MODEL LOCOMOTIVE CONSTRUCTION FOR BEGINNERS

Part XV

by Martin Evans

From page 295

Walschaerts Valve Gear (continued)

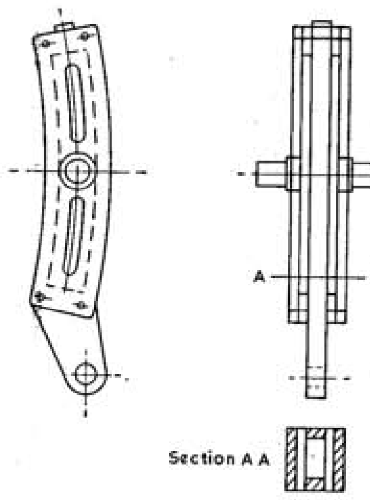
Design of Expansion Link

For model locomotives of 2½ in. gauge and smaller, the expansion link is cut from bright mild steel of suitable thickness and riveted or brazed to its trunnion pin, the pin being on one side only, with the radius rod with a single die-block lying on the other side of the link. If the trunnion pin is of adequate length, this simple arrangement is generally quite satisfactory. An improvement would be to use gauge plate instead of mild steel, and if the pin is to be a press fit rather than brazed, it can be hardened and tempered.

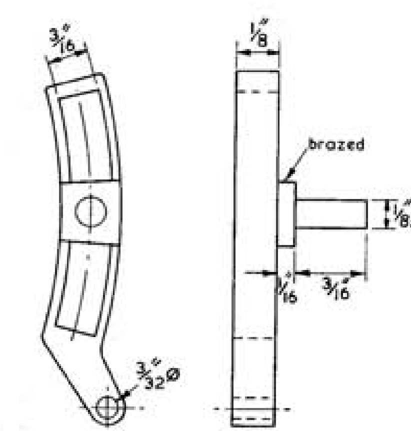
A better method, for larger models, is to arrange for a double bracket to be fitted to the expansion link, each arm of the bracket carrying a trunnion pin, the radius rod being forked to embrace the link itself. This design was used on many ex-Southern Railway locomotives. In this arrangement, the lifting link should be made as long as possible to minimise die-slip.

Some railways used an arrangement where the radius rod was raised and lowered by means of a lifting arm behind the expansion link, and for this scheme the link must be so designed that the radius rod can pass right through it. Gresley on the L.N.E.R., and Stanier on the L.M.S. both favoured this design. There is not much die-slip, especially if the link is of large radius, and provided the presence of other coupled wheels does not interfere with the weighshaft and its bearings, this is an excellent arrangement for a model as the weighshaft passes through the frames well below the bottom of the boiler, however low pitched the boiler may be. On some locomotives using the lifting gear mentioned earlier, the weighshaft had to be pitched so high up, that it had to be made in two pieces with a "set" in the middle, to clear the boiler, not a nice thing to make!

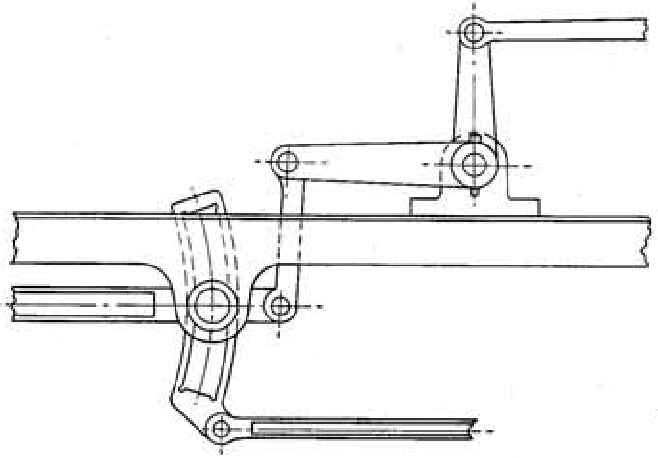
With the L.N.E.R./L.M.S. arrangement, a lifting arm with a long slot was used, the end of the radius rod being slotted and provided with a rectangular die-block sliding in the latter slot. The L.M.S. favoured a type of expansion link where two die-blocks were used, the two halves of the link being made as channel sections, while the L.N.E.R. preferred a link having a central slotted member and two plain outer members, to which the trunnion pins were fitted, so that the radius rod had to be doubled where it passed through the link—a neat arrangement but rather a lot of work! When making this type of link, great care must be taken to keep the two trunnion pins in line; ordinary screws are not good enough to align the parts truly, so turned and fitted bolts should be used.



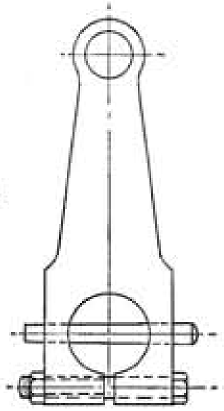
L.N.E.R.–TYPE 3-PIECE EXPANSION LINK



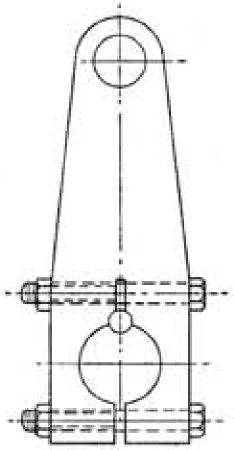
A SIMPLE TYPE OF EXPANSION LINK FOR ½" SCALE MODELS



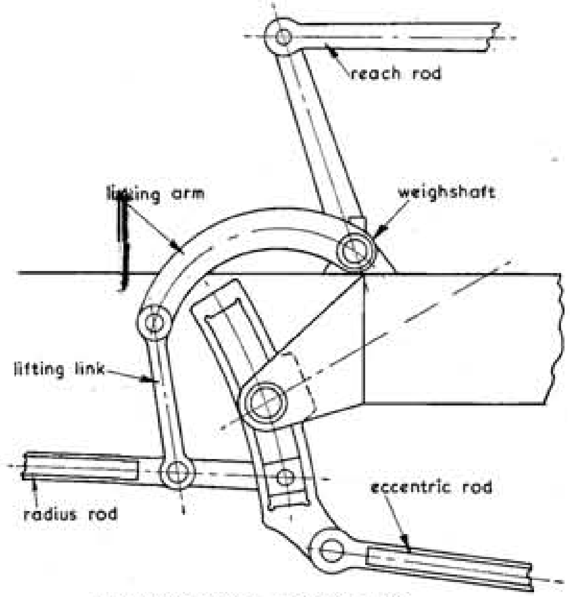
LIFTING LINK ON EXTENDED RADIUS ROD



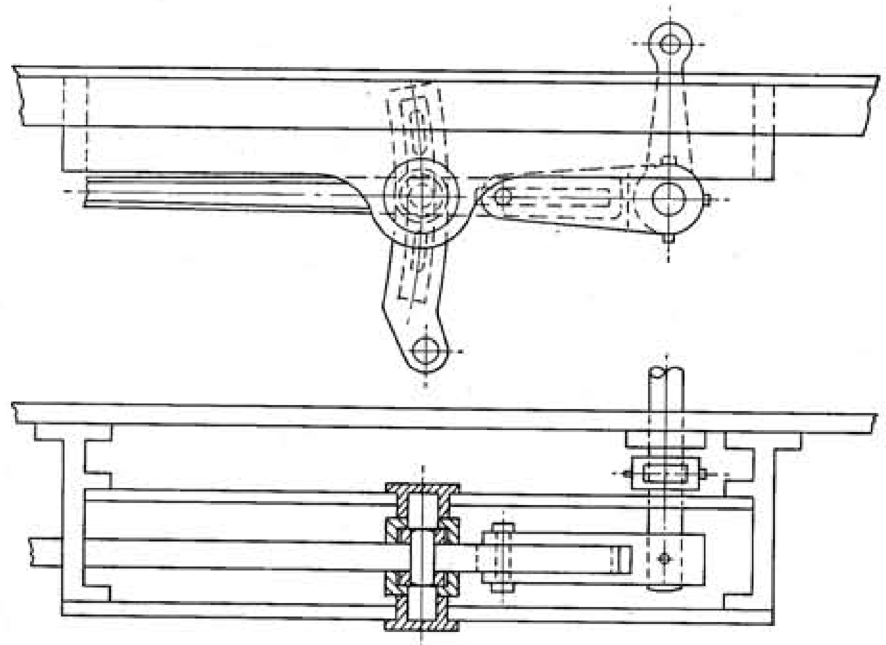
A GOOD METHOD OF FIXING RETURN CRANKS



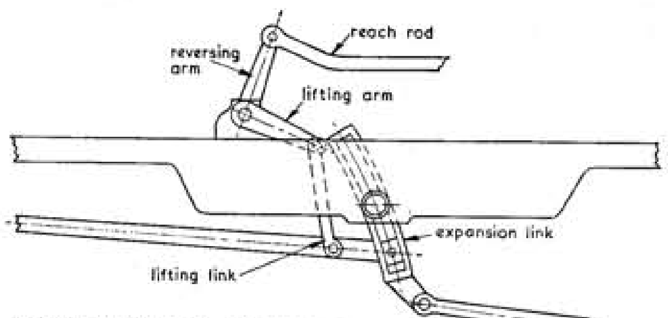
ANOTHER METHOD OF FIXING RETURN CRANKS



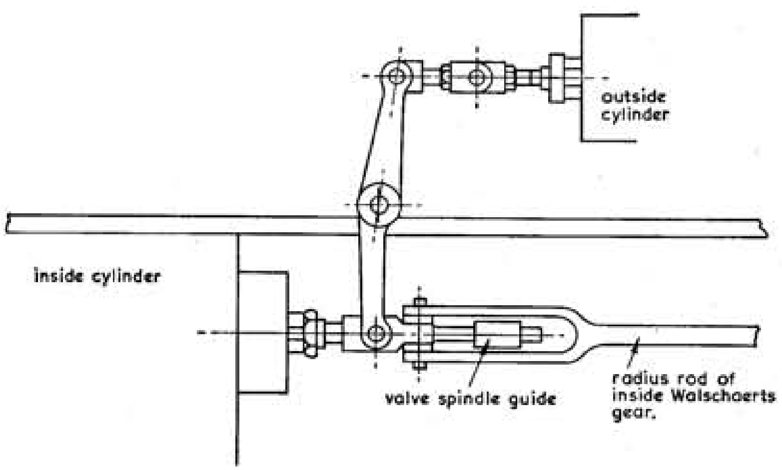
FORWARD–TYPE LIFTING LINK



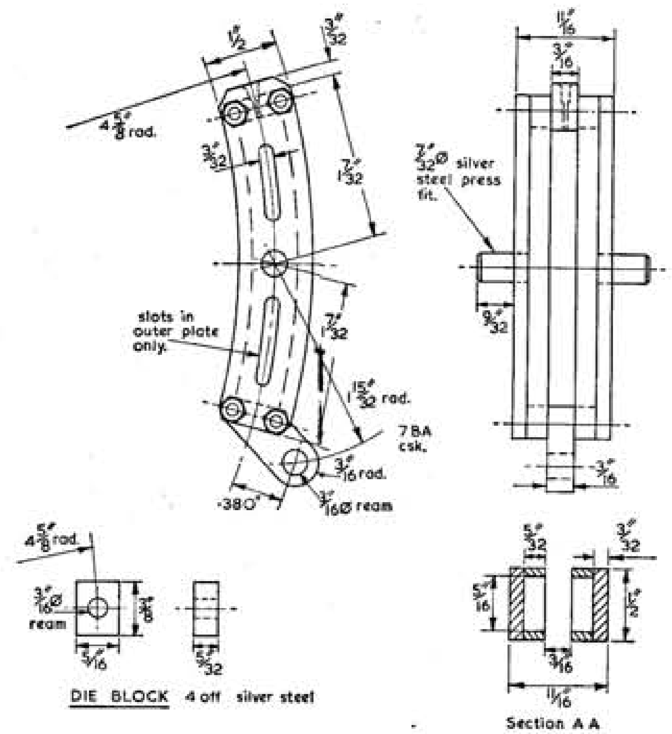
LINK SUSPENSION IN GIRDER FRAME



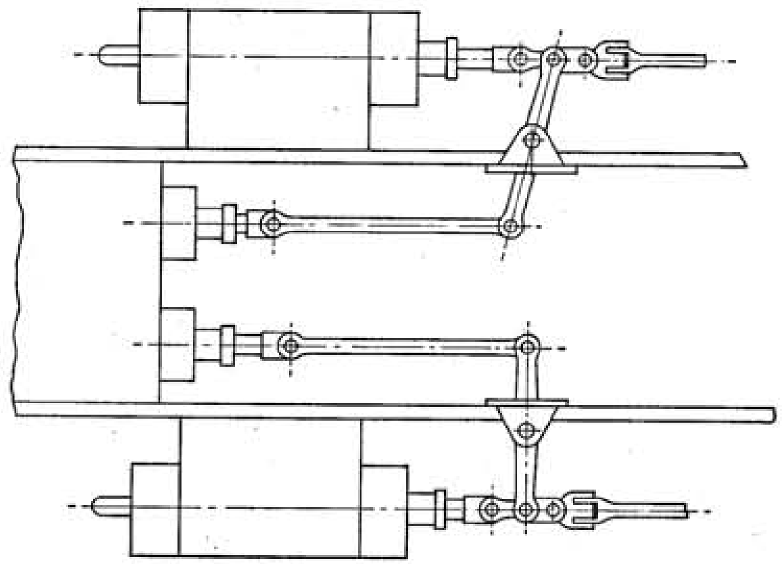
S.R. TYPE EXPANSION AND LIFTING LINKS



FOUR–CYLINDER ENGINE: INSIDE TO OUTSIDE GEAR



5" GAUGE L.M.S. TYE EXPANSION LINK



FOUR–CYLINDER ENGINE: OUTSIDE TO INSIDE GEAR

This type of link has to be assembled with its radius rod and die block *in situ*, so the outer plates cannot be riveted, bolts must be used.

The Return Crank

The return crank in Walschaerts valve gear is fixed to the outer end of the main crankpin and with the die-block in the lower end of the expansion link for forward gear, is in advance of the crankpin for outside admission valves or in retard for piston valves with inside admission. The angle of advance will be exactly 90 deg. if the motion is "all-square", but for an inclined layout, as was usual with British locomotives, it will be more or less than 90 deg. according to the angle of inclination. An important note regarding return cranks is that there is only one length for a given return crank pitch circle; thus it is not possible to increase the valve travel of the gear merely by setting the crank further out to describe a larger pitch circle. A new return crank of the correct length would have to be made.

The fixing of the return crank is an important point in model locomotives as there must be no possibility whatever of the crank shifting in service. The crankpin itself must be quite secure in the wheel, and I always make sure of this by pressing in a small parallel pin in the back of the driving wheels, half in the wheel and half in the pin. A good scheme, where the crankpin is of ample diameter, is to split the lower end of the return crank, and put a clamping bolt through this immediately clear of the crankpin. After the return crank has been correctly set, a standard taper pin of suitable size is put through the middle of both crankpin and crank. This method ensures that, should the return crank have to be dismantled at any time, it can be replaced in its correct position without difficulty.

This method is sometimes criticised on the grounds that the crankpin is considerably weakened. But this should not apply if the proportions of crankpin and taper pin are carefully decided beforehand. At all events, I have yet to see a broken crankpin due to this method of fixing.

In full-size practice, the end of the main crankpin is sometimes squared, the return crank being clamped to this by a bolt immediately below the square. This was used by Gresley on his outside cylinder locomotives. Another method was to mill a slot across the face of the crankpin, the crank being machined with a "tongue" to fit this slot for driving purposes, the securing being done by four set-screws or studs. These methods have disadvantages for the model engineer owing to the difficulty of obtaining the correct setting before machining either the end of the crankpin or the crank.

One sometimes sees four small countersunk screws used to drive a return crank, but this is a very poor method, as sooner or later, the screws will work loose with disastrous results.

The setting of the return crank in its correct position on the crankpin can be done as follows:

First determine the front and rear dead centre positions. To do this accurately, turn the wheels slowly forward, watching the crosshead closely until it appears to have stopped moving at its closest position to the cylinder. Make a pencil mark on the rim of the driving wheel and another pencil mark exactly opposite the first on some fixed part of the engine, or if no convenient place can be found, clamp a piece of flat metal of a thickness equal to the distance from the frame to the face of the wheel, i.e.—so that it will be flush with the face of the wheel. Now move the wheels a little further round, and it will be noted that the wheels can be turned a little without moving the crosshead at all. Make another pencil mark on the piece of metal opposite to the new position of the mark on the wheel. The correct dead centre position will now be half-way between the two pencil marks.

I should of course have mentioned that the wheels must first be jacked up to their correct running position. This can be done quite easily by inserting pieces of metal between the bottom of the axleboxes and the horn stays.

The expansion link is next clamped in its mid position, that is a position such that the die-blocks can be run from top to bottom of the link without imparting any movement to the combination lever or valve spindle.

Set the main crank exactly on front dead centre and set the return crank as near as possible by eye to the position given by the drawing being worked to. With a pair of large dividers, measure the distance from the centre of the hole in the tail of the expansion link to the centre of the return crankpin.

Now shift the main crank around to the back dead centre position and offer up the dividers as before, without shifting them. If they exactly tally, the return crank is correctly set, and can be tightened up and pinned. If the dividers do not tally, shift the return crank by half the distance and try again. It may be necessary to repeat the process two or three times, but it should be noted that when the position is correct, the dividers will be at the right setting to mark out the eccentric rod, which can then be made and fitted. Both sides of the locomotive should be checked in the same way, in case there is any slight difference.

Sometimes, ball or needle roller bearings are fitted to the eccentric rod crankpin bearings on the larger gauge models. These can be very effective, but they should not be of the "solid" type, double-row self-aligning bearings being the most suitable. Such bearings, especially if fitted with dustexcluding caps and kept properly lubricated, will have much longer lives than plain gunmetal or cast-iron bearings.

Now for a few words on the making of the various parts of valve gears. In almost all cases, the various holes should be marked out, drilled and reamed before shaping the remainder of the part, or before slotting the ends or "forks". For the larger components, the horizontal milling machine is the answer for quick removal of metal between bearings, and also for fluting operations. If no such machine is available, it will generally be found quicker to hacksaw away most of the unwanted metal and only use the vertical-slide and end mills or side-and-face cutters for finishing operations.

Fluting can be done by bolting heavy angle to the vertical-slide, bolting the rod to be fluted down on this, at right-angles to the lathe spindle, and using either small face cutters or Woodruffe cutters.

The circular bosses on the ends of components can be finished neatly by the well-known device of swinging the rod bodily about a pin of suitable diameter turned on the end of a piece of square material clamped on the top-slide, the rod being swung against an end-mill—preferably held in a collet, as if the 3-jaw chuck is used, the body of the chuck usually comes uncomfortably close to the hands. Great care should be taken in this operation to swing the rod against the cut of the end-mill, otherwise the end-mill will "catch up" and ruin the component. Short rods should be held by a toolmaker's clamp to give better leverage and control, although only very light cuts should be taken.

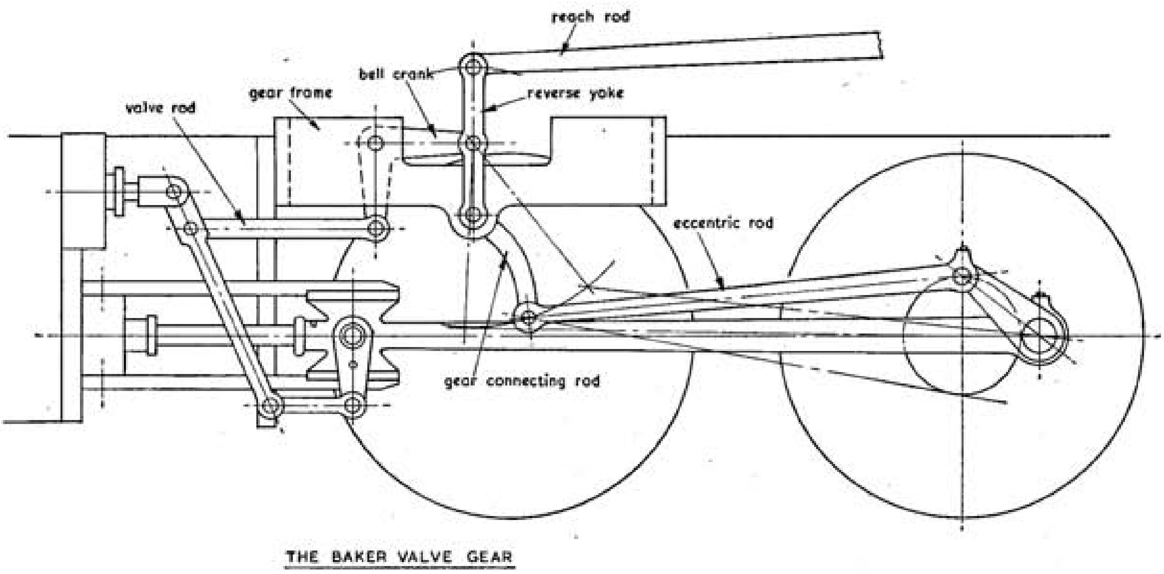
A similar method is to use a small grinding wheel instead of the end-mill; again, very light cuts must be the order of the day, and the usual precautions taken against the grinding dust getting into the lathe slides.

The pin holes of as many valve gear components as possible should be bushed with a good quality bearing metal such as phosphor-bronze or centrifugally cast iron, but if this is not possible due to the small size of the bearing, the eye can be case-hardened and polished.

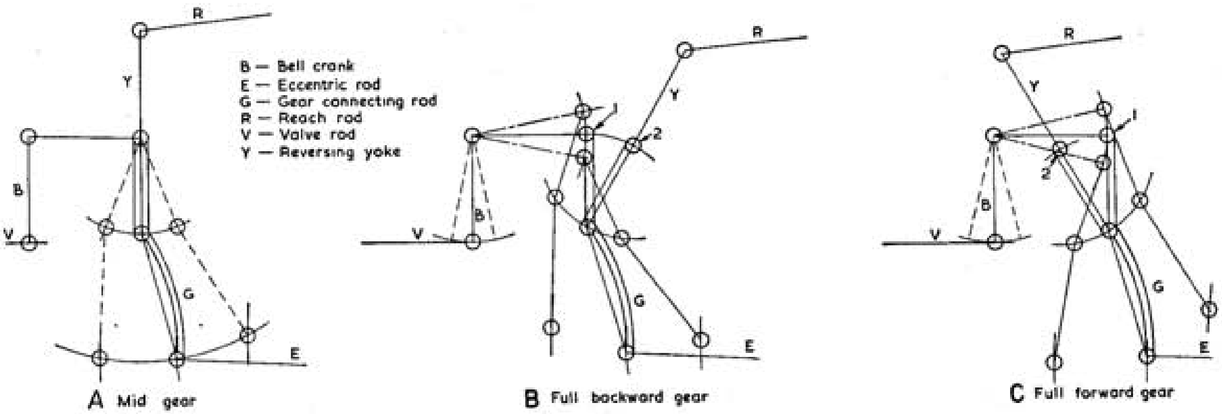
Baker Valve Gear

The Baker valve gear, invented by Abner D. Baker of Ohio, U.S.A., in 1903, is a modified form of the Walschaerts motion where the expansion link is replaced by a system of cranks and levers. It was very popular for a time in America and some other countries, but was never used on British Railways, mainly due to the fact that it is difficult to design it to lie within the British loading gauge. It is not suitable for inside cylinders.

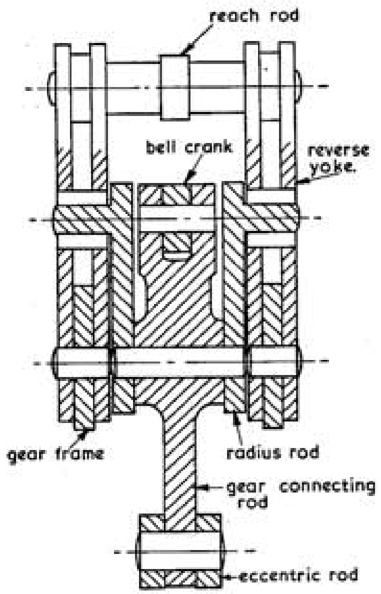
The return crank is arranged to give considerably more throw than is usual in Walschaerts gear and it drives an eccentric rod which is connected to a lever known as the gear-connecting rod. This lever is in turn connected at its top end to a bell crank which drives the valve rod. The gear-connecting rod is pivoted to another lever known as the radius bar, which is itself pivoted to the reversing yoke. As can be seen from the end section, the reverse yoke is usually doubled, and pivots at its lower end on the gear frame, which is bolted to the frame of the locomotive. The fulcrum point of the gear-connecting rod can thus be moved from its neutral position—in line with the radius bar—to a position either side of it, giving an angular movement to the bell crank and thus a



THE BAKER VALVE GEAR



LAYING OUT BAKER VALVE GEAR



BAKER VALVE GEAR
(section through gear frame)

longitudinal movement to the valve rod.

The Baker valve gear has been popular with model engineers owing to the fact that no expansion link, with its curved guides and die-blocks, is required. It is also comparatively easy to fit up, the necessary levers being attached to the gear frame which can be bolted to the main frame in a suitable position by angles. In the larger scales, all the pins can work in bronze or cast iron bushes, so that these can be quickly removed and replaced when wear takes place. It is however very important, in Baker gear, that all pins are carefully fitted, otherwise there will be considerable lost motion, with a corresponding bad effect on the valve timing.

In Baker gear, the eccentric rod should, whenever possible, be made at least three times the return crank pitch circle.

ERRATUM

Rebuilt Royal Scot double chimney: An error occurred in the width of this chimney, which was given as 1⅝ in. for 5 in. gauge on page 188 (Feb. 20). It should be nearer 1¾ in., but unfortunately we do not have the exact measurement owing to lack of official drawings. Can any reader help please?

"Evening Star"

SIR,—There has been some correspondence recently about the 3½ in. gauge *Evening Star*, possibly indicating a revival of interest in this fine loco.

Reeves, in their latest catalogue, have now offered photostat copies of the unfinished construction series that appeared in *Practical Mechanics*, in addition to their driving and coupled wheel castings.

Perhaps at the time *Practical Mechanics* ceased publication live steam was still with us, or had just been phased out by B.R., and the full implications of this had not been realised by the average model engineer.

As *Evening Star* was the last steam loco built by B.R., and therefore unique in that sense, I feel that there is now a real case for the publication of a set of 3½ in. gauge plans of this loco, which, in turn, would prompt one or two major suppliers to increase the number of available castings.

Perhaps the more enterprising clubs would care to sound out the views of their members, and let those views be known through the medium of *M.E.* so that an assessment could be made to ascertain whether extra castings etc. would be an economic proposition.

Southampton. H. J. Bassett

A 7¼ in gauge "MIDGE"
by P. Tarrant

THE PICTURES reproduced here represent some 14 years building the 7¼ in. *Midge* with a number of useful modifications. The track is electrically welded ½ in. x 1 in. m/s on 1 in. x ¼ in. strip sleepers with wooden sleepers screwed on; one 18 ft. length of m/s almost making a 9 ft. length of track. The articulated cars have three bogies and the articulation takes place from the centre bogie pin rather than from a common platform on top of the bogie. Brakes of the conventional block type are fitted throughout the train. An additional arm on the master brake shaft allows for connection to the vacuum cylinder. The car bodies are each 7 ft. 6 in. long made of ½ in. ply cross supported by 4 in. x 2 in. stays. Car ends of ¾ in. are built into box section to house the bogies. The car has a seat height of 16 in. x 14 in. wide with 4 in. footboards each side: quite generous proportions.

Modifications to the *Midge* basic design of 1935 are: Bonds' modified cylinders of 1938 with enlarged piston and valve rods. Cylinders are all bronze with stainless steel rods. Miniature ball races are fitted to the return cranks and rear of radius rods.

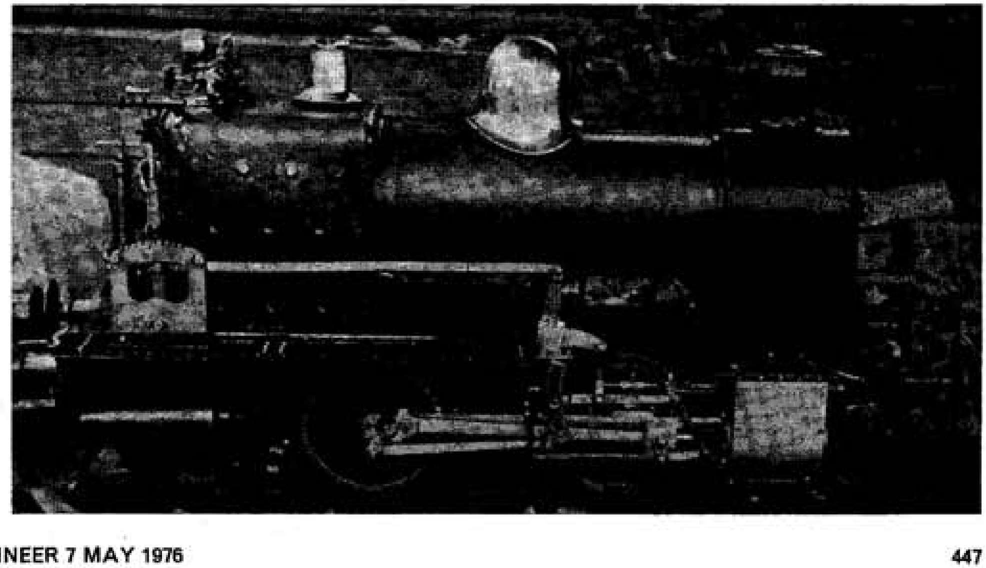
The trunnions have caged needle roller bearings pressed in. The leading crankpins were made with the bearing-retaining flange as part of the pin. This meant using split bearings as per motor car shell bearings. The oiler on the con rod screws vertically down into the top shell to prevent rotation. This gives extra clearance behind the crosshead and no cap screw on the crankpin to come loose and foul the crosshead.

I built the boiler in 1961-2 before the modification to the stays appeared in *M.E.* I think the extra stays are a very good idea. The ⅝ in. dia. firetubes share the tubeplate with two (I believe) 1 in. dia. superheater flues, which contain ⅜ in. bore radiant elements.

I now feel ½ in. bore is over ambitious as it tends to make an over generous store of power on the cylinder side of the regulator, and makes short movements difficult to judge. Working pressure is 80 p.s.i., more for the convenience of the injector than the cylinders. With 40 p.s.i. on the steam chest pressure gauge, *Midge* with her 1¾ in. bore cylinders really rockets away with a full load.

My dislike of water pumps working on locomotive axleboxes prompted me to fit a ½ in. bore x ⅝ in. stroke pump onto the front bogie of the car. Bypass control is provided on the car front as is the filler for observing the bypass water.

The car also has a 5-gallon drum to contain the water. Hydraulic rubber hoses carry pump and injector water to the rear buffer beam of the locomotive. The pump although seemingly small for 7¼ in. maintains the boiler level with an occasional topping up with the injector. The 7 in. long x 2 in. dia. tubes shown at the front of the cars allows clearance to fire and drive the locomotive and it also supports the detachable coal tray. The photograph shows the complete train with Mr. Ian Clark, designer of the very successful freelance 2-6-0 "Team Spirit" in 5 in. gauge which has just completed a great first season at the track of the Harlington Locomotive Society driving, with myself watching events from the mid-train position. My youngest daughter Deana, aged 12 years, who enjoys both riding and driving the train, sits on the tail end. My wife kindly provided the eats for the first outing and also took the pictures. I am now lagging the boiler and working on the cab and tank details.



The unfinished 7¼ in. gauge "Midge" 0-4-0T.

7¼ in. gauge "Midge": Ian Clarke driving, with Mr. Tarrant and youngest daughter on the passenger cars.

AN EARLY WINDING ENGINE

by Frank D. Woodall

TO AVOID any idea that I have a little factory building models of old mining machinery, a few words about the start of this model will not be out of place.

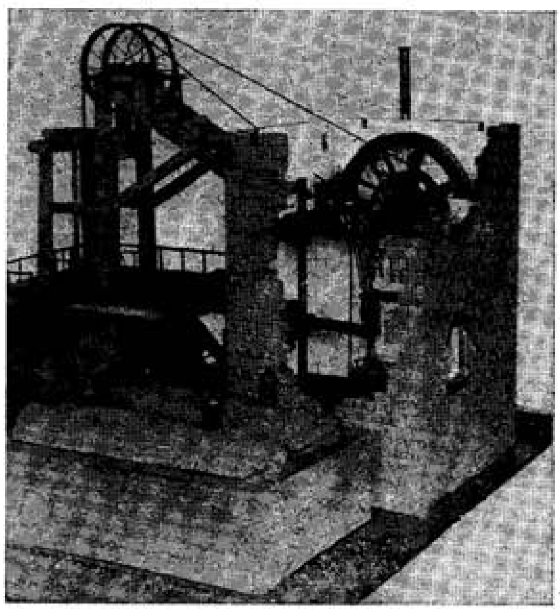
A short article in *M.E.* during the winter of 1942-3 resulted in my having a new-found friend in South Yorks. We set off to collect information on colliery winding engines that had the drum above the cylinders. There was no difficulty in finding these engines because the shape of the engine-houses was different from those which contained a horizontal engine. To see the engines was a different problem altogether. At some places we were only allowed inside, at others met by senior management, given a sharp refusal at Newstead where we had located two engines and finally chased off at Bestwood where we had seen a large engine of this type.

In the engines we did see there was a great deal of difference. Some had one cylinder and some two. We found engines with parallel motion and others with slide bars. The crankshafts on some were supported on masonry and in other cases on ironwork. A large two-cylinder engine with cast A frames and two parallel motions was seen at Langwith but for some now-forgotten reason not photographed.

On the other hand the engines all had one thing in common, they were getting to the end of their period of use either due to obsolescence or pit exhaustion. It is doubtful if one of these engines exists today, in fact I do not know of any steam winding engines in regular use. A model was built of a single-cylinder engine with parallel motion and described in *M.E.* It was shown to the Bradford M.E.S. at a war-time Sunday afternoon meeting. Later the engine was built up with a headgear, boilers etc. and my friend called it Hogsnorton colliery.

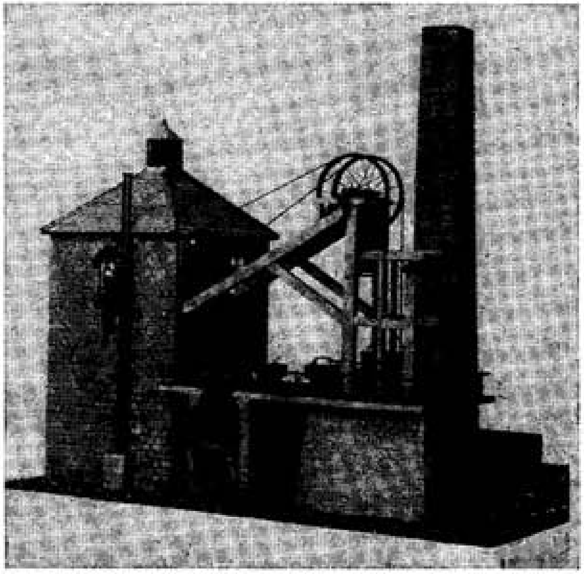
Model winding engines do not lend themselves to proper display so this was arranged for the rope to pass around a number of jockey pulleys so that it could run continuously. It ran at a number of exhibitions in the days when a model engine did not automatically mean a model locomotive.

The friend who had encouraged me to build the model lost his life through the absence of a split pin and this caused me to lose interest in the model; so when a museum asked to borrow it for a year I readily agreed. After it had been in the museum 22 years they asked to buy it. This was



arranged on condition that I altered a few items. It is to be preferred that models should look right and work right, but if both cannot be attained then it is best for them to look right. As this model was not required to run there was no excuse for retaining the system of jockey pulleys, so they were removed. Many of these early winding engines wound with flat ropes that wrapped layer upon layer on narrow drums or reels. The former wide drum was taken out and two narrow ones fitted, one at each side of the flywheel. These drums do not have flanges on the sides but horns with slightly curved out ends. At the same time a ring was pressed onto the flywheel rim because it was too thin. Many early flywheels had deep but not wide rims.

Having made the correct type of drum there remained the problem of making two lengths of flat rope. There is doubt as to how the full-size ones were made; some say that a number of round strands were stitched together but old rusty flat ropes that I have seen on fences looked to be plaited so attempts were made to plait one. Eventually it was made by pulling four strands through a tapering rectangular hole and feeding drops of adhesive into the large end of the hole. When it had dried, a good rub with oil and graphite gave it the right appearance. Two cages were made and a miniature in the engine house to



show their position. A little more was cut out of one wall of the engine house in order to give a better view. In models of this kind it looks better if one side has no cut-away, so as to give a correct outside view. A wagon tippler and a few piles of pit props were added before it was returned to its new owners. □

ON PARTING OFF

by George H. Thomas

Part V *From page 386*

THE CHIP PRODUCED by these tools is of vee formation which is free within the width of the slot and it tends to curl out in continuous form instead of being retained as a collection of short chips or tight spirals; furthermore, the surface finish on the work is, in general, much superior to that obtained with the conventional blades.

The pronounced vee section of the chip is not a result of the shape of the front of the tool which is almost a straight line (see plan view in Fig. 8). It must be remembered that the vee groove is not down the front of the tool but along the horizontal surface against which the chips slide. As is well-known, the chips from many metals, including steels, tend to lift or curl up from the top surface of a tool and with the tool under consideration the vee channel will cause the two sides of the chip to curl towards each other, thus bending it along its centre and reducing its overall width. It would appear that the improved performance of this tool is due to the slight contraction in the width of the chip which enables it to escape readily from the deep groove instead of being retained, broken up and compacted with resulting scoring of the sides and, on occasion, complete seizure. As will be gathered, I have not yet had much experience with this form of tool apart from the series of tests made with each blade and if, as a result of further tests, any more is learned about them, I shall, with the Editor's permission, report at a later date.

To beginners and less experienced workers I would like to emphasise that, in order to improve their parting-off performance, it is not necessary to make the more complex forms of tools which have been described; they have been made and tried out in an endeavour to overcome the few remaining difficulties which sometimes crop up due, largely, to the failure of the swarf to disengage itself from a deep groove. Some two dozen rear tool-posts have already been made to the drawings in this article and, as far as I am aware, they are doing what was intended — making parting-off easier. Over the years there have been many rear tool-posts, good and bad, described in *M.E.* and while the best of them couldn't make a poor lathe into a good one, even the least good probably helped its maker out of some of his trouble. The Mk. II tool-post has been evolved over a number of years

Continued on page 456

Adjustable Micrometer Collars for a Myford Lathe

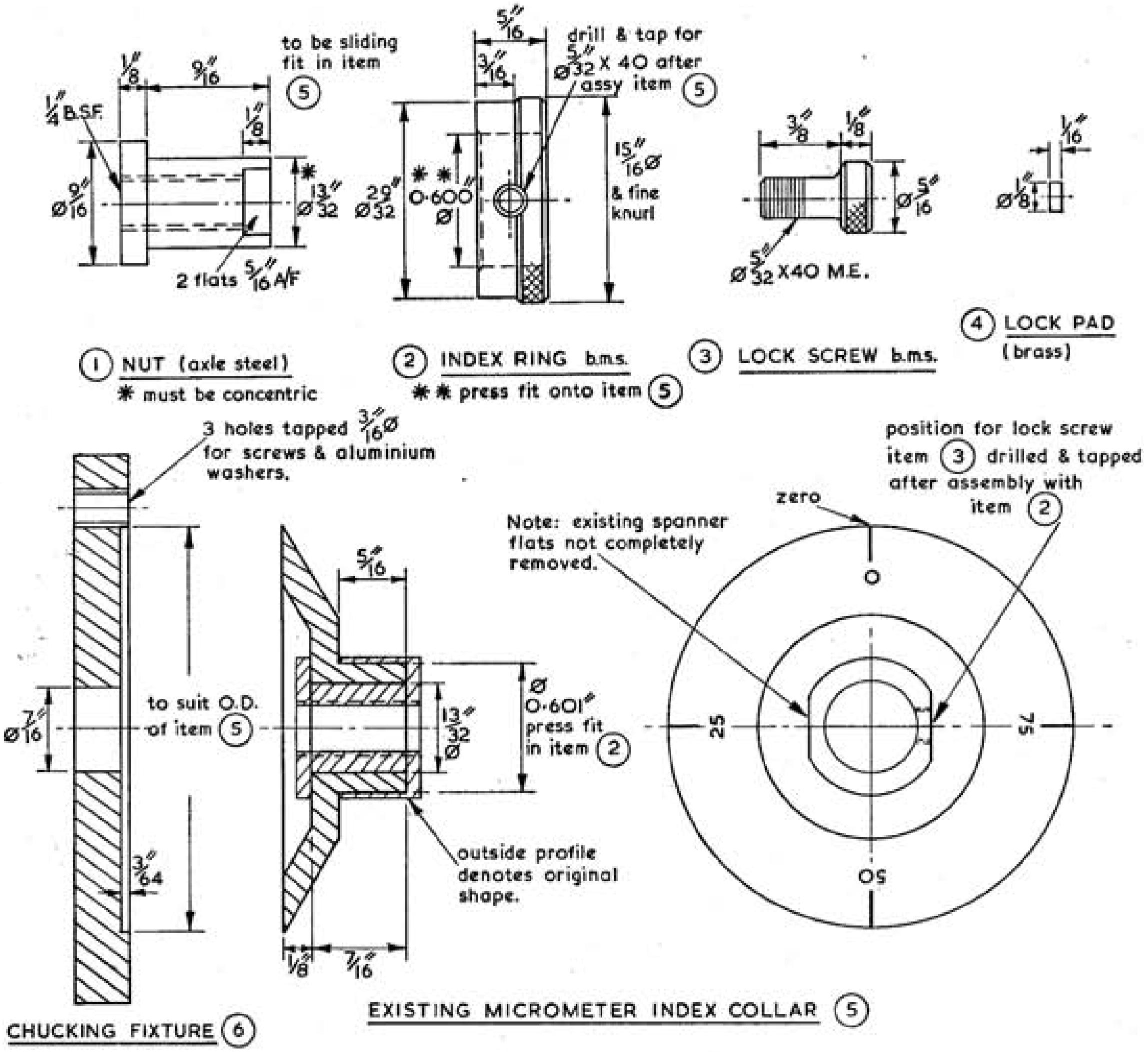
by J. O. Miller

HAVING RECENTLY ACQUIRED an older type Myford ML7 lathe, I found the fixed micrometer collars on the cross-slide, top-slide and vertical-slide screws most frustrating, having been accustomed to readjusting the graduations to zero or to the amount to be removed. Accordingly the existing fixed inch micrometer collars were quickly altered as shown in the sketches and photographs and these modifications may be of interest to other *M.E.* owners of the popular Myford ML7.

This job does not present many problems other than careful lathe work, and if a reader has a Myford vertical-slide, this extra micrometer collar will enable the work to be carried out without greatly interfering with the use of the lathe.

Before starting work on the existing collars Item 5 (see sketches) which, as they are plated zinc based die castings, are somewhat delicate, it would be advisable to make up a chucking plate Item 6 with a recess to locate the outside edge of the numbered bezel. This should be a neat fit on the carefully de-burred bezels and it would be advisable not to remove the chucking plate from the lathe chuck until the holding screws have been fitted and all the collars machined. This will ensure that the completed job will run true. A really sharp boring bar at lathe top speed is advisable for the 13/32 in. dia.

Continued on page 456



CLUB NEWS

News from Derby
The Annual Dinner of the Derby S.M.E.E. was well attended, and the Cup for the winner of the 5 in. gauge efficiency trial was presented to Steve Baker. Unfortunately, the 3½ in. gauge Cup was not available to be presented to Roland Dickens. At the track at Morley, a concrete bed is being laid on the embankment from the main bridge towards the signal box, and while the track is lifted, transverse bars are being welded across the underside of the rails to hold the 3½ in. gauge rail into the sleeper slots.

At a "bits and pieces" meeting on 10 February, Frank Hammersley's 5 in. gauge *Mountaineer* was on show, unfinished. Progress so far has been rapid, and it was suggested that all members turn up next time to help carry it in! Alan Gent had his unfinished 3½ in. gauge A.4, and at the other end of the scale, Ray Shirley showed his "OO" gauge 2-8-2 tender engines, a pair of (yes!) steam driven locomotives recalling North British practice. The Cup went to Alan Gent for his A.4, and was presented by Chairman Dennis Monk. Secretary: A. J. Gent, 31 Cromford Road, Ripley, Derbys.

Rochdale S.M.E.
Future meetings of the Rochdale Society will be held at the Springfield Park track, until 17 September. The Elvyn Kershaw Trophy was awarded to Mr. R. Crowther for an unfinished *Caribou*; the Harold Sutcliffe Trophy was awarded to Mr. G. Smith for a Mersey tug; the Ashworth Trophy went to Mr. N. Hemingway for a Gnome Monosoupape rotary engine and the Edward Hinchliffe Memorial Trophy for juniors went to D. Kinsella for an adjustable centre square. President R. Gardiner presented the trophies to the successful competitors.

Secretary: A. Potts, 23 Ferndale Close (Pitses), Oldham, Lancs.

Changes at Kinver
At the A.G.M. of the Kinver & West Midlands Society of Model Engineers, the following officers were appointed: Social Secretary, H. Brookin, 85 Stevens Road, Stourbridge, Worcs.; Membership Secretary, G. Ashfield, 15 Stella Road, Tipton, Staffs.; General Secretary, B. Clark, 13 Forge Lane, Cradley Heath, Warley, West Midlands.

Southern Federation
Readers will be interested in the new Insurance scheme being arranged by the Southern Federation of Model Engineering Societies. It will cover loss or damage to model locomotives and will apply anywhere in the U.K. while the model is in the certificate holder's custody, including while in transit or while contained in the holder's home or workshop. The scheme only applies to members whose Club is a member of the Federation. Full details can be obtained from the Federation Insurance Secretary, Mr. A. D. Lewis, 45 Repton Avenue, Gidea Park, Romford, Essex.

News from Tonbridge
At the A.G.M. of the Tonbridge Model Engineering Society, the following officers were re-elected: Chairman, E. Kennish; Vice-chairman, T. Boorman; Secretary, G. Davies (110 Speldhurst Road, Tunbridge Wells, Kent); Engineer and Treasurer, J. Mercer; Auditor, R. Turner; Social Secretary, G. O. Caird.

The Society's new passenger cars are almost ready for service; equipped with ball bearings and disc brakes, they will be a big improvement on present cars. Past Chairman W. Austen is in charge of the new extension to the track, which will add 660 ft. to the existing 790 ft., and it is hoped that this will be in full operation by August this year.

Hull S.M.E.
The A.G.M. of the Hull S.M.E. and also the competition for the "Shep" Trophy were held on 25 March, the latter being judged by Dr. Hubert R. Watson and two friends. The Trophy was awarded to Jeff. Chilvers for his *Tich* in Great Eastern colours. Other models displayed included a *Rob Roy* chassis in stainless steel, a finished *Rob Roy*, a diesel outline 0-6-0T, a clock with fluted columns and a period 3½ in. gauge 2-4-0.

Secretary: J. M. Proud, 1 Sixth Avenue, Ellerburn Avenue, Hull.

Exhibition in Northampton
The Northampton Society of Model Engineers are holding an exhibition in conjunction with the College of Further Education at the College, St. Gregory's Road, off Booth Lane, Northampton, on 14/15/16 May.

Secretary: D. E. Hillier, 43 Broadmead Avenue, Northampton.

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

MAY

7 East Sussex Model Engineers An illustrated talk on steelmaking by Mr. G. Bunn Mercatoria Hall, Mercatoria, St. Leonards-on-Sea, East Sussex. 7.45 p.m.

7 Brighton & Hove S.M.L.E. Arthur's moving pictures. Elm Grove School

7 Romford M.E.C. Competition Night. Ardleigh House Community Centre, Ardleigh Green Road, Hornchurch, Essex. 8 p.m.

7 Winchester M.E.S. "Street Furniture". 36 Bramshaw Close, Harestock.

7 Rochdale S.M.E.E. General Meeting. Springfield, 8 p.m.

8 Northern Ireland M.E.S. Trackside Meeting. Ulster Transport Museum, Cultra.

8/9 National Traction Engine Club. Merton Steam Rally, Wardle Park, Merton SW19.

9 Northampton S.M.E. The Society's Miniature Steam Railway, Delapre Park, London Road, Northampton. from 2.30 to 5 p.m.

9 North London S.M.E. St. Albans & District M.E.S. S.R. at Victoria Park.

9 St. Albans & District M.E.S. R.C. at St. Albans, Verulamium. 11 a.m. scale only.

9 Harlington Locomotive Society. Public Open Day. High Street, Harlington, Middx.

9 Bracknell Railway Society. Public Running Day. Jocks Lane, Bracknell. 3 to 6 p.m.

10 Bedford M.E.S. Modelling Ships. Clubhouse, Wilstead. 7.30 p.m.

10 Peterborough S.M.E.E. Film Night.

10 Clyde Shiplovers' & Model Makers' Society. Open Night. Partick Halls, Burgh Hall Street. 7.30 p.m.

10 Wirral M.E.S. Bits and Pieces Evening.

12 Bedford M.E.S. Modelling Ships. Clubhouse, Wilstead 7.30 p.m.

12 Southampton & District S.M.E. Visiting Speaker. 8 p.m.

12 Sutton Coldfield Railway Society. Russian Railways by Dr. M. Page (slides). Wydle Green Library, Emscote Drive, Little Green Lanes, off Birmingham Road, Sutton Coldfield. 7.30 for 8.15 p.m.

12 Norwich & District S.M.E. A talk by Rex Mewing on his Quorn Grinder and other items. The Assembly House, Norwich. 7.30 p.m.

12 Harrow & Wembley S.M.E. Locomotive Meeting. B.R. Sports Pavilion, Headstone Lane. 7.45 p.m.

12 Grimsby & Cleethorpes M.E.S. Bits and Pieces Night—Models in the making. Findus Sports Club, Hewitts Circus, New Waltham. 8 p.m.

12 Southampton & District S.M.E Visiting Speaker. 8 p.m. Atherley Bowling Club, Hill Lane, Southampton.

13 Leyland, Preston & District S.M.E. Meeting. Roebuck Hotel, Leyland Cross, Leyland, Lancs. 8 p.m.

14 Hull S.M.E. Model boat building—given by K. Nicklas. Trades & Labour Club (Room 3) 7.45 p.m.

14 Merchant Navy Locomotive Preservation Society. "From Cleaner to Driver"—Mr. E. Hewitt. Pillbox, Westminster Bridge Road, Waterloo SE1. 7.15 p.m.

14/15 Brighton & Hove S.M.L.E. Special train from Worthing to Aberystwyth and Tywyn.

More diary dates on page 453

JEYNES' CORNER

E. H. Jeynes on some old engines

RECENTLY LOOKING THROUGH some old American magazines before sending them towards the waste-paper effort, I noticed an illustration showing the engineroom of an early power station with belt-driven dynamos. The ungainly looks of the steam engines interested me enough to take another look; they certainly looked odd, one cylinder being horizontal and one vertical, both working on the same crankpin. The engines would be self-starting, as the placing of the cylinders at 90 deg. would have the same effect as having the crank throws at right angles. The engines showed that they had been built that way; of course I had seen steam engines with cylinders at 90 deg. before, in the form of Vee Twin, and Vee compounds, such as the Clarkson and Vosper engines, but these engines had looked neat compared with those in the illustration.

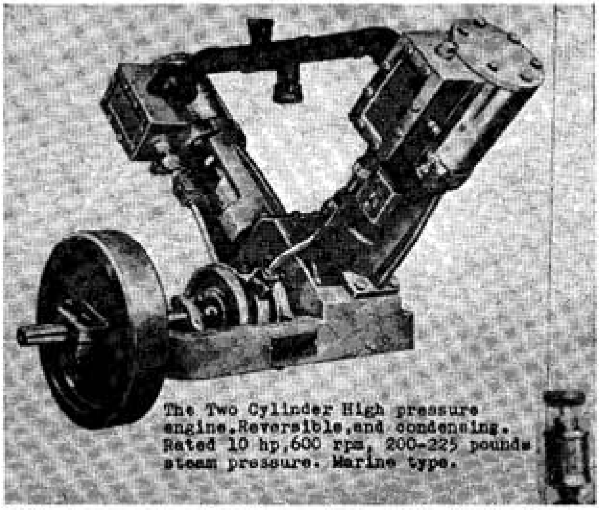
In his book *Local Historian's Table Book* published in Newcastle in 1846, M. A. Richardson gave a description of the underground railway from the Spital Tongues colliery to the East end of Newcastle Quay 1¾ miles long with a fall of 222 ft. This tunnel was commenced on 27 June 1839 and was completed on 8 January 1842. It was formally opened by the Mayor of Newcastle on 7 April 1842. The whole length of the tunnel was driven through clay, thus requiring lining and arching with bricks (for though no rock was encountered, clay was heavy going), the bottom having an inverted stone arch. The single line through the tunnel was 4 ft. 8 in. gauge, and chaldron wagons were employed; Richardson mentions that the haulage engine was of 40 h.p., and that later it was found to be wanting in power to haul the empties back to the colliery.

The colliery was not a profitable venture, and the whole of the colliery was put up for auction on 10 November 1859. Among the list of effects was a 70 h.p. haulage engine complete with a 14 ft. dia. winding drum with 1¾ miles of wire rope attached to it. The engine was described in the sale list as having one vertical cylinder and one horizontal cylinder, and it will be noticed that there is a discrepancy of 30 h.p. here, and I think it possible that another cylinder was added (working on the same crankpin) to the engine, when it was found to be of insufficient power for the haulage system.

After the closure of the colliery, the tunnel remained unused and forgotten until 1939, when it was converted into bombproof Municipal shelters, various entrances being effected to it, some by inclined ramp and some by steps. The tunnel was found to be unexpectedly dry after some 80 years of disuse, in comparison with the three-mile-long tunnel driven through solid rock mostly, on the other side of Newcastle, which was started by Christopher Bedlington in 1770, and by which coal was conveyed direct from the East Kenton colliery to the river Tyne at Scotswood. The rails in this tunnel were of wood, and according to *The Picture of Newcastle upon Tyne* (1807) and the *Cyclopaedia* by Abraham Rees (article *Coal*, Vol. VIII, 1819), this subterranean railway which at times carried passengers who wished to see actual mining in progress, could claim to be the world's first underground railway.

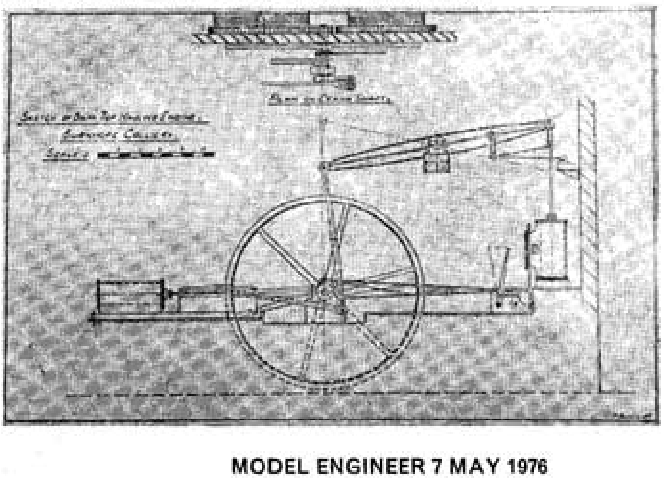
Reverting to right angle engines, and my supposition that another cylinder had been added to the Spital Tongues haulage engine, this was certainly done in the case of the Burnhope wagonway haulage engine which worked two inclines, hauling empties 3000 yards from the Craghead direction and hauling loaded wagons from Burnhope colliery 1500 yards to the summit at Bank Head, and of course lowering down the loaded wagons and empty wagons to return the ropes. When the change from the old chaldron wagons to the standard railway wagons was made, it was found the engine was not powerful enough, so an extra cylinder was fitted.

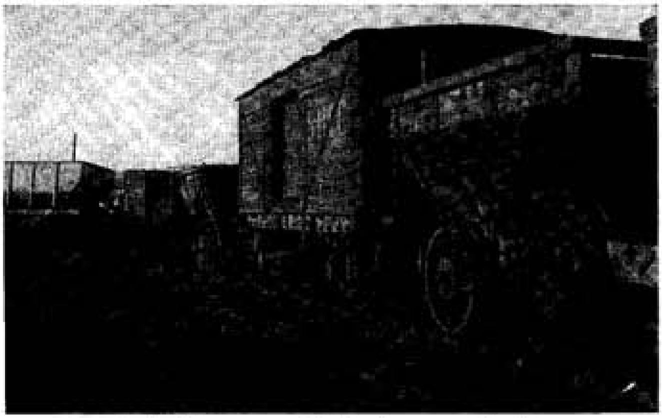
The engine as originally installed was a single-cylinder beam engine built by Thomas Murray of Chester-le-Street circa 1845, the cylinder being 27 in. bore by 5 ft. stroke, with a slide-valve operated from a slip eccentric. by the medium of a long lattice-type eccentric rod which terminated at the cylinder end in a gabfork; this was capable of being lifted off the driving pin on a rocker arm which worked the valve: a hand lever was also connected to the rocker to enable the valve to be worked by hand, as when starting and stopping. The end of the eccentric rod was lifted to



This steam engine is still manufactured in U.S.A. by Gordon Rosekilly.

Sketch of the Burnhope Waggonway haulage engine made by Mr. Harry Beavis before dismantling.





A chaldron wagon in the foreground with some standard railway wagons.

disengage the gab by a foot pedal. The addition to the engine was a horizontal cylinder of 24 in. bore by 5 ft. stroke with ordinary crosshead and slidebars and Stephenson link motion, the connecting rod driving on to the same crankpin as the beam. It must have been quite an interesting job to drive this engine, as the two reversing gears were not inter-coupled in any way: so when it was required to reverse the engine, the gab fork would have been lifted off the pin on the rocker, and the link motion reversed, and as soon as the engine moved enough to move the slip eccentric, the gab fork would be dropped on to the pin again. Should the horizontal cylinder have been on dead centre, the vertical cylinder would have been given steam, by working the valve by the handing lever. The flywheel was about 20 ft. dia. and the beam about 25 ft. long, and two winding drums one 9 ft. dia. for the Craghead side, and the other 7 ft. dia. for the Burnhope side, were connected by spur gear to the crankshaft, the drums being capable of being slid bodily to enable the required gearwheel to mesh with the pinion on the crankshaft. By this means either drum could be operated, but not both together. Both the beam and the vertical cylinder had been renewed at some time.

At the Burnhope colliery, one of the shaft winding engines was of the Crowther type, that is, an overcrank engine with parallel beam motion, and one of the beams was extended past its fulcrum point to work a pump. This engine was also built by Thomas Murray in 1845, and had a single-cylinder 27 in. bore by 5 ft. stroke: one crankshaft bearing was supported by the enginehouse wall, and the inner bearing supported by a massive pitchpine framework. The flywheel was again in the region of 20 ft. dia.; the Watt type valves were worked by hand for starting and stopping and the ropes from the winding drum went out almost horizontally to the headgear over the shaft.

Another thing of interest at this colliery was that two Lancashire boilers were employed underground to supply steam for haulage engines, the products of combustion were taken up a furnace drift to the upcast shaft for pit ventilation purposes, and it was believed to be the only pit still ventilated on this system when coal production ceased in 1949.

Chester-le-Street must have been quite an engineering centre in the past, having been the headquarters of "Newcomen Brown" who collaborated with Smeaton, and was the principal agent in the North of England for the sale of Newcomen pumps for collieries. The works of Thomas Murray must have contained some sizeable machinery to enable flywheels of 20 ft. plus diameter to be turned and bored; and must also have employed some skilled erectors in the field: the dismantling of some of these old engines has made modern engineers scratch their heads at times, even with all the modern equipment available in the way of massive mobile cranes, hydraulic jacks etc.

I am indebted to Mr. Harry Beavis, the well-known industrial archaeological draughtsman (who visited the engine prior to its dismantlement in 1949), for the particulars and dimensions of the Burnhope engines.

14/15/16 Northampton S.M.E. Exhibition in association with Northampton College of Further Education, The College, St. Gregorys Road, off Booth Lane, Northampton.

15 North London S.M.E. Southern Federation Rally, Cambridge.

15 Southern Federation of Model Engineering Societies. Spring Rally at Cambridge.

15 Welling & District M.E.S. Lessness Heath C.P. School, Upper Belvedere. Track Run.

15 Harrow & Wembley S.M.E. Southern Fed. Rally, Brighton.

15 S.M.E.E. Rummage Sale. Marshall House, 28 Wanless Road, London SE24.

15/16 National Traction Engine Club. Breamore House, Salisbury, Wilts.

15/16 National Traction Engine Club. The Dodington Steam and Vintage Fair. Dodington, Chipping Sodbury, Bristol.

16 Rugby M.E.S. Track Day. Hillmorton Community Centre, Hillmorton Road, Rugby.

16 Brighton & Hove S.M.L.E. Display and track at Bluebell Railway On Parade.

16 Harlington Locomotive Society. Open Invitation to other clubs to run at Harlington—not open to public.

16 St. Albans & District M.E.S. S.R. at Welwyn Garden City S.M.E. Stanborough Lakes 11 a.m.

16 Worcester & District S.M.E. Public Running—3½" and 5" elvated track 3½", 5" and 7¼" ground level. Waverley Street, Diglis, Worcester. 2.30 to 6 p.m.

16 Guildford M.E.S. First Public Open Afternoon. HQ, Stoke Park. 2 to 6 p.m.

16 Norwich & District S.M.E. Public Running. Eaton Park Track.

16 Bristol S.M.E.E. Public passenger running day. Ashton Court Track, Bristol.

16 Guildford M.E.S. First Public Open Afternoon.

17 Stafford & District M.E.S. Club Night at Track. County Showground, Weston Road. 7.30 p.m. or earlier.

17 Worthing & District S.M.E. "Rolls-Royce"—Film. Broadwater Hall. 7.30 p.m.

18 Great Western Society. Talk on Swanage Railway project by A. Goltz. British Railways Staff Association, Bristol. 7.30 p.m.

18 Chesterfield & District M.E.S. "Problems I have overcome" by Mr. A. Sell. Canteen, Bryan Donkin Co., Derby Road Chesterfield. 7.30 p.m.

18 Sutton Coldfield & North Birmingham M.E.S. Steam Night. 286 Brookvale Road, Erdington, Birmingham 23. 7.30 for 8 p.m.

19 Guildford M.E.S. Final of Bits and Pieces Competition. HQ, Stoke Park. 7.45 p.m.

19 Bristol S.M.E.E. Engineering Instrumentation by Bernard North.

19 Sutton Coldfield Railway Society. Other than Engines by Hugh Sykes. Wydle Green Library, Emscote Drive, Little Green Lanes, off Birmingham Road, Sutton Coldfield. 7.30 for 8.15 p.m.

19 Guildford M.E.S. Final of Bits and Pieces Competition.

20 Nottingham S.M.E.E. Amateur Foundry Work—"Chuck" The Friends' Meeting House, Clarendon Street, Nottingham. 7.30 p.m.

21 East Sussex Model Engineers. Pond Night—Boating Lake, Alexandre Park, Hastings. 7.30 p.m.

21 Stockport & District S.M.E. Talk by Mr. K. Swan on 7¼ in. gauge locomotives. Wellington House, 324 Wellington Road North, Stockport. 8 p.m.

21 Brighton & Hove S.M.L.E. Slides and sounds of Shildon by M. Gilkes. Elm Grove School.

21 Romford M.E.C. Track Night. Ardleigh House Community Centre, Ardleigh Green Road, Hornchurch, Essex. 8 p.m.

21 Rochdale S.M.E.E. General Meeting. Springfield, 8 p.m.

22 Chesterfield & District M.E.S. "Miniature steam locomotive trials" at the track, Hady, from 1.30 p.m.

22 Great Western Society. "Art in Steam" display of railway paintings by Paul Gribble and other railwayana. Pump Room, Bath. 10 a.m. to 5.30 p.m.

22 Great Western Society. Great Western Evening (films and slides). Ealing Town Hall, Ealing. 7.15 p.m.

22 West Wilts S.M.E. Model Engineering Exhibition. Holt Village Hall, Holt, Nr. Trowbridge, Wilts. 10 a.m. to 5.30 p.m.

22 Bournemouth & District S.M.E. Visit to the Triple Expansion Engine at Corfe Mullen Water Works.

22 Wigan & District M.E.S. Meeting.

22/23 National Traction Engine Club. Steam Surprise. Bowlee, Middleton, Manchester.

23 Bedford M.E.S. Opening of the New Clubhouse at Wilstead. Visitors Welcome.

SCALE WHEEL and TRACK STANDARDS

The Society of Model and Experimental Engineers, in collaboration with *Model Engineer,* have for some months past been considering the possibility of standardising the scales, gauges and wheel standards for gauges from 2½ in. to 10¼ in. Agreement has now been reached, and the following tables show the recommended dimensions.

Although these are only recommendations, it is the hope of both the S.M.E.E. and the Editor of *Model Engineer,* that enthusiasts constructing to these scales will in future adhere as closely as possible to these dimensions which should be of benefit to all.

For scale metric modelling of British prototypes, multiply inches by the appropriate conversion factor in column A.

For scale metric modelling of metric prototypes, divide millimetres by the appropriate conversion factor in column B.

To convert inches to millimetres in existing designs, multiply by 25.40.

It is recommended that tyres for model locomotives (but not passenger cars) should be machined to the dimensions given in the table. Although not exactly to scale, they are for all practical purposes sufficiently close to full-size practice, BSS 276 Contour A being the reference. The slight departure from scale has been made to simplify machining and to accommodate some of the variations found on existing Club tracks.

Machining Notes

The machining dimension Y will be used when the root radius is formed with a radial flank in one operation and the 20 deg. angle is machined as a separate operation.

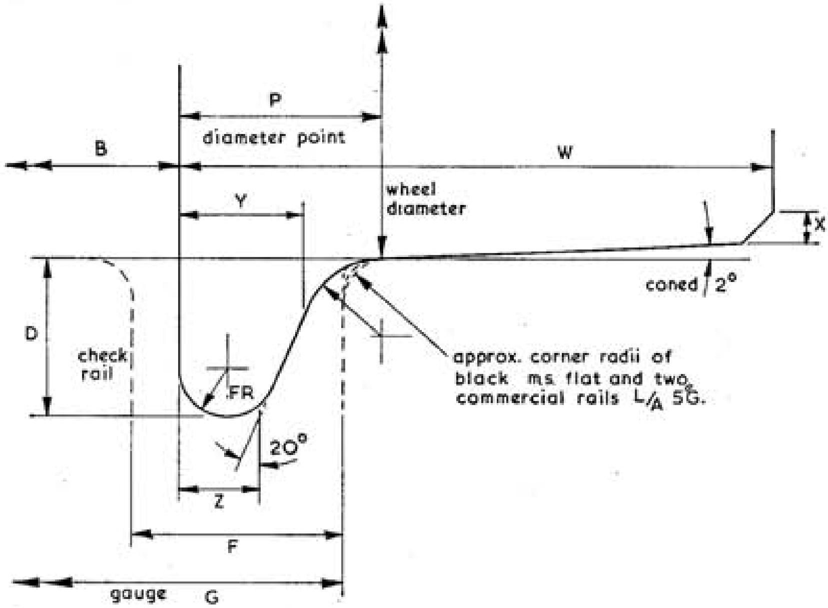
The machining dimension Z will be used when both the root radius and the angle of 20 deg. is formed in one operation.

Note. The tyre contour for the largest gauges may not be suitable for wheels used on some Contractor's track.

TABLE OF GAUGES AND SCALES

GAUGE		SCALE			CONVERSION FACTOR	
Ins.	m/m	Ins. per foot	m/m per foot	m/m per 100 m/m	A.	B.
2½	63·5	17/32	13·50	4·43	1·124	22·59
3½	89·0	3/4	19·05	6·25	1·587	16·00
5	127·0	1 1/16	26·99	8·85	2·250	11·29
7¼	184·0	1½	38·10	12·50	3·175	8·00
9½	241·0	2	50·80	16·67	4·233	6·00
10¼	260·0	2¼	57·15	18·75	4·763	5·33

GAUGE	BACK TO BACK	TYRE WIDTH	FLANGE DEPTH	ROOT RADIUS	FLANGE RADIUS	CHAMFER	TREAD DIAMETER POINT	M/C[9] DIMENSION	M/C[9] DIMENSION	FLANGE WAY
G	B	W	D	RR	FR	X	P	Y	Z	F
2½"	2·281	0·268	0·085	0·035	0·020	0·015	0·090	0·055	0·034	0·093
63·5 m/m	58	6·8	2·2	0·9	·50	·40	2·3	1·4	0·90	2·3
3½"	3·281	0·375	0·110	0·050	0·030	0·020	0·126	0·076	0·051	0·130
89 m/m	83	9·5	2·8	1·3	·75	·50	3·2	1·9	1·3	3·3
5"	4·687	0·535	0·140	0·070	0·045	0·030	0·176	0·106	0·077	0·190
127 m/m	119	13·6	3·6	1·8	1·2	·80	4·5	2·7	1·95	4·8
7¼"	6·800	0·776	0·203	0·100	0·065	0·040	0·254	0·154	0·110	0·270
184 m/m	172	19·7	5·2	2·5	1·7	1·00	6·4	3·9	2·8	6·9
9½"	8·900	1·017	0·266	0·133	0·086	0·050	0·336	0·203	0·146	0·350
241 m/m	225	25·8	6·8	3·4	2·2	1·30	8·5	5·15	3·7	8·9
10¼"	9·600	1·097	0·287	0·144	0·093	0·060	0·363	0·219	0·158	0·380
260 m/m	244	27·8	8·0	3·7	2·4	1·50	9·2	5·55	4·0	9·7



EIGHTH INTERNATIONAL MODEL LOCOMOTIVE EFFICIENCY COMPETITION

for steam locomotives of 3½" and 5" gauge

THE COMPETITION WILL BE HELD ON THE KINVER TRACK OF THE KINVER & WEST MIDLANDS SOCIETY OF MODEL ENGINEERS

(by kind permission of the Committee of the Society)

ON SUNDAY, 27 JUNE, COMMENCING AT 9 a.m.

Prizes this year will be as follows:

First. Martin Evans Challenge Cup and cheque for £30.

Second. Cheque for £10.

Third. Cheque for £7.

Fourth. One year's subscription to Model Engineer.

Fifteen entries have now been accepted. We regret that no further entries can be entertained.

Locomotives entered include the following:

3½" gauge G.W.R. "King" (last year's winner). 5" gauge Midland Compound 4-4-0. 3½" gauge South African locomotive. 5" gauge "Maid of Kent" 4-4-0. 5" gauge "Eva May" 0-6-0T. 5" gauge "Springbok" 4-6-0. 5" gauge G.W.R. "City of Truro" 4-4-0. 5" gauge "Minx" 0-6-0. 5" gauge G.W.R. "Torquay Manor" 4-6-0.

ADMISSION for SPECTATORS will be by TICKET ONLY, obtainable from Model Engineer.

ADMITTANCE 20p per person. Car parking free.

Please make cheques, P.O. etc. payable to "Evans Locomotive Fund"

Light meals and refreshments will be available all day. There will be adequate car parking space.

READERS' QUERIES

- ★ Queries must be within the scope of this journal and only one subject should be included in each letter.
- ★ Valuation of models cannot be undertaken.
- ★ Readers must send a stamped addressed envelope and a current query coupon with each letter.
- ★ Replies published are extracts from fuller answers sent through the post.
- ★ Please keep queries separate from orders.

Dynamo for "Big Lion"

What size dynamo would be suitable for a 1½ in. scale "Big Lion" showman's engine? Would a motor car or motor-cycle 6 volt dynamo be suitable and how would it be adapted?—W.E.C.

△ *It is not possible to specify a particular dynamo for this engine, nor is it possible to describe the exact method of adapting it to the casing, as the shape of brackets etc. used to centre it properly in the casing will depend on the shape and dimensions of the dynamo itself. A car dynamo would almost certainly be too large, but a small motor-cycle type might suit.*

Rob Roy coupling rods

I am having difficulty in getting the coupling rods of my Rob Roy to revolve freely. I have checked the "quartering", crankpin centres and all wheels run truly. The only way I can get the rods to revolve is by opening out the leading and trailing crankpin bushes to 9/32 in. for ¼ in. dia. crankpins.—R.M.B.

△ *If you are certain that the quartering of your wheels is correct, it is possible that your coupling rods were not made quite to the correct centres or possibly the spacing of your axleboxes on one side of the locomotive is slightly different from the other. However, if the engine runs freely with the leading and trailing bushes opened out by 1/32 in., we would be inclined to leave matters as they are. Normally, we would recommend that these bushes be opened out not more than 1/64 in., though the bushes on the driving crankpins should be a good working fit.*

Shand Mason Fire Engine

I am building the *M.E.* Shand Mason Fire Engine. Could you tell me the final position of the "distribution cock assembly" on the chassis and also supply a piping diagram. I would also like details of how the engine is attached to the boiler.—F.R.T.

△ *The position of the distribution cock assembly is on the inner side of the offside main frame about 3 in. from the rear end. Regarding the pipework, there are four ¼ in. union nipples on the underside of the body for connection to the main pump supply (S), feed pump inlet (F), main feed tank (M), and auxiliary feed tank (A). For the first of these (S) a ¼ in. nipple, not shown on the drawing, is fitted to the offside vertical face of the discharge cover of the pump, about ⅜ in. from the bottom.*

G.W.R. 2-8-2T locomotive

I am thinking of building a 5 in. gauge model of the G.W.R. 72xx 2-8-2 tank locomotives. Could the cylinders and valve gear, also the boiler, specified for your 5 in. gauge *Firefly* be used as they stand?—J.A.

△ *The cylinders of our 5 in. gauge "Firefly" would not be suitable for a 2-8-2 tank, as they are too short in the stroke, the full-size engine having a 24 in. stroke as against 30 in. for the 2-8-2T. Also the bore of the model would need to be at least ⅛ in. larger or even more. The boiler too is really too small both in length and diameter. We think you would do better to try to adapt the cylinders and motion of the "Torquay Manor" 4-6-0, which are very similar to those on the 2-8-2T. The "Manor" boiler would not be suitable as it stands, but if the barrel was tapered with a short parallel portion, and made to the correct overall length, this would provide a basis for a 2-8-2T boiler. You may, however, have to reduce the number of tubes, leaving out the two outer tubes in the bottom row, which would come rather too close to the underside of the barrel.*

Building Virginia

I am proposing to build the 3½ in. gauge model *Virginia*, but have heard that this locomotive is not a good passenger hauler due to poor adhesion. Would you advise—D.A.H.

△ *All 4-4-0 type locomotives tend to be "front-heavy", and "Virginia" suffers from this to some extent. Nevertheless, we would not say that it is a poor passenger hauler, as we have noted many such engines performing well on the track. To improve adhesion on this model, the springs on the leading drivers should be made heavier than those on the trailing wheels, and a heavy weight placed between the frames as far back as possible. This could take the form of a heavy iron casting, or just a piece of lead, suitably shaped.*

ON PARTING OFF

From page 449

and incorporates features which I find convenient and which suit my own method of working. Other workers can, if they desire, modify it to suit themselves.

Both forms of foot casting (and possibly 1½ in. square steel) will be available from Messrs. A. J. Reeves & Co. Ltd., of Birmingham, by the time this article appears.

MICROMETER COLLARS

From page 450

Subsequent machining of the 0.601 in. dia. and recessing the back of Item 5 to suit the head of Item 1 would best be done on a stub mandrel machined to suit, and the job pushed on and driven by friction alone. After pressing Item 2 onto Item 5 the locking screw hole can be drilled and tapped opposite the 75 on the bezel.

After assembly the two flats on Item 1 (milled or filed) will enable the thrust adjustment of the feed-screw to be made with a thin 5/16 A.F. spanner.

These simple modifications have proved their worth and make the operation of the ML7 much easier.

The Editor welcomes letters for these columns. He will give a Book Voucher for £3.00 for the letter which, in his opinion, is the most interesting published each month. Pictures, especially of models, are also welcomed. Letters may be condensed or edited.

2½ in. Gauge

SIR,—I am sure that many "2½ in. gaugers" will agree that most of the criticisms of this gauge and scale in "Smoke Rings" of 20 February 1976 issue, are not valid ones; indeed I am surprised that anyone as knowledgeable as our worthy Editor should hold this opinion. To take the points in order:

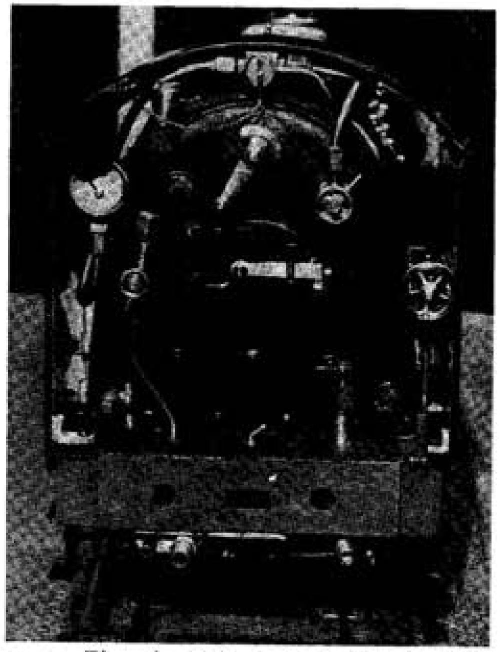
Firstly, stability of passenger trolleys; of course a 2½ in. gauge trolley would be unstable, but then so would a 3½ in. gauge one! I know, I have ridden on one on a poorly levelled track. Five-inch gauge is the generally accepted minimum for safety. Surely the great majority of loco owners steam their engines at club tracks. Few of us these days have gardens that can accommodate a 2½ in. or 3½ in. gauge continuous layout.

Secondly, a 17/32 in. scale express loco cab is nearly 5 in. wide and 5 in. high, footplate to centre of roof, and given a sensible arrangement a driver with a massive fist could handle all the controls with ease. I enclose a photograph of the cab and backhead layout of my Greenly 2½ in. gauge Pacific which should prove the point.

Thirdly, the boiler of this loco, which was illustrated in the *M.E.* issue of 4 April 1975, is of my own design and has an ample margin of safe water level, more than some 3½ in. gauge locos with taper boilers and Belpaire fireboxes. The boiler is an easy steamer and very easy to control, certainly no trickier to fire "on the run" than a 3½ in. gauge loco of similar type and a lot easier than small 3½ in. gauge 0-4-0 or 0-6-0 tanks. The grate of this Pacific is just under 4 in. x 4 in., almost 16 sq. in., a larger grate area than many popular 3½ in. gaugers.

Fourthly, the building of older type locomotives in 2½ in. gauge, 17/32 in. scale, is no more difficult than in 3½ in., granted anyone who chooses the rather extreme case of an inside cylinder loco prototype with Stephenson's valve gear would be a glutton for punishment, but it could be done, especially as many of the old-timers had outside frames. Not being a purist, dare I suggest using inside Walschaerts in such a case? No one can see the valve gear anyway.

If cost is to be taken as a limiting factor, I think that many model engineers would derive more pleasure and gratification building and running a 2½ in. gauge 4-6-0, 2-6-2 or Pacific, than a 3½ in. or 5 in. gauge 0-4-0. The former project types would be much steadier on the track and "look right" travelling at speed, whereas a "Tich" or a "Juliet", involving about the same building time and cost, are really "fun" engines. They always look ridiculous to me when driven at speed, bobbing about on their coat button wheels!



The cab of Mr. Andrews' "Pacific"

Regarding durability, I know of several 2½ in. gauge locomotives that are around forty years old and still going strong after years of passenger hauling, and as for efficiency, how about Mr. Charles Cormack's old "Fayette" which won the New Zealand loco trials in 1975, after 1000 miles of running, as reported in the *M.E.* issue 17 October 1975?

It was stated that "Elaine", the 2½ in. gauge "King Arthur" recently described in this journal, did not prove very popular. With all due respect to Don Young, small wonder! This fine design unfortunately incorporated many features likely to discourage the average amateur builder, e.g. some rather tricky eccentric turning on the valve spindles, cylinders designed for all "O" ring sealing. These are almost impossible to obtain in the correct grade and sizes called for, and if a supplier is located, some firms demand a £12 minimum order these days. The horns-cum-frame stretcher is a very unorthodox component and far from simple to machine; castings for this loco had to be purchased in sets or "boards" and were quite expensive, also the arrangement of the parts on the boards were split up so that one had to purchase at least two "boards" to obtain a complete set for a given component, say, cylinder castings. Not everyone is happy to lay out the amount of cash involved at one time.

Like Mr. Tyler, I would like to see published an up-dated version of one of the "LBSC" designed old-timers, say a "Fayette" with mechanical lubrication and perhaps optional three-cylinder layout, or for those who do not care for freelance locos a L.N.E.R. "Green Arrow" or a G.W.R. "Hall" class.

To conclude let me state that I am, myself, of the opinion that 3½ in. is the ideal gauge, but please let us not "knock" the merits of 2½ in. gauge for those who wish to build miniatures of larger prototypes that they are able to carry around and don't cost the earth for materials.

The rapid growth of the 2½ in. gauge Register is proof that I am not alone in thinking thus.

Colchester. P. Andrews, C.Eng., F.I.Prod.E.

I am not "criticising" 2½ in. gauge, Mr. Andrews, I do not criticise any gauge, in fact at this moment I am getting out drawings for something even smaller, viz.—Gauge "1".

My editorial comments were an attempt to explain why 2½ in. gauge is not so popular today, and I think my points were quite valid.

Having built locomotives for all gauges from "OO" up to 5 in., I am convinced that 3½ in. and 5 in. gauge engines are, generally speaking, easier to build than 2½ in., if one is trying to follow a definite prototype.

One cannot call an inside cylinder engine with inside Stephenson valve gear an extreme case. A large proportion of locomotives in this country from about 1890 to 1920 were of this type.—Ed.

2½ in. Gauge

SIR,—I was pleased to see the letter from Noel Tyler of Ontario ("Postbag", 20 February) who states the case for a revival of interest in 2½ in. gauge admirably and I feel the views of Martin Evans in the same issue tend to be rather negative and discouraging.

We at the Staines Society of Model Engineers are about to start the construction of our raised track in Staines Park and we consider that the 2½ in. revival has arrived both within and outside our own membership, therefore our track will be for 2½ in., 3½ in. and 5 in. gauges.

It is certainly easier and cheaper when starting from scratch to incorporate the extra 2½ in. rail and I believe that it is not cost or lack of demand that deters societies but the disruption to existing tracks whilst the work is carried out.

It would be interesting to know how many 2½ in. gaugers are under construction by members of societies where running facilities already exist for the gauge. Our own experience indicates that some of our members who are hovering around "what to build and in which gauge", may well start a 2½ in. gauger if they can be sure a track will be available, and one member has promised to rebuild his *Purley Grange*.

None of us would pretend that a 2½ in. loco would be a serious consideration if passenger carrying were the prime purpose or that construction in the gauge is any easier than the larger gauges, but the appeal to some people of a main line type in preference to a larger gauge 0-4-0 has a significant bearing when weighed alongside cost.

For the more senior modeller on a fixed income and possibly suffering the effects of advancing years a revival of 2½ in. gauge would appear very desirable and if the Cheltenham Rally is a true guide the gauge has a very wide appeal indeed.

I hesitate to criticise our worthy Editor whose comments I am sure are well intentioned but the lack of Don Young "King Arthurs" under construction I believe stems from the lack of running facilities rather than a lack of interest in the gauge.

Space in *M.E.* being precious, I realise that those subjects having the widest appeal should have first consideration and although not pressing for more 2½ in. gauge designs I would make the request that our Editor uses his influence to at least encourage societies constructing new tracks or rebuilding existing ones to incorporate a 2½ in. rail and in due course the increased numbers will make their own demands on publication space.

For our part we at Staines hope in the not too distant future to stage our own 2½ in. Rally and sincerely hope for the pleasure of the company of our Editor when we shall do our utmost to convince him of the revival of interest in the gauge, if by that time he still needs convincing.

Ashford, Middlesex. John Feeley

Gear Cutting

SIR,—You are to be congratulated in securing the articles by T. D. Jacobs, concerning his gear cutting machine. From what I saw of this machine at the Model Engineer Exhibition it appears to be a wonderfully universal little tool and it should fill a long felt want of many model engineers, especially in view of the current high cost and scarcity of diametrical pitch form cutters.

However, in the first article of the series (pp. 77-81, No. 3529) Mr. Jacobs went to some length to describe the method he used to grind a 29 deg. included-angle tool with which to screwcut the indexing worm for the machine. He makes no mention as to how he obtained the 0.157 in. axial pitch called for in the sketch of the worm shown on p. 81.

Now this produces a real problem which I believe most model engineers will find difficult to solve, because the axial pitch of a D.P. worm involves a multiple of π

$$\text{Viz. Axial pitch of D.P. worm} = \frac{\pi}{\text{D.P. No}}$$

$$\text{and Equivalent t.p.i. of D.P. worm} = \frac{\text{D.P. No.}}{\pi}$$

Thus to cut a 20 D.P. worm, as called for, we need a train to cut the equivalent t.p.i. of 6.3662 to obtain a reasonable approximation. This means that in a practical changewheel train we have to find wheels with a multiple of teeth equal to a multiple to four figures, of the numerical approximation of $\pi \simeq 3.1416$.

The usual pair of wheels employed in toolroom lathes for this purpose are 77 and 102 since

$$77 \times 102 = 7854 \simeq \frac{\pi}{4} \times 10^4$$

Thus for a simple screwcutting lathe we would need a train of $\dfrac{50 \times 100 \times 50}{77 \times 102 \times 40}$ which, when multiplied by the t.p.i. of the leadscrew (8 t.p.i.) gives the magic 6.36618 t.p.i. for a 20 D.P. worm.

Unfortunately most model engineers will not be able to muster the 77 or 102 teeth wheels, and anyway would need to make a fairly special banjo to carry such a train. The alternative for the worm might be to cut this to a regular axial pitch of say 6 t.p.i. and at the same time make a hob of the same pitch to cut the mating worm wheel(s) to the equivalent circular pitch. However, I suspect that in later articles, Mr. Jacobs is going to tell us how to make D.P. hobs, when we shall again encounter the need for a multiple of π.

Can you please advise of an alternative arrangement to cut a good approximation of a D.P. thread.

Wantage, Oxon. C. H. Baker

SIR,—Your correspondent is quite right in assuming that a worm may be cut to a fractional inch pitch, say 6 t.p.i., provided that the pitch diameter of the worm-wheel is adjusted accordingly, that is to say turned to a circular pitch diameter rather than a diametral pitch diameter.

I think Mr. Jacobs called for a 20 D.P. worm because he first used it to mesh with a standard 40 T Myford changewheel as a temporary expedient in order to be able to cut the proper wormwheel with which the machine is now equipped. An interesting thing about this machine, which I am sure will appeal to your correspondent and other readers, is that it is very largely self generating, that is to say it has cut all its own gears starting only with a set of standard Myford changewheels.

In regard to approximations to π, the one given by your correspondent is not particularly good. The fraction 355/113 is accurate to 6 decimal places and since 355 can be factorised leads to very simple trains. Thus a train of

$$\frac{40}{20} \times \frac{71}{113}$$

with a leadscrew of 8 t.p.i. will cut a pitch of 6.366197183 t.p.i. compared with the more accurate 6.366197723. It is used I believe in the Hendy lathes. Your correspondent's train gives 6.366182838 which is only accurate to 4 decimal places. (All figures by pocket calculator!)

However all this is of academic interest to the amateur who has neither the necessary wheels nor a leadscrew accurate enough to justify using them. For all practical purposes in model engineering the ratio 22/7 is near enough and can always be found since it only involves the factors 11 and 7, usually to be found in 55 and 35 T changewheels. A table was published in *M.E.* some time ago showing simple trains which will cut from 14 to 120 D.P. worms and hobs with sufficient accuracy for all practical purposes.

It may interest your correspondent to know that in cutting a hob, as distinct from a worm, it is the *normal* pitch, that is the pitch at right angles to the teeth, and not the *axial* pitch which is important. A correction for the spiral angle must be applied but it can be shown that if the hob is designed so that the spiral angle is 1° 37′ 31″, that is the pitch diameter of the hob is 35.24/D.P. the *normal* pitch, when the *axial* pitch is cut with a 55-35 T train, is accurate to 10 places of decimals, that is if the leadscrew itself is as accurate as that!

But your correspondent and others need not be over worried about theoretical errors in gear generating because the great advantage of the involute system is that it is, to a large extent, self correcting. Suppose for example that one set out to generate a 40 T, 20 D.P. gear with a hob which had a pitch error of 1%, that is to say it was 20.2 D.P. and not 20 D.P. exactly. The formula

$$\text{p.c.d.} = \frac{N}{\text{D.P.}}$$

must hold and since the gear is to be generated there can only be 40 teeth exactly, neither more nor less, the p.c.d. of the gear actually cut will be 1.980 in. instead of the theoretical 2.000 in. In practice even such a large error could be readily accommodated either by changing the centre distance, allowing increased backlash or cutting the blank slightly less deep. In the latter case there would be a small but acceptable change in the pressure angle.

To sum up therefore I suggest that the worm be cut with a

$$\frac{40}{35} \times \frac{55}{50}$$

train which, with an 8 t.p.i. leadscrew, will cut a worm which will mesh perfectly adequately with a standard 20 D.P. changewheel.

Quorn. D. H. Chaddock

Holtzapffel Lathes

SIR,—Mr. Hadden-Deering is to be congratulated on his acquisition and I'm green with envy, since I have acquired recently a very incomplete specimen and am desperately trying to equip it, whilst keeping the fight secret from my bank manager! How the value of such goodies has risen.

But I am dismayed to read that he has used his lathe for turning large castings, cutting steel worms and so on. Please, brother, have mercy. These lathes were not built for such work. He is lucky not to have damaged it already, and an even greater fear is that publication of this mechanical solecism will encourage other owners of Holtz equipment to do likewise.

The mandrel noses of these lathes are not made with a register to take the bending strains consequent on a "dig-in" on large metal work, also their threads are very deep on the small diameter.

They were made thus so as to facilitate the fitting of wooden chucks, or built-up work direct on the nose, also so that the chucks *would not bind* on the nose, as with the type of work normally done it was frequently necessary to remove and replace chuck and work together and the force needed to remove a tight chuck could have dislodged the work in it. The underlined words carry a warning for the use of power for these lathes which is obvious.

For the sake of his "Holtz", next time our worthy friend has a big wheel to turn, up to 12 in., if he sends it to me I will do it for him on my 6 in. centre "Muir" engine lathe.

Turning to happier parts of the article, the worm-drive spiral apparatus would appear to be very unusual, if not unique, and perhaps we could have further details of this? It is certainly not referred to in "the bible" which he has.

The frame or stand he has described is exactly as supplied by Holtzapffel, and although the hypotheses put forward may possibly have occurred in a case of long shipment it would even then be very unusual and certainly not likely in transporting from Charing Cross to Wales. Possibly the answer may lie in the name of the original owner, and if Mr. Hadden-Deering will let me have the number of the lathe, to be found at the front of the headstock just above the tongue, I will investigate the point for him with Warren Ogden, who has the original register copy. In any case this number ought to get to Warren for the current register which he is compiling for the Society of Ornamental Turners. Many of these lathes were sold twice, having been "bought-in" by the Company and renovated for re-sale.

Incidentally, if Mr. Hadden-Deering has not so far considered it may I recommend the Society to him, the subscription is not great, and the members are very helpful. The bulletin alone is worth the fees.

Lastly, may I appeal to any Holtz owners who are either not members of the Society or otherwise have not had their lathes registered, to let me have their numbers for transmission to Mr. Ogden who is compiling the register. So far as is known only about 200 of these magnificent machines still exist and everything should be done to preserve them from destruction by the ignorant. Too many have been broken up in the past by scrap metal dealers "for the brass" and it is hoped that by keeping track of them in a register this kind of thing won't happen in future.

West Wickham. Roger Davies

Single to Three-phase

SIR,—I have just seen Mr. E. H. Jeynes' 2-15 January 1976, reply to my previous Postbag letter. I have always read Mr. Jeynes' articles with great interest and consider him quite knowledgeable. However, in this particular case I must disagree with his comments. I apologise for my statement on rope starting not having been mentioned previously. I started to take *M.E.* in 1973.

The subject of my letter was converting single-phase power to three-phase to be available for use in running small three-phase motors, *not* starting a three-phase motor that was to run a machine. I certainly agree with Mr. Jeynes' negative comments regarding three-phase motors driving a machine being run on single-phase.

I have used the rope starting system in which a short piece of rope is wrapped around the unconnected three-phase motor shaft and is given a yank. The motor is brought up to only several hundred r.p.m. and then the single-phase, two pole switch is closed. The motor will growl a little but very rapidly come up to speed and run on one phase. Now from the three terminals of the motor, three-phase power is available for motors up to possibly one-third or one-quarter the capacity of the generating motor. In effect, the motor just started acts as a free running generator converting single-phase to three-phase power which can run other three-phase motors as long as they are *appreciably* smaller. I used this system on a 2 H.P., three-phase motor hundreds of times years ago and at present am using it on a 5 H.P. three-phase motor.

If the rope starting technique on a smooth shaft or even on a shaft with a keyway were dangerous, then for the first twenty years of its life the outboard motor industry would have been dangerous because this is the way an outboard motor was started. Bear in mind when you pull the rope, the motor will start in the same direction that you are pulling it, and if you close the switch before the rope is unwound, the motor simply unwinds it faster or stalls if not enough starting speed. There is nothing to catch on.

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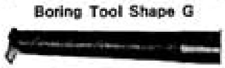

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3½" x 16" B.G.S.C. centre lathes, 5" and 7" stroke hand and power shaping machines. 6" x 12" cutter grinders, horizontal and vertical milling machines. 4" and 4½" lathe chucks and back plates. Fractional H.P. motors, plain and swivel, vertical slide and vices. 3" plain and 2½" rough jaw vices. Medium S.A.E. for lists.
PERFECTO ENGINEERING CO. LTD.
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Tel. 0533 768384

Metal turning lathe wanted for cash. Tel: Potters Bar 58972, Herts. S-X

SPECIAL OFFERS New design Drill Stand 1/16"-1/2" £1.20. Butane & Propane Gas Torch Kits, 8 different Burners & Adaptor £15.00. 150 Ass. BA Brass & Steel Screws £1.00. Genuine Swiss Precision Files: 10 Ass. Shapes and Cuts. Mixed: 12, 14, 16 mm. £2.25. 16 and 18 mm. £3.00. 18 and 20 mm. £3.50. Send 20p for complete list and claim your FREE file. NO CALLERS. P.&P.P. Overseas orders £1.25. extra **B & B** 17 Lingfield Road, East Grinstead, Sussex RH19 2EX

Wanted: Part or whole Southbend 4½" lathe. Also accessories. M. MacDonald, Tel: 01-603 3892. 17 Glazbury Road, London W14. RST

Myford indexing att, unused £70.00. 5" powered shaper on stand with motor £70.00. Perris lathe. No motor but several accessories £50.00. 6" 4-jaw chuck £20.00. Buyer must collect or carriage charged at cost. Tel: Boston Spa (Yorks) 843684 evenings. S

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The Wharf, Godalming, Surrey Tel 23977
New **EMCOMAT V8** compact, complete with motor and chuck, immediate delivery **£418** plus **VAT.**
One only **New MYFORD SUPER 7B** on industrial stand, 3 phase, ex stock. List Price.

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Wanted. Myford vertical slide. W. Brown, 20 Sutton Way, Heston, Middx. TW5 OJA. S

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A range of used Machine Tools is now in stock.
J. A. CREW
SPINNEY LANE, ASPLEY GUISE, MILTON KEYNES

Zyto 3½" lathe, 3 chucks, faceplate, angle, 1PH motor, box of lathe tools etc. in good order. £95. collected or £105 carriage paid. 1 North Road East, Wingate (Tel: 502) Co. Durham. S

Wanted, saddle and any other parts for 4½" lathe by J. Barnes, Rockford, U.S.A. 1 North Road East, Wingate (Tel 502) Co. Durham. S

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All these and more in our latest list. S.A.E. to:
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Myford ML7 on cabinet stand, with extras including clutch, fixed-travelling steadies, faceplates, long cross-slide, rear tool post etc. Immaculate condition. Offers around £300. Tel: 021-353-9422. (West Midlands). S

For Sale: Myford ML7, little used, Wolf bench drill, Sievert brazing gear, compressor. £300 the lot. Tel: Purfleet 5838 (Essex). S

For Sale—1½" Pixie lathe, chucks, change wheels, collets, motor. 3½" gauge Firefly 2-6-2, drawings, castings. 1½" scale Allchin traction engine, drawings, castings. Drawings Cutty Sark. Tel: Shipston-on-Stour 61847. S

For Sale—Dore Westbury vertical miller, motorised on stand, good machine, sensible offers please. Tel: Joe Elnor, Tel: Crewe 68179. S

Unimat lathe, model S.L. many extras £85 o.n.o., hardly used. Tel: Haynes 287, evenings. S

Victoria M.1. milling machine 34" × 8½" table. Automatic table feeds. 1½ H.P. single phase motor. Floor standing, substantial machine. £220. Will take bench shaper in part exchange. Phone Peatling Magna 424 (Leicestershire). S

Washita & Arkansas Whetstones: large selection including modelmaker's patterns available direct from importer. S.A.E. for lists. C. J. Rufino, The Old Vicarage, East Stoke, Newark, Notts. NG24 1BP. Q-V

Wanted to buy Myford ML7 or Super Seven lathe in good condition, or similar lathe suitable model engineering. Good price paid, please telephone Cranleigh 4464 Surrey. T/C

Bock & Ryan for lathes and workshop accessories, drilling machines, grinders, electric tools, surface plates, etc. 101 Tottenham Court Road, London W1. T/C

Metal Melting Crucible Furnaces, 1100° centigrade. Steel hardening, case hardening and annealing furnaces. For details S.A.E. to Craft & Kilns, 376 Finchley Road, London NW3 7AJ. T/C

Wanted by collector, traction engine, 1" or 1½" scale, for cash. Box No. 3236 (Herts) Model Engineer Office, P.O. Box 35, Hemel Hempstead, Herts. HP1 1EE. S

Wanted: Fixed steady for Granville 4" lathe. Tel: Farnborough 54405 (Kent) S

Cromwell high precision lathe 3½" SS & SC, on cast base. Bed is 24" long. The cupboard beneath encloses 1/16" to 1/2" collets, X 1/16" steps, 3 and 4-jaw chucks with backplates and 1/2" drill chuck tailstock. Also complete with finely cut set of change gears in very good order. Compound slide rest with 4 way toolpost. Speed control in addition to the fine gear box also controls the speed of the headstock which is indicated on an electric dial gauge in view on the back. 3 phase motor. Price £320. Buyer to collect. Gravograph Engraving Machine, model IT2. Present price from Messrs. Vitos Ltd. is about £720 plus alphabets. My price is £350 and the machine is almost new. It has a 19" jaws centring work holder with blocks for holding cups, vases etc., for engraving. Buyer to please collect. Davy, P.O. Box 18, Pendrea House, Penzance, Cornwall. Tel: Penzance 3519. S

For Sale—Various machine vice castings and other odds and ends of M.E. machines, in C.I. S.A.E. for details. Box No. 3231 (Colne). Model Engineer Office, P.O. Box 35, Hemel Hempstead, Herts. HP1 1EE. RS

MODELS & MATERIALS

Wanted, 2½" gauge Deeley Compound to exhibition standard. Box No. 3237 (Herts) Model Engineer Office, P.O. Box 35, Hemel Hempstead, Herts. HP1 1EE. S

"Bassett-Lowke" 1½" scale Burrell traction engine £650. o.n.o. Tel: Market Harborough 5052. S

For Sale: 'Tich' 3½" gauge, 99% complete. Unpainted. Offers. Faulkner, 1 York Ave, Chilwell, Notts. S

Hielan Lassie, frames, bogie, crank axle, 3 drivers, Cartazzi, tender frames and wheels. £50 o.n.o. Box No. 3235 (Surrey), Model Engineer Office, P.O. Box 35, Hemel Hempstead, Herts. HP1 1EE. RS

Wanted to buy 3½"-5" model steam loco, or traction engine, finished or part finished would suit. Please phone Cranleigh 4464 Surry, (code 04866). T/C

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M.E. QUERY COUPON
MAY 1976

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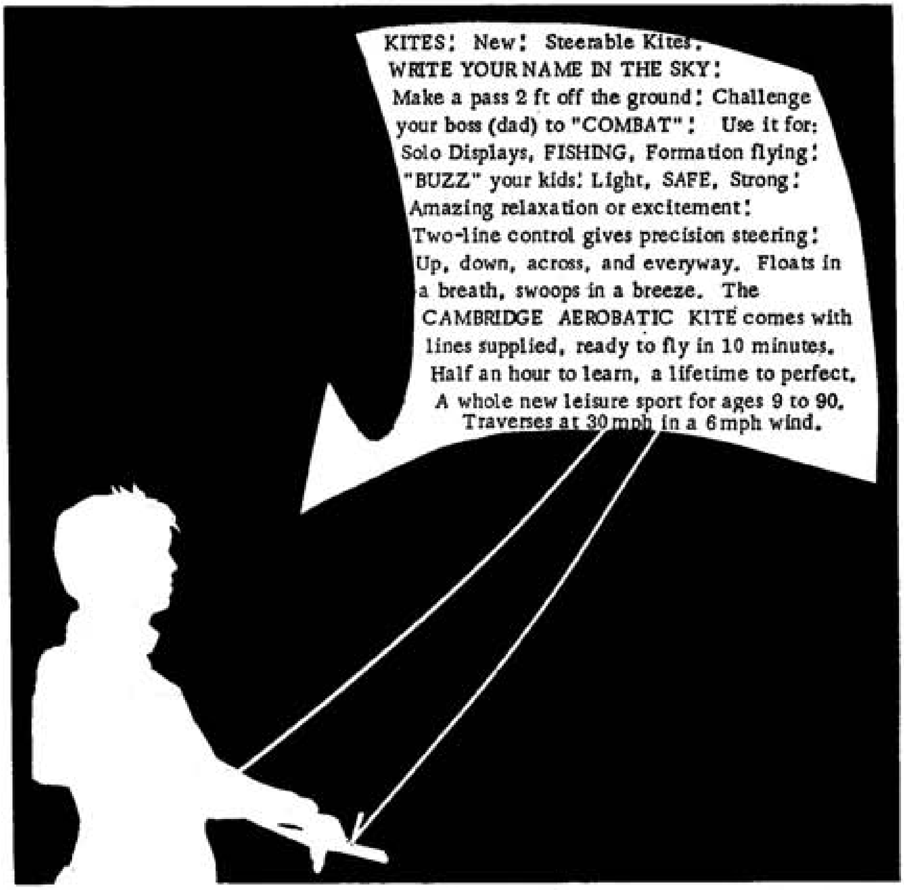

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