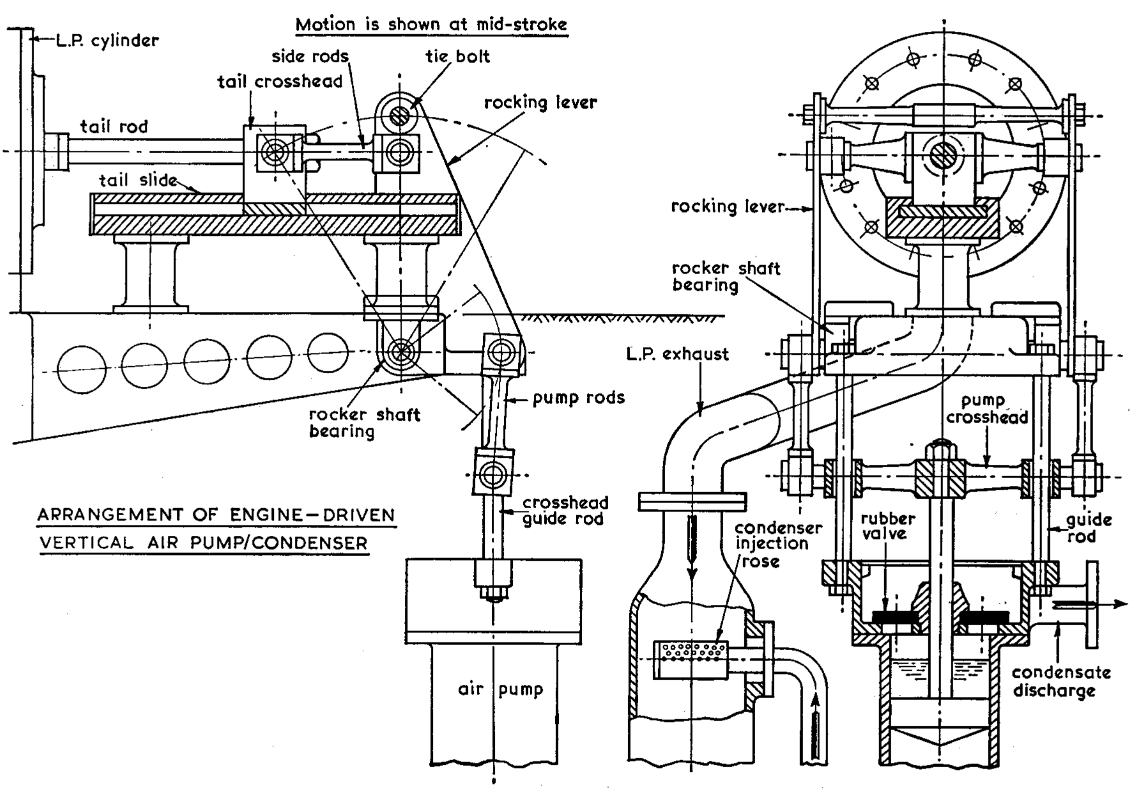
The second method is to use a "Planimeter". This is a scientific instrument which will give the area of a figure directly. It is supposed to be more accurate than using the ordinate method. It is certainly quicker, but persons employed in calculating the powers of engines are not usually on "piece-work". It will be seen from the formula that there are two variables, i.e. P. and N. (pressure and speed). The other two, "L" and "A", also 33,000, are constants. It was the practice to multiply "L", "A" and "N" together, and record this figure in the engine log. This considerably shortens the calculation required to ascertain the power.



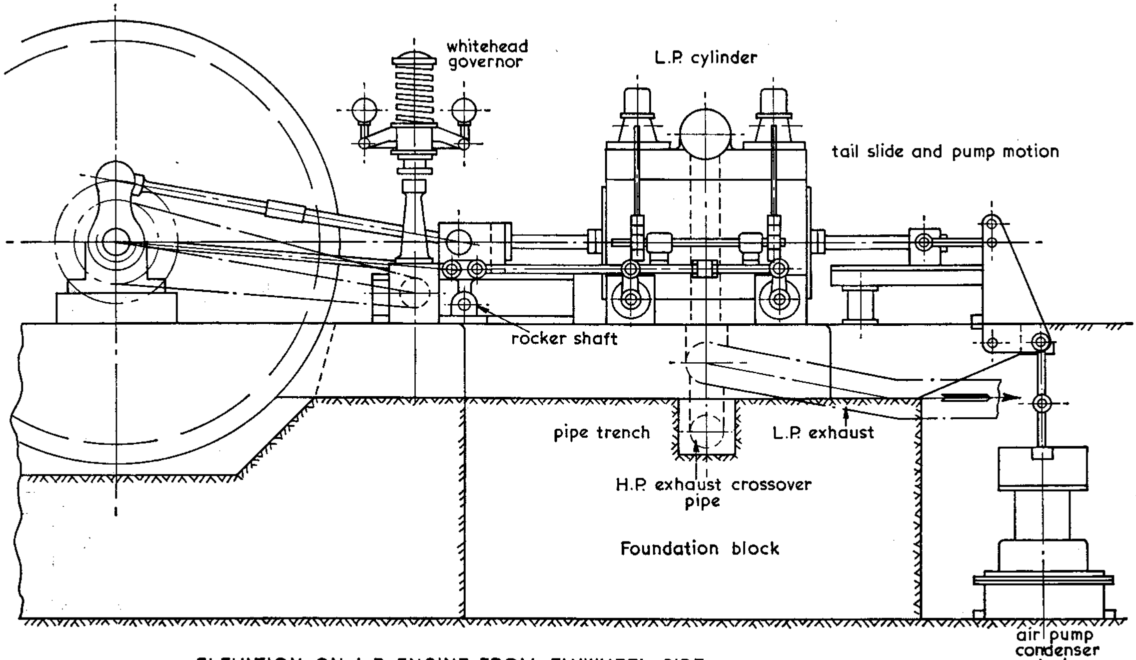
HIGH PRESSURE DIAGRAM



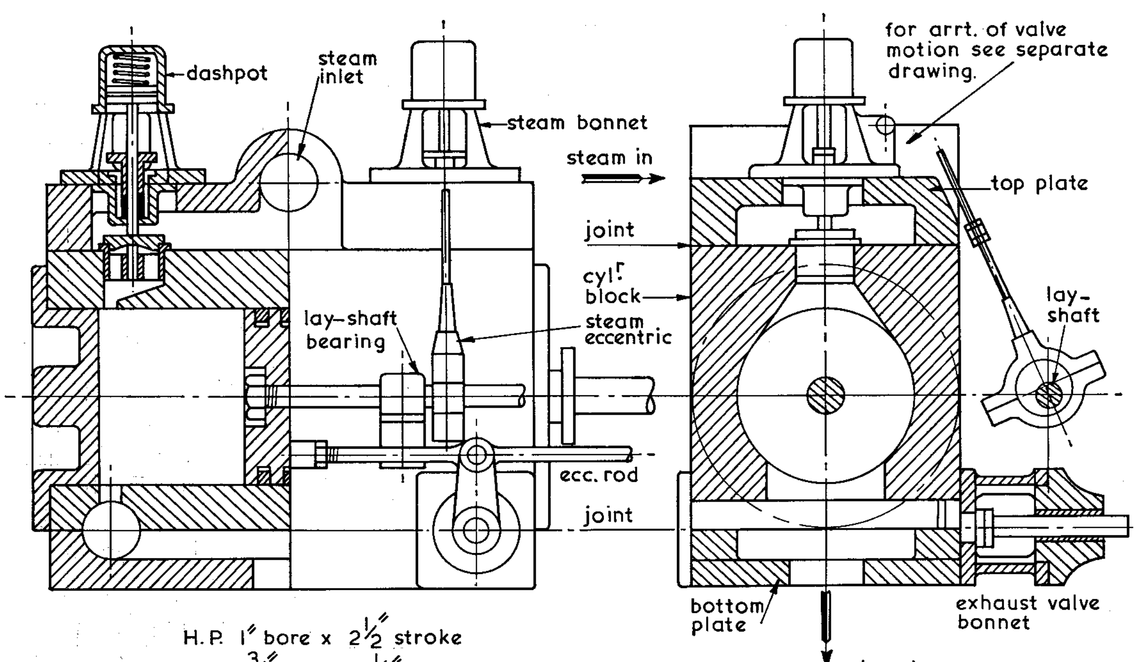
END ELEVATION



ARRANGEMENT OF ENGINE–DRIVEN VERTICAL AIR PUMP/CONDENSER



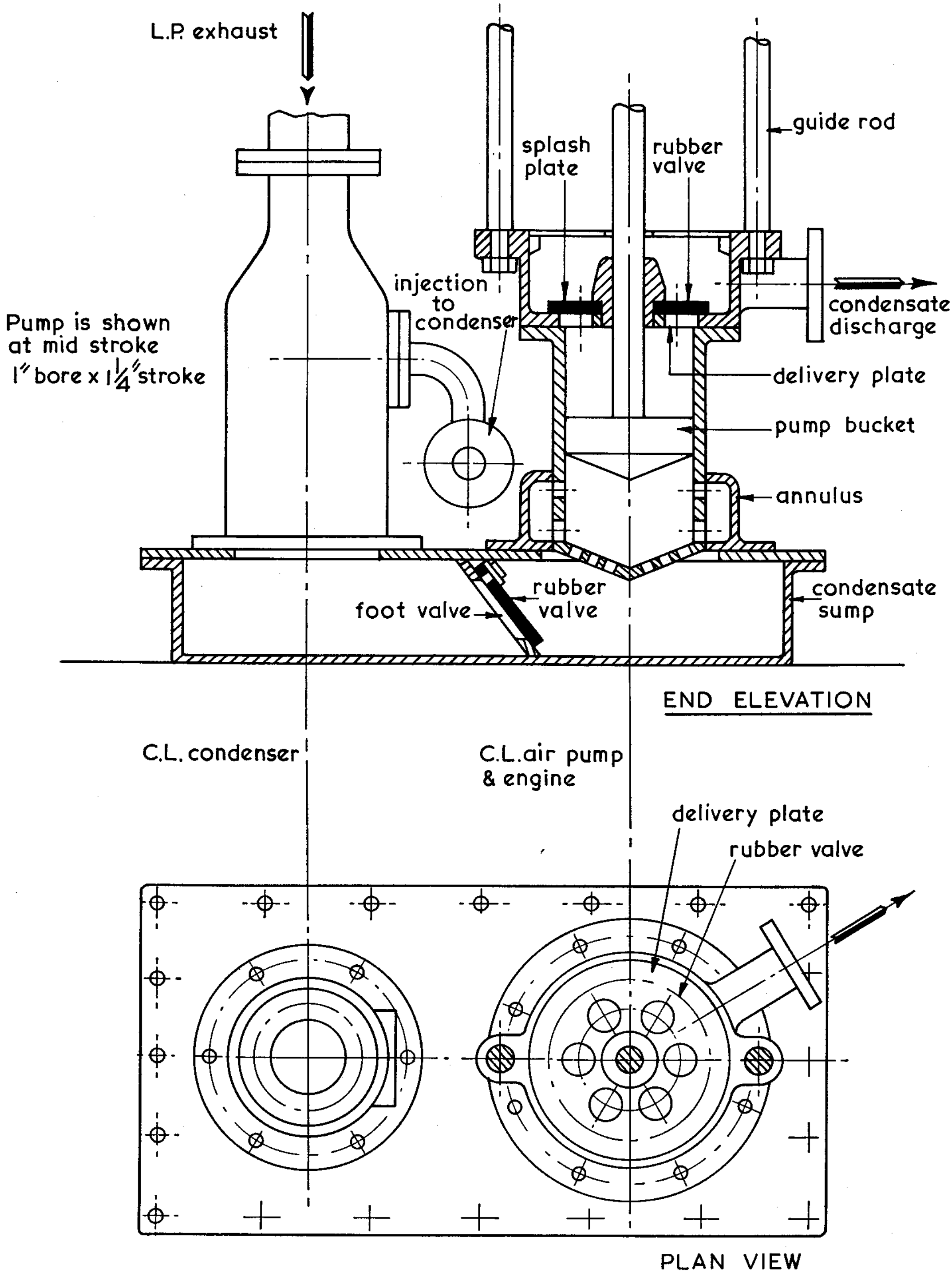
ELEVATION ON L P ENGINE FROM FLYWHEEL SIDE



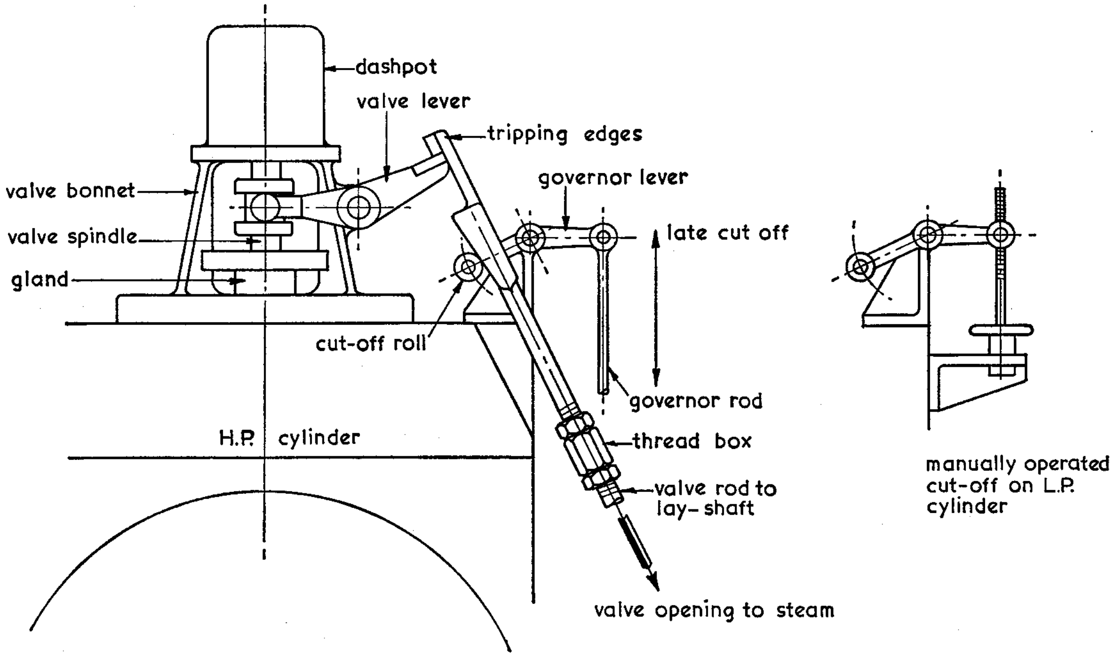
H.P. 1" bore x 2½" stroke
L.P. 1¾" bore x 2½" stroke

CYLINDER WITH INLET DROP VALVES AND CORLISS TYPE EXHAUST.

LOW PRESSURE CYLINDER DRAWN.



'EDWARDS' TYPE VERTICAL AIR PUMP & JET CONDENSER



ARRANGEMENT OF STEAM INLET VALVE OPERATING GEAR

It is not necessary to use an indicator to produce a diagram. A diagram which is called a Hypothetical Indicator Diagram can be constructed geometrically. This is an extremely valuable tool, and extensively used in the preliminary design of a steam engine. The procedure is simple and is accomplished as follows:

First, a boiler pressure and a length of stroke is selected. In the example given, a boiler pressure of 150 p.s.i. and a stroke of 4 ft. 6 in. has been chosen. We now draw the vertical axis to represent pressure and the horizontal axis representing stroke. In this case, the scale of pressure is 1 in. = 50 p.s.i. and the scale of stroke is 1 in. = 1 foot. We mark the axes accordingly. We now draw a line starting from the 150 p.s.i. point and parallel to the base. We now assume that cut-off will occur at $\frac{1}{3}$ of the stroke, and this is equal to $1\frac{1}{2}$ in. in length. This distance is measured off. The beginning of this line is "admission", the end of the line is "cut-off". The line is the "admission line".

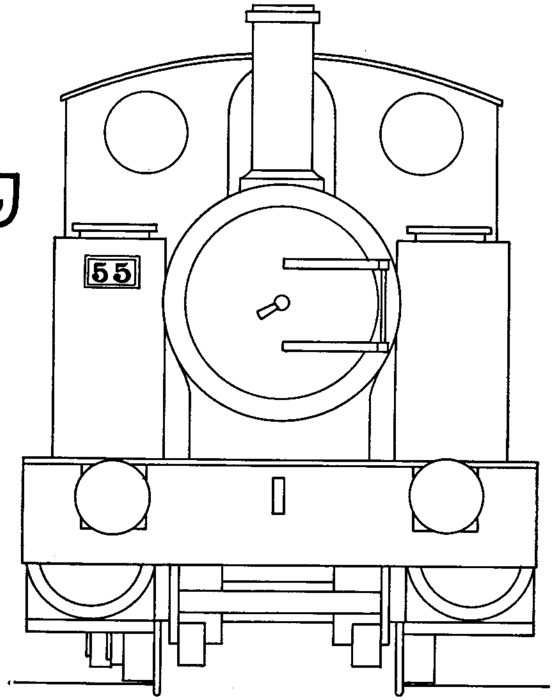
At "cut-off" the inlet valve closes quickly and no more steam enters the cylinder. It is obvious that the pressure will fall as the piston moves forward, thereby increasing the volume. But how precisely will it fall? Fortunately, this pressure drop has to obey certain well-known physical laws. The resulting curve, representing the pressure drop, is a "hyperbola". Such a curve can be drawn thus:

First, drop a vertical, from the point of cut-off down to the base. Divide the remaining line of stroke into an equal number of points, and drop verticals. Draw a diagonal from the intersection of the axes to these points. Where this diagonal intersects the vertical "cut-off" line, produce a horizontal to intersect the vertical from the point. This is a point on the curve. This construction is shown dotted on the diagram. It will be seen from the example that the pressure at the end of expansion is some 63 p.s.i. Such a diagram clearly shows the advantage of compounding, since the area below the diagram is available for work. The diagram is not mathematically correct, but it is sufficiently accurate for our purposes. An actual diagram taken from an actual engine working under these conditions would agree very closely to that drawn.

Another point to watch is that of the exhaust pressure. This is affected by many factors, i.e. the back pressure on the engine, the volume of the exhaust belt, the volume of the crossover pipe, etc. The actual inlet pressure to the L.P. cylinder can be calculated and is a somewhat tedious and lengthy procedure. The exhaust line on the diagram has been estimated. Another important property of the indicator diagram is its ability to show at a glance, any malfunction of the valves. It will immediately show if any valve, steam or exhaust, is opening, or closing, late or early. It will show if any valve is leaking, that is, passing steam when it ought not to be. Indicators are still extensively used for indicating large marine diesels.

‘SUGAR’

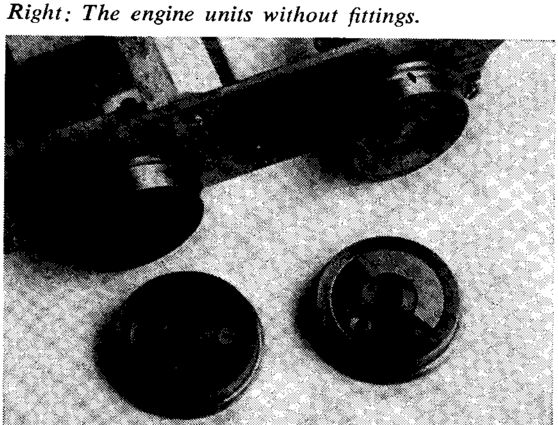
Rex Tingey commences the construction of his $2\frac{1}{2}$ in gauge 0-4-0 tank loco



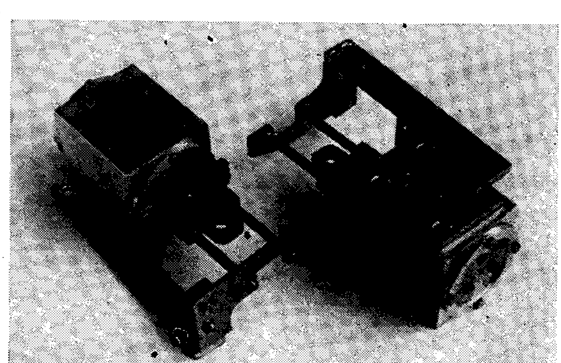
ALL PARTS ARE MADE as simply and as economically as possible. The boiler is constructed from half a square foot of 16 s.w.g. copper, plus the length of the seamless barrel, which keeps the expense down. The wheels are turned from cast iron piston blanks as supplied by Messrs. Reeves; the pistons are thick enough to make two wheels apiece. The coupling pins are of silver steel and made in two halves, one half of which is secured right through the wheel, the other half providing for ease of assembly.

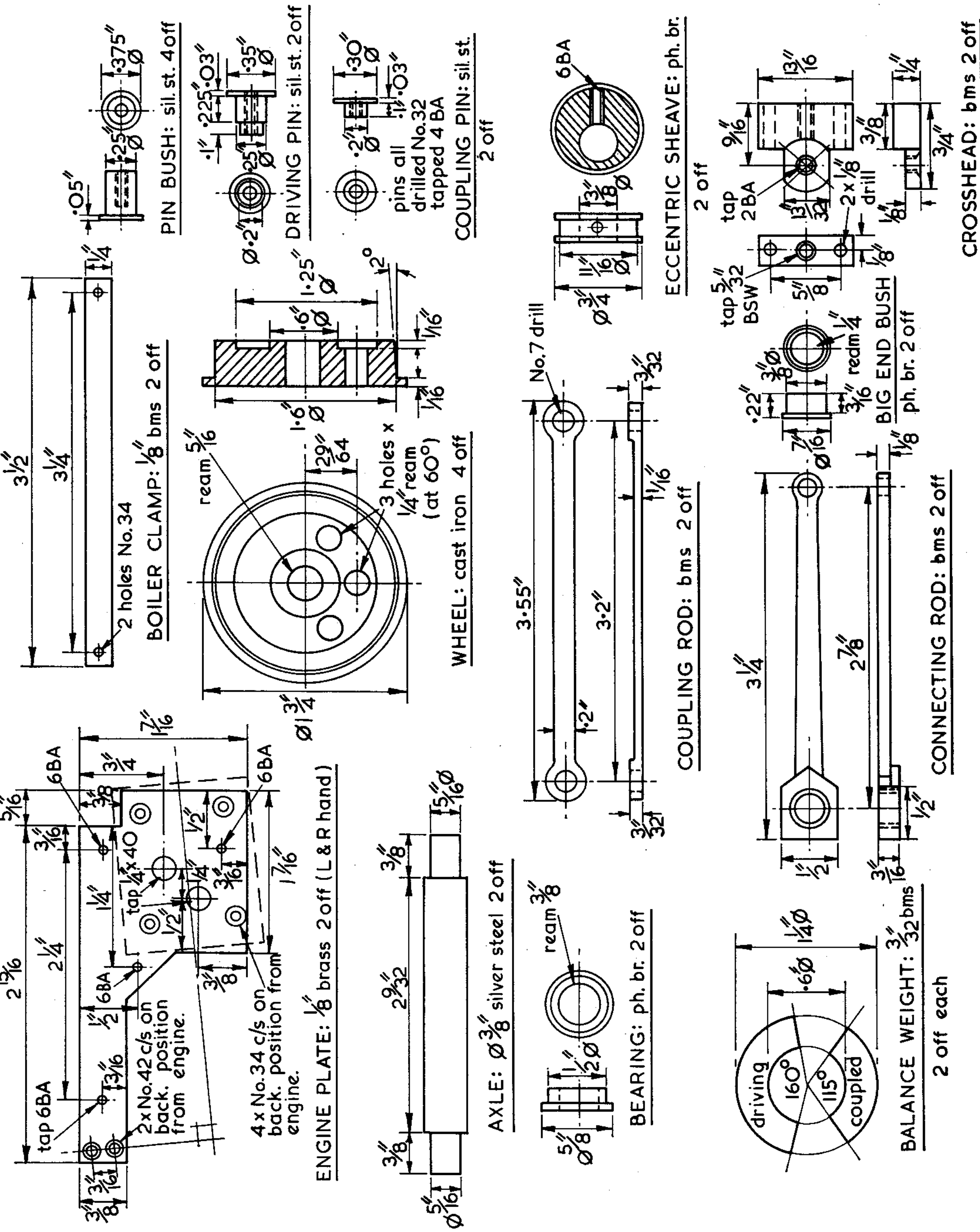
The frames are of 3/32 in. thick mild steel flatstock and minor imperfections can be tolerated as many stretchers are fitted and the frames themselves not used as reference surfaces. The usual care must be taken in marking out and drilling the holes, frames riveted together. The footplating and buffer beams are made as a separate unit, secured onto the chassis with four screws.

Below: Completed wheels.
Right: The engine units without fittings.



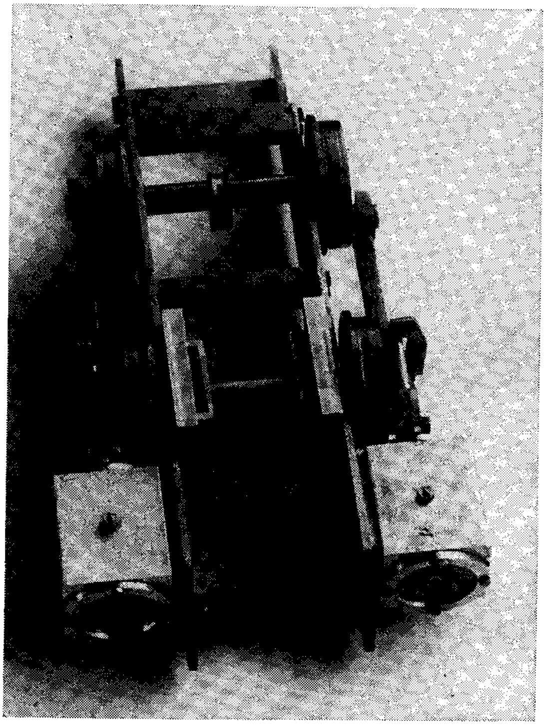
The engine units are made to my valveless design but with moving cylinders of thinner section to keep the bulk down. This has meant that the internal holes, drilled to the side holes, are smaller, and there are four of them each end to allow lots of steam to pass. Another simplicity in the construction is in using good quality brass tube, 1 in. internal diameter, as a lining for the cylinder blocks, eliminating the need for careful boring and polishing. The units are made on a $\frac{1}{8}$ in. brass plate complete down to the connecting rods so that the whole unit can be lined up and bolted into position on the frames. The unit is complete with steam unions which protrude through holes to inside the frames, so rusting problems are eliminated.

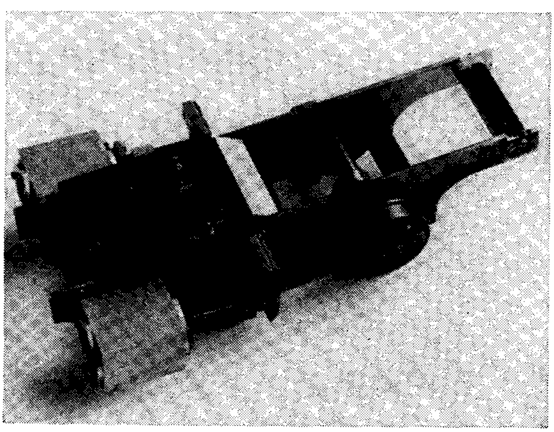



PIN BUSH: sil. st. 4 off
DRIVING PIN: sil. st. 2 off
pins all drilled No.32 tapped 4 BA
COUPLING PIN: sil. st. 2 off
ECCENTRIC SHEAVE: ph. br. 2 off
CROSSHEAD: bms 2 off
2 holes No.34
BOILER CLAMP: 1/8" bms 2 off
3 holes x 1/4" ream (at 60°)
WHEEL: cast iron 4 off
No.7 drill
COUPLING ROD: bms 2 off
BIG END BUSH ph. br. 2 off
CONNECTING ROD: bms 2 off
2 x No.42 c/s on back. position from engine.
4 x No.34 c/s on back. position from engine.
ENGINE PLATE: 1/8" brass 2 off (L & R hand)
AXLE: Ø3/8" silver steel 2 off
BEARING: ph. br. 2 off
driving
coupled
BALANCE WEIGHT: 3/32" bms
2 off each

Unit Assembly

The complete project is designed to be made as separate units, each of which can be altered slightly in size to suit modifications in fabrication, and then bolted together to still fit, intermediate bits and pieces being tailored to provide the fit. Thus the boiler can be made a larger diameter, shorter or longer by a quarter of an inch yet still be made to fit with no great effort, the idea being to not only make the design versatile but to cope with the little errors which tend to creep up on you and accumulate (particularly in boiler making and erecting).





Each unit of assembly can be made as I will show, or modified to suit the individual, and this one of mine is strictly "utility". No fancy bits have been added to the prototype, corners have been left unrounded and coupling rods unfluted. Handrails have not been added or lamps fitted, but you are at liberty to add all the frills.

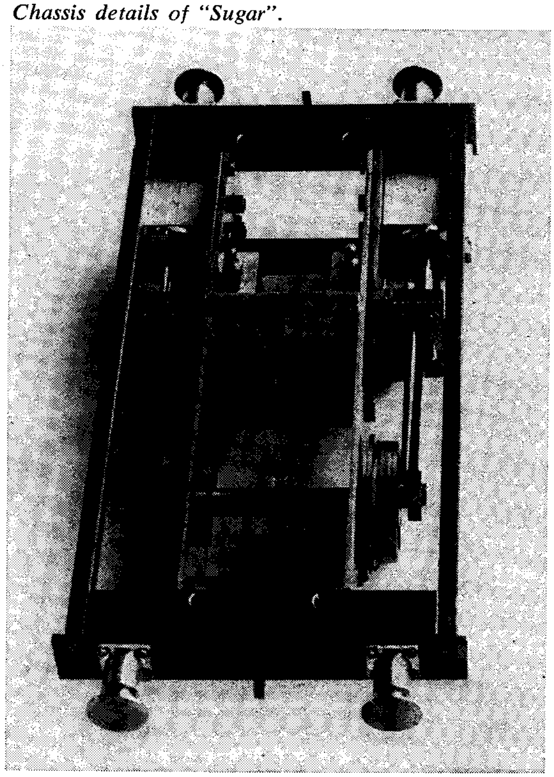
I hope that this locomotive will add to the growing revived interest in 2½ in. gauge railways. "Sugar" can be quickly and cheaply constructed by beginner and expert alike; on a little Unimat, as mine was, or on the largest of lathes. And this little locomotive could pull a youngster around a track laid in the average back garden.

I hope to present full constructional details in future issues.

Details of "Sugar"

Overall length	11⅛ in.
Overall width	5 in.
Height	6⅝ in.
Wheelbase	2½ in. x 3.2 in.
Minimum radius of track	2 ft. 6 in. approximately
Pistons	¾ in. dia. x 29/32 in. stroke
Boiler	Coal fired
Barrel	2 in. dia. x 3½ in. long
Firegrate area	4.2 square inches
Fire tubes	5 x 5/16 in. i.d.
Working pressure	70 p.s.i.

Chassis details of "Sugar".



CROSS-SLIDE MICROMETER COLLARS

George Thomas concludes his article by discussing the graduation and numbering

Part V

From page 1424

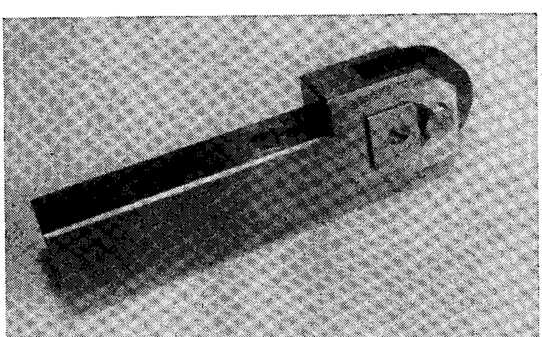
Graduating the vernier scale

The whole of the vernier scale, 10 divisions, is equal to 9/100 on the collar so each vernier division equals 9/1000 of a turn which, through a worm and 60T wheel will require 60 × 9/1000 = 27/50 turns of the worm. None of the four Myford plates has a 50 (or 100) circle so I had to find a substitute, the nearest being 20 holes on a 37 circle which is in error by exactly one in a thousand which represents an error in length of the complete vernier scale of only half a thou which can be ignored.

For dividing by change wheels I sorted out a series of trains, the easiest of which is possibly

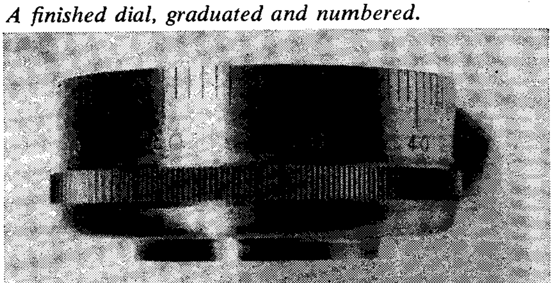
$$\frac{60 \times 35 \times 50}{21 \times 45}$$

where 60 is on the mandrel and 50 on the same stud as 45. 50 is the count wheel. See diagram on Fig. 4.



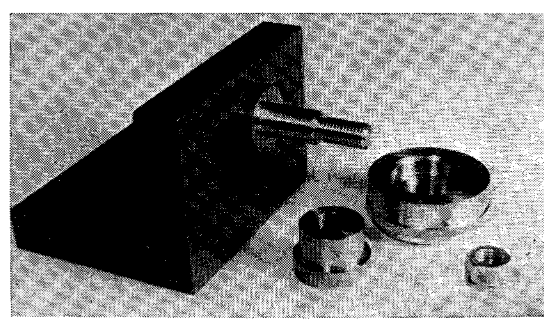
Small knurling tool for straight knurls.

A finished dial, graduated and numbered.



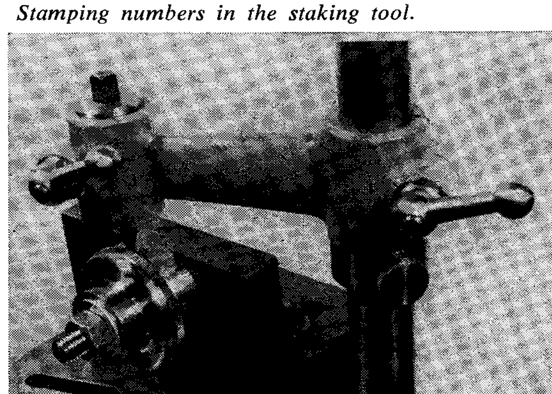
Numbering

I have already described the numbering and finishing of collars quite fully in the articles covering the staking tool which appeared in Vol. 140, pp. 1104, 1165 and 1209, and then under modifications in Vol. 142, pp. 1078 and 1149. The stamping of numbers is specifically described in Vol. 141, p. 351, and as these are of comparatively recent date repetition would be pointless, but I shall include a few photographs which many readers tell me they find interesting and helpful. Notes on



Simple fixture for stamping numbers.

Stamping numbers in the staking tool.



the finishing of the engraved and numbered surfaces are included in the article on the Tailstock Micrometer in Vol. 140, p. 1052.

Someone is bound to say "what about the knock-out pin for the auto crossfeed?". It is not required; the large diameter of the vernier ring now performs that function.

Knurling

After good tool finish there is nothing, to my mind, that imparts the professional touch to tool work as much as good knurling, and by "good" I include judicious selection of the type and grade of the knurl. Many tools and pieces of workshop equipment shown at "M.E." exhibitions have been spoiled by unsuitable or badly executed knurling, the worst fault being, probably, the use of a coarse diamond knurl on a comparatively small and delicate object.

For the items covered by this article my preference is for a fine straight knurl and this choice has not in any way been influenced by the fact that Myfords use an almost identical knurl on their Super-7 collars. In the past I have described my knurling as "medium" grade; I have two grades finer than the one used for this job which is actually 44/inch. Jones & Shipman, who list a wide range of knurls in their catalogue, would grade this as "fine"—.025 in. pitch. The makers will not supply singly but I find that J. & S. knurls are listed by Messrs. A. J. Reeves & Co. Ltd. Unfortunately, they carry only the largest size, $\frac{3}{4}$ in. dia. x $\frac{3}{8}$ in. wide, but perhaps for the straight knurls they might consider offering $\frac{5}{8}$ in. x 3/16 in. which are standard from J. & S. in either HSS or CS Type No. 8126-068 medium or 8126-069 fine. These fine, straight knurls can be used in a simple holder and I include a sketch and photo of mine which can be worked up reasonably close to a shoulder and the knurls can be readily changed by removing the keep-plate which holds the pin longitudinally and also prevents it from rotating. The smaller diameter knurls are less expensive and required less pressure in use; the reduced width in no way limits their capacity as I always traverse the knurl to and fro whilst maintaining a moderate pressure at a surface speed of about 50 to 75 feet/min. (say 200 to 300 r.p.m. for 1 inch diameter).

For diamond knurling I would suggest "medium" grade (25/inch), size $\frac{3}{4}$ in. x $\frac{1}{4}$ in., one of each hand. For our class of work and machines I feel that the narrower knurls are much more suitable. Whether or not there is any advantage in HSS over CS knurls I really do not know; Reeves list the former. The knurling operation is complete when the tops of the "ridges" or "diamonds" are seen to be sharp — even under an eyeglass. After it has been brought up to a satisfactory finish the edges should be attended to by turning with a double chamfer (a 90 degrees vee) tool, taking the point just a little below the surface which is adjacent to the knurling. This 45 degrees bevel at the edges of the knurling gives a pleasant clean appearance.

Generous dosing with soluble oil during the operation will assist in getting a really sharp knurl with a "bright" appearance, but make sure that the brush is clean and free from small fragments of swarf etc. which will ruin the appearance if they pass through and, secondly, it is oh, so easy to get the hairs of the suds brush caught up in the works!

In conclusion I return to the problem of using the lathe to modify some of its own components, the removal of which, in some degree, incapacitates the machine. There is an ever-increasing number of workers who possess two lathes or have access to a second machine—for them there is no problem and I have no doubt that there are many readers who will exercise their ingenuity to get over all the difficulties which might arise. The simplest solution is to beg, borrow or buy the necessary spare parts.

An offer to readers

Now, it so happens that I have spares for all the parts which have to be modified and I am quite prepared, provided I am not involved in too much work or expense, to make these parts available without charge to any readers who want to borrow them. The items available are: (1) Cross-slide bracket for ML7. (2) Complete cross-slide feedscrew, bracket and handle assembly for the older type Super-7. (3) Complete cross-slide feedscrew, bracket and handle assembly for the newer Super-7 with auto cross-feed. I will make and include an accurate centred plug for use in the reader's own feed-screw bracket. Any readers wishing to avail themselves of this facility should write to me, via the Editor, stating the type of lathe, i.e. (1), (2) or (3) and the date by which they are *certain* that they will be ready to use them and to pass them on to the next on the list. I shall prepare a list of names and addresses so that, once set in motion the (first) circulation can proceed without reference to me. Any names arriving too late for inclusion in the first list will have to wait for a second one.

Addendum

Since completing this article I have been in touch with Messrs. A. J. Reeves & Co. Ltd. who have now informed me that they are putting into stock the 5/8 in. x 3/16 in. knurls, fine and medium, straight and diamond cut, all with 1/4 in. bore.

Club Chat... with the Editor

Model Engineers Society N.I. heads the list this issue with a report on its involvement with the Model Engineering and Toy Exhibition held by the Northern Ireland Junior Motor Cycle Club at Newtownards. The Society took along 35 locomotives, ten stationary engines, nine boats, three artillery pieces, one diorama, one bus, one horse and cart, two traction engines, three clocks, six boilers, and many other items which may or may not have included a kitchen sink. The whole added to a very successful show and earns the members a very well done, and, perhaps, a few new members soon? An auction by the Society on 11 November was very well-supported but a new Unimat lathe and a 3½ in. flat bed Drummond remained unsold at the reserve prices. The secretary is Mr. T. D. Wilson, 97 Rosepark, Donaghadee. Telephone 888113.

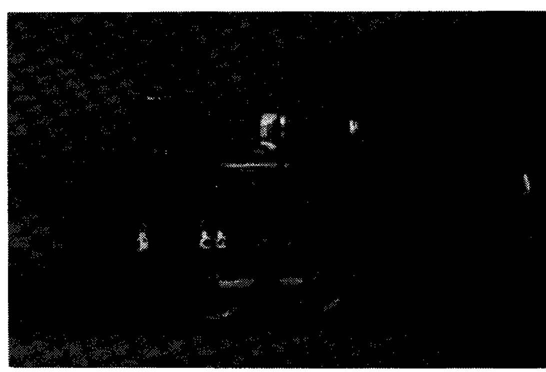
Despite having more than the usual attacks by vandals over the past year, **Hull S.M.E.** has managed to extend its straight section by a further 228 feet and the photo here shows the President, Dr. Hubert Watson, officially opening the track by driving the Hon. Sec's G.N. "Atlantic" accompanied by the Chairman, Guy Wilson. The event was supported by two traction engines and several other locos. The club, of which the secretary is Mr. J. Proud, No. 1 Sixth Avenue, Ellerburn Avenue, Hull, is now in its 40th year and celebrated on the same day as the track opening by having a dinner dance.

A sad moment for **East Sussex Model Engineers** came when their clubhouse at St. Leonards changed hands and members have had to find a new meeting place at short notice. However, with the same determination I have seen in many clubs, the E.S.M.E. has found refuge in the Lecture Room, Library Extension, Robertson Passage, Hastings. Members, visitors, friends, etc. are informed that meeting here will start on 13 January at 7.30 p.m. and will be held on the second and fourth Fridays in the month from then on. Secretary is Mr. R. W. Taylor of 24 Mitten Road, Bexhill-on-Sea. Robertson Passage, by the way, is off Robertson Street.

The November General Meeting of **North London S.M.E.** naturally included a chat about the M.E. Exhibition but was rounded off by an entertaining session by the 00 Section which is picking up again after a period of hibernation. Credit must go to Peter Roake for the current revival and operational status of the layout, which has yet to be finished. The North London club has a stand at the Exhibition and a look at the list of possible exhibits is enough to convince me that on the days when I will be at Wembley (I can't manage them all, more's the pity) I shall be having a good look around this one. But knowing the versatility of the clubs I don't doubt every society's stand there will be well worth a visit.

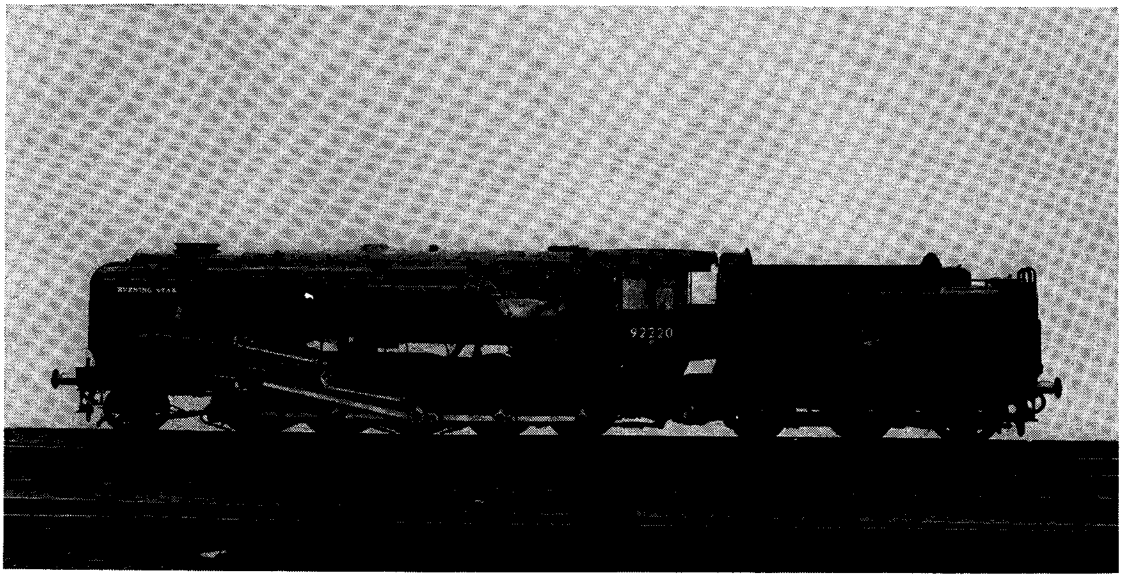
The **North Staffs. Models Society** is currently host club for **The Northern Association of Model Engineers.** So, on 23 to 28 March, that is Easter weekend, the N.A.M.E. will hold its Exhibition at the Cross Heath Drill Hall, Newcastle-under-Lyme, Staffs. This venue has easy access from the M6 and there is room for parking.

In the 21 October issue I mentioned that the **Model Engineers Society N.I.** had extended its track and at the same time experienced some good running weather on most Saturdays. Raymond McMahon's 5 in. gauge *Pansy* made its debut and I asked for a photograph. The message was received and the result is the picture shown here taken by P. Dalton. I'm glad I asked.



Track visits to Bournemouth, Portsmouth, Malden, Brighton and Hove, and Beech Hurst are reported by **Chichester & District S.M.E.** One highlight of this club's year has been the fitting of a new boiler to 69-year-old club loco *Winnie*. She is 10¼ in. gauge and following her overhaul, runs as sweet at ever. The club is also building a new 7¼/10¼ in. ground level track outside the present raised 3½/5 in. The length will be about 900 feet. A new secretary has been elected here. He is Mr. Bill Gage, 4 Highland Avenue, Bognor Regis, W. Sussex PO21 2BJ.

More than 3000 people attended the Exhibition last year held by **Sutton Coldfield Railway Society** and the club's ranks have swollen to over 100. This year the event will take place at The National Children's Home, Princess Alice Drive, Chester Road North, New Oscott, Sutton Coldfield, on 4/5 March. Times are 10.00-7.30 (Saturday) and 11.00-5.30 (Sunday). Admission, adults 30p, children (4-15) and O.A.P.s 15p. Exhibition Sec. is Eric Davies, 8 Conchar Road, Wylde Green, Sutton Coldfield, W. Midlands.



$3\frac{1}{2}$ in. gauge 'EVENING STAR'

by Martin Evans

FOR SOME TIME now, I have been receiving requests to complete the drawings of the late LBSC's $3\frac{1}{2}$ in. gauge locomotive *Evening Star,* based on the last steam locomotive built for British Railways. As many readers will know, LBSC started to describe this model, which is of the 2-10-0 wheel arrangement, in the magazine *Practical Mechanics,* but unfortunately, this periodical ceased publication when LBSC had only dealt with about half the construction of the locomotive.

Through the kindness of Geoffrey Cashmore, several unpublished sketches of LBSC's *Evening Star* have come to light, and M.A.P. have been able to produce six drawings of the engine, leaving only the platework, boiler fittings, cab details and tender to be dealt with.

Before I go further, perhaps I should list the six drawings, describing which parts are shown on each, so that anyone who has already started to build the locomotive will know which sheets of drawings he requires. They are as follows:

LO.99

Sheet 1. General arrangement of engine, details of frames, frame stretchers, driving and coupled wheels, main axleboxes, horns, pony bolster and kingpin stay.

Sheet 2. Main axles, crankpins, coupling rods, feed pump and eccentric, lubricator eccentric, details of pony truck.

Sheet 3. Full details of the boiler.

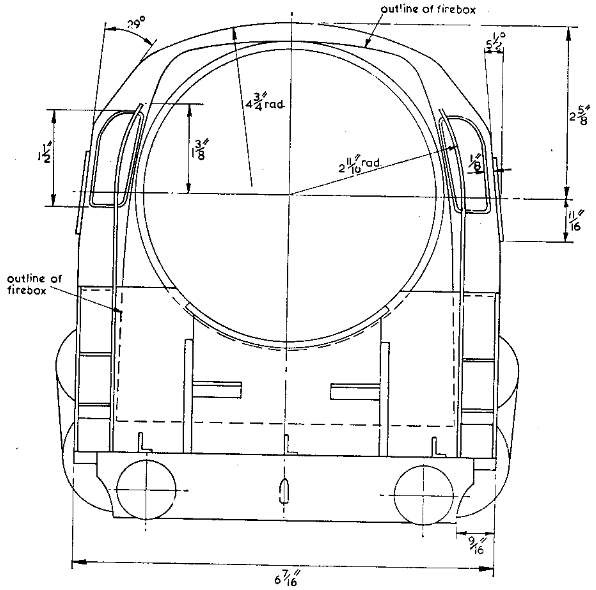
Sheet 4. Connecting rods, slide bars, details of piston valve cylinders, details of slide valve cylinders, crossheads, slide bar brackets.

Sheet 5. Buffer beam, drag beam, elevation and plan of Walschaerts valve gear, expansion link brackets, lifting arm and reversing shaft, radius rods, eccentric rods, expansion links, combination levers, lifting links, return cranks, reversing screw and nut.

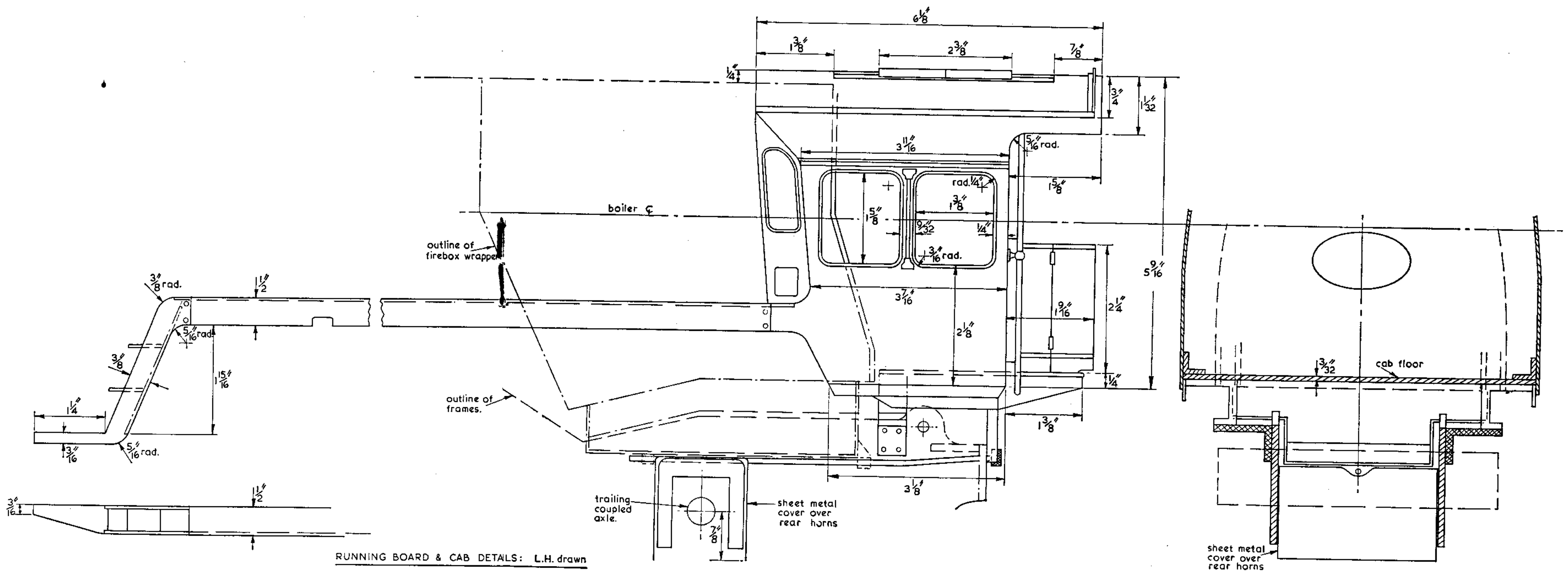
Sheet 6. Valve gear for slide valve cylinders, arrangement and details of lubricator, arrangement and details of steam brake, brake blocks, hangers and beams, smokebox, details of blast pipes for double chimney, alternate blast pipe for single chimney.

★ ★ ★

As readers will probably appreciate, it is not at all easy to pick up another person's design and complete it in the way that the original designer might have wished. In fact it is not an easy task even if one has a completely free hand. I quickly found this out when I had looked through the six sheets already available!



END ELEVATION: To show spectacle plate & smoke deflectors. (chimney & dome etc. omitted)



RUNNING BOARD & CAB DETAILS: L.H. drawn

My first problem was how to attach the running boards to the boiler. LBSC did not usually specify any form of lagging and cleading for his boilers, and in this case, the smokebox and boiler barrel specified were already very slightly over the strict scale diameter, so to add lagging and cleading was quite out of the question; the appearance would have been completely spoilt. So if the running boards (and the cab!) were to be attached to the boiler, it would have meant drilling and tapping the boiler barrel in quite a few places, and this is not a practice I would recommend.

The alternative is of course to attach these parts to the engine frames, as in most normal British locomotive types. But on *Evening Star,* the running boards are a long way above the top edge of the frames, and even the cab is some distance above. However, after much thought, I evolved two fairly simple brackets, built up from mild steel 3/16 in. and $\frac{1}{8}$ in. thick, which can be bolted direct to the frames. The shorter one is located near the front, at the point where the running board starts to slope down to the buffer beam; the longer one is located at $\frac{3}{4}$ in. to the rear of the point where the top edge of the frame drops down by $\frac{3}{8}$ in. between the leading coupled wheel and the second coupled wheel. These brackets can be bolted to the frames by 8 BA hexagon-head screws, and I don't think they will look too obtrusive.

At the extreme front end, the running boards are supported by the buffer beams, and at their rear end, they merge into the cab. The cab support gave me another headache! The boiler is, as usual, supported at the front end by the smokebox and saddle. At the rear end, it is usual to provide some form of expansion angle or bracket, to allow for the expansion of the boiler as it warms up. Where the boiler is of the narrow firebox type, going down between the frames, it is quite easy to arrange for a sound rear fixing, but with a wide firebox type of boiler, lying above a narrow pair of frames, one is rather up against it.

Having attached the running boards rigidly to the front buffer beam, and having attached the cab sides rigidly to the running boards, it seemed to me that the best solution was to attach the cab rigidly to the frames, and allow the boiler, or rather the firebox, to slide through the cab spectacle plate as it expands. The movement is in any case very slight; it will probably be argued that the very first time the boiler is steamed, the paint around the join between the firebox and the spectacle plate will chip! But I don't think this is a very good argument; if the spectacle plate is matched very carefully to the shape of the firebox, but leaving 5 thou or so between the two all the way round, this should be enough to avoid the paint being damaged, and in any case the problem is no worse than in a conventional model locomotive, where the boiler is allowed to slide and where the cab sides are bolted down rigidly to a rigid running board and footplate.

To hold the cab down, therefore, special brackets are suggested, of a more or less channel section; these being built up from mild steel by brazing, or maybe one of our castings suppliers will provide a gunmetal casting. This channel piece is then bolted firmly down to a short piece of 1 in. x $\frac{5}{8}$ in. x $\frac{1}{8}$ in. steel angle. A single 4 BA screw will be strong enough, one on each side of the locomotive. This could be hexagon-head, or better still, a socket cap screw.

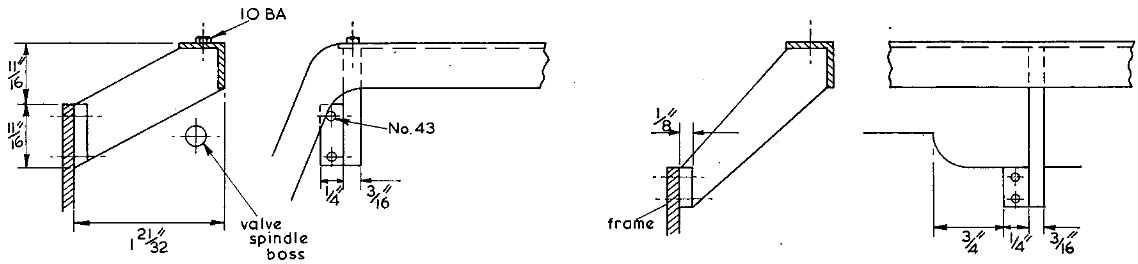
Another problem that arose was over the ashpan. At this point I came across several mistakes in the drawings of the boiler (for which I was not responsible!). The original overall height of the boiler, measured from the outside of the firebox wrapper down to the front bottom corner of the throatplate, amounted to 5 31/32 in. But this would have meant that there was no room at all for the ashpan where this lies outside the frames. (The overall width of the bottom of the firebox being 5 3/16 in., while the width over the frame is only $3\frac{1}{4}$ in.)

I have therefore had to reduce this overall height by $\frac{1}{8}$ in. There were also mistakes on some of the dimensions of the throatplate. The diameter of the hole in this plate must be 4 5/16 in., not $4\frac{1}{2}$ in., and the distance from the centre of the hole to the top must be 2 9/32 in., not $2\frac{3}{8}$ in., if the throatplate is to line up correctly with the barrel and if the top of the barrel and the top of the firebox wrapper are to be flush with one another. The correct overall height of the throatplate will now be 5 25/32 in.

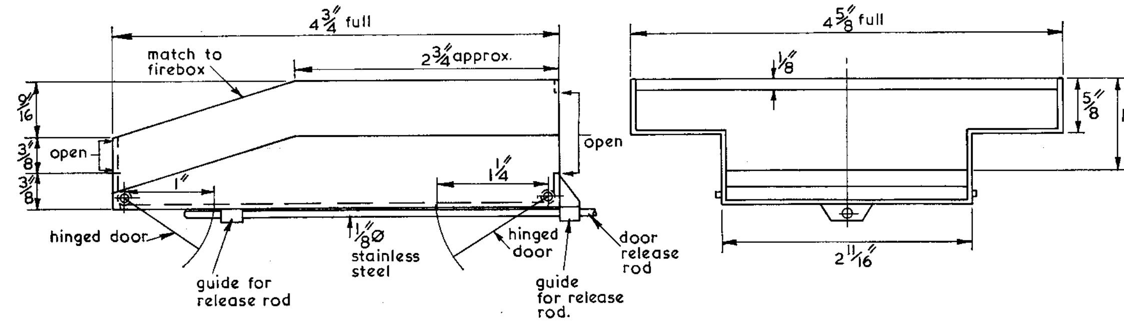
Other dimensions that are affected are the $1\frac{1}{4}$ in. depth from the underside of the barrel to the bottom of the throatplate—which will now be $1\frac{1}{8}$ in., and the overall height of the backhead, which will now be 5 3/16 in. instead of 5 5/16 in.

The full-size drawings of the *Evening Star* boiler (LO.99 sheet 3) are being altered to these new dimensions.

To return to the ashpan, as this had to be "stepped", so as to obtain a reasonable depth between the frames, it was impossible to design it so that it could either be dropped straight down, or withdrawn to the rear. It seemed to me therefore that it had best be made a permanent fixture retained by the weight of the firebox above it, which presses it firmly down against a simple sheet metal cover plate arranged over the trailing horns. This cover plate serves another important purpose—keeping the ashes out of the trailing axleboxes. The ashpan is however furnished with two hinged doors, which can be dropped to deposit ashes without their fouling the trailing axle. These doors are kept closed by a length of $\frac{1}{8}$ in. dia. stainless steel which slides through guides as shown. A hole about $\frac{1}{4}$ in. diameter should be drilled in the drag beam just above the engine-tender coupling slot, and slightly to one side (either side will do). This rod could protrude through this hole by about $\frac{1}{4}$ in.—long enough to take a small knob, but not



RUNNING BOARD BRACKETS: 2 off each type B.M.S. L.H. & R.H.

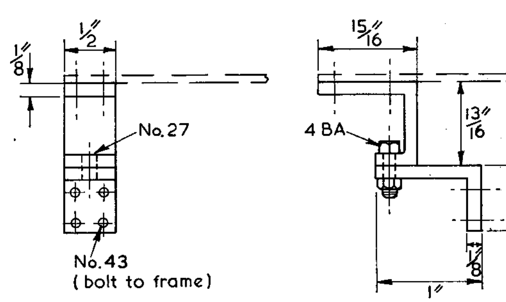


ASHPAN: stainless steel 18 SWG

so long that it fouls the tender drag beam when right "home". To open the ashpan doors, the tender must of course be uncoupled, when the rod can be pulled until both doors drop open. A further small point—to allow the rod to pass between the bottom of the ashpan and the cover plate over the horns, a small central depression must be made in the top of the cover plate, as shown in my end elevation.

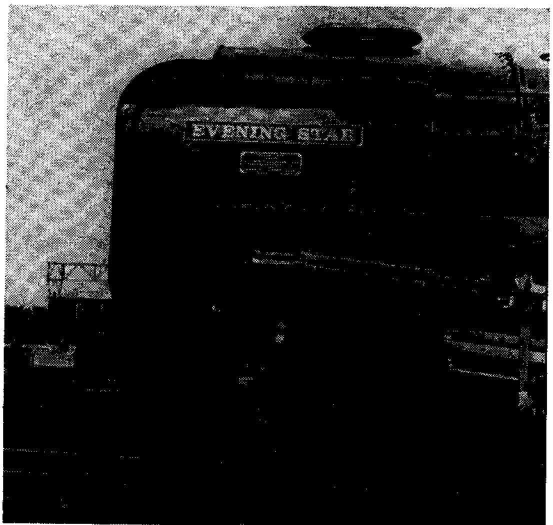
I certainly wouldn't claim that my solutions to the running board fixing and the ashpan arrangement are ideal by any means, and I would be most interested to hear from those who have already built 3½ in. gauge *Evening Stars* as to how they overcame these problems.

Reverting to the cab, the shape of the cab fitted to *Evening Star* is extraordinarily difficult to draw on the board, let alone make! This is because the sides slope upwards and inwards from the bottom line of the side windows, and slope inwards once again, at a steeper angle towards the roof, where they join the main radius at the top (4¾ in. radius at ¾ in. scale). To add to our difficulties, the sides and roof are flush all the way round, and the front or spectacle plate is made up of a short vertical piece above the level of the lookout windows (spectacles) while the lower part of the spectacle plate not only slopes upwards and forwards, but



CAB HOLDING DOWN BRACKETS: 2 off
(lower part steel angle,
upper part steel or g.m. casting.)

slopes inwards and forwards when viewed in plan! Well, it never rains but it pours, but I think the only way to tackle the cab is to take LBSC's own advice and make up paper or cardboard templates. In fact it might be worth while making up a complete cab in thin cardboard, using any quick-drying glue, then cutting this apart again, to make the metal pieces. I would suggest 18 s.w.g. hard brass for all the cab parts, except the floor, which might be 3/32 in. mild steel, as this has to carry the brackets holding the cab down to the frames, and don't forget that the cab, via the spectacle plate, holds the boiler down too!



Photos by courtesy of the Oxford Publishing Co.

Incidentally, the running boards could be made from ½ in. brass angle, except for the sloping front part, where two lengths of 1/16 in. brass sheet will be required, the footsteps being inserted between the two. At the rear end, the angle can be flush-jointed to an extension of the cab side; a break is made here on the full-size locomotive.

The other day, when discussing the design of *Evening Star* with a friend, the question of LBSC's boiler for this locomotive came up, and we were both apparently under the impression that LBSC's design for *Evening Star* was identical to his 3½ in. gauge *Britannia* boiler, apart from a difference in the length of the barrel. But we were both wrong, as there is quite a big difference in the shape and size of the *Evening Star*'s firebox, which is slightly longer and narrower than *Britannia*'s.

I hope to deal with the remaining details of *Evening Star,* and also the tender, in a future article.

To be continued

PROTECT AGAINST RUST

ONE OF THE hazards of this time of year is the effect of cold and damp upon the workshop—both its structure and its contents. It is true that the formation of rust is encouraged by warmth and damp and these conditions prevail in summer as well as in winter, but if the workshop is situated as part of the garage or a separate outside dwelling there is always the possibility that it is visited less frequently during the winter months. If the work bench is placed at the end of the garage, and the car is used daily, the storage of a warm, wet car overnight can wreak havoc with all the metal parts inside the building, and this applies to the car as well as the tools.

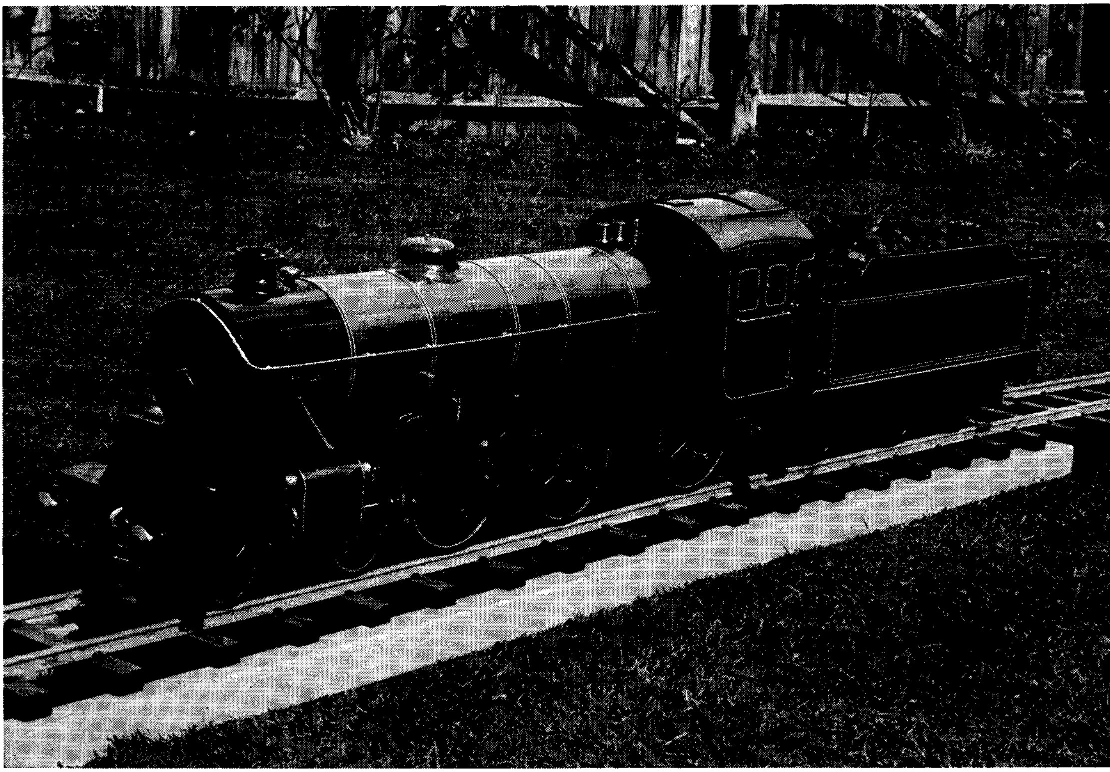
Even in the comparative warmth of the house, a workshop is not secure from these hazards unless it forms part of the general centrally heated area. And no doubt there are few who have not witnessed the effects of condensation here.

There are, of course, proprietary materials on the market sold not only as a protection against the elements but also as water repellants and displacers. The problem is knowing which one to use for each item of equipment. *Model Engineer* recently took a look at the products of LPS Research Laboratories Inc. which are marketed in the U.K. by Metprotek Ltd. It is not possible to give a detailed report on each product because the very nature of each is such that a long term study would be required.

For the model engineer it is likely that products LPS 1, 2, and 3 are the ones most in use and the difference between these three is basically one of application. LPS 1 is a lightweight, greaseless lubricant which has been developed for delicate mechanisms where it is essential that dust and dirt are not picked up. It will loosen rust and frozen parts and displace water so that it may be used directly onto wet parts. LPS 2 does much the same job but it will also guarantee one year's protection for metal parts out of doors and many years' protection for those indoors or less exposed. It gives a coat which is rust inhibiting. LPS 3 is the heavyweight of the three and will protect metal parts for two years under severe conditions. This product is also ideal as a chain and cable anti-seize lubricant.

All these products are sold in aerosol cans which means simplicity of application and an ability to reach those awkward parts. Related to LPS 1, 2 and 3 is the Instant Contact Cleaner which will not only remove grease, dirt, etc. but may also be used safely on electrical contacts while the equipment is in operation.

If you don't like aerosols and your equipment calls for really strong protection, LPS 100 is the answer. This withstands temperatures up to 572°F and will even prevent filiform corrosion on aluminium and dissimilar metals. If you are in the Guildford area, have a chat with Mr. Jim Elson of Five Star Products, 55 The Street, Shalford, near Guildford, Surrey, or telephone him on 0483 61447.



RON WARREN CONCLUDES

A QUESTION OF TRANSPORT

Part II

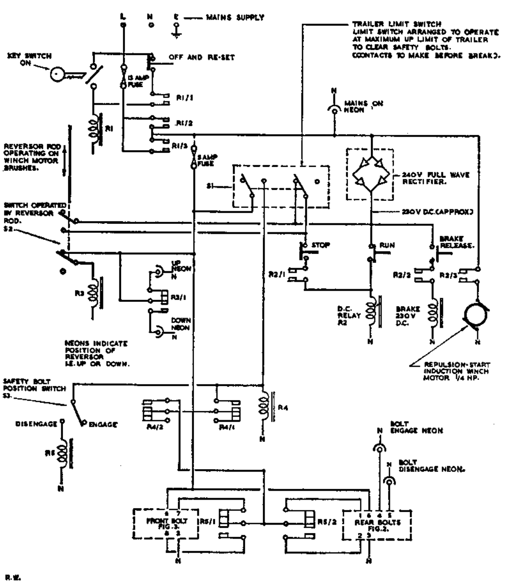
From page 1411

THE LIFTING MOTOR is ¼ h.p. of an ex-government type winch, and was obtained complete with gearbox giving a quoted output speed of 17.5 r.p.m. at a quoted torque of 100 lb./ft. This particular unit was not intended for normal reversing as it is a type giving a high output starting torque, involving the mechanical rotation of the starting winding brushes in order to reverse. A characteristic of the electric motor, particularly in this application, is that if it is man enough to lift the load it will, when reversed, lower the same load at the same speed, it will not over-run or over-speed.

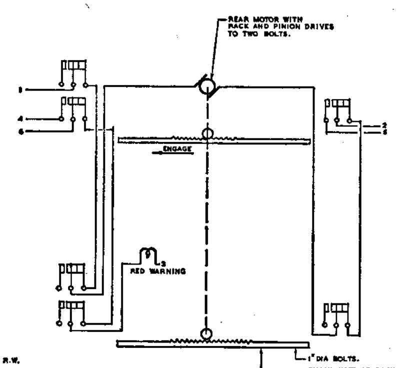
If, however, the electrical power was switched off the weight load would lower the trailer at speed, and by reason of the speed ratio necessary to obtain the lifting torque, the motor would be dangerously over-run, and perhaps would ruin the gearing with disastrous results, to say nothing of the trailer and supports. It was therefore imperative to ensure that this could never happen, and had to be prevented by an electrically operated brake mounted on the same shaft as the motor, electrically connected to apply the brake on "no volt" in conjunction with the motor supply.

There are many electrical brakes advertised on the market, adequate for the purpose; the torque rating will be comparatively low, but must be calculated from the speed and torque of the motor output shaft. In my case, diligent search enabled me to purchase a secondhand lift brake with a d.c. operating coil. This has a brake wheel 8 in. dia. x 2 in. wide with two brake linings spring loaded in the normal way and proved to work very effectively.

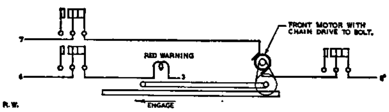
My predominant design criteria was to ensure that from the motor and brake output shaft the drive to raise the trailer was more than adequate. It also had to avoid complicated electrical circuiting and levelling switches, etc. to achieve the precise height location, and therefore the semi-



CONTROL BOX CIRCUIT WIRING
FIG.1.



REAR SAFETY BOLTS
FIG.2.



FRONT SAFETY BOLT
FIG.3.

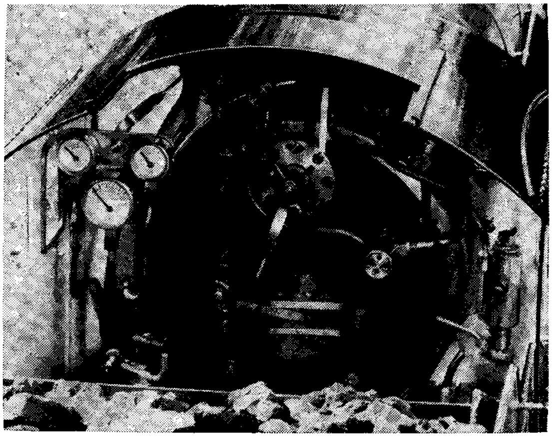
automatic system was adopted as described later.

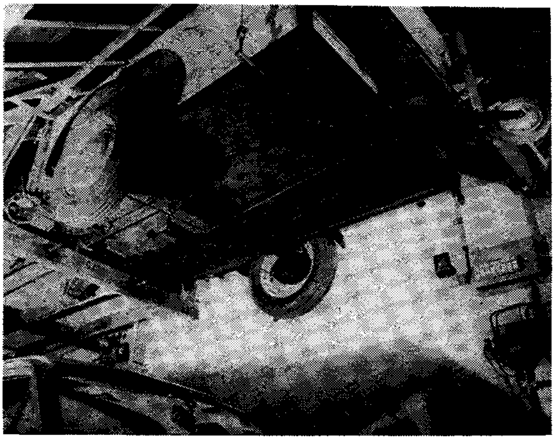
Flexible steel cables of good quality were selected to attach to the trailer, one at each corner, each $\frac{1}{4}$ in. dia. with a breaking strain of approx. 2 tons, and arranged to wind over a $1\frac{1}{2}$ in. dia. "winding" shaft, the shaft being adequately supported at each point of load with a self-aligning ball-bearing plumber block. The drive from the motor-brake shaft down to the "winding" shaft, with required speed reduction, is by sprockets and $\frac{1}{2}$ in. Duplex chain having a breaking strain of 7000 lb., far in excess of requirements.

To enable the $\frac{1}{4}$ in. steel cable to locate correctly both on the winding shaft and the trailer, four lay shafts running on ball races were provided, each comprising a short length of $1\frac{1}{2}$ in. shafting with a left-hand 4 t.p.i. groove to accept the cable, this ensuring that as the trailer is raised or lowered the cable is effectively "layed" onto the winding shaft, thus avoiding cable chaffing and a tendency to ride when under light load. Owing to the rigidity of construction necessary to prevent any suggestion of whip, and adequately to bear the load, I resorted to steel beams of bolted and welded construction, as can be seen in the photographs, and these formed one of the major expenses. I would like to explain that when looking at the photographs you will notice that one garage wall has been removed, and replaced by a steel beam running the length of the garage (this is the result of previous labours when enlarging the width of the garage with a flat roof over the extension). Nevertheless this increment in width does not affect the layout, nor is it a necessity in any way.

The storage floor comprises two load bearing steel beams with spreader timber beams between, and floored with $\frac{3}{4}$ in. chipboard, a suitable trap being provided to give access when the trailer is in position. Calculations gave the beam sizes as 4 in. x 2 in., but as local suppliers had available 5 in. x $2\frac{1}{2}$ in. this was the size decided upon. In order that I could sleep peacefully at night with the knowledge that the trailer and contents were stored above my car, or that at any given time my wife,

Cab details of Springbok.





children or others may walk under same, I considered it prudent to fit some hefty safety bolts. (The damage to the locomotive and trailer may be beyond repair in the event of failure!)

Winch motor output torque as quoted by manufacturer = 100 lb./ft. at 17.5 r.p.m.

As torque is inversely proportional to speed, the maximum torque at the winding shaft is given at the minimum speed. For practical considerations the largest drive sprocket that could be accommodated in the space available, and produce the desired speed, was 12 in. dia. having 76 teeth, whilst on the motor shaft a 19 teeth sprocket was a stock size available.

Hence the winding shaft speed =

$$\frac{17.5 \times 19}{76} = 4.375 \text{ r.p.m.}$$

Speed ratio between motor and winding shaft =

$$\frac{17.5}{4.375} = 4:1$$

Torque available at winding shaft = 4 × 100 = 400 lb./ft.

Diameter of winding shaft = 1.5 inches

$$\therefore \text{Radius} = \frac{1.5}{12 \times 2} = 0.062 \text{ ft.}$$

+ radius of $\frac{1}{4}$ in. dia. steel cable = 0.010 ft.

0.072 ft.
(i.e. 0.864 in.)

Height load raised = 6 ft. 4 in. = 76 in.

Time taken to raise load, when winding shaft is rotating at 4.25 r.p.m.

$$= \frac{76}{(2 \times 0.864 \times 3.142) \times 4.375}$$
$$= 3.199 \text{ min.}$$
$$= 3 \text{ min. } 11 \text{ sec.}$$

$$\text{Load lifting capacity} = \frac{400}{0.072 \times 2240} = 2.48 \text{ tons}$$

As the load that can be lifted is in the order of 2.48 tons and the anticipated load is in the region of 12 cwt. (1344 lb.) it gives an overall design safety factor of

$$\frac{2.48 \times 2240}{1344} = 4:1$$

At this maximum load each of the four steel cables would be loaded

$$\frac{2.48}{4} = 0.62 \text{ tons}$$

As the cables are of an approximate conservative rating of 2 tons carrying load the safety factor is

$$\frac{2}{0.62} = 3:1$$

The safety bolts comprise power driven 1 in. dia. m.s. rods, two arranged to support the rear of the trailer from the storage floor beam, and one arranged at the front of the trailer to pass under the trailer tow bar, this bolt being supported on a steel beam primarily for that purpose. The operation of the bolts is by electric motors and chain drives controlled by limit micro switches.

The electric motors are Paravoux mains-operated fractional geared type, each motor arranged for electrical reversing. The general construction of the rear bolts are indicated in Fig. 4. That of the front bolt is similar, but the drive is simpler using the endless chain principle.

The bolts are manufactured from 1 in. rod, running inside $1\frac{1}{2}$ in. steam barrel tube, the drive in the case of the rear bolts being achieved by milling a slot the clearance width of 8 mm. in the top of the barrel the length to suit the bolt throw. The 8 mm. chain was used as a rack, being attached to the bolts by suitable steel blocks and connecting links. The height of the blocks also accommodated actuating pads for the micro switches, determining the travel of the bolts.

The drive to the chain rack is via two sprockets on a common motor shaft, the bearings being brass blocks arranged to afford adjustment. All that remained now was to co-ordinate the various electrical requirements, get rid of the semi-lethal lash-ups derived during the testing periods, construct a suitable control box, and make a respectable job in a workmanlike manner of the wiring executed in PVC trunking and conduits.

The electrical circuit diagram gives the relevant data wherein it can be seen that the system is semi-automatic in operation. Full automation could doubtless have been achieved, but this brings forward a new set of problems, more work, and expense, and added to that I did not wish to make the system completely straightforward to use, thus deterring unwarranted demonstrations, usage, etc.

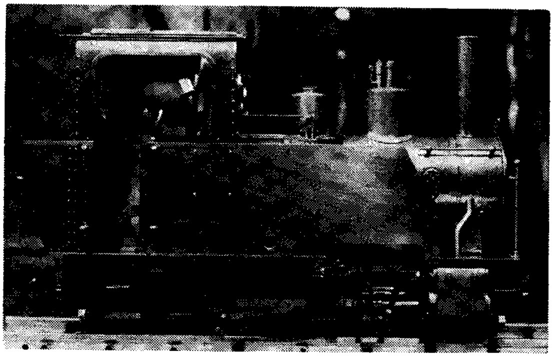
To sum up, and thus basically explain the method of control, the operation is as follows:

1. The trailer is made ready with its contents, ready for storage, and fitted with its tarpaulin or cover.
2. The lifting cables complete with shackles are lifted from the wall storage clips, and the four locating rods slipped into the four "lifting tubes" on the trailer.
3. The tail board is removed, to enable the locomotives to be passed from the trailer to the storage floor at the raised level.
4. The control box is actuated by inserting the key in the key switch, the control set to "raise" and the bolts set to "engage". Red warning lights indicate that it is not recommended to walk near or under the trailer.
5. The raise button is pressed, and the trailer goes up. It can be stopped at any point by pressing the stop button, which turns off the power and applies the brake.
6. The trailer rises to a height of approximately ½ in. clear above the level of the safety bolts, when a limit switch actuates:
   a. The stop switch, and applies brake (opens relay R2).
   b. Safety bolt relays (R4 and R5), causing the safety bolts to operate and locate under the trailer. This prevents any lowering accidentally or otherwise, and the correct engagement of the bolts actuating the appropriate micro switches (Fig. 2 and Fig. 3) turning off the red warning lights suggesting immunity to all who pass underneath.
7. The Panel control is re-set to "down" (by the reverser rod), the "run" button pressed and the trailer is lowered onto the safety bolts. This incidentally ensures that the loading floor and trailer are correctly levelled each time.

8. The off, reset button is pressed, the actuating key is removed, and all electrics are dead. The safety bolt switch is set to "disengage" in readiness for future operation.
9. The trailer is lowered to the ground in a similar manner but the first operation is to raise the trailer clear of the safety bolts until the limit switch (para 6) operates, stopping the lift, applying the brake, and disengaging the safety bolts. The red warning lights again indicate the necessity for caution.
10. The trailer is lowered by adjusting the reverser rod control to lower, and press the run button. Upon reaching the ground the off reset button is pressed all as para. 8, the cables disconnected and hung back on the wall, within the clips supplied for the purpose.

I trust this little article may have given you food for thought, and perhaps an idea as to how it may be adapted to suit your own needs. It has certainly given me much enjoyment during construction and overcomes the very serious storage problem. Finally, it gives pleasure to see it operate.

GAUGE I STEAM LOCO *Continued from page 15*



into consideration, if and when we expect the engine to pull a man. In short, there is a limit to the engine power and I have succeeded in minimising the mechanical losses.

The expansion links of this locomotive are not arc, but straight-line in shape. This means that the travel of the piston valves is not equalised on both sides of the neutral point. I have succeeded in correcting this by properly determining the length of the reversing arm, the lifting link, and so on. Also, it took me a lot of time and labour to adequately determine the height and the diameter (0.8 mm.) of the blast nozzle orifice.

A Light Compound Steam Tractor

at 2 in. Scale

Part VII

by John Haining

From page 1351

THE HIND WHEELS of the full-size engine were quite orthodox in design and typical of those fitted to other contemporary steam tractors, with several of which they shared the feature of double drawing pins through a two-lobed hub.

Dealing first with steel straked wheels and plain steel tyred front wheels, the hind wheels were 4 ft. 9 in. dia. by 12 in. wide (with an alternative width of 14 in. if required by a customer) having 12 spokes 2 in. wide x $\frac{1}{2}$ in. thick, secured to the tee rings with three rivets to each spoke-head. The prototype engine of the class, number 20047, had a single tee ring to each hind wheel and slightly wider strakes set at a steeper angle to the horizontal. Subsequently, engines of the total of 48 had double tee rings on hind wheels, either with 3 in. wide strakes—48 per wheel—set at a flatter angle which appeared to vary between 15° and 18°, or solid rubber tyres, two per hind wheel. The spokes followed normal traction engine practice by being cast into the hub—why is this once commonplace foundry technique now regarded, in this age of advanced technology, as being so difficult? The strakes fitted to all engines had, by law, to be not less than 3 in. wide and the gap between them not more than 3 in., the maximum thickness allowed being $\frac{3}{4}$ in. Strakes on the Ransomes tractors were all $\frac{1}{2}$ in. apart except on number 39149 which had them spaced wider apart.

It was also customary to set strakes back from the edge of the wheel to avoid protruding sharp edges when the ends became worn and hammered flat after prolonged contact with cobblestones or hard roads, and those on the Ransomes engines were set back $\frac{1}{4}$ in. from each edge, measuring $11\frac{1}{2}$ in. against the wheel width of 12 inches.

The front wheels were 3 ft. 1 in. dia. by 5 in. width, having ten spokes, the same width and thickness as those on the hind wheels, secured to the tee ring by two rivets per spoke head; again, the spokes were neatly cast into the C.I. hub.

Unlike the usual practice, the steel tyre, in four segments with angled joints, scarfed at 45°, embraced the full width of the wheel, being riveted to the single tee ring. Viewed from the front, the full-width tyre gave the front wheels a somewhat spindly and narrow appearance, but doubtless the construction was robust enough for the tasks these little engines were called upon to perform.

One of the features which always appears to arouse comment is the width of the front wheels of ploughing engines, compared to those of road locomotives and agricultural traction engines. This, of course, is both to help in presenting a bigger area to soft ground and, in conjunction with double vee-rings, resisting the side pull of implements in heavy ground. All except the smaller classes of ploughing engines had the characteristic two tee-rings to each wheel, a feature shared by some crane-engines with smoke-box mounted jib and heavily loaded front end.

The prototype, pictured in my opening article with its wide strakes rather steeply angled, together with a fairly narrow wheel and fractional inter-strake gap, would certainly make for smoother running on normal road surfaces but must, on the other hand, have been decidedly tricky on wet and greasy fields, had it ever been sold. After some debate with Locoparts, who are supplying the castings for this engine, I decided not to use cast tee rings for either hind or front wheels, but to either fabricate from mild steel plate, cut and rolled to form the rim, with a flat ring welded or brazed in position for the leg of the vee, or alternatively to machine the tees from rings cut from 1 in. and $\frac{7}{8}$ in. m.s. plate — the lathe method being dependent on the good nature of my local scrap-man and his willingness to part with any suitable and desirable oddments, of course.

Rolling the rim and attaching a flat ring pro-

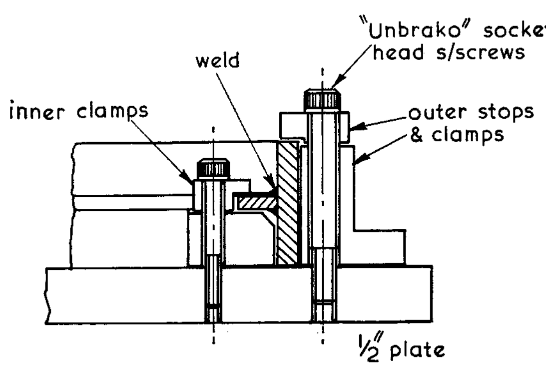


Fig. I Fixture used in fabrication of M.S. tee rings

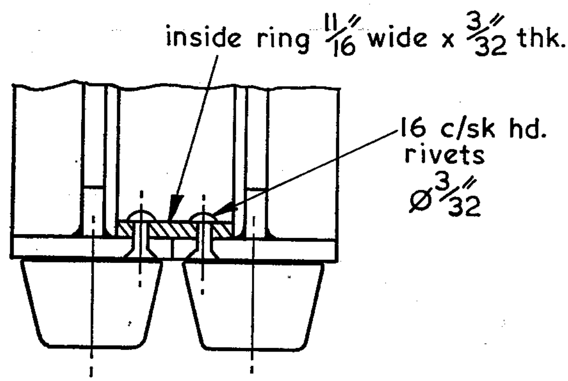


Fig. 2 Wheel construction with rubber tyres. (hind wheels only)

duces a strong enough wheel. I have built up the wheels of my 2 in. scale Fowler ditching plough this way, but the flat ring in this case is a mere 5/16 in. wide by ⅛ in. thick, and great care is required to prevent it distorting badly when heated. The only way to minimise the risk of this happening is to set the ring up as shown in Fig. 1 with the flat ring firmly secured inside it, by at least four clamping pieces—I use six, in fact—equi-spaced around the inside diameter, at the same time supporting the outside of the rim with m.s. stops and clamping the top edge with another set of six equi-spaced studs and clamps.

The half-inch plate used as a baseplate tends to carry away heat, so if you are intending to braze or silver-solder the components together, house the whole thing in a firebrick hearth, otherwise heat is wasted and the job takes toll of both time and temper—as well as gas. If silver-soldered or brazed, slightly chamfer the top outer edge of the flat ring where it joins the rim and run the Easy-flo or B6 well into the angle between the two surfaces.

By far the easier technique, if you have welding —preferably arc—facilities available is to spot weld at four points, alternatively, on centrelines, allow to cool while still firmly clamped in position, then remove the clamping pieces one by one, again alternatively, and turning the whole thing over and re-clamping, repeat the welding sequence. Four more welds can be inserted between the four spot-welds each side, following the same setting-up and clamping procedure as before, or preferably a light continuous run made around the outside of the tee ring, between rim and ring.

I have used this method when fabricating both flywheels and road wheels, the dished Fowler flywheel for instance, being anchored at six points to a slab of one inch thick m.s. plate and left for a few days before being released from the clamp fixtures, resulting in a fabrication remarkably free from any distortion which machined very evenly and cleaned up well; no attempt was made to normalise fabrications before machining.

Having access to bending rolls in a friend's workshop, I am using the foregoing method to fabricate the tee rings for both hind and front wheels, but am using 3/16 in. (6 s.w.g.) thick mild steel strip to form the rim, as this leaves an allowance for finish turning to the O.D. called up for each pair of wheels and makes sure they are truly circular, an even more important point when it comes to the rubber tyred wheels.

A glance at the drawing will show that the two-inch scale hind wheel works out a 9½ in. O.D. (over the strakes). Making the strakes 3/32 in. thick gives us 9 5/16 in. dia. over the bare tee rings which should be ⅛ in. thick when finished. The front wheels, allowing for steel tyre segments 3/32 in. thick, works out at 6¼ in. dia. (over tyre) and 6 1/16 in. dia. over the bare single tee rings.

Two methods of fitting solid rubber tyres to steam tractor or traction engine wheels was used. The first method, used when "rubbering" an engine already fitted with steel straked wheels, was to fit the tyre over the existing strakes, either using the correct type of tyre complete or making up a tyre from redundant lorry solid tyres, cut through and opened up under hydraulic presses to form segments of the cover radius to fit over the straked engine wheels, all solid tyres of whatever size being moulded directly on to circular steel flat rings, machined on the inside and grooved to take the rubber on the outside diameter.

Road lorries belonging to the heavy haulage contractors such as Norman Box or to fairground owners, being designed as road haulage engines, had their big solid rubber tyres pressed directly on to their wheels, no strakes being required and the worn tyres on their steel bands simply being removed by hydraulic pressure when new tyres were needed, although some of the earlier road locomotives had their "solids" pressed and bolted over the steel strakes, as earlier engines were turned out on

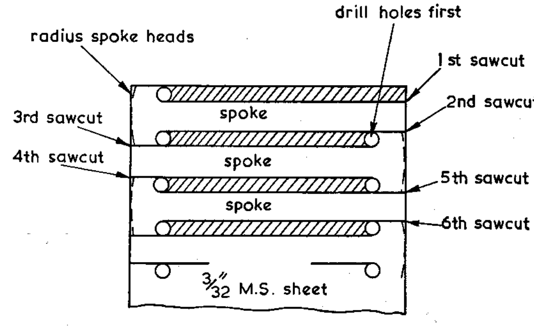
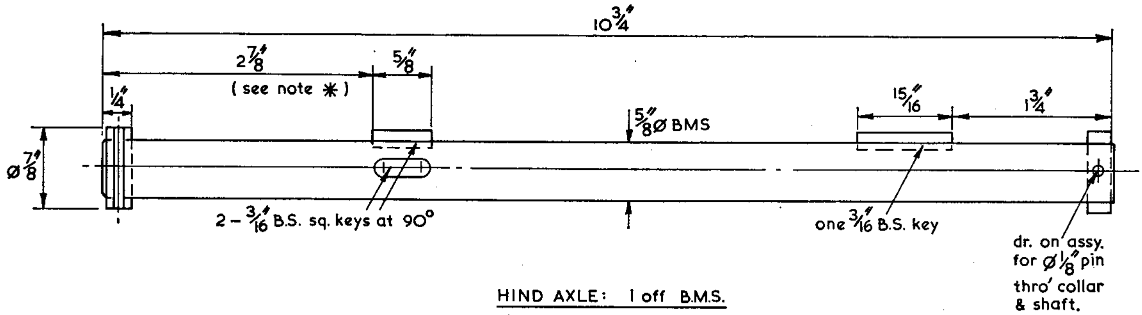
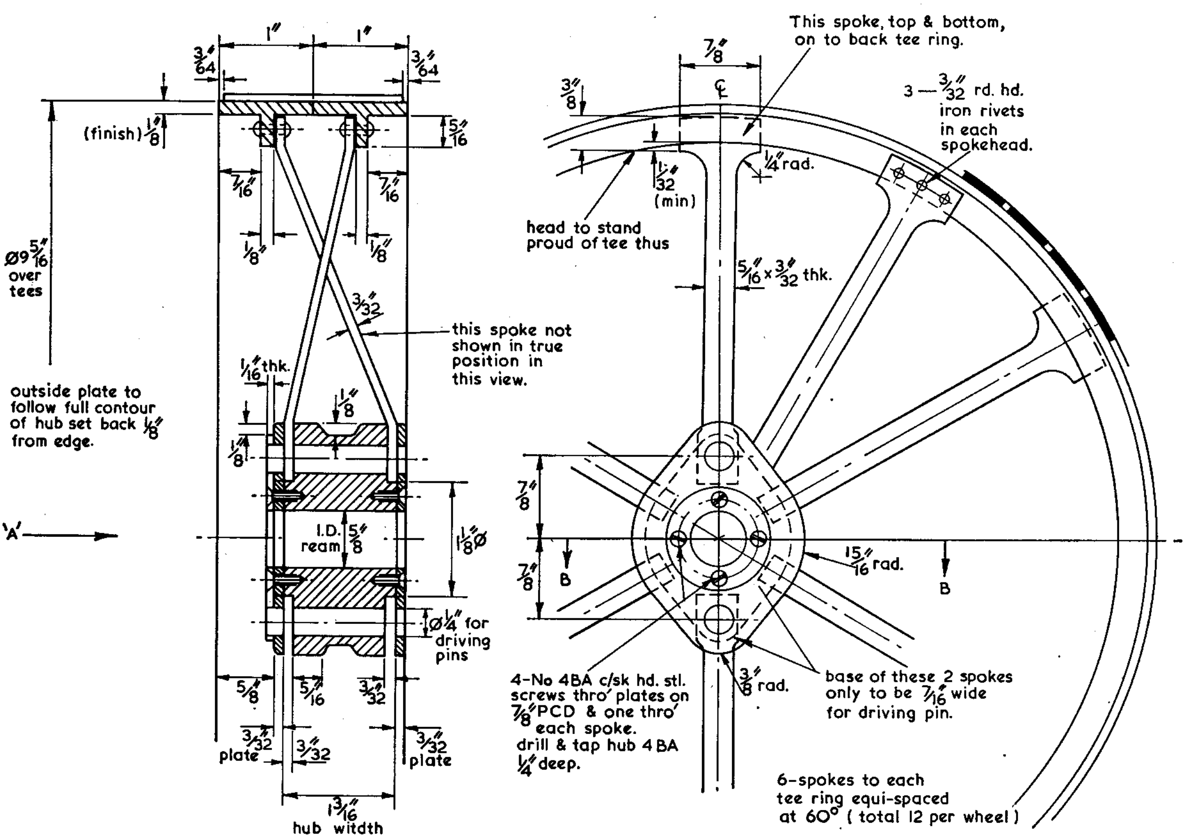


Fig. 3 Method of cutting out spokes



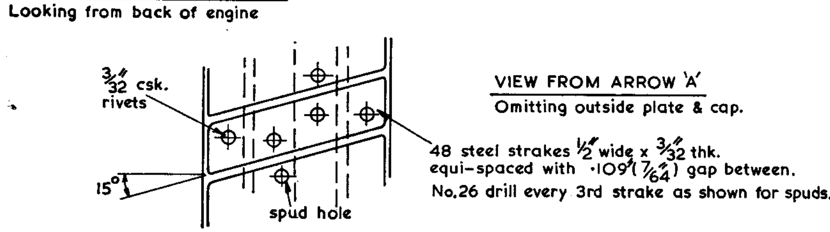
HIND AXLE: 1 off B.M.S.

✱ Note: — check this on assembly
with compensating gear



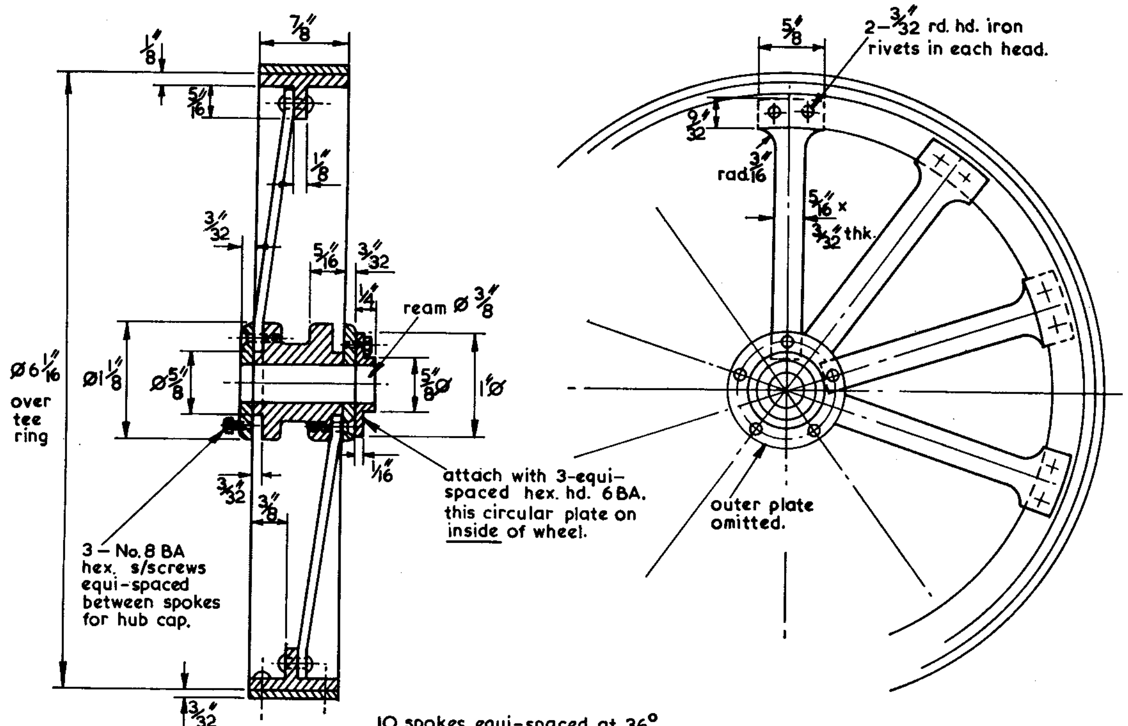
SECTION ON ℄ OF N.S. WHEEL

Looking from back of engine

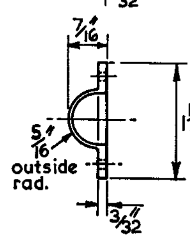


VIEW FROM ARROW 'A'

Omitting outside plate & cap.



10 spokes equi-spaced at 36°, with heads on alternate sides of tee ring. No. 4 BA csk. screw thro' each outer plate and spoke.
Dr. & tap hub 4 BA to suit.



FRONT HUB CAP: 2 off
brass (bright finish)

steel wheels when new and probably converted to rubber in later years.

An Act was passed some years before world war 2 requiring all engines (except ploughing engines) to be rubber mounted by, I think, the end of 1939 and this led some owners of agricultural engines to have them converted to rubbers by the first method I have described, cutting and pressing open the now unwanted solid tyres, once used for lorries and buses, and now languishing in tyre stockists' stores all over the country, and bolting the sections, double on hind and single on front, to engine wheels. This was heavy and hot work, as engines usually came into the works to have work carried out during the summer months before the threshing season started again, usually being regarded by the apprentices as an unpopular and punishing task awarded by the foreman to any pair of apprentices currently in his bad books.

The coming of war in September 1939 meant that the Act was never enforced; and many engines worked through the war years and into the forties on their original steel strakes.

Of the little Ransomes tractors surviving (five in all), three are on rubbers, the official works photographs showing both the type of solid tyre pressed on to a plain unstraked rim as described and also a tractor fitted with rubber strakes as an alternative method. However, it is the more commonly used type of solid rubber tyre which I intend to use on my method and as on the full-size engine, this will involve wheels of slightly smaller diameter, with another slight variation on the hind wheels which I will come to later.

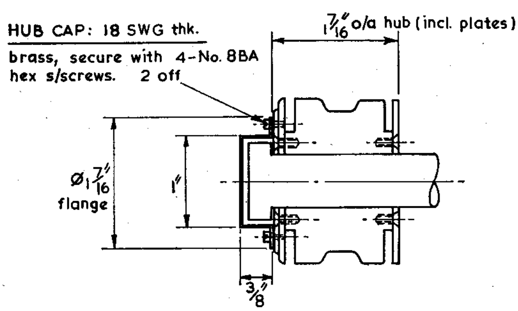
The outside diameter of the tyres fitted on the hind wheels was 1530 mm. ("solids" were always quoted in metric sizes for some reason) which gives us an O.D. of 10 in. in 2 in. scale, as against the 9½ in. over strakes of the steel wheels; the twin tyres on hind wheels were 5½ in. (140 mm.) wide, as were the single ones pressed on the front wheels, this working out at about 29/32 in. for 2 in. scale.

Looking around or something suitable, I decided on using synthetic rubber standard vee belting, size "C" giving us a vee section 22 x 14 mm., or nominally ⅞ in. wide by 9 1/16 in. deep, very nearly to our scale required and determining the hind wheel O.D. of 8⅞ in., with front at 5⅛ in. O.D. This has necessitated increasing the front wheel width from the exact scale width of .8334 in. to .875 in order to take the width of the tyre.

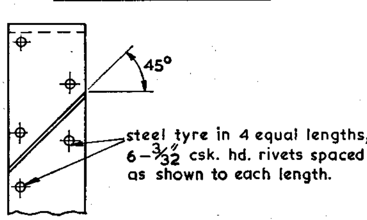
Using vee belting means that the tyres will not, as in full-size practice, be moulded on to grooved steel rolls and pressed on to the wheels; instead the inverted vee belting should be cut to exactly fit directly around both front and hind wheels, with an angled joint as shown on my drawing.

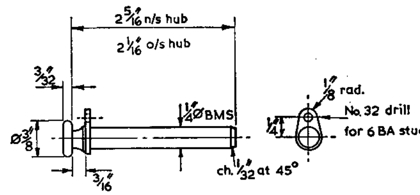
Allow a length of belting, at least 28 in. long for hind, and 16¼ in. for front wheels—that is, for each individual tyre—and clamp the tyre tightly at intervals around the wheel to allow the bonding agent to set—preferably use a circular wire or clip, all round. Now to the slight variation between steel and rubber shod wheels. The two tee rings of the hind wheels are held together by the steel strakes, four countersunk rivets securing each strake to the tee rings. As each rubber tyre is bonded to a steel ring or hoop of approximately the same width as the tyre itself, pressed on to the plain unstraked rim of the hind wheels, there is nothing to keep the two tee rings together and an additional steel ring has to be inserted between the tee rings, inside the wheel as shown in my sketch, Fig. 2. This is riveted to the tee rings with countersunk head rivets to ensure a smooth outside diameter for the tyre hoops to press on to, and apart from the difference in wheel diameter is the principal difference between the two types of wheel.

Three final points before we leave the wheels: Firstly, the heads of front and hind wheel spokes differ very slightly, as I have shown on my drawing. Secondly, the strakes are ½ in. wide and work out at 7/64 in. apart, at 48 spaced equally around 9 5/16 in. dia. wheel.

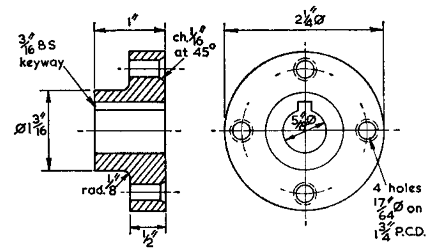


SECTION THRO' HIND WHEEL HUB ON B-B SHOWING CAP.





DRIVE PINS: 2 off B.M.S.



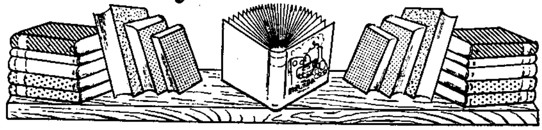
DRIVE PLATE: 1 off M.S. (for o/s wheel)

I find it easier to set out, drawing a circle on white card and setting the spacings around the circle, cutting out to fit over the wheel and marking off directly from the card to the wheel.

Thirdly, an alternative method to milling the spokes in batches of several at a time, is to use a piece of 3/32 in. thick m.s. plate of sufficient width to cover the full length of spoke and head, plus a little extra length for bending, and mark out a line of spokes head to tail as shown in Fig. 3. I used this method to cut out the spokes of the Aveling and Porter roller, first cutting out a stiff cardboard template of the spoke and marking around it on to the plate. Then centre-pop for two lines of holes which will form the radius at the spoke head and drill these through, next sawing through to meet each hole from the lower or top end of each spoke upwards. Clean up each head to form the radius and don't forget the slight difference between front and hind wheel spokeheads, as mentioned above. As the drawing shows, the hubs are turned down to accept the toe of each spoke, with a plate on the outside following the outline contour of the hub (this will differ slightly between the inner and outer face of both back hubs but will be identical on both sides of each front wheel). The spaces left between each spoke must be filled-in with one of the metallic compounds — I use "Molecular E-Metal" which is easy to work down into the inter-spoke apertures and sets smooth and hard— my only concession to using a material which was not used in construction of the full-size engines and for which I must, of course, add the usual trade disclaimer.

To be continued

......for your BOOKSHELF



"Model Engineering"
by Martin Evans
Published by Pitman Publishing, 39 Parker Street, London WC2B 5PB
Price £7.95 plus p. & p. 50p.

This book, one of several written by the well-known former Editor of *Model Engineer*, is unique in that it is not a handbook on any particular aspect of model engineering, the design of a particular model nor the workshop processes in building it, but an account of all aspects of the hobby from the initial choice of which model to build to its display at a Club track or Exhibition. It will therefore be of special help and interest to newcomers and perhaps even more so to "lone hands" who, although they may have been making models for some time, are unaware of the full breadth and scope of the hobby.

Starting therefore, after a brief introductory chapter, with types of model, some 40 pages are devoted to an excellent series of photographs of models ranging from locomotives to clocks. Many of course are old friends, entries from previous Model Engineer Exhibitions or the pages of *Model Engineer* which it is nice to see again and although it is probable that most model engineers make their choice from purely personal grounds this section does most certainly give an impressive account of the scope of the hobby and the range from which a choice can be made.

The following chapters on the home workshop, its tools and equipment are more controversial because, as the author himself says, it is a big subject and a large volume would be required to do justice to it. Selection must be made therefore and the author chosen to cover the widest possible range, going from simple hand hammers to machine tools which, with their equipment, would cost up to £1000. No reference is made however to planers, shapers or tool and cutter grinders nor, surprisingly, to the vertical slide.

A section then follows on Castings, Materials and Working Drawings. This explains, in non-technical terms, all the materials the amateur is likely to meet together with some useful hints on colour-coding to identify different materials. The section on working drawings is, however, most disappointing, comprising no more than two pages of reprinted drawings with no explanation whatsoever. "Reading" a drawing is an art which must be learnt by most people who have not had an engineering training and it is a pity that the author with his wide experience and skill as a draughtsman did not explain the conventions that are used in, for example, sectioning, dimensioning, and the projection of different views. It has been said that a good drawing is worth pages of print and a better appreciation of the many excellent drawings which appear in *Model Engineer* might save much repetitive description of the "take a piece of brass and turn down $\frac{1}{2}$ in. to $\frac{1}{4}$ in. diameter" type.

The final section deals with Societies, Rallies and Exhibitions, and here again the author has missed an opportunity of being a real help to newcomers and lone hands. It is not easy to locate the officers or meeting place of a Society in any town or city, even if one knows that one exists, and a list of names and addresses would have been of great value. Admittedly they change from time to time but even so no ex-Secretary would be unwilling to pass on a letter of request for information to the current holder of the office.

Altogether a book which will be useful and interesting to both the expert and the beginner alike. To the former as a reference book containing much to ponder upon, and to the latter as an introduction to all aspects of a popular and ever growing hobby.

D. H. CHADDOCK, C.B.E.

"Kings of the Great Western 1927-1977"
by Rex Coffin
Published by the 6000 Locomotive Association and available from Sales Manager, 6000 L.A., 44 Church Road, Tupsley, Hereford
104 pp., price £3.95, or £4.55 post free

The "Kings" of the Great Western Railway have always been amongst the most popular of Britain's locomotives, and No. 6000 *King George V* is perhaps the best loved of all, with the possible exception of the ex-L.N.E.R. *Flying Scotsman.*

No doubt the popularity of the "Kings" was as much due to their magnificent appearance as to their performances, for surely no finer looking locomotives ever took the rails.

Rex Coffin's book tells the story of the "Kings" with a minimum of technical detail, but with a very fine collection of photographs, many of which few will have seen before. This reviewer particularly liked the close-up of the bell on No. 6000 and the picture of No. 6026 entering Paddington Station.

All railway enthusiasts must be grateful for the help given by Messrs. Bulmers in preserving No.

6000 and for the efforts of the 6000 Locomotive Association in keeping alive this fine locomotive in spick and span order. It is greatly hoped that No. 6024 will before long be once again in running orders, thanks to the preservationists at Quainton.

Two minor criticisms. On page 70, the caption states that in 1949 it was decided to fit a "superheater unit" to a "King", suggesting that these locomotives were not built with superheaters; but of course they were all fitted with the usual Great Western type of superheater on first building. And on page 74, Mr. Coffin claims that the "Kings" were Britain's most powerful steam passenger locomotives. Admirers of the L.M.S. "Pacifics" or of Gresley's "A.4s" would certainly wish to dispute that! Nevertheless this is a fine production, on good quality paper, and it is very reasonably priced. It should find a place on the bookshelf of all admirers of the old Great Western Railway.

R.M.E.

CLUB DIARY

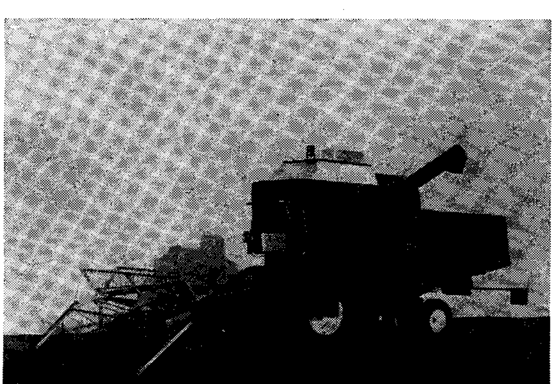
Dates should be sent at least five weeks before the event to ensure publication. Please state venue and time. While every care is taken, we cannot accept responsibility for errors.

JANUARY 1978

5-14 Model Engineer Exhibition, Wembley Conference Centre, 10.00 a.m. to 8.00 p.m. (7.00 p.m. January 14)
Adults 75p, Children 50p.

North London Soc. of M.E. Film show arranged as usual by Jim Robson.
6 Romford M.E.C. Competition Night. Ardleigh House Community Centre, Ardleigh Green Road, Hornchurch, Essex. 8 p.m.
6 Stockport & District S.M.E. Bits & Pieces. The Parish Hall, Church Street, Cheadle, Cheshire. 8 p.m.
6 Hull Society of M.E. Surplus Engineering Materials Sale.
7 Bristol S.M.E.E. Railway films past and present. prizewinners by Gordon Dando. at 7.30 p.m. Staff British Rail/Asscn. club. Temple Meads Station, Bristol.
7 Huddersfield S.M.E. Family night—75p each, Meat & potato pie, sherry trifle, raffles, games and prizes.
7 M.E.S. of N. Ireland. Monthly meeting. Strathern Hotel, Holywood, Co. Down. 3 p.m.
9 N. Wales M.E.S. meeting at Penrhyn New Hall, Penrhyn Bay, Llandudno 7.30 p.m.
9 Clyde Shiplovers & M.M. Society. Nautical quiz.
9 Bedford M.E.S. Bring and Buy Sale.
9 Worthing & District Society of Model Engineers. Fire Engines—talk by member J. Weeks, Broadwater Paris Room, 7.30 p.m.
9 Wirral M.E.S. Members Slides. Victory Hall, Upton. 7.30 p.m.
10 Milton Keynes Model Society. A.G.M. 8 p.m. Royal Engineer, Stratford Road, Wolverton, Milton Keynes.
10 Guildford M.E.S. ex. com. meeting.
10 Sutton Coldfield & North Birmingham M.E.S. Film show.
10 Derby Soc. of Model and Exp. Eng. A.G.M.
11 Southampton & District S.M.E. 'Manufacture of Antique Firearms' Alan Scarr.
11 Sutton Coldfield Railway Society. Trams of Birmingham. R. T. Coxon.
12 N. Devon Soc. of M.E. Film show by D. Hayward.
12 Sutton M.E. club. Details to be announced.
12 Hull S.M.E. Dore-Westbury Miller Talk by Jeff Chilver.
13 Chichester & District S.M.E. Illustrated talk by Don Mitchell, Do's and Don'ts of photography. 7.30 p.m. Boys High Schools Kingsham Road, Chichester.
13 Asscn. N.I. Group. The Isle of Man Steam Railway supporters/Welsh Railway, Film—Samuel Bracegirdle.
13 Kinver & West Midlands S.M.E. Workshop electrical. 7.30.
13 Polegate M.E.C. Mr George Barlow on the Romney, Hythe & Dymchurch Railway
15 N. London Soc. of M.E. US Social evening—Potters Bar N.L.S.M.E. members only.
16 City of Leeds S.M.E.E. 7.30 Salem Cong. Church, Hunslet, Leeds. Here, there and everywhere, a slide show by Mr. Dickinson.
18 Sutton Coldfield Railway Society. German Rail—B. Goldingay—cine.
18 Guildford M.E.S. Bits and pieces comp. 7.45 at HQ stoke Park.
18 Cannock Chase M.E.S. 7.30 meeting. Lea Hall Club. Matheau, Murray steam engineer. Mr F. Caunce.
19 Sutton M.E. club. A journey through North Africa, an illustrated talk by Dr. Settle.
19 Warrington & District M.E.S. Tool & Drill grinding by H. Pugh in Pavilion, Daresbury at 8.00 p.m.
19 Leyland, Preston and District S.M.E. Meeting. Roebuck Hotel, Leyland.
20 Stockport & District S.M.E. Talk—speaker to be announced. The Parish Hall, Church Street, Cheadle, Cheshire. 8 p.m.
20 Romford M.E.C. A.G.M. Ardleigh House Community Centre, Ardleigh Green Road, Hornchurch. Essex 8 p m
21 Wigan & District M.E.S. Annual General Meeting, Co-operative Guild Room.
21 Wigan & District M.E.S. Annual General Meeting, Co-operative Guild Room, Thompson Street, Whelley at 7.15 p.m.
23 Bedford M.E.S. Informal meeting, loco building.
23 Clyde Shiplovers & M.M. Society. The year on the river—M. Campbell.
24 Sutton Coldfield & North Birmingham M.E.S. Auction.
25 Bristol S.M.E.E. Pistols and mechanical music, by Ken Rawlings. British Rail Staff Assocn. club. Temple Meads, Station, Bristol, 7.30.
25 Sutton Coldfield Railway Society. Steam Miscellany—D. J. Bradbury.
26 Rugby Model Engineering Soc. Discussion on proposed 7¼" gauge track. 7.30 Hillmorton Community Centre.
26 Sutton M.E. club. Screwcutting Ken Webber enlightens us on this gentle art not understood by all.
27 Kinver & West Midlands S.M.E. Practical Boiler construction. 7.30.
28 West Wilts. Society of Model Engineers. M.E. Exhibition at St. James Hall, Trowbridge.
28 Society of Model and Experimental Engineers. A.G.M. Caxton Hall (2.30 p.m.)
30 Stafford & District M.S.E. Annual General Meeting. Doxey Arms, Stafford 7.30 p.m.

Further examples of Mr. Wingrove's work—a 12 inch high Combine harvester and a selection of engines.



Post Bag

The Editor welcomes letters for these columns. Pictures, especially of models, are also welcomed. Letters may be condensed or edited.

I.M.L.E.C.—"D. E. Lawrence Reports"

SIR,—Oh dear me! Two critics in close succession in *M.E.* for 21 October and 4 November last. Dave Capener appeared in print first, so perhaps I can offer a mild reply to him first. I don't know (and certainly would *not* even seek to blame anyone) who entered on the scoreboard the numbers of passengers carried on the trains. I reported what I saw and counted myself. On the first run, I think, but anyway very early in the day, I was told by one "rail sander" that the "sand" being put on the rails was scouring powder and I reported this. Several weeks later, friend Percy Wood of the Chingford M.E.C. told me that they had found scouring powder ineffective and that he had brought from his home a supply of fine sand (ex-foundry sand blast) and the containers were emptied and refilled with that. And that stuff was effective.

I am well aware of the basic design considerations which attended the making of Dave's set of excellent articulated passenger trolleys. In my report I said that —quote—*and has worn very well and has obviously been decently maintained*—unquote—and that meant, of course, that they had stood up to wear very well; my eyes and fingers told me so. My ageing backside was less appreciative and told me they were just as hard as ever.

So that Mr. Moretti's criticism can be seen in its correct perspective, perhaps I may be allowed to explain how I tackle the job of reporting I.M.L.E.C. Any member of a host Club on duty for this Competition will know that it is an all day stint, and I mean *all* day. For me it is not less than 12 hours, sometimes more depending on the distance I have to travel. The hosts have to do a good deal of advance preparation and, if I am to do justice to a club for its efforts, I too have to do some things in advance. Club officials concerned with the organisation do not have much time to talk to me on the day and, in any case, their attention is usually on other matters. What I do is to go along on the Saturday before and get "genned up". Because Chingford had to stage the Competition on a Saturday, I went along on a week-end prior to this and was told what was in store for us. Amongst such information was an item that Mr. Moretti of the East Herts. Railway Club would be operating a portable 7¼ in. gauge railway and this I duly reported.

On the day, I did go outside the track enclosure (I had to) and verified that there was a 7¼ in. gauge ground level track in operation and that the other things which were scheduled to appear were, in fact, there. Other than that, my day was already fully committed the moment the first competitor appeared in the steaming bays.

One continuing regret I have about this Competition is the great number of half-started conversations I have with a great many friendly and interesting people; I am rarely able to stay with them for long before duty calls me elsewhere.

London SW2 2BQ. D. E. Lawrence

Colin Tyler's Digging Engine

SIR,—Colin Tyler's Digging Engine series interested me greatly and his remarks on the patterns for the various gears set me thinking. I have used the lost wax process for quite large items using melted candle ends and plaster of paris, inverting the mould over the kitchen fire when air dried to burn out the wax, but unless the mould was heated enough to burn out all the wax from the plaster, bubbling took place and if heated enough the mould was often damaged. I am now making patterns in polystyrene which just disappears when heated. I have a friend who has a friend, a patternmaker for ships' propellers of the largest size, and polystyrene is used for these. There is a cheap wire cutter on the market and one firm markets soldering irons with suitable tips.

York, N. Humberside YO4 2XN. E. Rudd

Variable Blastpipes

SIR,—With reference to Mr. D. C. Piddington's article in *M.E.* 3557 on Variable Blastpipes, I recently came across some information which may be the origin of this device.

In Colburn's book *Locomotive Engineering*, page 61, it is stated that Mr. Henry Booth of the Liverpool & Manchester Railway patented a variable blastpipe in 1836 for the purpose of increasing the back pressure on the pistons in order to retard the locomotives. This was also one of the claims made by Mr. John Carey, then of the L. & M. and later of the Hull & Selby & LB & SER in his patent of 28 July 1838 covering numerous locomotive improvements.

Gray's arrangement is also clearly shown in Figs. 76 and 50 in E. L. Akron's book *British Steam Railway Locomotive* which shows express and goods locomotives of the Hull & Selby Railway built by Shepherd & Todd in 1840 and 1842/4.

While the object may not have been to increase the steam generation of the boiler, from the figures it is clear that this was also possible since any restriction of the exhaust nozzle would increase the sharpness of the blast; thus on these engines the drivers probably soon discovered the dual function of this device.

These dates, which are prior to the establishment of a major railway in France, firmly place the variable blastpipe as a British invention.

May I request through your columns a source of information I was originally searching for, mainly a general arrangement drawing of Stockton & Darlington Railway 238 Class 4-4-0s (Ginse's Babies) as built at Darlington in 1871? I would be obliged if anyone could suggest a source of suitable information.

Paisley, Renfrewshire. J. B. Rowley

Pools

SIR,—Recent interest shown in the 4½ in. Pools lathe prompts me to ask readers whatever happened to the popular Pools Horizontal Bench Milling Machine.

The Reeves 1955 catalogue had a photo of this miller with vee drive for £27.50 but recent correspondence from them says they have no knowledge and think it finished years ago; a run down on the firm would be interesting. .

The 4½ in. size that Pools introduced seems to be just about right, and a pity in these advancing times that Myfords, who have a tremendous reputation, still hang on to their old 3½ in. standard, an item which for many years now the user has continually tried to alter, as pages of *M.E.* reveal. One wonders if it has ever occurred to them to change all this.

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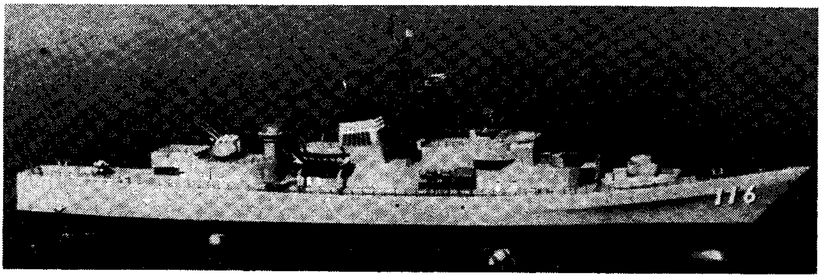

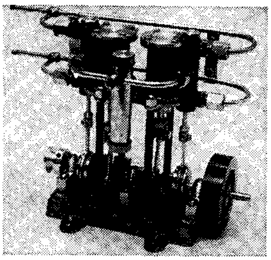

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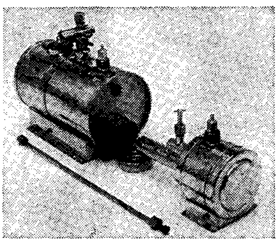

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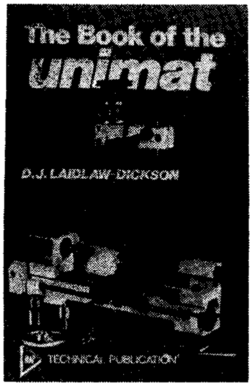

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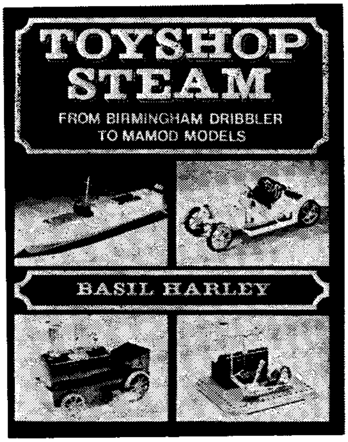

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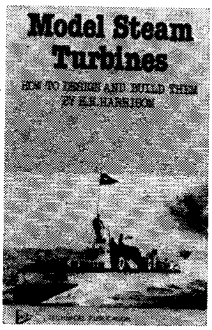

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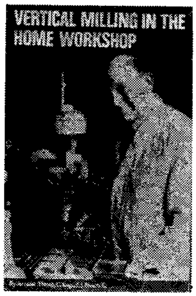

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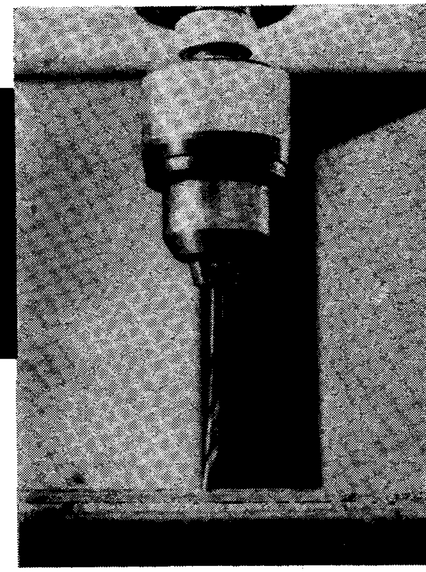

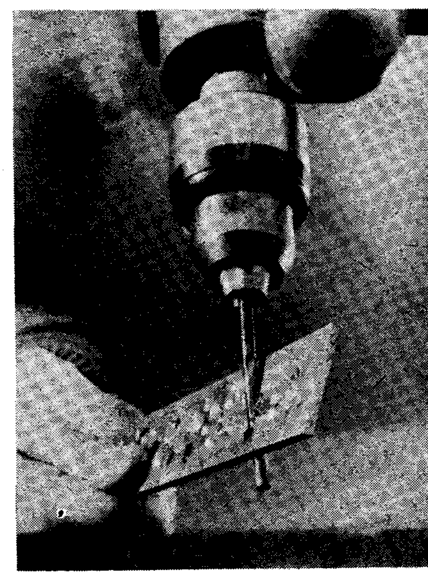

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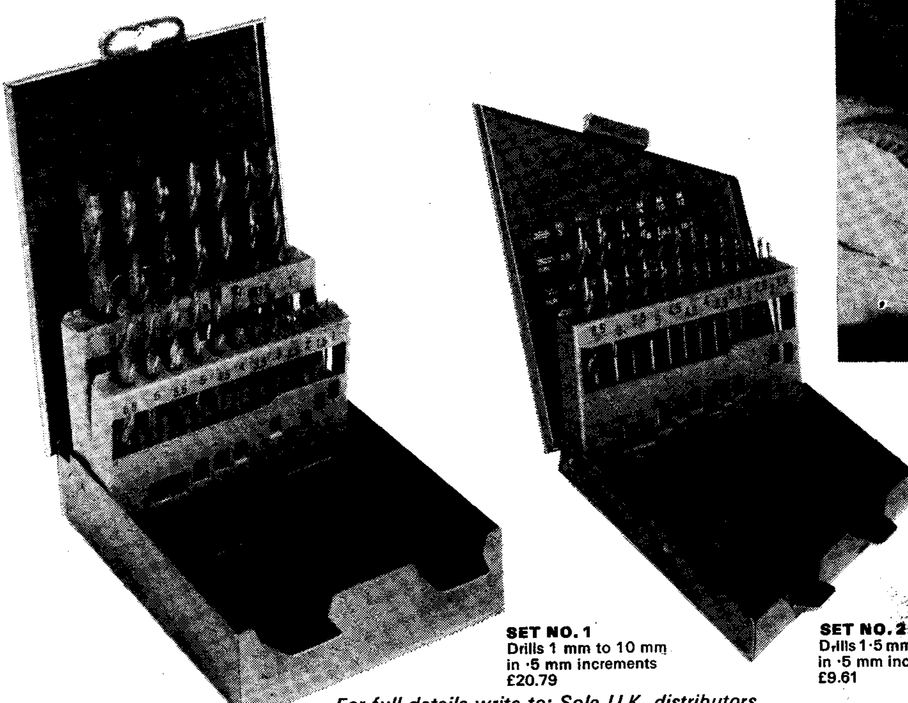

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