September 6 1974

A LARGE SCALE BURRELL

by Fred Horseman

My addiction to traction engines started ten years ago when Mich Glenn acquired the Fowler Empire Pride. With Arthur Mason we enjoyed long hours transforming this beast into a magnificent Showman's engine renamed The Iron Duke.

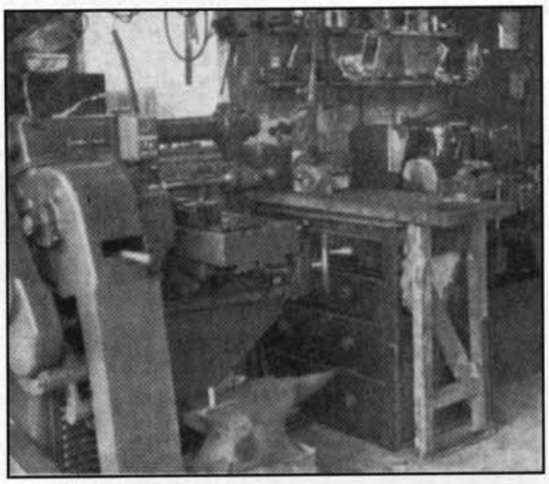
After several years grounding in traction engine engineering I decided five years ago to build my own engine. It had to be big enough to carry me and pull several wagons so the Lion Engineering 4½ in. scale Burrell 6 n.h.p. was about right. Several features have been upgraded within the scale and character of Burrells to make a robust hard-working engine.

To start with I needed some floor space and just sufficient capacity to cope with the machining that was going to be necessary for a model of this size. My garage at home gave me space enough, but eventually my car was turned out to face the elements, and has rusted less by the way!

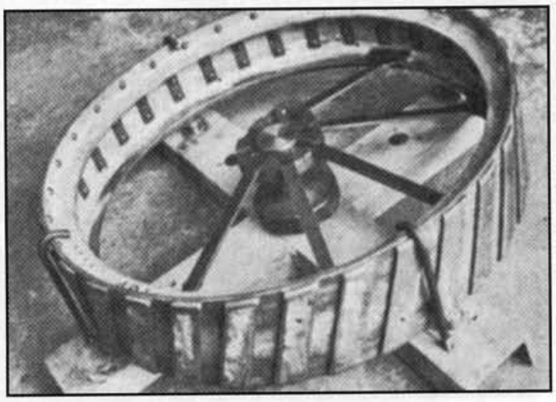
Scrapyards have a fascination for me and vast quantities of new offcuts have been used to reduce costs. A Churchill Cub lathe came to light at a local shipbreakers, and this 6 in. centre lathe was my only machine tool for a year, using it as a milling machine at times until the cylinder block arrived and then I realised a milling machine was going to be essential. Fortunately a friend found an old model Cincinnati, lend-lease from the last war, I think, in a scrap yard, which turned out to be my second best bet. With its 3h.p. motor it was quite a lump to squeeze into the corner of the garage.

Everything I made for the Burrell was my first attempt, so inevitably several parts were made two or three times. Eccentrics, slide bars, hornplates all had to be thrown away. Fortunately one crankshaft and a cylinder block were right first time made.

Many full size traction engines have the most appalling gears with teeth way out of mesh to take suspension movement, yet they are satisfactory in use. So with this in mind I was not too worried about machining teeth with a fly cutter and no dividing head. The blanks were marked out with a fine centre punch, a watchmaker's glass and a steel rule in 1/100 of an inch. These gears run very well.



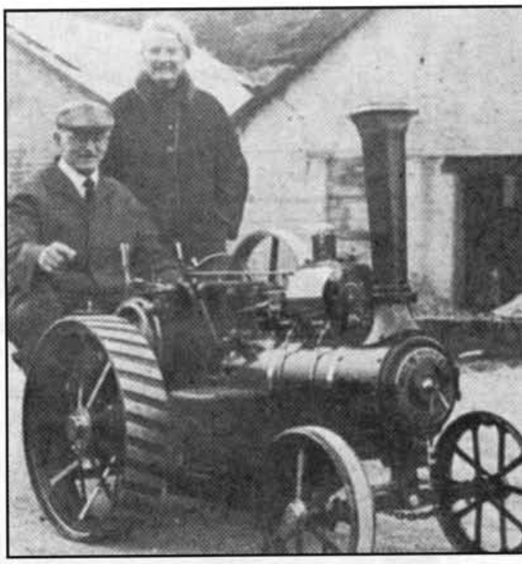
The garage workshop where Burrell was built.



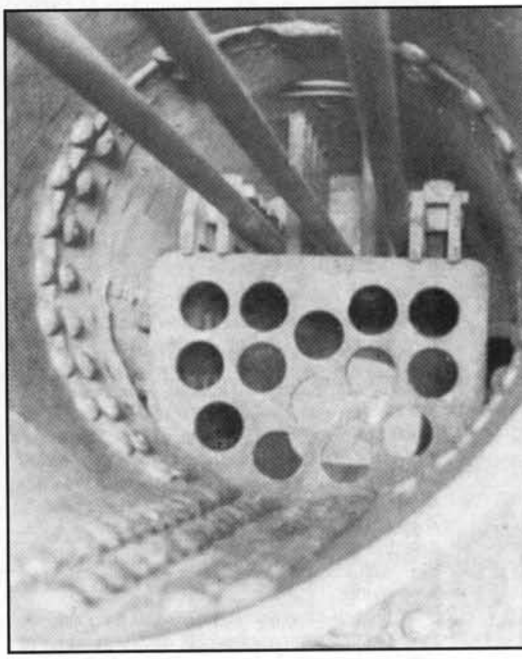
One of the fabricated all-steel wheels.

A ⅝ in. chain is being used as a temporary final drive on one wheel which is alright for driving on firm ground, and with both wheels locked with the driving pins it will bound through deep mud with a delightful slithering motion!

Ted Jeynes has not been over critical of this project, and occasionally I have taken note of his deliberations. The photograph of him on Mr. Rusty was taken in February sunshine. Note the reversed expansion link because of the chain drive. Since this photograph was taken, belly tanks of Burrell pattern have been fitted, mainly to give extra weight on the front end. ●

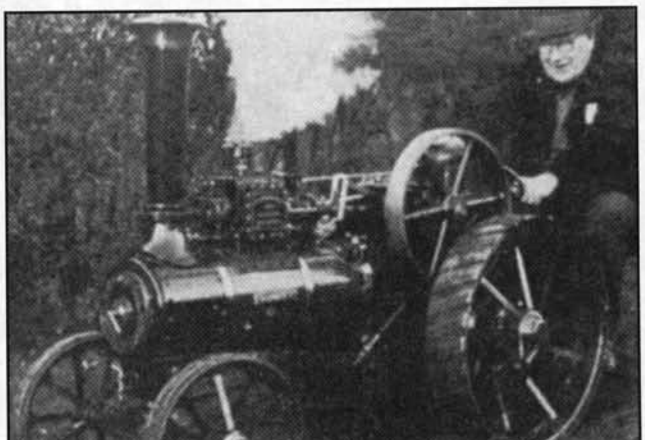


Mr. Horseman Senior and daughter Mrs. Perkins with the 4½" scale Burrell.



The interior of the steel boiler.

A Fowler re-built as a showman's engine.



Our contributor Ted Jeynes enjoys a drive behind the Burrell.

February 7 1975

JEYNES' CORNER

E. H. Jeynes on a large scale model

The Burrell doing some actual generating

The recent article by Fred Horseman describing the building of a 4½ in. scale model Burrell traction engine was to my mind far too short: five years of real amateur work, dismissed in so few lines I have been very interested in the building of this engine, and have been able to see it at various stages of its construction.

To begin with, the builder is a professional man, and not an engineer and in this case, there has not been a series of instructional articles with diagrams, photographs, and pages of detailed instructions which have so helped the many builders of "Allchins" and "Minnies"; here each machining operation had to be thought out before tackling it and in many cases his years of full size traction engine experiences were of great benefit in knowing the functional operation of the various parts. I was also rather surprised to see the photograph of Mr. Horseman Snr. and no word as to his model engineering prowess, he having only recently finished a scale model Burrell.

Although a photograph depicted one of the rear wheels being built there was no mention of the large jig constructed which introduced a measure of accuracy which surprised me. The base of the jig was cruciform welded, and the centre marked out, bored, and a spigot turned and fitted; a radius was struck from this, and four points marked out and pegs fitted to locate the rim centrally with the hub. The hubs were bored and faced, and the slots to receive the spokes milled; building the wheel then commenced. In addition to the strakes riveted to the rim, it will be noticed in the photograph of the wheel building which accompanied the article, that there is a cross pad which receives the inner rows of rivets, these being provided on the prototype, as in that case the rear rim consists of Tee rings. In most models of Burrell engines I have examined, these pads have been omitted.

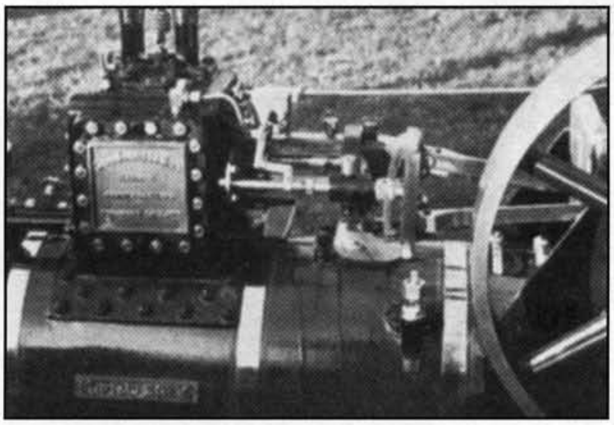
Although it was not used to produce brass castings for the engine, a furnace was built with the intention of doing so, but some brass castings being forthcoming, so the furnace has not up to now been used.

The wheels were constructed by rolling steel strip to diameter with an overlap, the ring, which was cut out of steel plate to form the leg of the Tee section, was tacked into position, and the overlap neatly cut off and the strip joined into a continuous ring; then the ring was finally welded into position. The photograph of the mockup shows the overlap of the rims, also the edge ring tacked in position in the nearside rim ready for measuring and cutting off the overlap.

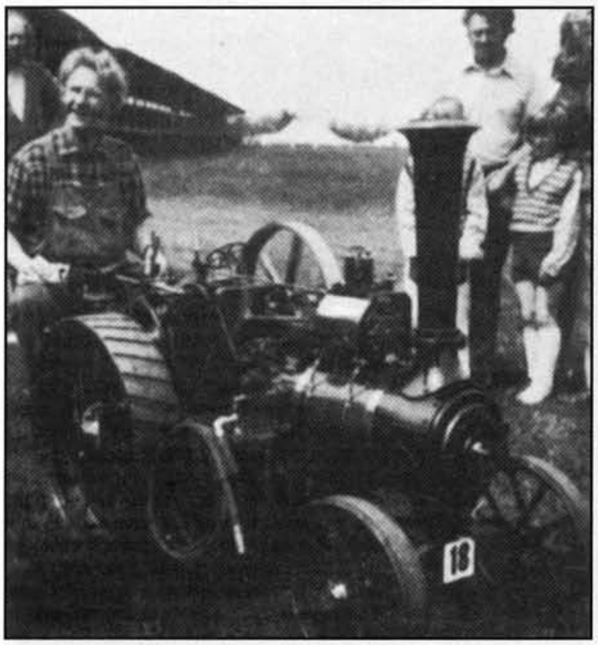
The front end, smokebox, chimney and base, and kingpin bracket were finished off first; and such was the finish, that when the front spring axle and wheels were added and painted, that the assembly was accepted by Mrs. Horseman into the lounge: one of the finest ornaments I have seen—I can imagine the better half of many model engineers refusing to allow such an ornament in the lounge as the front end complete of a 4½ in. traction engine; but Mrs. Horseman is an enthusiast, often having been part of the crew of the Iron Duke, the showman's type engine mentioned in the article; Mrs. Horseman is standing second from the left in the photograph of the showman's engine.

I was invited to a steam up, and after the departure of the boiler inspector who had passed the boiler, the engine was belted up to a hefty dynamo, Arthur Mason signalling when the lamp voltage had been reached. The next time I saw the engine, the boiler had been lagged, painted, and lined, and a nice cast nameplate Mr. Rusty fitted. A seat for the driver had been fitted to the back of the bunker, this is a splendid driving position, but when a hefty driver got up, it was found that most of the weight on the front wheels was counterbalanced. So a belly tank was made and fitted, complete with water lifter and hose (it works) and to my idea adds greatly to the appearance of the engine.

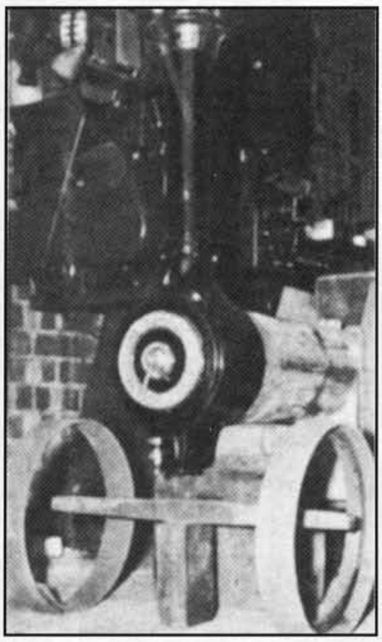
The engine has attended a number of rallies and exhibitions and although not yet finished as regards the differential gear it has been most favourably placed, and commented upon. ●



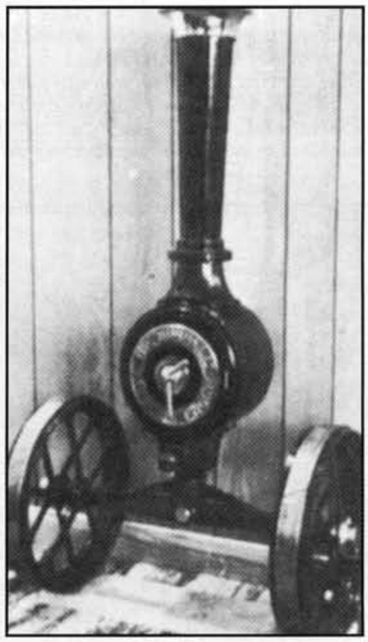
A close-up of the motion.



Fred Horseman with his engine at a rally. Note the water lifter.



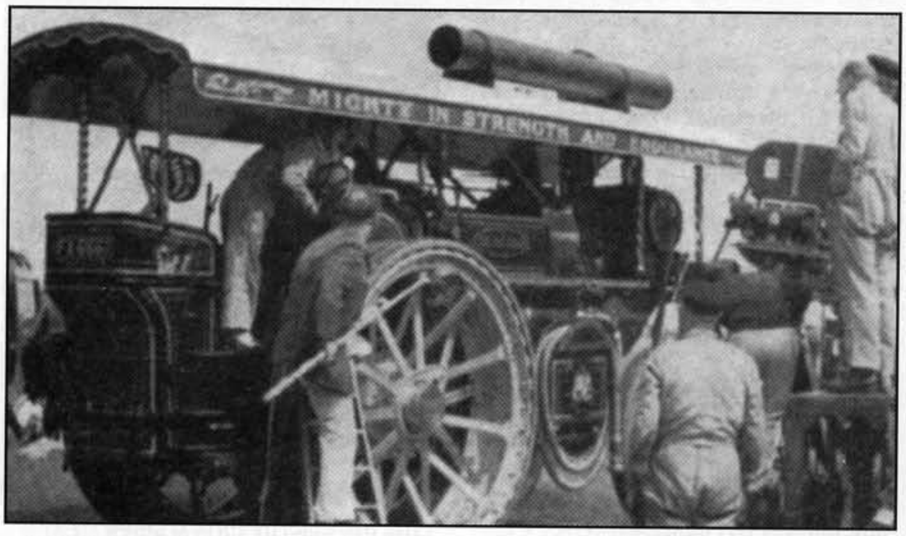
Above: How the wheel rims were constructed.

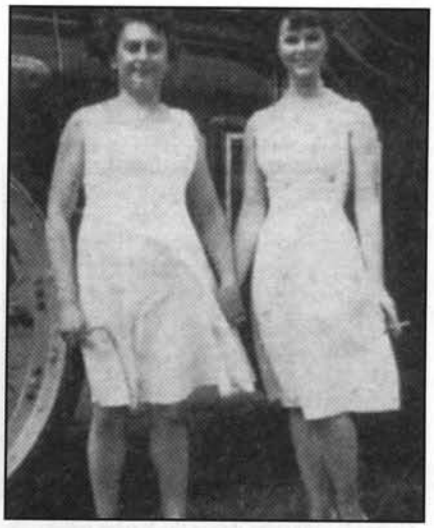


The completed front end– a lovely ornament.

April 4 1963

I have seen the film 'Iron Maiden' a few times now. The engine itself has recently been re-restored, a new box and so on, and is a frequent rally visitor. No doubt the film will come around again on the TV but before you watch it re-read these notes by the then owner, John Crawley. You will view the film in a different light. The detail on the Ply Maiden is quite remarkable.





The IRON MAIDEN (left) and the author with Anne Helm, for whom he doubled in the crash scene.

JOHN CRAWLEY had no idea of what awaited when he lent one of his traction engines to a film studio

Appointment with an IRON MAIDEN

As the owner of a number of traction engines, I was approached by a representative of Pinewood Studios in November 1960 and asked to help with the making of the film *The Iron Maiden.*

Several months passed before the first of a series of meetings took place between Producer Peter Rogers, Director Gerry Thomas, the production manager and myself.

It was decided that a full-size replica of *The Iron Maiden* would be needed for the shooting inside the studios because of the fire risk and the weight limitation on the floor. The replica would be made of plywood and fibreglass in the studio workshops and would be mobile. The flywheel would be driven by an electric motor with the correct revolutions provided through a reduction gearbox.

Steam would came from a small boiler fired by Calor gas. In the final scene, when the volume of steam required would be beyond the capability of the boiler, a portable steam plant would be used.

I must admit that I doubted the ability of the craftsmen at Pinewood to make a reasonable copy of my engine. Arrangements were soon well in hand. The engine was to attend the 1961 Woburn traction engine rally, for authentic shots which would later be mixed with shots of a make-believe rally to create the right illusion.

In my opinion some of these shots are the highlights of the film, especially those of the 84 competing engines which were lined up in the ring and filmed from the top of an 80 ft extending jib crane.

After the rally, operations came to a stop until March 1962, when a meeting was held at Bedford and the details of the engines were discussed. The *Iron Maiden* was inspected by Bert Mansell, who would be responsible for the building of her twin. It is very nearly impossible to shake men like Bert Mansell. They are used to being asked to build very nearly anything, but I think that Mr Mansell was taken aback by the size of the *Maiden*, which he had to reproduce. He looked long and hard at the unblushing *Maiden*, his thoughts very much his own.

The next move was to get the *Maiden* under cover for the convenience of Bob Laing, who was the chief draughtsman. After two weeks at Bedford measuring and drawing his charge he returned to Pinewood to produce the complete drawings for Mr Mansell's department.

It was not long before the familiar outline of a Fowler R3 Little Lion (*The Iron Maiden's* official works designation) became recognisable. The replica, which cost about £3,000 to make, was known to all the craftsmen as the *Ply Maiden*, a name which was to stick.

It soon became obvious that for the *Ply Maiden* to resemble the iron engine they would have to be brought alongside each other so that comparison would be possible.

Alter a complete repaint, the *Maiden* began to look ready for her star role. We steamed her the 60 miles down to the studios and arrived five minutes beyond my estimated time. Even then she was late merely because I had forgotten the time that I had given the studio.

We arrived with a small fire in the box as the *Maiden* was to be kept in the carpenters' shop. She was soon bedded down beside the replica, sighing and snorting as though in disdain of her make believe neighbour.

I visited the studios every week, helping with the questions which arose as the *Ply Maiden* approached the stage when she would have to be moved into the paint shop for her first taste of make-up.

Boxes of wooden rivet heads were being stuck on in all the right places, and the teeth of the wooden gears were wiped over with graphite to give them the look of worn oily metal. The steering gear which was fully operative, represented the biggest departure from full-size practice, in that a bevel gearing was used in place of worm and wheel as they were readily to hand.

The day arrived when the engine was missing from her usual spot and I found her in the paint shop sporting a black and maroon two-piece, her matching accessories lined out in goldleaf edged with black and red. She was as near as mattered to the real thing. The only trouble was that she would not go anywhere unless she was pulled or pushed. Despite this obvious shortcoming, she was a very attractive maiden and people came from all over the studios to admire her.

In mid-June *The Iron Maiden*, the *Ply Maiden* and the actors and actresses, were introduced to the Press at a luncheon. Filming began on July 2 at a location just outside Beaconsfield. Among the props needed that day were two new bicycles to be run over by the engine. They had to be severely treated before they were knocked about enough to satisfy the director.

After the engine had been over them they still did not lock sufficiently bent.

Imitation soot and tar (black peat and water) were needed, and gallons of Dettol were mixed with the water, to make the imitation milk for spilling out of the churns which the *Maiden* knocks over when she comes through the side of the barn.

Batteries were provided for the *Ply Maiden*. A five ton lorry carrying coal, water and firewood attended on *The Iron Maiden*, and the *Ply Maiden* needed the services of a lowloader and a small Bagnall tractor.

Vehicles employed included a Rolls-Royce camera car, a sound truck, an electrical van, a construction van, the producer's caravan, the changing van, the make-up van, a Land Rover, a 33 seater unit coach, a 12 seater Minibus, a construction coach, two unit cars, a 1,000 amp. mobile Mole Richardson generator truck and, of course, the catering transport, Whenever this convoy arrived at a location it had the welcome that the fairs used to receive when the loads were being pulled into the market place, by engines of the very kind that were used in the film.

All this time the Maiden had been in the care of Jack Fensom, who was able to devote his full attention to her. Jack has been a steam man all his life. Then Gerry Thomas asked me to double for Anne Helm in the driving sequence where the engine runs away with her. "You will, of course, have to be made up to resemble Anne," he said, looking somewhat dubiously at my large stomach and somewhat bulky frame.

I promptly told him that, provided I did not have to part with my trousers, I would do anything that I could to be of help. After visits. to the wigmakers in London and to Monty Burman's, the theatrical outfitter. I was ready to do my bit. I prayed that none of

George Woodbridge drives the Fowler roller, PRINCESS CAROLINE in the film.

my friends would come that day to see how things were going.

Although I was on location long before most members of the unit, nobody thought of calling me until a minute or two before I was wanted. The result was that everybody was kept waiting while the dresser, hairdresser and make-up experts struggled desperately with the biggest challenge of their careers. After what seemed a terribly long time, they told me kindly that they had done their best with the material at their command.

Crashing through the five-barred gate of balsa wood needed little effort, though we shot this scene three times. Poor Jack was curled up on the footplate between my legs, well out of the camera, his help was required in stopping, for after going through the gate the roadway dropped steeply away, and we had to halt before reaching the barn through which I was later to crash.

As soon as I had come to a marked position on the road, I would shout "Right" to Jack, who then uncoiled himself from the floor and started winding on the handbrake wheel while I pulled on the reversing lever. My wig had slipped, my dress was covered with blobs of oil and smuts, and I was pleased when the director said: "That's fine. We've got all we want of that scene."

Members of the public watching from a distance were slightly disconcerted when the lady who had been driving the big engine suddenly threw her dress over her head and took a cigar from her rolled-up trousers underneath.

There followed a number of shots where we went into the barn and stopped before we hit the other side — a difficult piece of work as the width of the barn left only a foot clearance on each side and Jack had to stay put until the last minute so as not to be in camera. The difficulty was overcome by my going slightly slower and stopping the engine by myself, the speed correction being obtained by over-cranking on the cameras.

That afternoon I was asked to do the next scene—the Maiden coming out of the side of the barn; it was originally intended to push the Ply Maiden through for this shot. The barn, which had been specially built in the studio and erected on the site, had a balsa wood portion in the right place so that no harm would befall the engine. When everything was at last ready, I made my first run, crashing through the wall and coming to rest against a studiobuilt haystack.

You can imagine, my disgust when I was told to do it again. The milk churns had not tipped over as we came through as the cord on the leg of the stand, which collapsed when pulled upon, had broken.

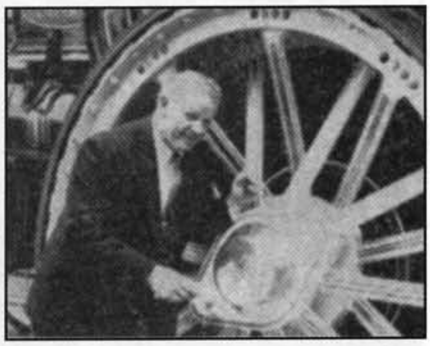
We had to wait for the Dettol and water to dry out, helped by a few shovelfuls of fine sand; the wet would have shown in the film.

This time, 1 thought, 1 would give it everything that I had. I would make sure of the milk churns by putting on a little right-lock. After the front of *The Iron Maiden* had burst through, the rear wheel should take care of the stand and churns.

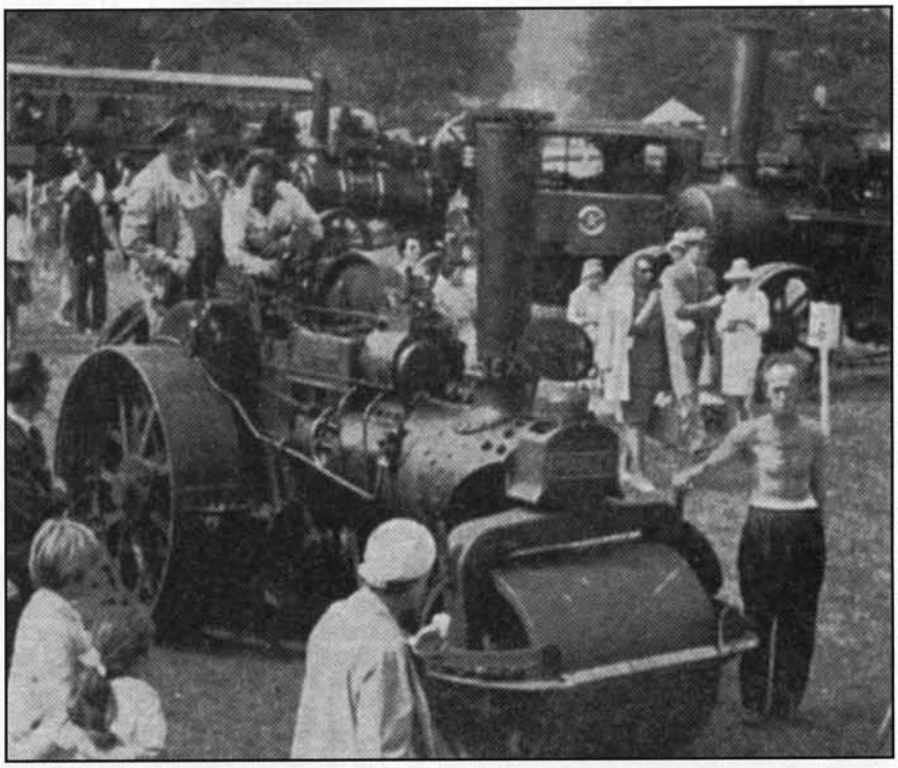
All went according to plan, except that I took out two or three feet of the side of the barn which was meant to be left standing. Poor Dickic "Props" who was sitting just inside the barn, was terrified by the noise. As he had pulled madly on the rope this time, he thought that he had caused the collapse. To complete his afternoon I ran over

Anne Helm with THE IRON MAIDEN

Dick Joyce and Joan Simms.



Alan Hale with THE IRON MAIDEN.

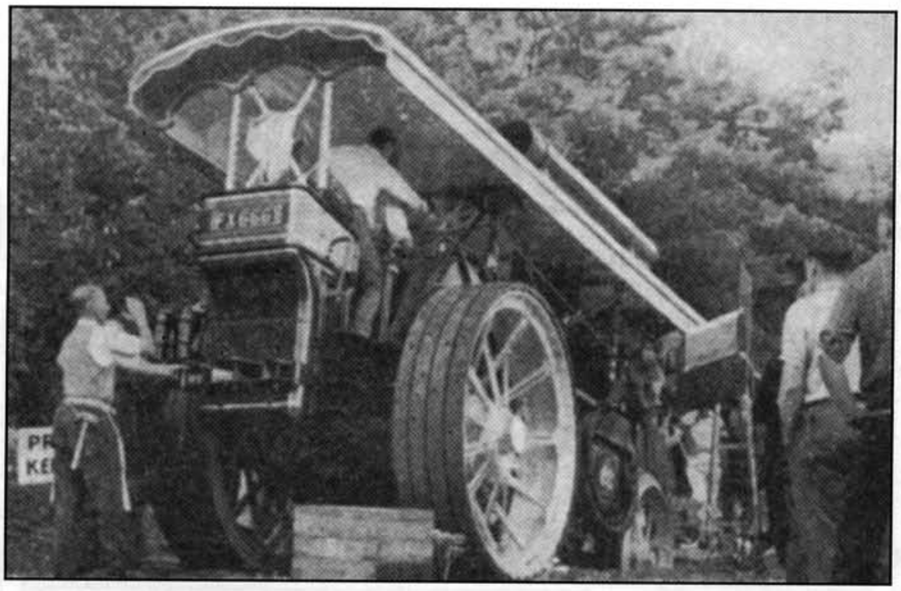


George Woodbridge and Des Smith on PRINCESS CAROLINE. The spectators at the mock rally are mostly film extras.

the end of the metal pipe on which he was sitting and gave him a terrific kick in the seat of his pants.In mid-July the unit moved to Woburn for a week's shooting. Here the two rallies were filmed, the Westover and District and the larger Woburn Rally.

Once again I was required to double for Anne in the driving shots. Gerry had persuaded me to part with my trousers, and I duly appeared in corsets and bra. As we had more than 20 other engines present with their crews, I came in for a good deal of leg-pulling.

Every day 225 extras were brought in from London to provide the rally with spectators. Back-end replicas of the Dreadnought and *The Iron Maiden*, both mounted on Queen Marys complete with steam units, generators and



The PLY MAIDEN in a booby trap.

arc lamps, were used for the closeups of the race shots. Interspersed with the running shots for which I was doubling, they provided the right effect.

Finally, to create the illusion that there were many more engines present than there really were, about dozen fullsize cutouts were made in hardboard, painted in the correct colours, and mounted round one side of the rally field.

Dickie "Props" rushed to and fro lighting smoke cartridges concealed behind the tops of the chimneys. By the time that the first had burnt out he had just finished lighting the last; and so he spent his afternoons.

We then returned our attention to the Beaconsfield area, where the Ascot Road scene was filmed. We used my son David's small Fowler steam roller. The gallons of imitation tar had to be washable; when the rain came down it washed away faster than it could be replaced.

Head-on "crash"

In the next scene—a film is not made, of course, in the order of the narrative—*The Iron Maiden* and the Cadillac meet head-on in a country lane. The bonnet of the car was removed and replaced with a special bonnet made of fibreglass and shaped as it would appear after the accident.

After lunch it was gently suggested to me that perhaps I would like to go to the pictures, as the film men thought the blow-up scene scheduled for that afternoon might go off much easier if I were absent. They knew that I was rather unhappy about this part of the story.

The Ply Maiden was placed into position and set upon by members of the art department, headed by the art director, Carmen Dillon. Roofing planks were removed and replaced with broken and splintered pieces of wood. The front was jacked up, the front wheels were removed, and the engine lowered down on to the ground with the wheels leaning lazily up against it. After the removable parts had been strewn about on the ground, everything was liberally sprayed with oil and soot.

The larger steam generator was fired up, together with the Calor gas unit, and steam soon issued from all the intended places, together with a few that were not intended. Half-a-dozen men concealed behind the *Ply Maiden* had to rock her gently when the cameras were ready for shooting.

To me this scene was distasteful, as also was the continual hitting of a displacement lubricator with a hammer on the pretence of releasing steam pressure. Apart from these two shortcomings, the film I think was technically acceptable. To help with the making of it was great fun.

By the end of the film Michael Craig was driving *The Iron Maiden* quite as proficiently as her owner. ●

November 15 1963

One of the more bizarre vehicles is Big Lizzie. Perhaps not truly a traction engine, she was after all powered by an oil engine, she performed yeoman service in the Australian outback, and is one of the few recorded commercially successful uses of the Ped-rail system. It is easy not to fully comprehend the scale of the vehicle until you pick out the man (driver?) between the wheels.

BIG LIZZIE, WEST OF MILDURA

The tractor, Big Lizzie, seen at the top of this page was a primitive machine built in 1914 to provide cheap transport across roadless and semidesert country in Australia. It was 32 ft. long and was driven by a 62 h.p. horizontal Blackstone engine running on crude oil. The 8 ft. flywheel weighed three tons.

Pedrail wheels made movement easy over sandy areas. The tractor pulled two trailers and could carry 70 tons of freight, the train then weighing 121 tons in all. There were three forward speeds, from half a mile to two miles an hour, and one reverse speed.

You will see above right a picture of one of the trailers carrying two portable steam engines into the country west of Mildura, Victoria, in 1920. ●

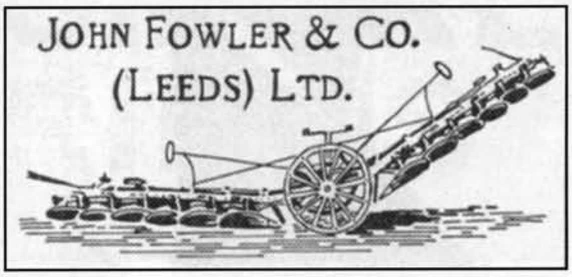
July 15 1966

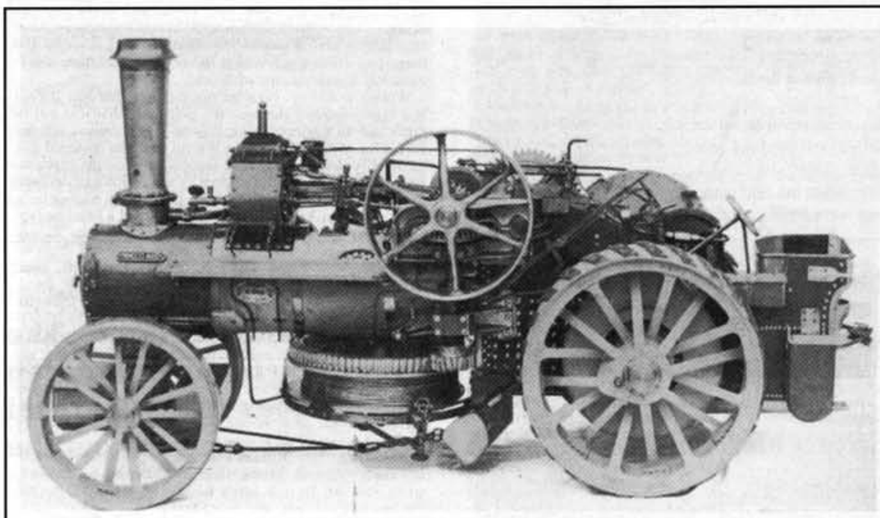
The most prolific designer of traction engine models is John Haining. John began his articles with co-author Colin Tyler. Their first design was the Fowler BB ploughing engine in 2 in. scale. After Part I, where the prototype and Fowlers themselves were explored, John and Colin outlined their reasons for their choice of model. The magnitude of the task in hand is clear from the number of patterns needed, 82 in all.

FOWLER COMPOUND PLOUGHING ENGINE

TWO INCH SCALE

J. Haining and C. R. Tyler





The flywheel side of the model ploughing engine.

As a hobby, model engineering covers a vast variety of subjects. However, there are many branches which have yet to be investigated and developed. Some steam engines for example lend themselves to modelling admirably, whilst others, mostly of modern times, are difficult if not impossible to reproduce as working models, bearing in mind not only technical requirements but the limited availability of machines, finances and spare time, which the majority of model engineers have to face.

Originality is a desirable asset in any model, together with practicability of construction and beauty of the final product. It was with these considerations in mind that we decided to embark jointly on the venture of building replicas in 2 in. scale of the Fowler Class BB ploughing engine. We considered this engine to possess most of our requirements and to be within the limits of our scope.

Full-size ploughing engines still exist and are in working order and the makers still have information available, which meant that accurately-detailed models could be produced. Alas, this cannot be said of many modelling subjects. The earlier ploughing engines have suffered particularly in this respect. The Kitson and Hewittson engine of 1860 and later slanting shaft engines have now disappeared and remain only in photograph and sketch form. Hence another reason for preserving the shape and form of the Fowler Class BB, lest it too is lost for ever.

The similarity between traction and ploughing engines is unmistakable. The two machines were nevertheless designed for very different purposes. Readers who have constructed a model traction engine will readily appreciate the massive lines of the Fowler engines.

To the best of our knowledge, the engine described in this series has not previously been modelled, certainly not to this scale, which we chose to enable details to be incorporated without the need for too much fine work. The attraction of such a model is not just that it possesses the best features of a traction engine, but that happily, it has few of the less attractive features from the modelling point of view—a differential axle for one! Once constructed, the implements can be added and the engine used for its original purpose, with all the haulage power of sister traction engines thrown in!

A complete set of steam ploughing tackle consists of two engines, cultivator, plough, mole drainer, living van and water cart. Now, like most schemes there are apparent drawbacks and the prospect of building two engines may dismay many readers. The mere problem of where to keep them would be trouble enough. For the average storage space, two engines with all the implements would be too large. Such problems are made to be overcome, and in our own case we decided to construct only one engine, cultivator and mole drainer each. Having done this, we can now use our engines combined to make a complete set if we wish, or on the other hand, we can use them individually by utilising a self-moving anchor in place of the second engine, although this does involve using the drum to haul the implement one way, and a second drum to return it in the opposite direction—known as "main and tail". This arrangement we will describe later in this series, when dealing with the winch drum and drive.

Although of earlier origin than the twin engine set, the anchor is a useful implement with models, and the slight historical inaccuracy incurred by using a class BB engine for roundabout ploughing may be overlooked!

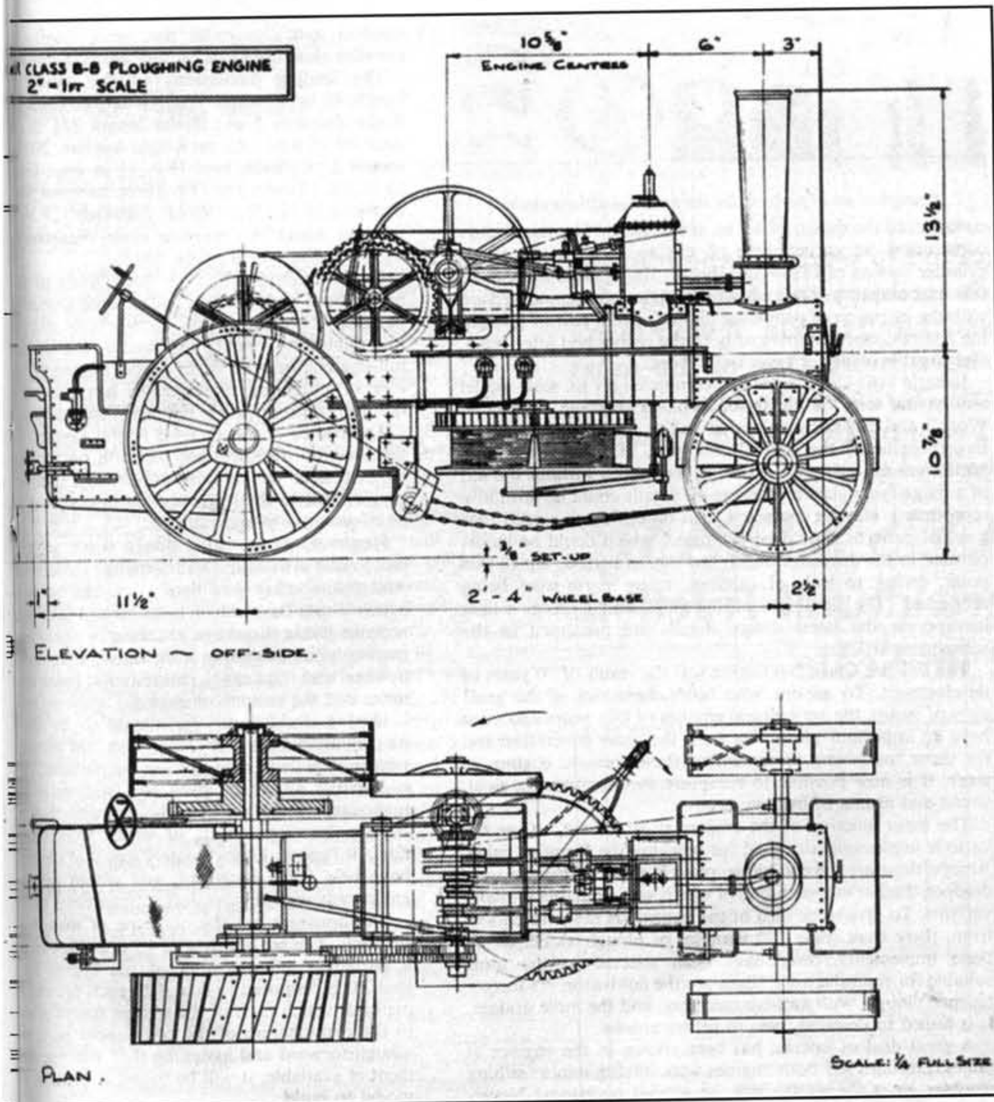
The initial stage of development work on the model Fowler class BB goes back to 1962, when John Haining commenced the design of a 2 in. scale replica. Having already constructed an earlier type of engine—the Fowler single cylinder version of 1880—and this proving a great success, he was encouraged to proceed with the later compound version with the intention of providing himself with a pair of ploughing engines, representative of both the earlier and later types, and capable of performing useful work.

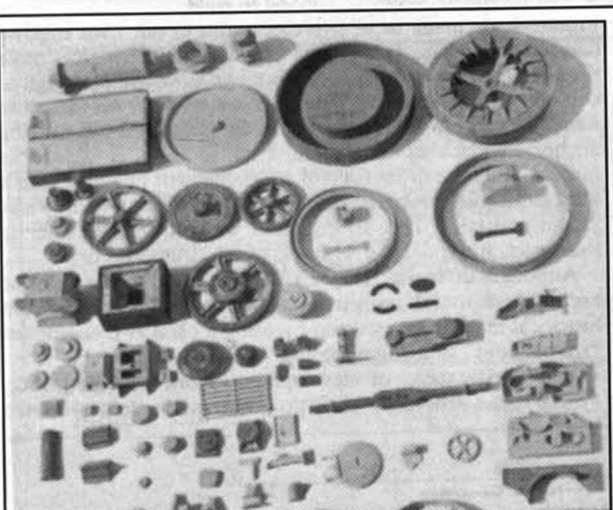
In early 1963 Colin Tyler had completed a ¾ in. scale model and having seen the illustrated book "Ploughing Engines at Work" and full-size engines at rallies, decided to make a larger engine of the agricultural type, in which individual parts were not too small to be worked upon without the aid of a magnifying glass and where all details could be faithfully reproduced. Having contacted each other, it was agreed that a set of patterns should be produced, which could be incorporated in the drawings during the design period. Up to this point, owing to lack of castings, many parts were being fabricated. The final sets of drawings and castings which incorporate the latest design details are presented in the subsequent articles,

The full-size Class BB engine was the result of 70 years of development. To anyone who holds memories of the great days of steam, the agricultural engines of fifty years ago must have an important place. For both the older generation and for those too young to remember these massive engines at work, it is now possible to recapture in miniature the sight, sound and aroma of bygone days.

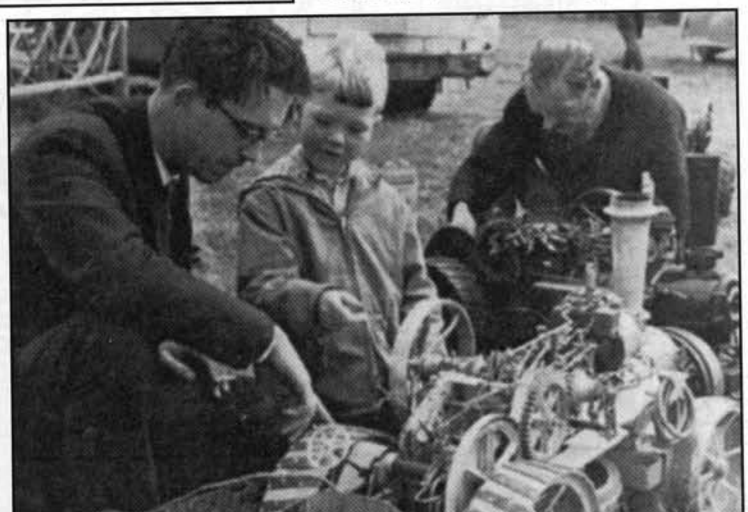
The main function of the engines is, of course, to use the various implements designed for working the farmers' fields. Among these are the cultivator, plough, mole drainer, harrow dredger, ditcher etc. each one of which was available in many variants. To give some idea of the enormous range to choose from, there were some 740 varieties of plough alone. Of all these implements, three have been selected as the most suitable for reproduction. These are the cultivator, six furrow balance plough, with anti-balance gear, and the mole drainer. It is hoped to describe these in future articles.

A great deal of interest has been shown in the engines at rallies. During 1965 both engines were having minor teething troubles, as is always the way on spe-





A complete set of patterns for the model ploughing engine.



The authors with their engines at the Usk show, showing the two types of chimney cap.

cial occasions! Nevertheless, they are giving a fair account of themselves and during 1966 we hope to be able to give—for the first time—full working demonstrations with our combined set of two engines, cultivator plough and mole drainer—depending largely on the condition of the soils at the various rally grounds. They are not intended for ploughing up rocks!

Now that the inevitable teething troubles are eliminated, the performance of our engines fulfil initial expectations. The engine has been designed with a choice of two cylinder diameters, 1⅛ in. and 1⅝ in. or 1¼ in. and 1¾ in. giving ample power either on the winding drum or for direct haulage, but the smaller size has proved the most economical in water and coal consumption, while still providing plenty of power for normal use. One pleasing effect when the models are in steam is the realistic sound, both in the exhaust note and ring of the gears as they are in motion. It is most satisfying to hear the beat of the steam in the chimney as the balance crankshaft revolves and dips, with the gears ringing merrily as she trundles along or hauls on the winch drum.

The leading dimensions of the model are: Overall length 46 in.; Overall Width 16¼ in.; Overall height 24 in.; Boiler diameter 5 in.; Boiler length 22½ in.; Boiler working pressure 75 p.s.i.; All up weight approx. 200 lb. : No. of road speeds 2.; Cylinder bore H.P. 1¼ in dia.; Cylinder bore LP, 1¾ in. dia.; Stroke 2 in.; Flywheel diameter 9 in.; Front Wheel diameter 10 in.; Rear Wheel diameter 12¾ in.: No. of strakes per rear wheel 26.; Winding drum diameter 10⅝ in.; Length of 3/32 in. dia. winding rope 300 ft.

Careful consideration has been given to each item on the model from both the time and expense angles. Where possible, parts have been cast, thus cutting time and material wastage to a minimum, a policy followed by the manufacturers of the full-size engines. To us as model engineers, casting is a sure way of obtaining materials in a preformed manner, and faithfully reproducing in miniature the castings of the original.

The choice of metals used in the castings was dictated by their section thickness and location on the engine. Cast iron or cast steel was almost universally used on the full-size engine. Due to the low stressing of cast iron, sections had to be of generous proportions.

However. when scaled down, some sections became too thin to cast in iron, and an alternative material had to be found. Aluminium alloy was finally selected as the best material which would flow well on pouring and take the original shape without giving shrinkage, cracking or porosity troubles. Some castings of course are in iron, among them the cylinder block, flywheel and road gears, this material being essential for these items and the volume of material allowing ease of casting.

Having decided on the metals to be used for castings, namely aluminium alloy, cast iron and phosphor bronze, the next problem was in producing the patterns. The total number of these is 82 which gives 148 castings to a set. Made of mahogany, they are largely reproductions from original Fowler drawings, prints of which were obtained from the late Alf Pepper. Unfortunately many of the original drawings have now been destroyed, and where necessary, an actual engine was used for obtaining dimensions and details.

The drawings are the outcome of many hours of patient research. The set consists of 15 drawings, each one depicting a particular subassembly of the engine and complete in itself. It is proposed to deal with each drawing, describing the methods which each of the writers found to be most suitable in the manufacture of the component parts. Most parts are straightforward and assuming that average workshop equipment is available, it will be found a pleasant and rewarding model to build. ●

In due course John and Colin decided to work independently. John embarked on the task of describing the building of a series of different engines and associated tackle. A very large number of John's designs have been built. One of the most popular is the Durham and North Yorks, serialised in 2in. scale. It was to this model that I eventually turned, to select some examples of John's narratives.

"COUNTRYMAN'S STEAM"

A Single Cylinder Agricultural Traction Engine in 2 in. Scale

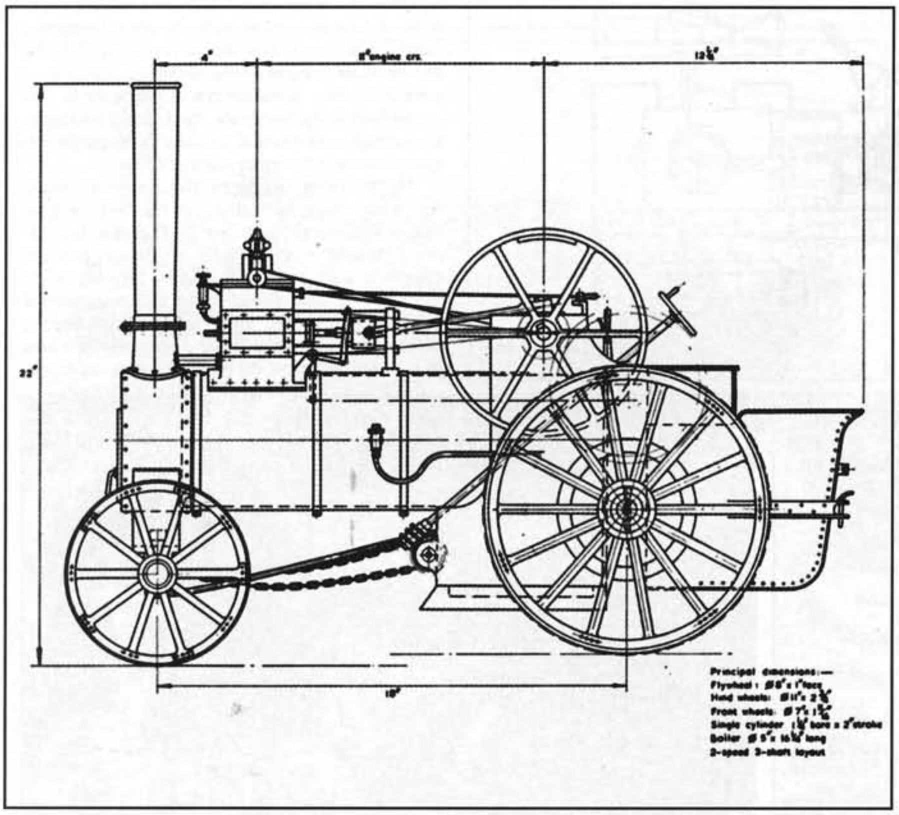


Fig. 1. General arrangement Drawing.

Choosing an engine upon which to base a series of constructional articles in the pages of Model Engineer is not an easy task as so many differing factors have to be taken into consideration.

Judging from letters received and conversations with readers at Engine Rallies and similar events, many readers — particularly the younger ones — like to be given something of the background history of an engine and its makers and the reasoning behind any particular points of design prior to embarking on the construction of a model. It is comparatively easy to give a potted history of any of the twenty-two or so well-known engine builders — indeed Colin Tyler and the writer covered part of the story of Fowlers of Leeds when we described the building of the 2 in. scale class BB/BB1 ploughing engines, Colin later dealing with Savages of King's Lynn and the writer both Aveling and Porter of Rochester and Ransomes of Ipswich in subsequent series of constructional articles. However, there were other makers who built extraordinarily interesting and sometimes very unusual engines, not necessarily in any great quantities, and while researching into the history of these firms and their products always proves absorbingly interesting to the writer, as subjects for reproducing in model form many of the engines or machines would probably prove too unusual to have a wide appeal to the readers of Model Engineer.

One example which comes readily to mind is the range of agricultural traction engines built by Tuxfords of Boston, Lincs in the latter half of the 19th century, most of which would prove interesting prototypes for reproducing in smaller scale — those readers who have visited the Hove Engineerium will have seen the nice contemporary model of a Tuxford "lock-up" portable engine in the fine collection of models exhibited there — but somewhat unusual in layout and therefore probably lacking in popular appeal.

The choice of a prototype, therefore, must lie somewhere between the two extremes: a "modern" engine, built by one of the well-known manufacturers between, say, 1905 and 1932, when traction engine design had reached almost its final stage of development and many similarities existed between the principal makes of engine, or an engine built in the years of intensive development between say 1865 and 1890 when designs were many and varied and even the big makers were constantly experimenting with new ideas and methods of construction.

A further factor influencing choice was the fact that my last two engines had been compounds, and as both are small engines in full size many of the component parts have been fairly "finicky" to make in 2 in. scale and to give readers a complete change a fairly straightforward single-cylinder agricultural two-speed engine seemed the obvious choice, and the period from which to choose the prototype must preferably be towards the end of the development era, using an engine typical of the period but not too unorthodox in appearance.

For many years the activities of a small North country steam cultivation firm and the handful of engines they built in their small works had interested me, even to the extent of roughing out an engine in two inch scale based on the information then available, but it was not until a tour in early June this year of the Border country and the Dales enabled some further research to be carried out that a firm decision was made to go ahead with the design and construction of this engine.

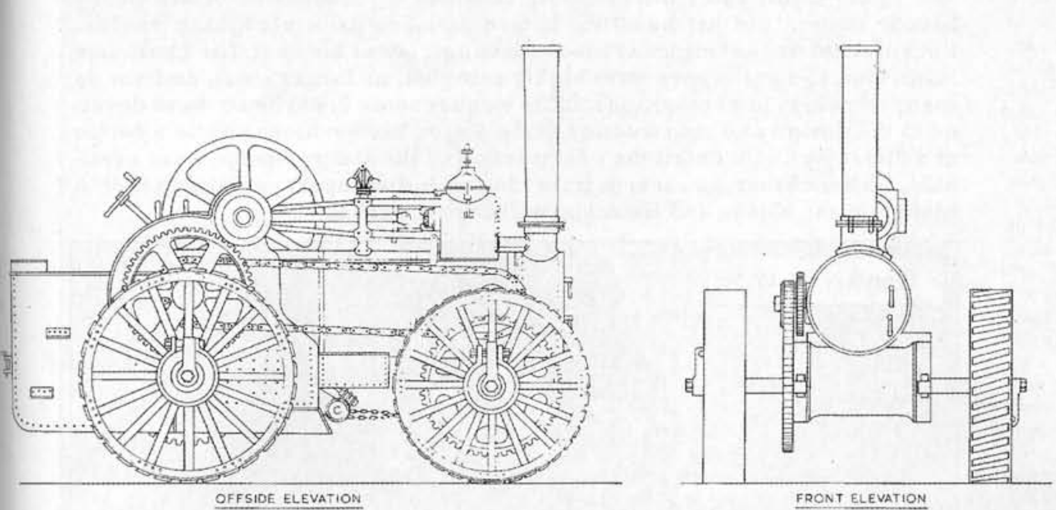
Successful development of the cable system of steam cultivation from 1860 onwards led to a number of wealthier farmers, able to afford the cost of engines and implements, hiring out tackle to neighbours on a contract basis; a natural extension of these activities was the establishment of a number of steam ploughing firms in all the corn growing regions of the country,

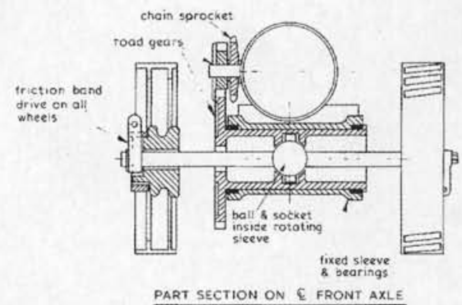
Many of these early contractors' businesses, lacking adequate financial backing, did not survive the hard early years; some, like the Herefordshire Steam Ploughing and Threshing Co. using the unconventional early Howard three-wheeled cable ploughing engines, were under-financed to survive the cost or repairs and replacement of unproved tackle; others not only survived the early years and the long series of appallingly wet summers which occurred in the '70's and '80's but by using only well-tried engines and implements and extending the scope of their businesses to cover other operations such as threshing and rolling, managed to prosper through the years into the first third of the 20th century.

One of the smaller of these cultivating firms, working in the lovely and fertile countryside around Ripon and the lower Dales was the Durham and North Yorkshire Steam Cultivation Co. Ltd., whose repair shops, North Bridge Engine Works, in Ripon turned out no less than five engines between about 1873 and 1883, using their spare workshop capacity; and it is this firm's No. 2 engine, built in 1875 and supplied to a Mr. Michael Welsh of Laverick Hall which is the prototype of the engine to be described in these articles.

The first engine built by this small works was supplied new to the same owner sometime in 1873. It was a single-cylinder single speed unsprung agricultural engine, reported to have been later converted to a two-speed by the addition of a bell-pinion on the crankshaft end, and a second gear on the next shaft. According to the scant information, now available it had a long working life until, together with

March 7 1980





The Durham and N. Yorkshire engine.

No. 2 engine, it was sent for scrapping under a Draconian Ministry of Supply scrapping order in 1944 — the fate which overtook so many engines and machines, often quite unnecessarily, at the hands of the Philistines at that period.

Leaving out the No. 2 engine. to which we will return later, No. 3 was similar in many respects to No. 2, built in 1880 and supplied to the Broomhill Collieries Limited in Northumberland. Of 7 N.H.P., it was fitted with an ingenious form of 4-wheel drive.

Early in the series covering construction of the two inch scale 6 N.H.P. Durham and North Yorkshire Steam Cultivation Co. agricultural traction engine of 1875, I mentioned the two four-wheel drive engines turned out from the North Bridge Engine Works at Ripon in the early 1880's; a number of readers have written asking me for further details of these engines.

A description of one of them — opinion is divided as to whether this was No. 3 or 4 — was published in "The Engineer" at the time of their construction, and extracts from this article, together with a rather incomplete engraving, are held in the portfolio records of the Road Locomotive Society.

From the same source we are told that the four-wheel-drive engines were designed by Messrs. Johnson and Phillips for the Ripon firm and that like the three conventional pattern traction engines built there, the boilers were of bowling iron, with 140 square feet of heating surface and longitudinally welded seams — this must have meant fire-welded at that period, a practice used by several other engine makers for their fireboxes in those pre-gas or arcwelding days.

Two road speeds were provided, as on the other three engines, 1½ and 3 m.p.h. and the hind wheels were 5 ft. 6 in. diameter while the front were 5 ft. only.

The engines weighed eight tons, and if this was a true figure, was comparatively light by comparison with other makers' engines. Due to weight restrictions and other running conditions imposed by councils in those days it was not unknown for new engines to be run on to the weighbridge minus as many fittings as possible, or even with certain castings temporarily replaced by wooden substitutes!

It was claimed by the makers that either axle could be put out of gear if required, but this would appear to be possible only by slackening the bolt and nut of the friction band which transmitted motion from the live axleshafts, via an arm, to a circular drive plate integral with each hub casting — a common method of power transmission on early engines, particularly if no compensating gear was fitted.

Sometime previous to the building of these two engines at Ripon, a Mr. Whittingham had patented a method of transmitting power to the front road wheels of an engine. However, in the rather brief and sketchy technical description of the front wheel drive used on the Ripon engines no mention is made of a patentee, and it is interesting that the two four-wheel-drive engines built by John Fowler at Leeds both used a layout based on the Whittingham patents. In view of the difficulties encountered in transmitting chain and gear drive to a centrally pivoted front axle, it may be that the Ripon built engine used the Whittingham principle several years before Fowlers based their design on it. Current correspondence with the Patent Office will, no doubt, shed light on this point, but in the meantime I have pieced together, from several different sources, a view of what one of the Durham and North Yorkshire engines locked like.

The section drawn through the front axle showing the front drive layout is based entirely on the contemporary description and illustrates the principle and not the details. Doubtless the patent drawings when available will enable detail to be verified. The Fowler four-wheel-drive engines wore two; Number 4920 a conventional class "A" single cylinder engine with drive added to the front wheels, supplied new to an owner in Nantwich, Cheshire on 25 August 1885; and Number 5042, a compound undertype engine. This was built in 1885, retained by Fowlers for their own use, and scrapped in 1895 — a very short life for a traction engine, as "works engines" usually lived to a ripe old age. The 4-wheel-drive Durham and N. Yorkshire engine, despite its slightly "nose-down" appearance and consequent tendency to a dry firebox crownplate when descending hills, would, to my mind, make a very handsome model. There are some obvious differences between this and the 6 N.H.P. conventional-drive engine upon which the 2 in. scale engine is based, but even so I personally am very tempted to add the front drive layout to my own engine at present under construction — despite the additional labour of straking an extra pair of wheels! ●

February 16 1990

Three of John Haining's designs, left to right: John Cunningham's 2 in. Ploughing Engine. L. Kear's 2 in. Tandem Roller and Ian Bromley with his 2 in. scale Durham and North Yorkshire Traction Engine.

March 4 1977

COLIN TYLER'S DERBY DIGGER

The name Colin Tyler immediately conjures up memories of his Darby Savage digger and his beautiful Kitson and Hewitson ploughing engine. Both of them are examples of the model engineer at his best. The challenge is obvious, the prototypes were highly complex, no longer exist, and nor do many drawings or photographs. Little wonder some 2,000 hours were devoted to the design and construction of the Darby Savage alone. While a series of articles by Colin detail the construction of the Darby Savage were available, I have chosen an excerpt from the exhibition report pertaining to it. A picture of the Kitson and Hewitson will have to suffice.

Most readers will recognise the name of Colin Tyler not only as a writer in these pages, but also as an authority on steam ploughing and steam digging. Now he has built a 2in. scale model of the Savage Derby Broadside Steam Digger, and this was the runner-up to the Fowler Showmans' Engine. The prototype was built by Savages of King's Lynn in 1888, and the model was built using the original works drawings. It took 2,000 hours in the design and construction — understandable for such a complicated machine.

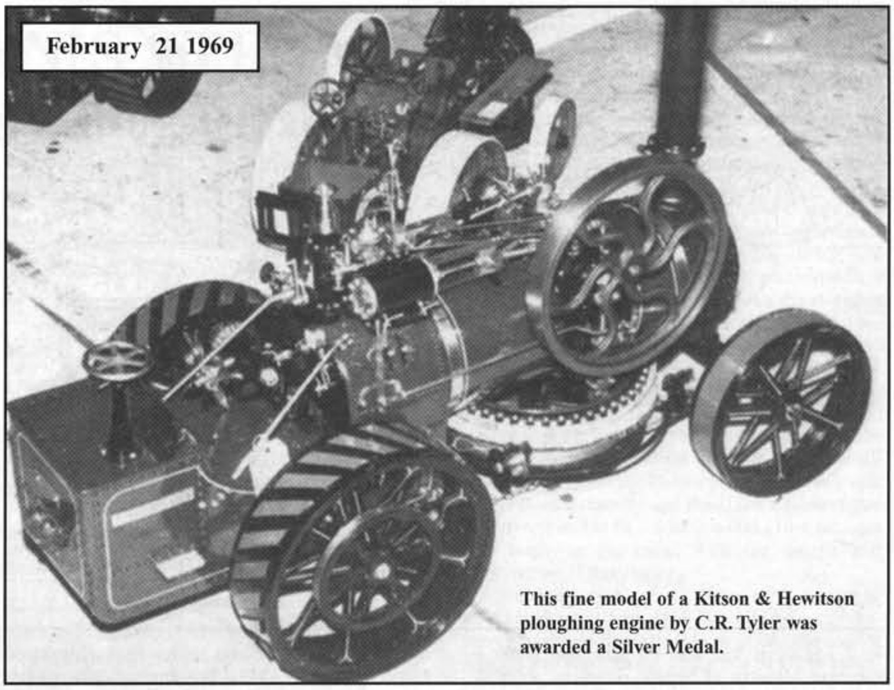
The boiler is double-ended, with a central firebox and a smokebox and chimney at each end. It carries a single cylinder with the motion set longitudinally, and there is a bevel wheel drive from the crankshaft to a longitudinal shaft (relative to the boiler) with a clutch interposed so that one wheel can be disengaged by sliding on splines.

From this shaft, bevel wheels (also with clutch gear) drive a nearly vertical shaft from which further bevels drive a five-throw longitudinal crankshaft. Each crank drives a large digging-fork, of which the tines are detachable for case of maintenance and replacement. The two outer forks have five tines each, the next two have six, and the central one has seven tines. In line they dig a band which is wider than the machine's length. since the outer forks project outside the carrying wheels. A small handcrane is provided, however, which can be slotted in at either end to lift off these end forks, so reducing, the machine's overall width when on the road.

To propel the engine, the upper longitudinal shaft carries yet another slidable bevel, which drives a cross shaft passing beneath the motion. From this another pair of bevels drives a vertical shaft passing in front of the boiler, and this shaft in turn drives another one passing beneath the water-tank and parallel to the axle. A pinion at either end of the last shaft engages with a spur wheel attached to each rear wheel with a pin-type drive on the nearside to allow disengagement for cornering.

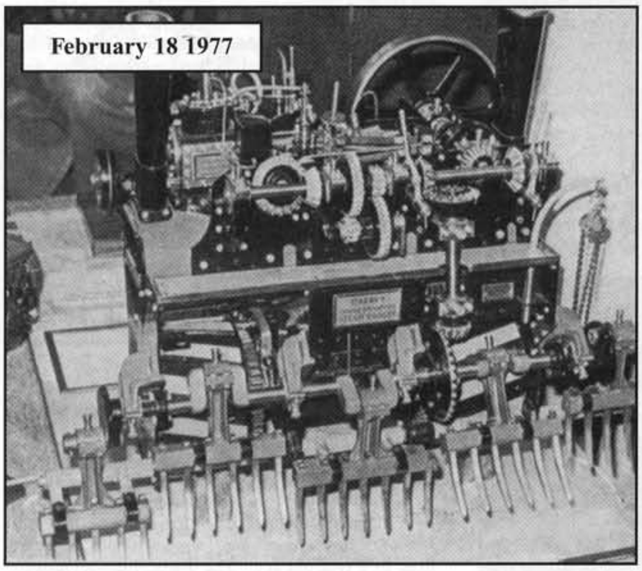
The driver's footplate is in front of the boiler and central firebox and on top of the water tank, with a coal bunker on the nearside. Projecting forwards from the

February 21 1969



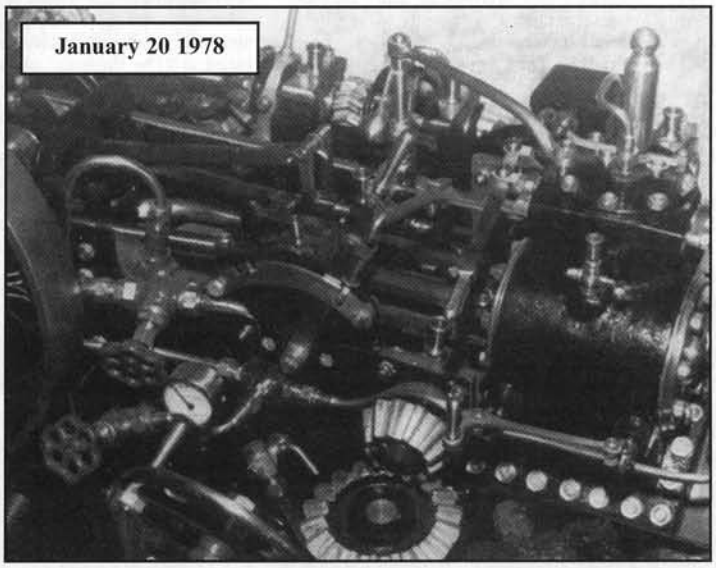
This fine model of a Kitson & Hewitson ploughing engine by C.R. Tyler was awarded a Silver Medal.

February 18 1977



An unusual and impressive model by C. R. Tyler, a 2in. scale Savage/Derby steam digger.

January 20 1978

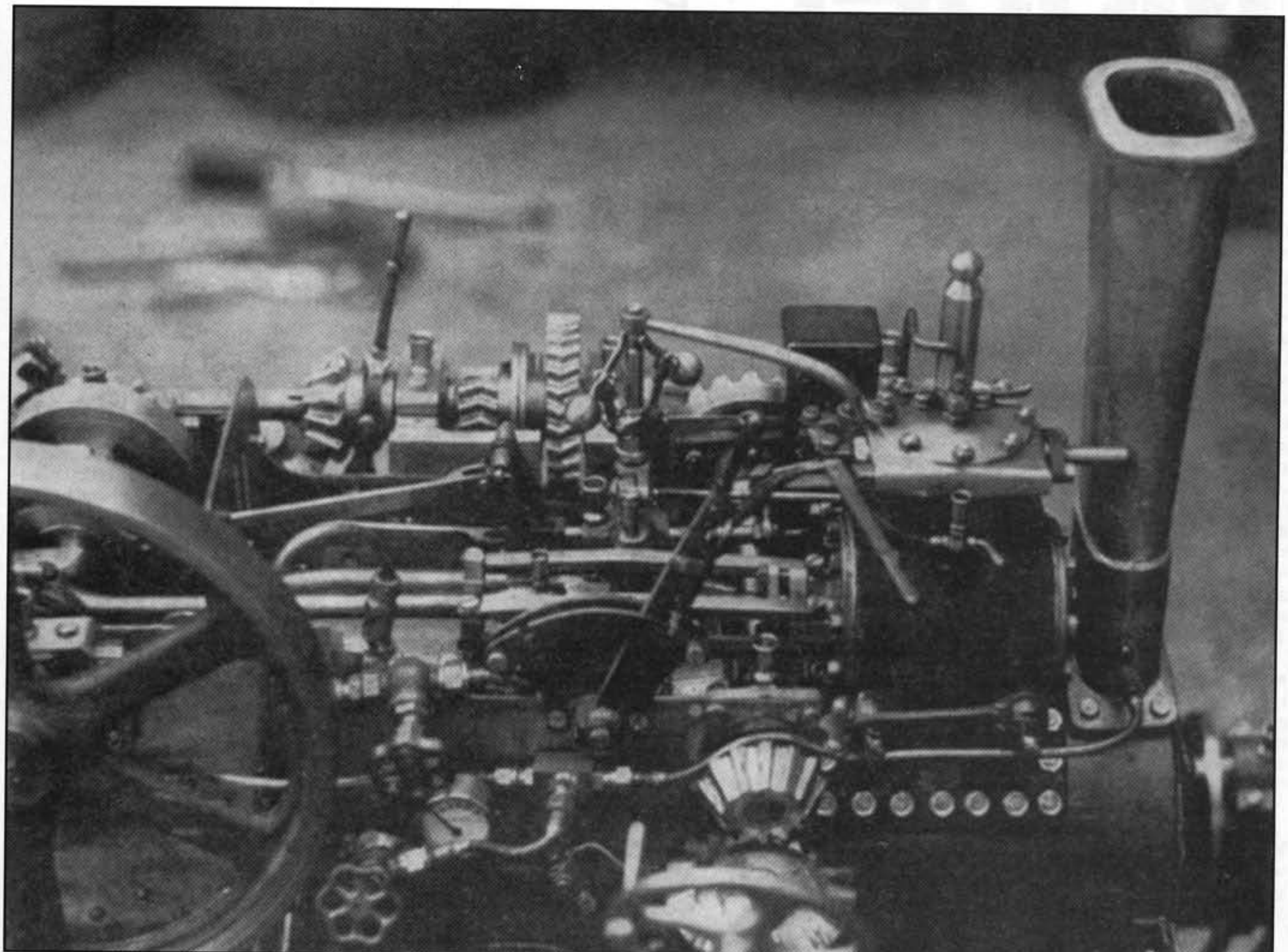


This close-up view of the motionwork emphasises the amount of detail put into the model.

tank-footplate construction are twin A-frames, like an elongated pyramid, and these carry the forecarriage, with four wheels on the front axle. This is steered by shaft, worm-wheel and worm, and reduction gear.

The frame's lower arms are pivoted at the foot of the tank, and screws are fitted at the top by which its angle relative to the footplate can be varied. Thus when the frame screws are fully extended, its nose (with the forecarriage) is tilted down relative to the footplate, and this, pivoting about the hind axle, is lifted. In turn, this depresses the digging forks to give maximum depth of spit. But when the "nose" is lifted, this raises the forks clear ready for travelling, and intermediate positions of course will vary the depth of spit being dug.

This complicated and highly detailed model could be criticised in places as regards finish, but it created great interest and was much admired. I hope that in due course it will take its rightful place in some public institution, for the edification of generations to come. Meantime, the model was awarded a Silver Medal, and the James Crebbin Memorial Cup.●



December 1 1967

I am certain it is best to leave the description of the work of Mrs Cherry Hill (formerly Miss Cherry Hinds) to W. J. Hughes and Prof. D. H. Chaddock. The list of medals, awards, and cups awarded to Cherry is indeed impressive. I have included two descriptions relating to the rare occasions she did not win. The dilemma facing the judges is evident from the reports. I have also included the interview Cherry gave to Mike Wade, some years ago.

TALKING ABOUT STEAM

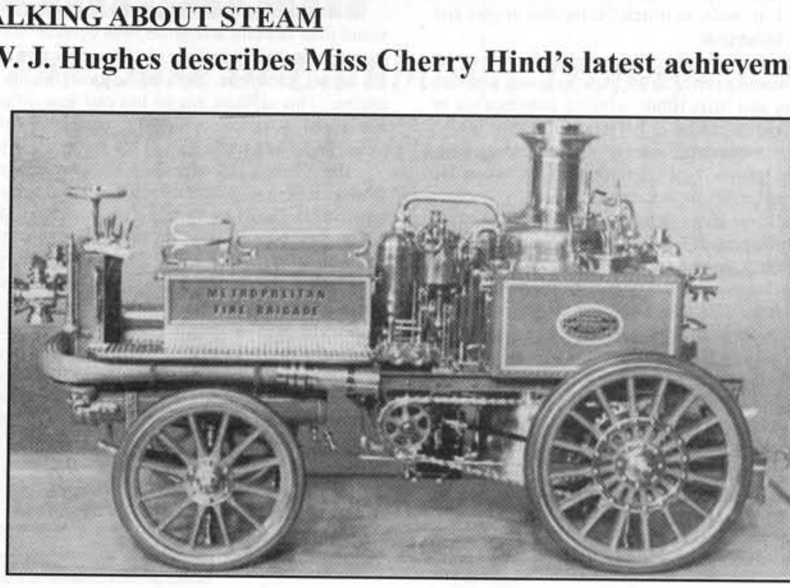
W. J. Hughes describes Miss Cherry Hind's latest achievement

The model steam fire engine to be described in this article owes nothing to the current series by E. T. Westbury; indeed, its construction was completed well before the commencement of those excellent articles. But perhaps it may give additional inspiration to readers who are contemplating, or have started, the building of the Westbury design.

Miss Cherry Hinds will be remembered by many readers as the builder of a beautiful ¾ in. scale Royal Chester, made half size from my 1½ in. Allchin drawings. I had the pleasure of describing the engine in Model Engineer early in 1964; subsequently it was entered in the 1964 Model Engineer Exhibition, where it was awarded a Silver Medal. At the same exhibition Miss Hinds also won a Bronze Medal for a stationary steam engine.

Soon after this success Miss Hinds wrote to me to say that she was hoping to build a self propelled steam fire engine, but could obtain no drawings. I was not able to assist with these directly, but gave her the address of Messrs. Merryweather, and also mentioned that some years previously — May 13, 1954 — I had described in these pages a fine model built by Mr Jonas Francis, and now in the National Museum of Wales at Cardiff.

Unfortunately, Merryweathers were not able to supply drawings either — they had all been lost in the blitz, rather ironically — but they sent some contemporary photographs of the "Fire King," as the selfpropelled engine was known. The Curator of the Department of Industry at the Museum, Mr Morgan



Miss Cherry Hinds with her prize-winning models at the Exhibition. Photograph by Keystone Press Agency Ltd.

Rees, kindly allowed Miss Hinds to measure up Mr Francis' model. It was of a heavier duty type that those in the Merryweather photographs, but she was able to take all boiler particulars, engine, motion, and pump details from it. It was also built to 2 in. scale, whereas Miss Hinds wished to build to the far more delicate 1 in. scale, to match the traction engine and her own inclination.

Working from the photographs and sketches, there followed a period at the drawing board, and here I may say that Miss Hinds' working drawings are as delicate and as precise as her modelling. She is also extremely methodical, with all her drawings, notes and photographs kept in folders to be accessible quickly and easily for reference.

It will give some idea of the extreme fineness of some of the parts if I give the chief dimensions, and the reader compares them with the photographs. The front wheels, outside the tyres, are $2\frac{9}{16}$ in. dia., and the hind ones $3\frac{1}{8}$ in. The wheel base is $5\frac{3}{4}$ in., and the overall length from front of lamps to back of coal bunkers is 10 in. To the top of the chimney is $6\frac{1}{4}$ in., and to the top of the box is $4\frac{1}{4}$ in. The width outside the wheels is $4\frac{3}{8}$ in.

The channel section main chassis girders are milled from $\frac{1}{4}$ in. by $\frac{3}{16}$ in. solid bar, and the engine bearers are of angle section, also cut from the solid. The twin cylinders are $\frac{3}{8}$ in. bore by $\frac{5}{16}$ in. stroke, driving a builtup crankshaft, which carries a small flywheel on the offside.

Hollow slides at the rear guide the crossheads and support the cylinders, which also have column supports at the front. These extend below the footplate to carry the pumping cylinders. The valve chest is between the cylinders, with Stephenson reversing gear which was scaled down quarter-size from the $1\frac{1}{2}$ in. scale Allchin valve gear.

It is typical of Miss Hinds' thoroughness that she found time to build a separate twin cylinder vertical steam engine, of $\frac{27}{32}$ in. bore and $\frac{3}{4}$ in. stroke, to check the layout, clearance, etc., of the gear for the fire engine. This separate engine has cast iron cylinders and bored trunk-guide supports, cast locally from Miss Hinds' own patterns.

The cylinders and valve chest of the fire engine are fabricated from steel, with bronze liners and brass lagging. Steel cylinder-ends are held down with six 14 BA nuts and studs each, which themselves are home-made as are all others on the model. The oilers on the cylindersides are dummy, being so small, and so are the "pipes" leading from them to the bearings.

Forked little ends and marine-type big ends are used in the main connecting rods. There are two separate vertical connecting rods bolted to each of the main crossheads, and these pass the front and rear of the crankshaft respectively to drive directly the pump crossheads below. The twin pump cylinders are of $\frac{5}{16}$ in. bore and stroke, and their pistons each contain four valves. It should be emphasised perhaps that the engine and pumps have been tested and are fully working.

The water is pumped to a copper expansion chamber, and thence to two branches for attachment of hoses, at the near side. Each branch has a separate water-cock, and a clip to hold the end of an attached hose. The main suction hose is attached to the inlet valve chamber of the pumping cylinders, with another copper expansion chamber above, and is carried on brackets round the front of the chassis, terminating in a brass rose. This has rows of $\frac{1}{32}$ in. dia. holes, but since it has a taper to the outer end, the holes were opened out slightly larger towards that end with a reamer, to maintain on equal distance between them. The holes were drilled on a dividing head to ensure regularity.

Of correct Merryweather design, the boiler is copper, with water tubes for rapid steam raising.

It has a brass casing for the lagging above footplate level, below which the boiler and firebox are cone-shaped, with the firedoor above the level of the hind axle. It is not intended that the model should be steamed, but it has been worked on compressed air.

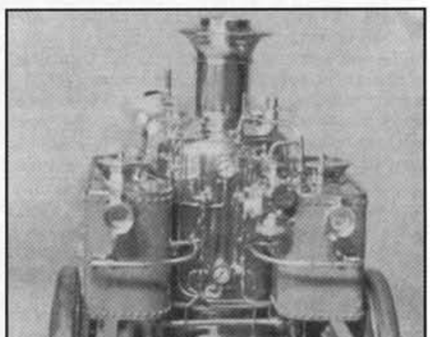
The main steam pipe emerges from the top part of the boiler, passing to the regulator block at the front of the valve chest. This has a separate screwdown stop valve and a displacement lubricator. The regulator valve itself is in the block, and is worked by linkage from the hand lever on the driver's footplate nearest to the steering wheel. The central one of the three hand levers controls the reversing gear through linkage, and the third lever works a hand brake which bears on a flange on the outside of the compensating centre of the differential gear.

Twin exhaust pipes pass from the rear of the valve block and through the brass boiler casing to the blastpipe in the base of the chimney. The brass casing carries dummy water gauges and pressure gauges, a whistle and two safety-valves. There is also a blowdown cock and boiler drain, and injector low down at the rear, and a pipe at the front from the feed water pump. All the several pressure gauges on the model have hands filed down from the second hands of small watches.

Pendant from the chassis at the rear is the stoker's footplate, made of bars on edge with spacers between, and at each side of this is a coal bunker. Shovel, slicebar and pricker are carried in the bunkers.

The hind axle is curved to pass behind the boiler shell, and is carried on two leaf springs, which are correctly shackled to the chassis. Three springs carry the front of the machine, two being parallel with the chassis girders and their rear ends are shackled to a transverse spring which is secured to the front water tank under the box. All the leaves of the five springs are made from spring steel 22 thou thick, hardened and tempered.

The front wheels rotate on stub axles, working in forks at the ends of the front axle, with screw oilers



Rear view of the "Fire King" Merryweather $\frac{3}{4}$ in. scale self propelled fire engine.

below. They are coupled by a track rod, the nearside end of which is linked to a bellcrank at the front of the chassis. This in turn is linked to each side of a small die-block which is threaded on to the screwed lower end of the vertical steering column. The steering wheel is six-spoked, of brass with wood rim riveted on.

Besides supporting the steering column brackets and the gates for the three control levers, the front apron carries two large dummy brass oil-lamps, and two brass hose-nozzles on brackets. There is a grab-handle at each end. An instrument panel carries dummy pressure gauges, and there is a small lever which is correctly linked through to the cylinder drain cocks.

The front box above the chassis on which the driver and crew sit is made from box wood. It has a toolbox at the front, and behind this contains ten lengths of hose complete with brass screw unions, and six spanners for tightening the same. The hoses are each 24 in. long, and are made from the outer braided cover of electric cable, flattened to look like canvas hoses rolled up. The large diameter suction-hose is plastic tubing covered with similar braid, and a very realistic appearance results in both cases. The sides of the box can be lifted off, and are secured when in place by tee-shaped brass pins slotted in.

Along each side is a serrated brass footplate, hinged to lift up to allow the suction hose to be removed. The serrations on the footboard were made by drilling holes in rows at centres of 80 thou by 80 thou, inserting a 20 gauge brass wire stub in each and riveting with a dolly to form a rounded head, and to expand tightly the body of the stub in the hole. The various handrails on the box, the apron, and at the rear for the stoker's benefit, are all of polished brass.

Above the chassis at each side of the boiler is a water tank, with brass beading round its top edge and a brass filler. Each carries a dummy brass rear-lamp. The tanks are connected by a balance pipe at the rear, to which is carried the bypass from the feed pump, with stopcock handy for the stoker. His grab rails are attached to the tanks at the rear.

The road wheels are built up from duralumin, with 16 spokes to the hind wheels and 12 to the front ones. The spokes of each were fitted out and shaped up in the form of a spider, and a separate turned rim pressed on. They were secured further by 8 BA screws inserted radially through the rims into the spokes, two each on the rear and one on the front.

Each rim has a half-round section brass ring at each side to form a channel for the tyre, and these rings are secured by brass pins passing through the dural and sweated into holes drilled on the insides of the rings. The pins were then turned off to half-round section and secured by a small cotter drilled through and pressed into the dural. The rear wheels also have brass reinforcing rings riveted on at each side of the spokes, and all four hub caps are solid brass, secured by 12 BA screws and nuts. Tyres of solid rubber are fitted, and these were ground to shape using a grinding wheel in the lathe.

The initial drive to the road wheels is from a 30-tooth pinion sliding on two splines on the crankshaft, which can be engaged with a 40 tooth wheel on a countershaft carried in brackets below the chassis frame. The 40 tooth wheel is integral with the compensating centre, the bevelwheels of which are 36tooth engaging with 12 tooth bevel-pinions. The straight-cut gears of 48 d.p. and the bevels of 64 d.p. were all cut by Miss Hinds. Oilers were incorporated in all the bearings.

In the final drive the chainsprockets have 18 and 36 teeth respectively, and these as well as the chains are home-made too. Special tools were made to press out the side plates of the chains, to jig-drill the holes, and to rivet up the ends of the rollers. The sprockets were made by drilling holes at the correct pitch diameter using the dividing head: the surplus diameter was then turned away and chamfered, and the teeth finished by hand filing.

The side tanks each carry an oval plate with the raised legend "Merryweather London First Grand Prize Steam Fire Engine," and below the front apron on the front tank is a rectangular plate with "Motor Fire King Merryweather London." Every one of these 127 capital letters, perhaps 3/64 in. high, was cut out individually from brass sheet and sweated to its backplate. In fact, it is quite possible that the total was in excess of 127, as I recall that when Miss Hinds was telling me some three years ago about the works nameplates on her Allchin, she said that if she accidentally dropped a letter on the workshop floor it was quicker to make a replacement than to search for the original!

The engine is, of course, painted fire-engine red, and all the steel, brass, and copper bright parts are highly polished. Miss Hinds uses a miniature spray gun and cellulose paint: the bright parts are clear cellulosed after polishing. On each side of the hose-box and on the front apron are the words "Metropolitan Fire Brigade" in black, shadowed in yellow: the panels are lined out in umber and black. Miss Hinds' method of lining is to use gouache paint, which can easily be wiped off in the event of a mistake, without damage to the cellulose surface. It is applied with fine brushes and subsequently scaled " with clear cellulose.

The model is mounted on four turned steel columns with the wheels just clear of the baseboard, so that it can be demonstrated under compressed air if desired. On the front of the board is a raised brass nameplate "Merryweather," made, like the others, with separate cut-out letters. The baseboard, and the framing of the glass case which covers the model, are made, very appropriately, of cherry wood.

Miss Hinds can be very proud indeed of the result of her 2½ years' work, although in actual fact she is a very modest person. However, she does intend to enter her model, and also the twin-cylinder engine, at the forthcoming Model Engineer Exhibition, and I venture to say that the "Fire King" especially will be one of the highlights there.

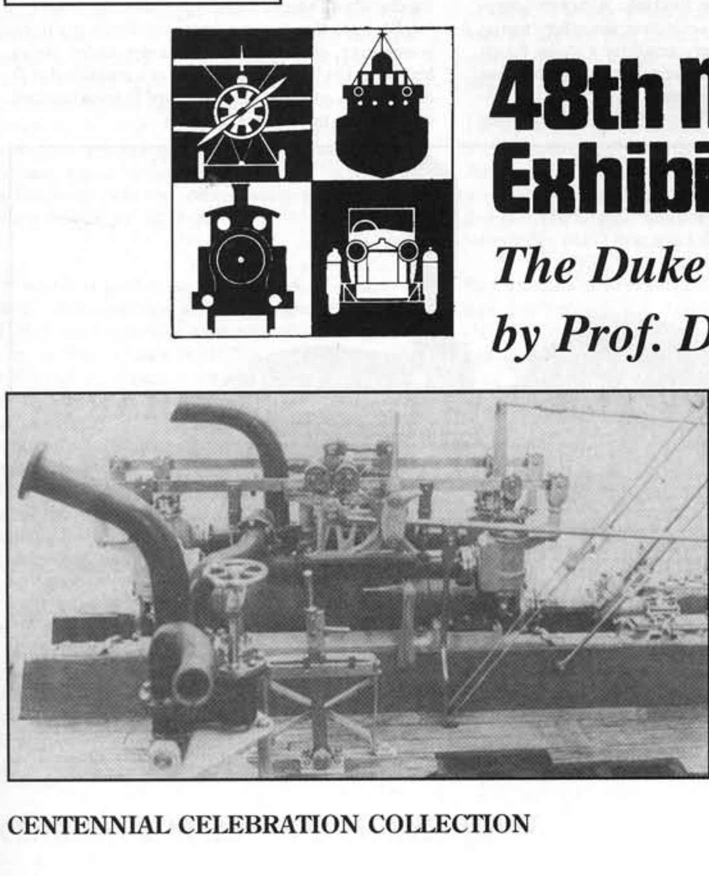
Readers will be pleased to know that the ¾ in. scale Allchin is to be entered for the Duke of Edinburgh Trophy at the Exhibition. Those who saw it in 1964 will be glad to have another opportunity of inspecting it again, whilst those who didn't, have a treat in store.●

April 6 1979

48th Model Engineer Exhibition

The Duke of Edinburgh Trophy

by Prof. D. H. Chaddock



A close-up of the cylinder and valve gear of Mr. G. Hartung's model.

Special interest always attaches to the outcome of this competition because it is a battle of the giants, models competing with one another which are so far removed from the average as to belong almost to another world. How then can a decision be reached between equal standards of perfection?

At first sight it might appear that perfection of workmanship might be the only and sole criterion but this is not necessarily so. Just as in the case of all other classes other factors such as quantity of work, suitability of materials, finish and especially originality and fidelity have to be taken into account.

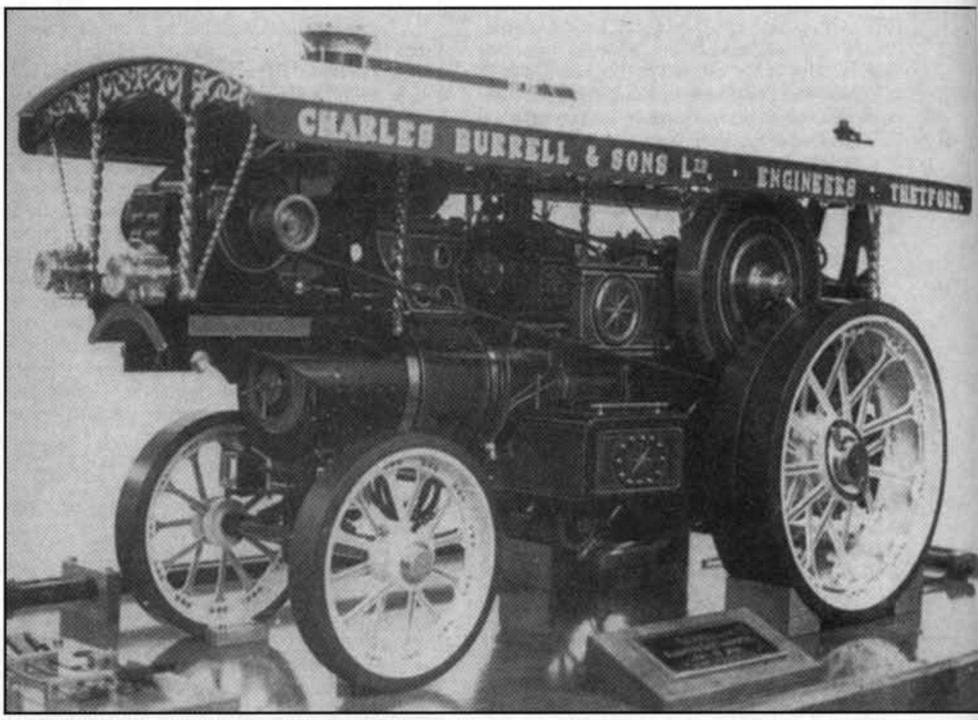
It was the latter which decided a needle match between Miss Cherry Hinds' Burrell Scenic Showman's Road Locomotive and Mr. Hartung's Starboard Engine and Part Hull of an American

Sternwheeler. The Burrell was perfection, no doubt of that, but how far was it original? The prototype is well known, an example was available to the builder of the model for photography and measurement so given the stupendous skills which all Duke of Edinburgh competitors possess the outcome was inevitable — a perfect model which could not be faulted.

The stern wheeler was rather a different kettle of fish. No prototype ever existed in this country and none now probably exists in the U.S.A. the land of their birth. A tremendous amount of research work must therefore have been done before construction could even begin and the result is a model which will enshrine for all time an outstanding phase of American boat building unknown in this country.

Another factor taken into account was that sheer miniaturisation, although it may lead to great delicacy of works, is not of itself over-riding otherwise a lady's wrist watch would always beat a long case clock in competition. The stern wheeler was therefore in some respects rougher in finish than the showman's engine but then so were the originals. They were built by carpenters, blacksmiths and millwrights to do a rough, tough job of work and this too should appear in the ambience of the model.

So after much heart searching, it was the unanimous decision of the Judges that the Duke of Edinburgh Challenge trophy should be awarded to the sternwheeler engine as an outstanding example of model engineering with the Burrell as a neck and neck runner-up. ●



March 15 1985

THE DUKE OF EDINBURGH CHALLENGE TROPHY

by Prof. D. H. Chaddock

The battle of the giants. If ALL the models receive 200 out of 200 marks for workmanship. 100 out of 100 for finish and 150 out of 150 for authenticity, as most do, how then is it possible to find a winner in this the supreme competition of all? The answer seems to be that one has to introduce a new criteria, the "X" factor, which does not affect the average entrant in the other competitions and that is the sheer difficulty of doing it at all.

The miniatures therefore, although superbly executed, could not compete with the larger engineering models which were also working models. The Vickers 'Viking' Mk.1 Airliner by Mr. A. Clark of Hitchin attracted much attention because with its metal covering it was so much more realistic than balsa wood painted with silver paint but alas it was not a working model. Shall we perhaps one day see, to a larger scale, an all metal model aeroplane built just like the prototype with a scale model engine which actually flies? That is the sort of challenge the Duke of Edinburgh Trophy now presents.

The 5in. gauge Adams "02" class 0-4-4T locomotive *Totland*, entered by Mr. G. A. Tull of South Cerney is superb, nothing could be faulted but the "X" factor was not large. Bill Carter and Peter Dupen have already shown that scale models of this size and calibre can also be very successful runners and Totland was a very worthy follower in their footsteps.

The same really applied to Mr. A. Woolfall's Bentley B.R.2 Rotary Aero Engine.

Mrs. C. Hill of Malvern, better known to model engineers throughout the world as Cherry Hinds, entered one of her superb almost miniature and glass case models, this time of Taylor's Patent Steam Elephant of 1862. The 'X' factor here was quite large because not only must it have been extremely difficult to interpret the Patent drawings of this weird and wonderful creation which, apart from four wheels bears little resemblance to conventional traction engines, it must have been even more difficult to fit all into the limited space available. Although admittedly to a much larger scale than the other 'miniatures' ¾ in. to 1 ft. is very small for a steam driven traction engine and here everything works and has been tested on compressed air.

And so to Mr. R. Jarvis' Bell Crank Blowing Engine. This represented a complete and highly successful interpretation of the 'scenic' type of model with a great deal of engineering skill and know-how. Not only did the builder have to research the details of a long vanished real engine but he had to appreciate the methods and materials of the men who built her. Even so, fundamental problems remained in scaling such things as the height of a column of water and solving them in such a way that neither the visual appearance nor the correct thermo-dynamic function was impaired. So the 'X' factor was very high indeed and by unanimous agreement the model was awarded the cherished Duke of Edinburgh Challenge Trophy.

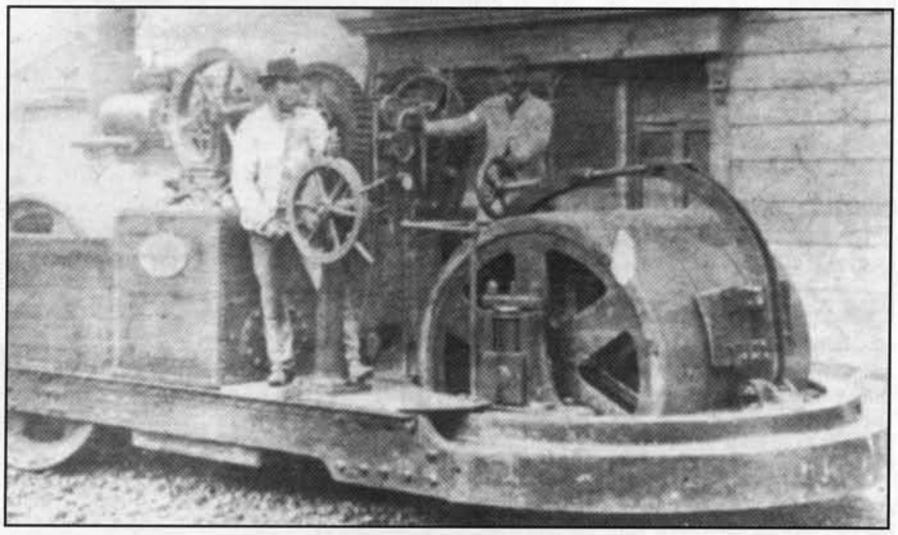
We hope that at some future exhibition it will be possible to demonstrate this model under steam because it has become something of a tradition that D of E models are necessarily destined to spend the rest of their lives under glass cases. ●

The impeccable Gold Medal winning Taylor's Patent Steam Elephant by Miss Cherry Hinds.

October 16 1987

THE BATHO ROLLER

In an exclusive interview, Cherry Hill talks about her 1/16 scale model of William Batho's Steam Road Roller of 1870



The photograph above plus two sketches were the total of material available to Cherry Hill when she began planning her model of the Batho Roller.

The only available information on the full-size Batho roller consists of three line drawings and one photograph. There is also a three paragraph report in the Proceedings of the Institute of Mechanical Engineers (1870) describing how Batho's roller was a supposed improvement over previous three-roller machines by Aveling & Porter to Batho's designs.

Batho's changes were the mounting of the front rolls on separate axles; all rolls to be on sprung suspension; the use of a double cylinder engine; the employment of a powerful lever brake. Drive could be transmitted partially or totally to each front roll through clutches housed in the gear casing of the second shaft. Originally Weston's friction clutches were fitted, but they proved unsatisfactory and "an ordinary solid clutch was adopted". The system shown in the drawing is that designed for (and fitted to) the model, and is a working system suitable for the full-sized roller.

Evidently Batho's design for the roller was not a success, for only one was made and this is borne out by the photograph which shows the roller in a somewhat derelict condition.

To Cherry Hill, the lack of available information gave added interest and the prospect of building a scale model of the roller was just the sort of challenge which she enjoys.

Many of our readers have seen and admired the exquisite models which Cherry has built over the years. Each of her models has been made with the same painstaking research and attention to detail and she has gained a reputation for being one of the finest model engineers of our time. Most of us have spent time at Model Engineer Exhibitions drooling over the craftsmanship and superb quality of her work, myself included. So, when I was offered the opportunity to visit Cherry, I was off like a shot. My quest was to try and find out some of Cherry's "trade secrets" and get an insight into why she chooses to model some of the more obscure prototypes.

Mike Wade

M.W. *Cherry, what made you decide to model the Batho Roller, and how did you go about the project?*
C.H. I saw a picture of a three rolled roller, an early one, in either Clark's or Hughes book and the first roller that most people talk about is the Aveling & Porter Liverpool Roller; it has got a great ballast tank at the back and it is a bit humpy. To me it doesn't look quite right but the other Aveling & Porter rollers were a little smaller, at 15, 20 and 25 tons, whereas the Liverpool Roller was 30 tons. Then I saw the photograph in Whitehead's book "A Century of Road Rolling" which showed the Batho version which is much more complicated.

Batho and Aveling were working together until they fell out over a difference of opinion. In fact that roller was the reason why they fell out with each other because Batho preferred his two cylinder roller and Aveling preferred his own single cylinder version. Aveling was a difficult man anyhow, and so when they presented their paper at the Proceedings of the Institute of Mechanical Engineers in 1870, Aveling gave his single cylinder version and the costs of it on one day, then Batho went to give his paper on the second day. Such was the strength of ill feeling between them at that time.

In October 1981 I went to Aveling and Barford at Rochester to see Mr. Olive, their Records Officer. He was much more interested in the single cylinder version but he did give me a copy of the Proceedings and the three line drawings that came out of it. The drawings had a scale on the bottom, so I was able to work out some details from that.

But I wanted to find out more about where the roller might have got to, or about the history of it, and so I started writing letters, even at that time. The correspondence went on until July 1983. Out of some 36 letters which were written, most came back saying that they couldn't help. However, I did manage to find the negative of one photograph, and that was a great help.

During this period I also went to the Birmingham Library to look up the history of Thomas Astbury & Son, Engineers & Ironfounders of Smethwick, Birmingham. They were a firm of jobbing engineers who actually made the roller to William Batho's design. Unfortunately this possible source of further information didn't bear much fruit either.

In July 1982 I went to the Patent Office looking for particulars of Weston's clutch which, I discovered, they didn't actually use. Apparently they used a dog clutch because the friction clutch got too hot. So, I had to design a dog clutch for the model.

M.W. *Did you prepare a complete set of drawings for the model before actually metal?*
C.H. I started doing the drawings in August 1983. When I draw up the design for a model I draw all the component parts as well as assembly drawings. For the Batho I ended up with 23 sheets each 40 in. x 30 in. As you can see, you could make a full size engine from them. I find that when making models this helps me to visualise, for example, what the size of the valve chest would be and so on.

I also prepare paint scheme sketches in colour to get an impression of what the finished model is going to look like.

M. W. *I notice that all your drawings are drawn to a larger scale than that of the model.*
C.H. Where possible I draw parts full size, but obviously some of the larger parts are drawn half full-size to fit them on the drawing board. I find it easier to think in "full size" all the time — for instance, it is easier to estimate how many bolts would be used to hold down a valve chest cover when it is drawn full size. If drawn 1/16 size it could be misleading and I might not put enough bolts in.

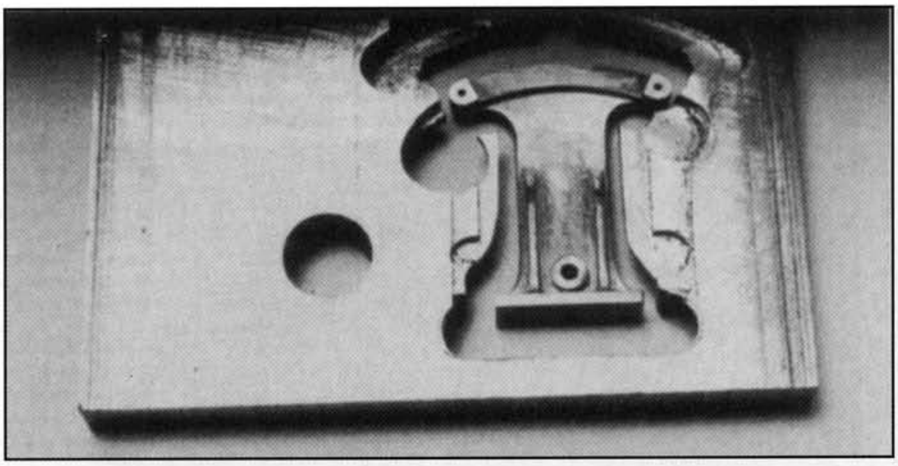
But the dimensions I put on the drawing are the model dimensions. That way I don't have to convert measurements while I'm actually making the parts.

M. W. *The dimensions look as if they are in metric. Do you work entirely in metric?*
C.H. No, I haven't gone metric at all yet! All the dimensions are in Imperial inches.

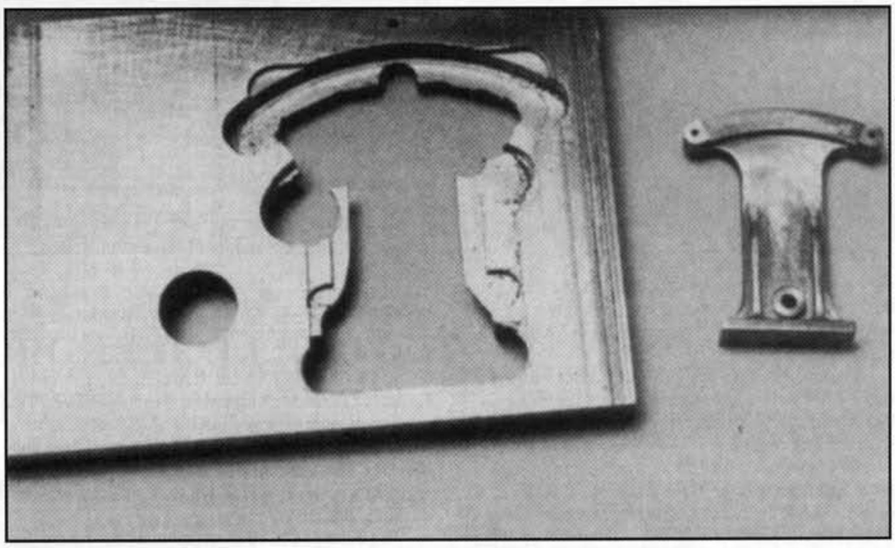
M. W. *But I saw a dimension of 1002 on the drawing — that must be in millimetres.*
C.H. That would be 1.002 in. That's what I call a thousand and two. You see, I never put any decimal points in. If you see a dimension of 965 on the drawing it actually means 0.965 in., or 82 actually means eighty two thou. It's really my own shorthand way of putting it.

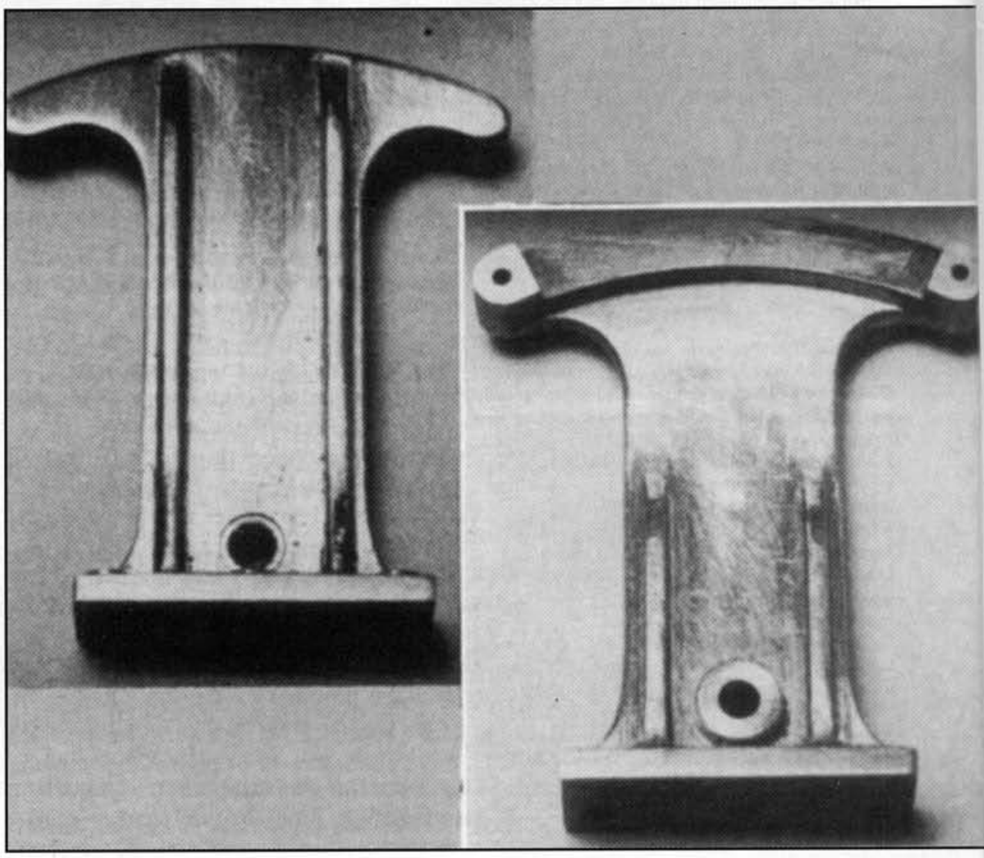
M. W. *So when did you actually start to make the model — was it after you finished all the drawings?*
C.H. Not really. I drew some of the parts and made them, and then did some more drawings as I went along. The drawing work started in August 1983 and I started making the model in December 1983. By May 1986 the model was finished and the paintwork was completed in September 1986 after the model had been tested and run on compressed air. There is a total of 5,900 parts in the model and it took about 6,000 hours of work to make it.

M. W. *Six thousand hours spread over five years from when you started research in October 1981 until the painting was finished in September 1986. Considering the lack of available information that's not bad going. What were some of the most difficult parts which you had to make?*
C.H. Sorting out the clutch drive was quite a problem. None of Batho's drawings were of any help because they only showed an outline of Weston's friction clutch — which wasn't even used in the end! So I had to design a suitable working dog clutch from



Three stages in making a typical reverser stand from the solid.
Left: A large piece of material is used to allow for clamping, and a sequence of milling operations on each side give the basic shape.
Below: The embryo stand is then sawn from the parent stock.
Bottom: Two views of the finished stand after filing to shape This method is easier than fabrication in very small scales.
(It should be noted that the sizes of the objects in the photographs are many times larger than life size).





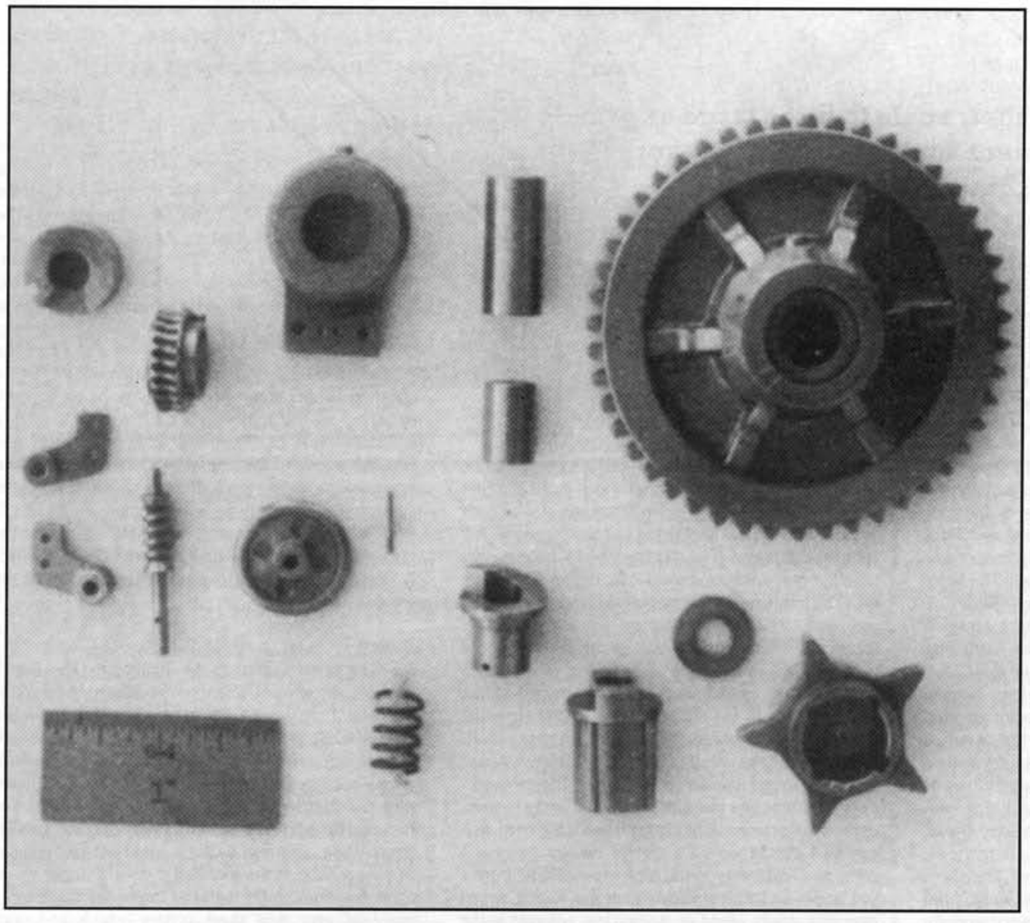
scratch. That wasn't an easy task because it had to be designed using materials and techniques which would have been available in the 1870s. They didn't have so many machine tools in those days, so most of the parts had to be made by hand. Welding hadn't been heard of either, so parts either had to be cast or forged.

Working out how to make the rolls proved to be quite difficult. If you look inside the rolls you can see that they have got webs inside them. The rolls themselves were machined from solid bar and had to be milled out in the right order to provide slots to position the webs. Then the webs themselves were made and fed through into the roll and a previously machined back plate with milled slots in it was used to hold the webs in place. Knowing in what order to machine and fit the parts was quite a puzzle to solve in itself.

M.W *What about the drive and steering chains. Did you make your own punches and dies for them?*
C.H. The steering chain was made with a punch and die but the drive chains were made up from side plates and centre pieces which were all made by hand as they are too thick to make with a punch. (I haven't got a proper press I just squeeze the punch and die in the bench vice). So I started with a length of material of the right thickness for the centre piece and drilled across it (using a drill jig) for the rivet holes. Then each link was cut out and filed to shape. The side plates were done the same way. Then I made another little jig to hold the centre pieces while each one was drilled number 80 (0.013 in.) for the oil holes. They look a lot bigger because each hole is countersunk to provide a pocket for the oil to get into.

M. W. *(I didn't dare to ask Cherry how to countersink number 80 holes! So I asked her about the crankshaft was it machined from a solid bar?)*
CM. No, the crankshaft is a built-up construction, silver-soldered together. From a length of round bar material I machined two "discs" with an integral "pin" between them — this formed a pair of crank webs and pins. Having made two of these sections, each from solid, they were assembled with the joining shaft between them put right through, quartered, and were then silver-soldered together. The unwanted pieces of the shaft were cut away to clear the. connecting rods. Finally the excess material in the "discs" was milled off and then I used files to make it look like a forged crankshaft.

M. W. *Doing the job that way, did you have any problems with distortion or alignment?*
C.H. Surprisingly it was all right. I always think I might get problems — that when I cut it is going to spring out of line — but if you don't overheat it when silver-soldering, you can normally avoid such problems. You know, when you put a very fine slitting saw through one side of the shaft, you think to yourself "I'm not going to get it through the other side", but usually you can. It is amazing how you can get away with it — probably because it is made from the solid.



The component parts of one side of the dog clutch for the Batho Roller. The one inch length of rule gives a good indication of the small scale involved.

it together and then to use dummy rivets to make things look right. Whenever I use dummy rivets I just make them a light drive fit in the hole and just give them a tap to hold them in place.

M.W. Talking about rivets brings us round to the chimney on the Batho Roller. The rivets on the back of the chimney obviously indicate that the original was rolled up from sheet material. Did you follow suit?

C.H. No, I turned it out of the solid. In such a small scale it would be extremely difficult to roll the taper section accurately, and then you've got to make and fit the top cap and the bottom fitting. So I turned it all from round steel bar. First I turned a series of small "steps" down the length of the plain portion and then finished off with a file. Turning the top and bottom fittings was straightforward. Then the inside was bored out — tapered, of course, to get the correct wall thickness all the way down. A strip of material riveted down the back completed the chimney.

When the completed model was run on compressed air, the sound from the chimney was lovely.

M. W. *The bearing brackets which hold the crankshaft are very delicate and small. Are they fabricated and, if so, how did you hold them for soldering?*

C.H. Those bearing brackets were probably one of the most difficult things I have ever had to make, especially the ones which come up from the side of the boiler. They were each made out of solid material. I just started with a big chunk of steel and used the milling machine to cut bits away until each bearing bracket was left with all its webs on. I spent ages thinking about what bit to mill away in what order. If you are not careful you can cut off the bit which you will need to hold it with for the next operation. I think it took about three months to make the six bearing brackets.

The water pump casting was another tricky item to make. It was all milled and filed from the solid but the worst part was getting all the internal passages in so that the pump works properly.

M.W. *You are getting into watchmaking techniques there. Did you have to make jigs to hold it while you were working on it?*

C.H. If you start off with enough extra materials and decide which bit will be cut off last, you can avoid the need to make holding jigs. Time spent thinking about the job and planning the operations carefully before you start can save an awful lot of time and wasted effort.

M.W. *What about those beautiful etched name plates? I assume that you do all your own artwork and etching.*

C.H. I start off by doing an enlarged drawing of the nameplate and lettering in Indian ink. Then, using ordinary film, I take a photograph of the drawing. By working out how far away the camera is from the drawing, I know what size the image on the negative will be, so it is easy to get a negative exactly the right scale size for the finished nameplate.

Using the ordinary photo-etching technique, I apply a resist coating to the brass and expose it to an infra-red light. Then I put it in the etching bath for a little while and just hope. The mortality rate is pretty high. I usually do about 30 plates and carefully pick the best one. Often part of a letter will be etched away or there might be a faulty bit in the brass and a couple of letters will disappear.

M.W. *Do you use modern techniques and materials such as Loctite in the building of your models?*

CH. I prefer, where possible, to make my models in the same way that the full-size version would have been made. As was mentioned earlier, in the late 1800s the makers of engines and so on had very limited resources and tools compared to modern day engineers. So, if a part was made to be an interference fit in the old days, my model part should be made in the same way.

Take the road spikes on the front rolls for example. On Batho's original roller they were turned with a shoulder to locate in the roll and a threaded length to accept a nut on the inside of the roll. That is also how I have done it on my model.

M.W. *Something which I often wonder about is how you manage to get such beautifully straight lines of rivets and rivet holes. How do you position the holes and how do you stop the drill from wandering when you drill them?*

CH. Just draw a straight line! Usually I just draw a straight line and use dividers to mark the hole centres. Accurate marking out is the key to success. Patience and time spent on marking out carefully and then using the scriber to "lead" in to the right position is well spent. In the very small scales I don't use a centre punch before drilling, I use one of the minute Archimedean drills that watch and clock makers use — just to start the hole off. That gives a much more accurate start for the drill than a centre punch.

The other thing which is a great help when doing riveting is a staking tool. The staking tool keeps the rivet snap upright and so gives a neater finish to the rivet head. Of course, it isn't necessary for every rivet to actually hold things together. In many cases all that is needed is to use a few rivets in "key" places to hold

M.W. *I know all your models are tested on compressed air when they are finished. A lot of people wonder if you steam them and how often you will run them once they have been finished.*

C.H. Once they have been tested I will not run them any more because in 50 years' time I hope they will still look as good as they did when they were built. The fire engine which I made 30 years ago still looks exactly the same. The brass has discoloured slightly but there is nothing you can do about that really.

I have steamed the Allchin, the Aveling & Porter and the Burrell, but the later models got a bit delicate. Think about all that delicate valve gear and the effects of getting it covered in oil and steam. It would be a devil of a job to clean it all up each time.

M.W. *Paint finish is something that can make or mar a model. Have you any advice to give to other modellers on the subject?*

C.H. I use cellulose paints on my models and apply it with an airbrush. As it is not a good idea to spread spray dust around in the workshop, I use a separate room for all my spraying. It's actually just a brick built outside shed. I painted some anti-dust paint on the interior brickwork and fitted an extractor fan to take the fumes out.

Cellulose paint dries so quickly that dust isn't such a problem as long as you can keep it off the paint for two minutes while each coat dries. It's only when the midges get in and land on the paint while you're, spraying that you get into trouble.

An etching primer on brass is essential but I use an ordinary primer on steel. I'm not keen on etching primers on steel, because you can often see it showing through the paint. Four or five coats of undercoat, followed by four or five top coats are usually sufficient to give a good finish — provided, of course, that the surface to be painted has been properly cleaned, and filled if necessary. Isopon or cellulose putty fillers are all right for models but I find that the industrial metal fillers are often too coarse for use on models in my small scales.●

May 2 1969

Many builders choose their scale to be as large as practical for the prevailing equipment and finance. However, Mr. Caton chose to take off in the other direction.

A 3/8 in. SCALE TRACTION ENGINE

Built and described by B. M. Caton

FROM AN EARLY AGE, I have been fascinated by my father's steam-driven miniatures, especially his "0", gauge and 5/8 in. gauge locomotives, and since I acquired some skill in model engineering and light metalworking myself, I have successfully produced a few scale models in our garden workshop. The latter is equipped with two lathes, one a very old 3½ in. Myford and the other a plain 1 5/8 in. lathe, a sensitive bench drilling machine made by my father, a grinding and polishing machine and the usual hand tools.

One of my greatest ambitions has long been to build a very small scale, working steam traction engine, and since I recently felt that I had acquired sufficient skill, I suggested this idea to my father. Whilst he showed great interest in the possibilities of such a project, he was doubtful of my ability to construct an engine of such small dimensions (3/8 in. scale), but at the same time encouraged me to try.

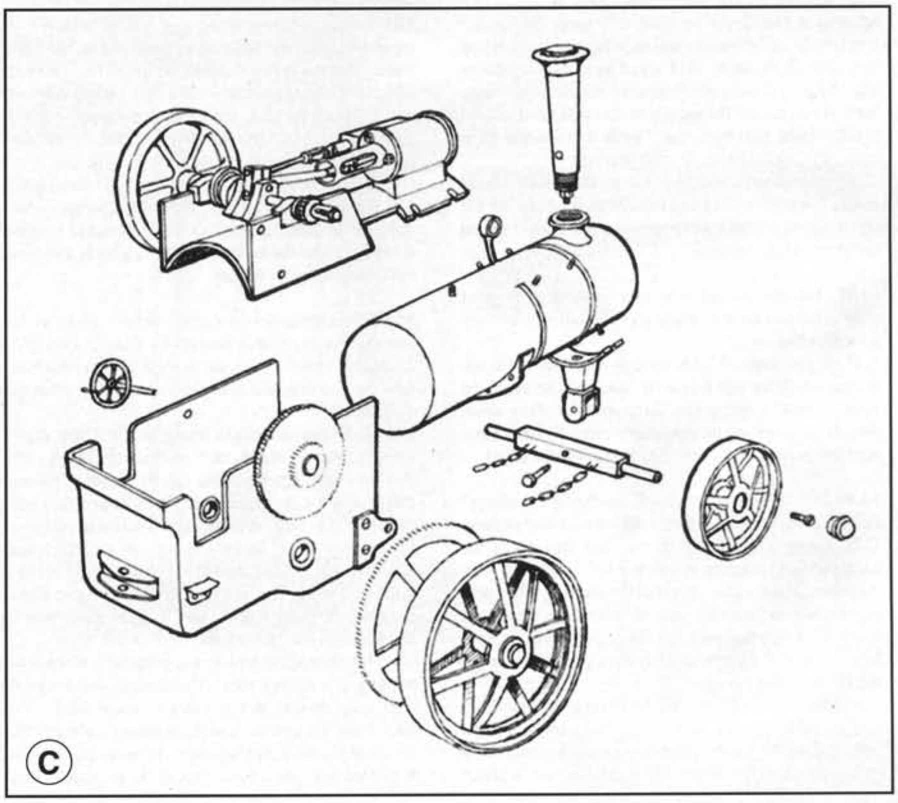
As with all the models produced in our workshop, I wanted it to be an original design and although I did not envisage a model which contained every working detail of a full-size engine, I wanted it to have a well proportioned outline. I also decided that it must at least be capable of forward and reverse motion, running in and out of gear, exhausting up the chimney, steering from a steering wheel in the normal traction engine manner through chains, and have the power to haul a small load up an incline of not less than one in ten. This was the task which I set myself.

The first thing to do was obviously to get to work at the drawing board and evolve a design which would meet these various requirements, and to concentrate initially on the design of the power unit. This, I decided, would be an engine complete in itself, capable of being bolted down to the boiler and of being tested independently from a test boiler.

I considered this engine unit to be the greatest challenge to my skill in the whole construction, although I afterwards found that the wheels were equally difficult to make in this small scale.

I considered a bore and stroke of 5/16 in. to be the smallest dimensions to which I could possibly work with our equipment. I started with the construction of the all-important cylinder which is turned from phosphor bronze bar, the steam chest, which is of the same material, being soldered on to the side. The valve spindle, which is made of 1/8 in. dia. stainless steel, is of the piston type, and the boring of the valve posed great problems: I made about six attempts before obtaining a really good steamtight fit! It is actuated by a slip eccentric of 1/8 in. throw and 11/32 in. dia. The cylinder head and back cover are each secured to the cylinder barrel by three 10 BA studs and nuts, and the trunk guide and back cover are turned from one piece of brass bar. The dimensions of this would not allow the inclusion of the normal type of packed gland so I relied solely on a very good fitting piston rod in the back cover, the piston rod diameter being 1/16 in. There is the usual crosshead, and forked connecting rod which is 7/8 in. long and machined from the solid with a split big-end, 3/16 in. square, working on a balanced crankshaft, of 3/32 in. dia. and 5/32 in. throw. This crankshaft I considered to be a very difficult part to make but succeeded in making a satisfactory one at the first attempt. It runs in tiny brass plummer blocks each notched into the hornplates and secured by one 10 BA countersunk screw. The flywheel, of 1 3/8 in. dia., was turned from solid mild steel bar, the spokes being made by removing the metal between them by drilling and filing. The cylinder unit and hornplates carrying the crankshaft are built up on a plate which is curved to the same radius as the boiler, forming a self-contained engine unit which is secured to the boiler by five 10 BA studs and nuts, the studs being threaded and soldered into the boiler shell.

Now that the engine unit was completed it was necessary to test it under steam, as the efficient working of this part was absolutely essential to the success of the whole undertaking; indeed, had it not been successful I should not have carried on any further. I coupled a temporary steam pipe to the engine from a test boiler and was amazed when the engine ticked over at a steady speed on a very low pressure at the first trial. I ran for my father and I shall never forget the expression on his face when he saw the engine working so sweetly! He was delighted to see it and, from that moment on encouraged me to carry on, as he thought I had then overcome the difficulties of constructing this most vital part.



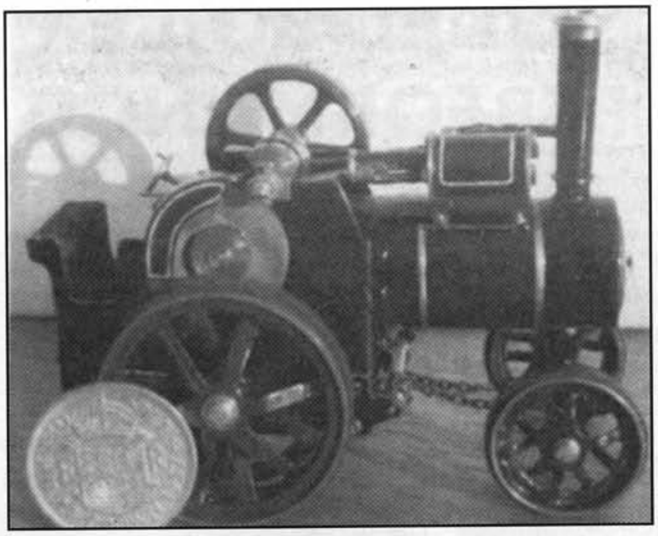
Wheels

Next in order of difficulty was the construction of the wheels so I decided to go ahead with these as I could see that they also might well have decided the success or failure of this tiny traction engine. The driving wheels are 2 in. overall diameter and the front wheels 1 3/16 in. dia. The outer rims of both driving wheels and front wheels were turned from solid mild steel bar and the spokes formed by cutting out from sheet steel in spider form and silver-soldering to a central hub. The outer ends of the spokes were similarly secured to the rims—riveting was out of the question in this scale—concentricity being ensured by doing all the soldering with the parts held in a specially made jig. The final drive gear wheel was attached to one of the rear wheels and is driven by an intermediate gear which in turn is driven by the crankshaft pinion, giving a total reduction of 18 : 1. With all the wheels completed, I knew then that the greatest obstacles had been overcome so I now firmly decided to go ahead with the construction of the whole engine.

Boiler

I made two attempts at the boiler. The first I made from a thin-walled solid-drawn brass tube, diameter 1 in., length 3¼ in., recovered from an old pocket telescope, but difficulties encountered in silver-soldering this first attempt led to failure. The soldering appeared so unsatisfactory after several hours of patient work that, quite disgusted with it, I hurled it down the garden resolving later to make another from copper. Unfortunately I could not find a piece of copper tube of the required diameter in our workshop, but hunting through our metal stock I found a piece of very thin sheet copper which had once formed part of a domestic wash boiler and, from this, fashioned a silver-soldered, seamed boiler to the required dimensions with turned brass ends, this time with success. It has no flues or water tubes and can only be described as a "pot" boiler.

Where to mount the safety valve was a great



Offside view. Note the steering chains.

problem. The cylinder was much too small to accommodate it, which I knew was the usual place for it, so after much thought I decided that the only possible place where it could be concealed would be in the base of the chimney. It forms part of the chimney assembly and screws out with the removal of the chimney stack (which is turned from brass bar), the exhaust pipe entering the chimney stack a little above this valve.

The tender was built up from 20 s.w.g. mild steel sheet, all the joints being silver-soldered, and was attached to the underside of the boiler by means of an angled flange and three 10 BA screws. It was also secured to the hornplates (which form part of the engine unit) with countersunk 10 BA screws.

The fire space is extremely small, measuring only 1 in. wide, 1⅜ in. long and ⅝ in. deep, and is not large enough to accommodate a spirit burner, though the steam for the first running test was raised using a makeshift spirit burner which I made especially for the test. Having decided that spirit firing would be unsuitable, owing to the very close proximity of the spirit tank to the flame, I considered "Meta" fuel as an alternative. I found that a higher steam pressure was raised using this fuel and with it the model's performance was greatly improved, the "Meta fuel being burned on a small gauze tray measuring 1 in. x 1¼in., ahead of the rear axle.

Before producing all the finishing details, I decided to test the model under steam and was amazed, when full pressure had been raised and the eccentric correctly set, to see the engine "chuff" forwards at a lovely scale speed. It performed equally well in reverse. I was satisfied that the model could easily propel itself and climb a reasonable gradient, and now it was necessary to go ahead with the making of the remaining part, which would complete the whole job.

Steering gear

Deciding that the steering gear was next in importance, I started by turning, from mild steel bar, the steering wheel which is of ⅜ in. dia. and has six spokes integral with its hub and rim. To complete the wheel I riveted into its rim a handle of 1/32 in. dia. and length 3/32 in. The steering column is 1/16 in. dia. silver steel and to its lower end is secured the steering worm made from a 2 BA screw which happened to mesh perfectly with a little pinion of 3/16 in. dia. found in our collection of small gear wheels. The chain drum was turned from silver steel to 5/16 in. dia. and is carried in two trunnion plates screwed to the side of the firebox. I searched the house for a piece of jewellery chain which I thought would make suitable steering chains but without success so I was obliged to try my hand at making them myself. I filed up a little bending former from a piece of brass and using very thin iron binding wire formed each link on it. After about two-and-a half hours of this tedious work, I succeeded in making two passable lengths of chain and soon had them secured in their working places on the drum and front axle. At first, because of slackness in the chains, the steering was not satisfactory but after some adjustment a very good response to the movement of the steering wheel was obtained at the front wheels.

One other detail which I think requires description is the method of engaging and disengaging the crankshaft drive to the road wheels. On a crankshaft of such small diameter (3/32 in.), filing an accurate square to fit a corresponding square in the driving pinion, I considered impracticable, while to cut splines in the shaft seemed even more difficult; for some time I was at a loss as to how to achieve this disengaging and driving motion, but after much thought I devised the method shown in the sketches. The pinion is a tight press fit on a sleeve which in turn is a sliding fit on the crankshaft and has a longitudinal fine saw cut along most of its length and is driven by a 1/32 in. dia. silver steel peg which passes through the diameter of the crankshaft, and into the saw cut in the sleeve. A 1/64 in. dia. steel pin which is riveted into the end of the gearshift lever engages in a groove turned in the pinion sleeve, enabling the pinion to be pushed in and out of mesh with the gear train by operating the lever from side to side.

At the moment the model is fitted with rubber tyres made by cutting short lengths from bicycle inner-tube and stretching these into place on the rims of the wheels, two bands on each driving wheel and one on each front wheel. One of the driving wheels is left loose on the axle to facilitate easy cornering. I regard these rubber tyres as only temporary and hope to fit the rear wheels with metal strakes at a later date.

The model is finished maroon and black and all parts such as chimney cap, boiler bands, hub caps and smokebox door handle are polished brass. The overall dimensions are: 4⁹/₁₆ in. long, 27/16 in. wide and 3⅝ in. high, and I think that I can safely assume that it is possibly the smallest working model steam traction engine ever constructed. The building of it has afforded me great pleasure and from it I have learned many lessons in precision engineering. It has delighted many of my friends and relatives when they have seen it performing under steam.●

February 5 1971

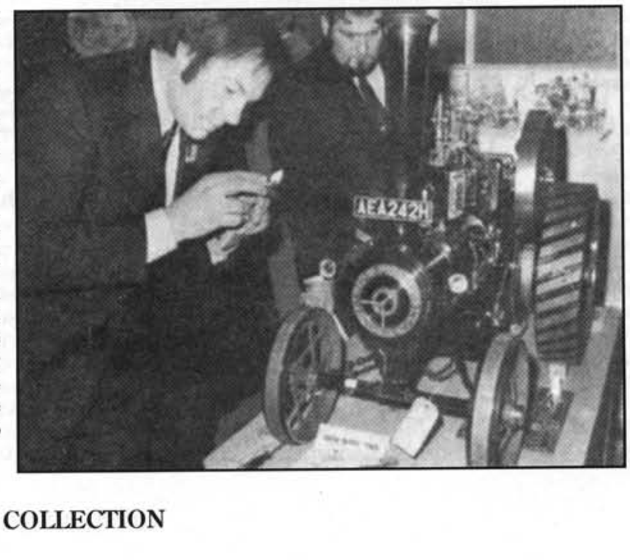
I chose to slip in this picture and brief details of a very fine model, the 3in. scale Burrell by Len Crane. This model even had working oil lamps, as illustrated, which after a long period of experimentation were made to work in the casing. Mr Hughes mentions these lamps in his accessories article elsewhere in this issue. The builder, Len Crane is nowadays better known for his work with full-size traction engines, including his very popular Fowler crane engine.

THE ROAD VEHICLES

by W. J. Hughes

LAST YEAR'S winner of the Championship Cup in this class was Miss Hinds' ¾ in. scale steam roller, and this year's was four times the size — the first class 3 in. scale Burrell traction engine by Len Crane of Wolverhampton. When I had seen this incomplete at the Dudley Exhibition in early Autumn, it was obvious it would create great interest at the London Exhibition, and so it did.

Actually, it was very difficult to fault this model: the chimney cap was not quite pure Burrell, and there was a "temporary" cadmium-plated nut on the motion which Len had meant to exchange for a steel one before bringing the engine to London. But the machinery and the paint finish were really excellent. The lining had been done by paint-wheels — these used to be advertised in these pages some years ago, but it seems they are no longer available.



The crankshaft had been turned from the solid, and then filed up to represent a "bent-from-the-bar" one. All gears, including the bevels for the compensating gear and the governor, were cut by the builder. The boiler is of copper, with 29 tubes ½ in. dia., instead of the 18 in. x ⅝ in. called for by the published design. It certainly steams well, as I can confirm.

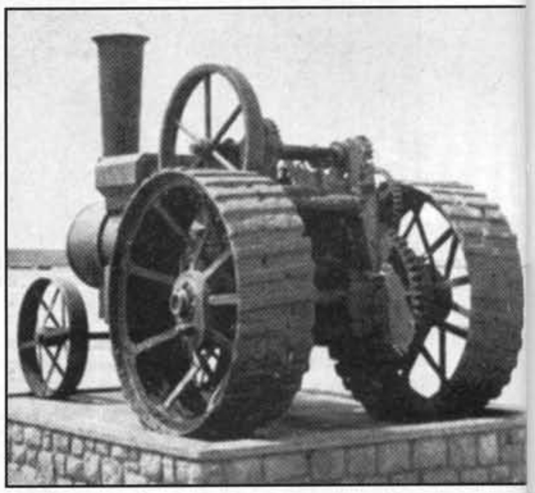
The details included a set of fire-irons, four double-ended spanners, a hammer and screwdriver, a working oil-can, a teacan, a bucket correctly seamed and riveted, a long pin for locking the differential, and a set of spuds and cotters. Incidentally, it has to be reported that some unprincipled rogue stole the draught-pin from the engine's drawbar. (Fortunately, this type of offence is rare at the Exhibition!) ●

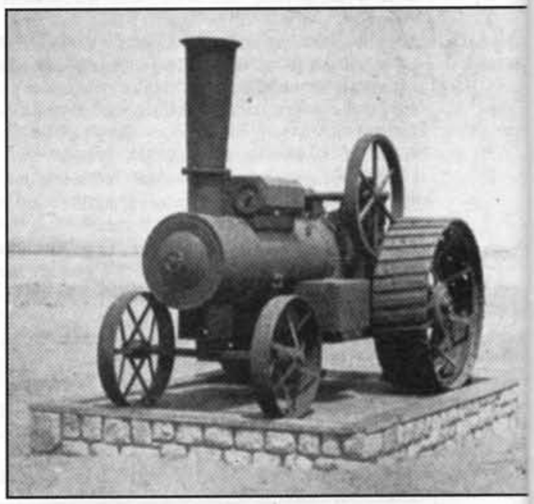
August 2 1971

This story is one which has floated about in the back of my mind ever since I first read it. It was none too easy to track down as I could neither remember the year, title or author. However in my 'trawl' through the back numbers I found it, and hope you enjoy it.

A STRANGE STORY OF A TRACTION ENGINE

By Gordon Rosekilly of California





MY PHOTOGRAPH shows a Fowler traction engine at Walvis Bay, South Africa, formerly German South West Africa, also known as Namibia and also as the Skeleton Coast. There are several coincidences in connection with this, that are quite amazing.

When I started out first, I lived in Buenos Aires with a Yorkshire family who had travelled the world erecting Fowler traction engines, getting them running and collecting the payment. They were not with Fowler at that time.

I often heard the story of the engine at Walvis Bay. A man came over to Yorkshire to buy a traction engine, would not say what it was for, but had the money. They told him that from what they knew of Walvis Bay there was very little fuel, no water (whisky was cheaper and easier to get).

The regular arrangement was that they delivered the engine, set it up and ran it, then collected. So the parts were sent out with our friend, and there was just nothing but sandy beach. No docks, no cranes, no fuel, no water. The ship gave them enough dunnage to build a working platform on the beach and the engine was erected right there with what they brought with them. The ship provided enough fuel and water to get up steam, and in due course this beautiful Fowler engine stood chugging away gently. Our man rocked it back and forth on the platform, demonstrated as running order. The customer could not wait to drive it, but our man said first of all, please sign on the dotted line, accepted. Then without anything further, he pulled the throttle open, the engine took off the length of the platform, and buried itself in the sand. The firebox sank in and the fire went out. He used up all the water in the boiler and there she was, immovable. Brand new and unused. Fowler collected, but there was a big fuss over it. Our man would have taken it ashore, by moving the dunnage a piece at a time, but too much hurry. This was possibly 1896, or could be as late as 1906.

Years later, when I got my present house, the previous owner was born in Walvis Bay. Immediately I asked about the engine. He knew about it but not how it got there; it was still very firmly stuck in the sand. More time went by, and a gentleman came here from Walvis Bay to speak on missions. I asked him about the engine and that opened up a flood. He also did not know how it got there, but gave me the name of the Editor of The Namib Times, who kindly supplied some photographs. By then, it had been somehow placed on a plinth, but had been well robbed. The rear wheels, though, had not been taken off, and I wonder how many readers could have put them on, on an open beach with no facilities?

After some more correspondence, the Town. Clerk wrote, and the later pictures show that they have been encouraged to get it on four wheels again, and put on a dummy boiler and stack.

Mighty good try, considering they never saw as much as a picture of it.

It is a "National monument" now, so not for sale. It is named the "Martin Luther". Those who remember their history will remember that when Martin Luther nailed his pronouncements to the Cathedral door he said something, like "Here I stand. God helping me, I can do no other". This seems particularly appropriate to the remains of the engine. ●

April 16 1976

As promised in the introduction to this issue, here is W. J. Hughes' short series on accessories for model traction engines. For clarity I have brought the series into one chapter, although in the magazine it appeared in different issues.

ACCESSORIES FOR MODEL TRACTION ENGINES

by W. J. Hughes

IT IS NOT CLAIMED that there is anything unique about the accessories to be described — after all, many builders of fine traction engine models have embellished them with lamps, fire irons, spanners, and so on. But I think this is the first time that drawings have been available of what in some cases are now collectors' items. Even the simple metal bucket now seems virtually to be a thing of the past!

To take the lamps first, three of these are required, two for the front and one for the rear. Lamps came in various shapes and sizes, but quite often they were in a matched set, with the rear one exactly like the other two (Fig. 1) except for having a red glass. In this case the lens or bull's eye illuminated the number plate.

Some years ago, I conducted extensive experiments to try to make 1½ in. scale model lamps which would work, and found that with the access door open it was possible to keep the flame alight. But with the door shut the flame died. The trouble was that it just wasn't possible to induce sufficient air into the lamp interior to maintain combustion.

Len Crane, with his beautiful "Duke of Edinburgh" Burrell in 3 in. scale, managed to make working lamps, but of course these have eight times more oxygen inside them than a 1½ in. scale lamp.

And more recently, Miss Cherry Hinds made working lamps for her lovely 1 in. scale Burrell showman's engine, but found that the only way to get them to burn was by using the much more volatile lighter fuel instead of paraffin.

In the circumstances, then, I have designed the lamps for the Allchin as dummies, which will be easier to make, but can look just as well. The photographs show what you have to aim at, figs. 1 to 4 being of a left-hand front lamp, and fig. 5 a rear lamp (now electrified) which I photographed at a rally. Note the slightly different rear panel on this, with a different catch at the top. Do not forget that a pair of lamps is needed for the front — one left and one right — and that the rear one matches the front left.

Mount a length of 1 in. square brass bar truly in

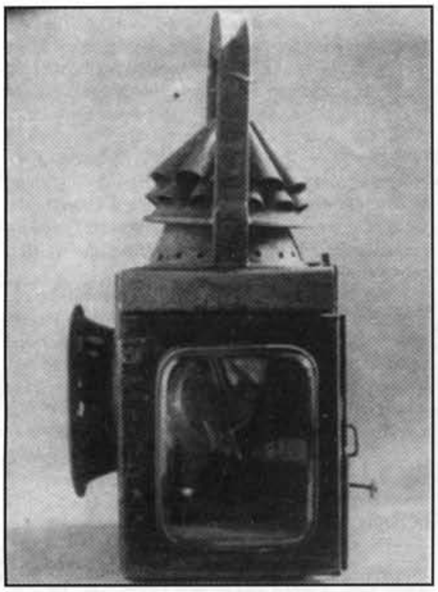


Fig: 1

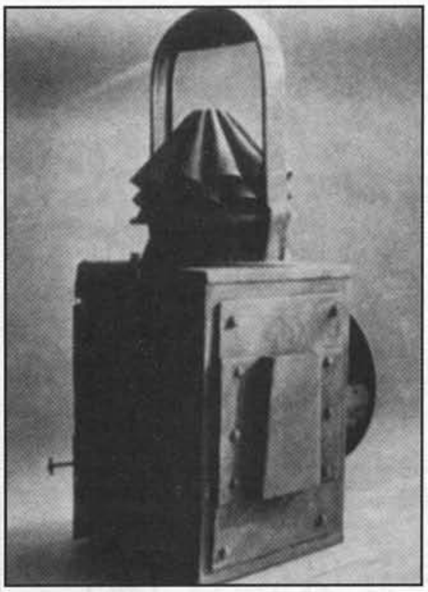


Fig.2:

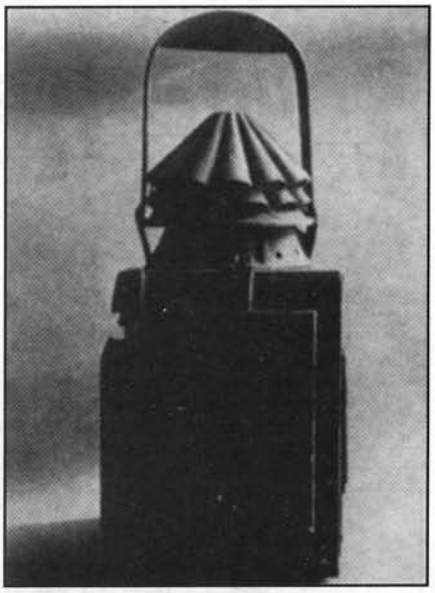


Fig.3.

the four-jaw chuck, face the end, centre, and drill and bore to $\frac{9}{16}$ in. Part off at a shade over $\frac{15}{16}$ in., and repeat twice more. Face up the parted end in each cast. Drill one side to $\frac{5}{16}$ in. for the lens hood, and on an adjacent side in each case mill out the $\frac{7}{16}$ in. by $\frac{9}{16}$ in. cavity. (This is where you need to remember one right, one left, and one rear!)

Make the squares of 22 gauge brass a little oversize for top and bottom, and silver-solder in place.

These could be sweated on, but with a number of other small pieces to sweat on later I think a spot of the hard stuff is advisable now. In fact, if the brass hoods for the lenses have been turned previously (from $\frac{3}{4}$ in. rod) they also can be silver-soldered at the same heat. The slightly bevelled top strip above the side opening should be done too. File off any surplus on the overlap of top and bottom to leave it at $\frac{1}{64}$ in.

Ventilators

In the full-sized lamp there are four separate ventilating cones at the top, all formed from tinplate. In the model the lower two are turned in one piece from a bit of solid brass rod, with a small spigot to be sweated into the top of the body.

To make the upper fluted ones a small die will be needed. Grip a piece of $\frac{7}{8}$ in. mild steel rod in the three-jaw chuck, and turn it on the end at 45 deg., leaving a flat of $\frac{3}{32}$ in. dia. (Fig. 6A). Now set the topslide at 38 deg., with a vee-tool on edge with its point set to centre height (Fig. 6B). Set up the dividing attachment in the mandrel which we have used before, and use the tool in the topslide to mark out twelve divisions on the conical end of the rod. Being set at 38 deg., but scribing on to a 45 deg. cone, the incisions will get wider and deeper to the outside (Fig. 6C).

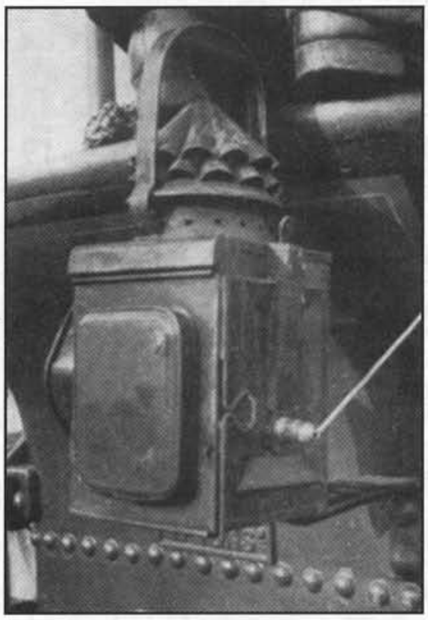
Remove the work from the lathe (marking it at No. 1 jaw which should be habitual by now), and nicely round off all the twelve divisions of the rose by careful filing with small smooth files. It may be an advantage to grind off the teeth from the edges of a small flat file to provide safe edges for this operation.

Cut a $\frac{7}{8}$ in. dia. disc from a piece of annealed 26 gauge copper, and replace the die in the chuck. Support the disc on a lead block supported in turn by the drilling pad in the tailstock, and bring it up to touch the die, both being centralised. Apply pressure with the tailstock handwheel, and the die should force the disc into the lead (Fig. 6D), shaping it as it goes.

Probably it will be necessary to anneal the copper two or three times before the cap is complete. And having made a trial, it may be necessary to enlarge or cut down slightly the initial diameter of the discs to get the correct finished diameter of $\frac{5}{8}$ in. for the fluted caps.

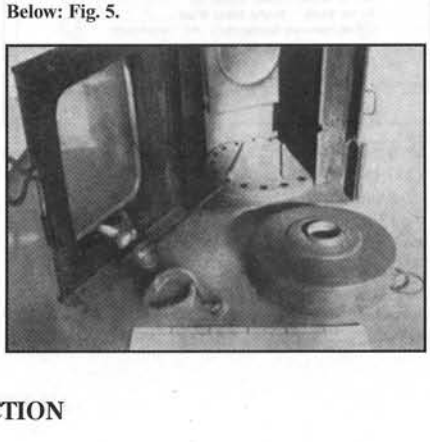
The lens or bullseye may be turned up and polished on the end of a 1 in. perspex rod before parting off, when the flat side will need polishing too. The "cutting compound" used for brightening up car cellulose will be useful here, followed by ordinary car polish.

For the side-glass it would be very difficult to solder a frame to the lamp body and to fit the $\frac{1}{8}$ in. sheet perspex to it. The easy way out is to cut the perspex to shape, cement a strip of tinplate around its edge, and



Above: Fig. 4.

Below: Fig. 5.



then cement the whole "window" to the body — but not until the dummy burner is made and fitted, of course. Don't forget the tail lamp needs red "glass" here.

Incidentally let us spare a thought for the ingenuity of the old timers who made these lamps originally. When I acquired a pair many years ago (buckshee from a farmer who was clearing out a barn!) it was easy to admire them as a supreme example of the tinsmith's art, now largely disappeared. But having cleaned off the filthy deposit of years, and, polished up the nickel plated reflectors, it was amazing how much light was given off by this simple device with a simple and comparatively small paraffin flame.

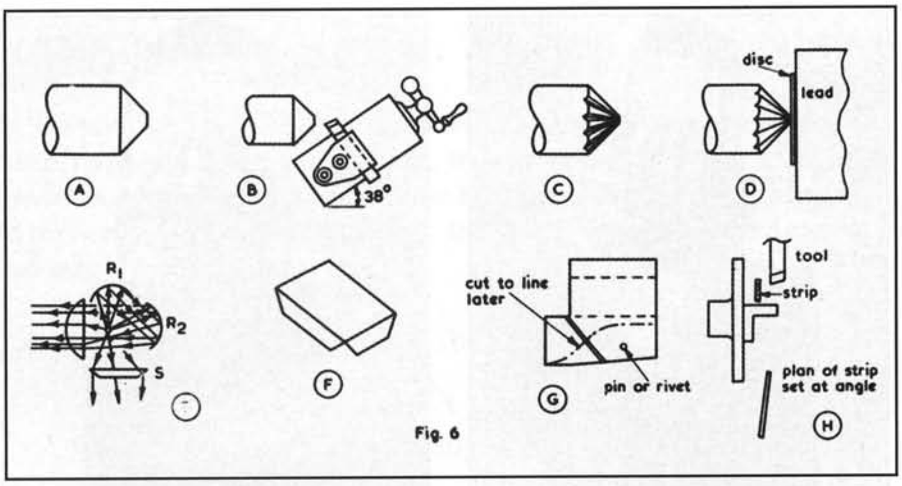
However, examination soon showed that the reflectors were brilliantly shaped and arranged (in more ways than one!) at such an angle that they multiplied the power of the flame many times.

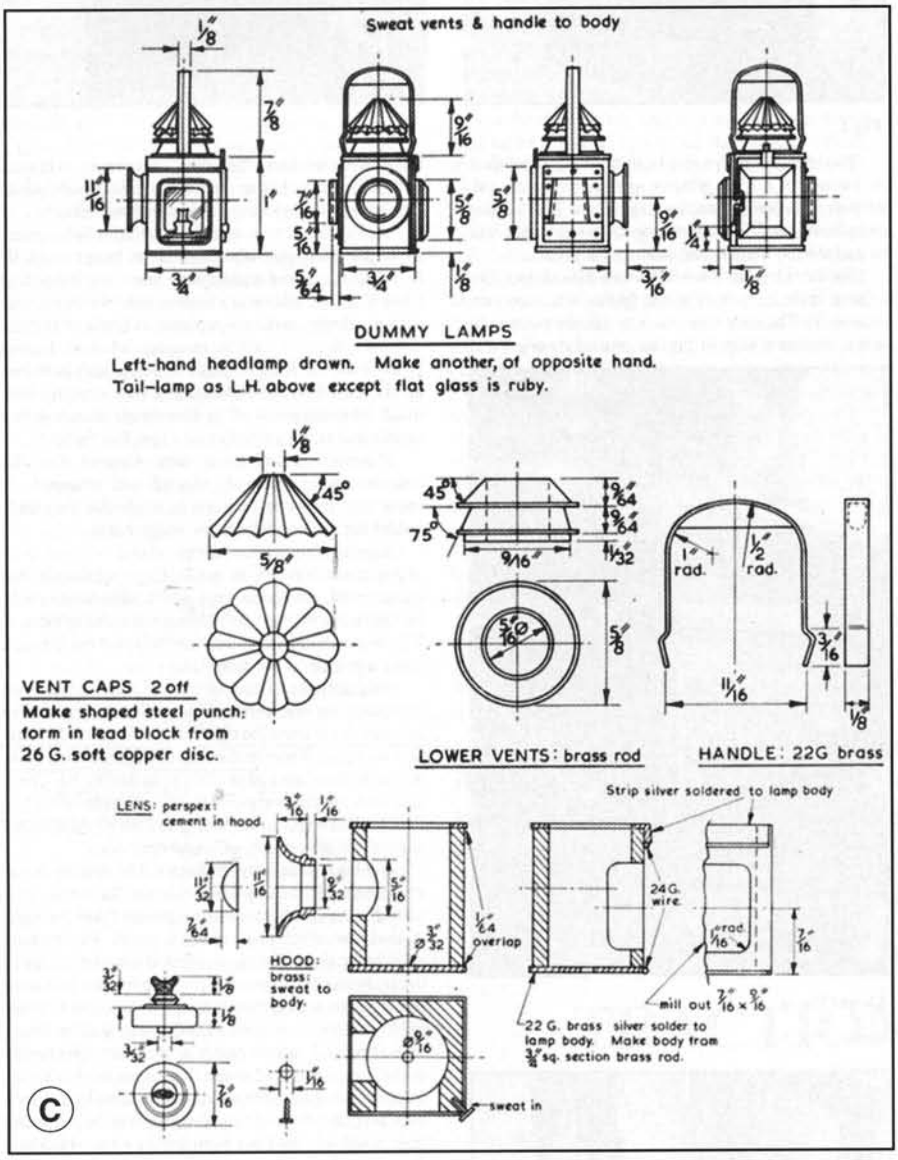
Figure 6E gives a rough sketch of the plan arrangement but not to scale. Quite obviously the reflector RI, intercepts rays which otherwise would be lost in the interior of the lamp and reflects them to R2, from which in turn they are reflected out through and magnified by the front lens.

Additionally, of course, rays of light direct from the flame are concentrated by the bull's eye, and so are rays direct from the right hand reflector R2. Some rays also pass direct to the side through the side glass S, and to them are added some reflected by RI. These side rays are further aided by the prismatic effect of the bevelled edges of the side glass. So all things considered we have a very efficient operation.

But back to making the lamps. The dummy burner is a simple turning job, with the "ceramic" part turned in one with it and subsequently filed to shape. A touch of white paint finishes it off. The dummy wick lifter, also in brass, is sweated into the corner of the body during final assembly. The bracket and reinforcing plate are cut from tinplate, from 12 to 15 thou. thick. In these expensive days this may well be found in a "tin can", which come in different thicknesses according to size and usage. For example, a one gallon can which has contained motor oil will yield well over a square foot of tinplate; you will be surprised how much oil can have been left in a tin which you thought had been drained!

Note that in the bracket the slot which fits over the lamp bracket on the engine is not central, so you need a pair and not two alike. The back plate, preferably about five or six thou. thick, should be cut to 1 in. by $\frac{13}{16}$ in., the corners mitred, and the edges first turned over as Fig. 6F, before being tapped down. If using "secondhand" tinplate at all, by the way, use a bit of paint stripper to remove any paint outside, or lacquer on the inside surface,





before bending to shape or soldering.

The handle, a 1/8 in. strip of 22 gauge brass, and its hand hold may be silver-soldered with No. 1 solder and then Easyflo'd to the body before sweating on the ventilators. Little will be seen on the inside surface of the body, but it will be as well to tin it before final assembly to give a better appearance than the brass, which otherwise would be seen.

A tip for final assembly, when small bits might tend to fall off as others are sweated on, is to use a damp cloth to keep them cooler. I used to recommend a piece of potato for this, but who can afford that today? For finishing, the lamps should be painted semimatt black, with no brass left bright, not even the hoods.

Fire Irons

Like lamps, fire irons came in various shapes according to each maker's idea, but those drawn are quite typical. For the blade of the fire shovel, file up a block of steel to the correct shape, having regard to the two sections given. But before hammering the blade to shape on it, just check the size of the firehole door to make sure that the shovel will enter it when made. It ought to do, but check just the same.

It is a simple matter to hammer the flange down, but remember to anneal — medium red heat, cooling slowly — if it work hardens too much. Make a second blade, for the clinker shovel, and perhaps one or two more for future use (e.g. for the portable engine perhaps, which is soon to follow this!)

The socket is an easy turning job, drilled at one end for the spigot of the handle, turned taper at the other end, and filed flat on one side. It will need careful bending to fit to the blade, to which it is then silver-soldered. This gives quite a good representation of the real thing in which the socket is stamped out in sheet, in one piece with the blade. File off the outer end at an angle as shown. On the shaft the shoulder of the 3/8 in. long spigot will need to be trimmed off to match. The handle is probably best filed to shape on the end of a piece of 5/16 in. dowel, and cut off it when finished.

The clinker pricker or poker, clinker shovel, fire rake, and flue brush all have handles made from 13 gauge wire, formed into an oval loop 1 1/16 in. by 1/2 in. For the pricker, the other end is made from a length of 1/8 in. square section, forged to a point and drilled to take the wire which is silver soldered in.

On the rake, the end is simply forged flat and bent to shape. On the clinker shovel the shaft starts thicker at 5/32 in., tapering down to 3/32 in. about halfway along, where it can be half lapped to the looped piece. This thickening is due to having to lift heavy lumps of clinker out of the firebox.

For the flue brush, a simple screwed joint piece, 5BA as drawn, is used, which in the prototype allowed a new brush to be fitted without the expense of a handle replacement. In the model the diameter of the brush is well over scale, and whilst the handle can be kept with the fire irons (which usually were tied to the footboard with binder twine or rope when travelling), I suggest the brush be kept with other oversize equipment and not on the engine.

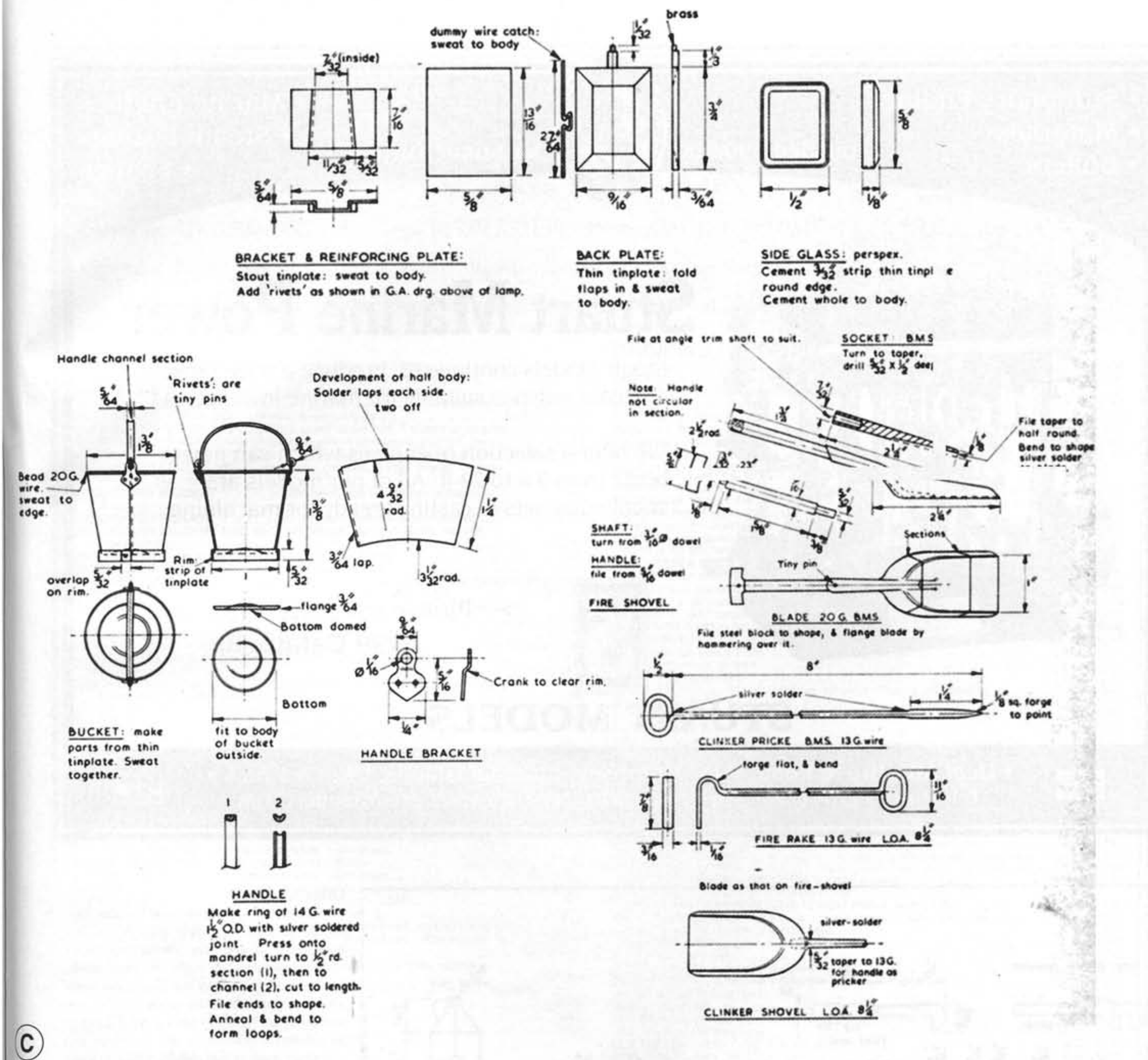
Bucket and Oil Can

Galvanised buckets were made in two halves to economise in material, and the drawing gives the development of these. In thin tinplate the pieces can be shaped quite easily by finger pressure around a 3/4 in. or 7/8 in. rod, with final adjustment of the rounding after soldering the lapped joints.

Shape the two handle brackets, and sweat them in place over the seams, with a circle of 20 gauge wire to represent the wired edge at the bucket rim. The bottom should have a narrow flange, but could be fitted without it. The dome in the bottom can be made by using a ball pein hammer as a die, on a lead block. A simple strip of tinplate is sweated on for the lower rim. The handle should be of channel section, which was done for strength and economy. Bend up and silver-solder a ring of 14 gauge brass wire about 1 1/2 in. dia., and press it on to a slightly tapered wooden mandrel held in the chuck.

See that the ring runs true, and skim off the top to make it half-round section. Then use a thin round nosed tool to form the channel. Saw through at the joint, anneal the wire, and bend to shape, noting that the handle is not semi-circular but a little flatter at the top. Cut off any surplus. File up the ends and bend them to shape, but before finally fixing the handle, tin it over to represent the galvanised coating.

Regarding the oil feeder, working models of these have been made in the past, and good luck to you if you decide to make one. Personally I would settle for the dummy one as drawn. I don't think it calls for detailed instructions, and the same applies to the oil bottle, which has a solid, not a working spout. Just one point about the oil feeder is to coat the pieces all over with solder paint so that the finished object appears to be of tinplate.



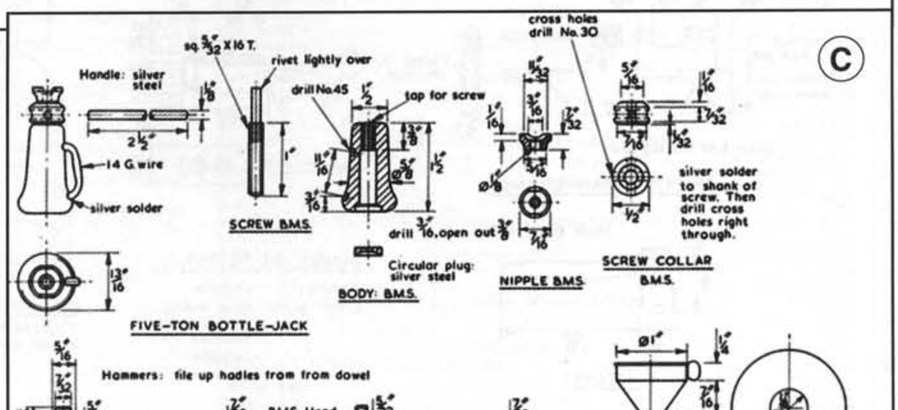
Bottle Jack

Again in the bottle jack there is not much out of the ordinary, apart perhaps from the square threaded screw. However this is the same size $\frac{5}{32}$ in. by 16 t.p.i. — which we used for the screw for the hand brake, and of course it can be turned in exactly the same way. We made also a tap to suit the thread, and this may be used to tap the body of the jack.

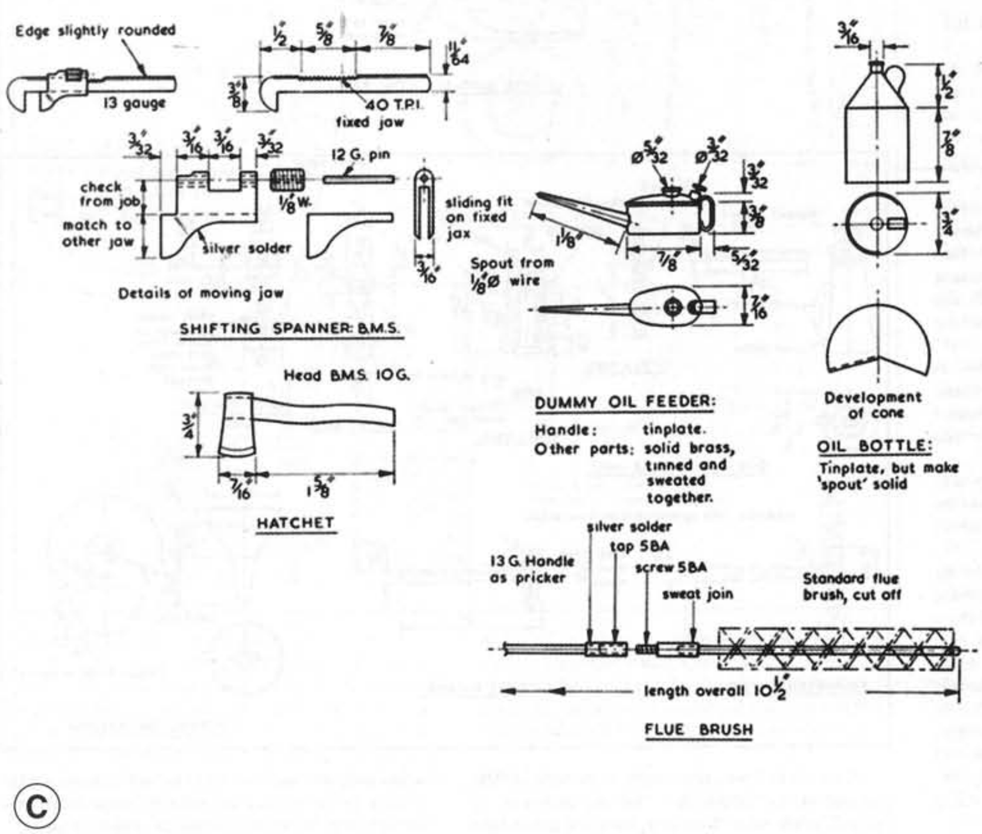
The collar into which the handle fits is silver-soldered to the spigot of the screw, but the nipple or cap should be able to rotate on the spigot. It is retained by riveting lightly the end of the spigot, but even then should still be able to turn separately.

In the shifting spanner one of the main things is to get the moving jaw a nice smooth fit on the stem of the fixed jaw. If the latter is 13 gauge and the jaw milled out to $\frac{3}{32}$ in. this should just do it.

At first sight, it may appear a bit tricky to solder the jaw itself into the slot of the sliding piece, but if both are left oversize (Fig. 6G), and a pin put through and riveted, this will hold them for the silver-soldering. It may appear difficult also to cut the teeth, 40 per inch, in the edge of the fixed jaw to correspond with the 40 threads of the nut. But these can be done as follows, preferably whilst the stock is still $\frac{3}{8}$ in. wide. Mount the strip on an angle plate on the faceplate, set it dead horizontal, and lock the mandrel. The strip should not be exactly parallel with the faceplate, but set at an angle corresponding to the helix of the 40 thread screw (Fig. 6H).



Set a vee tool point downwards on the vertical slide, mounted on the cross-slide. Now the teeth may be "planed" in the edge of the strip, using the saddle hand wheel to traverse the tool. This may be fed downwards to increase the cut by using the feed of the vertical-slide, and the teeth may be spaced by using the cross-slide index.



Other Accessories

The engineer's hammer, coal hammer, funnel and hatchet, are simple enough objects I think, not to need detailing. Two or three assorted fixed spanners too might not come amiss, but presumably builders will have these available and by now even the veriest tyro — who will no longer be a tyro anyway after building an Allchin! — should be able to reduce and reproduce these to one eighth of their original size.

A Disclaimer

Readers will have noticed recently advertisements for a "¾ in. scale Allchin traction engine of 1906", and I was surprised, to find at the Model Engineer Exhibition how many people assumed that I was connected with this — presumably because of the "Allchin" name.

To make my position clear regarding this model, I think it is only fair to its producers as well as to myself to state clearly that I have no connection either with them or with the model itself, on the design, production, or financial side, or indeed in any way. ●

HOME AND WORKSHOP MACHINERY

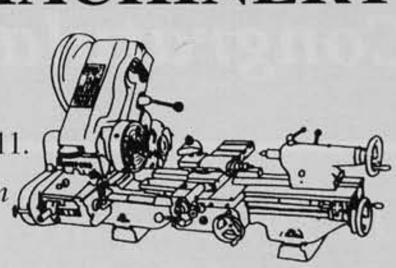
QUALITY USED MACHINE TOOLS

144 Maidstone Road, Footscray, Sidcup, Kent, DA14 5HS.

Telephone 0181-300 9070 – Evenings 01959 532199 – Facsimile 0181-309 6311.

Opening Times: Monday-Friday 9am-5.30pm – Saturday Morning 9am-1pm

10 minutes from M25 – Junction 3 and South Circular – A205



LATHES

BOXFORD TUD 4½" x 20" 3 jaw chuck, cabinet stand, hand feeds ....Only £295
BOXFORD 4½" x 20" model CUD, changewheels, 3 jaw chuck, cab. stand £750
BOXFORD AUD 4½" x 22", gearbox, power cross feed, 3 jaw chuck, cabinet stand .... Excellent Condition £1,250
BOXFORD CUD 5" x 22" MkIII, c/wheels, 4 way toolpost ....As New £1,400
BOXFORD BUD 5" x 22" MKIII, c/wheels, power cross feed, T slotted cross slide £1,400
BOXFORD AUD 5" x 24", (Imperial) gearbox, power cross feed, Dickson, Tools £1,400
COLCHESTER BANTAM 1600 model, 5" x 20", geared head,power feeds, gearbox £1,200
COLCHESTER BANTAM 2000 Geared head, gearbox, 3/4 jaw chucks, Dickson tool post, gap bed coolant £3,450
COLCHESTER STUDENT 6" x 24", geared head, gap bed, power cross feed, 4 way tool post £950
COLCHESTER STUDENT 6" x 24" 1200 (sq head) gearbox, well equipped £2,550
COLCHESTER STUDENT 1800, 6½" x 40" models, 3/4 jaw chucks, two with taper turning £3,250
EMCO UNIMAT 4, powerfeed, 3 jaw chuck, topslide, collets £495
HARRISON L5, 4½" x 24", fully tooled, complete with clutch £950
HARRISON L6, 6" x 24", geared head, gearbox, excellent toolroom machine. Choice 6 ..From £950
HARRISON 140, 5½" x 24", 3 jaw chuck, gap bed, power feeds, clutch £1,400
HARRISON 140, 5½" x 24", geared head, gearbox, two speed motor, 3/4 jaw chucks, gap bed, coolant £1,750
HARRISON M250, 5" x 30", 3 jaw chuck, in excellent condition £3,450
HARRISON M300 6" x 24" geared head, gearbox, 3/4 jaw chucks.... choice £2,450/£2,650
HARRISON 155 6½" x 25" precision lathe, fully geared, well equipped....£1,850
KERRY AG2 5½" x 24" Lathes. Choice ....From £825
LORCH LAS (1974) complete with changewheels, chucks, steadies, Lorch stand for the serious instrument maker £3,250
MYFORD ML10 3¼" x 13", changewheels, 3 jaw chuck, centres, tooling....£725
MYFORD ML10 3¼" x 13", changewheels, 3 jaw chuck, late green model £825
MYFORD SPEED 10 3¼" x 18" change wheels, 3 Jaw chuck, fixed steady, tools, stand (new chuck fitted) £850
MYFORD ML7 3½" x 19", changewheels, 3 jaw chuck, we have a large selection of this popular model ....From £725
MYFORD ML7B 3½" x 19", gearbox, 3 jaw chuck etc. £1,250
MYFORD ML7TB 3½" x 19", Tri-lever, gearbox, 3 jaw chuck, 4 way tool post, cabinet stand....£1,200
MYFORD ML7 3½" x 31", changewheels, 3 jaw chuck £1,125
MYFORD ML7R 3½" x 19", excellent selection ....£1,750 to £1,950
MYFORD SUPER 7 3½" x 19", changewheels, 3 jaw chuck, ...Choice £950-£1,150
MYFORD SUPER 7B 3½" x 19", gearbox, 3 jaw chuck.... Choice £850 to £1,400
MYFORD SUPER 7 3½" x 31", changewheels, 3 jaw chuck ....Choice £1,400
MYFORD SUPER 7, 3½" x 19", 3 jaw chuck, power cross-feed, late model....Choice
MYFORD SUPER 7B, 3½" x 19", gearbox, 3 jaw chuck, cabinet industrial stand, **Power cross-feed**, late machine £2,450
MYFORD SUPER 7B, 3½" x 19", gearbox, **Power Cross Feed**, cabinet stand, tooling....£2,750
MYFORD SUPER 7B, 3½" x 19", gearbox, **Power Cross Feed**, cabinet stand £2,950
MYFORD SUPER 7B 3½" x 31", gearbox, cabinet stand ....Just £1,500
MYFORD SUPER 7B 3½" x 31", gearbox, 3/4 jaw chucks, travelling steady, tools, coolant, industrial stand, 240 volts....£2,300
MYFORD SUPER 7B 3½" x 31", gearbox, power cross feed, 3/4 jaw chucks, travelling steady, cabinet stand, coolant, tray and blocks £3,250
SOUTHBEND 8" x 52", gearbox, power feeds, 3/4 jaw chucks....£950
SOUTHBEND 4½" x 24", c/wheels,3 jaw etc £400

TOO MANY LATHES TO LIST!!

MILLING MACHINES

V – Vertical, H – Horizontal

ADCOCK AND SHIPLEY 1ES, Horizontal prec. machine, table 30" x 8" (powered), coolant £975
ARNO H-V + slotting head, 40INT, 39" x 9½' table, powered....£1,650
ASTRA L4 Horizontal/vertical 1" arbor, 2 horse taper swivel head, cabinet stand £1,150
BRIDGEPORT turret mill, R8/powered quill feed, 42" x 9", 1970....£1,750
BRIDGEPORT turret mill, R8/powered quill feed, 42" x 9", very nice, 1970 ....£2,450
BRIDGEPORT turret mill, R8/powered quill feed head, 42" x 9", powered table, 1978 ....£3,250
BRIDGEPORT turret mill, R8/powered quill feed head, 48" x 9", powered table, Heidenhain DRO 1978....£3,250
BRIDGEPORT SERIES 1 /2hp, variable speed, 42" x 9" table, heidenhain DRO....£3,250
CENTEC 2B H/V, vertical head, 2 morse taper/swivel, cabinet stand....£1,400
CENTEC 2B Horizontal, 1" arbor, table powered, 3 ph motor, single phase main motor £725
ELGAR EMTOC H/V H-30INT, V-2 morse taper, table 24" x 6" powered, coolant, pedestal stand....Just £1,250
EMCO MENTOR, V, 2 morse taper/swivel head, table 20½" x 6" ....Now just £750
EMCO (Made in Austria) FB2 vertical 6 speed 2 morse quill feed head complete with power feed to table....£2,250
HARRISON horizontal, 31" x 8" powered table ....Very clean £650
RISHTON VM60 Bench Machine, table 24" x 6", geared 6 speed head Clarkson chuck and vice....£2,200
RISHTON complete with powered table and cabinet stand £2,450
TOM SENIOR M1 horizontal, 25" x 6" powered table, 1" arbor....£575
TOM SENIOR M1 V/H, 25" x 6", 2 morse taper, 1" arbor. ....Selection £1,200 – £1,450
TOM SENIOR MAJOR ELT, H/V, extra large table, variable speed table....Exceptional £3,250

DRILLS

FOBCO ½" Bench, Tilting Table £325
FOBCO ½" Pedestal Drill Tiling table....£345
POLLARD CORONA Pedestal ½"/1 Morse ....From £100
PROGRESS 3A 3 morse taper, power down feed, speeds 70-1180....£675
STARTRITE Pedestal Model, ½" capacity....£225

JIG BORERS

BCA MKIII Jig Boring Machine, 8" diameter table, 10 spindle speeds 300-3,250rpm....Reduced to Clear £750 - £1,250
ELLIOT Mini Borer, collets, powered quill feed head, table 16" x 7" £1,400

GRINDING / BUFFING

CLARKSON MKI Tool and Cutter Grinder....£550
EAGLE Model 2 surface grinders, mag. chucks ....Choice £750
HOBART AND SHIPMAN Surface Grinder £1,150
I.D.P. Trimtool cutter grinder £250
MILFORD 12" Pedestal Grinder....£325
PINNACLE MODEL 450A Tool and Cutter Grinder (current model) capacity, 8¼"x16" 1986 £1,275
VICEROY Grinder, pedestal model....£145
VICEROY Buffers, pedestal models....Each £145

MISCELLANEOUS /FABRICATION MCH.

BOXFORD 4½" vertical swivel slide....£345
KINGSLAND 4ft/16g Fibricated guillotine....£750
DENBIGH NO.5 Flypress complete + stand £375
ESSEX Tapping machine ....late model £145
GUYSON sand blasting cabinet + extractor ....late model £775
SMART AND BROWN Screwcutting (gearbox) lathe, as is....£400
COLCHESTER STUDENT capstan unit....£525
WEBER 1½ ton mobile garage crane, late blue colour £495
VANCO 1" belt sander, bench model....£325
UNION 4½" x 30" bench centres....£175
MYFORD coolant complete....£245
CLARKSON 40INT collet chucks ....Each £100
HARRISON L5 Vertical Slide....Never used £345
HARRISON L5 Boring Table £165
AJAX 6" Hacksaw, coolant....Clean £425
ESSEX Tapping Machine £140
ESSEX FORGE/gas, two bay, chimney extraction/blowers, all switching ....As new £525
SURFACE TABLES; 4' x 4', 4' x 3', 3' x 2' ....Just £150 – £325 – £225
CENTEC VERTICAL QUILL feed heads....Each £750
BCA MKIII stand....Just £140
MIDSAW vertical metal Bandsaw £1425
HUNTON punch press £275
ECLIPSE 9" round magnetic chuck suit lathe £225
POTTER'S WHEELS foot or 240 volts operated ....£100 / £300
ELLIOTT 1250 STURDIMILL vertical head....One off (rare) £525
DORMER MODEL 108 Drill grinder + wheels, cabinet Pedestal stand....£475
SMART AND BROWN, collet lathe, late square stand type, compound slides....£475
RJH linisher 4" wide belt, pedestal £345
DENBIGH/NORTON No.2/3 Flypress....From £145
THEIL collets (horizontal) ....Each £20
MYFORD Vertical Slide....As new £145
JONES AND SHIPMAN/ SEDGEWICK Arbor presses....From £140
STEEL STOCK Just arrived – to callers only
ELLIOT SAMSON 3R5/KEETONA 13 Hand shears and stands ....£85 / £75
JONES AND SHIPMAN rotary table, 12" still crated, horizontal/vertical....£550
CLARKSON Collet Chuck, 3 Morse (Lge)....£125
CINCINNATI dividing Head £375
ELLIOT 10' rotary table....Choice £250
KINGSLAND 2ft/14g treadle guillotine....£650
BRIDGEPORT No.1/No.2 Boring Heads ....£145 / £175
ELLIOT U1/U2 Slotting Head....£475
SWAGE BLOCKS....£125 / £145
PVE NO.2 Co-ordinate table, 13" x 12"....£425
J&S Universal Grinding Vice ....Choice £275 / £325
BOX TABLES: Grade A and B, many sizes ....£40 - £150
SINE TABLES, New Selection, just in ....Each £275
PVE Sine Square....As New £120
SINE BARS, Metric/Imperial....From £35
SLIPS/GAUGES Metric/Imperial, New Sets; 87/81 piece....£215 / £145
PARALLELS (Boxed Sets), Some Grade A ....£35 / £45
HORIZONTAL METAL BANDSAW 6" x 4½" capacity....New £170
MEDDINGS Fretsaw, 24" throat ....Choice from £350
RAPID Chipper Hopper....£325
KASNET Mini Furnace ....Each £175
COLCHESTER STUDENT/MASTER Round head, faceplates,small/large....£50 / £80
ROTARY TABLE, 6" Horizontal/Vertical ....New – Now just £150
ROTARY TABLE, 8" Horizontal/Vertical....New – Now just £245
ROTARY TABLE, 10" Horizontal/Vertical....New – Now just £295
QUALTERS AND SMITH 6" Hacksaw £345
VEHICLE MOUNTED CRANES/Epco Electric up-swing round 1 ton....From £375
FORGE DS130 Ceramic Chip Type £350
BORING HEADS 2/3 Morse, R8 Taper, Max. Cap 4½"....New, each £90
ANVIL, 1cwt on stand....£125
ODONI Machine Bed Clamps (pair)....Special £24.50
HEIGHT GAUGES by Chesterman, Shardlow, Moore and Wright....From £95
EDWARDS 1.5 metre Guillotine 16BG....£950
ELLIOTT 10M Shaper, 10" stroke....£325
ELLIOTT 5" Universal Dividing Head and Tailstock....£325
SMART AND BROWN H3/H5 Toggle Press....£145 / £165
DIE Boxes ....From £45
TRANSWAVE 3HP Converter....New £280
TRANSWAVE 5HP Converter....New £350
TRANSWAVE MMC rotary converters now available....From £425
CROMPTON PARKINSON ¾ HP, resillient mount, Boxford/Myford Super 7 Type motor,.... New £135
DEWHURST TYPE A Reversing Switch, ...New £49
TAYLOR HOBSON Model D complete with script....£750

JUST IN – WOODWORKING

GRADUATE/WADKIN wood lathes ....From £925
WADKIN/STARTRITE Tyzack Sawbenches ....From £345
WADKIN/STARTRITE/WHITEHEAD Planers....From £395

VISA

PRECISION TOOLS/MACHINE SPARES

MasterCard

WE HAVE A LARGE SELECTION OF MACHINE TOOLS AND MEASURING EQUIPMENT FAR TOO MUCH TO LIST.
PLEASE RING US WITH YOUR REQUIREMENTS. WE WILL BE PLEASED TO HEAR FROM YOU.
DISTANCE NO PROBLEM!! *ALL PRICES EXCLUSIVE OF V.A.T.*

DELTA

SWITCH