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The term 'traction engine' tends to be used to cover a wide variety of prototypes which are reproduced in miniature by the model engineer. There is no doubt that construction of any of the various types of engine is, in itself, a significant achievement and the end result is most attractive. These models can, if built in a large enough scale, also be useful passenger haulers and several have been used on public roads. To do this the vehicle has to be registered with the authorities and then taxed and insured, in the same way as the domestic car!

It must carry a number plate which, alas, because of the law will have to be considerably over scale! Even so, such problems are not insurmountable if one is interested enough in running on public roads. Running on private ground which includes fetes, carries with it no necessity to register the vehicle or to tax it although to drive without an insurance for third party damage would be extremely foolhardy.

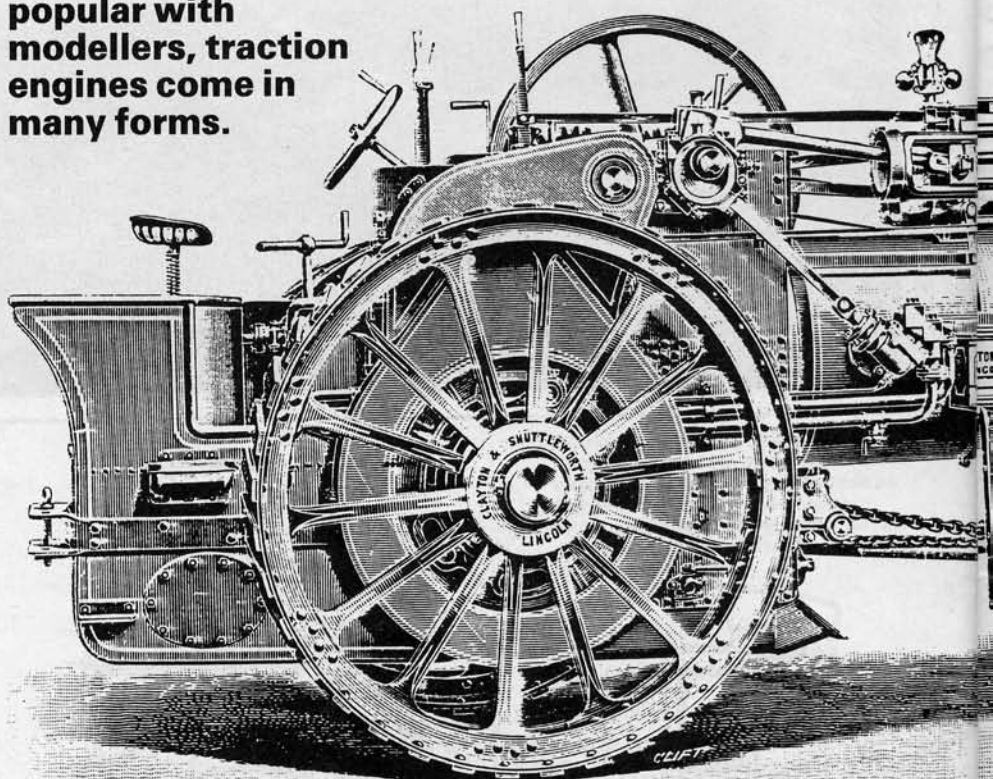
Before discussing the construction of traction engines let's have a brief look at their history; it should give a better understanding of the model we may wish to make. After all, it is doubtful if many readers of this 'Special' will ever have seen such a vehicle working for its living, let alone have been able to study how they were constructed. Nevertheless, some knowledge of how they work will be necessary when we come to build one.

We have already seen how steam power developed in mines and factories and on many other duties and it was not long before it was realised that the steam engine could also help agriculture. Small steam engines were tried on various agricultural jobs and these took the form of the many that were already employed in industry. They were carried to their place of work on carts pulled by horses and it did not take long to realise that, if the engine could be combined with the boiler and the whole lot mounted on wheels, a great deal of time would be saved even though the contraption would still need to be taken to its place of work by horses!

These became known as 'portable engines'. Usually the portable engine had the actual engine on top of the

TRACTION ENGINE

Deservedly popular with modellers, traction engines come in many forms.

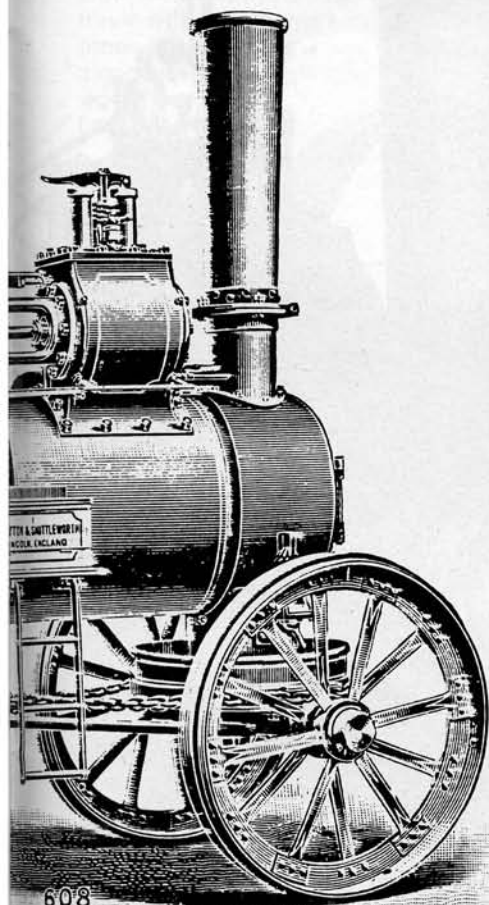


boiler although there are records of some which were placed underneath. The engine drove a large flywheel to which a belt was attached and this was used to drive various machinery. Whilst in the summer the portable would mainly be used in the fields on threshing machines, in the winter it would possibly be connected to a circular saw and used for sawing wood. In order to keep speed at a constant level a governor was fitted. The use of an engine in a stationary

position controlled by a governor and working machinery via the flywheel, continued throughout the history of traction engines.

The first attempts at fitting the engine with gears to drive the road wheels was not all that successful and basically the construction was too light and wheels broke under the strain. The use of chain drive was also tried but with only limited success and was soon abandoned. It was not long before strength was built in, but

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even then the idea of the driver being able to steer as well did not catch on and a separate operator steered from a position on the front of the engine.

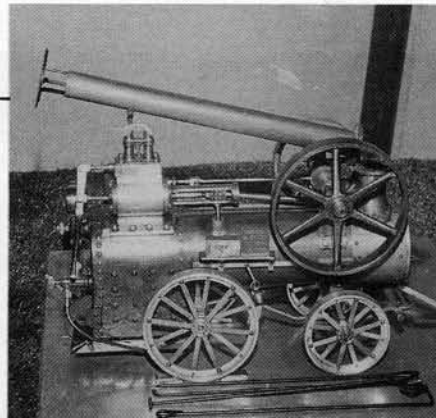
If one looks at a full-sized traction engine then the massive construction of the machine is evident. The machines were built originally by blacksmiths and later by heavy engineering firms and the general construction tended to be rather on the rough side, particularly if we compare it with a modern motor car.

The general-purpose engine is, I suppose, the type that we think of most when thinking of traction engines. This would be used for agricultural work and also for road haulage, as well as work on the saw bench, etc. Like all new inventions it was heralded with much suspicion and, to allay that, the power of the engines was quoted by manufacturers as NHP. One assumes this stands for 'Nominal Horse Power' although I have heard it suggested that it stands for 'New Horse Power'. The reason for the latter suggestion is that, in fact, the rating was about eight times less than it should have been and was specially formed for the vehicles in order not to arouse suspicion as to their true power!

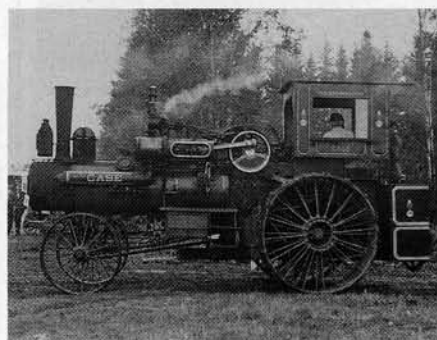
As far as work on the roads was concerned, the later Road Traffic Acts defined vehicles by weight rather than power but it is interesting to note that the terms 'locomotive' and 'tractor' remained to describe the power units. Notices can still be found on roadways warning that locomotives – which were the heaviest – should not cross a certain bridge.

Most general-purpose engines were single cylinder but there were some two cylinder engines and some compounds as well. Usually axles were sprung and transmission was through gears on shafts giving two, and sometimes three, speeds. There was no clutch and the gears were used according to the section of ground that was next to be run over. The vehicle had to be stopped to change gear but there are stories of various drivers developing techniques of changing gear on the run. Drivers of traction engines sometimes became legends as did railway locomotive drivers and there is cause to wonder if possibly some of the stories told about them are somewhat exaggerated...

A development of the general-purpose engine was the showman's engine. These days, travelling fairs are hauled by lorries which are the modern-day traction engines. In steam days the traction engine had the job. Again the road traffic laws, until recently, recalled the days of the engines prescribing the number of trailers that could be hauled and the passengers that could be on those trailers, such passengers only being there to act as brakesmen.



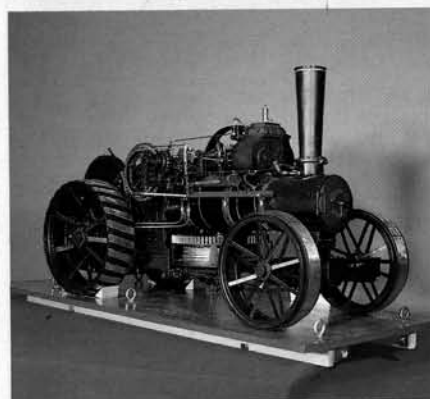
Top, this model portable engine represents the link between the horse and the traction engine in farming. Next down, model traction engine parts. Above, this full-size Foden steam lorry at the Thursford museum would make an attractive subject for a model. Below, American tractions engines differed from their British counterparts; this is a Case type.



Having hauled the fairground to its next point of rest the engine would be set to work driving machinery from its flywheel. It also carried a large dynamo, usually in front of the chimney. This would be used for lighting the various fairground attractions, and frequently the engine itself would have a string of lights along the canopy. The canopy invariably went full-length to provide some protection for the crew and was supported on neat twisted brass pillars which were called 'Olivers'. Showman's engines were painted elaborately and make very fine models – they are possibly the best-loved of all traction engine types.

The road locomotive

I have no doubt that all readers will, from time to time, have seen very heavy loads being hauled along our roads on large trailers, invariably with a police escort. Such loads need detail planning in order to avoid low bridges or bridges that simply will not stand their weight. They also have to be



Above top, Ken Taylor's mighty 1/3rd scale Burrell Scenic Showman's engine. Above, this Fowler ploughing engine is by Reg Chambers in 2in. scale. Right, this lovely 3in. scale Burrell traction engine by John Parry-Jones has won a Gold Medal and the Duke of Edinburgh Trophy at the prestigious Model Engineer Exhibition. Far right, "Minnie", a popular ASP Plans Service design – this one built by Eric Baynes.

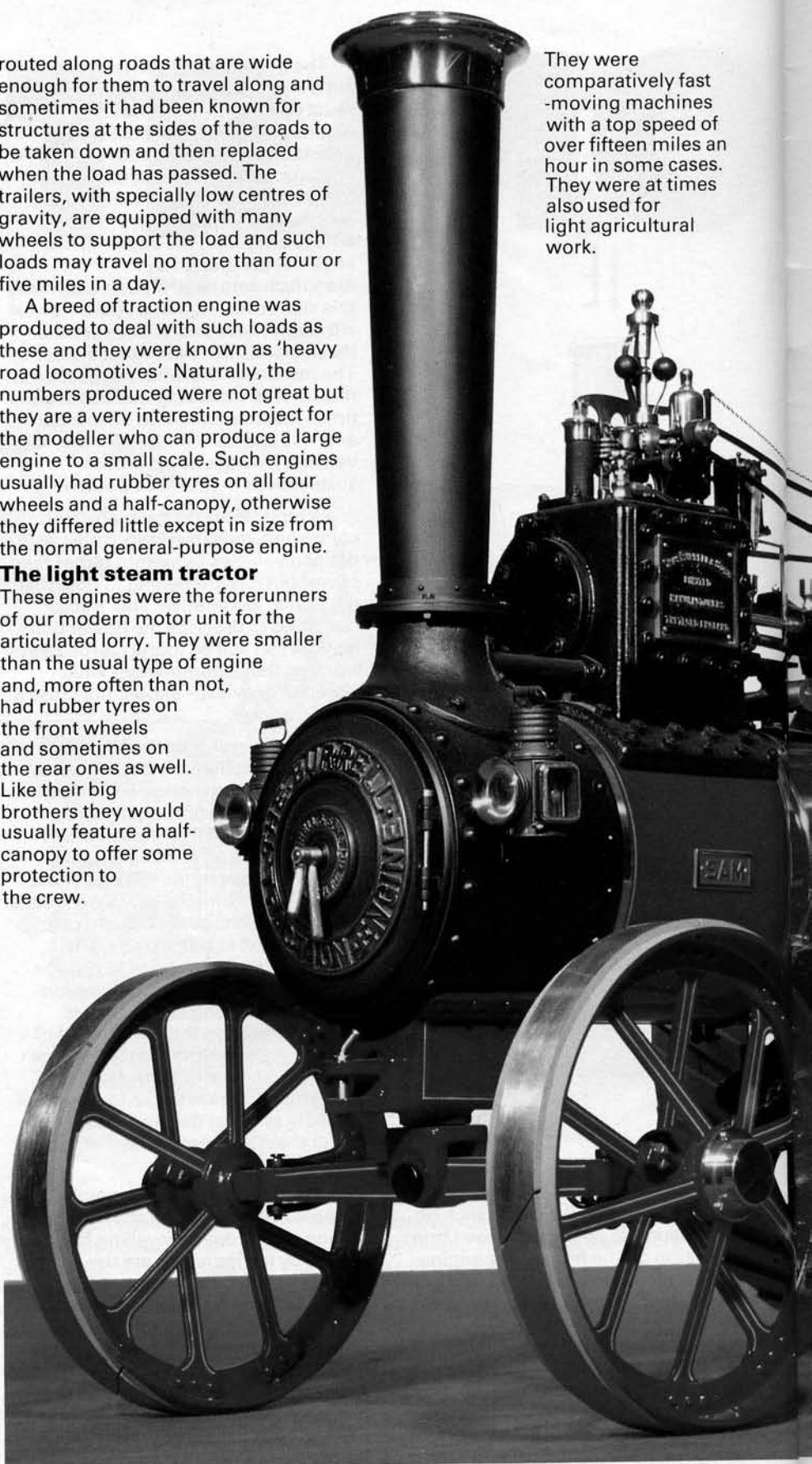
routed along roads that are wide enough for them to travel along and sometimes it had been known for structures at the sides of the roads to be taken down and then replaced when the load has passed. The trailers, with specially low centres of gravity, are equipped with many wheels to support the load and such loads may travel no more than four or five miles in a day.

A breed of traction engine was produced to deal with such loads as these and they were known as 'heavy road locomotives'. Naturally, the numbers produced were not great but they are a very interesting project for the modeller who can produce a large engine to a small scale. Such engines usually had rubber tyres on all four wheels and a half-canopy, otherwise they differed little except in size from the normal general-purpose engine.

The light steam tractor

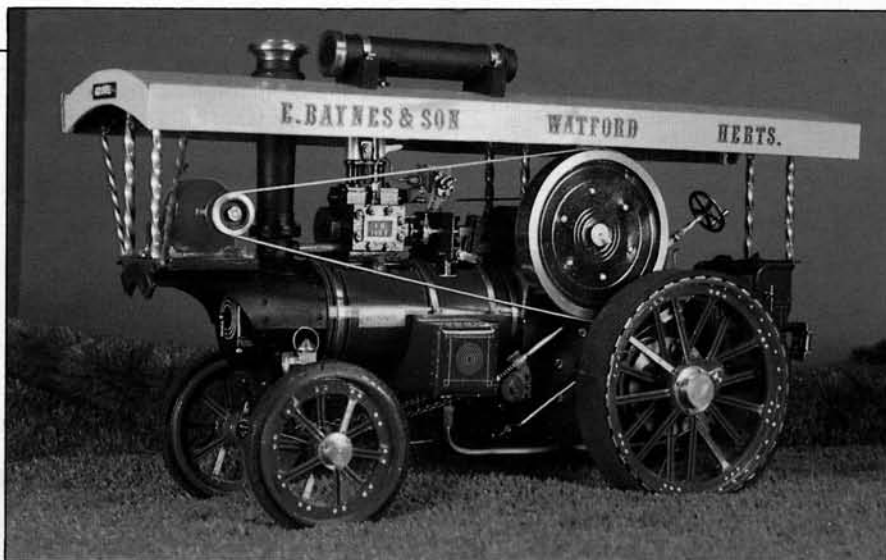
These engines were the forerunners of our modern motor unit for the articulated lorry. They were smaller than the usual type of engine and, more often than not, had rubber tyres on the front wheels and sometimes on the rear ones as well. Like their big brothers they would usually feature a half-canopy to offer some protection to the crew.

They were comparatively fast-moving machines with a top speed of over fifteen miles an hour in some cases. They were at times also used for light agricultural work.



The ploughing engine

To some extent we must thank the ploughing engine for the modern farming idea of large fields. They were big engines and had, in addition to the more common fittings seen on engines, a winding drum set underneath the boiler. A cable from this would be attached to a plough and from there to another ploughing engine. One engine would be at either end of the field and the cable would be wound up and the plough would travel with it from one engine to the other. Both engines would then edge along and the plough would be wound back again.



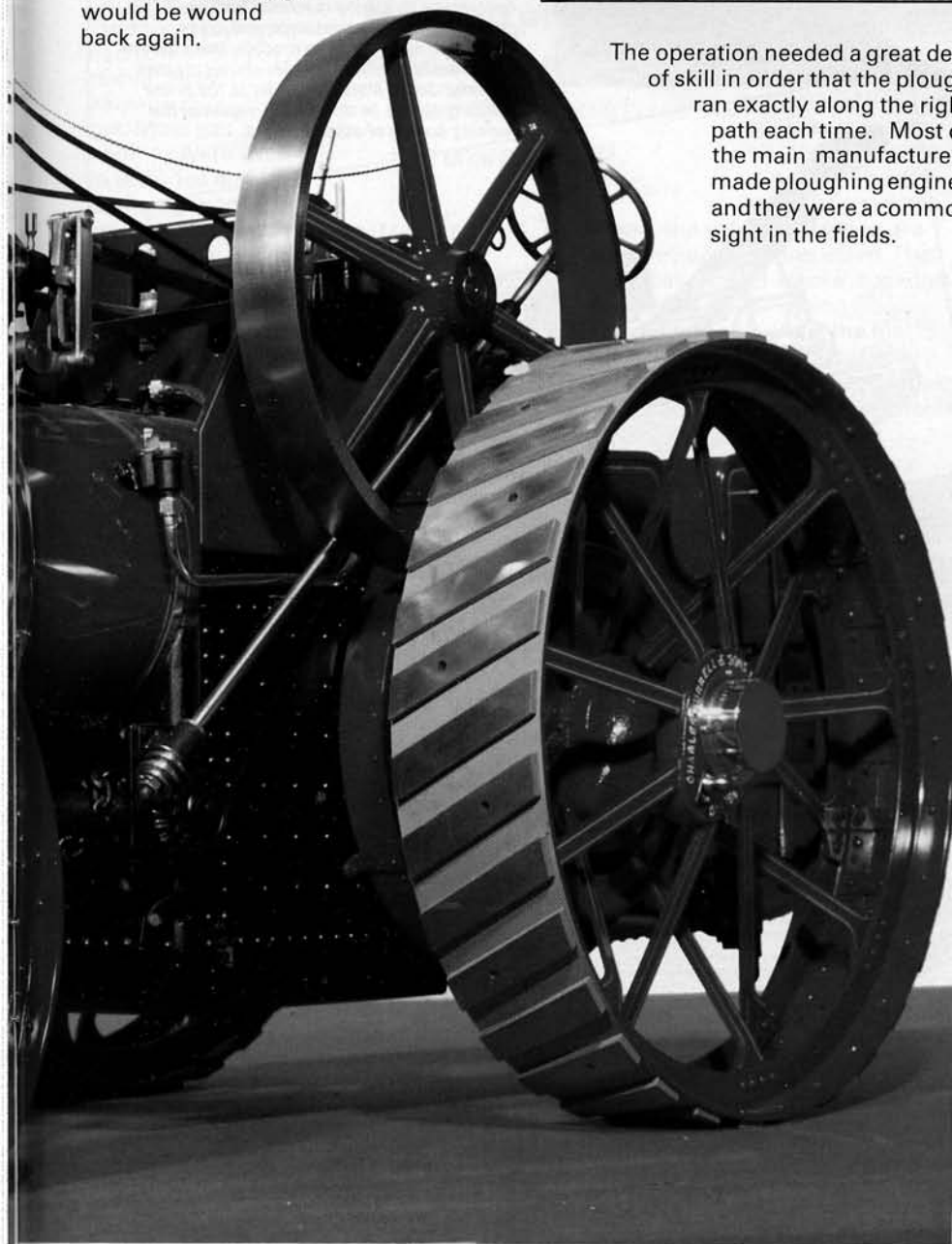
The operation needed a great deal of skill in order that the plough ran exactly along the right path each time. Most of the main manufacturers made ploughing engines and they were a common sight in the fields.

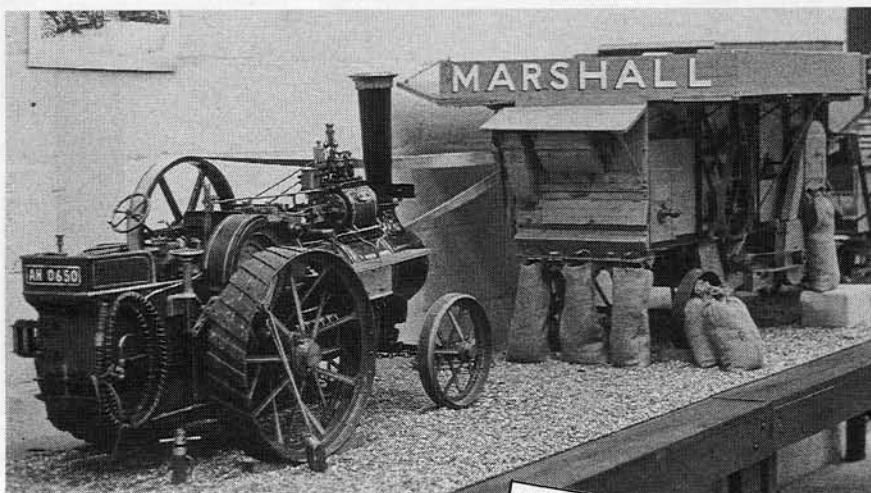
That covers the basic types of engine but there were various extras that would sometimes be fitted, the most common one being a small crane. Most engines were capable of being used for stationary operations as well as mobile ones. They were rather slow and somewhat dirty in operation and, with the coming of the petrol and diesel engine, rapidly faded from sight.

Happily many have now been rescued from the scrapyards and have been restored, usually not just to former glory but considerably beyond what they possibly ever looked like when in use! They are very popular and there are many traction engine rallies held throughout the country. These are graced by numerous engines as well as having other popular attractions and mostly a number of very fine model engines into the bargain.

The steam roller

Once very common on our roads when they were invariably accompanied by the smell of hot tar, alas these too have now disappeared except for those preserved by enthusiasts. They have similarities in their construction to those of a traction engine but, of course, have rollers in place of wheels. The front roller is usually supported on a massive bracket. They do not normally feature springs whereas most traction engines have some form of springing. They make good models and are often easier to construct than the traction engine. There is no need (unless the engine is to be used for hauling a lot of passengers) to have a differential gear and, having no springs, this is another job one does not have to contend with!





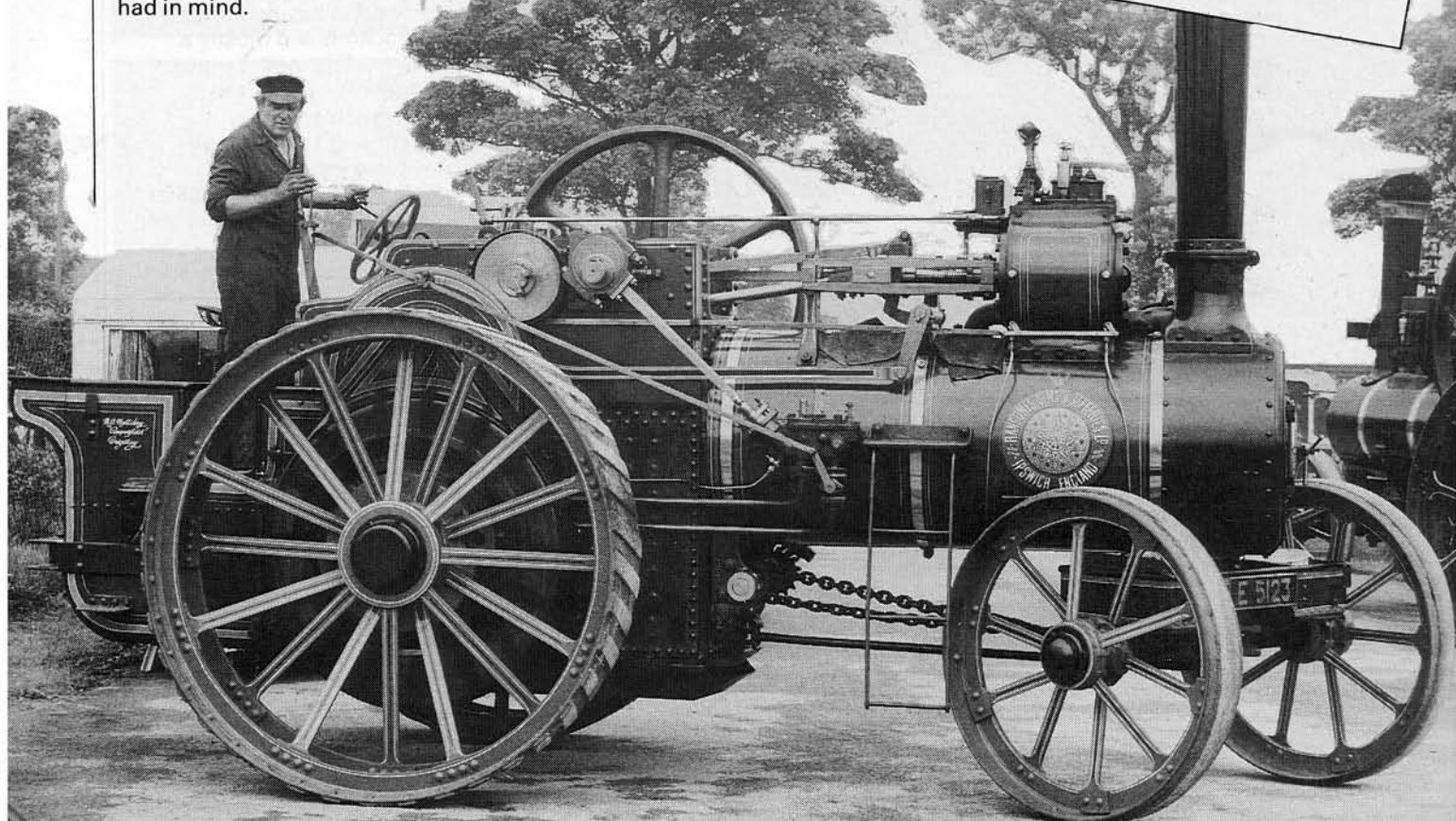
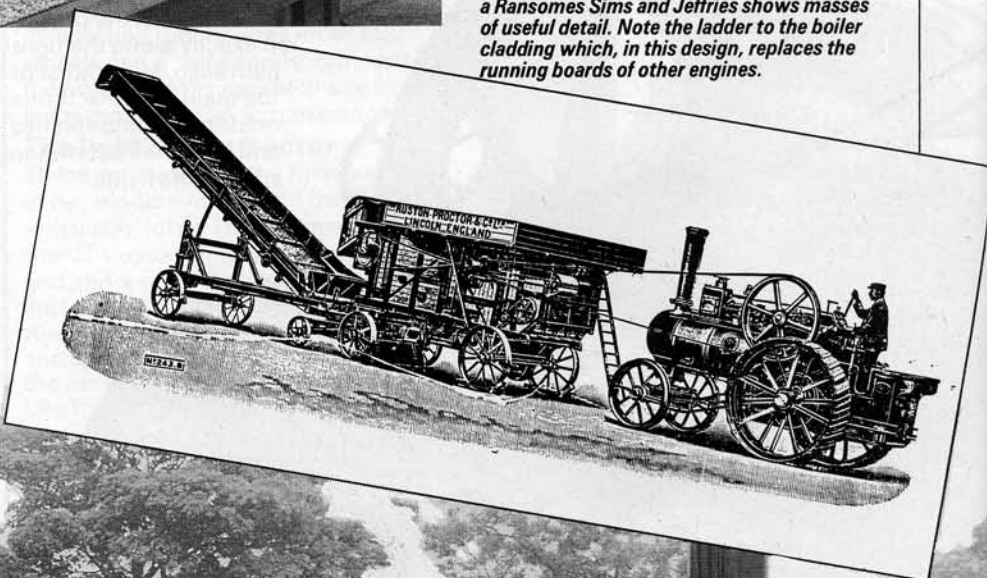
Attachments

I suppose that 'attachment' is hardly the word but many accessories were produced for use with traction engines and steam rollers. The most obvious one is the living van. A somewhat primitive form of caravan, these were hauled behind both traction engines and steam rollers. Because of their slow speeds drivers were likely to be away from home for long periods and the living van provided suitable accommodation.

Sometimes they hauled water carts and various specially made trailers were frequently used for the particular purpose which the owner had in mind.

There were also mole ploughs which literally made a tunnel through the ground – this, by the way, is something which has recently been re-discovered and is being hailed as a breakthrough! Steam rollers often hauled a scarifier which pulled up the road ready for re-laying and they would also sometimes have a water sprayer to help lay the hot tar. All these accessories make interesting models and are well worth consideration by the model engineer.

The agricultural traction engine was used for a variety of farm jobs; this fine model shows one operating a threshing machine. Bottom, photographs of the prototype will prove invaluable when building models; this study of a Ransomes Sims and Jeffries shows masses of useful detail. Note the ladder to the boiler cladding which, in this design, replaces the running boards of other engines.



The internal combustion engine is so much a part of our life these days that it is difficult to imagine that we have ever been without it! Although it was invented in the late 1800s, apart from small improvements it still retains its basic form. It was not long after the first engines were produced that it began to replace steam as a prime mover and it has been used for many applications since.

At one time there was a move to using gas as a fuel in such engines and, whilst this quickly changed to the use of petrol, during World War Two the gas engine had some form of revival when petrol became difficult to get. Most gas engines were used in factories and for pumping where the storage of fuel was no great problem and, indeed, the mains gas which in those days was produced from coal could be used. These engines make very fine models and there are a number of suitable designs available on the market. They can be run on low pressure gas such as propane if one wishes. Quite a number of gas engines have been preserved by enthusiasts who often run them for the benefit of the public.

The petrol engine, like the gas engine, differs from steam in that, whereas the latter relies on the expansion of the steam to drive it, the internal combustion engine relies on the mixture of air and fuel exploding and forcing the piston down. For this reason, cylinders on internal combustion engines can only be single-acting whereas on the steam engine, by introducing steam at each end, it is possible for the cylinder to be double-acting with the steam pushing the piston back up again.

In the case of petrol and gas engines the igniting of the fuel is caused by an electric spark which is introduced via a spark plug. It is quite possible to make spark plugs of scale proportions but there is a little more difficulty in producing a scale ignition coil which will create the high tension current for the spark. For this reason the coil is usually situated at a distance from the actual model engine.

The diesel engine creates the necessary explosion by pure

compression, the fuel being compressed so tightly that enough heat is generated to cause the explosion. For this reason the diesel has advantages for the modeller as the irksome problems related to spark ignition are no longer relevant.

One difficulty with model internal combustion engines is the introduction of fuel. This has to be mixed to correct proportions with air

and, in the motor car, this is done with a carburettor. With a diesel engine an injector is used. Whilst a small simple carburettor can be produced, the diesel injector is not quite so easy...

The mixture is introduced into the engine via a valve which then closes allowing it to compress. When it has

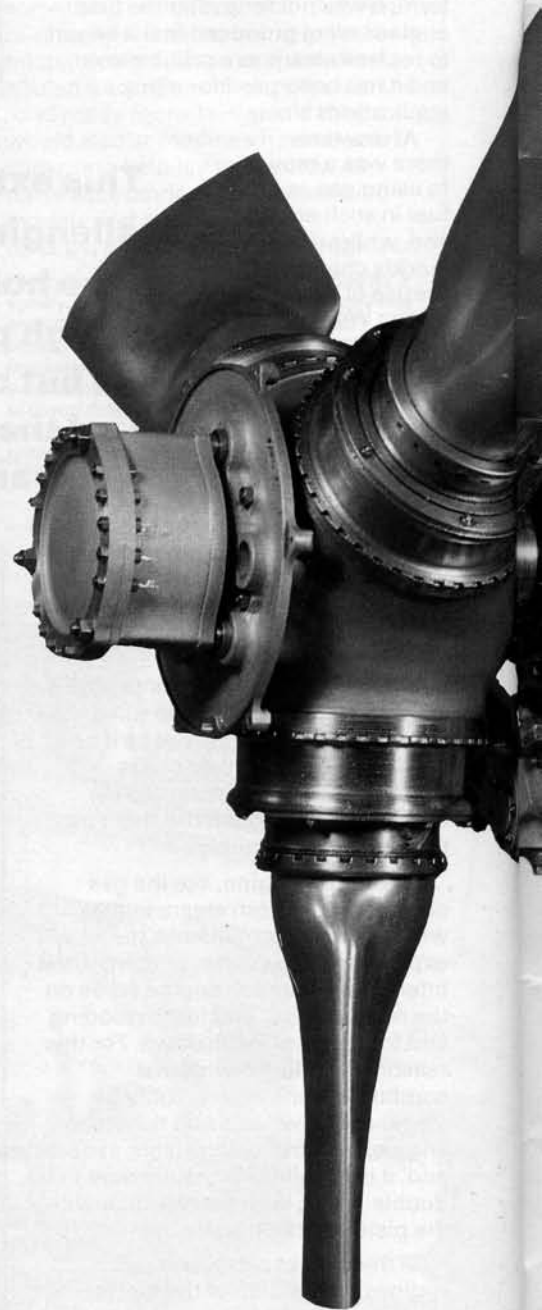
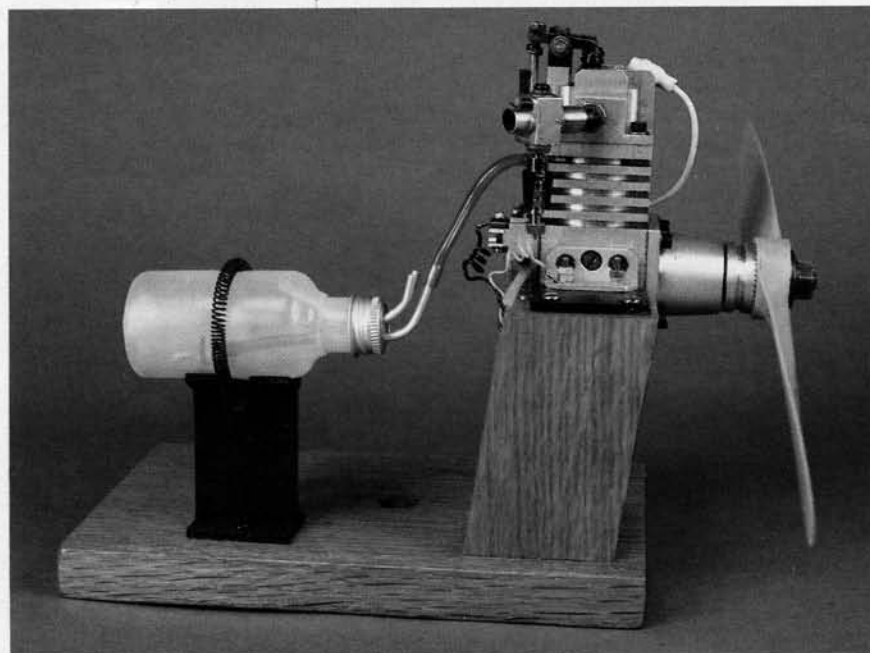
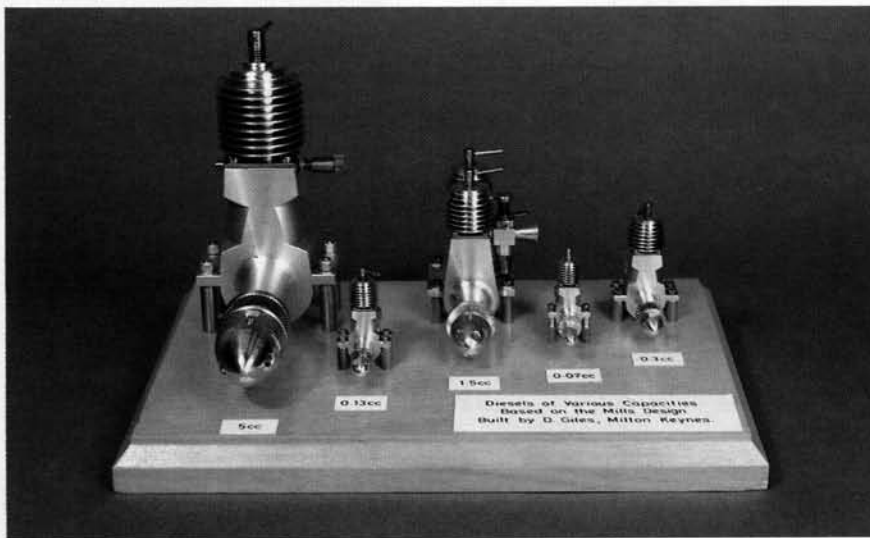
been fired, the exhausted gases are released through another valve. The system is called 'four-stroke' because the engine has the following functions: induction when the fuel is drawn in; compression as it compresses; explosion as it explodes; and exhaust as it exhausts. The effect of the piston being blown down the cylinder is transferred to rotary motion by means of a crank.

A simpler type of engine is known as a 'two-stroke'. In this case there are no valves, just ports rather like the little oscillating engine. As the piston travels down the cylinder the inlet port is uncovered and allows the fuel in. This is forced round the crankcase which covers the crank and crankshaft and through a transfer port that allows it above the piston. The piston, on its way up, compresses it and, when fully compressed, the mixture is exploded and the gases go through the exhaust port. The cycle then repeats itself.

Given good castings correctly made, the two-stroke engine can be easier to make than the four-stroke as there are less moving parts. In all internal combustion engines good engineering fits are essential in order to make them work efficiently. Whilst in this day and age the internal combustion engine reigns supreme and is used in most of our transport as well as to provide power in industry, there seems a strange reluctance for it to be made as a means of driving models. We do see some so-called 'diesel' locomotives on the tracks but,

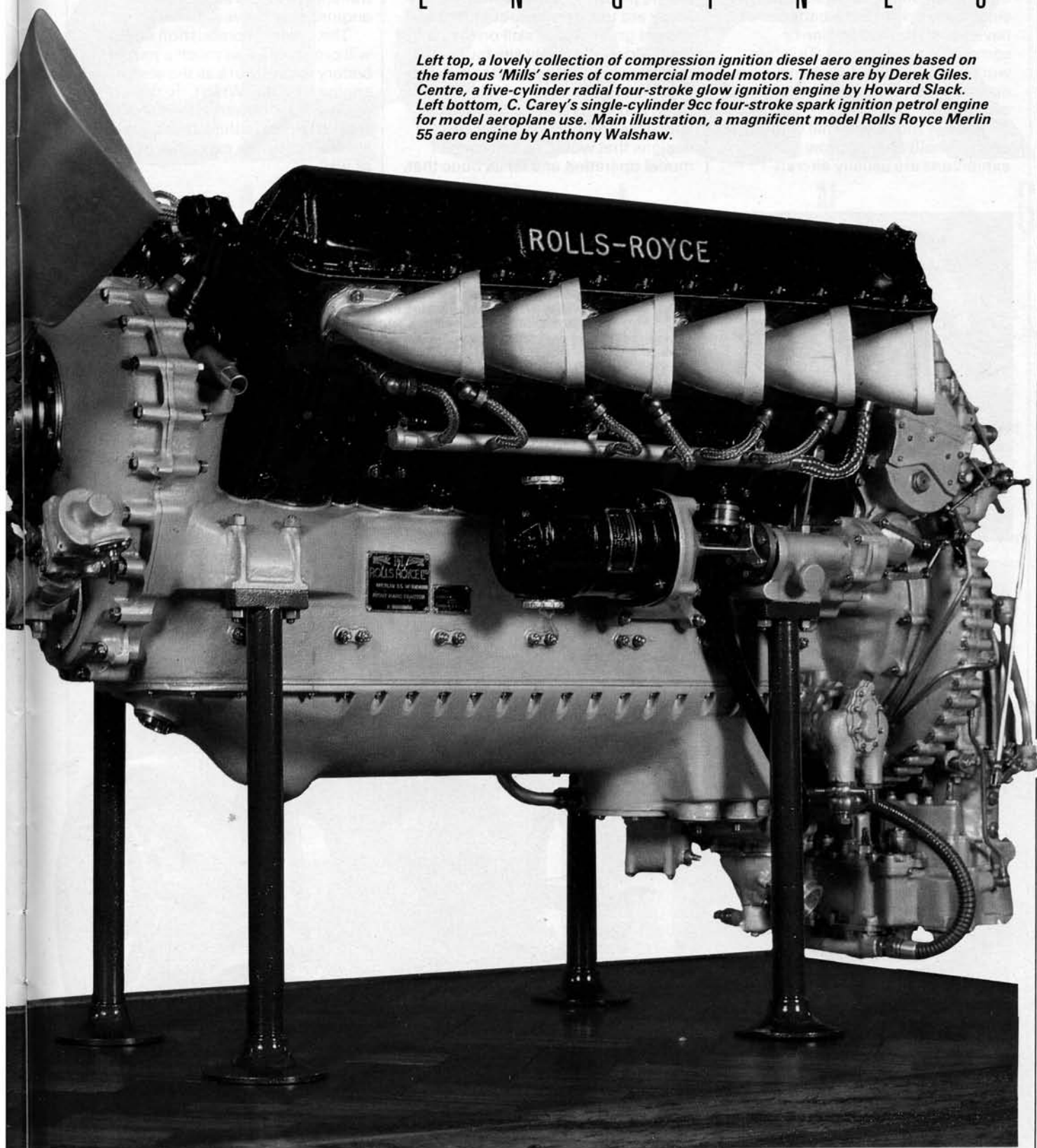
**This extremely
challenging branch
of the hobby calls
for high precision
skills but can be one
of the most
rewarding.**

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I N T E R N A L COMBUSTION E N G I N E S

Left top, a lovely collection of compression ignition diesel aero engines based on the famous 'Mills' series of commercial model motors. These are by Derek Giles. Centre, a five-cylinder radial four-stroke glow ignition engine by Howard Slack. Left bottom, C. Carey's single-cylinder 9cc four-stroke spark ignition petrol engine for model aeroplane use. Main illustration, a magnificent model Rolls Royce Merlin 55 aero engine by Anthony Walshaw.



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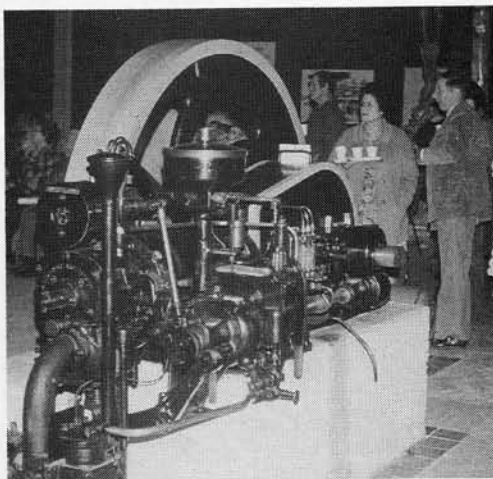
more often than not, these are either electrically driven from batteries or have a lawn mower engine or something similar fitted. This may work but it is certainly not anywhere near as satisfying as making one's own motor!

The few model internal combustion engines built and on show at exhibitions are usually aircraft

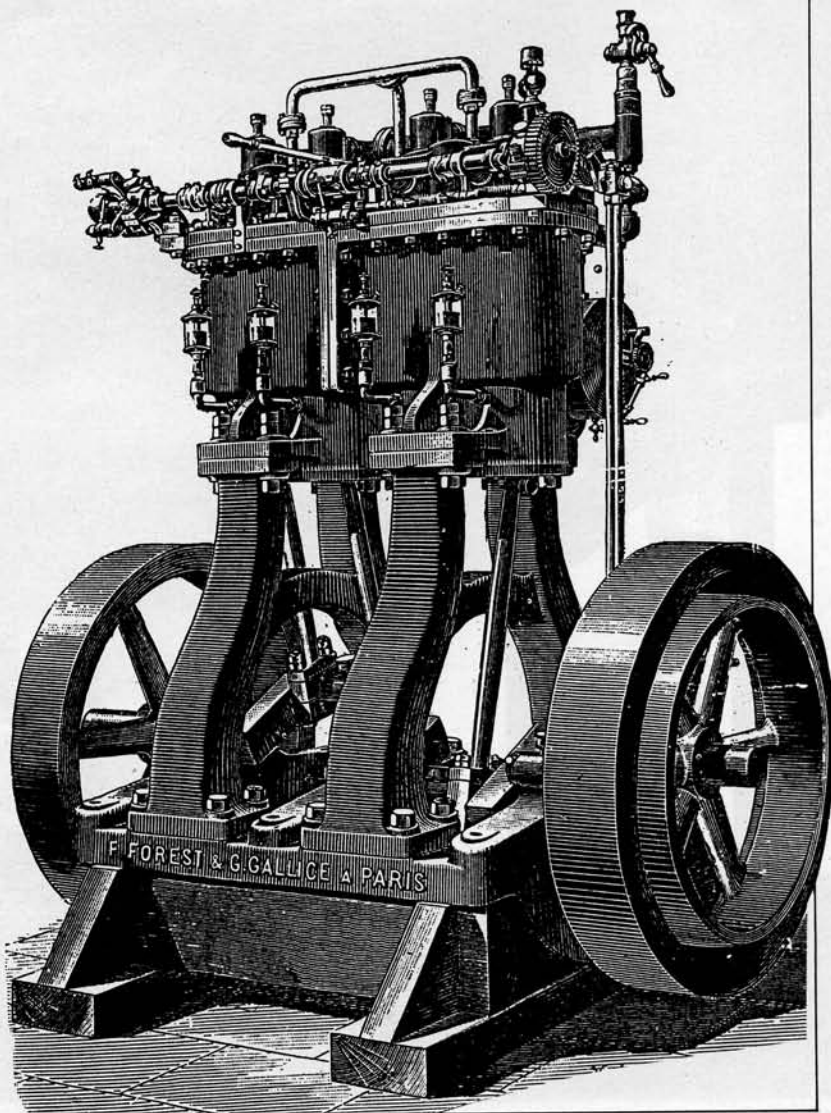
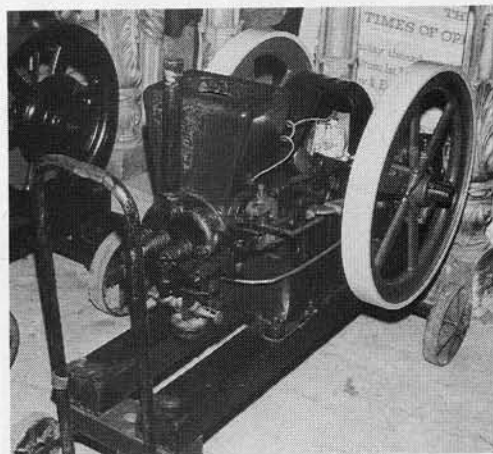
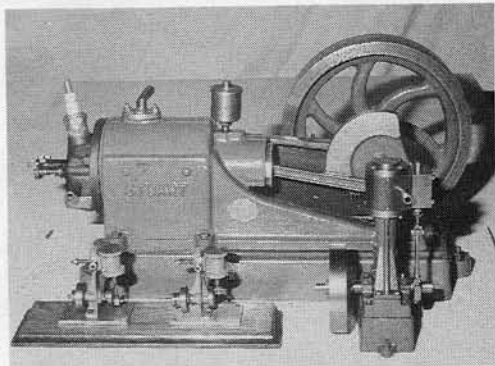
engines. They include some very fine models and, as exercises made purely for the pleasure of modelling are fine. Many are to a very high standard and show a great deal of skill on the part of the builder. We rarely see four cylinder engines built and to see one used in a model road vehicle is even rarer. I do know that a couple of our suppliers are trying to produce designs that would be suitable for model operation and let us hope that,

when these come along, there will be attempts at producing working transport models as well as the engines themselves.

The internal combustion engine will probably be as much a part of history in the future as the steam engine is today. Whilst, no doubt, many will be preserved in full-size it would be nice to think that there will also be some fine examples of models as well. ■



Left top, a gas engine preserved at Thursford Museum; typical of the type used for pumping water. Centre, a model Stuart gas engine [at the back] and two small oscillating and one slide valve steam engines in the foreground. Bottom left, stationary petrol engines like this were used extensively by farmers and can make interesting working models. No designs for them survive but a visit to a traction engine rally or agricultural show can often yield working examples which can be photographed and measured. Below, not all gas engines were horizontal; this engraving shows a two-cylinder vertical 'Forest' engine.



CLOCK

M A K I N G

We measure time in this enlightened age by means of our clocks and watches. It was not always so, however, and no doubt primitive man reckoned the time by the sun and the moon. Ancient astronomers worked out the sequence of time as we know it today and early methods used for calculating time included a candle which would be graduated in such a way that, as it burnt down, so the time would be recorded against markings on it.

The sun dial was popular in countries where weather conditions allowed its use and older readers will be familiar with egg timers – but

An important branch of the model engineering hobby, clocks offer an intriguing challenge . . .

perhaps younger ones will not, as such timing is done electronically nowadays! In fact, any movement that can be measured can be made to record time. An interesting timepiece now owned by the British Horological Society was used by the Chinese for calling monks to prayer. A series of

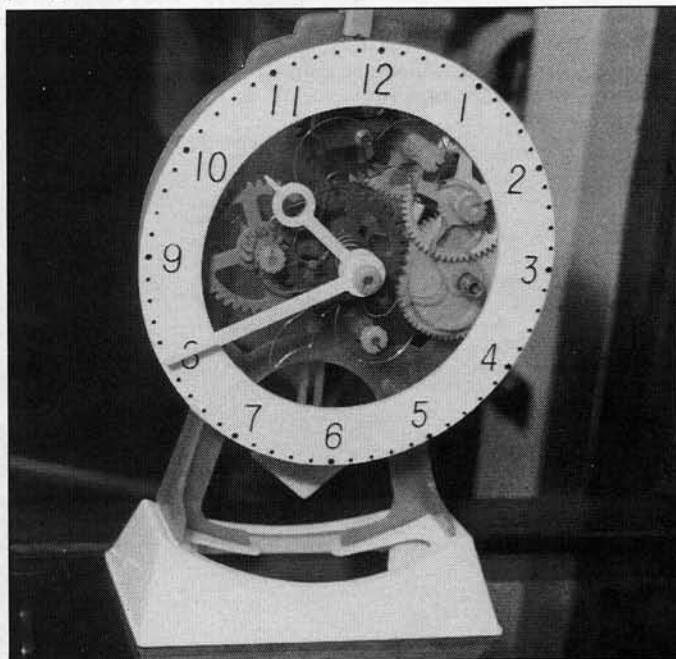
heavy balls are suspended on string over a gong. A joss stick was lit and, as it burnt, it would sever the strings holding the weights, dropping them at intervals onto the gong. No doubt the forerunner of chiming clocks!

Basically the clock is not a terribly complicated piece of machinery. It calls for some means of rotating a shaft – either by a wind-up spring or a weight on a cord – and this movement, by careful observation and adjustment, can be made to work steadily at a given speed. This is achieved by a form of governor although, in the case of a clock, it is known as an 'escapement'. Careful

The Congreve clock uses a rolling ball in a grooved track to keep time; this type of timepiece is popular with home constructors.



A clock made entirely from plastic that can be taken to pieces and re-assembled; it was built as an educational tool to help youngsters understand clock principles.



gearing enables a shaft to be driven by the mechanism and a hand fixed to this shaft will register the time on a dial. A second shaft through the centre of the first and driven at a ratio of sixty to one provides a record of the passage of the minutes and the same principle can be applied to the second hand as well. Some electric clocks also work on this principle and others work by controlled impulses.

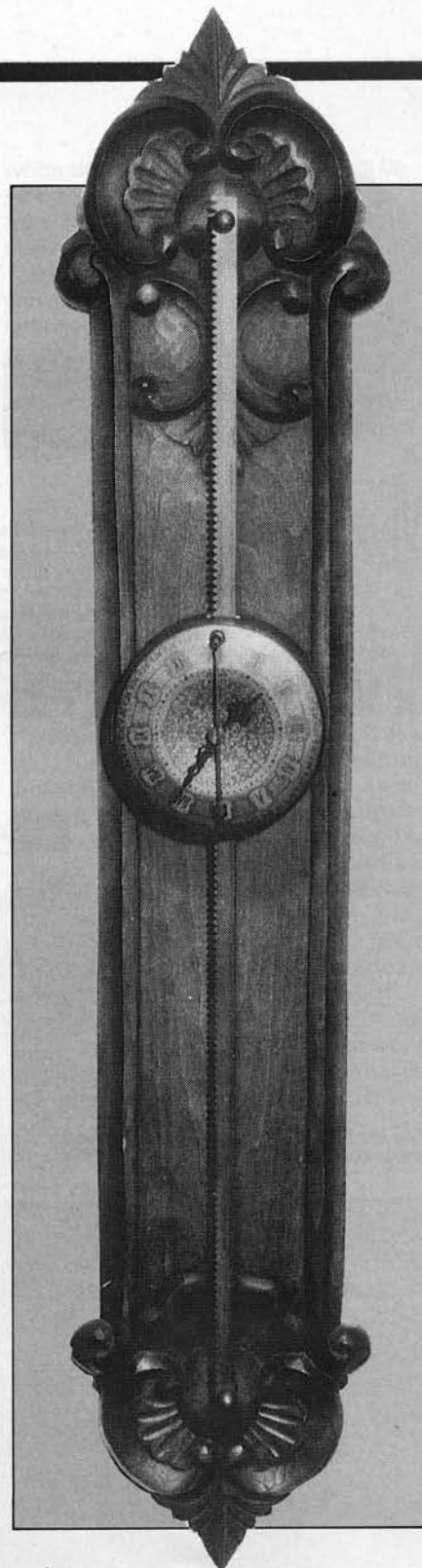
Making clocks is extremely popular with model engineers and many at some stage or another like to have a go at clock-making. There are many articles published and plenty of books which will help the beginner along. Although special lathes and other machinery are available it is quite possible to make a clock with ordinary model engineering equipment. The ability to turn small parts and to cut gears are the most important needs. When making larger-sized clocks there is not quite the need for extreme accuracy and, without doubt, it would need far more accurate working to make a model internal combustion engine than it would to build a clock. I know of one person who built a clock without any machinery at all, filing all the parts by hand and it keeps perfect time.

The gears are, of course, a very important part of clockmaking and require careful division. The professional clock-maker, and many amateurs as well, will use a special machine or possibly a dividing head for the purpose. They also use specially shaped cutters for getting the shape of the teeth; they are sold by suppliers of clock-making

equipment. Whilst such cutters and dividing equipment are desirable they certainly are not entirely necessary. Suitable cutters can be made and, whilst the specialist ones are like milling cutters, the home-made ones need only have a single cutting edge. Dividing can be done by means of the lathe lead screw with a little care and thought. It is, anyway, possible to purchase indexing plates at fairly reasonable prices and to make one's own dividing equipment.

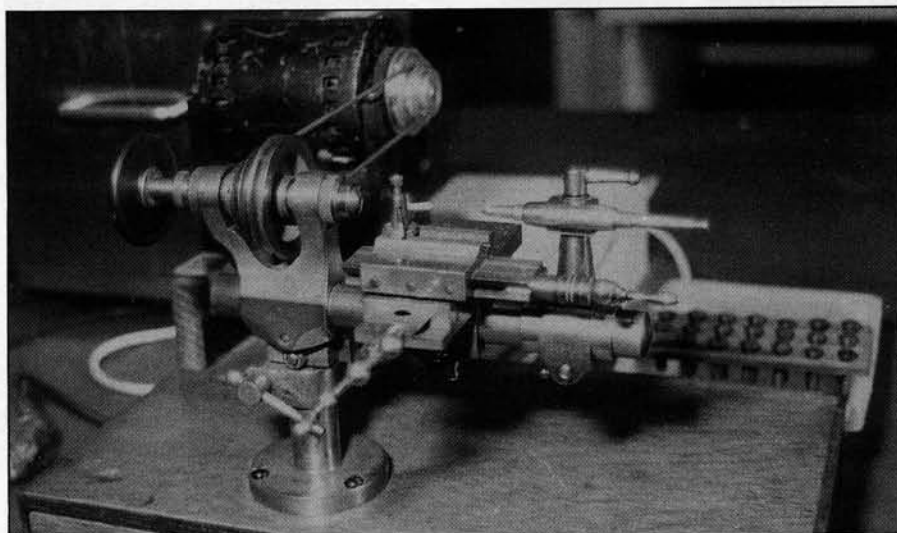
I hope that I have encouraged some readers to have a try at clock-making. The end results are lovely to look at as well as being entirely practical and the construction of a clock is far cleaner than other forms of engineering! Anyone who does not know how to start and finds it difficult to follow the written instructions found in magazines and books would do well to pop along to a jumble sale and buy an old clock and take it to pieces to see how the parts are made. Weight-driven clocks are easier to construct than the wind-up type, if only because of the difficulty in fitting a suitable spring – it would probably be as well to start with one of these.

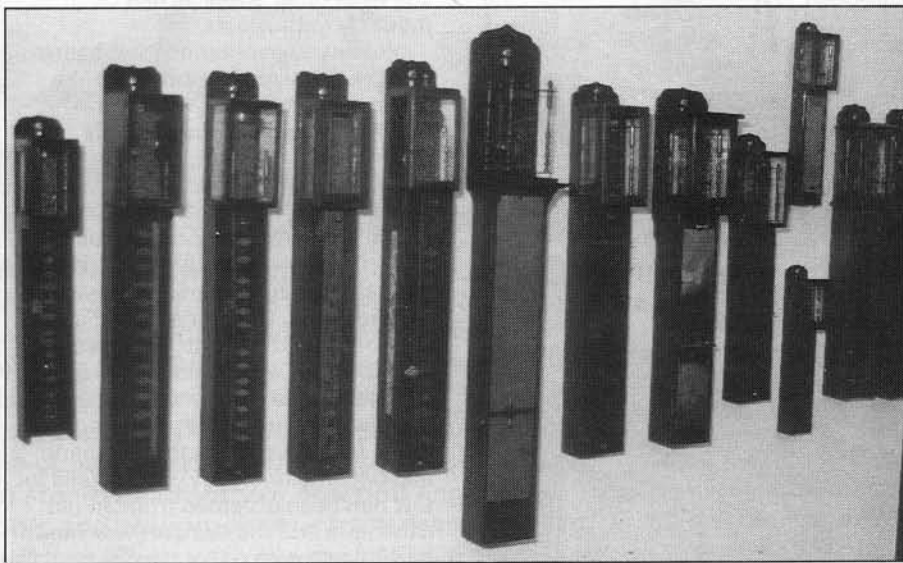
The British Horological Institute, Upton Hall, Upton, Newark Notts. NG23 5TE runs correspondence and residential course on the subject and these could be worthwhile considering. The correspondence course, in particular, covers a very wide range of clock-making subjects and, if one wishes, examinations can be taken giving the right to a Fellowship of the Institute for those successful.



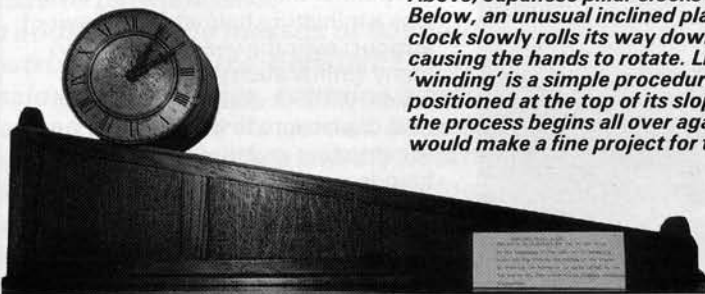
Above, a gravity clock; the principle here is that the clock itself moves down a toothed column under its own weight. 'Winding' consists merely of lifting the clock to the top of the column.

Left, a typical clock or watchmaker's lathe; they are generally smaller and lighter than their engineering counterparts and are excellent for small, fine work.

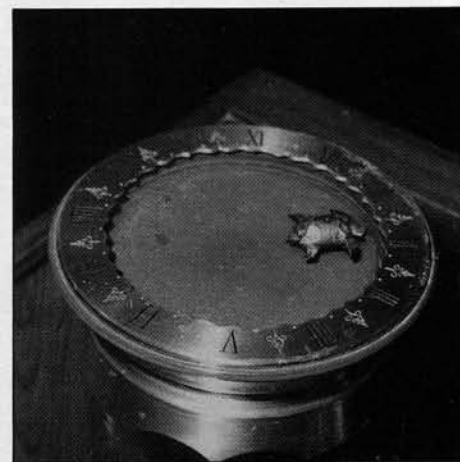
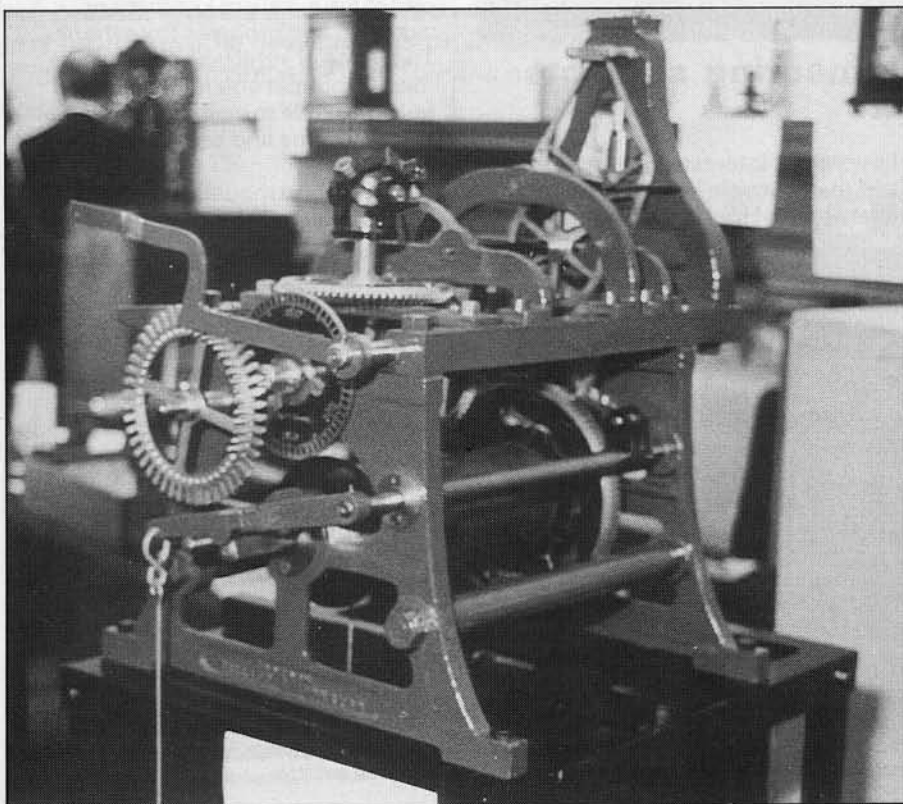




Below, a close-up of the mechanism of a Japanese pillar clock. At bottom, the unique moving frog clock made by J.D. Reid, National Vice President of the Horological Society. The frog floats in water and is activated from below by a magnet attached to the clock mechanism concealed beneath the dish. As a consequence, the frog always points to the correct time on the dial!



Above, Japanese pillar clocks in a variety of sizes. Below, an unusual inclined plane clock. Here the clock slowly rolls its way down the slope, a cord causing the hands to rotate. Like the gravity clock, 'winding' is a simple procedure – the clock is repositioned at the top of its slope each week and the process begins all over again! Such a clock would make a fine project for the home builder.



At left, mechanism of a bracket clock; typical of the type used in clock towers, it is of more robust form than is usual in clockmaking.

WHAT ELSE?

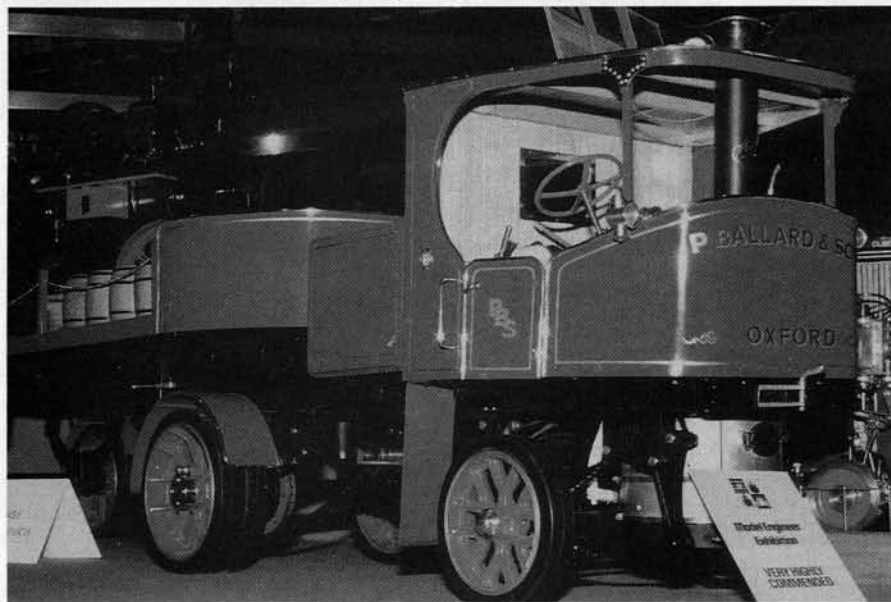
1988 Model Engineer exhibition just to see what other subjects had been made by enthusiasts.

We must bear in mind that I am thinking in terms of model engineering. A young lady from Colchester had produced a port pourer and a desk set; both were beautifully made and both would grace any home. For anyone who doesn't know, a port pourer was a Victorian device. The bottle of port was laid in it and when a screw was wound along, the bottle tipped and the port would run into the glass placed underneath. I am not sure whether it was designed for getting a correct measure or for use when so much had been drunk that the hand had become unsteady! The details for this had been obtained from an old catalogue and the desk set was made by similar research.

Another interesting item on display was a miniature helmet from a suit of armour; over the years I have seen many similar such models all of which, without doubt, give a great deal of pleasure to both the constructors and their families and friends.

Making horse-drawn vehicles is a section of the hobby that is increasing in popularity. As for the boat enthusiast it is possible to start with one of the excellent kits that are available and progress from there. The range of vehicles which can be made is almost unending. It is also quite possible to visit one of the many folk museums and see the originals on display.

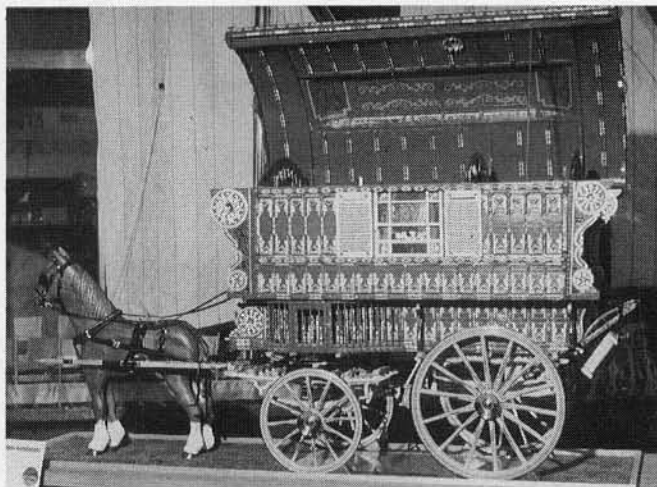
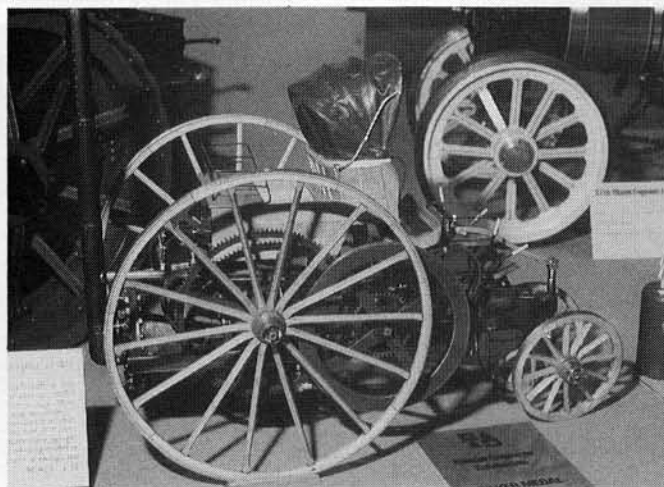
Fairground models have long been popular subjects for modellers.



The choice of model engineering subjects is endless. Take your pick!

So far I have discussed prototypes that are most commonly modelled. Not everyone,

however, is interested in these things and many people have different interests, so I took a look round at the

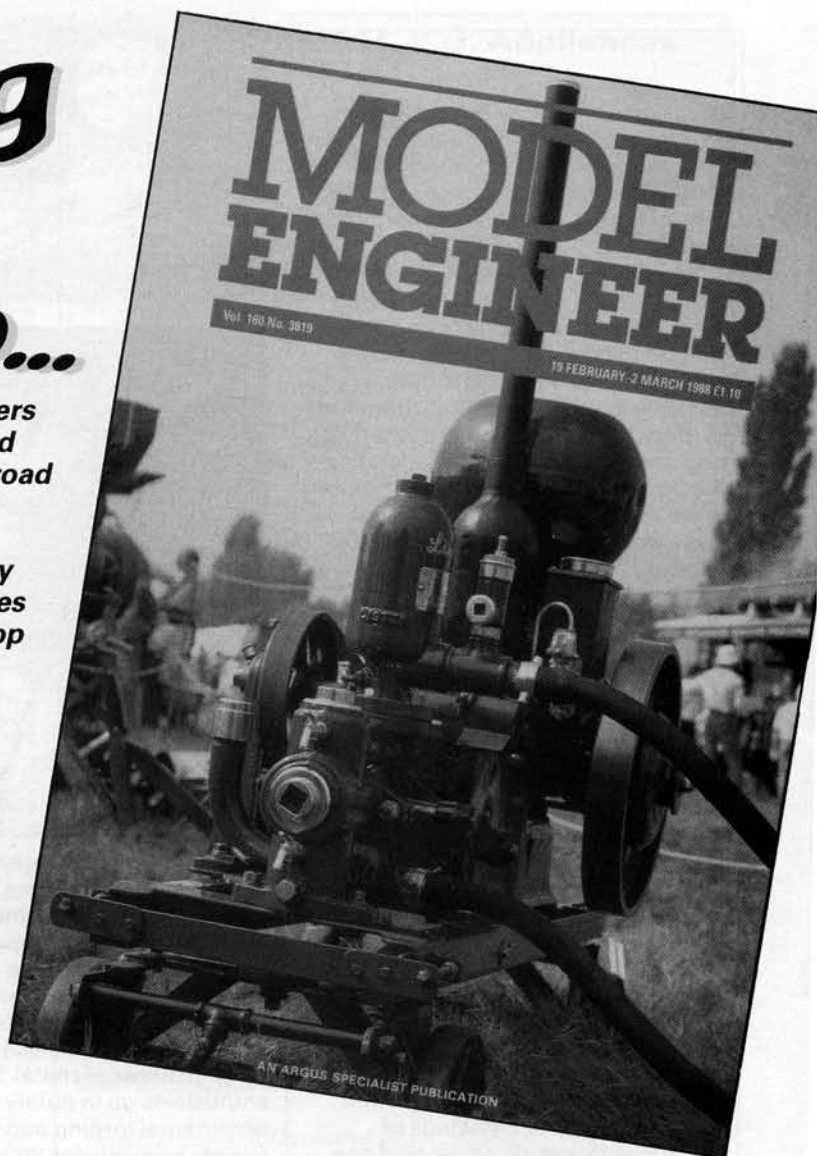


How about a Clayton Undertype steam lorry [top] or this delicate Trevithick steam car [above left]? Or even this lovely horse-drawn wagon at right which combines woodworking skills with metalwork? Plenty of plans, and kits, exist.

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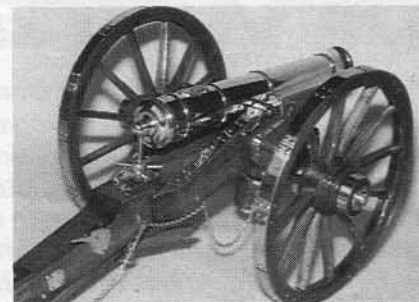
To make these it may be necessary to develop a variety of skills as they often involve metalwork and woodwork. Mostly the end result is also operational which gives even more pleasure!

Model armaments continue to intrigue many model engineers and the models made range from simple cannon to complicated anti-aircraft and field guns. In fact, it is quite possible in this case to find something to model to a high standard whether a beginner or advanced modeller. For the beginner the simple seige cannon is the answer. I say 'seige cannon' rather loosely as, no doubt, the experts can tell me that not all the types I am writing about are seige guns!

Anyway the guns I refer to are the sort of thing invariably found at a preserved castle and consist usually of a barrel, a wooden frame and four wooden wheels. The barrel can either be turned from solid material or it can be made in wood and taken to a foundry for casting. The latter would be the more correct form but might not be quite so easy as turning one.

The wheels are interesting and need some study. Some are made from wooden segments joined together, others from two pieces of wood laid back to back. Some have iron hoops on them while others do not; one presumes that this is because some guns had to be moved about more than others? Drawings of various guns can be obtained if one wishes but it is also equally possible to go along and measure an original.

There are so many more subjects that can be modelled that the list

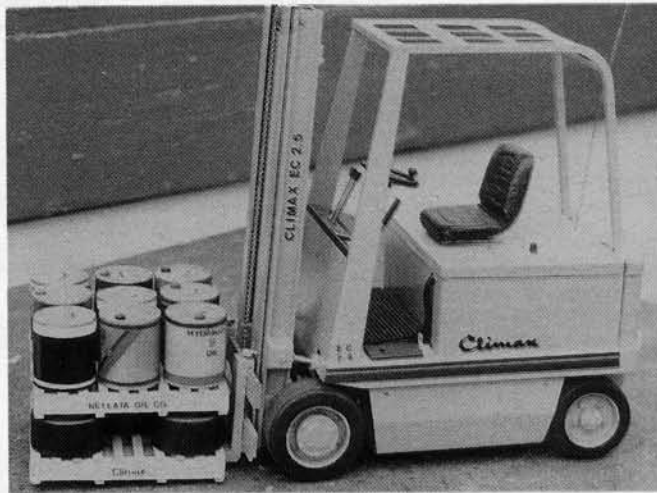
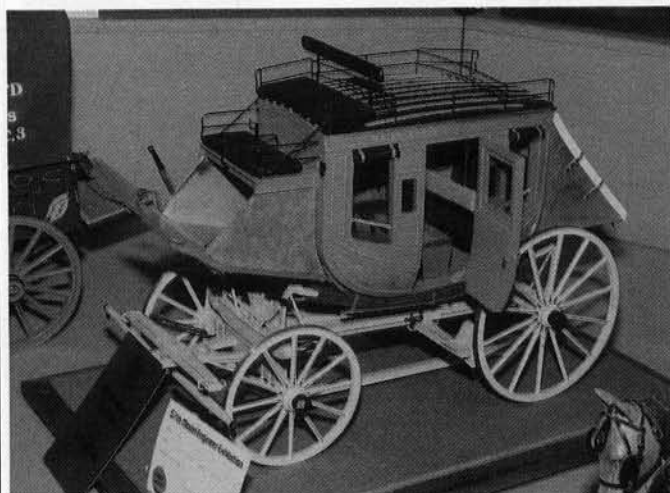


Unusual subjects like this tiny violin and case [top] have enormous appeal while this armoured helmet offers scope for delicate work with sheet metal. Artillery pieces [above], western stage coaches [bottom left] and even modern machinery, so much a part of everyday life, like this fork-lift truck, make super working models.

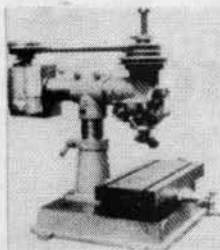
would be endless. Excavators, cranes, etc., all lend themselves. However, supposing a lathe, no matter how small, has been purchased and at least in the early stages there is no interest in modelling any particular prototype, there is no reason why pleasure should not be obtained just from turning pieces of metal. Some enthusiasts go in purely for ornamental turning and there is a society specially for those with such an interest! Members produce very ornate pieces of work but the beginner can be satisfied with a lesser amount of ornamentation. A candlestick lends

itself well to such an exercise; true, it needs to be made of brass and brass can be very expensive. However, as the work, if done properly, will take many months and the object give pleasure for many years, it does not work out expensive in the long run.

Well, there it is — the list of what can be made is endless and part of the fun of the hobby is having to think and scheme things out for oneself. Hopefully I have given readers some ideas and possibly inspired the desire to get into the workshop and have a go.



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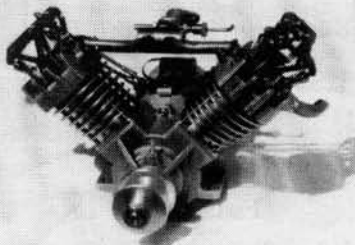


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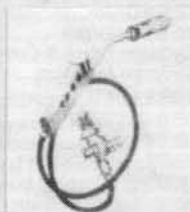
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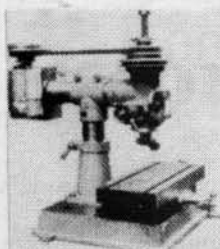
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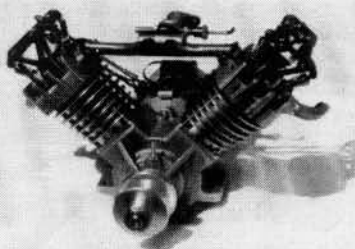


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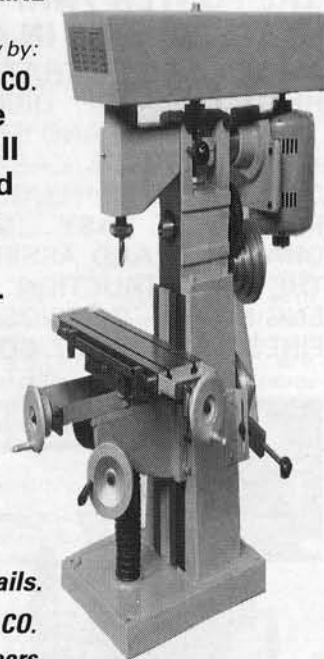
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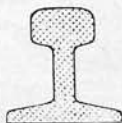
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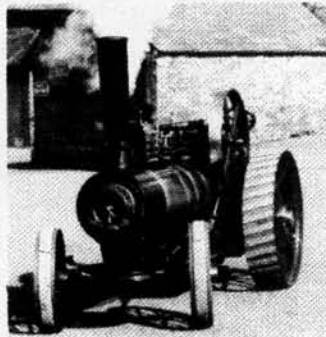
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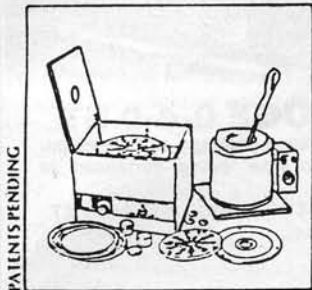
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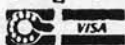
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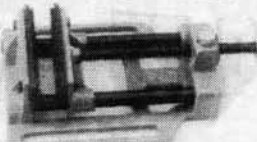
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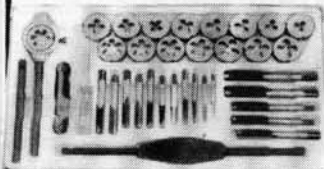


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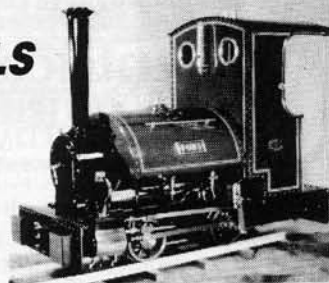
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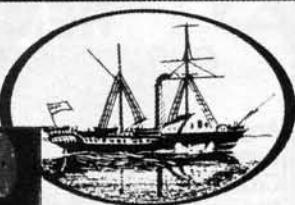
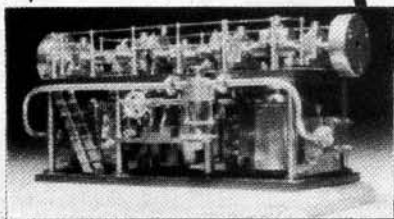
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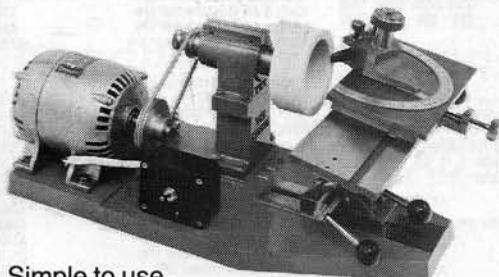
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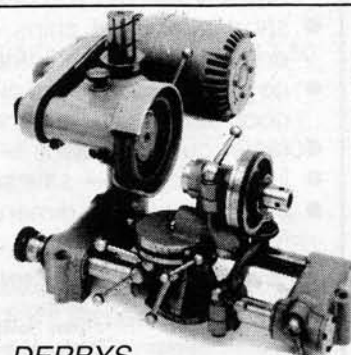
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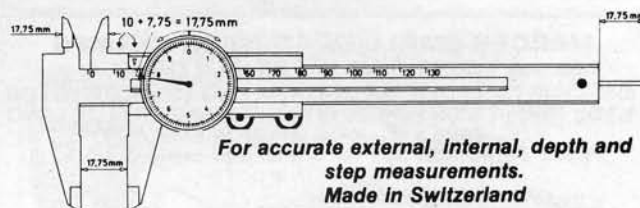
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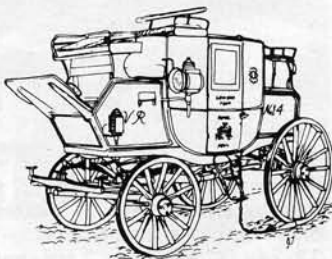
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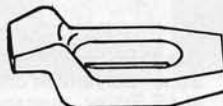
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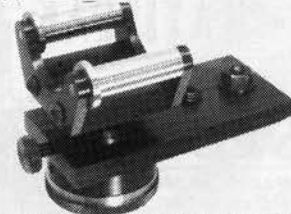
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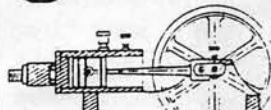
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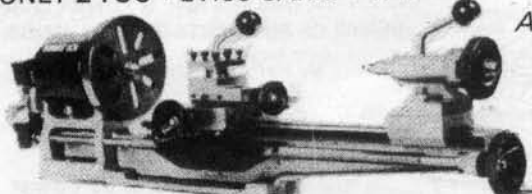
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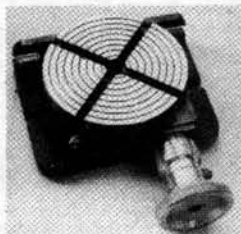
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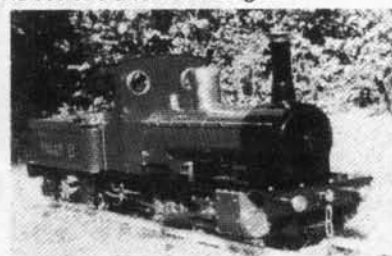
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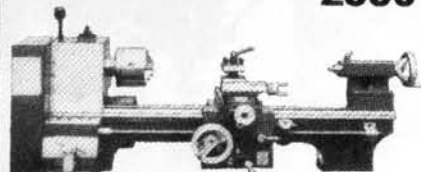
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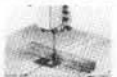
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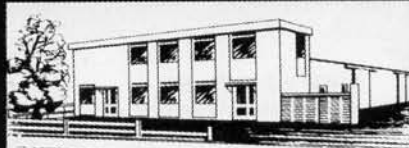


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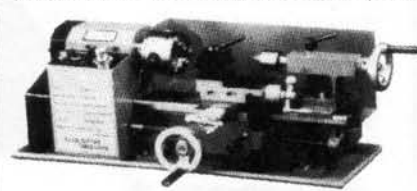
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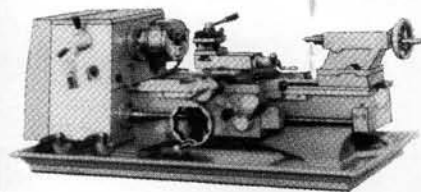
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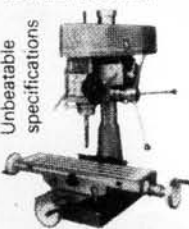
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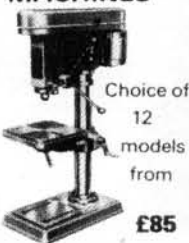


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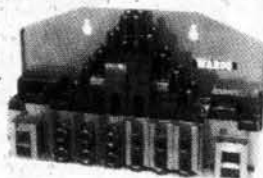
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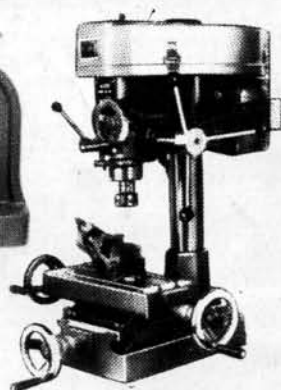
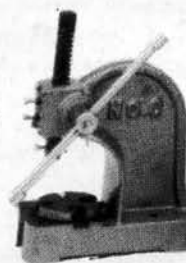


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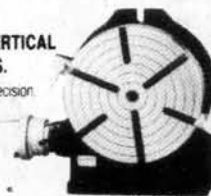
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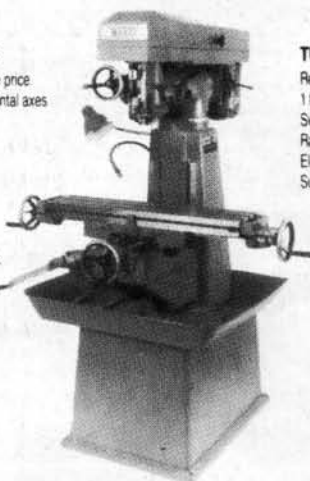
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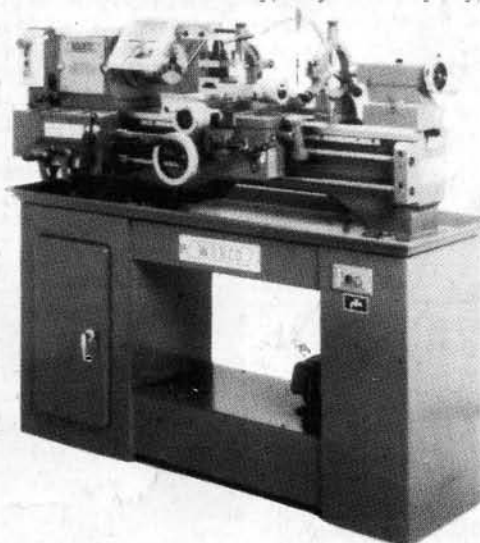
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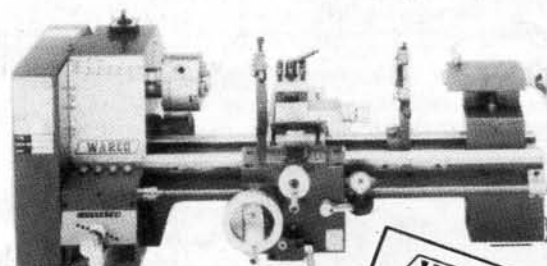
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