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Model Mechanics

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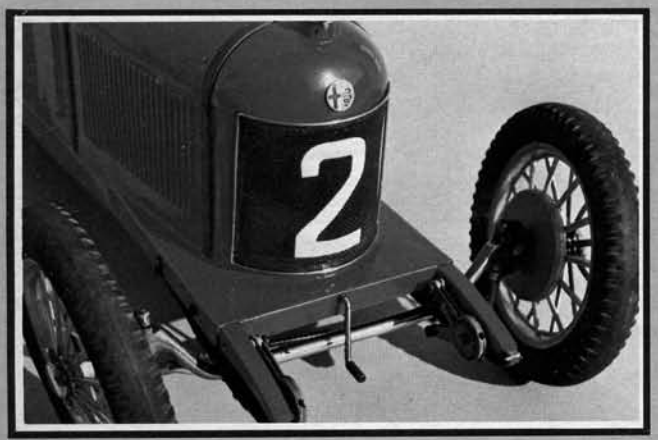

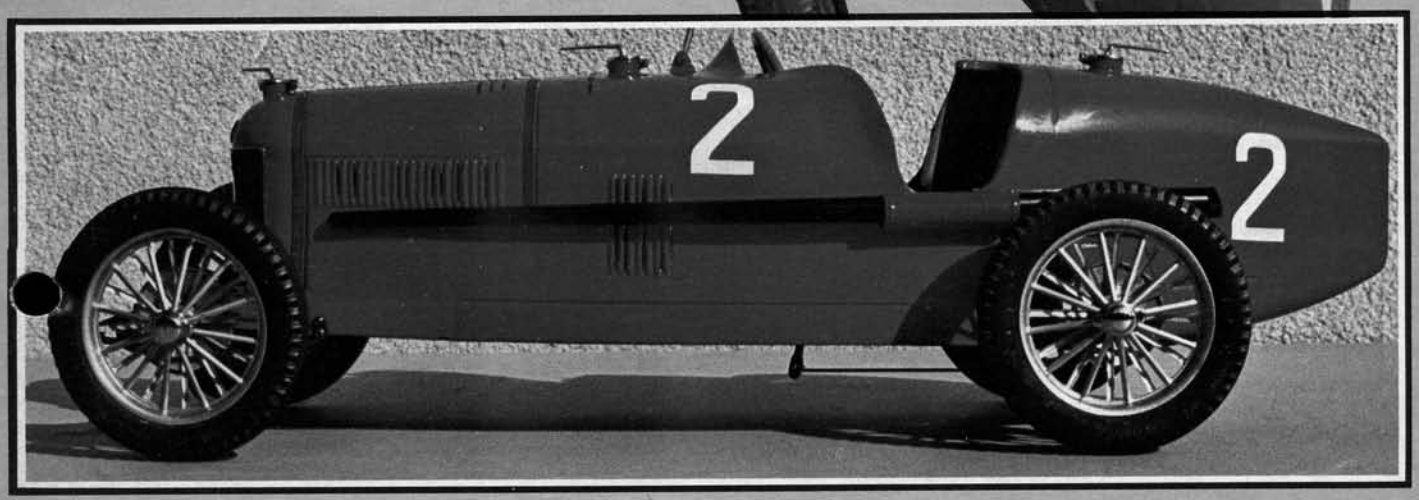

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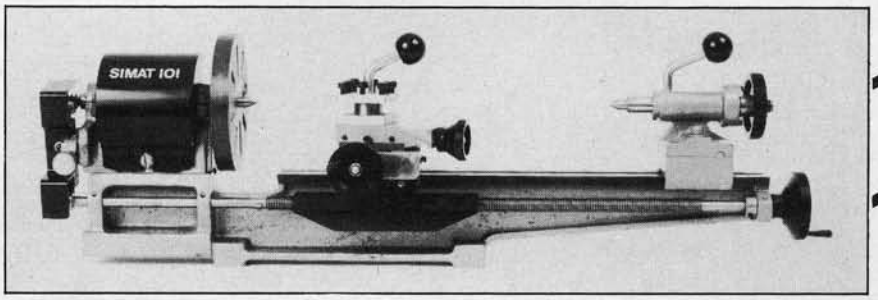

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Model Mechanics

Volume 1 Number 12
January 1980

A 40-year-old clockwork powered Alfa Romeo P.2. See page 671.

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Our regular Meccano feature by Bert Love has shown some incredible models, that when you think about it are made from very simple components, strip, flat shapes, wheels, etc.

I would like to publish some examples of the models you have built, perhaps using similar components, or from materials that at first sight one may not think of using. Only last week I read an article on the construction of large scale radio controlled aircraft, and these chaps for instance, use artists' Bristol board for covering parts of the fuselage.

Talking of aircraft, a Mr. Peter Price has written to the office asking for help with his latest project. This is to be an airship capable of carrying 4 lb. in weight. The idea is to use the airship to take aerial photographs in connection with geological studies.

I have in fact passed Peter's letter over to Ray Morse (designer of the Double Eagle II hot air balloon), as I know he has built and flown one.

Perhaps you have made an airship or have ideas on the subject, if so how about sending details to me, I am sure Peter would be most grateful for any help. Maybe I will be able to publish the results of Peters efforts if all goes well.

A note to any one wishing to submit an article. Good black and white photographs, preferably 5 in. × 7 in. prints or the negs, and drawings, should give as much information as possible, we can always delete, but it is often hard to fill in detail.

Book Reviews

'How About Railway Modelling', by John Craven and John Cackcraft. Published by E:P. Publishing Ltd., East Ardeley, Wakefield, W. Yorkshire WF3 2JN.

John Craven, new to the hobby, gives a refreshing insight into the world of model railways. Apart from catching the atmosphere of the hobby and helping you choose a railway system, joining a club etc. Part II of the book by John Cackcraft gives a very comprehensive coverage of the construction side.

There are well illustrated sections on baseboard building, track laying, electrical work and making scenery. An excellent book and good value at £1.50.

'LBSC's Shop, Shed and Road', by Martin Evans. Published by Argus Books Ltd., 14 St. James Road, Watford, Herts. Priced at £4.25.

This well-established book on the construction of miniature live steam locomotives, first published in 1929 and then reprinted as 'The Live Steam Book' in 1950, has been completely revised by Martin Evans, with new drawings and plates together with additional chapters, it appears again under its original title. For anyone at all interested in the construction and working of a live steam locomotive, this book is a must!

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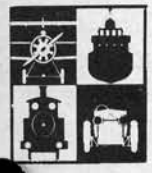

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Meccano

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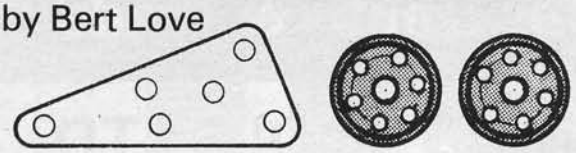


This article reviews the second of the two new Meccano kits "Space 2501" and suggests some modifications and developments which will be of interest to the progressive model builder. All manual diagrams, edited for this article, are by kind permission of Meccano Ltd.

A BRILLIANT combination of standard Meccano parts, in white enamel, with purpose designed special parts has produced a most attractive construction outfit aptly named "Space 2501". A glance at Fig. 1 shows what can be done with this latest product of Binns Road; Liverpool. This model, the Federation Protector, is one of twelve models illustrated on the front cover of the manual supplied with each set. Construction of all models is straightforward and almost self-evident and although no motorised mechanisms are included, these are very much "action" models thanks to the special components which have been designed and developed to give the outfits an attractive and a degree of realism to the finished models which is comparable with that of detail found in advanced plastic kits. Moreover, the rugged and versatile standard parts add many advantages over a standard plastic kit. Regular Meccano modellers may find many of the new parts quite unfamiliar, a number of which are seen in the close-up views of details on the Federation Protector as shown in Figs. 1a and 1b. A series of line-drawings appear in the set manual to illustrate the function and application of these new parts and the edited drawings are reproduced in this article.

Fig. 2 shows the main missile launcher which is a die-cast component attached to any model by a ½" Bolt and Nut so that it may be set to a pre-determined angle of launch. The main missile, shown at B has a hollow stem which is placed over the launcher spigot and pressed back against the compression spring and then twisted slightly until the rear fins of the missle are located against the stop ramp (x) and the holding lug (y). A firm red plastic material is used for the missile body but its black conical tip is made of a very soft rubber-like plastic to avoid any injury to the person when the rocket is fired by twisting the fin out of engagement with the holding lug (y). Two secondary missile launchers are also included in the set and are illustrated in Fig. 3. This time it is necessary to remove the elevating unit of the launcher (by springing open the plastic sides of the lower section) to gain access for the ½" fixing bolt. Retention of the smaller

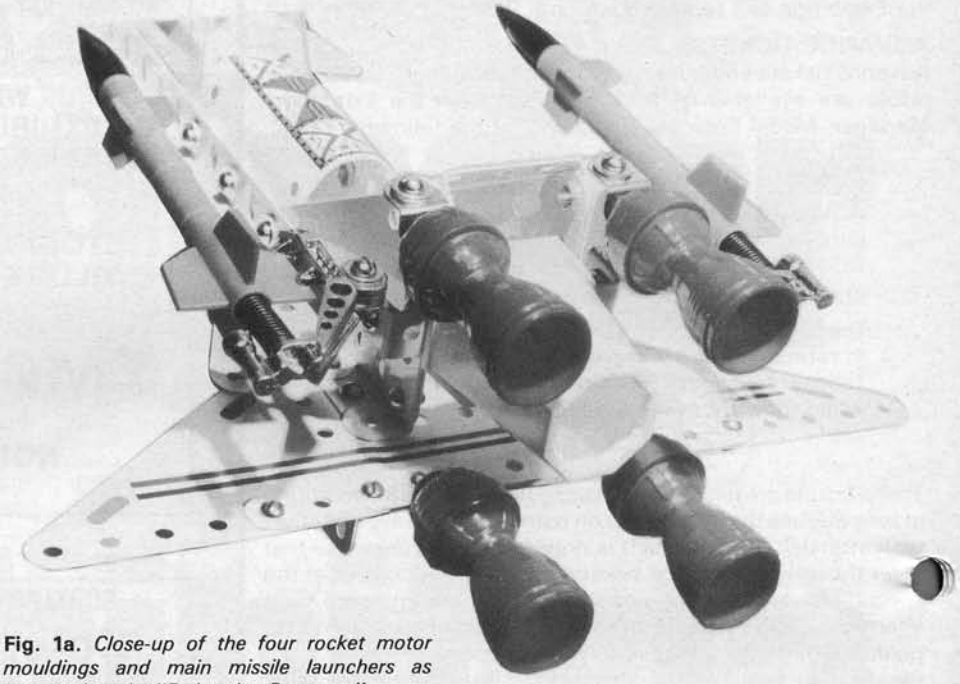


Fig. 1a. *Close-up of the four rocket motor mouldings and main missile launchers as mounted on the "Federation Protector".*

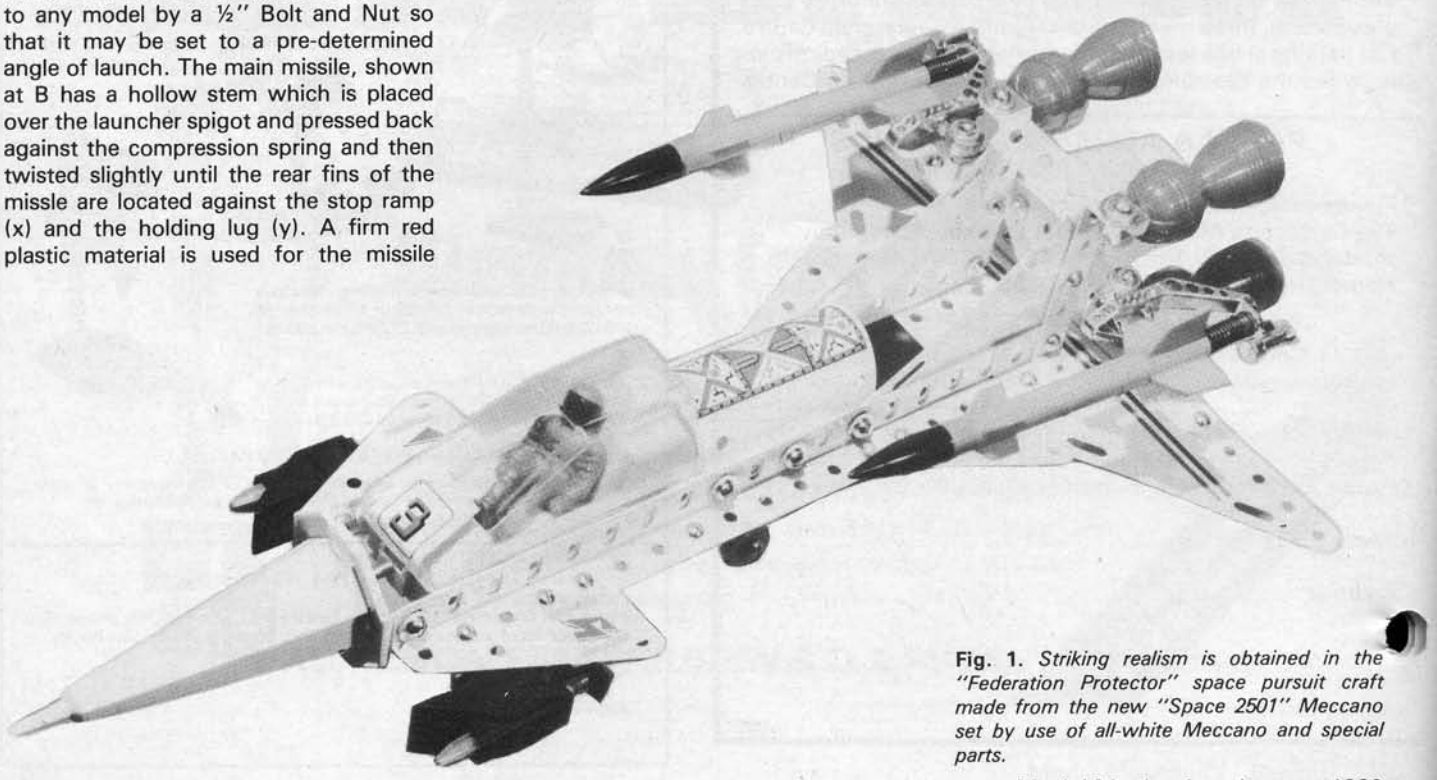


Fig. 1. *Striking realism is obtained in the "Federation Protector" space pursuit craft made from the new "Space 2501" Meccano set by use of all-white Meccano and special parts.*

missile is by means of a notch moulded into the rear of the upper section of the launcher and it is advisable to support the launcher at point D when firing the missile by downwards pressure as shown.

A simple, but realistic rocket motor, which snaps together in two halves, as shown in Fig. 4 may be attached to the rear section of any model by a ½" Bolt although experienced constructors can make do with the standard length Bolt. Made in bright red plastic, up to four of these motors may be fitted to the published models. Perhaps the widest departure from the standard Meccano parts in the three-part cockpit unit illustrated in Fig. 5, which relies entirely on four plastic 'pips' on each side of the canopy which coincide with the ½" spacing of Meccano Strips and Girders. Two tips at this stage will help the constructor when fitting the cockpit. In the author's modified model shown in Fig. 1 the astronaut is first attached to his "couch" by his very convenient plastic 'tail' which will be found to accept a standard Meccano Nut which will self-thread itself onto the tail and will hold the astronaut securely in place. Between the parallel 9½" Angle Girders forming the main body side supports, a pair of 5½" Strips are fitted, one hole back from the front of the model to give a tight wedging effect to the cockpit canopy and it will be found that the four 'pips' lock firmly into the holes of the 5½" Strips. Two other modifications to the Federation Protector may be seen in the close-ups of Figs. 1a and 1b. One of the two spare 5½" Strips in the set is bolted across the top rear edge of the tail plane to reinforce it and the under belly is strengthened under the cockpit by using two 2½" Strips in the positions shown in Fig. 1b. These strips are 'robbed' from the tail fins, but are replaced there by 2½" Double Angle Strips (giving a stronger construction at that point). Two more 2½" D.A. Strips are used as additional bracings below the body, the forward one giving improved supports for the secondary missile launchers. No extra parts are required for these improvements.

Supersonic realism is given to the space pursuit craft by a versatile three-section nose cone which is illustrated in Fig. 6. A view of the cone base is given in the parts list of Fig. 8 and this is first attached to the model in the appropriate position with a choice of three holes. The nose cone (front) is shown at J and it clips directly into the base. When combined with the rear section, at K, the long nose version is obtained. Used on its own, as at K, the rear nose cone may be used as a jet intake or exhaust and it can even be fitted to the base concentrically with the front nose cone as shown at L. As the cone sections are made in hard white plastic, it goes without saying that these models must never be thrown with any force in the direction of another person, where safety demands the use of common sense. Apart from the manual, a sheet of self-adhesive Vynyl-type coloured labels is provided with each Space 2501 set and these have both excellent adhesive and decorative properties. They are re-usable so may be transferred to different models.

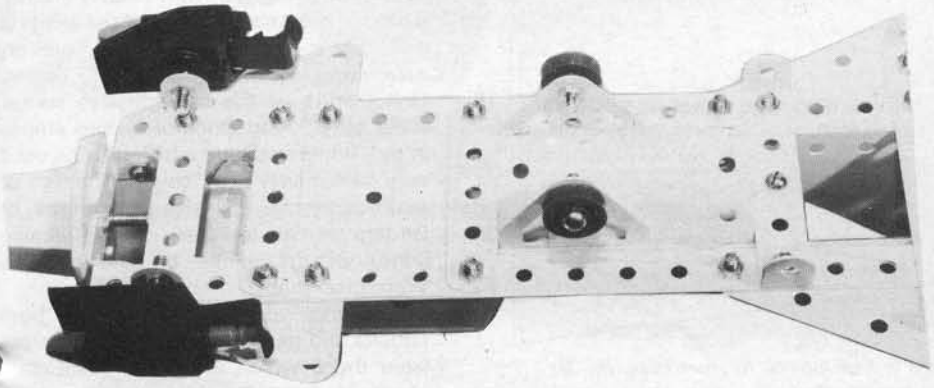


Fig. 1b. *Underbelly view of Protector, showing reinforcement in construction by use of 2½ in. strips.*

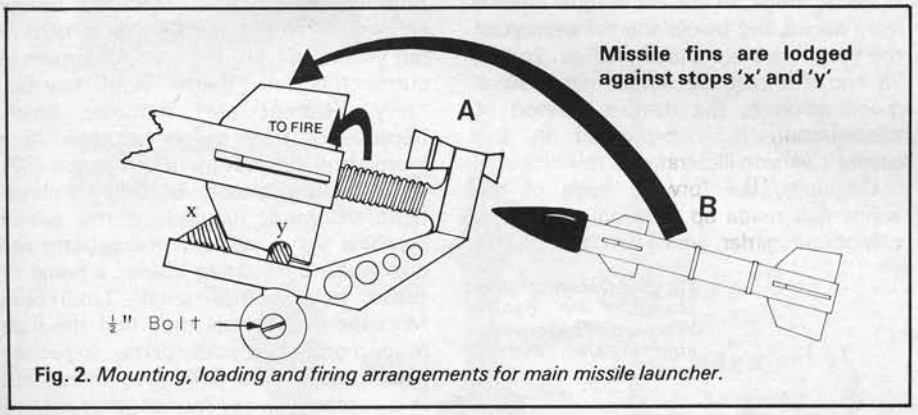


Fig. 2. *Mounting, loading and firing arrangements for main missile launcher.*

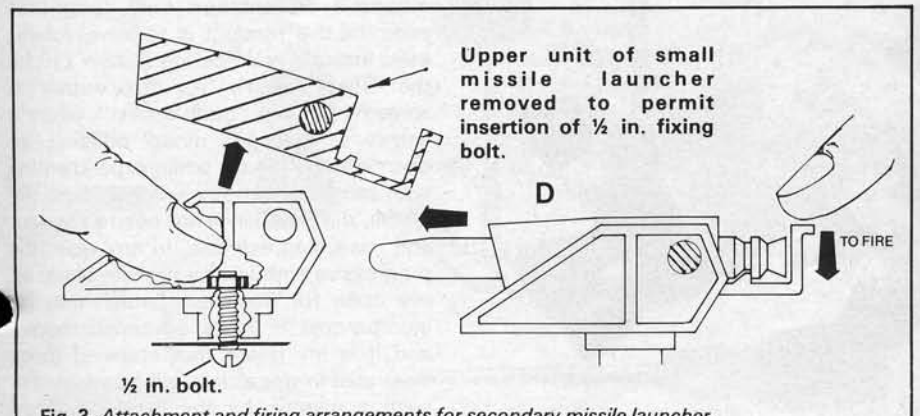


Fig. 3. *Attachment and firing arrangements for secondary missile launcher.*

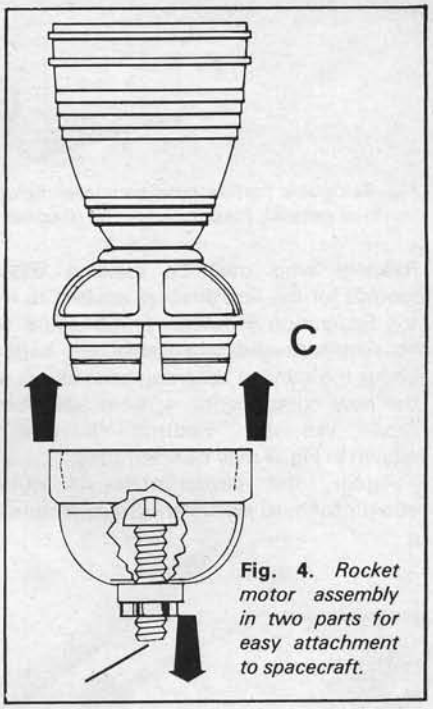
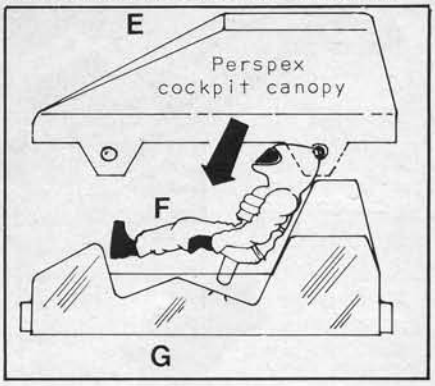


Fig. 4. *Rocket motor assembly in two parts for easy attachment to spacecraft.*

Fig. 5. *Moulded plastic cockpit and canopy.*



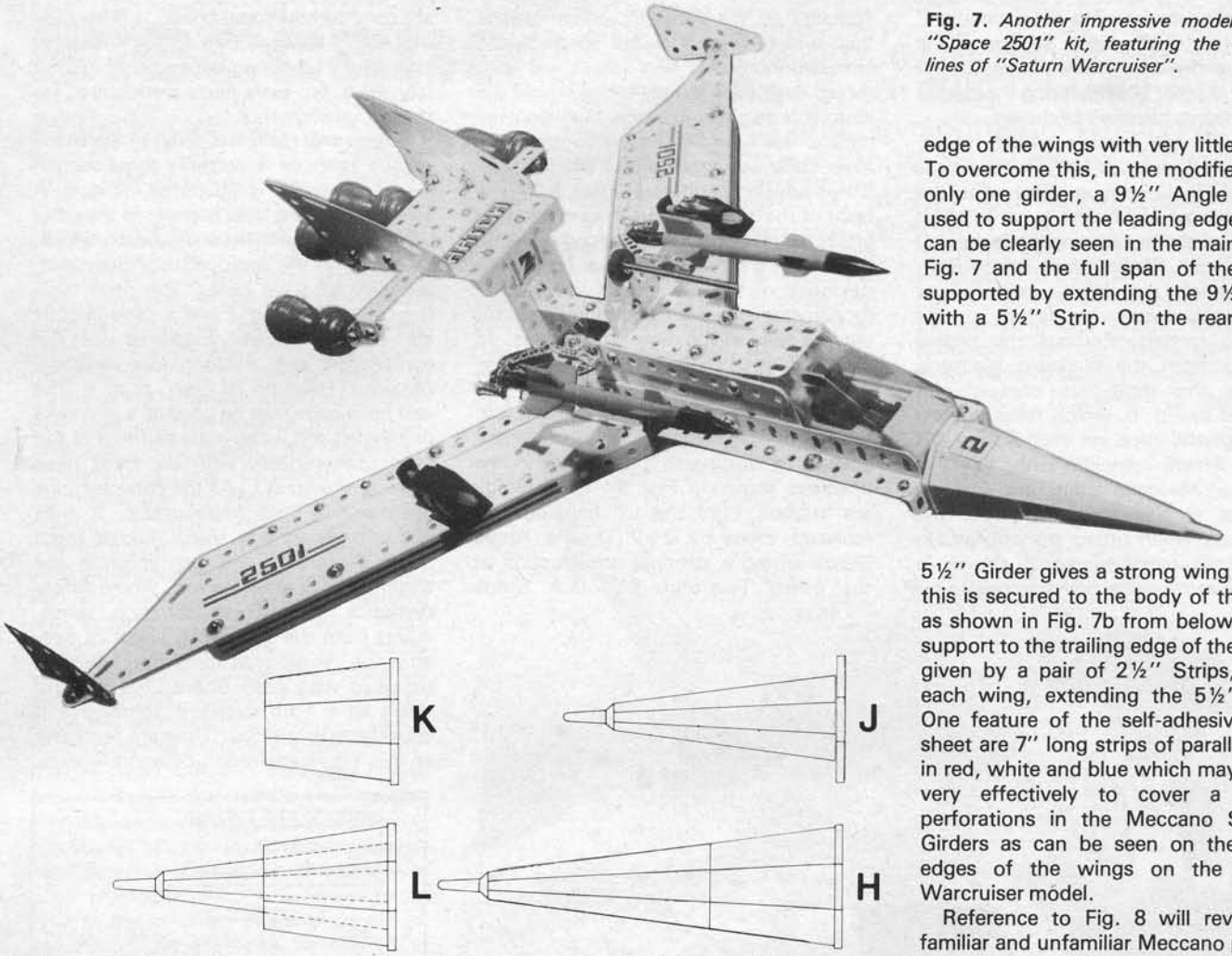


Fig. 6. *Double section nose cone may be utilised in four modes. (j) short nose, (k) Jet intake or exhaust, (h) Long nose and (l) concentric ram-jet entry.*

Readers who may be tackling these models for the first time are advised to try the Federation Protector first because of its simplicity and when they are happy about the general assembly and fitting of the new components, a more advanced model like the "Saturn Warcruiser", shown in Fig. 7 may be attempted.

Again, the construction is quite straightforward and is shown in pictures, stage by stage, in the set manual. Views from above and below the tail section of the Warcruiser are shown in Figs. 7a and 7b and it should be noted that a small modification to the manual method of construction is incorporated in the author's version illustrated in this article.

Originally, the forward edge of the wings was made up from an overlapped compound girder which left the trailing edge of the wings with very little support. To overcome this, in the modified version only one girder, a 9½" Angle Girder is used to support the leading edge and this can be clearly seen in the main view of Fig. 7 and the full span of the wing is supported by extending the 9½" Girder with a 5½" Strip. On the rear edge, a 5½" Girder gives a strong wing root and this is secured to the body of the cruiser as shown in Fig. 7b from below. Further support to the trailing edge of the wings is given by a pair of 2½" Strips, one on each wing, extending the 5½" Girder. One feature of the self-adhesive sticker sheet are 7" long strips of parallel stripes in red, white and blue which may be used very effectively to cover a row of perforations in the Meccano Strips or Girders as can be seen on the leading edges of the wings on the author's Warcruiser model.

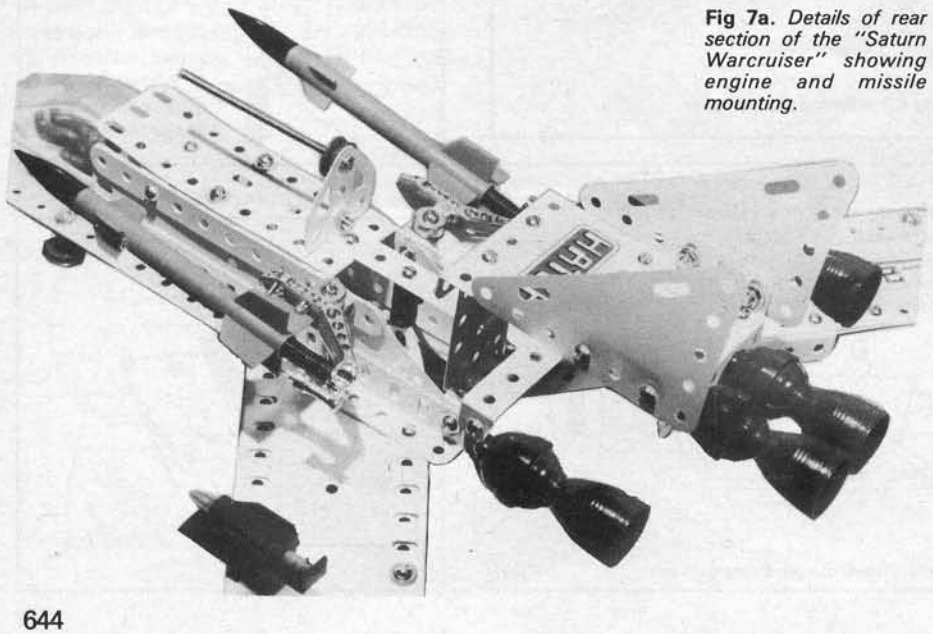


Fig 7a. *Details of rear section of the "Saturn Warcruiser" showing engine and missile mounting.*

Fig. 7. *Another impressive model from the "Space 2501" kit, featuring the supersonic lines of "Saturn Warcruiser".*

Reference to Fig. 8 will reveal both familiar and unfamiliar Meccano parts but even those which are existing standard components carry a different part number simply because they are enamelled white. Blue is the standard Meccano colour scheme for Strips and Girders in 1978-79 but yellow and Army green also appear in current Meccano "theme" sets. They too, carry different part numbers solely because of their colour scheme. One more attractive feature of the Space 2501 outfits is the supply of brightly-plated (zinc) domed headed Bolts which combine very well with the brilliant red and white contrasting colour scheme of these new space sets. Traditional Meccano enthusiasts may find the high proportion of special parts, expecially plastic ones, a little difficult to accept, but in a competitive toy market, modern and attractive presentation and design are essential if a product is to have volume sales inside a price ceiling (below £10 for the Space 2501). As the author is something of a "traditionalist" when it comes to Meccano model building, an open mind was kept while experimenting with samples of the new set and, on the whole, the experience has been a pleasant and rewarding exercise. In any case, the progressive enthusiast will always keep an eye open for new parts which may be incorporated in more advanced models and it is my guess that some of those illustrated in this article will be adopted in such a manner by the more advanced constructors.

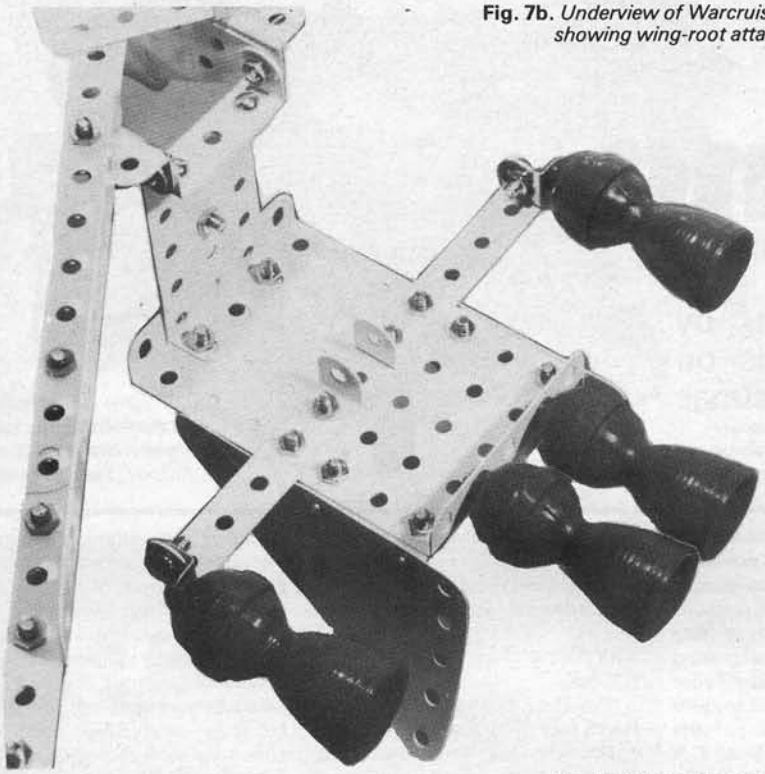
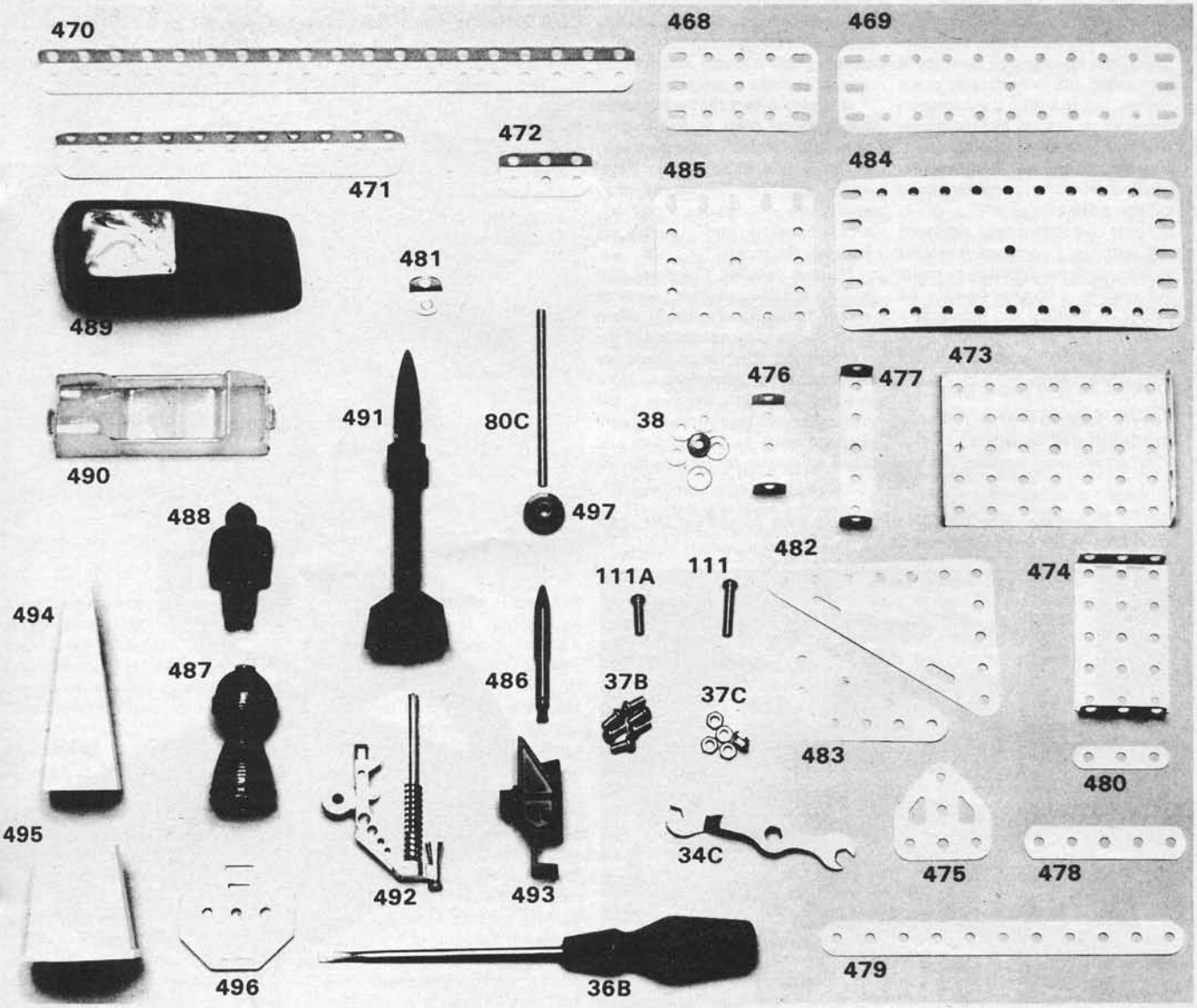


Fig. 7b. *Underview of Warcruiser tail section showing wing-root attachment point.*

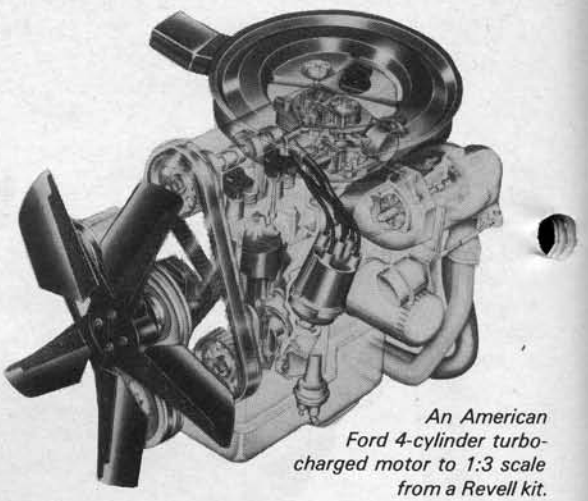
PART No.	DESCRIPTION	QTY
470	9½" Angle Girder	4
471	5½" Angle Girder	2
472	1½" Angle Girder	2
473	3½" x 2½" Flanged Plate	2
474	2½" x 1½" Flanged Plate	1
475	Flat trunnion	2
476	1½" x ½" Double Angle Strip	4
477	2½" x ½" Double angle Strip	4
478	2½" Perforated Strip	2
479	5½" Perforated Strip	4
480	1½" Narrow strip	2
481	½" x ½" Angle Bracket	8
482	3½" x 2½" Triangular Plastic Plate	4
483	2½" x 1½" Triangular Plastic Plate	4
484	5½" x 2½" Plastic Plate	2
485	2½" x 2½" Plastic Plate	4
469	5½" x 1½" Plastic Plate	2
468	2½" x 1½" Plastic Plate	2
486	Small Missile	3
487	Rocket Motor and Cap complete	4
488	Alien Space Man — Astronaut	2
489	Canopy	1
490	Seat	1
491	Large Missile complete	2
492	Large Missile Launcher Complete	2
493	Small Missile Launcher	2
494	Nose Cone Front	1
495	Nose Cone Rear	1
496	Cone Base	2
497	½" Plastic Pulley	8
498	Sheet of Self Adhesive Labels	1
36B	Screwdriver	1
34C	Spanner	2
80C	3" Screwed Rod	1
111	¾" Bolt	6
111A	½" Bolt	10
37B	¼" Bolt	80
37C	Nuts	85
38	⅜" Washer	20

Fig. 8. *Illustrated parts list of the new Meccano "Space 2501" construction kit, featuring many purpose-made parts.*



Winter Modelling

This review of modelling products by James and Rita Vanderbeek leads on from the December feature Christmas Modelling.



An American Ford 4-cylinder turbo-charged motor to 1:3 scale from a Revell kit.

Revell Engineering

Worth looking for are two of the latest Revell products — plastics assembly kits to build either a ¼ scale replica of an American Ford V-8 engine, or a $\frac{1}{3}$ size replica of a Ford 4-cylinder turbo unit.

When installed under the bonnet of the modern car and surrounded by a multitude of accessories — from battery to screen wiper reservoir or heater — it is not easy to appreciate the mechanical elegance of a modern IC engine. With either of these kits such difficulties are avoided because it is possible, not only to build one's engine, but to watch it work when powered by a small electric motor which operates the crankshaft, pistons, camshaft and valves, besides providing correctly timed ignition sparking.

These are beautifully prepared kits, with every component at least as accurately produced as its metal automobile counter-part. As means of learning the basics of a multi-cylinder high performance engine, these unusual Revell products are ideal.

Town, country and railway modelling in plastics

When we were working out the scope and content of this Model Mechanics feature, the arrival of the latest 1979/80 catalogue of **Faller** plastics model kits made us realise how this range has developed into a model making hobby in its own right. The **Faller** kits have long been used to build lineside accessories and adornments in both HO and N scales but, increasingly, enthusiasts are building up whole areas which represent sections of old time or modern cities, country locations and, of course, those in which rail, road and water transport plays a part.

It is also a fact that a European based range such as **Faller** is of constantly increasing appeal for, as more and more people travel about on the Continent, they appreciate its country, architectural and industrial features the more.

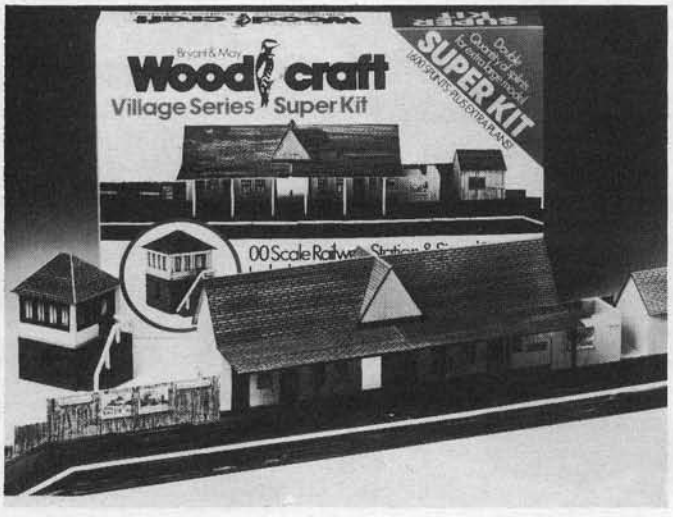
May we suggest, therefore, that as a specific project towards winter modelling activities — when plastics kits to be assembled in the warmth and comfort of home are at their most attractive — our readers should examine the possibilities of area-modelling with a range such as **Faller.** The kits have so much to offer with, or without, model railways to go with them, that their enjoyment by perhaps unexpected members of the family will result!

The Lone Star Match-Craft packs

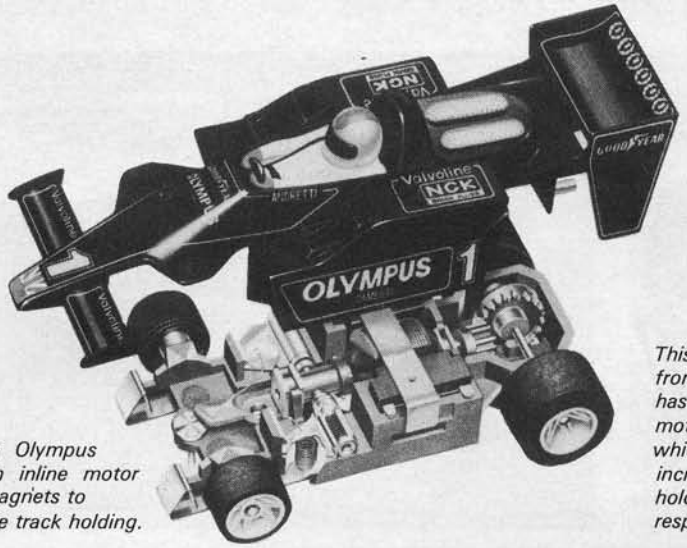
The Lone Star trademark now heads four groups of wood model packs with the Wild West, the Countryside, Historic Buildings and, in the larger Match-Builder kits which each contain almost 3,000 matchsticks, buildings such as a country inn, church, windmill, caravan and stagecoach.

The designs are universally attractive and, although a number of them have been slightly simplified for modelling in this manner, they retain the proportions and character of the prototypes very satisfactorily. The cowboy country group is particularly appealing, with its buildings including traditional structures such as a saloon, hotel, bank, livery stable and, inevitably, a fort complete with timber walls, massive gates, firing platforms and look-out posts. These kits have been checked out by the writers and found to be equally applicable to modelling newcomers and to

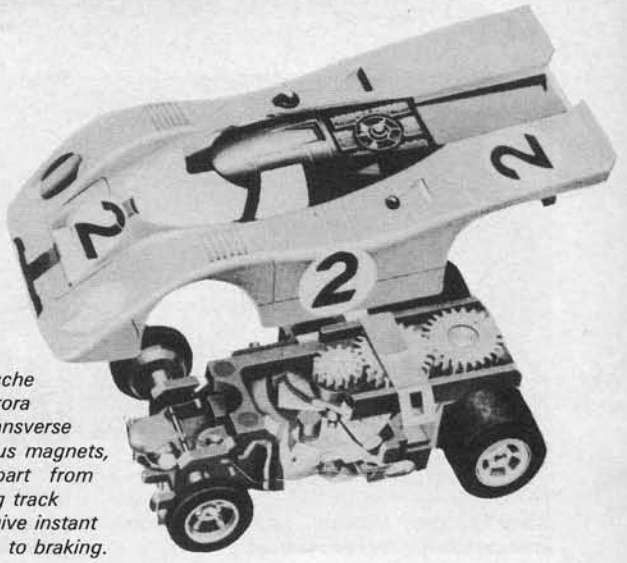
One of Bryant and May's Woodcraft outfits with completed OO scale station and signal box in foreground.



The p.c.b. Mini Drill with its adjustable stand, as distributed by Kam Circuits Ltd.



Aurora Olympus has an inline motor and magnets to improve track holding.



This Porsche from Aurora has a transverse motor, plus magnets, which apart from increasing track holding give instant response to braking.

more experienced builders. The sticks (about 950 in the smaller packs) are glued on to pre-cut board shapes, so that assembling panels of the right shapes and dimensions is made easy.

Matching crafts from Bryant & May

Although this is only the third year in which the company — best known for its means of generating flame — has been in the hobby and craft field, its products have been well chosen, well developed and well to the fore.

The Bryant & May Woodcraft range of craft packs takes over where those intended for very young users leave off, and includes several series of packs of different sizes and degrees of complexity. The subjects include a village pub, cottages, garage, church, railway station with its own signal box and an elaborate farmhouse with its outbuildings. Scale models of siege machines are also featured, including the Mangonel-catapult, a battering ram and a seige tower — wheeled and with three floors. The kits provide also for accessories to be assembled from extra plans supplied in the main kits so that these $\frac{1}{32}$ nd scale working replicas are a means of bringing history to life.

For modellers who require something with more than the usual scope in match model-making, there is a Make-Anything pack, which contains about 2,000 wood splints and simply an ideas sheet. These modelling ideas can provide the builder with construction themes, whilst the execution is left entirely to him or her to develop.

Each Woodcraft kit — these are in 00/HO scale — comes complete with a supply of wooden sticks, colour printed roof, window and door panels, glue, sandpaper and a special safety cutter with which the sticks may be cut accurately and cleanly.

Mini-drill with adjustable stand

A battery powered miniature drill which can be mounted on its own adjustable stand is available from **Kam Circuits Ltd.**

The drill has its own on/off switch and is neatly contained in a moulded plastics case. It weighs 260gms and turns over at 2,500rpm. Three drill bits are supplied with the unit. The drill stand is all-metal and provides for the drill to be held vertically and adjusted to give a range of operating heights. A return spring brings the unit back to its original height after drilling is completed.

This looks a neat and practical unit which can be used for a variety of precision drilling operations.

A Sinclair Digital Multimeter

We know that the new Sinclair PDM35 Digital Multimeter is a neat and compact unit because we have a pocket calculator which is contained in an identical plastics moulded case. Power for the meter is provided by a 9v battery of PP3 type — preferably high power or alkaline — but an AC adaptor is available as an option.

The meter is supplied complete with test leads and prods, a protective wallet and operator's manual. It is designed to be of particular service to development and field engineers, computer specialists, radio and electronic hobby users and has the advantage that precise digital readings are provided through every scale.

The Little Beaver Saw

In all modesty, **Neill Tools** state that the new Eclipse Little Beaver is "the most useful saw you'll ever use". To back the claim for this modelmaking size, hacksaw type tool, they supply it with three different and interchangeable 150mm blades — 32tpi for soft metals, plastics and fibreglass, 14tpi for woods and 7tpi for rough woodcutting. Other features include a neatly shaped pistol grop handle and simple positioning of the blades in the frame with screw and knurled knob assembly to adjust tension.

This looks a worthwhile modelmaking and DIY tool, one which is not only reasonably priced but which comes complete with a vacuum formed plastics storage tray which can be used to contain small parts.

Como Drills and accessories

Quite a large range of miniature drills and accessory equipment is distributed by Model Flight Accessories under the Como Drills banner. The range is based upon the Mini Plus 385 hand-held unit, which turns at up to 14,500 rpm, and can cope with 6-18v DC current. It has a chuck which will accept drills of between 0.1mm to 2.5mm. The Mini Plus drill is available as an individual item or in packs, with additional tools and a battery adaptor, or in a moulded plastics carrying case, complete with the mains transformer which is an optional extra either with or without a built-in speed control.

There is a most useful range of drills and other small tools matched to the basic unit, including abrasives, polishing wheels, diamond tipped burrs, saws and carborundum discs.

The Como Drills range can be applied to many types of model-making and model engineering, besides having wide use in craft activities including lapidary,

Some of the Humbrol craft tool packs. The knives all have interchangeable, locked-in blades.

PVC painting problems are overcome with Humbrol Upholstery paint—available in 12 colours.

jewellery, clock making etc. One other Como item which was especially interesting to your reviewers was the vertical drill stand, No. 402D, which not only encloses the standard drill in an adjustable container, but can be moved through 360° to suit those more difficult drilling and finishing tasks.

Humbrol craft tools

For quite a while now Humbrol have offered a range of craft tools which, as one would expect from this company, is well matched to the needs of model, hobby and craft users. The items are available both separately and in set packs, and include a Razor Saw which has a fine cut blade with negative rack to the teeth to allow it to be used without clogging on soft woods, Balsa and plastics materials. The Humbrol craft knife has a series of seven matching blades, including chisels and a keyhole saw, and these can prove invaluable for many modelling jobs. There is also a fine, half round, pointed file, tweezers in polished stainless steel and a disposable Hobby Knife which has a high carbon steel blade, set in a moulded plastics handle. These tools have a multitude of applications, not least for the aircraft and marine modeller where cutting precision is vital.

Mention might usefully be made here of Humbrol's series of dopes, thinners and colour finishes, besides the special fuel-proof lacquers which must be used on craft fitted with diesel and glowplug motors.

A new Burgess mini-bandsaw

Many years ago we learned that many modelmaking operations were within the scope of a good bandsaw. Certainly the cutting to shape of aircraft parts — wing ribs are a perfect example — can be rendered so simple that one wonders how one ever had the patience to cut them out by hand, singley, the hard way!

Now Burgess Power Tools Ltd. have introduced their Powerline mini-bandsaw, based on 2-wheel design, and study of its specification and of the photograph reproduced here has gone a long way to convincing us that it will be a boon to the modelmaker and the do-it-yourself enthusiast. Apart from hard and soft woods the new tool will cope with materials such as chipboard, hardboard, plastic laminates, acrylic resins (Perspex), hard and foam rubbers, thermo-plastic tiles, soft metal alloys and cork. A maximum cutting depth of 3 in. is available and the table size is 8.8 × 10.2 in. The saw has an overall height of 21.45 in., depth of 11.88 in. and width of 10.23 in., and the complete unit weighs less than 13 lbs. It is powered by a .15 hp electric motor which provides for a cutting blade rate of 2,000 ft/minute.

A bandsaw can prove to be one of the most useful power tools in the workshop — this one looks interesting.

Look, no hands, with a Handstand

Just announced by **Combined Optical Industries** is a very useful magnifier which can be used either hand-held or, in living up to its name, by having its handle fitted into a simple pressed metal stand so as to leave both hands free.

The magnifier lens, its outer rim and handle are all made as a single moulding in high-grade acrylic plastics material. This, of course, means that the magnifier is resistant to shatter and has good light transmitting qualities but care must be taken to avoid scratches on the lens surfaces. The lens diameter is approximately 4 in. so that both eyes may be used to view the work. When mounted on the stand there is provision for either of two positions to be selected so as to achieve the most comfortable viewing angle, according to the type of work.

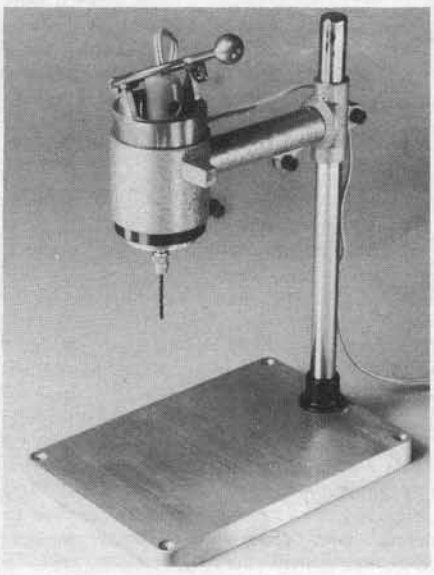
This multi-purpose magnifier looks as though it might usefully find a place in many modellers' workshops, particularly as its pricing is realistic.

Miniature precision tool sets

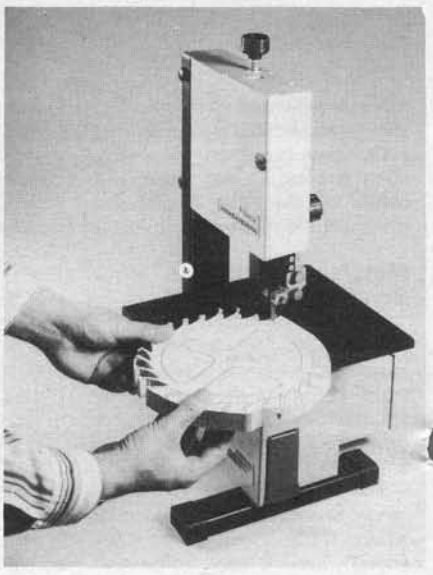
If, like your reviewers, you are never particularly confident that you have all the small tools necessary for modelmaking, four new sets from **Light Soldering Developments Ltd.** may well be of considerable interest. Each set comes in a moulded plastics pack,

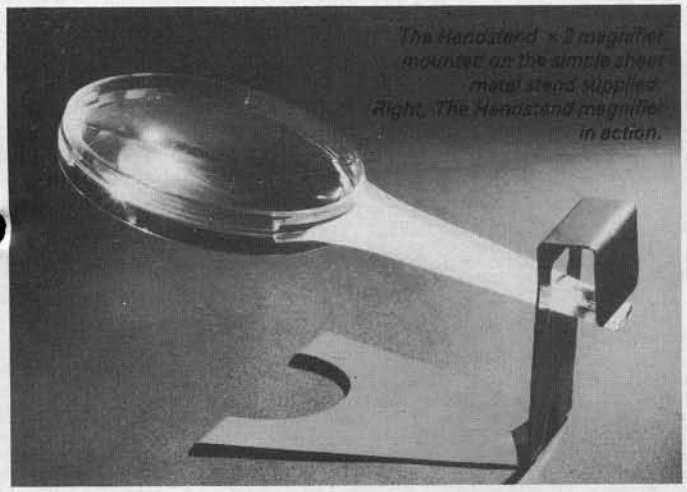
The Sinclair PDM 35 Digital Multimeter in its neat plastic case.

The Mini Plus 385 drill set up in the Many Direction stand from Como Drills.



The new Burgess Powerline mini-bandsaw which is ideal for many modelling tasks.

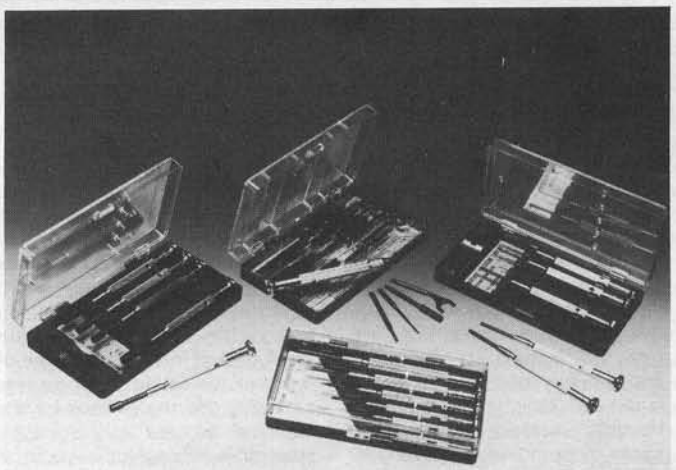




The Handstand × 2 magnifier mounted on the simple sheet metal stand supplied. Right, The Handstand magnifier in action.

with appropriately shaped nests for the individual tools, and clear plastics lids. The contents may consist of six instrument screwdrivers with hardened and tempered blades from 0.8 to 3.8mm wide; a nineteen piece combination set spanning $\frac{5}{64}$ ths to $\frac{5}{16}$ in. across flats in open and socket spanners, a socket head, a cross head, plain screwdrivers and a scriber.

The third set contains five metric box spanners with a tommy bar, ranging in size from 3mm-5mm. Last and, in fact, the latest Litesold product is a pack containing two cross-point screwdrivers, three hexagonal key wrenches and tommy bar. The screwdrivers and wrenches in these sets are all fitted with ribbed and chromium plated brass handles. They look extremely useful and have obviously a multitude of modelling applications.



Four of the miniature precision hand-tool sets from Light Soldering Developments.

Scalextric — the 20 years young slot racing system

The $\frac{1}{32}$ nd scale Scalextric range has been in production for about twenty years and has long been the most popular of its type in Britain. Throughout the period the cars, the track and all the accessories have been steadily developed and, in a number of instances, totally re-designed, so that the present range has a wealth of experience built into it.

The elaborate Scalextric catalogue offers a wide choice of sets, plus all the extra cars and other accessories that might be needed. The reliability and performance of the latest cars is extremely good. The Super Formula types available, as one would expect, cover most of the major Grand Prix cars with the most recent introductions being the Elf Tyrrell 008, the Elf Renault Turbo RS-01 and the Ferrari 312 T3 — all in appropriate racing team colours. Rally cars now include the BMW 3.0 CSL, besides the Triumph TR7, Mini and a Porsche. The third group of cars — also Formula 1 Grand Prix types — includes the new Wolf WR5 besides Brabham, BRM, U.O.P. and McLaren classics.

There are many track units available so that the layouts can be of any desired complexity and the number of lanes can be either 2, 4 or six. The catalogue describes various ways of getting the best out of Scalextric layouts, including races involving autostarts, lap counters and penalties, such as those "won" via the special cards now included in the Scalextric sets. Although the basis of the Scalextric system is that it is easily assembled and a market leader in ready-to-run sets, there is plenty of scope for slot racing enthusiasts who wish to bring it further towards a major hobby activity. It is great fun, yet every Scalextric layout demands different driving techniques, just as the cars are all highly individual in their handling characteristics. As Scalextric themselves say, driving a Super

Como Drills drill and variable speed transformer outfit in moulded carrying case.

Scalextric scene—with pit-stop and grandstand used to good advantage. Note also the 6-wheeled March F.1 car.

One of the world's most potent naval fighters, the F-14A Tomcat—modelled to 1/48th scale by Revell.

Formula car well does not necessarily mean that the driver's results with a Mini, even on the same track, will be as good . . . . and it is interesting to find out why!

Aurora AFX—a high efficiency 00/HO scale slot racing system

The scope and amount of modern technology which is crammed into one of the small Aurora AFX cars is quite surprising. The plastics moulded body shell, whether it be for a Lotus, Shadow or an Indianapolis Special envelopes a most interesting chassis which features a high performance motor, with long life armature bearings, ceramic magnets which double in simulating braking forces, replaceable silver plated current pick-up strips, and a Nylon crown wheel and pinion drive which ensures low friction in this vital department. The wheels have closed cellular sponge tyres on plastics hubs — of wide section and matched efficiently to the moulded plastics track surface.

Besides the cars mentioned above, the range also includes a number of sports-racing, saloon racing and rally cars, whilst special types are led by a police sedan with alternate blue and red flashing roof lights and even a selection of team trucks with 6-wheeled tractors and twin-axle, high cube trailers.

The system offers a comprehensive range of track sections, of various types and radii, plus special purpose accessories such as the lap-counter, which can be either a simple mechanical unit or an electronic counter with timing mechanism and LED display. New this year is the Aurora AFX Flex-track which looks something like scaled-down caterpillar track, and is just as flexible, to enable curved, humped, banked or cambered tracks to be individually arranged.

This new track is even available in one of the Aurora Sets — the GX 1300 and which also includes two saloon cars, controllers and all the necessary accessories. Very demanding is the Flame Thrower GX 1750 Set, which has a 24-hr race theme which involves a pair of headlamp equipped models to race on a circuit which includes two crossovers.

We treated a typical Aurora AFX Racing Set some time ago and, apart from the fact that it provided us with plenty of thrills, spills and excitement, was noteworthy for its mechanical and electrical reliability. This we regard as absolutely essential — especially in a small scale such as this, so the makers obviously have developed quite a system!

Hornby's live steam

All those people who thought Hornby Railways meant only electric power were very surprised when the 3½ in. gauge scale model of Stephenson's Rocket was announced. Live steam was back, albeit with the modern advantages of butane gas firing and neatly concealed reduction gearing. Add in the advantages of modern diecasting and plastics moulding and the reasons for the technical success and eminently reasonable pricing for a model of this type begin to be understood.

Each Rocket Set contains the locomotive and tender, plus operating accessories and 25 ft. of moulded plastics track — one which depends on its order of assembly for making up straights or curves. Extra track packs are also offered, either containing a further 25 ft of track, or with 'Y' points. It will be surprising also if appropriate rolling stock is not available in the new year but, in the meantime, the Hornby Rocket can provide the pleasures of large gauge steam.

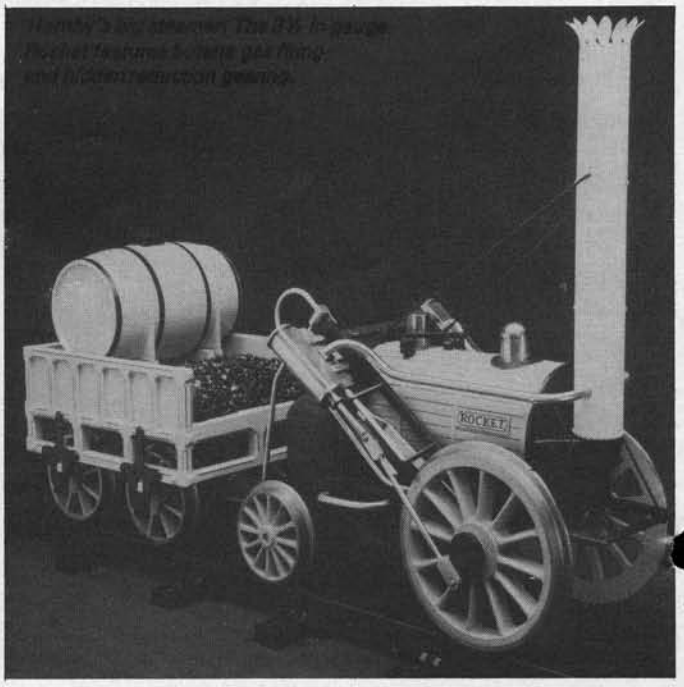
The Dunford Kites

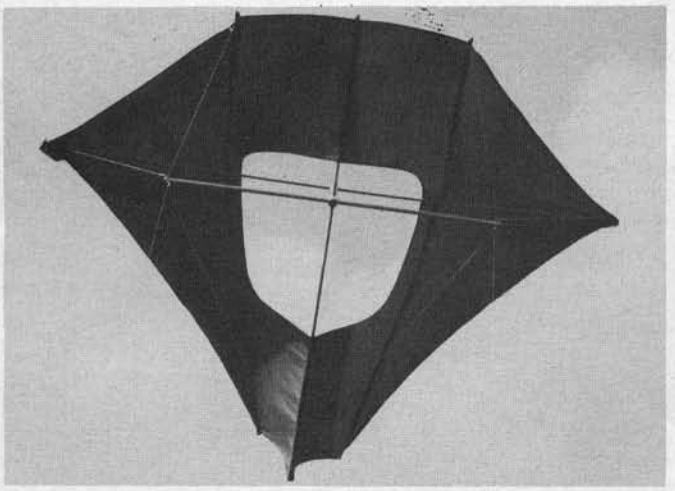
The original Dunford aerobatic kite was one of the first in or, should we say, on the field and it has maintained its popularity against the tremendous amount of competition which developed. The Dunford Flying Machine works on the now widely used twin-line principle and comes in three different sizes — 41 in., 51 in. and 81 in. span.

Also included in this maker's current range are various other designs, both for beginners and more experienced fliers, and they include a Flying Delta which has a sail shape rather similar to the original Avro Vulcan, with twin tails. It is a high flying kite but may easily be converted to twinline aerobatics.

Very intriguing are the Dunford Miniature Kites, which include shapes ranging from rabbit or butterfly to bird and shield, and which may be printed up by the owner.

Triumph TR7 1/32nd scale rally car from the Scalextric slot-racing range.





Two action shots of the Dunford Flying Machine twin-line aerobatic kite.

This range of kites has been, and is, one of the most successful produced in U.K. The aerobatic performance of the Flying Machine and other stunt fliers is consistently good and renders them excellent value for money.

Radionics with 'chips'

When, earlier this year, the latest Radionic experimental outfits were shown to the trade, there was universal interest in their incorporation of the new silicon chips — those minute components which can provide circuits built around them with better overall performance, besides louder and clearer amplication of sound from units such as radios.

The first Radionic outfit with chip incorporated is the Audio 5, with which experimental circuits for an AM/MW radio, burglar alarm, skin resistance tester, water level detector and a Morse Code trainer can be assembled on the special Radionic board. Wiring is made the easier by the use of coil spring connectors, into which the bared ends of both connecting wires and the smaller components are placed. There is provision below the deck for a loudspeaker to be installed and, in these days of expensive dry batteries, the incorporation of a reliable on/off switch must be welcome. A big feature of Radionic Kits is the inclusion, with every outfit, of highly detailed handbooks which describe not only the components and their uses, but provide theoretical and practical circuit diagrams.

Larger Radionic outfits in this new chips-plus group are the Radionic 70, with which no less than 70 different hook-ups may be completed, and the Radionic 140 which, as its name suggests, provides the almost indefinite enjoyment of building and using 140 different circuits. As winter-time outfits which make modern science real pleasure, this group takes a lot of beating.

Esci plastics kits from Italy

The latest Esci catalogue is a 24-page publication which covers a wide ranging series of $\frac{1}{24}$ th scale automobiles, $\frac{1}{48}$ th scale aircraft and $\frac{1}{35}$ th scale military vehicles and soldiers. In the largest $\frac{1}{9}$ th scale there are British, German and American military motorcycles — including that remarkable tracked machine, the kettenkrad — plus the Volkswagen kubelwagen 4-wheeler which was the equivalent to the Allied Jeep.

The standard $\frac{1}{72}$ nd scale also is covered by Esci, with a very fine series of kits for German and Allied AFVs, trucks, soldiers and heavy guns. To complete the range there is a series of packs for dioramas depicting scenes of famous operations in Europe, Italy, Africa and Germany.

The Esci kits have been widely reviewed in U.K. and have merited considerable praise. Awaiting review in Model Mechanics at the time of writing are some of the latest Esci aircraft kits to $\frac{1}{48}$ th scale, and it will not be pre-empting our individual comments if we mention in advance that these are excellent.

Good books about good modelling

Only rarely in a feature such as this are we able to cover some of the publications which reach us via *Model Mechanics*. However, two superb catalogues are worthy of inclusion here for, quite by accident, they complement each other in subject and in specific content. First is the **Beatties** guide to 00/HO scale, British outline, model railways which illustrates in full colour the many ranges of ready-to-run locomotives, passenger coaches and freight wagons. This ambitious publication incorporates many new features, such as standardised copy pages providing all the necessary data on each loco or vehicle, plus guides to prices etc.

To keep up with the ever changing pattern of model availability, **Beatties** provide an up-dating service which includes self-adhesive, full colour printed, illustrations of new items to be mounted on the appropriate pages, besides additional pages of copy and illustrations to be added either as new units or replacements. An extra in **Beatties** 00/HO guide is the inclusion of a number of special offer vouchers — indicative of the intense competition in this field.

In considerable contrast, the handbook of scale model equipment and accessories issued by **W. & H. (Models) Ltd.** has most of its 200 plus pages devoted to the outfits, accessories and materials produced primarily for the enthusiasts who prefer kit or scratch building.

W. & H. include all the main scales and gauges, illustrate and

One of the new Radionic Silicon Chip experimental outfits. Note the spring connectors and the chip in place.

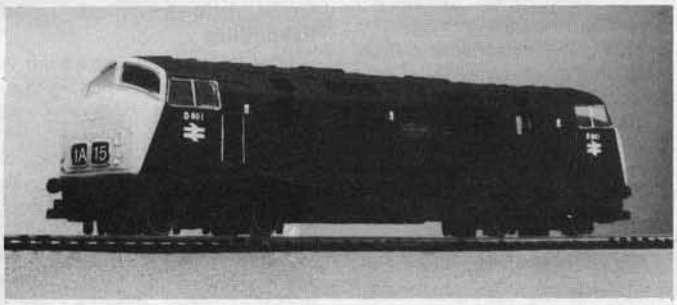
The multi-national Panavia Tornado—one of the excellent kits in the Esci range.

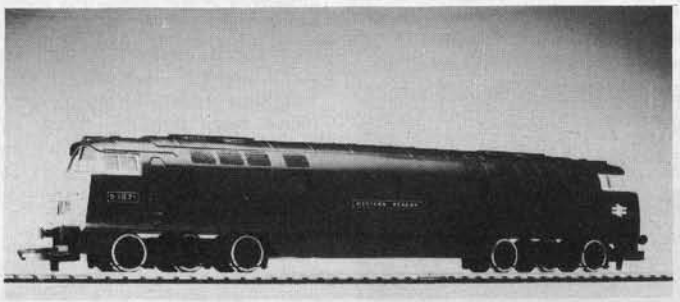
describe a high percentage of the vast number of white metal and plastics kits for locomotives, rolling stock, signals, scenic models and lineside structures that are available today. Also dealt with in detail are the many specialist kits for rail associated road transport — from the inevitable Mechanical Horse with its box or open trailers, to the buses and charabancs of pre-War days.

This book is not only one of the finest references extant as far as model railway catalogues are concerned, but also is a marvellous additional source of reference to many of the lesser known locomotive types. Both this book and Beatties guide are reasonably priced.

A Model Flying Handbook which was originally published in 1971 in Norway has just had its fourth printing and is now available in this country, in English, and as a paperback.

The book is not exactly an academic work on the subject, but it more than makes up for this in the practical approach afforded to almost every branch of model aircraft building and operation, and contains so much useful information that it most certainly qualifies for membership of the "hard to put down" group. The main illustrations (several per page) are line drawings and these are of a type which makes them worth hundreds of extra words. From a description of the various types of model aircraft, the book takes the reader through basic aerodynamics and on to the tools, materials, power sources and other aspects of the hobby. The main model groups merit chapters to themselves and, whilst the 160-page limit means that certain subjects inevitably are given only minimal space, this is still one of the best introductions to model flying that we have read for some time. It is distributed in U.K. by Ward Lock and costs £2.50.





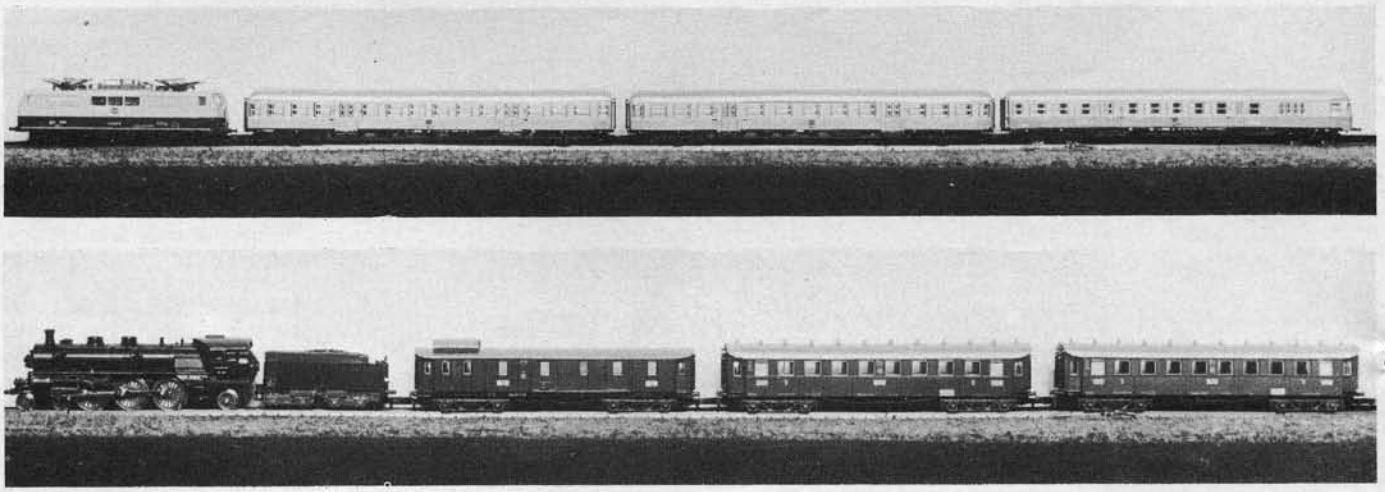
The BR (WR) Warship class loco, Vanguard, has now joined the highly successful Westerns in the Lima OO scale system.

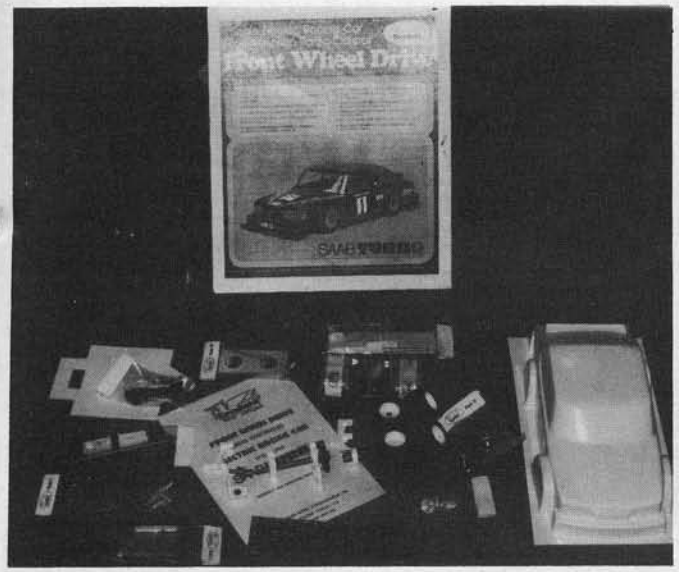
The fourth of our modelling publications, and by far the most ambitious, is the twenty-five year edition of The Hornby Book of Trains. It contains over 170 large pages, has full colour and black and white photographs and drawings in plenty and textually deals with the period between 1954-1979. It was edited by S. W. Stevens-Stratten, FRSA, whose qualifications for the task are beyond question, and it deals in interesting manner with the model railways hobby in general and the Hornby Railways story in particular.

The various sections are contributed by people who are specialists and it answers — as has always been one of the primary purposes of the Hornby books — many of the questions most frequently asked about the origins, the production and the operation of the models in this leading, ready-to-use, 00-gauge system.

As a production job the book has remarkably few shortcomings and represents outstanding value at £4.95. Our copy will be in constant use as a work of reference and this, we believe, will be typical.

How small can you get? Vintage steam and modern electric trains from the Marklin Mini-Club system of 6mm gauge models.





Bill Burkinshaw compares the design characteristics of two new 1/12th scale R/C cars by Micro-Mold and Cambria.

Contrast in Design

ALMOST simultaneously two major British kit manufacturers have released their contenders in the 1/12th scale electric R/C car market. Micro-Mold, long noted for their excellent range of moulded plastic modelling accessories and Cambria, whose R/C aircraft kits have frequently been innovative, both in concept and use of new materials, have both adopted totally different approaches in their quest for race winning pedigrees.

Although the basic concept of 6 × 1/12th battery pack driving a standard size electric drive motor with control over steering and speed via a resistor controller operated by 2 function R/C is common to both, practically, there is a wide variation. Surprisingly, Micro-Mold, with their extensive plastic moulding background, use only a limited number of injection mouldings in their conventional rear-wheel-drive car, whilst Cambria have not only broken new ground by choosing front-wheel-drive, embody a host of specially produced injection moulded parts for their kit.

Cambria's front-wheel-drive system is strictly orthodox employing a live axle with centrally mounted spur gear terminating in pegged ball joints to transmit the drive to the swivelling stub axles. The live stub axles incorporate the female part of the ball joints and run in 'oilite' sintered bushes. Several robust mouldings carry the centre portion of the axle and the stub axle. Front-wheel-drive almost certainly dictates a front moulded motor for the ideal of plenty of weight over the drive wheels. Exactly what the ideal weight distribution for a front-wheel-drive vehicle should be is open for debate, but doubtless, Cambria experimented to some length before determining the practical ideal arrangement for the car. Speed control for the Cambria vehicle is taken care of by a three-speed resistor controller driven by a servo, the resistors of which incidentally, double as dropping resistors when the 6 cell battery pack is charged from a 12 volt source.

Add to this power pod package a further array of mouldings to mount the rear axle, servo tray, body and steering servo saver and connectors, and the list of special mouldings incorporated in the kit becomes most impressive.

Micro-Mold have chosen to rely on their expertise in metalwork to quite a large extent, experience gained in manufacturing and kitting not only models such as the Lark helicopter but items such as retracting undercarriages $\frac{1}{8}$th scale R/C cars as well. The heart of the Micro-Mold model is the Astro 0.05 motor mounted in a formed sheet metal frame which carries housings for the PTFE bushes in which plain turned portions of the hexagonal section rear axle runs. The drive assembly closely follows the well established Lectricar (Bo-Link system) which does have the advantage of allowing very quick final drive ratio changes. The large drive gear simply slipping onto the hexagonal section axle being retained by the wheel which is locked onto the axle with an 'E' type spring clip. Motor pinions are grub screws retained onto the motor shaft.

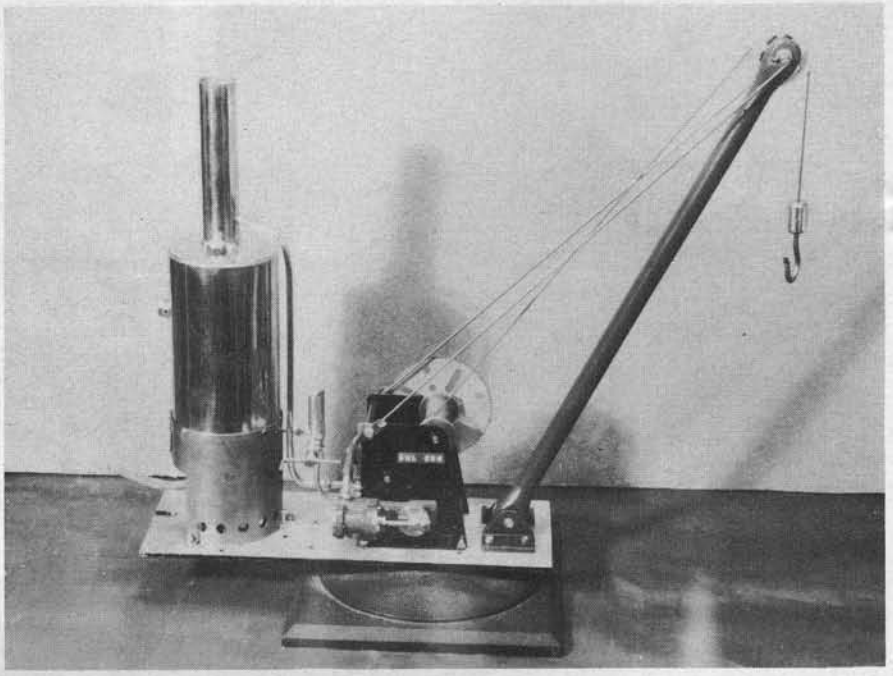
In common with the Cambria model, an aluminium alloy chassis is used, but in Micro-Molds case, the plate is flanged; a big plus this, for it should help keep handling characteristics constant by being more resistant to bending than a simple flat plate. Both alloy chassis, motor pool and battery tray are finished in a hard matt black paint, which coupled with the injection moulded axle, steering servo saver and spring steering pivot assembly, results in a neatly uniform look to the rolling chassis.

Speed control on Micro-Molds racer is catered for by a resistive mat proportional controller, which is servo driven. The resistive mat fits directly to the top of the servo case and wiper blades are attached to the servo output arm. A built-in resistor and charging socket allows the car to be charged directly from a 12 volt source.

How do they handle? To be fair, neither kit has yet been assembled so no real comment can be made. However, from experience it would seem likely that the Micro-Mold car by virtue of its comparatively stiff chassis and lack of king pin inclination, should have a positive feel to it and be fairly forgiving from the point of view of tyre choice on slippery surfaces. Cambria FWD Porsche, however, is a totally unknown quantity; if full size experience is anything to go by, though the front wheel drive should put road holding such as never before experienced in the hands of its builders. The theory is of course that you drive the front of the car where you want it to go and all the rest follows in direct contrast to trying to push an unwilling front end, round a slippery corner, from the rear! Time will tell.

Steam Crane

Part I Making the engine and winch frame. Described by Tubal Cain



I thought that perhaps it was time for something different. What better than a Steam Crane for the first New Year project.

I have specified the readily obtainable Meccano gears and to make things easier still I have used currently available castings for the cylinder(s) though the whole thing can be built up if desired. These are the "Popular" set, marketed by Reeves for 30-odd years, but any similar will do. For those in a hurry, Stuart Turner market a similar engine (the "S.T.") in machined parts. The rest of the bits and pieces will probably come from your stock or from "Jack the Scrap". The jib, for example, can be made from brass curtain rail, suitably stiffened with spacers, or from brass angle stiffened with lattice work or, as shown in the photos, from a piece of steel tube with two brake-rod fork-ends brazed on. So long as it's about a foot long and looks "proper" you can make it to suit yourself.

The "engine" can be a twin-cylinder, double-acting, cranks at 90°; twin single-acting, cranks at 180°; or even a single cylinder, double-acting on one side only. Mine has the twin DA set-up, and doesn't really need a flywheel, but the others will; so I put one on mine to make sure it would go in. The type of engine used won't affect the lifting capacity all that much, as the limit here is what it will carry without toppling over, not engine power. Mine will lift over 10 lb. with 10 p.s.i. of steam—if I clamp it down.

The boiler is a very simple pot, with a steam drying coil. The main problem is not *making* steam, as much as reducing blow-off; steam demand is intermittent, and there can be quite lengthy idle periods whilst loads are hooked on and balanced (a crane teaches a youngster quite a lot about centres of gravity and such) so I have called for a "top-hat" damper to go over one of the wicks to reduce fire in such periods. But you might care to consider using Meta fuel, and give the youngster a bit of experience in managing a fire. I *don't* advise this if there are any toddlers in the family as the tablets look too much like sweeties and won't do the tummy any good. You will notice I have called for a screw-plug as a water-level indicator when filling the boiler. Most people put a drain tap here, but I prefer a plug as there is less risk of the tap being opened when under steam; even at 5 p.s.i. this can give a nasty scald.

None of the unmarked dimensions is critical and you can adjust many others to suit yourself or the contents of your scrap-box. The base wants to be either large or fairly heavy (one I made 25 years ago was mounted on an old cast-iron pulley) and the pivot for rotating the crane should be more or less underneath the winding drum—forward of centre of the baseplate, that is—to give a bit of counterbalance. The rotating base can be of wood if you like, but I used a bit of steel plate well painted against rust from leaks. The "works" are thus located with "proper" bolts which won't work loose over the years as woodscrews might. In which connection, try to use nuts and bolts which will be easy to come by; e.g. 2-4-6 BA rather than 3-5-7; or even Meccano ones where suitable. Use 8 screwdriver slot bolts—this is a case where they are entirely appropriate, as it makes running repairs and periodic overhauls easier for the lad (or lass!) and it's better that he gets this sort of experience than that he has true-scale hexagons all over. So, to work.

Engine

Reeves can supply part-sets of the engines. For the two-cylinder job you require parts 3, 4, 5, 6 and 9; and two stands, part 10. If you decide to fit a flywheel (you must for the single-acting designs) this is part 1. I also suggest you obtain the screws, part 14. The drawing is part RV23, and it will help to have this, if only to save mucking up the magazine in the workshop. Start by making the following alterations to the drawing. *Stand.* Steam inlet and exhaust bosses to be $\frac{5}{32}$ in. drill (or to suit your steam pipe), not $\frac{3}{16}$ in. × 40; steam and exhaust ports drill No. 46, not No. 50; main bearing hole, $\frac{3}{16}$ in. *Cylinders.* Drill the ports No. 51, not No. 52. These changes will improve the performance of the engine on load.

Saw off the foot of the standard, leaving as much of the column available as possible, and also the bearing boss and rib at the back. File or mill the back dead flat and trim up the sawn-off end. Now mill or file the port face parallel to the back face—keep reasonably near to the $\frac{5}{16}$ in. dimension. File the boss of the main bearing to $\frac{1}{8}$ in. above this port face. Mark out the longitudinal centreline and fix the position of the crank bearing . From this, mark out for the pivot-pin hole (No. 34) and from this scribe at $\frac{5}{16}$ in. radius to find the centre of the ports. mark these out very carefully, start with a *very* fine dot-punch, enlarge the dot with a tiny drill, and then very carefully drill them No. 46. The idea of drilling the ports first is that if you make a boss-shot and have to plug and re-drill you still have the pivot pin centre to mark out from again. Drill the pivot hole, the two No. 23 fixing bolt-holes, and drill and ream the bearing. Put in a $\frac{1}{16}$ in. oil hole. (Get it right way up! The two frames are to opposite hands).

Mark out for the No. 42 passages (not needed on the single-acting engines) and drill these, finally drilling the bosses to fit whatever steam pipe you decide to use ($\frac{5}{32}$ in. is O.K.) through to meet the passages. Tap the no. 42 holes 6 BA just a few threads, screw in a short length of 6 BA brass, and seal with soft solder. Blow out all holes well with compressed air.

Cylinder

This is machined in the usual way—I don't think I need go through the process on a little chap like this. However, don't forget that it is *vital* that the cylinder bore be parallel to the port face. I recommend either milling supported on a mandrel through the bore *or* filing and scraping and measuring to a mandrel (a parallel one) to get this right. Again, mark out for the pivot pin and the ports, drilling the

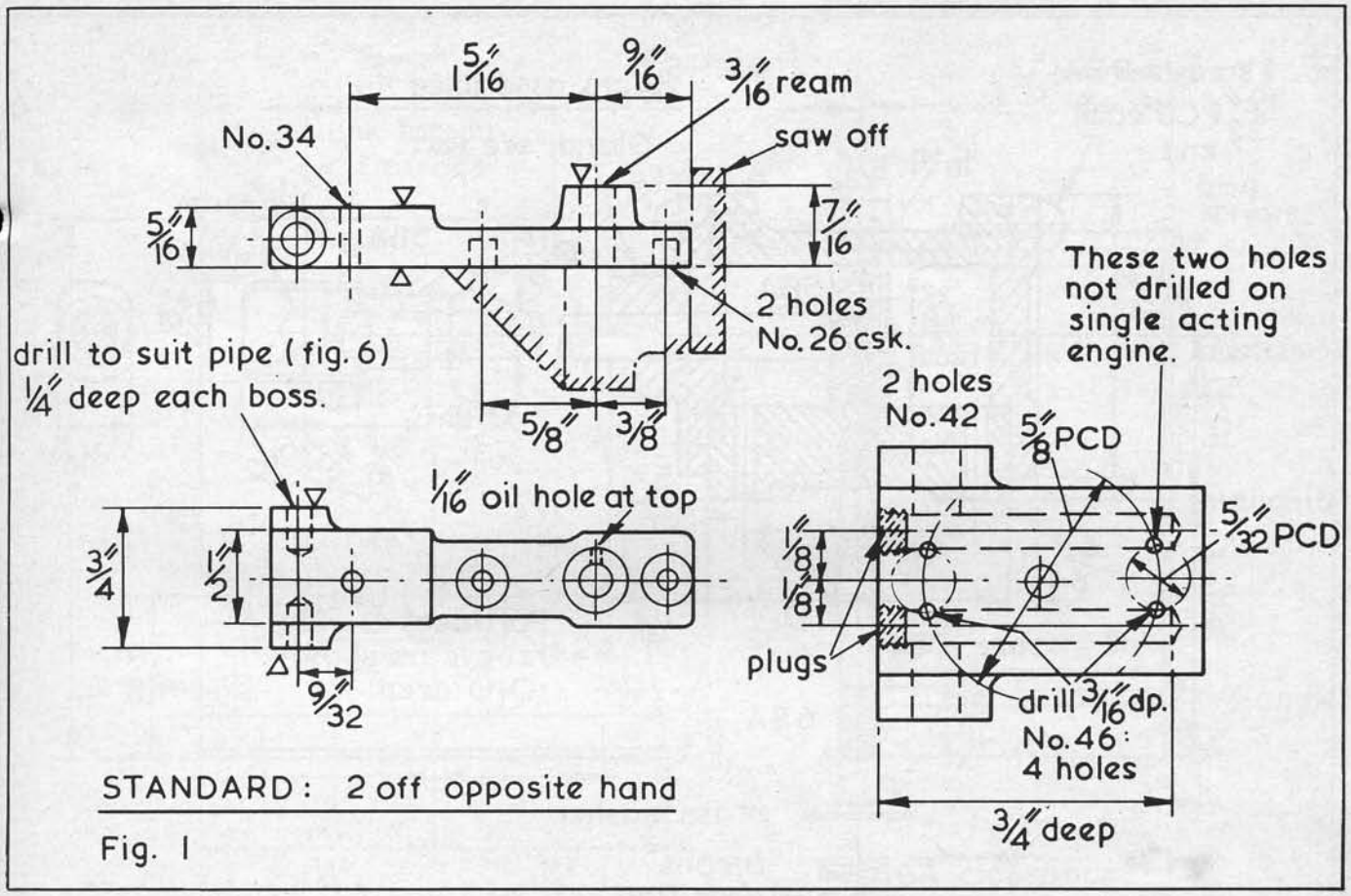
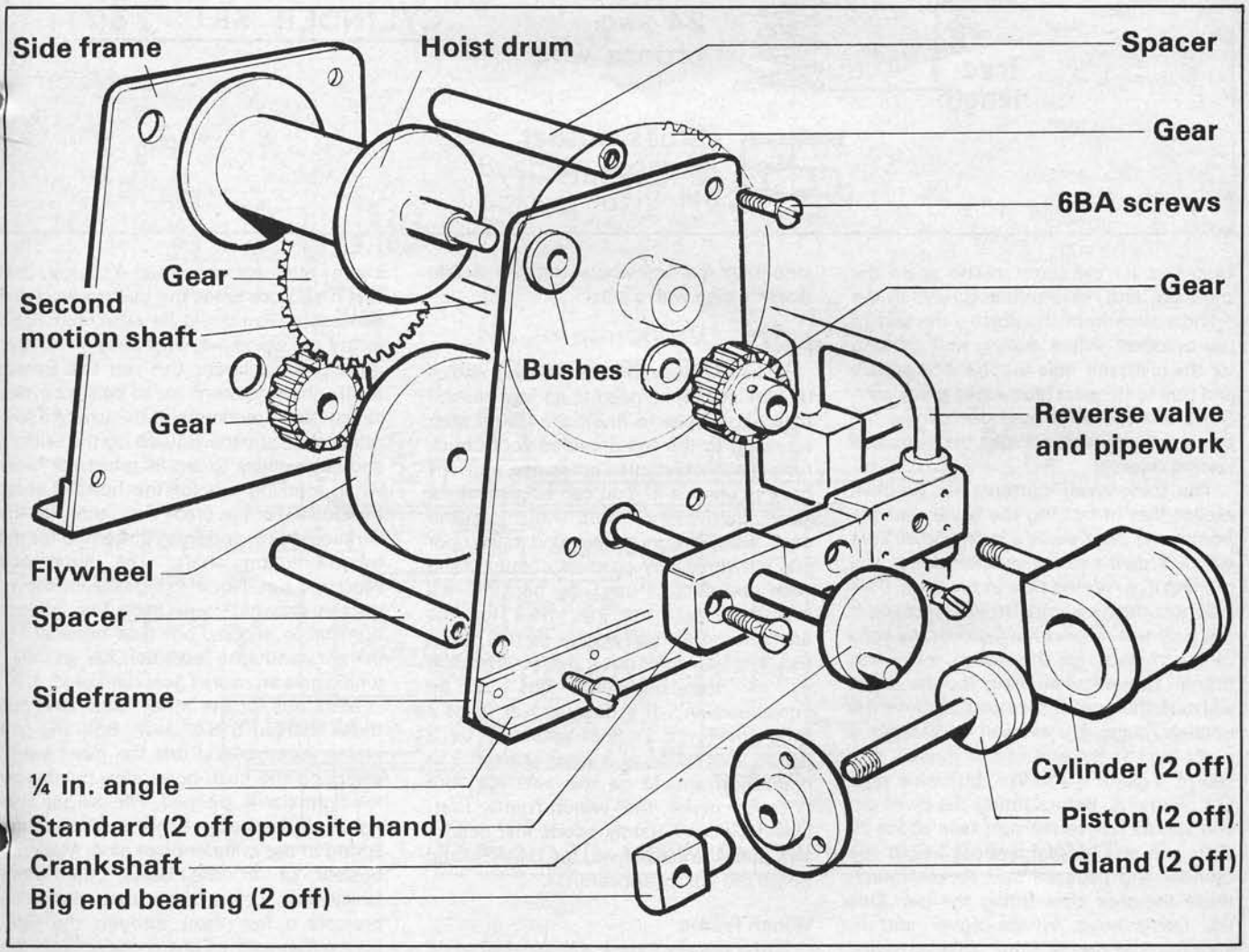

1 5/16
9/16
3/16 ream
saw off
No. 34
5/16
7/16
2 holes
No. 26 csk.
These two holes
not drilled on
single acting
engine.
drill to suit pipe (fig. 6)
1/4" deep each boss.
2 holes
No. 42
5/8 PCD
5/32 PCD
1/16 oil hole at top
3/4
1/2
1/8
1/8
plugs
drill 3/16 dp.
No. 46:
4 holes
9/32
3/4" deep
STANDARD: 2 off opposite hand

Fig. 1


Side frame
Hoist drum
Spacer
Gear
6BA screws
Gear
Gear
Second
motion shaft
Bushes
Gear
Reverse valve
and pipework
Flywheel
Spacer
Sideframe
¼ in. angle
Standard (2 off opposite hand)
Crankshaft
Big end bearing (2 off)
Cylinder (2 off)
Piston (2 off)
Gland (2 off)

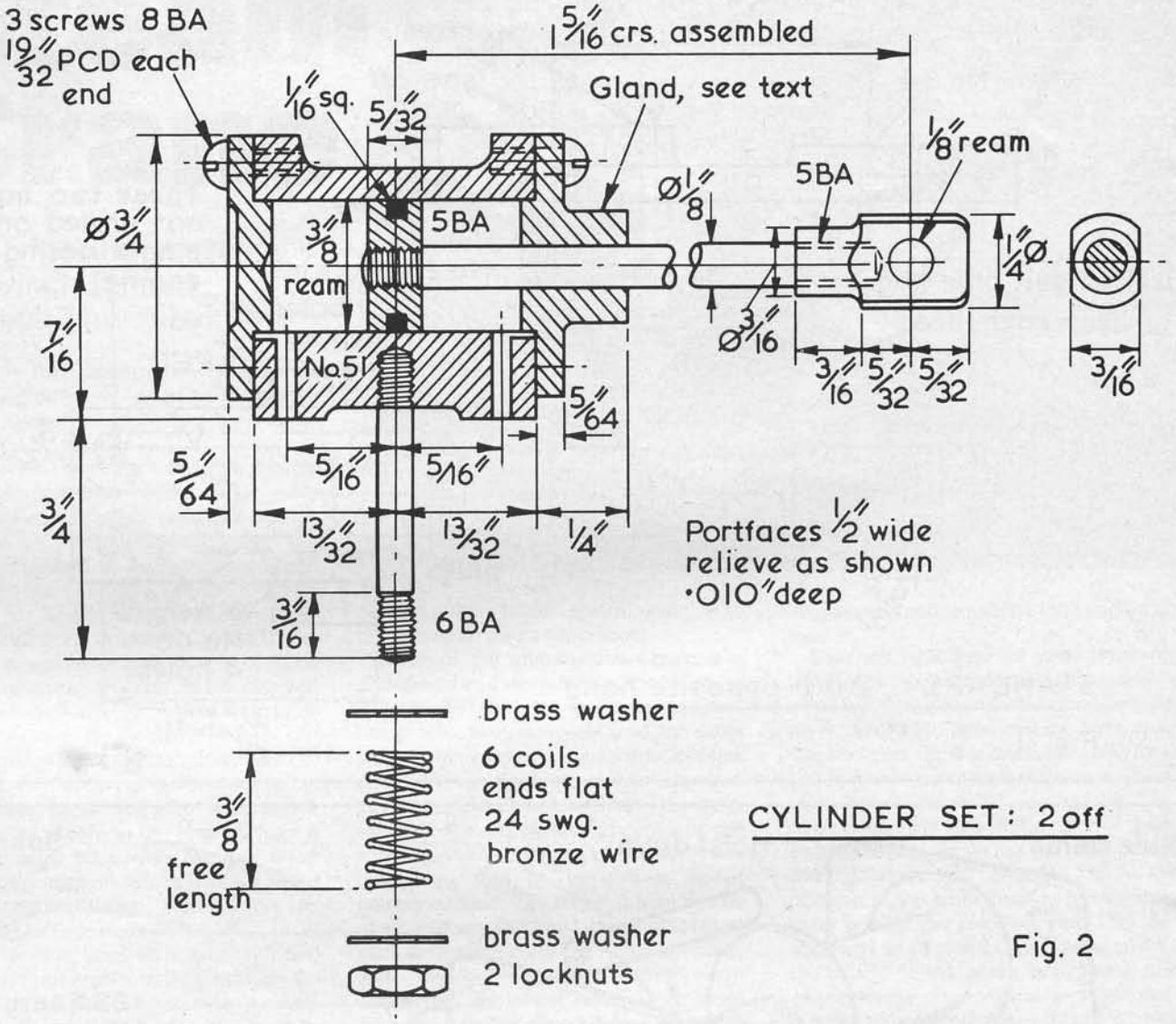


Fig. 2

latter first for the same reason as on the standard, and make a little groove in the cylinder bore from the port to the end of the cylinder. When drilling and tapping for the pivot pin, this too *must* be square and true to the port face—take great care. Don't drill too deep, and don't force the pin in so hard that it bulges the bore; use Loctite instead!

The back cover presents no problem except that of holding the brute, but the front cover does show a rather fiddly little gland. *I didn't use one*, my piston rod running in a reamed hole in the boss. This is almost dead steamtight, *but* if you do it this way you must run a file over the tops of the threads on the piston rod when fitting. The act of running the die down will raise the tops of the threads above the nominal diameter, as well as leaving a nasty burr at the end of the thread. You can fit a gland if you like, but mine runs O.K. without. Before fitting the pivot pin you should relieve the port face about 15 thou and also "make smooth" both the cylinder and pedestal port faces—match these together after fitting the pin. Drill the fixing holes in the cover and in spotting through to the cylinder make sure that the screwhole (tapped 8 BA) doesn't align with a port!

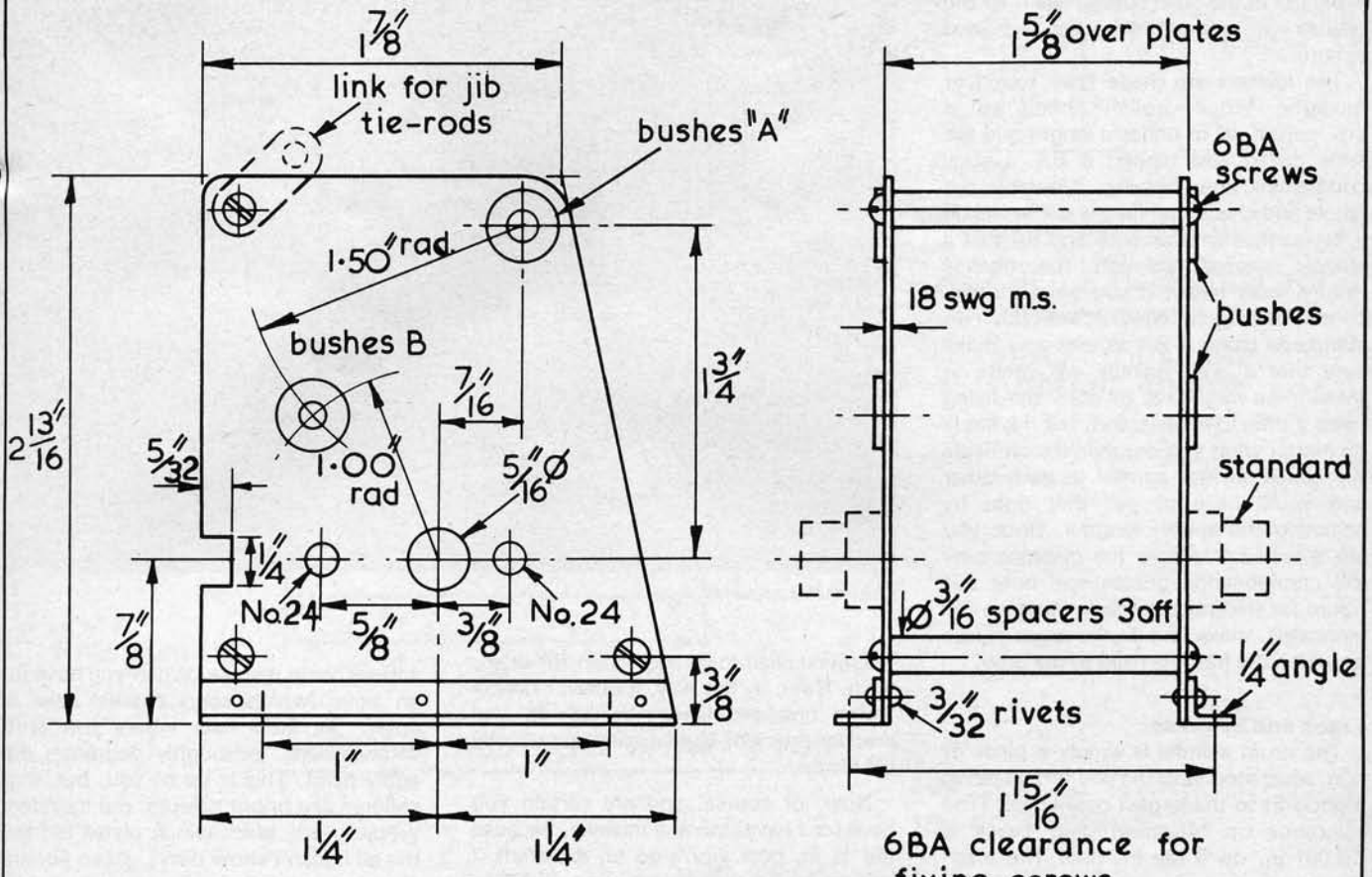
Piston

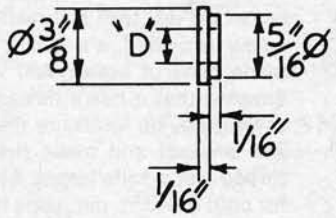
Make the piston of brass, the big end of bronze. Again, no need to go into detail, I think. It will pay to finish the piston after screwing to the rod provided your chuck runs reasonably true, otherwise you will have to chance it. You can either make a single groove $\frac{1}{16}$ in. wide and deep, and pack with cotton thread and tallow, or just cut three tiny grooves about 5 thou wide and deep. I used the packing. It's important that the $\frac{1}{8}$ in. hole for the crankpin be at right-angles to the piston rod, and you can't put it right by bending it, as the big end has to be "unscrewable". If it does appear to be a trifle cock-eyed in final assembly try a *gentle* application of a taper reamer! The crankshaft should be the next job, but best to make the winch-frame first. Oh—Flywheel. Hardly needs instruction, but machine it all over for balance and polish the rim for appearance.

Winch Frame

Either brass or steel will do—I used 18 s.w.g. steel for economy! You may feel that if you use brass the bushes won't be necessary; you could be right, but don't forget the crane may well pass on to your great-grandchildren! Cut out the frames to the shape shown—or to suit your own ideas—and I recommend the use of a saw rather than shears. Square up the bottom and back edges to act as reference faces when marking out for the holes. Locate the centre for the crank first, then for the winding drum, and from these two for the second-motion shaft. The sizes and Meccano Cat. No. of the gears are shown on the drawing—you need two pinions nominal ½ in. dia., one gear nominal 1½ in. dia. and one nominal 2½ in. dia., which give an overall gear ratio of 15:1.

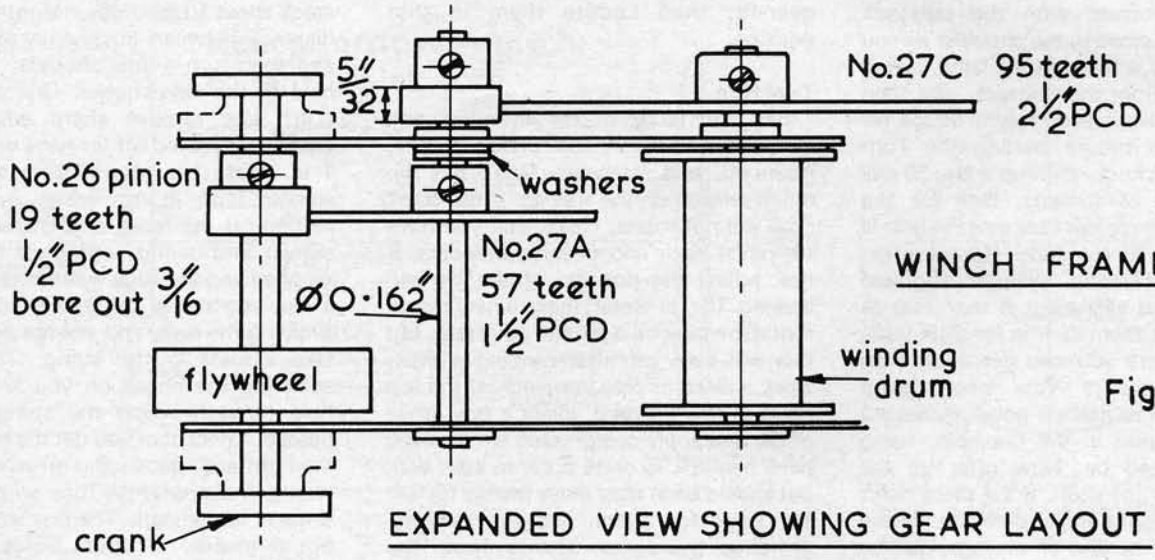
Mark out for the other holes, and drill those marked 6 BA clear. Bolt the two plates together and drill the other holes, enlarging the bush-holes step by step till the right size is reached. File out the little notch at the back—this is to clear the spring of the cylinder pivot pins. Make the bushes to fit the holes, the width (thickness) being such that the bush projects a few thou through the side-plates. Remove all sharp edges from the





bush A ream 3/16" 2 off
bush B drill No.20 2 off

No.26 pinion 19 teeth 1/2" PCD
reduce as shown



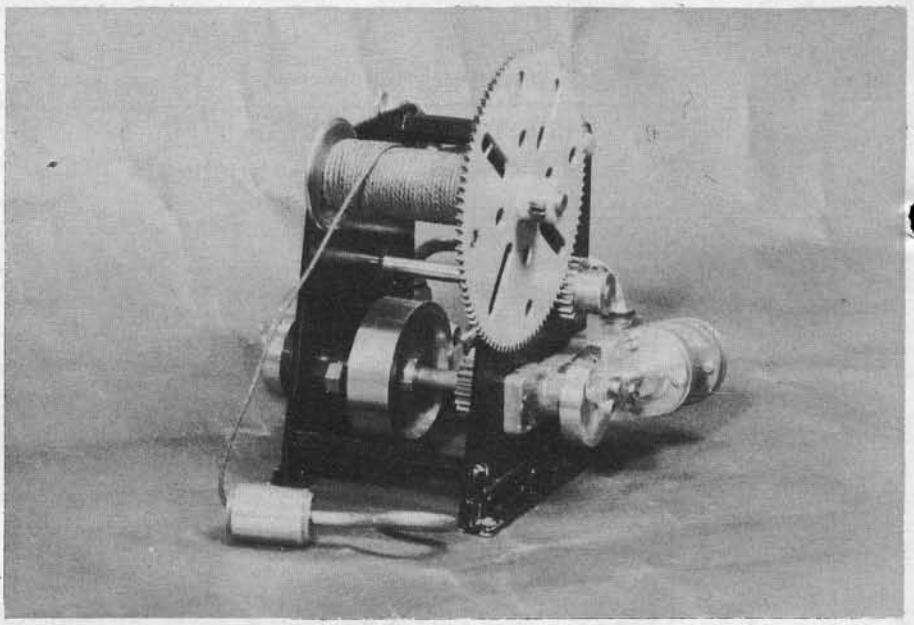
WINCH FRAME

Fig. 3

EXPANDED VIEW SHOWING GEAR LAYOUT

plates, more than mere de-burring, to avoid risk of the child cutting itself. Fit the bushes with a touch of Loctite and leave to cure.

The spacers are made from round or hexagon stock—polish them up a bit—parted off to uniform length and the ends drilled and tapped 6 BA. Lightly countersink after tapping. Assemble the whole and check that (a) the frame sits on a flat surface without rock and (b) that a spindle passed through the bushes rotates fairly freely. If you have trouble, correct the fault. Now attach the two standards using 4 BA screws and make sure that a $\frac{3}{16}$ in. spindle will rotate in these. You *may* have to draw the fixing holes a trifle to achieve this, but if it binds no matter what you do, then it's probable the plates are not parallel to each other and you'll have to put that right by adjusting the spacer lengths. Once you are satisfied, measure the distance over the crank-bearing bosses and note this figure for making the crank. Remove the standards, make and fit the angle pieces by which the frame is fixed to the base.



The winch completed.

Crank and Spindles

The drum spindle is simply a piece of $\frac{3}{16}$ in. silver steel with the end turned down a good fit to the largest gearwheel. (The tolerance on Meccano gear bores is $\pm$0.001 in. on 0.162 in. dia.) The intermediate or second-motion shaft can be a plain Meccano axle (these are made from nominal 20 s.w.g. coated wire) but I find that the coating doesn't like running in a well-fitting GM bush and soon wears slack. So I turned this shaft to 0.162 in. dia. from $\frac{3}{16}$ in. steel and then polished it so that it was both a good fit to the gearwheel and a nice running fit to the bushes.

For the crankshaft, this is turned so that the distance between the shoulders is that shown *provided* that this is at least $\frac{1}{64}$ in. more than the distance over the bushes mentioned earlier. Make it the greater of these two figures. The ends must be screwed with the tailstock dieholder, as close to the shoulder as you can. The disc is faced in the lathe, drilled and tapped from the tailstock, and then marked off using your height gauge for the crankpin before parting-off. Turn round in the chuck, and run a No. 30 drill in a couple of threads. Drill for the crankpin, taking great care that the hole is truly vertical to the face. (Chaps often sneer at oscillating cylinder engines, forgetting that alignment is ten times as important for them as it is for slide-valve engines, where you can get away with almost anything! You need *good* workmanship to make a good oscillator.) Make and press in the crankpin, using Loctite if need be. Now offer up the crankdiscs to the shaft. If the discs don't come at the right angle, carefully file the back face of the disc till they do—90° or 180° as the case may be. If it's only a few degrees away that doesn't matter much; if a trifle more you may be able to force it; but if you need to go more than 15° or so, file it. Note, by the way, it doesn't matter which crankpin leads; though in real practice the right-hand engine was usually the leader.

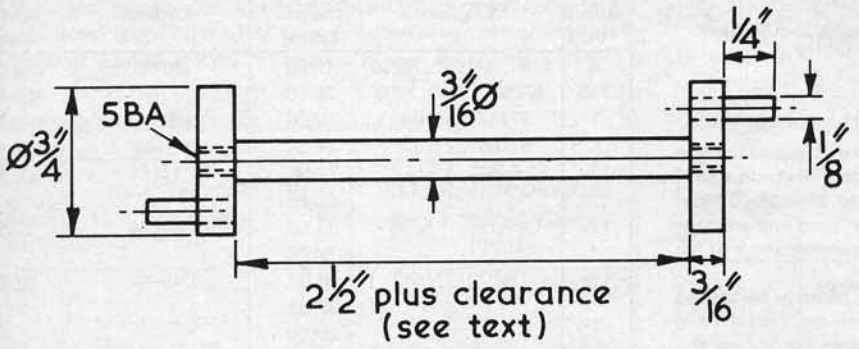
Now, of course, you are certain you have (or I have) made a mistake, because the ½ in. gear won't go on the shaft. I know; you have to bore it out to fit! Grip lightly in the 4-jaw by the boss and adjust till the bore runs true, using a bit of axle to help you set it. Then carefully enlarge the bore with successive drills and finish with a $\frac{3}{16}$ in. reamer. Take the grub-screw out first, though! You can now offer all up and try the gears for mesh. If there is slight binding here or there, ease the top of the teeth of the offending gears *very slightly*. If they are miles out, then you have the second-motion shaft bushes misplaced, and the best thing to do is to knock them out, and make new ones with the hole slightly eccentric. Reassemble and rotate them till you get reasonable gear-fit; then Loctite them in that position.

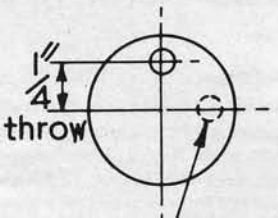
Trial Run

Bed the faces of the cylinders and standard with a very little Brasso and oil, clean off, and assemble. Don't put too much tension on the springs. If the crank now will not rotate, check that you have clearance each end of both cylinders; if not, adjust the position of the big-end bearing. (Or, at worst, make a new piston rod!) She may be a bit stiff to rotate, but this will ease off after running a little. Stick a piece of pipe into each of the top holes in the standard, inject a few drops of oil, and apply compressed air. She will need perhaps 10 or 15 p.s.i. to start with but should soon buzz away merrily on 5 to 10. Look for faults, like rude noises, grinding gears, or grunts from the pistons, and correct each as it arises. Then fit the pipes to the opposite holes (a push fit should be quite good enough) and try her in reverse. When you have run an hour (which soon passes) take all apart, file little flats where the grub-screws were, thoroughly degrease, and apply paint. This is up to you, but small children like bright colours, red cylinders, yellow gears, black winch plates (so that the oil doesn't show dirty), green jib, and all pipes etc., polished brass.

Winding Drum

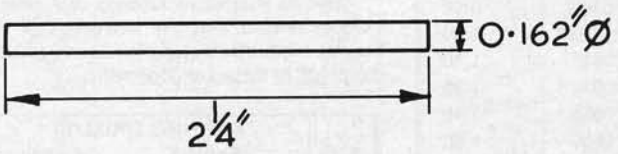
This is shown as $\frac{5}{8}$ in. dia., but can be larger or smaller as you please. A smaller one lifts more, but carries less wire (string to you) and vice versa. It can be made of whatever comes to hand—even wood; boxwood will take a thread for the grub-screw provided it's not a fine pitch. I made mine of brass. You will see in the drawing that it has a thread on it. This is the wire-guide measure the cord (fishing line is ideal) and make the pitch of the thread just a trifle larger. Mine is 24 t.p.i. for cord 0.040 in. dia. Face the ends of the stock about 10 thou less in length than the distance between bushes on the winch, and then turn a little shoulder to fit the hole in the side-cheeks. Drill and ream $\frac{3}{16}$ in., and remove sharp edges. The cheeks are parted off (or mine were) from 1 in. brass bar after drilling to fit the spigots ($\frac{3}{8}$ in. in my case), *but* before parting-off the faced end is filed slightly convex and *during* parting-off the cut is stopped and the edge well rounded. make a saw-cut across the end of the drum, avoiding the hole, and enlarge one end to take a knot in the string. Then after soldering the cheek on you will have a hole through which the string can be passed. Check that you get the saw-cut at the right end, depending on whether you want to hoist with the rope on top of the drum or underneath. The first is "pukka", but it makes no odds. Solder on the cheeks, drill and tap for the grub-screw, polish all up, and there you are! File a flat on the shaft to match up with the grub.





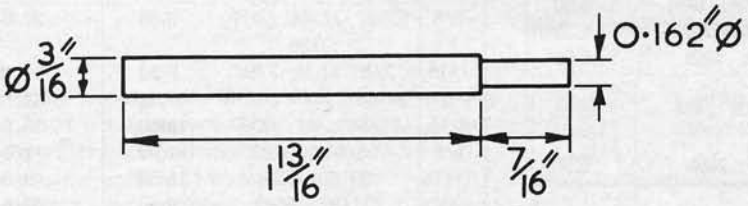
90° R.H. leading for DA engine
180° for single acting engine

CRANKSHAFT: 1 off m.s.



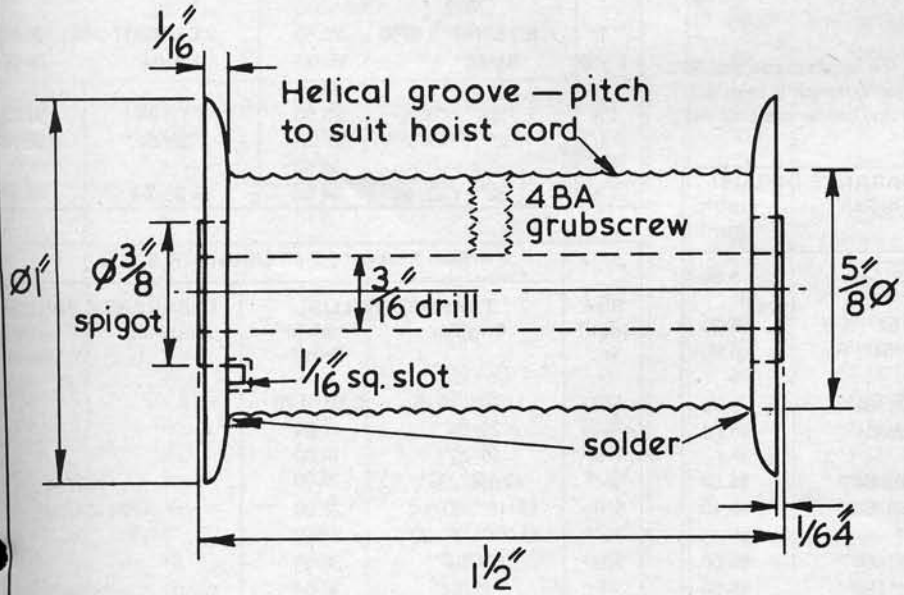
SECOND MOTION SHAFT: 1 off

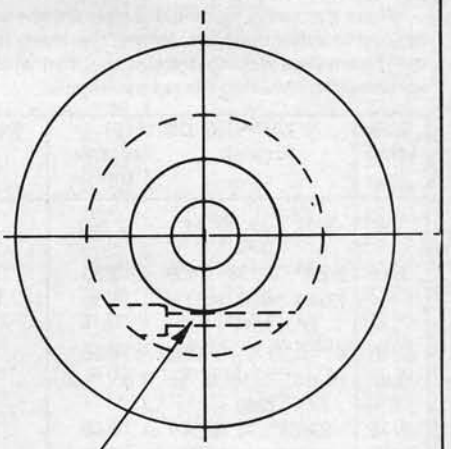
see text re: flats to grubscrews



DRUM SHAFT: 1 off

Fig. 4





slot for cord anchor cut before fitting flange

HOIST DRUM: 1 off

Fig. 5

Data by R. H. Warring

BA (British Association)

BA (British Association) threads are the model makers' popular choice since they cover a range of miniature sizes smaller than ¼ in. diameter. The range extends from No. 0 (6mm diameter) to No. 16 (0.8mm diameter), although sizes smaller than 10 BA are little used and are hard to come by. The thread form is based on metric dimensions and a 47½° angle with rounded roots and crests.

Both English and metric drill sizes can be used for holes to be tapped with BA threads. The table shows suitable inch fraction, decimal inch and number drill sizes. Where alternative tapping drill sizes are shown the smaller drill size will, of course, yield a greater depth of tapped thread. This would be a preferred choice in softer materials. For hard or brittle materials, the larger of alternative drill sizes may be preferred.

BA size	TAPPING DRILL(S) English	metric (mm)	CLEARANCE DRILL(S) English	metric (mm)
16	73; .0236	0.60	62; .0386	0.98
15	70; .0276	0.70	60,61; .0394	1.00
14	1/32"; 69; .0295	0.78	57; .0433	1.10
13	62; .0386	0.98	55; .0512	1.30
12	58, 59; .0413	1.05	54; .0551	1.40
11	3/64"; 56; .0469	1.20	52; .0630	1.60
10	54, 55; .0512	1.40	50; .0709	1.80
9	1/16"; 53; .0590	1.50	45, 46, 47; .0787	2.00
8	50, 51; .0689	1.80	3/32"; 42; .0938	2.30
7	5/64"; 45, 46, 47; .0807	2.00 or 2.10	37; .1043	2.65
6	3/32"; 42, 43, 44; .0886	2.30	31; .1181	3.00
5	37, 38; .1029	2.50 or 2.60	30; .1299	3.30
4	1/8"; 31, 32, 33; .1161	3.00	23,24; .1935	3.90
3	30; .1299	3.30	16; .1772	4.50
2	9/32"; 23, 24, 25; .1539	3.90 or 4.00	9; .1968	5.00
1	11/64"; 16, 17, 18; .1732	4.50	2, 3; .2126	5.50
0	8, 9, 10; .1968	5.00	F; .2559	6.50

British Standard Whitworth (BSW)

BSW is the traditional English engineering thread applied to diameter sizes from 3/16 in. to 6 in. The thread is relatively coarse, but high in strength for bolted-up assemblies. There is also a 1/8 in. BSW size, but this is something of an oddity as the pitch is finer and virtually the equivalent of BSF.

Where alternative tapping drill sizes are shown, the smallest size should be used in softer materials. Where maximum thread strength is required, use the smallest tapping drill size specified which any harder material will accept without making the tap too 'tight'.

Size (dia.) in.	TAPPING DRILL(S) English	metric (mm)	CLEARANCE DRILL(S) English	metric (mm)
1/8	3/32"; 39, 40, 41; .0938	2.50	9/64"	3.60
3/16	9/64"; 27, 28; .1406	3.50	13/64"; 5, 6	5.20
¼	13/64"; 8, 9, 10, 11; .2031	5.00	17/64"; H	6.80
5/16	¼"; C, D, E, F; .2500	6.50	21/64"	8.40
3/8	19/64"; 5/16; M, N; .2969	7.00, 7.50	25/64"	10.00
7/16	23/64"; T; .3594	9.00	29/64"	11.60
½	13/32"; X, Y, Z; .4955	10.00, 10.50	33/64"	13.10
9/16	15/32"; .4688	12.00	37/64"	15.00
5/8	33/64", 17/32"; .5312	13.00 13.50	41/64"	16.50
11/16	37/64"; 19/32"; .5938	15.00	45/64"	18.00

Continued

Size (dia.) in.	TAPPING DRILL(S) English	metric (mm)	CLEARANCE DRILL(S) English	metric (mm)
¾	5/8", 41/64"; .6250	16.00	49/64"	19.50
7/8	47/64", ¾"; .7500	19.00	57/64"	23.00
1	27/32". 55/64"	22.00	1 1/64"	26.00
1 1/8	61/64", 21/32"	24.50	1 9/64"	29.00
1¼	1 5/64", 1 3/32"	27.50, 28.00	1 17/64"	32.50
1½	1 19/64", 1 5/16"	33.50, 34.00	1 33/64"	38.50
1¾	1½", 1 33/64"	38.00, 38.50, 39.00	1 49/64"	45.00
2	1 23/32", 1¾"	44.00, 44.50	2 1/64"	51.50

BSF (British Standard Fine)

BSF threads are of Whitworth form with a greater number of threads per inch (finer pitch) than their BSW counterpart. They are particularly suitable for use on light assemblies; or for tapped threads of relatively shallow depth or in brittle materials.

Various alternative tapping drill sizes are shown, it being generally recommended that the smallest drill size be used wherever possible (except in brittle materials) to ensure maximum depth of thread and thus strength of thread engagement.

Size (dia.) in.	TAPPING DRILL(S) English	metric (mm)	CLEARANCE DRILL(S) English	metric (mm)
3/16	5/32"; 22, 23, 24, 25; .1562	4.00	13/64"; 5, 6	5.20
7/32	14, 15, 16; .1811	4.50	15/64"; A, B;	6.00
¼	13/64"; 4, 5, 6; .2031		17/64"; H	6.80
9/32	15/64"; A, B, C; .2349	6.00	19/64";	7.60
5/16	17/64"; F, G, H; .2656	6.50	21/64"; Q	8.40
3/8	5/16", 21/64"; O, P; .3129	8.00	25/64"	10.00
7/16	3/8"; U, V; .3750	9.50	29/64"	11.60
½	27/64", 7/16"; 4219	11.00	33/64"	13.10
9/16	31/64", ½"; .5000	12.50	37/64"	15.00
5/8	35/64"; .5469	14.00	41/64"	16.50
11/16	39/64; .6094	15.50	45/64"	18.00
¾	21/32" .6562	16.50	49/64"	19.50
13/16	23/32"; .6719	18.00, 18.50	53/64"	21.25
7/8	49/64", 25/32"; .7812	1950	57/64"	23.00
1	7/8", 57/64"; .8750	22.50	1 1/64"	26.00
1 1/8	63/64", 1"	25.00, 25.50	1 9/64"	29.00
1¼	1 7/64", 1 1/8	28.50	1 17/64"	32.50
1 3/8	1 7/32", 1 15/64"	31.00, 31.50	1 25/64"	35.50
1½	1 11/32", 1 23/64"	34.50	1 33/64	38.50

Size (dia.) in.	British Standard Pipe Threads (B.S.P.) TAPPING DRILL(S) English	metric (mm)	CLEARANCE DRILL(S) English	metric (mm)
1/8"	11/32"; R, S	8.60, 8.70		
¼"	29/64"	11.50		
3/8"	19/32"	15.00		
½"	47/64", ¾"	19.00	NOT APPLICABLE	
5/8"	13/16", 53/64"	21.00		
¾"	61/64", 31/32"	24.50		
7/8"	1 7/64"	28.00		
1	1 13/64"	30.50		
1¼"	1 35/64"	39.00		
		39.50		
1½"	1 25/32"	45.00		

Unified Threads

The Unified thread form was established by agreement between the United States, Great Britain and Canada in 1948 in an earlier attempt at International standardisation. It produced two series—UNC (Unified Coarse) and UNF (Unified Fine). In practice Unified threads never became universally adopted, but they are still the main type specified in America.

English drill sizes are shown in inch fraction, letter or number, and decimal inch.

AMERICAN NATIONAL FINE (U.N.F. and N.F.)

Size	TAPPING DRILL(S) English	metric (mm)	CLEARANCE DRILL(S) metric (mm)	
0	55; .0512		51; .0650 .25	1.65
1	1/16"; .0629	1.55	48; .0768	1.95
2	48, 49; .0748	1.90	43; .0886	2.30
3	44; .0866	2.15	37, 38; .1093	2.65
4	3/32"; 41; .0949	2.40	31, 32; .1181	2.95
5	35; .1063	2.70	30; .1249	3.30
6	32; .1161	2.95	9/64"; 28; .1406	3.60
8	9/64"; 28; .1406	3.50	18, 19; .1693	4.30
10	20; .1614	4.10	8, 9; .2008	5.00
12	3/16"; 13; .1850	4.70	7/32"	5.60
¼"	7/32"; .2158	5.50	17/64"	6.50
5/16"	I; .2717	6.90	21/64"	8.10
3/8"	Q; .3346	8.50	25/64"	9.70
7/16"	25/64"; W; .3858	9.90	29/64"	11.30
½"	29/64"	11.50	33/64"	12.90
9/16"	33/64"	12.90	37/64"	14.50
5/8"	37/64	14.50	41/64"	
16.50				
¾"	11/16"	17.50	49/64"	19.50
7/8"	25/32"	20.00	57/64"	22.75
1"	29/32"	23.25	1 1/64"	26.00
1 1/8"	1 1/32"	26.50	1 9/64"	29.00
1¼"	1 5/32"	29.50	1 17/64"	32.50
1 3/8"	1 9/32"	32.50	1 25/64"	35.50
1½"	1 13/32"	36.00	1 33/64"	38.50

ISO Metric threads

ISO Metric threads are identical with ISO Unified threads and the intended subject of world standardisation. They are produced in two series—Coarse and Fine. Metric Coarse threads provide a replacement for general engineering superceding BSF, BSW, UNC and UNF.

Suitable tapping drill sizes are shown for English inch fraction, number and letter drills, and for standard metric drill sizes. It is recommended that the latter be used.

ISO METRIC THREADS

Size (dia.) mm	TAPPING DRILL(S) English	metric (mm)	CLEARANCE DRILL(S) English	metric (mm)
1.0	69	.75	57	.95
1.1	66	.85	3/64"	1.10
1.2	63	.95	55	1.20
1.4	57	1.10	53	1.30
1.6	55	1.25	51	1.50
1.8	54	1.45	48	1.70
2.0	52	1.60	44	1.90
2.2	50, 51	1.75	3/32"; 42	2.15
2.5	46	2.05	37	2.35
3	40	2.50	1/8"; 30	2.65
3.5	31	3.00	26, 27	3.20
4	30	3.30	19	3.70
4.5	9/64"; 29	3.50	13	4.20
5	19	4.20	5, 6	4.70
5.5	9	5.00	15/64"	5.20
6	7/32"	5.50	¼"	6.20
7	A; B	6.00	9/32", K	7.20
8	17/64"; H	6.80	P	8.20

AMERICAN NATIONAL COARSE (U.N.C. and N.C.)

dia. (in.)	Size	TAPPING DRILL(S) English	metric (mm)	CLEARANCE DRILLS(S) English	metric (mm)
.073	1	1/16"; 53; .0590	1.55	48; .0768	1.95
.086	2	49; .0728	1.85	43; .0886	2.25
.099	3	45; .0827	2.10	37, 38; .1043	2.60
.112	4	3/32"; .0938	2.35	31, 32; .1181	2.95
.125	5	37; .1043	2.65	30; .1299	3.30
.138	6	33; .1122	2.85	9/64"; 28; .1406	3.60
.164	8	9/64"; 28, 29; .1406	3.50	18, 19; .1693	4.30
.190	10	23, 24; .1539	3.90	8, 9; .2008	5.00
.216	12	16; .1772	4.50	7/32"	5.60
	¼"	5, 6; .2047	5.20	17/64"	6.50
	5/16"	G; .2598	6.60	21/64"	8.10
	3/8"	O; .3150	8.00	25/64"	9.70
	7/16"	U; .3661	9.40	29/64"	11.30
	½"	27/64"	10.80	33/64"	12.90
	9/16"	31/64"	12.20	37/64"	14.50
	5/8"	17/32"	1.50	41/64"	16.50
	¾""	41/64"	16.50	49/64"	19.50
	7/8"	49/64"	19.25	57/64"	22.75
	1"	7/8"	22.25	11/64"	26.00

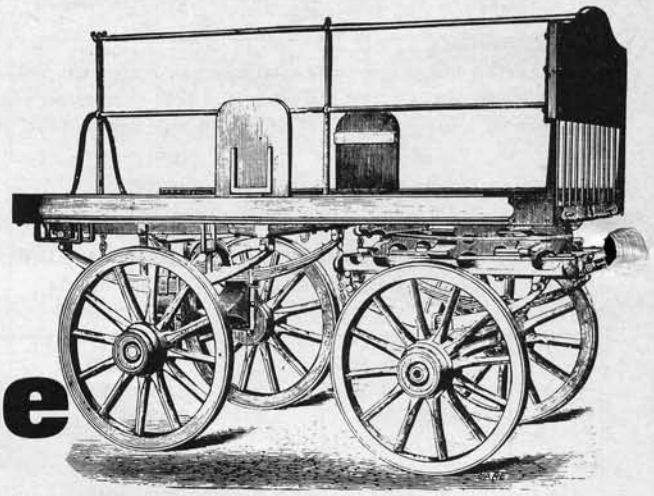
ISO METRIC THREADS

Size (dia.) mm	TAPPING DRILL(S) English	metric (mm)	CLEARANCE DRILL(S) English	metric (mm)
9	N	7.80	23/64"; U	9.20
10	Q	8.50	Y	10.30
11	3/8"	9.50	7/16"	11.30
12	Y	10.30	31/64"	12.30
14	*15/32"	12.00	9/16"	14.30
15	*17/32"	13.50	19/32", 39/64"	15.25
16	*35/64"	14.00	41/64"	16.25
17	*39/64"	15.50	11/16"	17.50
18	*41/64"	16.50	23/64"	18.50
20	*11/16"	17.50	51/64"	20.50
22	*49/64"	19.50	57/64"	22.50
24	*53/64"	21.00	31/32"	24.50
25	*29/32"	23.00	1"	25.50
26	*15/16", 61/64"	24.00	1 3/64"	26.50
27	*31/32"	24.50	1 5/64", 1 3/32"	27.50
28	*1 1/64"	26.00	1 7/64", 1 1/8"	28.50
30	*1 1/32"	28.00	**1 13/32", 1 27/64"**	30.50
32	*1 11/64"	30.00	1 17/64"	32.50
33	*1 15/64"	31.00	1 5/16", 1 21/64"	33.50
35	*1 19/64"	33.00	1 13/31", 1 27/64"	36.00
36	*1 19/64"	33.00	1 29/64", 1 15/32"	37.00
38	*1 11/32"	34.50	1 17/32" 1 9/16"	39.00
39	*1 25/64"	35.50	1 9/16", 1 37/64"	40.00
40	*1 27/64"	36.50	1 39/64" 1 5/8"	41.00
42	*1 31/64"	38.00	1 11/16", 1 45/64"	43.00
45	*1 39/64"	41.00	1 51/64", 1 13/16"	46.00
48	*1 23/32"	44.00	1 59/64", 1 15/16"	49.00
50	*1 25/32"	45.50	2"	51.00

*nearest English equivalent to recommended drill size.

Building a Horse Drawn Coal Trolley-1

Making the Undercarriage



A two part feature

By John Thompson Part 1

Timber

10 ft of ¼ inch sq., for Parts 2, 6, 7, 9, 10, 11, 12, 14, 21, 22, 23, 24.
3 ft 6 in. of ½ by ¼ in. for Parts 5, 4, 8, 13.
2 ft 6 in. of ¾ by ¼ in. for Parts 3, 20.
2 ft of ½ in. sq., for Parts 16, 17, 18, 19.
1 piece of 3mm plywood, 4½ in by 12¼ in. for Part 1.
1 piece of 3mm plywood, 12 by 4 in. for Parts 25, 26, 27.

Metal Parts: Some of these items are optional — see the notes)
(Note that brass stip is specified, because it is easy to work, and is obtainable from Hobby's and other craft suppliers. However mild steel, copper or aluminium could be used.
8 ft of ¼ in. brass strip, preferably 18 or 20 swg, i.e. $\frac{1}{16}$ th inch thick or less (To make up spring and axle clips).
Piece of sheet metal, approx. 6 by 5 in. or equivalent area, 16 or 18 swg. (Aluminium is best for this).
3 ft of wire or rod, about 16 swg or $\frac{1}{16}$ th in. dia., to make up axle clips, shaft fittings etc.
8 in. of $\frac{3}{16}$ in. rod, for axle arms.
(Alternatively round headed brass wood-screws could be used, or Hobby's supply axle arms.)
4 ft of wire or rod, 12 or 14 swg. (A strong wire coat hanger will do.)

Fixings etc:

6 dozen brassed escutcheon pins, $\frac{3}{8}$ in. long.
½ oz. small pins, preferably brass, ¼ in. long.
4 brass screws, $\frac{3}{8}$ in. No. 2, for fixing springs.
4 off, ¼ in. dia. plastic beads.

History

UP TO THE 1950's, most coal deliveries were made by horse-drawn coal trollies, so many older readers will remember with nostalgia the crunch of the iron tyred wheels, and the powerful horse "steaming" after a sharp pull on a cold day. This authentic model should re-create that atmosphere. The design of the model is based on: (a) the coal merchant's trolley on display at the Science Museum, London; (b) Information kindly supplied by Charrington's Solid Fuel Ltd.; (c) Description and drawing in "The Horse World of London" by W. G. Gordon (1893); and (d) The coal trolley in the "Bristol Carriage and Wagon Works" catalogue of 1894, as illustrated above.

The average load was around 2 tons, and with the weight of the dray, scales etc the single horse had to pull about 3 tons. A good horse could manage this on the level or up a steady slope, but on bad hills help was needed. Often the rounds were arranged so that two carters co-operated on the hills, the pair of horses taking one cart up, and then returning for the other. Sometimes a high seat was fitted for the driver, but more often he just stood behind the frontboard, or sat on an old box.

Livery

For the livery of my model, I chose that of the "Royal Arsenal Co-operative Society", because the bright red nameboard looks very effective on the black painted trolley and a fair approximation to the original style of lettering could be obtained using the "rub down" sheets as sold for model railway goods wagons.

Materials

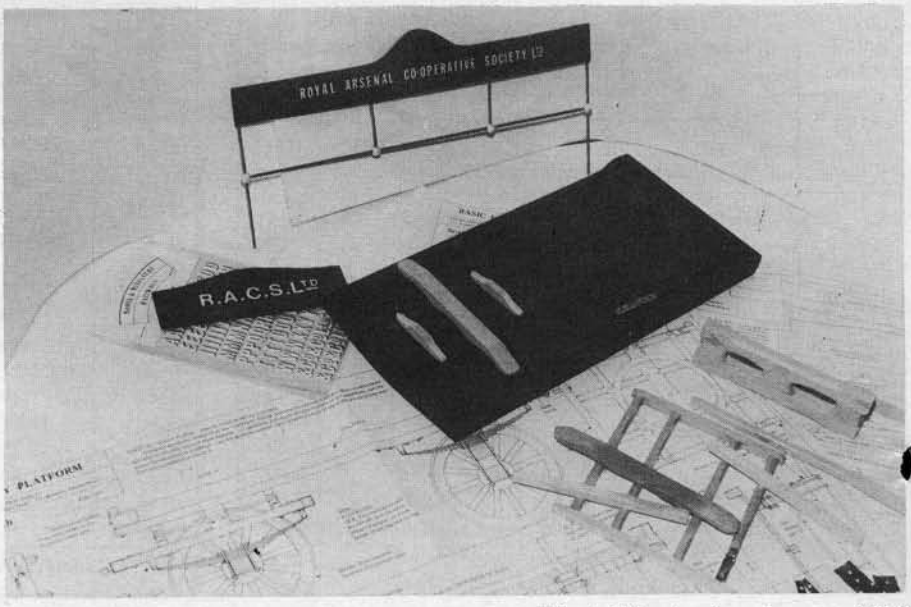
As with the cart featured in the May 1979 issue of this magazine, this design can be built with few tools and from materials you can buy in local shops. I used ramin for the timber — this is the hardwood sold in D.I.Y. shops, and is quite adequate provided you drill holes for all pins, to avoid splitting the wood. Compared with the cart there are a good many metal parts on the trolley. You can make most of these from ordinary wire or sheet metal, although you will find it easier to make the springs from brass strip, purchased from one of the mail order model engineering suppliers.

Construction

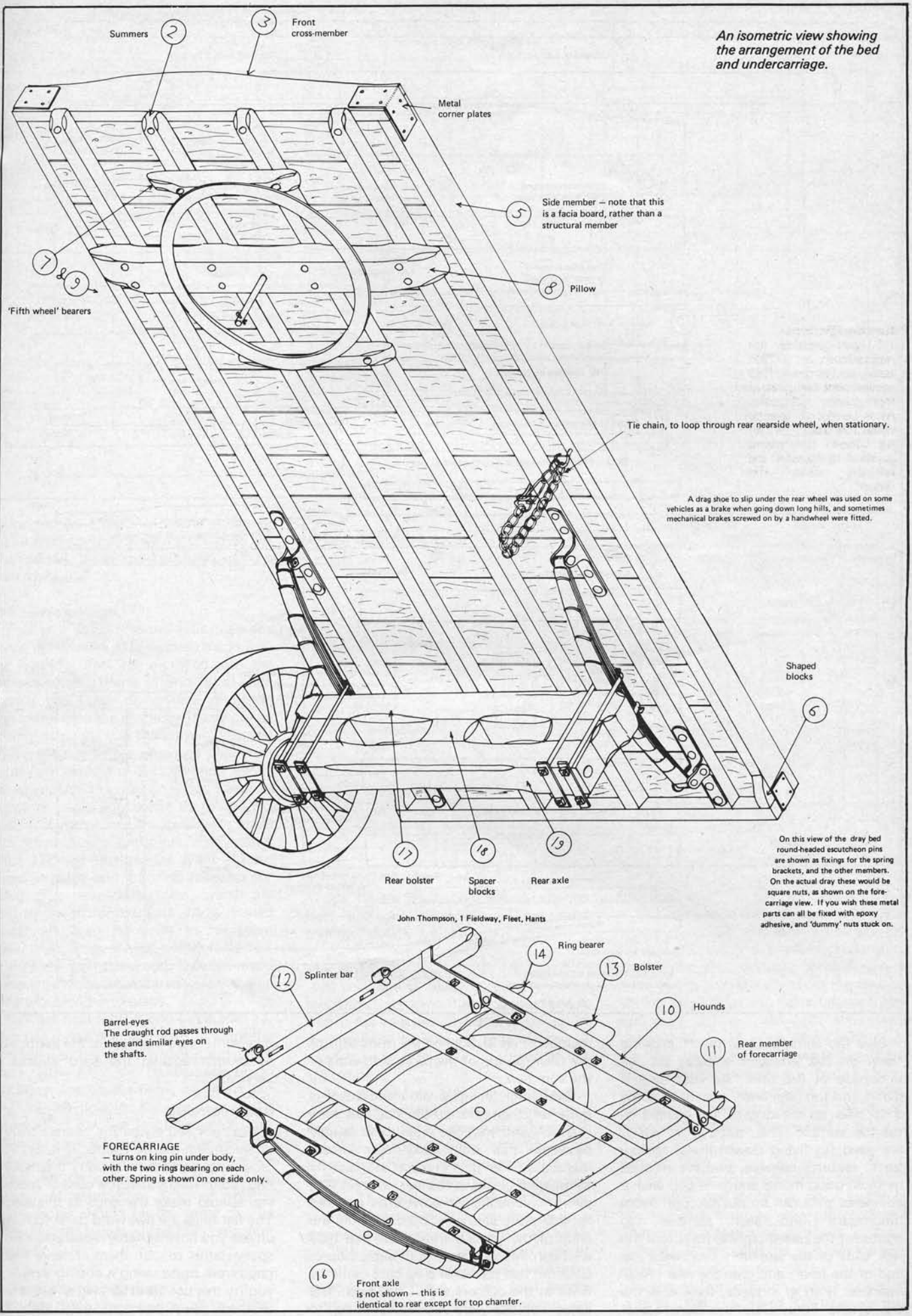
First I will deal with building the flat bed of the trolley. The most straight forward way is to start with the piece of plywood for the floor and to add the framework onto it. Cut a piece of 3mm plywood, 4½ by 12¼ inches, with the grain going across the width, so that plank "joints" can be scored on, using a pointed scriber, or the back of a craft knife. Sand smooth, and mark out the positions for the "summers" (the 4 lengthwise members) both on the top and the bottom surfaces.

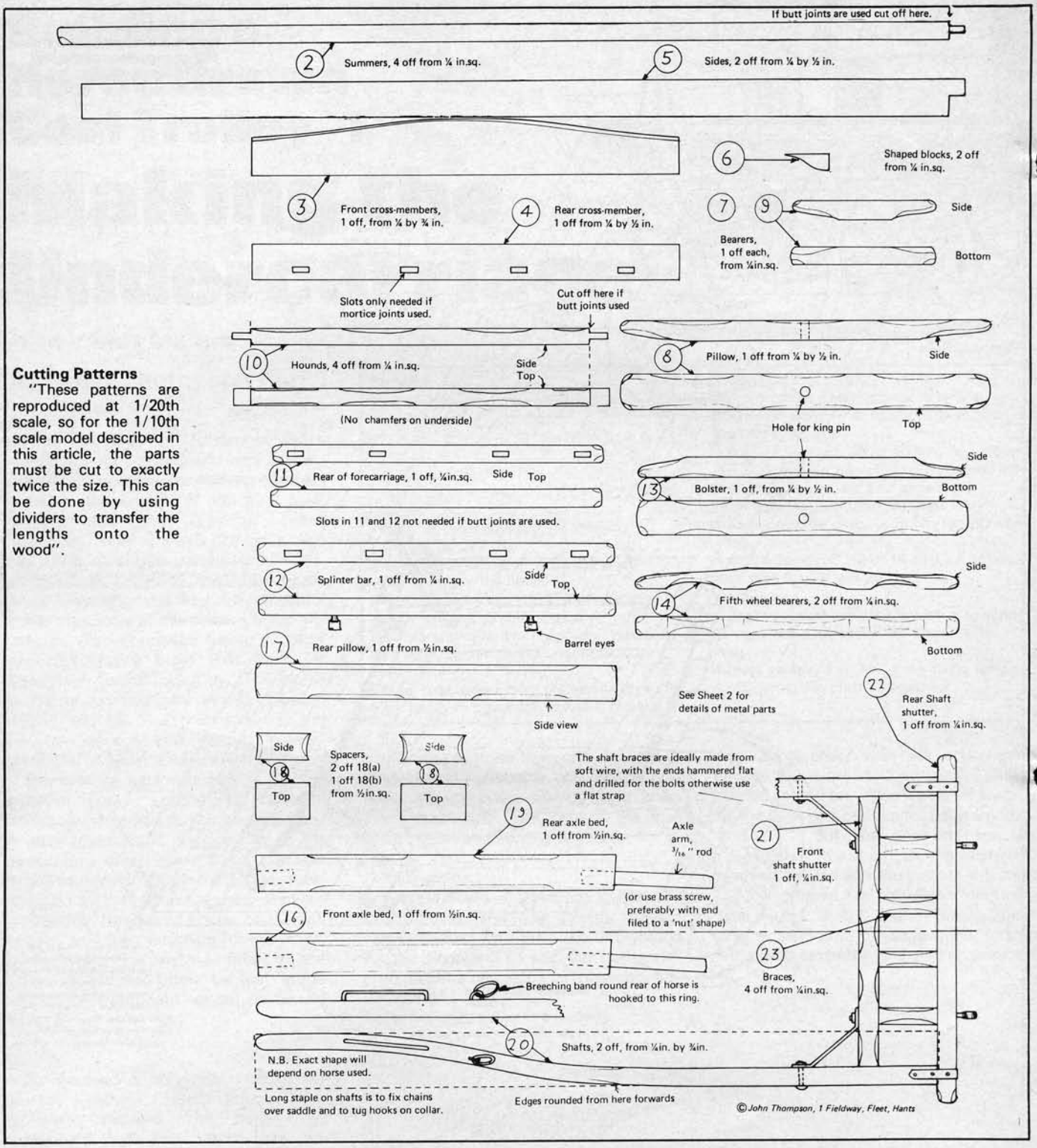
Now prepare the framework members (see parts 2, 3, 4, 5 and 6), leaving about an $\frac{1}{8}$ th inch extra on the lengths, to trim off during assembly to ensure an accurate fit.

Trolley bed and parts of fore-carriage.



An isometric view showing the arrangement of the bed and undercarriage.





Cutting Patterns

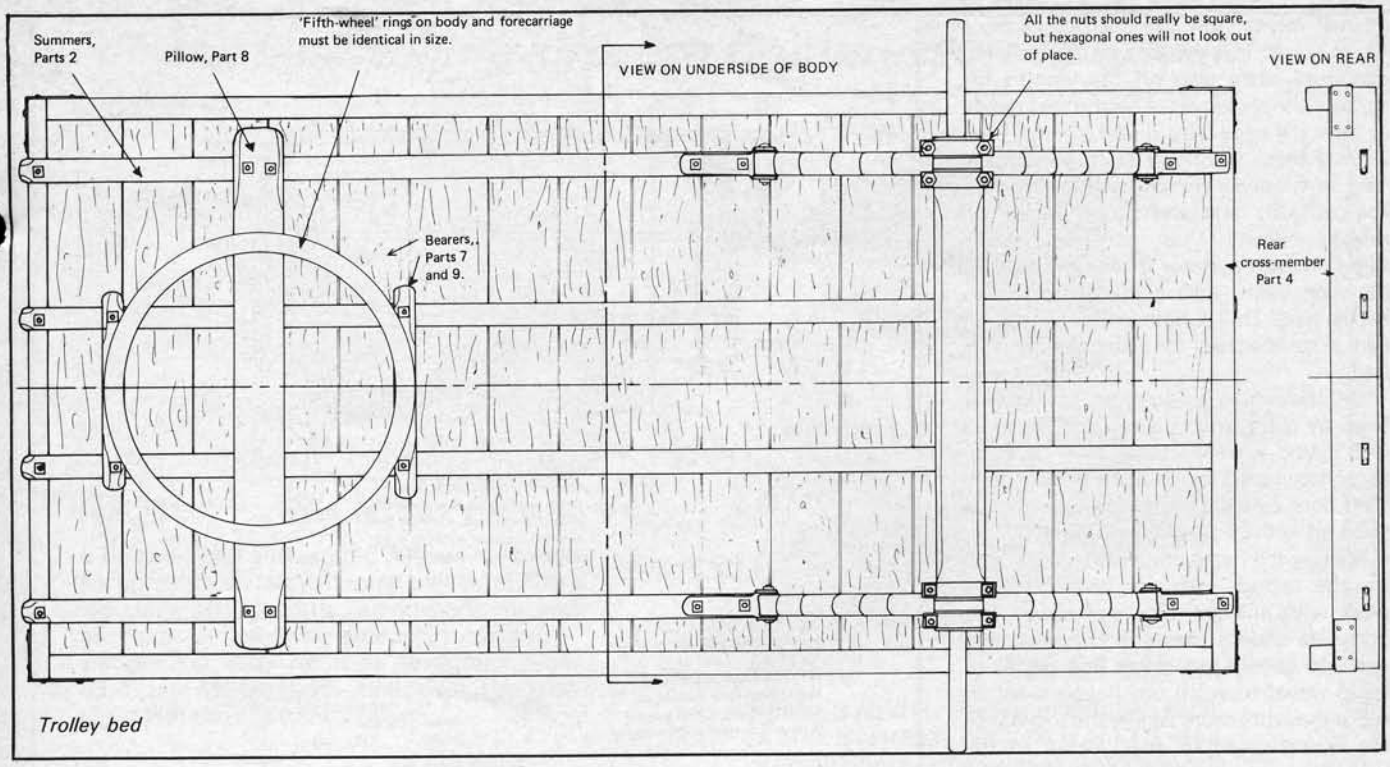
"These patterns are reproduced at 1/20th scale, so for the 1/10th scale model described in this article, the parts must be cut to exactly twice the size. This can be done by using dividers to transfer the lengths onto the wood".

Give the summers into place, locating them on the positions marked on the underside of the floor. As each one is glued turn the floor over, and insert some small pins, on the location line marked on the top surface. The "track pins" which are used for fixing down model railway track, are very suitable, and are stocked by most good model shops. If you wish a couple of pins can be put through every 'floorboard' into each summer, to represent the nailed planks. Next trim the rear ends of the summers flush with the end of the floor, and glue the rear cross-member. (Part 4) in place, level with the top of the floor. Glue the front cross-member (Part 3), against the front edge of the floor, on top of the projecting ends of the summers.

Wait until the glue on these parts is quite set, then offer up the side members (Part 5), and trim the ends to fit snugly between the front and rear cross-members. Then glue in place, and also fix the shaped blocks at the rear (Part 6). Add pins, 'coachbolts' or dowels as required for adequate strength, then trim off the ends of the cross-members so that they are flush. Metal plates, from brass strip or cut from thin pieces of a tin can, could be fixed to the corners with small pins. The actual vehicles were "ironed up" thus, to give some extra strength at the joints, and to protect against the hard knocks in service.

Undercarriage

Next cut and shape the bearers for the undercarriage parts. (Items 7, 8, 9). The cross-pieces at the front carry the bearing ring, so to fix them at the correct spacing you should make the rings at this stage. The flat rings are awkward parts to make, unless you have suitable metal and a slow speed lathe to cut them. I have made rings from brass using a coping saw — if you try this use 20 or 22 swg sheet, a fine toothed saw, and cut with the ring



Trolley bed

supported on a piece of waste plywood. As an easier alternative they could be cut from 40 mil. black styrene sheet, using a craft knife.

The Forecarriage

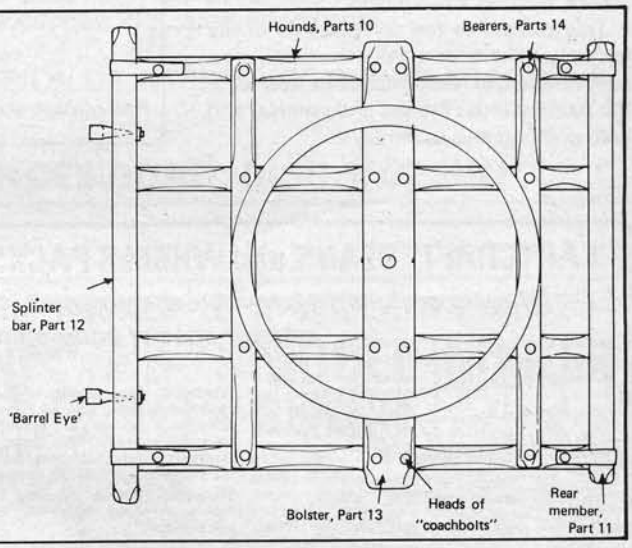
This is a simple frame, which on the actual vehicle would have been made with the hounds (Part 10) morticed into the cross-members (Parts 11 and 12) at each end. If you fancy doing this 'joinery in miniature' then the mortices can be cut by drilling through, and the corners squared up using a needle file. However plain built joints are sufficient if stuck with epoxy adhesive. Use a couple of elastic bands to keep the joints tight while the glue sets. Pieces of metal can be fixed with small pins to re-inforce the joints. The bolster (Part 13) and the bearers (Part 14) are glued in place and imitation 'coachbolts' fitted. The escutcheon pins, which are sold by most ironmongers, have domed heads and can be used to represent coachbolts. They should not be forced in, or they will split the wood. Drill clearance holes, and smear the pins with epoxy glue before pushing into place.

Drill the hole for the king-pin in Part 13, then use a pair of compasses to mark the position for the 'fifth wheel', and fix in place. Now offer the forecarriage up to the body, line up the rings, and mark out and drill the hole for the king pins in the pillow (Part 8). The front axle-bed (Part 16) must have it's ends cut at an angle as shown, and the holes for the axle rod are drilled at the same angle, to give the correct outward cant to the wheels. These holes should be the same size as the axle rods, which will be fitted at a later stage.

The Rear Undercarriage

The rear axle, spacers and pillow (Parts 17, 18, 19) are fitted under the rear springs later, but can be cut, shaped and glued together now.

Plan view of forecarraige.



The Shafts

If you intend using a pottery horse model with this dray then you must check that it fits between the shafts shown in the pattern, and make any alterations needed to give a slight clearance at the shoulders.

As with the forecarriage morticed joints were used on the shafts of the actual vehicle, and it does make a better job if you can manage them, although butt joints stuck with epoxy adhesive will do, especially if you fit metal reinforcing plates. The actual curved shafts (Part 20) should be cut slightly oversize with a coping saw, or a bandsaw if you are lucky enough to have one. Then clamp the pair together, or hold them in a vice, while you smooth them down to the final profile with a file — this will ensure both are identical.

Cut and shape the two cross members (Parts 21 and 22), and form the tenons on 20 and 21, using a small hacksaw and craft knife. Cut mortices by drilling out and filing up the corners. Trim the tenons till they are a good fit — don't make them too tight or you will split the small sections of wood, then smear with glue for final assembly. The small braces (Part 23) can be trimmed to be a snug push fit, and glued in place, and the metal plates for reinforcement cut from a tin, holes punched or drilled, and pinned in place.

The Springs

The springs are a prominent feature of the vehicle, and should be made as much like the real thing as you can manage. There is no particular difficulty in this, although if you wish the shackles on the ends can be simplified.

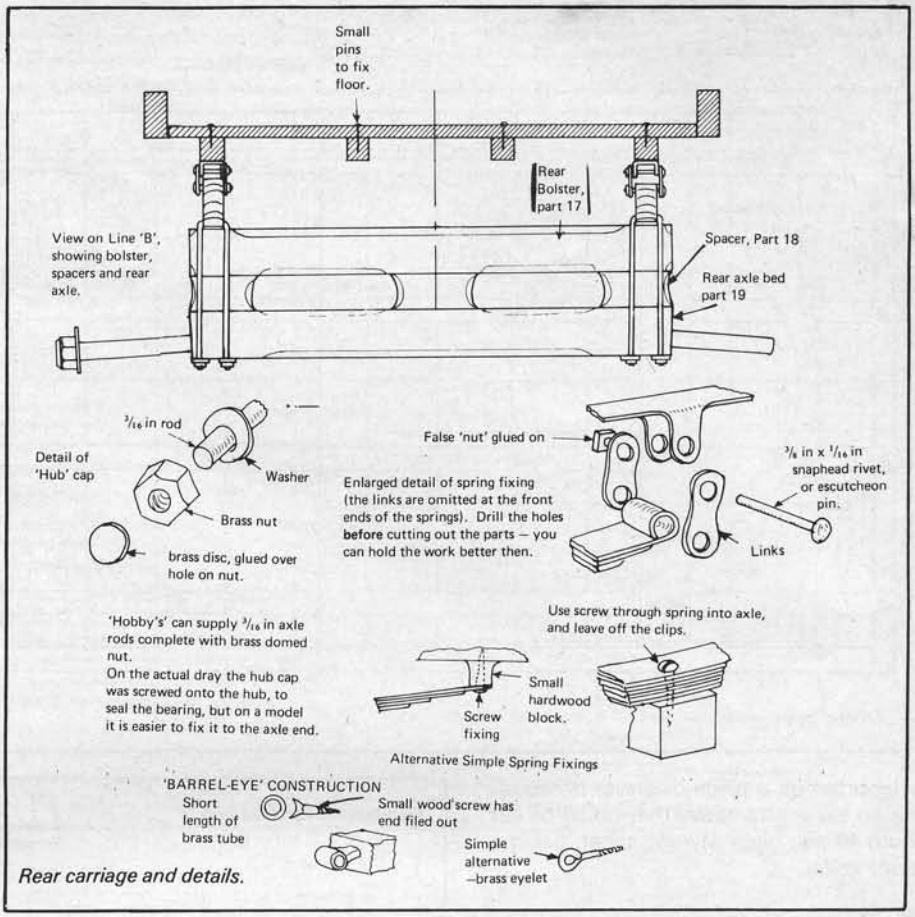
Use metal strip ¼ inch wide, a bit under $\frac{1}{16}$ th in. thick, i.e. 18 or 20 s.w.g., or the

nearest you can get. Wind it round a paint tin or something similar, to get an even curvature, then snip off the lengths for each of the six leaves. The top leaf needs to have it's ends bent round to form eyes — soft brass will bend easily as shown. The other leaves should have the corners snipped off, and the rough edges all rubbed down. Then put the leaves together with a smear of epoxy adhesive between each, and bind together with sticky tape. Drill a hole in the centre, to suit a small screw for fixing to the axle bed.

On the actual vehicle the spring was fixed by clips, and you can add these as well if you wish — make them up from wire, hammered flat over the middle part, then bent to shape and with dummy nut fixed on with epoxy adhesive.

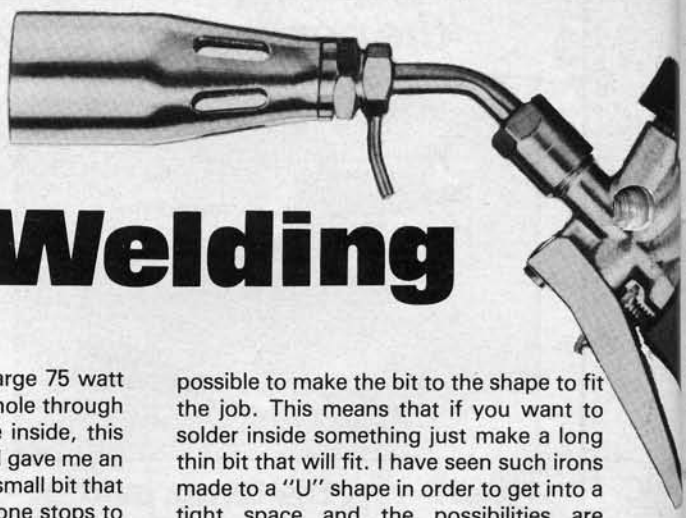
Making the fixing brackets and shackles for the springs calls for some delicate work with tinsnips, files and pliers. The parts are shown clearly in the sketches, and you should be able to find pieces of scrap metal to work on. If you want to make the work more simple the top leaf of the spring could be fixed direct to the timber, or onto small blocks.

This completes the components of the trolley platform and undercarriage. The continuation of the article will deal with the nameboards, fittings and wheels, and with painting and assembly.



Rear carriage and details.

Soldering Brazing & Welding



Part II By Stan Bray
The tools and how to do the job.

In the last article the types of materials used for soldering, brazing and welding were discussed, even so, the full range of materials used for soldering, brazing and welding were not all mentioned and to do so would have meant very many more pages of text. What was dealt with were the most common items and probably enough different products to deal with all aspects of model making. It must be emphasised that knowledge of those materials and their properties is absolutely essential for really successful joining of metals.

If then we assume that you have the full knowledge of your materials, then the next step is to get an equal knowledge of the tools required, only after that can we think of how to do the actual job. When that stage is reached it will be seen that soldering, brazing and gas welding are so similar that you only need to know the basic requirements to be successful in all three.

Soft soldering

The tools used for soft soldering are soldering irons and blowlamps or gas torches. The irons have a limit on the job they will do but if it is possible to use an iron to solder then a much neater job is possible. These days most people use electric irons and even here the range is pretty staggering, from very small to very large. No one iron will do for all jobs and personally I have four electric irons and one of these has interchangeable bits. I still found that when constructing "O" gauge locomotives I needed something different and finally I got a large 75 watt iron with a big bit. I drilled a hole through the bit and put a smaller one inside, this was secured with a screw and gave me an iron with plenty of heat but a small bit that could get into small areas. If one stops to think about it, this is really what is required from an iron. The ability to get to the area to be soldered and to heat it. However, when irons are purchased they are not like this. If you have only a small space to work in and use a standard iron of the size that will fit the space available, then it will often not give enough heat to solder other than a small area and any attempt to use one will result in bad joints. It therefore follows that the iron must be a big one if a large area is to be soldered and usually this means a big bit which is difficult to use, hence the one mentioned above, with the extra bit put in. A word of warning, however, do not put too large an extra bit in as it will not heat up sufficiently and will defeat the object.

Also available are solder guns, these are really only a solder iron with a thin bit, (actually a length of copper wire). The advantage here is a good bit of heat in a small area and a quick warming up time. I have never yet seen one capable of soldering up a large job such as a gauge one tender, but they are useful tools. Still available are the good old-fashioned solder iron that is heated on the gas. This is only a piece of copper screwed to a steel rod with a handle on it. Whilst not always convenient to use, they have one big advantage. If you make your own it is possible to make the bit to the shape to fit the job. This means that if you want to solder inside something just make a long thin bit that will fit. I have seen such irons made to a "U" shape in order to get into a tight space and the possibilities are limitless. About the only other type of solder bit is the one that clips to a small blow lamp, the flame of the lamp heating it up. I have never had success with these in model making as I have found heat control difficult.

Using a soldering iron

The mention of heat control brings us to the techniques of using a soldering iron. The job to be soldered must be thoroughly clean and if it is not then do not bother because it just will not work. If we assume that both the parts to be soldered have been cleaned, then a layer of flux should be spread along both parts. If using paste it can be spread with a matchstick, a liquid should be painted on with a small paint brush. Do not overdo it, but at the same time it must be fully covered. When this is done the job should be tinned. Nothing in that, it merely means a layer of solder spread on the metal to be joined. The advantage of this is that in no way can the work then oxidise. If for any reason it is not possible to tin the job, then a good joint can still be made with care.

Let's get to the actual application of the solder. The iron must be clean. To do this heat it until a piece of solder will melt on it, give it a rub over with a wire brush, and dip it in the flux, it should now have a nice

Soldering irons with replaceable bits 75W, 40W and 25W.

A typical Paraffin Blowlamp.

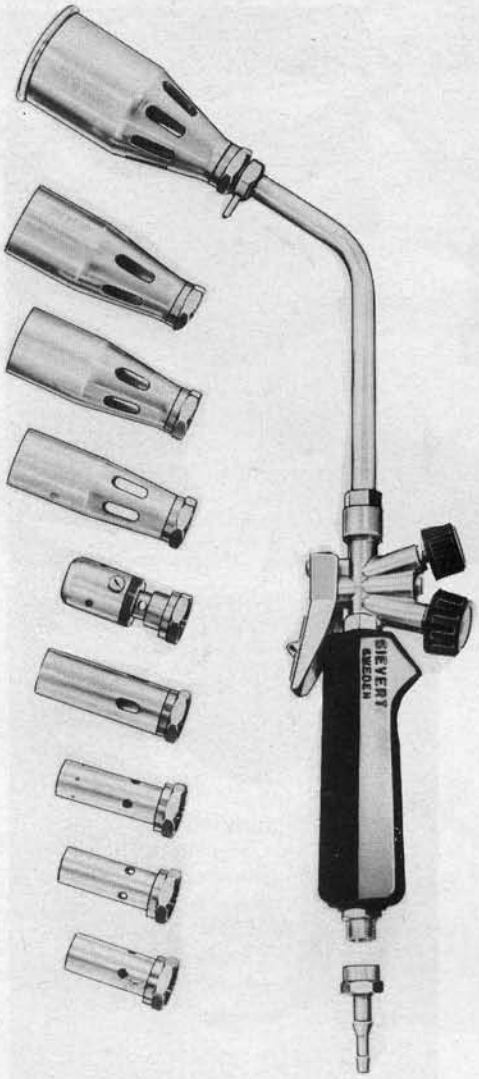
coating of solder left on it and look nice and bright. The iron is then put on the job and held there for long enough to heat the metal. Put the solder about $\frac{1}{32}$nd in. away from the iron and touching the work. When it melts, put some on the iron and run it very slowly along the job which should cause it to flow right into the joint. If the job has previously been tinned, then more solder may not be required as the two lots of tinning should dissolve into each other making a solid joint.

Using a blowlamp or torch

Torches and blowlamps also come in a variety of shapes and sizes. Depending on type and size they can be used for soft soldering or brazing. Advertised in many journals are very small blowlamps that work on small gas and oxygen cylinders of the size of those used in soda siphons. Claims are made that these will reach very high temperatures and they certainly will do this. But they are only suitable for very small jobs. The rule must be as in the case of the iron, a large area to be joined, a large blowlamp, and a small area a small blowlamp, too much or too little heat are equally as bad as each other and the lamp must be matched to the job. If you can afford it, the best idea is a butane or propane cylinder with control valve, hose and torch with three or more different size nozzles. Of course, if you are only going to do small jobs then you will only need a small blowlamp and there is no need to go to the expense of a lot of equipment. There are a variety of small ones on the market and it should not be difficult to get one to suit your particular needs.

Paraffin blow lamps are still obtainable and worth considering. They come in a variety of sizes and generally give a greater heat than butane lamps for a given size. Of the bottled gases then propane is the better, Butane, however, is more easily available at D.I.Y. shops. When purchasing equipment you must make sure that it is suitable for the type of gas you wish to use.

The technique of soldering or brazing this way is much the same as with an iron.



A Propane torch with a full set of burners. The torch has both air and gas controls for the best adjustment. The heat can be increased by use of the lower lever.

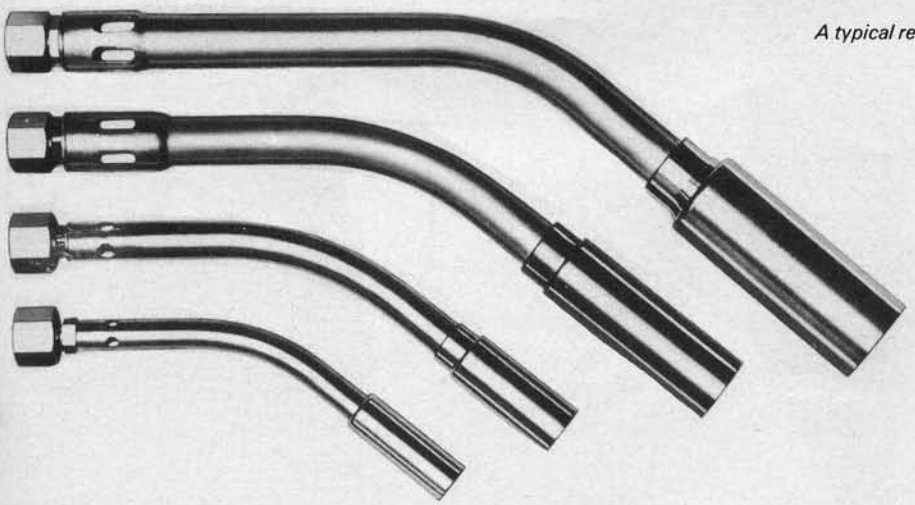
The job must be cleaned and well fluxed. The right flux must be used. The work is raised in temperature until the solder will melt on it. NOT BY THE HEAT OF THE FLAME, but by the heat of the metal to be soldered. Remember too much heat is as bad as too little and will destroy the flux as well as burning out the solder. With the correct temperature the solder should flow easily. One trouble with this method of soldering is the problem of solder spreading where it is not required. This can be prevented by coating the area where solder is not required with "plummers black". The best way to buy this is as "Zebo" grate polish, in a decent hardwear shop. Be careful though, the first time I used an inhibitor I put on too much, it melted and flowed into the joint completely ruining the job. So the same rule must apply. Not too much, but just enough.

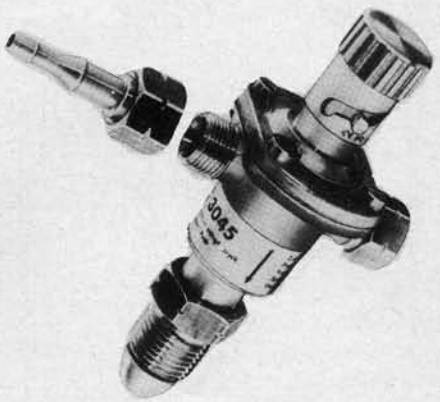
For very large jobs then, you must prevent loss of heat. The best way of doing this is to pack the job with firebrick. There are various types that can be used, I know people who used broken-up gas fires, and others who use bricks. Personally I use a white silicon brick which is used normally for packing pottery kilns. It is the best I have come across but it is difficult to get. When making joints it is an idea to chamfer the edges of the job and allow a fillet of solder to form. All solder needs to have a minute gap to run into, but it must be very minute indeed, particularly in the case of silver solder.

Cleaning

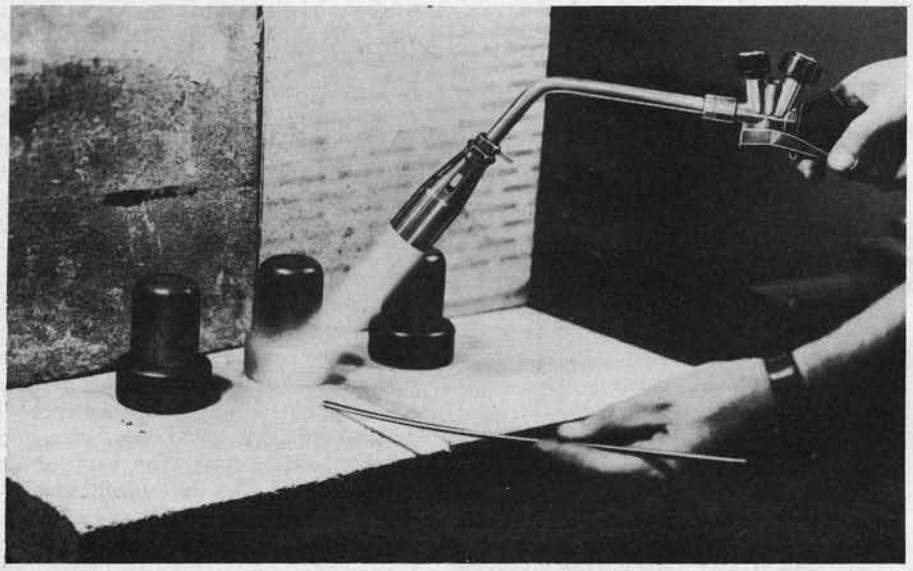
Finally, how to clean the metal. In the case of small work a rub over with emery paper or a file will do. For a boiler or similar job, then some form of acid bath is reuired. Sulphuric, or Nitric Acid will do the job, but it needs a great deal of care in its use, particularly if children are about. If concentrated acid is obtained, then it will need diluting and this means mixing it with water. You must put the acid to the water. If you put water on the acid, it will shoot up and all over you. A less dangerous substance that will do the job quite well is one of the liquid kettle descalers on the market. I now use a pickle bath called 3HP marketed by Three Aitch Mouldings. I have found it a wonderful cleaner and perfectly safe. For my pickle bath I use a small plastic dustbin with a lid. But a plastic bucket will do. Do not use metal.

A typical regulator for a Propane gas torch.





A selection of Propane burners.
It will be seen that these have the air hole at the base of the tube. This is useful for soldering and brazing inside.



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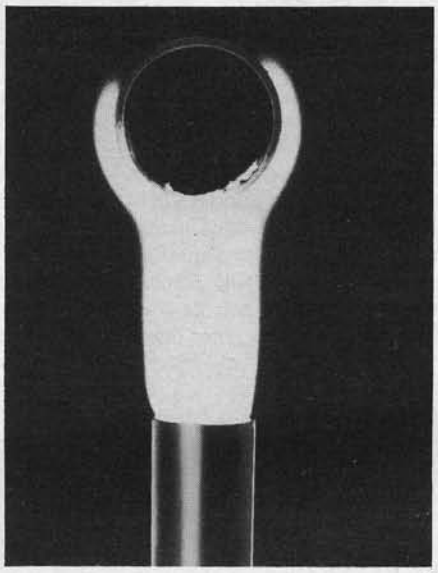

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Welding Techniques

This has not been described so far. If you do decide to purchase welding gear then it is as well to go and learn how to use it. If for some reason you cannot do so then the following may be of some help. Firstly remember the oxygen is turned on after the torch is lit and off before it is put out. The flame before turning on the oxygen should be turned up just enough to start smoking. Then when the oxygen is brought in a small blue cure should be obtained about ¼ in. in length. The flame should be silent and if it is making a roaring sound needs to be adjusted. (For brazing with this equipment you will need a slightly larger flame). Having got the correct flame it is brought to the metal so that the tip of the core is just touching. The metal will heat up and form a liquid pool. It is the running together of the pools of both metals to be joined that creates a good weld. Do not hurry and do not try to use welding rod to join the metals. It must be both metals running into each other.

Whether soldering, brazing or welding, if the metals are of different thicknesses then the thicker one must be heated first. Remember that the solder must melt on the work and not by the heat of the iron or flame. Only then can the job be done successfully. Finally, I must say that to describe fully the technique for joining metals in this way would fill a book. It requires plenty of practice and time must be taken to allow the work to fully heat up.

I will be glad to answer any queries on the subject to the best of my ability.

We would like to thank Kenneth Johns Ltd. and C. G. & W. Young for use of their photographs.

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1 *Brazing with a Propane torch.*
2 *A new product is this cyclone type flame which will heat right round a tube as shown in this picture.*
3 *When heating a tube with a Propane burner only one side as shown in this picture gets the maximum heat.*
4 *A typical home arc-welding unit.*
5 *Portable gas welding unit.*

5

The Story of my Alfa Romeo P2

By Ettienne Becker

When I was twelve years old, I often used to pass by an attractive shop window in Rabat (Morocco) where the beautiful Alfa Romeo shown in the attached photos was on display.I would like to introduce it to you.

I was fascinated by the size and finish of that car, as well as by its price, and I naturally asked Santa Claus if I could have it for Christmas. Santa Claus said I could on condition that I obtained better marks at school.

So I stepped up the "intellectual pressure" on my brain and at Christmas I was presented by my Mother with that magnificent dream car!

However, I had not yet acquired enough respect for the beautiful little thing and I promptly got its "spring engine" running at top speed on our garden terrace. Sure enough, on that first "Monza-type flying start", I sprung the front axle!

I certainly wasn't very proud of that feat and ran in tears to the best mechanic in town. Well, he managed to straighten out everything with his blow pipe, but the paint had been burnt and it was impossible to find a similar colour.

The fact is that I was simply mad about speed and I soon found a tennis court where I could again indulge in those terrific spurts! But there was never anyone at the "winning post" and as the toy's steering was not particularly accurate, it swerved rather unpredictably—somewhat like a rugger ball. In short, there were more accidents which again called for the services of the good mechanic.

Still craving for that feeling of speed, I tried to find a means of getting the car to turn at the right moment. Eventually, I devised a "system" which might be regarded as the prototype of mechanical remote control. Indeed, I discovered that by winding a piece of cord around the clutch-shaft and fastening the end of that cord on to the steering-wheel by means of a hook, the taut cord would bear on the steering-wheel (by about half-a-turn) and my Alfa would then be able to corner properly.

Well, the result was quite spectacular at times: the car would dash forward in a straight line over a distance of about 20 yards, then come to an abrupt stop, with one of the wheels fully locked, and finally turn a somersault. It all looked quite realistic to me.

I felt that in order to prevent the car from overturning, the track had to be rendered slippery and this I did by applying a sort of "water film". This, too, produced a most striking visual effect: you had speed, with plenty of "rain water" splashing from the wheels, "sliding cornering" and the car slewing round impressively when braking. Not bad at all for those days, I think.

Later on, I took a fancy to reduced-model 'planes and the Alfa remained in the cupboard.

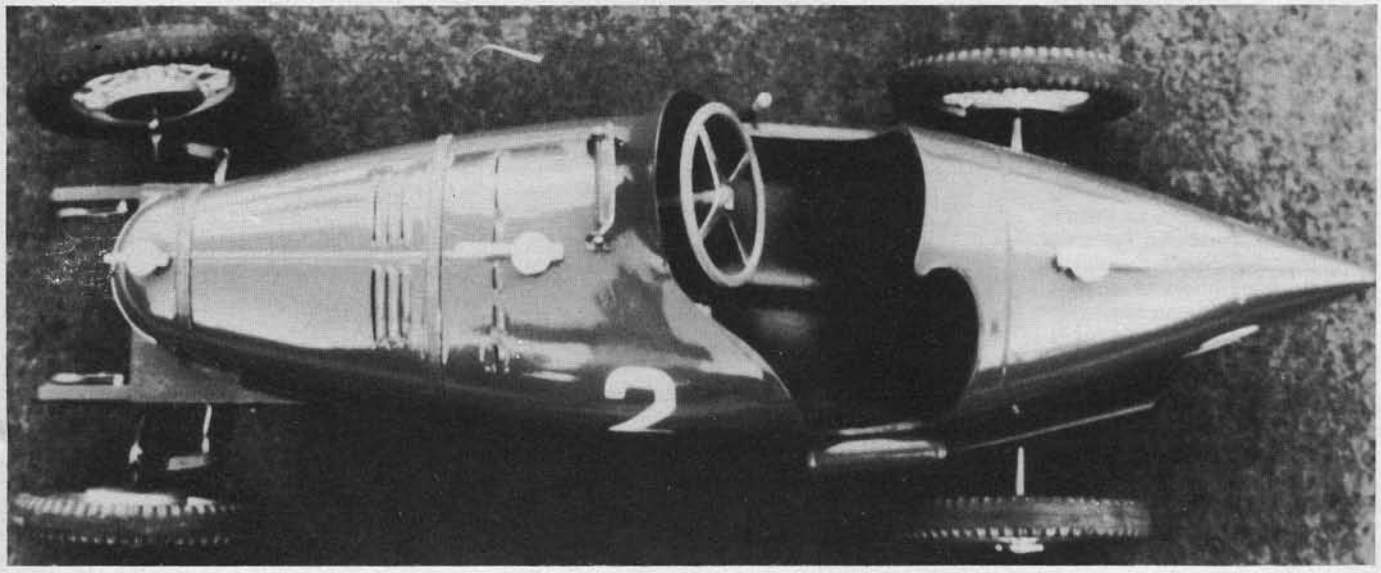
Forty years after that, I took it out again and felt that it needed a complete overhaul, as we do for those time-honoured Rolls-Royce or Bugatti vintage cars. This is actually what I did:

I had the shock-absorbers and front springs remade with real blades. I fitted a new wooden-rimmed steering wheel, as well as a complete dashboard. I fixed an enamelled Alfa Romeo monogram plate on the door. The seats were re-covered with real leather and the body given a new coat of paint. The radiator was "revamped" with a nickel-cap and a real gate fitted. The floorboard was entirely renewed and so were the tyres—on a Meccano tyre-base.

The engine is still in good order but, quite frankly, I have neither the desire nor the courage to get it running again at full speed on a tennis court. This may be regarded as a sign of wisdom, yet is it really preferable to that uncontrolled youthful enthusiasm?

I almost forgot to mention a manufacturing detail: on repairing the car and removing the engine, I had access to the inside of the car's rear part, and, to my amazement, realised that the raw material used at the time was tin-plate, of the type commonly used for tin cans. In fact, the words, "Paris Mushrooms" and the producer's trade-mark could still be clearly read.

This is what they would call in France "a real Scottish story".



Check and Report

by James and Rita Vanderbeek

Our Review Models this Month . . .

This is the issue of Model Mechanics which will appear just a week or two before Christmas, so it seems appropriate to cover some of the model products which will be to the fore in the specialist retailers. The year 1979 as a whole has been very interesting as far as kits, models and equipment are concerned. Competition has been, and is, fierce so it is true to say that 'shopping around' has never been of such potential advantage to the buyer as it is at present.

And now to look at a few of the latest modelling 'goodies', besides concluding these introductory notes by adding our own best wishes to the readers of Model Mechanics to those of the Editor and his Staff.

Arnold-N railway stock

Our recent reviews of some of the latest Arnold N-gauge locomotives—including the superb Swiss 'Crocodile'—must now be followed by a report on the rolling stock which this West German manufacturer is now distributing in Britain. Our first model is a vehicle representative of the latest European standard tourist coach and which is now available in first and second class forms in liveries such as DB beige-red, SBB orange-white, SNCF silver grey-dark grey and OBB orange-white. The external outlines are pleasingly accurate, with the ribbed roof, large windows and corridor connections of the prototype and, of course, the black finished underframe which includes all the modern braking and passenger comfort equipment. The coaches all have Fiat type Y 0270 S bogies and in the model these replicas are equipped with very free-running wheels on plated metal, needle point axles. Standard type, spring-loaded auto-couplings are fitted at both ends. The coach interior is similarly well finished, with its correct arrangement of compartments and corridor partition.

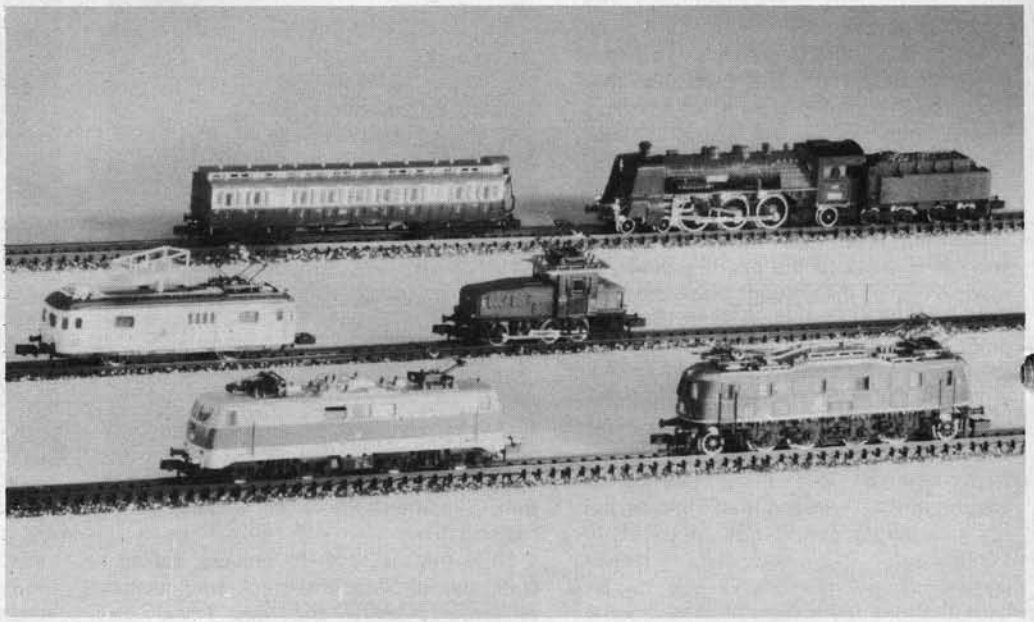
The second group of Arnold N-gauge coaches goes back to the German Railways of the 1930s, with non-corridor vehicles as used on local trains. The liveries then used were quite striking, so that our three test samples were in the all-green of the Prussian State Railway, the violet-beige of the so-called Ruhr District Express Service and the alternative beige-bordeaux of that same railway. All have yellow window frames, silver finished clerestory roofs and carry their full shares of compartment markings, grab rails and destination panels. There are full-length footboards and the underframes, to be true to type, include gas cylinders.

The coaches all behaved like thoroughbreds on the test track and completed the whole of our session without incident. This is praise indeed, for our N-gauge test layout has (on purpose) some particularly bad sections of track and pointwork. These were in no way sufficient to cause the Arnold coaches even to hesitate, so confirming our initial impression that these models are of especially high quality.

Revell's fun kits with lights, action and sound

When Revell attempt something in the kit line which is out of the ordinary they usually make a good job of it, so the addition of Electronic Action to models which usually are static sounded interesting. The three kits include 1/40th scale models of the P-51 Mustang (Skull Duggery) and P-40 Flying Tiger, plus a 1/32nd scale model of the Hughes OH-6 Cayuse helicopter. The big features are the inclusion of electric motors to drive airscrews or rotor, Flex Circuit panels which consist of copper wiring circuits printed on flexible plastics sheet, sets of miniature bulbs and sheets of self-adhesive insignia matched to the particular aircraft involved. Add self-coloured plastics component which are designed to be snapped together rather than cemented and you have a set of fun model kits which is as appealing as they come.

Lest any readers who are potential buyers of these kits for the junior modellers in the family have any worries about the addition of electrics to what are otherwise very simply assembled models, may we point out that the multi-language instruction booklet deals so clearly with every stage of both model building and electrics link-



Some of the latest Arnold N scale models.

Below Mustang P57-B with Revell's electronic goodies.

ups that these are ideal for total newcomers to the hobby. We enjoyed our session with these three well-known aircraft types and can well understand why Revell have chosen to give them so much publicity.

Four Fords from Revell

Revell automobile series have always been very successful and, indeed, the present range includes some of the best models of this type currently available. Just received are four kits which are intended as additions to the 1/48th scale range and which are all of American Ford origin. The types involved start with the 1925 Model T, through the 1929 Model A and 1932 Model 18 coupé, to just one post-War example in the very distinctive shape of the 1957 Thunderbird.

All the kits have neatly detailed moulded components, including flexible plastics treaded tyres and bright plated parts for engine and trim detail. The two last-named cars feature, in addition, red finished body mouldings—proof positive of the eventual demise of the Ford dictum that any colour is available as long as it is black.

The Classic Cards range, of which these kits now form a part, already includes a number of superb examples of automobile engineering—the Dusenberg S.J. of 1934 and the Mercedes Benz 540K of 1939 being typical. As a whole, the range is very tempting to car model enthusiasts and, with these new models being so competitively priced, it will be very surprising if they do not figure under many a Christmas tree.

Some interesting Airfix kits

The three most recent Airfix kits to arrive on our desk all have wide appeal. First is a re-issue, the 1910 'b' type London double-deck bus carrying the route numbers and boards of the No. 14 which, to this day, operates through the same areas. It is joined by two brand-new packs, the first being a Battle of Britain period Hawker Hurricane Mk 1 to 1/72nd scale and, to link up with the British and German operational high-speed craft, an RAF Rescue Launch in the form of the British Power Boat Type 2.

The omnibus kit is one which will be remembered by a considerable number of our readers so it will suffice now to mention that the red finished mouldings of vehicle and its crew are as interesting as ever and that, in addition to waterslide transfers for the general markings, there is a colour printed sheet of advertising panels, plus destination and fares boards.

The Airfix organisation has had several attempts at modelling the Hurricane, but none of the previous efforts have equalled this new Mk 1 version in accuracy both of outline and detail. The grey mouldings are all beautifully finished and provide accurate representations of the surfaces, from metal to fabric. There is a set of waterslide transfers for a 1940 Hurricane of No. 1 Squadron (a unit known with equal distinction for its performance in the pre-war Hawker Fury) and there is even a display stand.

The ft. British Power Boat Type 2 launch was designed by Hubert Scott-Paine and was affectionately known as the 'whaleback' from the curves of its main deck. The Airfix research team have done just as well with this craft as with the Hurricane mentioned above, so that the grey finished mouldings are well up to the standards demanded in a kit such as this. Features include the defensive armament, searchlight, deck vents and the padding around the bridge as protection from splinters and small calibre bullets, whilst in typical Airfix style there are sets of waterslide transfers depicting the yellow, red and black markings of three representative 'whalebacks'.

The land, sea and air options make this Airfix group particularly attractive at this time of the year.

The 1910 London bus—from the re-issued Airfix kit.

The New Airfix 1/72nd scale Hurricane Mk1.

Top quality Spanish kit for American Revenue Cutter

In addition to its rapidly growing selection of home manufactured products, Humbrol is importing ranges of special marine and aircraft kits. Thus it is that the Artesania Latina kit for the 1/50th scale Revenue Cutter 'Dallas' came to us for review in these columns. Dallas was a classically proportioned vessel, very fast and manoeuvrable and these qualities were used to the full in the American revenue marine's activities against smugglers and in the suppression of slave trading and piracy.

The kit model has an overall length of 28 in. and height of 22½ in. The kit provides for a wooden model to be built— apart from a basic ply framework in traditional manner, with double skin hull and main deck planking and quite astonishing accuracy in deck and rig detail. The kit timbers include ply panels which are partially cut-to-shape, so that they still require final cutting with fretsaw or modelling knife. There is also a selection of shaped block parts, besides planking strip and other structural units from mahogany, walnut and ramin. Dowels of several diameters are provided for the masts and yards, and three thicknesses of rigging thread are included.

It is in the provision of detail parts and fittings that this kit is so well endowed. A printed board shet has plastic bags stapled to it, with each one containing its share of

small parts such as boxwood blocks and dead eyes, turned brass cannon (with a supply of balls), belaying pins and staunchions, brass eye bolts and rings, moulded plastic anchors and many others. All are beautifully made.

The model is described by its manufacturers as being "designed to appeal to the new and experienced modeller of historical sailing craft" but Humbrol, and your reviewers, believe that building Dallas is perhaps best undertaken by experienced modellers only. There are three large sheets of full scale drawings which will do much to simplify the building task, but it is at this point that we come to our main criticism of the Dallas kit—the instructions, by modern kit production standards, are simply not good enough. It is a great pity that such a superb kit is lacking in this respect and we hope that Humbrol will take steps to rectify the matter in due course.

N-gauge locomotive kits to fit standard Farish chassis

Although the locomotive type situation in British outline N-gauge is far better than it was, there are many interesting prototypes which have not been commerically modelled—either in ready to run or kit form. One of the companies tackling this problem is D. & M. Castings, and their new LMS/BR 4-6-0 Patriot is already in the shops, where it joins previously released locos such as the Royal Scot and the LNER Class J39 0-6-0 tender loco. In an advanced stage of preparation, and possibly available by the time these words are printed, is a further LNER type, the J52 0-6-0 tank. This last-named locomotive has been designed specifically to be simple to construct and thus to form a suitable 'first model' for newcomers to white metal N-gauge loco modelling. The makers sent us a pre-production set of castings and reminded us that work was still to be done on the tools, but the J52 went together with ease and left us in no doubt that it will be a very popular addition to LNER loco studs. Interestingly enough, there are but seven parts in the D. & M. kit and, as they may be assembled using cyanoacrylic or Epoxy resin adhesives, the J52 is a model which need hold no terrors for the uninitiated. The recommended power unit for the J52 is the Graham Farish 0-6-0 pannier tank chassis and the D. & M. loco is designed to fit directly over this unit.

Reverting to the larger Fowler Patriot model, this kit is representative of D. & M.s latest production standards and proved to be almost as simple to assemble as the smaller tank. It is designed around the Graham Farish Black Five 4-6-0 chassis and includes GF tender wheels on their axles and two auto-coupling mouldings. Both kits deserve to achieve hit status with N-gauge modellers, for they have so much to recommend them.

Mallard and Patriot join Hornby OO scale loco stud

Hornby has introduced some nice locomotives through the past year, with types as divers as the LBSC Class E2 tank, the highly-successful BR Western diesel and now, for this review, the LMS Patriot Class 5XP 4-6-0 and the LNER world steam record holder, the Class A4 Mallard. It is a fact that all these 1979 locomotives serve to show just how much improved is the present Hornby Railways range. Competition is a tremendous spur and, with Hornby having the lion's share of the OO market in U.K., they have had to work hard to keep ahead of the more recently introduced systems.

The Patriot—happily named Duke of Sutherland to match the larger Coronation Class model, Duchess of Sutherland—is a very neat example of LMS express steam as created by Sir Henry Fowler. The Hornby model has tender drive with ringfield motor driving two of the three pairs of wheels, with current collection from the loco drivers. The amount of detail both above and below the running plates is better than previously achieved and the finishing touches to the very neatly lined out bodies of both units are provided by the wire hand rails with their plastic moulded mounts.

The Mallard has been heralded as one of the best—if not, the best—Hornby Railways loco model ever built and with this sentiment we are hardly disposed to argue. Our review model created a very good impression whilst still nestling in its expanded polystyrene pack, and impressed us still more when viewed in action on the test track. Detailing throughout makes this one of the finest LNER Class A4 models we have seen, whilst the loco's selection as the first Hornby model to have the cab detail picked out in brass colour is particularly fortunate.

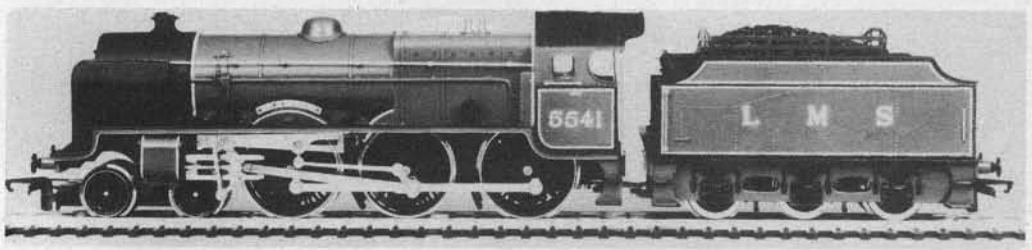
Both of these locomotives were interesting and totally snag free test subjects. They share the same basic Hornby motors in their tenders so there was very little difference in noise level or overall performance between the two. We noticed that the friction losses from the loco chassis were minimal—indicative of good assembly of drivers and side motion and, as we expected, load hauling performance and maximum speeds were up to Hornby express standards.

These two steam outline locos take the marque a big step further: technically, and in value for money, they have much to recommend them.

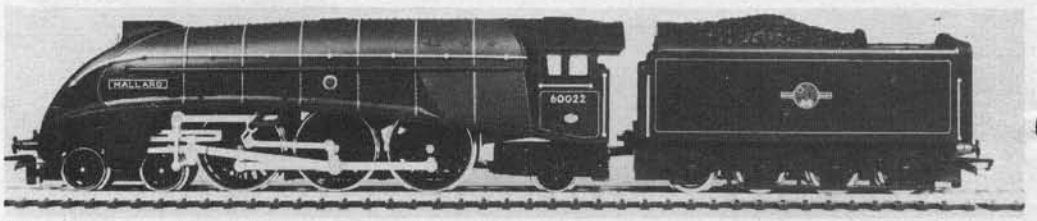
Modellers' bargain packs from Proops

That long-established company, Proops Bros. Ltd., offer a range of bargain packs, priced at £1 each, of the various small parts and fixings so sought after by modelmakers. The list reads like the contents of a modeller's Alladin's Cave—self-tapping screws, various types of washers, hose-clips, crocodile clips, springs,

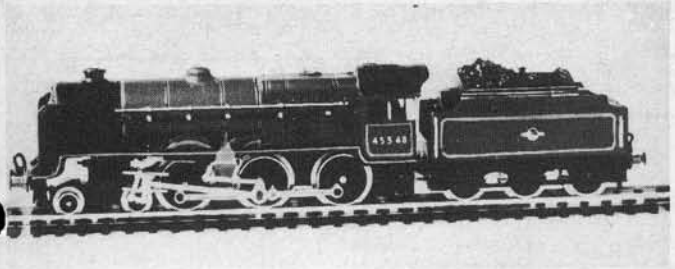
Air Sea Rescue 'Waleback' from the Airfix kit.



The new Hornby OO scale LMS Patriot class 4-6-0.



World steam speed record holder Mallard to OO scale by Hornby.



Patriot class 5 × P N-gauge loco assembled from the D&M castings kit.

copper tubing, Bowden cable, micro switches, mains neons, matching steel gears, rivets, switches and many more. We have been examining a selection of these packs and must applaud their tremendous value. From one we picked out parts for which we had been charged over 12p each, and which worked out at only about half that price—for a slightly superior design—from this supplier.

Our further checks through the bargain packs served to confirm that none of them contained less than good quality items—which we would have no hesitation in incorporating in our own constructions. We were particularly impressed by the pack of ten matching steel gears, for these turned out to be well cut and finished, designed to accept 2mm or 3mm diameter shafts and with diameters (6mm and 14mm) which made them especially applicable to model gearboxes.

Proops bargain packs of springs, S/T screws, large washers.

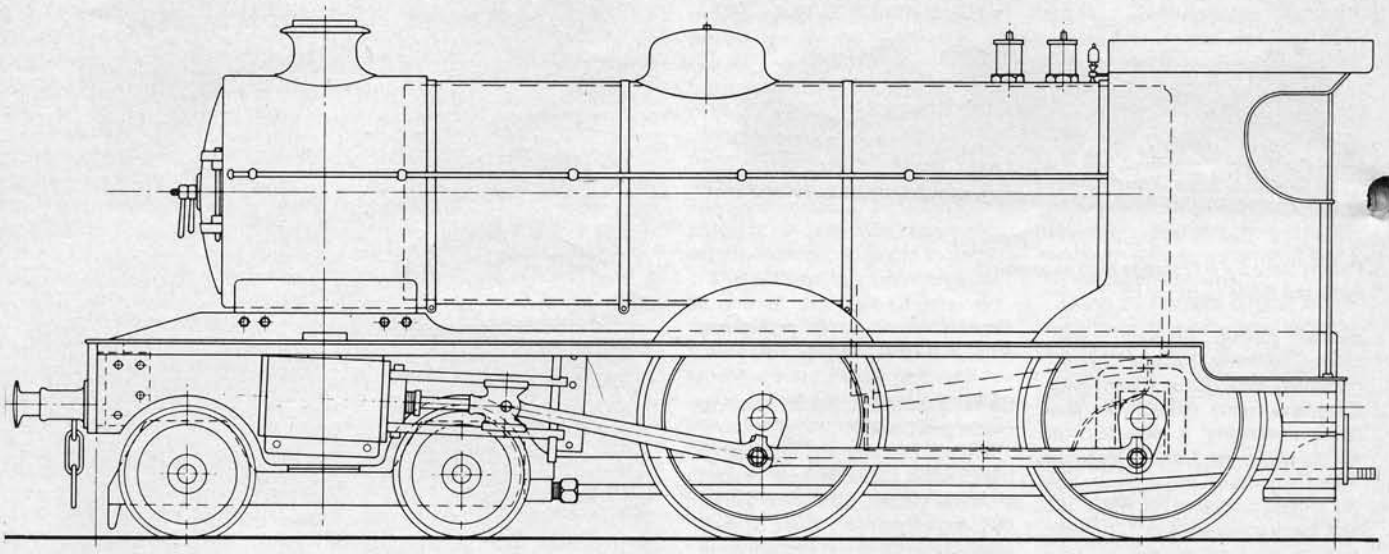
We will be returning to some of the goodies available from Proops in future issues. Suffice to say at this stage that acceptance of their products has been so immediate in the Model Mechanics offices, that it will be surprising if we are allowed to retain their items long enough to check and report upon them!

Facts of finishes from Humbrol

A slim pack, titled Humbrol Modellers Reference Library, proved to contain nineteen full-colour printed cards, each measuring 8¼ × 5¾ in., and providing finish/camouflage drawings of aircraft and two representative AFVs. besides two of the Authenticards devoted entirely to the national markings of british and American aircraft.

The World War II aircraft cards include the most important operational types of the RAF, Luftwaffe and the United States Air Force. Multi-view full-colour plans of camouflage schemes are on one side—plus details of specific aircraft—plus, on the reverse sides, potted histories of each type and with colour notes which include direct references to the Humbrol paints correct for that machine.

The Library pack provides an inexpensive way of obtaining reliable references to the machines of that period. One further useful touch is the transparent laminating of the cards on both sides so that if an accidental spillage of paint occurs the unwanted coating may be easily removed.



The 'Eagle'

A Simple 2½ in. gauge 4-4-0- Locomotive. Described by Martin Evans. Part 10

IT IS NOW TIME to tackle the remaining boiler fittings. No doubt some builders will prefer to buy these ready made, as they are mainly "standard" fittings, obtainable from people like Reeves, Kennions, Don Young, Blackgates, "Steam Age", etc., etc. However, there is more satisfaction to be gained by making these oneself, and none of them are difficult to make, in fact the silver-soldering of the little parts together should be a pleasant exercise after boiler brazing.

Let us start off with the safety valves, which are the easiest of all. These are made from $\frac{7}{16}$ in. a/f hexagon gunmetal or brass—gunmetal is the better of the two, but brass is satisfactory as there are no "working" parts. It is easier to turn the bottom end first, so turn this down to $\frac{5}{16}$ in. dia., and thread 32T. Then cut off sufficient from the bar for the first valve and repeat for the second. Now chuck a short piece of mild steel in the 3-jaw, face off, centre deeply, drill and tap $\frac{5}{16}$ in. × 32T. We can now screw the partly turned valves into this, for the remaining machining operations—turning the outside, then facing, centring deeply, drilling and reaming right through $\frac{1}{8}$ in. dia. Then open out with $\frac{7}{32}$ in. drill, following up with a $\frac{7}{32}$ in. D-bit. Be careful not to go in too deep. Put the $\frac{1}{8}$ in. reamer through again, at dead slow speed. Then tap ¼ in. × 40T. to a depth of about $\frac{5}{16}$ in. That completes the "body" of the valve. Repeat for the second valve.

We now have to form a seating for the ball, which is a $\frac{5}{32}$ in. stainless steel one. Drop the ball in, and give it a *light* blow with a hammer, but don't be tempted to use just a length of brass rod, and drilled accurately for the rod to be used against the ball. This could be $\frac{1}{8}$ in. dia. and well countersunk on the lower end, so that it won't slip off the ball.

The adjusting nut is just a $\frac{1}{8}$ in. length of gunmetal rod threaded ¼ in. × 40T. to match the valve body, drilled centrally $\frac{5}{64}$ in. dia. (or No. 47 drill) and with eight No. 55 or 56 holes drilled around this, as close as possible without breaking into the $\frac{5}{64}$ in. hole. It is advisable to leave the threads of the adjusting nut a shade oversize, so that it cannot work loose in service. We then need a pin or "pintle" to locate the spring and ball, this being turned from $\frac{1}{8}$ in. dia. gunmetal or bronze, deeply countersunk on its underside, to locate the ball, and turned down to $\frac{5}{64}$ in. dia. (or a thou or two below) so as to pass through the adjusting nut.

Finally, we need the spring, which should be stainless steel or hard phoshor-bronze. These can be obtained ready made from Reeves and similar suppliers, so it is hardly worth buying a reel or coil of wire just for two valves (though it is always worth having a spare or two!)

Although a formula can be given for deciding the gauge of wire from which to make the springs, this is somewhat complicated, as of course the diameter of the finished spring has a considerable effect on its strength. However, there is a simple way of deciding whether a spring is suitable for its job—by working out the pressure of steam required to push the ball off its seating. For instance, in our case we have a ball seating of $\frac{1}{8}$ in. dia. If we require the safety valve to "blow" at a shade above the working pressure of 80 p.s.i., we can say that the pressure on the ball will be, say, 82 × 0.0123 p.s.i., as the latter figure is tne area of a $\frac{1}{8}$ in. dia. hole. This works out to 1.009 lbs. So if the builder has a suitable weight of 1 lb. he can test its effect on the spring to get a good idea of whether it will be suitable for the job in hand. For my part, I always set my safety valves under steam, using the large pressure gauge which was used for boiler testing, temporarily fitted to the boiler; then there is no question that the valve will blow at the desired pressure.

Check Valve

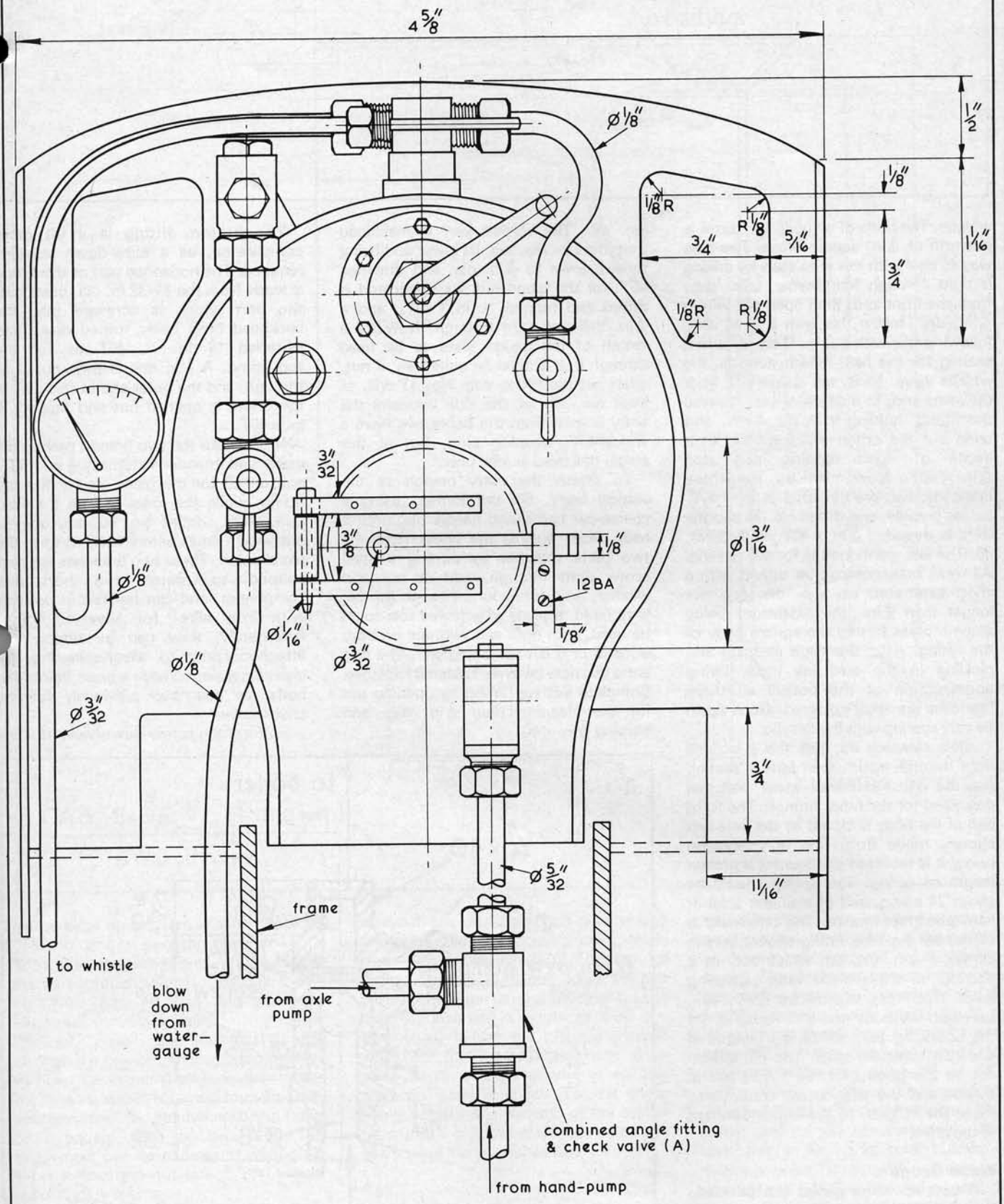
The check or non-return valve is fitted to the bush on the lower part of the boiler backhead. Only one will be required as the intention is to use a "two-way" fitting to bring both the water feed from the axle pump and that from the tender hand pump into the single check valve.

Little gunmetal castings can be obtained for check valves, but they can be made quite quickly by silver-soldering the branch piece into the vertical "body" of the valve. Note that the lower part of the body, forming the seating for the ball, is machined off at an angle. This makes for a more efficient ball seating than one that is square (as formed by a D-bit or end-mill). The reason for this is that any speck of dirt or foreign matter that might get into the feed water will not become lodged on the ball seating, but will tend to fall clear.

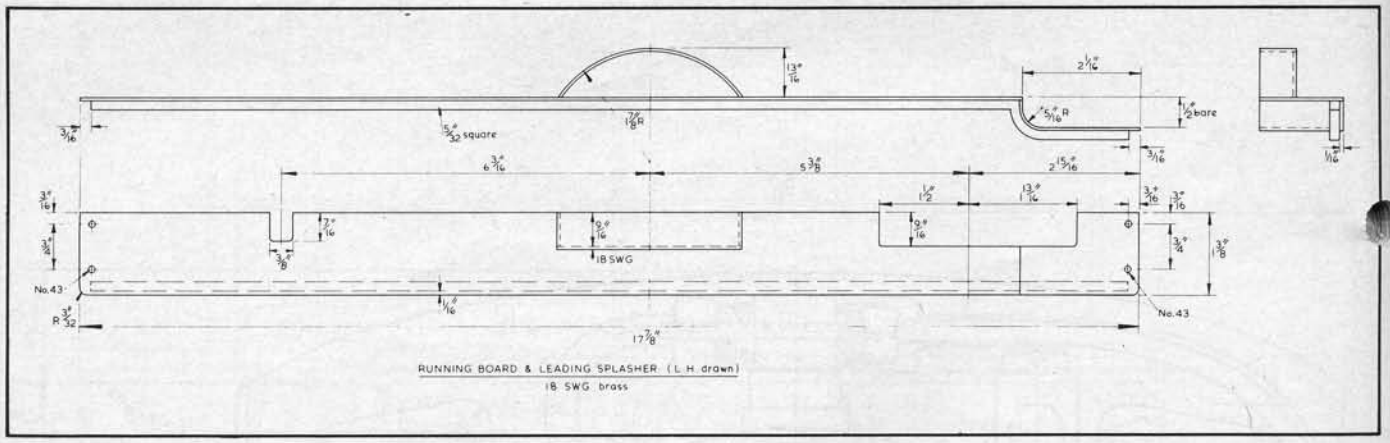
The body of a "built-up" check valve can be made from 11/32 in. dia. gunmetal or brass, with 11/32 in. a/f hexagon for the ball seating part and for the top cap. The branch piece can be turned from $\frac{5}{16}$ in. dia. material, and this can be turned down to say $\frac{5}{32}$ in. dia. and made a press fit into the body, ready for silver-soldering. Incidentally, only a very small flame will be required for these miniature silver-soldering jobs, and if the metal is really clean, and well fluxed, only a very tiny bead of Easyflo silver-solder will be needed, so that cleaning up will be a minimum.

Turret

The turret, or manifold as some call it, is fitted to the top rear corner of the firebox, and supplies dry steam to the blower valve, the pressure gauge and the



Arrangement of the Cab fittings



whistle. The basis of a "built-up" turret is a length of $\frac{5}{16}$ in. square brass. The best way to deal with this is to start by drilling it right through lengthwise $\frac{3}{32}$ in. dia., from the front end, then open out with a $\frac{5}{32}$ in. drill, follow this with a $\frac{5}{32}$ in. drill, following this with a $\frac{5}{32}$ in. D-bit to form a seating for the ball—which controls the whistle valve. Next, tap $\frac{3}{16}$ in. × 40T from the same end, to a depth of $\frac{1}{8}$ in. Reverse the fitting, holding it in the 4-jaw, and open out the other end $\frac{5}{32}$ in. dia. to a depth of $\frac{3}{16}$ in. tapping this also $\frac{3}{16}$ in. × 40T. Now turn up the three branches, two are threaded ¼ in. × 40T. on the outside, and drilled No. 34 and the third is threaded $\frac{3}{16}$ in. × 40T., drilled No. 50. The last mentioned is for the whistle. All three branches can be turned with a short extension, say $\frac{1}{8}$ in. dia. and not longer than $\frac{3}{32}$ in., the extensions being made a press fit into the square body of the fitting. After thorough cleaning and pickling in the acid (as used during construction of the boiler) all three branches are silver-soldered. Once again be very sparing with the Easyflo.

After cleaning up, put the $\frac{3}{32}$ in. drill right through again, then form a seating for the $\frac{1}{8}$ in. stainless steel ball, as described for the other fittings. The front end of the body is closed by the little cap shown, made from $\frac{5}{16}$ in. a/f hexagon brass; it is recessed to allow for a greater length of spring. The spring should be about 24 s.w.g. and of stainless steel or hard phosphor-bronze. The other end is closed by the little fitting shown, which carries a $\frac{1}{16}$ in. dia. pin which acts as a bearing for the whistle valve operating lever. This fitting is threaded $\frac{3}{16}$ in. × 40T. to match the body and is drilled $\frac{1}{16}$ in. for the operating pin, which is a length of $\frac{1}{16}$ in. dia. stainless steel. The pin should not be too good a fit, or it may jam in service and the whistle will continue to rouse the echoes, to the embarrassment of the driver!

Water Gauge

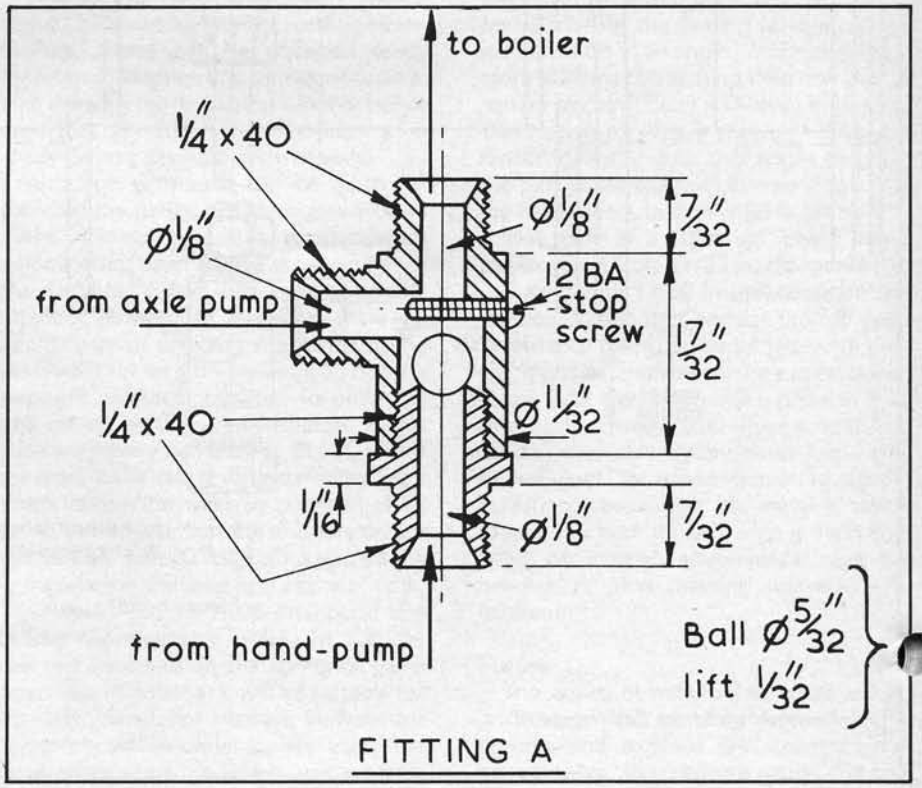
A built-up water gauge can be made from lengths of $\frac{3}{8}$ in. dia., 11/32 in. and $\frac{5}{16}$ in. dia. brass rod. To take the top fitting first. The branch is turned from the $\frac{5}{16}$ in. dia. rod. It is turned down to ¼ in. dia. and threaded 40T. to match the bush in the boiler backhead, and is drilled through $\frac{1}{8}$ in. dia. The vertical part is machined from the $\frac{3}{8}$ in. dia. rod, its lower end being turned down to $\frac{5}{16}$ in. dia. and threaded 40T. for the gland nut. Its upper end is drilled and tapped ¼ in. × 40T., and a $\frac{3}{16}$ in. drill put right through. Now try a length of the gauge glass to be used through it. It should be quite free; if not, open out the fitting with No. 11 drill, or even No. 10. At the side opposite the entry branch from the boiler, we have a $\frac{3}{16}$ in. × 40T. cleaning plug, but at this stage, drill this $\frac{1}{8}$ in. dia. onlv.

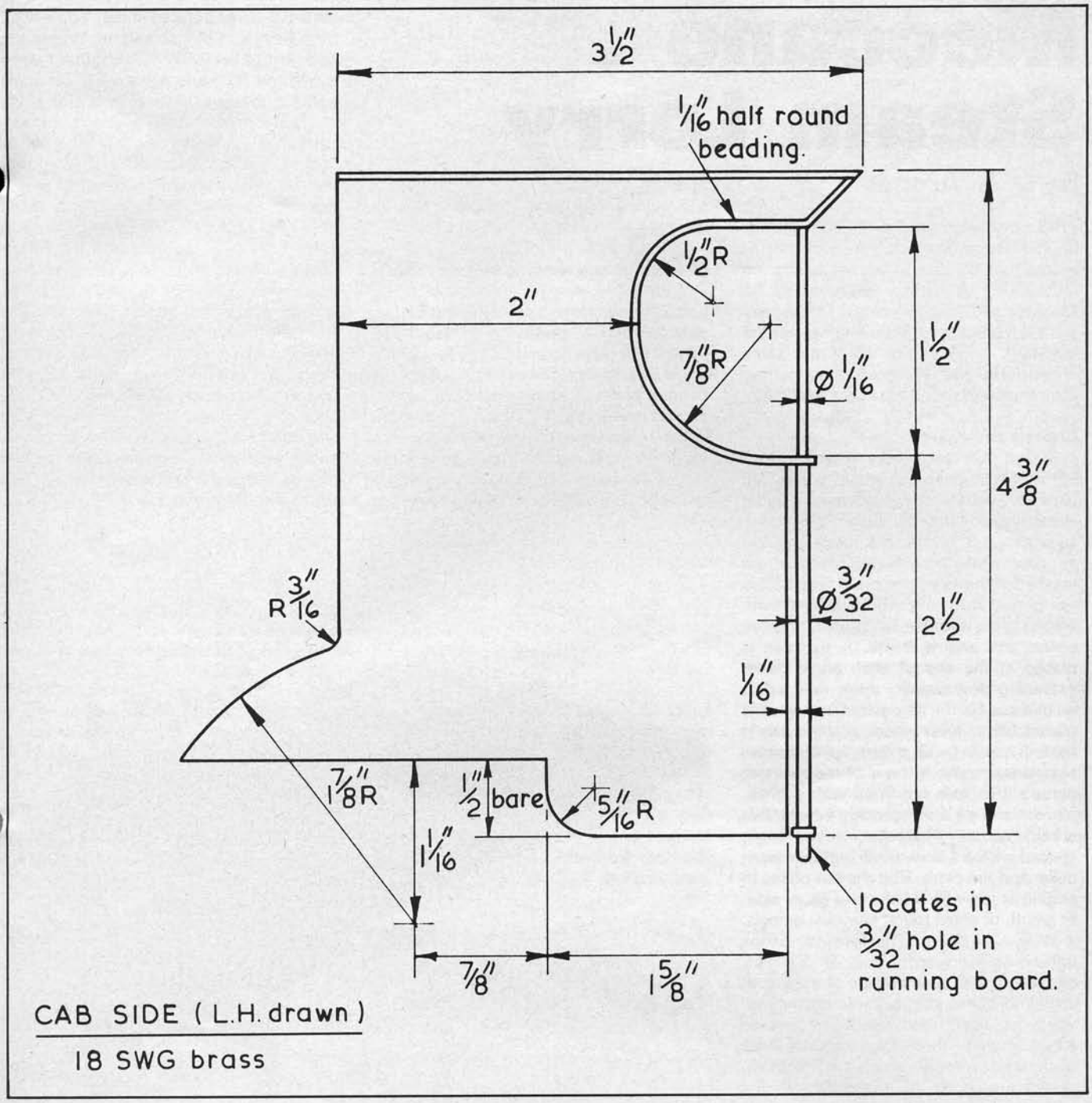
To attach the entry branch to the vertical body, file the former, using a coarse-cut half-round needle file, until it beds nicely against the body. Hold the two parts together by putting a steel screw right through, with a nut and washer, if no screw long enough for this is to hand, a piece of screwed rod could be used, with nuts and washers on both sides (5 or 6 BA will do nicely). The two parts can now be silver-soldered together. Complete this top fitting by opening out for the cleaning plug $\frac{5}{32}$ in. dia. and tapping $\frac{3}{16}$ in. × 40T.

The bottom fitting is a bit more complicated, as a blow-down valve is required. The horizontal part of this fitting is made from the 11/32 in. dia. brass rod, the part which is screwed into the backhead bush being turned down and threaded ¼ in. × 40T as for the top fitting. A $\frac{1}{8}$ in. drill is then put right through, and the outer end of this part of the fitting is opened out and tapped ¼ in. × 40T.

Next, make the two branch pieces, the upper one threaded externally $\frac{5}{16}$ in. × 40T, and drilled for the glass, as for the top fitting, while the lower one is threaded $\frac{3}{16}$ in. × 40T., drilled No. 50, and opened out with a small centre drill, to form the usual union. These two branches are next shaped to match the horizontal component, and can be held in position with iron wire, for silver-soldering. Alternately, they can be temporarily attached, prior to silver-soldering, by short extensions, made a press fit into the body, as described previously for the check valve.

To form the screw-down valve (for the





gauge blow-down) turn a short piece of 11/32 in. or $\frac{3}{8}$ in. hexagon brass down to ¼ in. dia. and thread this 40T. then drill the part through with No. 53 drill. Open out with No. 40 drill and tap this $\frac{1}{8}$ in. × 40T. for the spindle, leaving about $\frac{3}{32}$ in. of "plain". Put the No. 50 drill through the branch, breaking into the No. 40 hole. Clean out the burrs, then make the spindle, which is turned from $\frac{1}{8}$ in. dia. stainless steel, the handwheel being fitted on a square, filed on one end. The handwheel can be a press-fit, though a short thread and nut (say 8 BA) would make it more secure.

Two gland nuts are now required, threaded $\frac{5}{16}$ in. × 40T. internally. These can be made from $\frac{3}{8}$ in. A/F hexagon brass. They should be drilled quite an easy fit on the glass.

The finished top and bottom fittings are screwed into the backhead bushes and are locknutted, the locknuts being made from $\frac{3}{8}$ in. hexagon also. The use of locknuts assists the lining up of the two parts of the water gauge, which should be done by inserting a length of $\frac{3}{16}$ in. dia. silver-steel, before the glass is tried in place. For the glands, little pieces sliced off a length of rubber tube of suitable diameter can be used. To cut these neatly, slide a short length of the rubber tube onto a piece of steel rod, and use a sharp razor blade, well wetted.

Cab

My drawing shows the cab sides, which are cut from 18 s.w.g. hard brass, and also the running boards, which are made from the same material. The running boards are stiffened by the edging, which on the full size locomotive would be steel angle, but we can use $\frac{5}{32}$ in. square brass, which can be flush riveted or merely soft soldered to the running board. Cut-aways will be required to clear the driving and coupled wheels, and the leading splasher, also made from the same brass sheet, can be permanently attached to the running board—soft solder should be adequate here.

The drawing showing the arrangement of the backhead fittings also gives dimensions of the spectacle plate. Note that this is flat, it is carried down to running board level, with suitable cut-aways for the trailing coupled wheels, the "part-splasher" being added afterwards.

This leaves just the chimney and dome and firedoor to deal with, when we can make a start on the tender.

TO BE CONTINUED

Meccano Steam Lorry

By C. A. Archer

THIS lorry was built 3 or 4 years ago for my nephew to play with. The steering is virtually inoperative, due to having no differential, as it was designed to go forward and reverse only. The power plant is a Meccano Steam Engine, but the MAMOD S.P.3 engine is of the same dimensions, and this would save cutting the windshield round the boiler level plug.

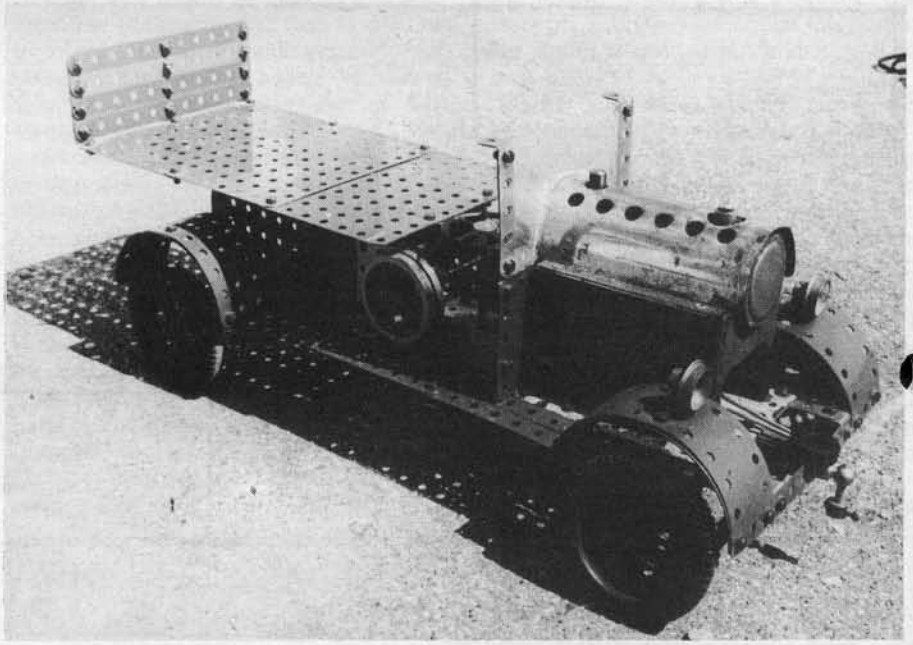
Chassis and gears

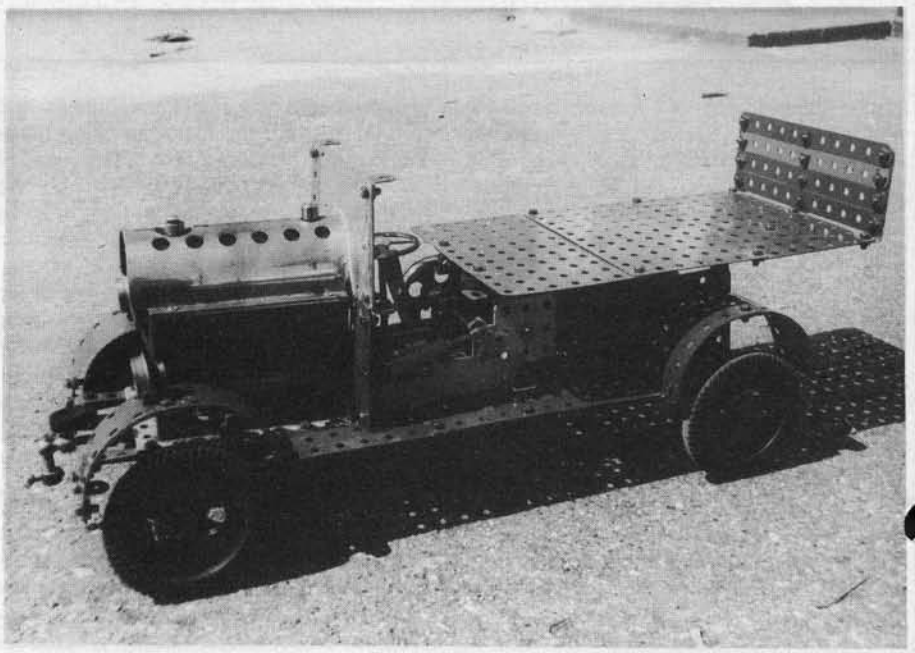
Extend the rear of the engine with 2 5½ in. angle girders. A 4½ in. × 2 in. flat plate is bolted to each angle girder extending below to take final drive sprocket. A 3 in. axle rod fitted with 1½ in. gear wheel and ¾ in. sprocket are meshed with the engine drive pinion. This rod is held internally with 2 collars, with screws, $\frac{3}{8}$ in. washers are placed between collars and engine frame. A trunnion is placed at the end of each angle girder extending downwards, these take a 6½ in. axle rod for the rear axle. On this rod is placed 1½ in. gear wheel, and the axle is held in place by 2 collars, with screws placed externally. In front of the rear axle place a 3 in. axle rod fitted with a ¾ in. pinnion and a 1½ in. sprocket wheel. This is held internally by 2 collars, with screws, spaced with a $\frac{3}{8}$ in. washer between each collar and flat plate. Bolt the flat plates to engine at top with a fish plate either side, fit length of chain round sprocket wheels.

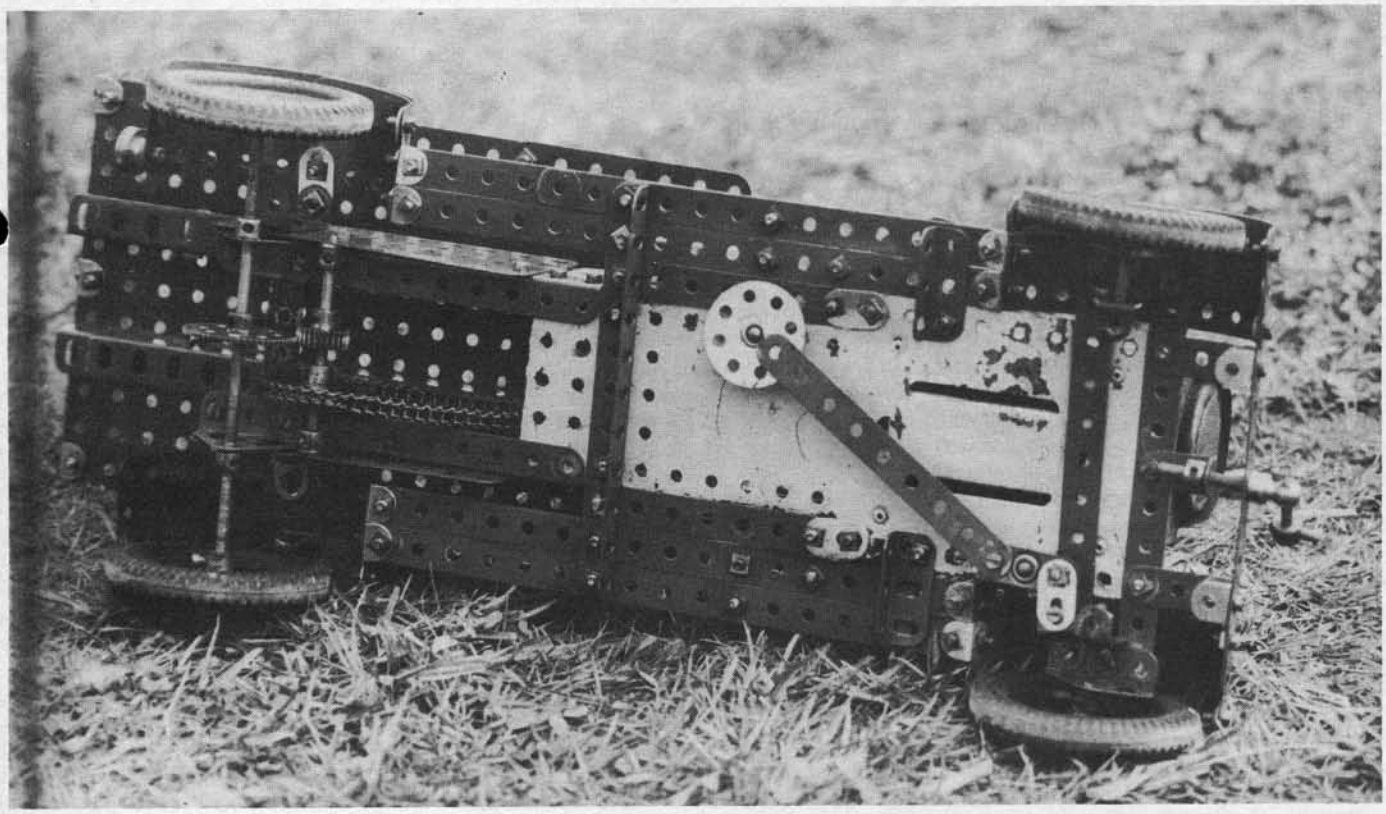
With 2-1½ in. perforated strips extending forward, bolt a 5¼ in. perforated strip to underside of engine, at each end of this strip lock-nut a trunnion, which has been fitted with a 1 in. reverse angle bracket—these take the stub axles of the front wheels—another 5½ in. strip is lock-nutted to the trunnions, on the right-hand side, also on the right-hand side trunnion fit a ½ in. reversed angle bracket. Bolt a double arm crank to left side of engine base plate behind boiler. Fit steering wheel to 3½ in. rod, place rod through boss in double arm crank and fit bush wheel to underside. Place 1 in. rod into double arm crank and fit to engine with collar with screw connect to ½ in. reversed angle bracket with fish plate. Connect other end of crank to bush wheel, lock-nuts, with 4½ in. perforated strip. Onto the 2-1½ in. strips protruding from front, bolt 2-½ in. × ½ in. double brackets protruding downwards. Across the front of these brackets bolt a 5½ in. perforated strip. Fit 2-2 in. pulleys with tyres, and fit to rear axle. 2 more 2 in. pulleys with tyres and fit through trunnions on 1½ in. axle rods. Hold in place with a collar, with screw. The lorry should now run. So fill boiler with water and have a trial run. The gears and all moving parts will require a drop of oil.

Mudwings and running boards

With a 5½ in. × 1½ in. flexible plate, bolt 2 formed slotted strips to one 5½ in. side to form a mudwing—(4 required). With a fish plate connect a 1½ in. double angle strip to top of mudwing, and bolt to flanged plate—1 above each rear wheel. Extend to 8½ in.—2 off 5½ in. perforated strips—(4 required)—and bolt 2 to each side of rear mudwings, extending forwards with ½ in. × ½ in. angle brackets. Bolt a 1½ in. angle bracket to the 2-8½ in. perforated strips, 1 hole back from front and bolt to engine. Where the back join of the 2-8½ in. perforated strips is, remove nuts and place a 5½ in. angle girder crossways under engine. Bolt a 3½ in. perforated strip to this girder, extending forwards, and front end to engine by a fish plate. Place a ¾ in. bolt through from underside centrally in the top of two front mudwings and retain with nut. Screw a $1\frac{1}{8}$ in. flanged wheel to each of these upright bolts to form front lights. Connect front mudwings to 8½ in. strips with ½ in. × ½ in. angle brackets, and by a nut and bolt to front strip. In front centre of engine bolts a 1 in. × ½ in. angle bracket into the base of a handrail coupling, push a 1½ in. axle rod, and into one side hole push a 1 in. rod. Push the assembly through front perforated strip and retain with a collar, and screw. A collar, with screw, is pushed onto the end of 1 in. rod and a bolt is screwed in. This forms the starting handle.







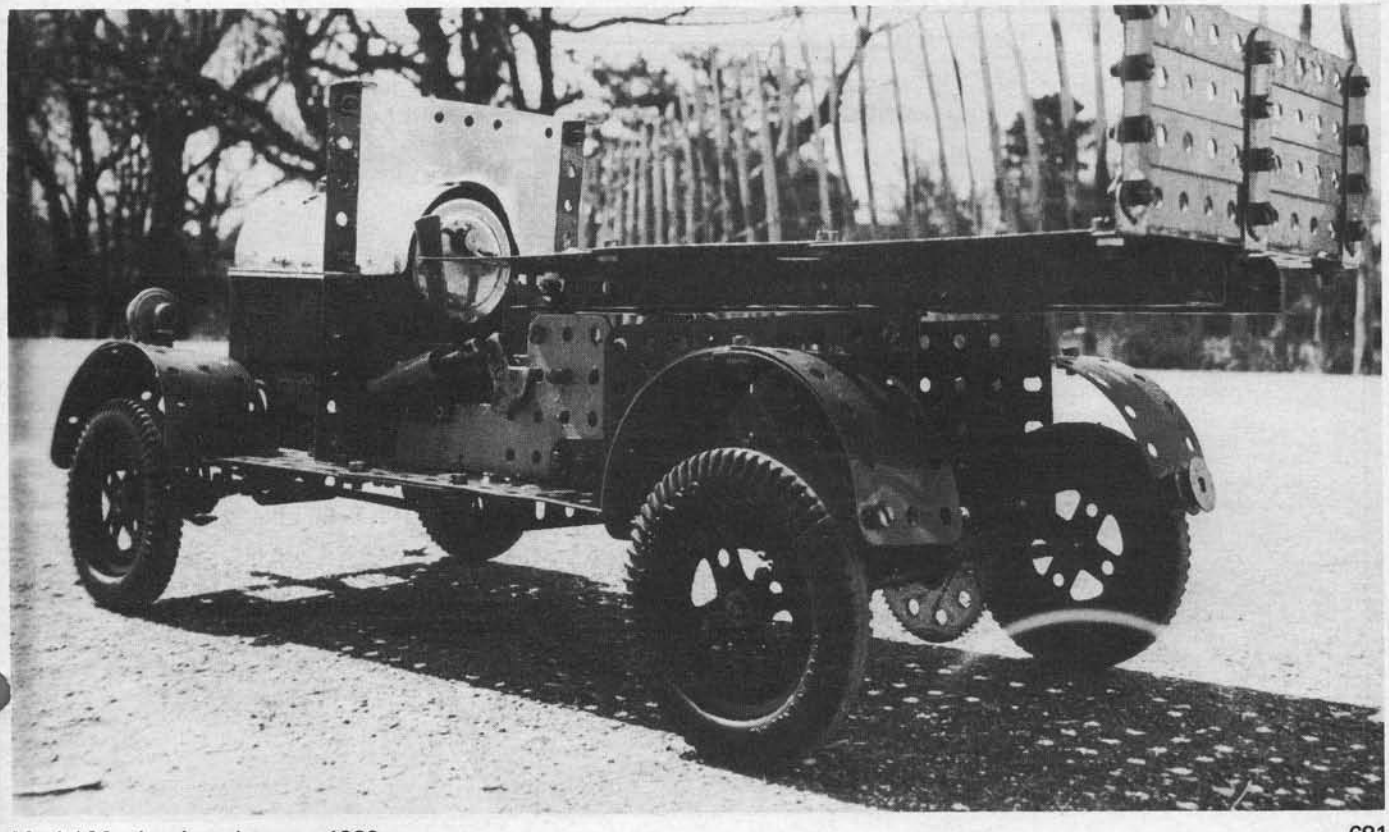
This view shows the general construction of the chassis and steering linkage.

The Windshield

The windshield is formed by bolting together 2-2½ in. double angle brackets—1 set for each side. Bolt a 4½ in. × 2½ in. transparent plate across to form windshield, below windshield, at each side, a 2½ in. × 1½ in. flexible plate is bolted. A semi-circle will have to be cut out to clear the boiler level plug. Bolt this assembly centrally behind boiler.

To build lorry platform

Join the rear tops of flat plates with a 2½ in. double bracket, spacing with washers, just behind and above engine pinnion bolt another 2½ in. double bracket. Over these double brackets, overlapping front bracket by 1 hole, bolt 2-9½ in. angle girders, and bolt to these girders 4 fish plates. Assemble the body platform from 3-5½ in. × 3 in. flat plates, 5½ in. edge together, bolt middle plate over end plates. The Tailboard is constructed from 4-5½ in. perforated strips, across these are bolted 3-2 in. perforated strips. The tailboard is bolted to the platform by three ½ in. × ½ in. angle brackets. The rear light is a ½ in. pulley screwed to a ¾ in. bolt.



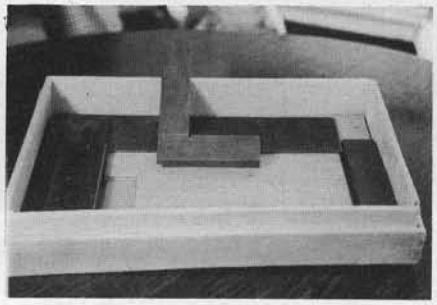
Keeping your Squares Square

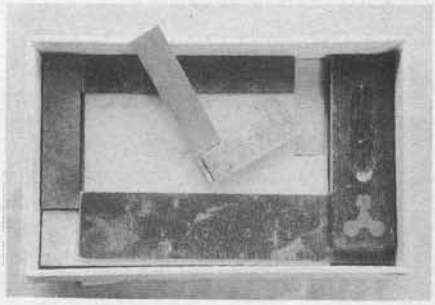
A square is only any good as long as it is just that — square. Once it becomes even one degree out it is next to useless and might just as well be thrown away. It does not matter which branch of modelling one follows, the basic fact remains that a square is a precision tool and should be treated with respect. All too often, however, they have to suffer abuse.

I am sure my experience is typical of many in the way squares are just tossed in the box with the other tools and left to take their chances. Here they fall against pliers, hammers and other tools where the chances of a knock or a bang are considerable. Of course squares are well made and can take a certain amount of rough usage but there are limits, the weight of heavy tools lying on top of them is bound to cause distortion. Realising what might happen I checked my squares against each other and found that they were still true but they could so easily have been knocked out of true.

If squares are treated in this way what is even more likely is that the blade will be nicked and this can be most irritating. What happens is that the square is placed on a piece of material which is then marked off with a pencil or a knife, if the blade is nicked then this line will have a kink in it and for accurate work will have to be remarked. It is much the same as having a straight-edge which is not straight.

There was a time when the all metal engineers squares were sold in protective wooden boxes but this is not often the case now. Certainly the wooden stock carpenters type are never sold this way, at least as far as I know. Therefore I decided to make a case to protect my squares against any future damage. The case houses three squares—a small engineer's type for fine modelling, a larger engineer's type for larger metal work and modelling together with a standard carpenters square. I am sure many modellers find, as I do, that it is impossible to segrega[illegible] tools into some which are purely [illegible] modelling and those for use throughout the house. Therefore it seemed sensible to fit one case to hold all three squares securely.



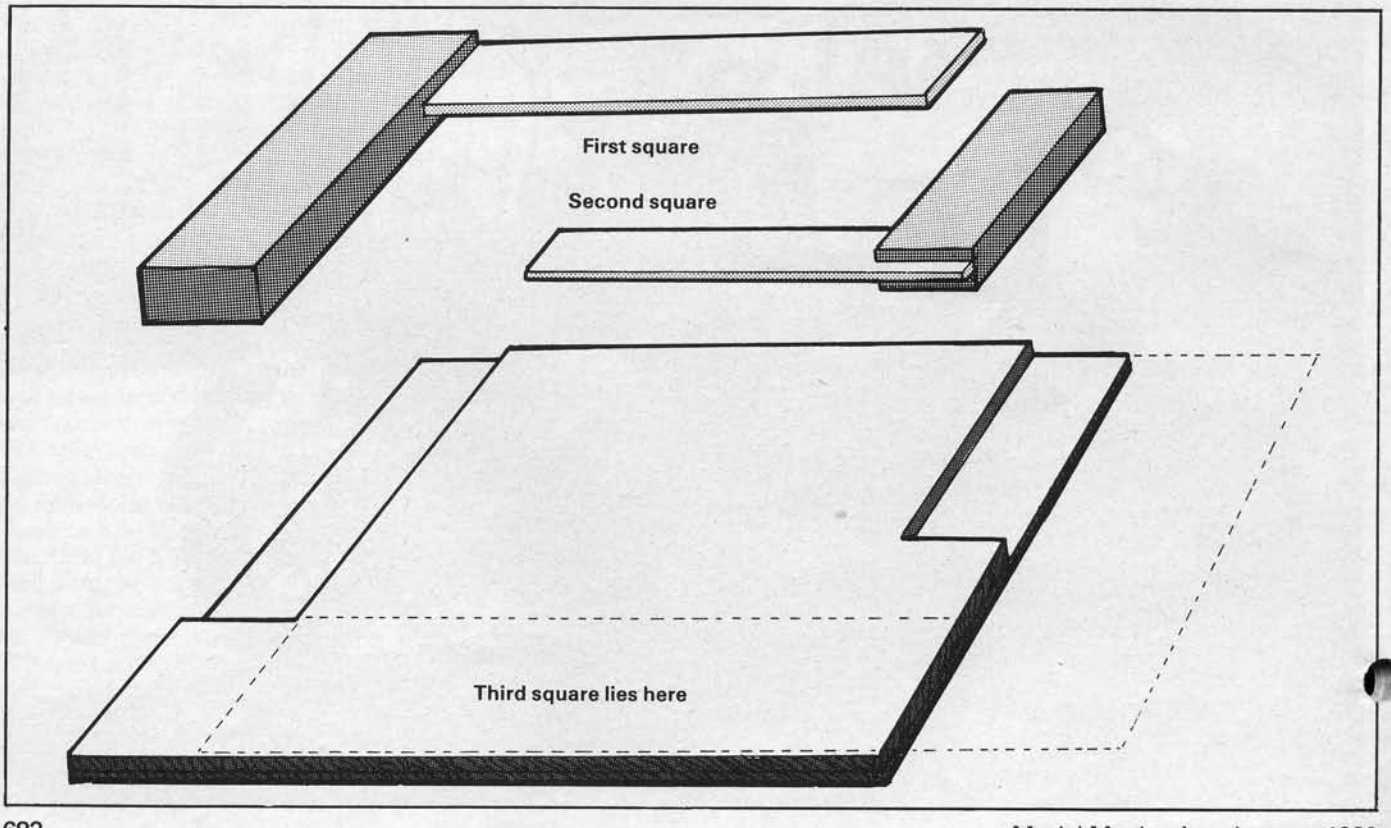


This is one of those projects to fit into odd spare moments in the workshop. The case is really nothing more than a simple box with a drop on lid, construction is so simple that I have not included details and the design can be varied to suit individual needs. Actually you do not have to make the box if a suitable piece of junk can be found, mine contained preserved fruits and was left over from Christmas. It was simply sanded and given a couple of coats of clear varnish.

What is of interest is the way the three squares are located in position so that neither can slide about and bang into the others. It is quite simple to do and is just a question of cutting and fitting three ply to fit and then sticking this into the case. This gives each square its individual slot and although a refinement is well worth the trouble.

This is only a simple project which should not take too much time away from more productive modelling but it is something well worthwhile doing. At least you can be sure that in the futu[illegible] your squares are going to remain accurate and true.

Ian T. Thwaites



Science Today

Marjorie Harper describes the models of crystals designed by Dr. B. C. Beevers for use by scientists

If you go into the Chemistry department of Edinburgh University, near the door you will see a glass case of brightly coloured models, scientific crown jewels.

Like jewels they have many sizes and shapes—cubes, pyramids, hexagons, spirals. They are of crystals, and the brainchild of Dr. B. C. Beevers, now retired from teaching and concentrating on model-making.

Just what is a crystal? The scientific answer is a regular arrangement of atoms to form a patterned structure. They are unearthed by mineralogists and synthesised and studied by chemists and physicists. Snowflakes, grains of common salt and sugar are crystals, and mineral jewels are the most perfect known example.

It's strange to think that diamonds and graphite, the core of our everyday pencils, are from the same element, carbon (both represented by a black bead in the models). The difference is that in graphite the atoms are arranged in loose layers, in diamond packed hard together.

Until 1912 it was only possible to study the surface of crystals. Then a German scientist named Laue made the great discovery that the interiors of crystals could be examined by X-ray diffraction.

As recently as fifteen years ago, models of crystals were bulky and cumbersome, made of painted wood or plastic, with thick rods, they took up a large amount of space. Scientists complained of being so short of room they had to hang models from the ceiling.

With great patience—an especial virtue of his—Dr. Beevers set out to solve this problem.

His answer was round perspex beads, and stainless-steel wire rods. After initial difficulties—such as the balls being not exactly round—were overcome, the whole process was miniaturised.

Now a few glass cases hold models which would once have filled several rooms.

Their originator has designed several drilling machines, some with multiple drilling heads, which can drill as many as twelve holes in the tiny balls. They can produce hundreds of finished balls an hour, fed in by tube rather like a bagatelle game, and shot out into the sort of bowl which gives you your change at the store. There is also a guillotine for cutting the rods which fit the balls. A computer is used to calculate the necessary angles and lengths from the X-ray measurements.

The unique feature of all his models is that they scale the real crystals by one part in a hundred million.

He is helped in his work by the Simon Square Work Centre of Lothian Regional Council (formerly run by the Cripples Aid Society, of which Dr. Beevers was chairman).

In a hut extension in Simon Square six men are hard at work in jobs ranging from the simple fitting by pincers of balls with rods, to drilling the balls and actually assembling models. Packing and parcelling models for posting round Britain and across the world takes place here, too.

They are at present constructing a model of part of the famous life-molecule, D.N.A., which has at least a thousand atoms arranged in a double-spiral.

The hut contains more machines of Dr. Beevers' design—one drills at an angle of 109.5° for tetrahedral models—including one controlled by bellows which can be operated with the foot. As in the Chemistry department, shelves of colourful jars of beads await assembly.

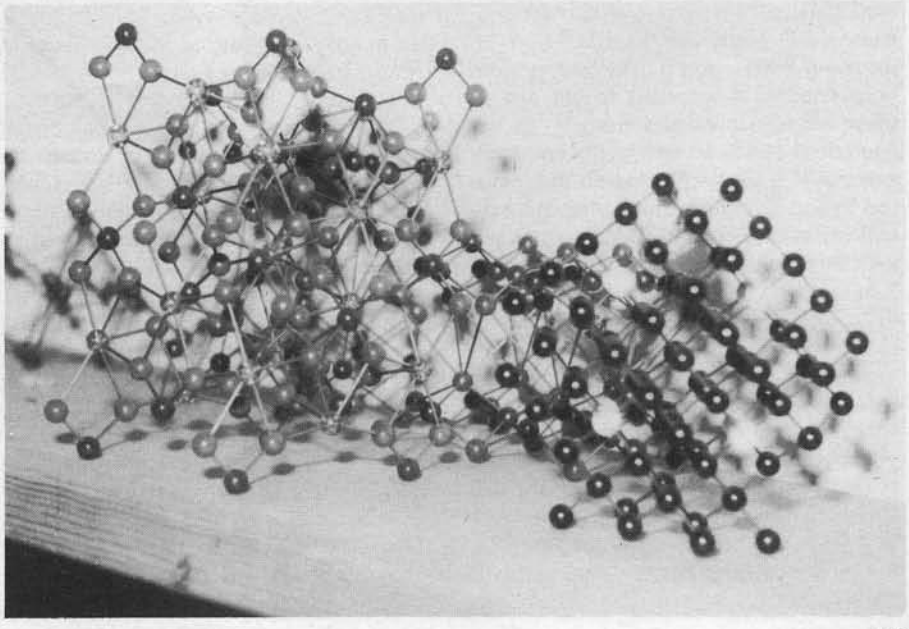
The colours sound like an artist's dream—Lilac, Sapphire, Emerald, Ruby, Turquoise. But though twenty colours are available, there are ninety-two atoms, so there has to be some duplication.

During the course of his work he and his one-time partner, Dr. Henry Lipson, met many famous scientists, including Sir Lawrence Bragg, Nobel prize-winner—who was most interested in model-making—and his father, Sir William Bragg, a pioneer in the use of X-ray analysis to unravel the structure of crystals.

Now "Beevers Miniature Models" and materials for assembling them (which can be done as at Simon Square with pliers) are supplied to schools, universities and research institutes—for instance, Caltec—in U.S.A., Germany, Denmark, Mexico and many other countries.

One of Dr. Beever's drilling machines featuring multiple drilling heads.

Two examples of Dr. Beever's models made from round perspex beads and stainless steel rods scaling the real crystals by one part in a hundred million.



Introduction to the model steam locomotive

Laurie Lawrence continues his article, explaining the whys and wherefores of model steam locomotives.

The Engine—Walschaerts Valve Gear

The two most popular valve gears are 1, Walschaerts valve gear; 2, Stephensons valve gear; the former is called a *radial* gear and the latter a *link motion.* Walschaerts gear, **Fig. 73, 74,** is named after the Belgian *Edige Walschaerts*, who invented it and first put it on a locomotive around 1844. Essentially it consists of two motions derived from the piston rod movement. The parts are itemised in the layout drawing and it will be seen that, directly connected to the crosshead, is a small bracket known as a *drop link* or *drop arm*; this is fixed and is only a means of lowering the point of attachment of another small part called the *anchor link.* The purpose of the anchor link is mostly to ensure that when the cross-head is in mid-stroke, the next small lever, the *combination lever* will be normally upright or at right angles to the piston rod. The combination lever does what it says, it combines two motions together.

Now let us move down to the wheel, where our old friend the crank pin is located. Very firmly attached to the crank pin is a small arm called a *return crank* and this is nothing more than a simple eccentric which is defined in my dictionary as "a contrivance for taking an alternating rectilinear motion from a revolving shaft", and it does too! In more simple terms, if we want to get one of these rectilinear wotsits from it, all we need do is attach an arm to the crank pin and put in a pin and locate on that pin a rod free to swing about it. When the axle and wheel revolve they take the crank pin with them and, say the crank pin is set at 1 in. away from the axle centre, it will describe a circle of 2 in. diameter (known as the *crank throw*) and assume the pin in the arm is ½ in. away from the crank pin towards the axle centre, it will describe a circle of only 1 in. diameter. The rod attached to it can be constrained to move in one plane at its other end and it will move to and fro by the same amount i.e. 1 in. However, that is not quite what we want, we have to actuate that slide or piston valve not only by the right amount of movement, but at the *right time.* So instead of the pin in the return crank being set in line with the centres of crank pin and axle, it is offset to one side by a certain distance. This offset beings the return crank (eccentric) pin to a certain important location approximately 90° from the centre line of axle and crank pin. I say approximately, because the exact amount of offset is determined by or influenced by something else. The effect of this offset is to make the rod attached to the return crank go to and fro for just the right amount but at a *different time* to the crosshead.

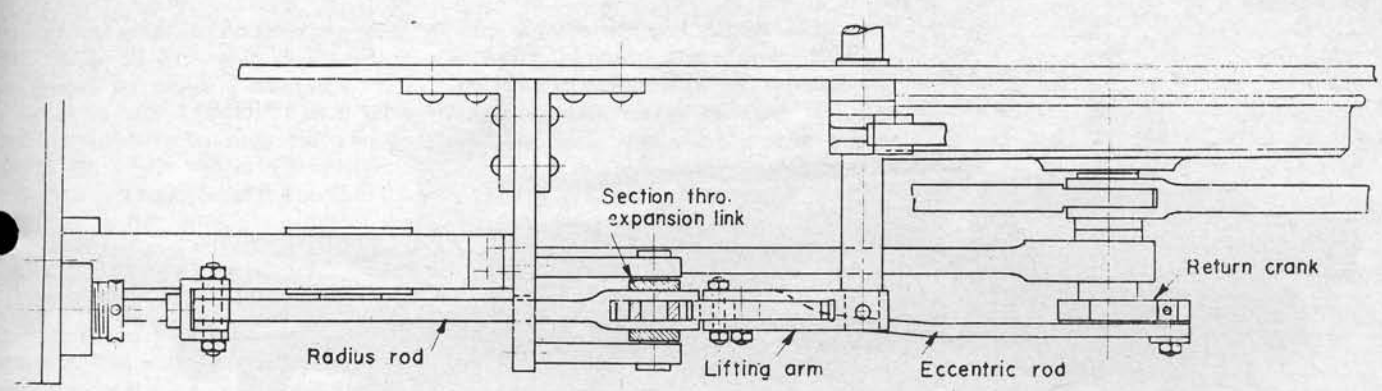
Now about that bit of "approximately" in the return crank location: because of the practical difficulty of locating all the valve gear parts to lie in the most favourable positions to each other — for example, you'll see in the various illustrations that some of the bits do not lie in the same horizontal plane, some are displaced above or below a line through the axle centres — some so-called "errors" creep in due to the geometry of the valve gear. The text books say these "errors" are due to the angularity of the rods, etc., that is, the rods are not where the designers would like them to be for perfection and they try to minimise the effects of "errors" when laying out the valve gear. Anyway, because of this, the return crank can very rarely be set exactly at 90° to the engine crank, **Fig. 75.**

The rod swinging on the pin of the return crank (eccentric) is called the *eccentric rod* and this in turn is attached, at a very carefully determined point, to something called an *expansion link* which is only a curved lever able to swing on pins located at its middle. This link is mounted in a *motion bracket,* **Fig. 74a,** or a *cradle* fixed to the frames. Expansion links come in various shapes, but they basicaly have a machined groove or grooves in them to guide a very small part called a *die block.* Sometimes there are two die blocks each sliding in carefully matched opposing grooves or ways in the link. The die block has a pin going through extending on either side into matching holes in the *radius rod* (it's a radial gear remember) which is boxed around the die and the groove in the expansion link. Sometimes a pair of dies have the radius rod between them. I hope the drawing will make clear the arrangement of these parts. The radius rod extends forwards to a pin joint in the top of the combination lever. The groove in the expansion link is curved and the radius of this curve is the same as the distance between the pin joints in the radius rod. You'll see now where the combination lever gets its name, it combines the motion derived from the return crank (eccentric) with that derived from the cross head; more about that in a while. The combination lever has a pin joint connection with the *valve spindle* which, as its name suggests, drives the valve to and fro across the ports in the port face in or on the cylinder block.

The Engine — Valve Gear — Reversing and Cut-off

The expansion link has two functions; you'll remember in the part about the slide valve that I mentioned about expansion; one of the functions of the expansion link is to allow the die block to be moved, under the driver's control, up and down in the link. This means the total travel back and forth of the radius rod can be varied. In the drawing, **Fig. 73** you will see the link has an upper and lower part. In the arrangement shown, when the die block is in the lower half, the engine is known as in *forward gear* and moves in a forward direction on the rails. When the die block is in the upper half of the link it is in *back gear*, the leverage is reversed, i.e. instead of the radius rod going back and forth, it goes forth and back! and the engine goes backwards.

When the die block is at the ends of the expansion link, the engine is known as in *full gear*, i.e. the maximum travel is imparted to the radius rod and valve. At any point in between the ends and middle of the link, the leverage, as I said, is reduced and this is termed *linking up* or *notching up* and the effect of this is to cut off the admission of steam to the cylinder earlier in relation to the stroke of the piston and allow the steam to work expansively for the rest of the stroke. This is usually defined as a *percentage of cut off,* i.e. 40% cut off means that steam was cut off from entering the cylinder when the piston had travelled 40% of its stroke. When the die block is exactly in line with the expansion link centre, no lateral movement is imparted to the radius rod and the only movement of the valve spindle is that obtained from the crosshead and the port remains covered; this is known as the *Mid-gear* position. Normal maximum cut off is around 70% to 80%. A small extension of the radius rod behind the link is connected to a system of levers reaching—via a *reach rod,* **Fig. 76, 77** to the driver on the



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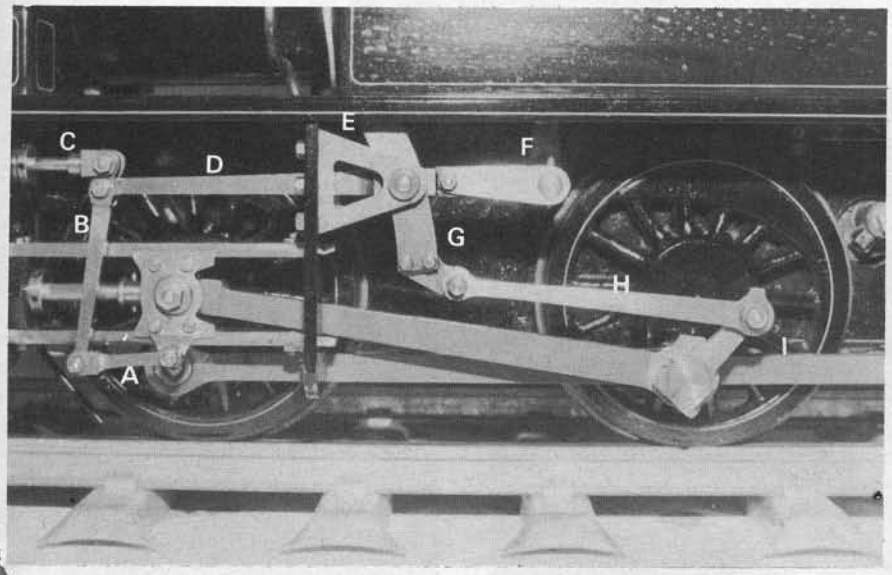
LAYOUT OF VALVE GEAR



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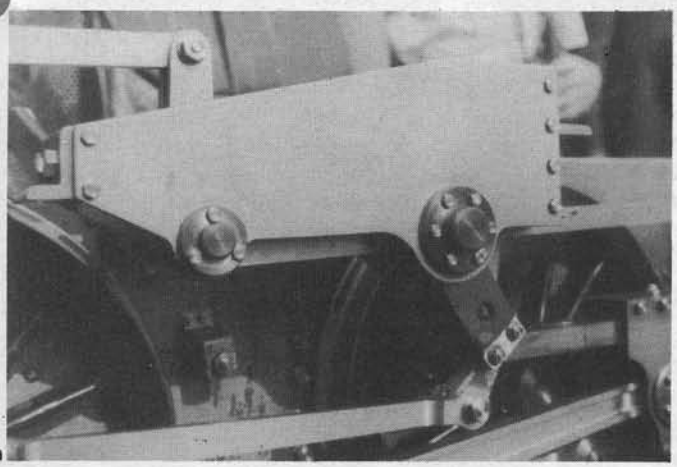
73 *Walschaerts valve gear.*

74 *Walschaerts valve gear*
A *Union link*
B *Combination lever*
C *Valve spindle*
D *Radius Rod*
E *Cradle (or expansion link bracket)*
F *Lifting arm behind expansion Link*
G *Expansion Link*
H *Eccentric Rod*
I *Return crank*

74a *Another type of expansion Link cradle*

76 *Walschaerts valve gear*
A *Lifting Arm in front of expansion Link (see Fig. 77)*
B *Reach Rod connects to Lifting Arm*

77 *Forehung lifting link (arrowed) positions radius rod as required.*



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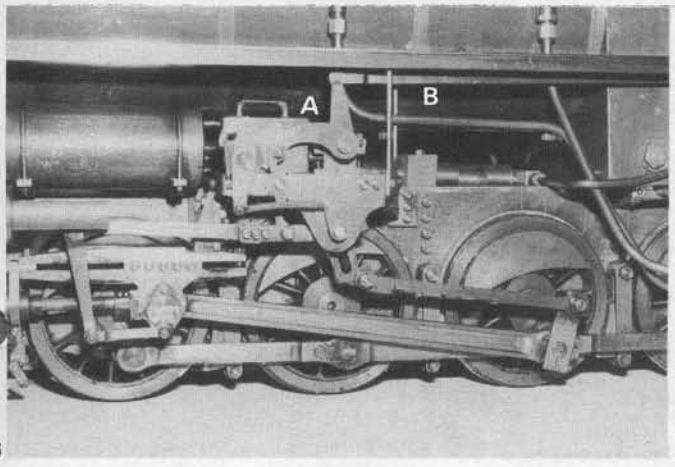

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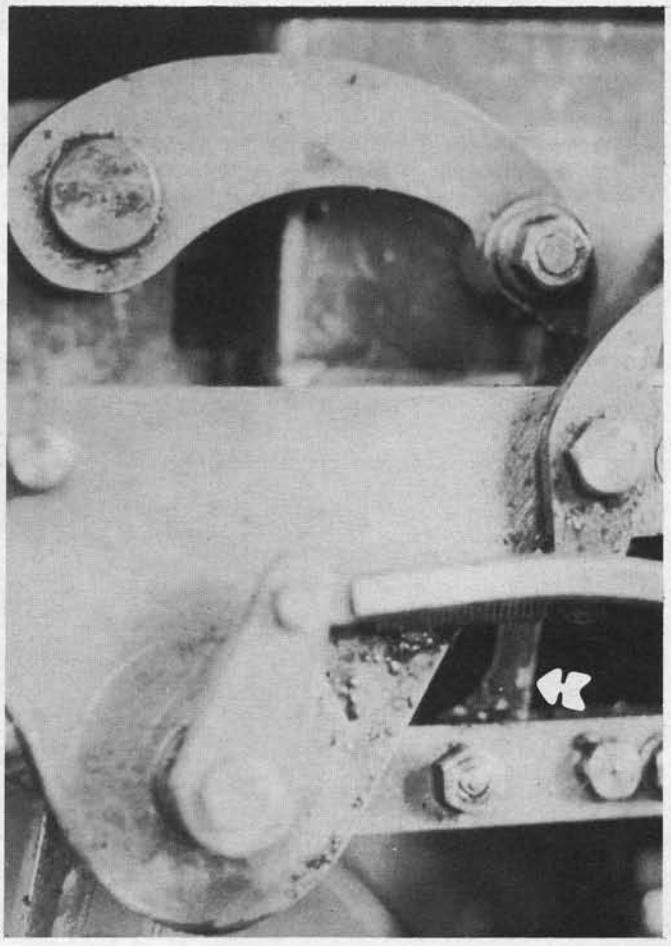

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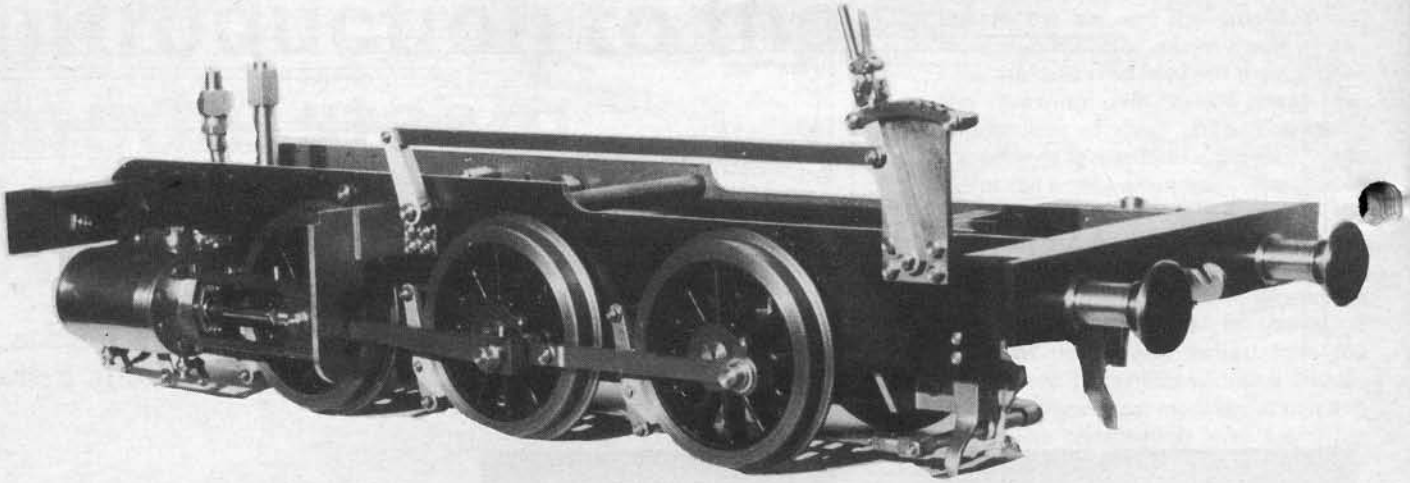

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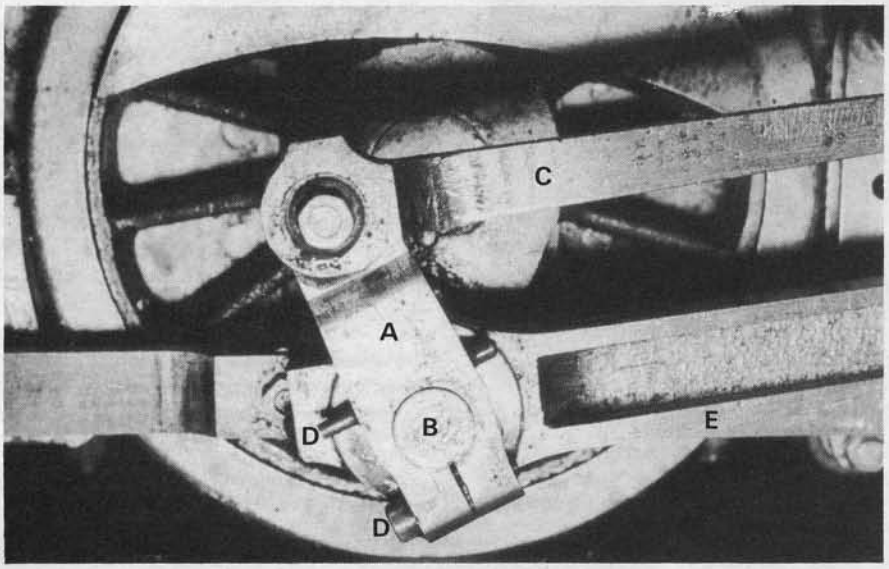

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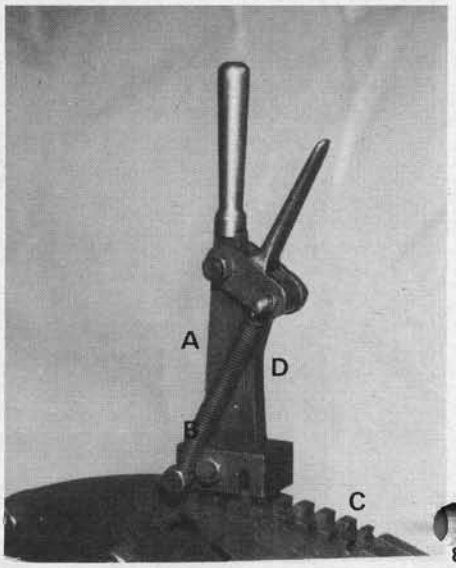

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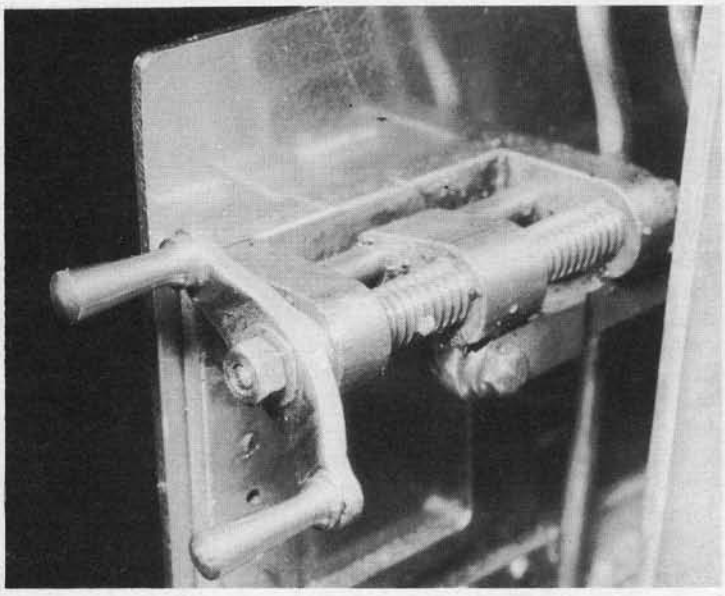
78 *Reversing lever and Reach Rod erected on engine*

75
A *Return crank*
B *Crank Pin (in wheel)*
C *Eccentric Rod*
D *Locking Pins prevent Return Crank from displacement*
E *Connecting Rod*

85 *Underside view of Stephenson's valve.*

80 *Pole type reversing lever*
A *Lever*
B *Latchspring*
C *Notches in sector plate for latch*
D *Latchlocks into sector plate.*
E *Latch handle for lifting latch clear of notch*

81 *Screw reversing lever, Reach Rod is under screw.*



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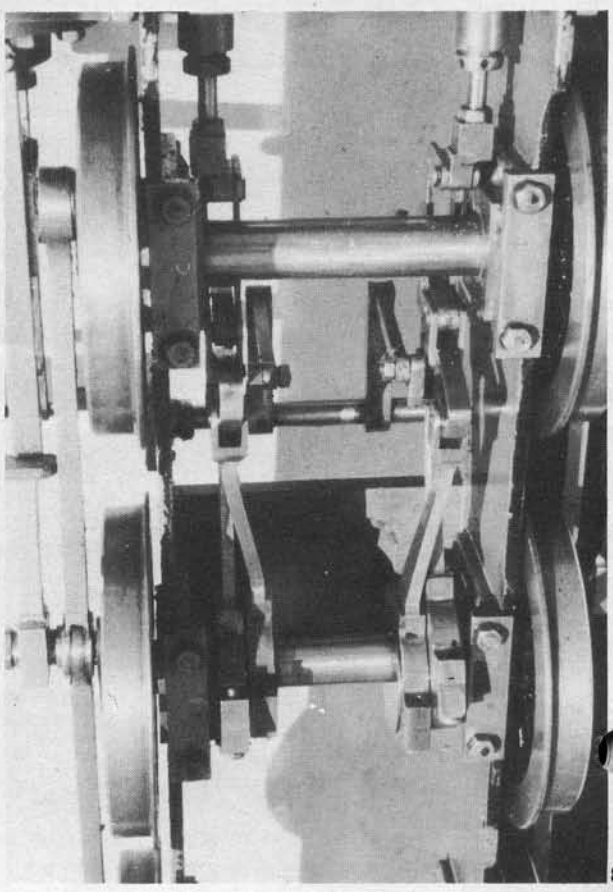

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footplate where he has a *reversing lever,* **Fig. 78, 79, 80, 81,** which allows him to set the gear just where he wants it.

Let us go back a bit to the slide valve and this expansion business. Have a look at **Fig. 82,** which shows a simple slide valve on a scrap section of the ports in the port face. In this valve the width of the port is the same as the width of the part covering it. Now you will appreciate there is only one instant when the port is totally covered if the valve slides to and fro across it. This sort of valve is known as *without lap* and it is a very wasteful device discarded in the very early days of steam because steam is admitted for the full piston stroke and no use is made of the expansive properties of steam. In **Fig. 83,** you'll see the valve overlaps the port by a considerable amount, the extra bit is called *lap.* All of you with your thinking caps on will now realise that the port can be kept closed for a longer time than if it had no lap. The combination lever's function is to move the valve enough to take care of the lap and a little bit more. So this is what all these levers etc. do, shift the valve across the ports and let steam in and out of the cylinder by the right amount and at the right time with reasonable efficiency, all of it being under the driver's control.

Incidentally, all the pin joints I have mentioned, have nice close tolerances, easy enough to work, but without appreciable play; we don't want sloppy work upsetting the valve events!

I have so far left out one small matter of valve gears and this is *lead* (pronounced leed not led) which is got from the little bit more on the combination lever I mentioned. Conventional reciprocating steam engines traditionally have the valve gear arranged so that the valve opens to steam very slightly before the piston begins its return stroke. The reason for the application of *lead* is generally accepted to be that a little steam let into the cylinder will cushion the return stroke of the piston. Not everyone believes this and I think it is only part of the truth because nobody, it seems, has ever said why lead was applied in the first place way back in the history of steam locomotives and even British Railways, who did a lot of investigation into steam locomotives, never found time to enquire into the mysteries of lead; it remains a tradition. In Walschaerts gear, the amount of lead is fixed and cannot be varied by the driver.

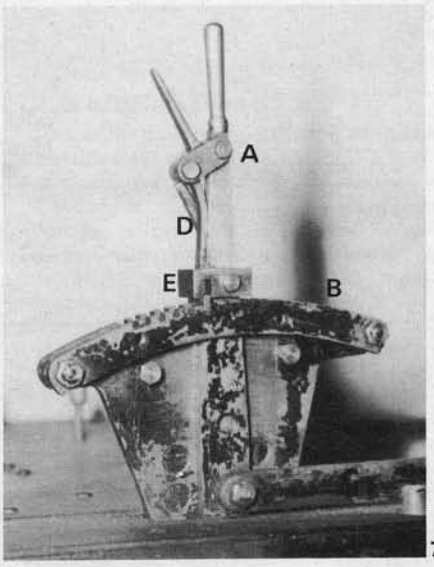
The Engine — Valve Gear — Admission of Steam

Before we leave slide and piston valves, there is one aspect of them which fundamentally dictates the way the valve gear is arranged. A valve can be either *Outside admission* or *Inside admission* and this refers to the passage of steam from the steam chest into the cylinder. A slide valve is normally *outside admission* in which the steam presses on the back of the valve and keeps it on the port face and the underside cavity is used for the exhaust path. The valve has to move backwards to uncover the front port and forwards to admit steam to the rear port. In a piston valve steam normally enters the steam chest between the heads of the valve and this is called *Inside admission* and the valve has to move forwards to admit steam to the front port and backwards to admit steam to the rear port. There are **outside** arrangements for piston valves, but these are not very popular owing to the troubles experienced in keeping the steam chest free of leaks.

In Walschaerts valve gear the way outside admission is taken care of is by connecting the radius rod to a point underneath the valve spindle connection on the combination lever and then setting the return crank (the eccentric) so that it is in *advance* of the crank pin when the wheels turn in a forward direction. For *inside* admission these connections are reversed, the radius rod connects to a point above the valve spindle and the return crank is set to *follow* the crank when the wheels turn in a forward direction.

The Engine — Stephenson's Valve Gear

Now a short piece about *Stephenson's* valve gear which was invented a couple of years before Walschaerts gear. There are eight variations of arrangements for this gear depending on whether the cylinders are outside or inside the frames, on outside or inside admission, and on the location of the steam chests in relation to the cylinders. Understandably perhaps, I'll confine myself to a simple description of how the gear works and its basic parts. The slide or piston valves and valve spindles are, of course, used in this gear too, only the means of driving them is different. **Fig. 84, 85,** shows one half or one side of the gear serving the valve for one cylinder and it will be seen there are two *eccentrics* (you'll remember the bit about taking a rectilinear motion from a



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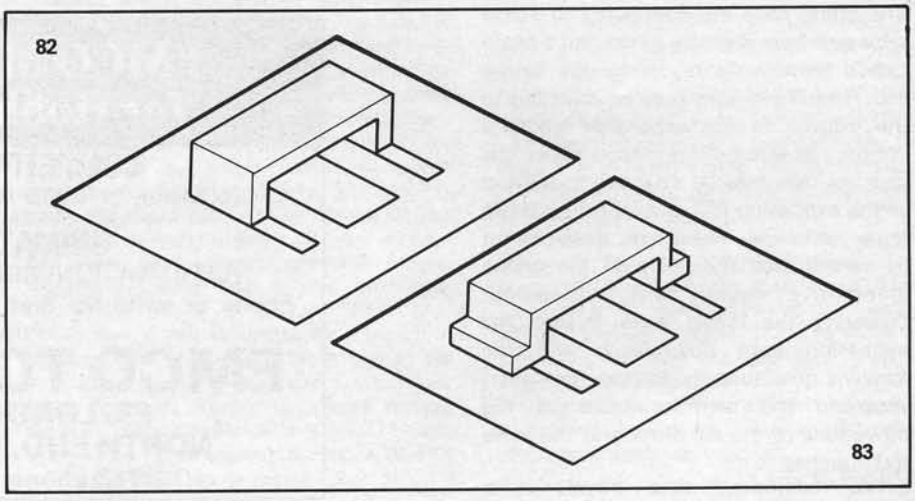
circular motion), they are just circular discs of good wearing metal fastened to the axle, one for forward gear and one for backward gear. They are mounted on the axle so that their centres are offset in relation to the centre of the axle. The effect is the same as the return crank. About each eccentric (sometimes known as the sheave) is an *eccentric strap* which is usually in two parts bolted to a nice sliding fit around the sheave. The front part of the strap is extended into a block to which an *eccentric rod* is securely fastened; as there are two eccentrics, there are two rods and one is the backward rod the other is the forward rod, of course. The forward eccentric rod is attached by a pin joint to one end, usually the top, of an *expansion link,* the backward rod is attached to the other end of the link, which, although shaped differently to the Walschaerts gear link, has a similar sort of machined slot or curved guide in it. This curved slot has a radius which is NOT the same as the distance from the centre of the eccentric to the centre line of the curved link; you might expect it to be but it is not. The radius is the same as the distance of a line joining the centres of the eccentrics on the axle to the centre of the link when all the lot is depicted at right angles to the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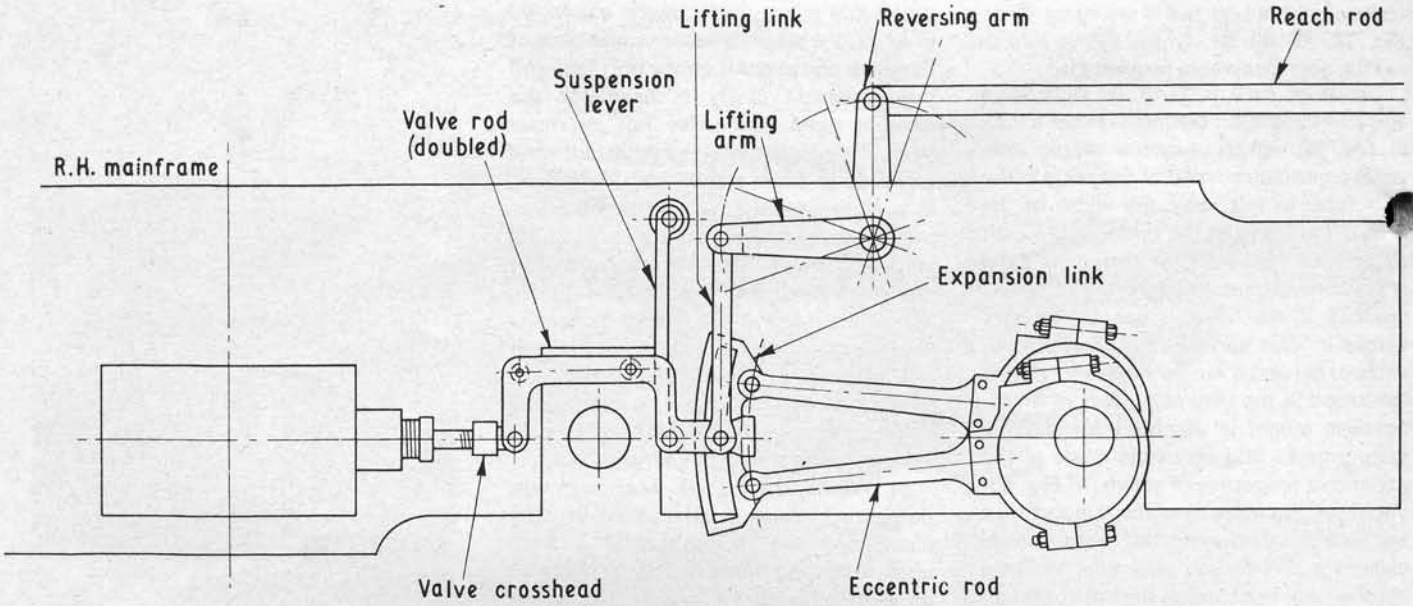

84 *Arrangement of valve gear*

centre line of the gear's layout. (Sounds rather awkward, but a study of the drawing will help make it clear). This arrangement has some importance as we shall see later.

In the curved slot of the link a die block is placed and this has the usual pin through it connecting a rod which goes off to the valve spindle or other levers connecting to the valve spindle. In the first case it is known as the *valve rod*, in the second case it is the *intermediate valve rod*. The valve rods have to either pass through guides in a *motion bracket* or *motion plate* set in the frames or have to be suspended by links, so that they only travel to and fro.

To prevent the expansion link falling by its own weight to its lowest position, it is suspended from a bracket or brackets either integral with or attached to the link on the horizontal centre line but with a small displacement to the front or rear of that centre line. Usually, but not always, attached to the pins in the small brackets there are *lifting links*, sometimes only one link on one side on one bracket which is known as a single-sided arrangement. The lifting links are connected to *lifting arms* and from there by levers and a *reach rod* to the driver's reversing gear in the cab. The lifting links may be attached to the bottom of the expansion link and connect to lifting arms placed above the gear, or they may be attached to the top of the expansion link and raised by lifting arms set below. There's no doubt about it, variety was the spice of life where locomotive design was concerned! Lowering the lifting arms pushes the expansion links downwards and the *forward* gear (usually termed *fore gear*) eccentric rod provides most of the movement of the die block and the valve rod attached to it.

The locomotive then travels in a forward direction. Hauling the expansion link upwards so that the die is in the lower half of the link means that the back gear eccentric provides most of the travel of the die and valve rod. And, somewhat like Walschaerts gear, the amount of travel of the die block and its associated valve rod and valve, can be varied according to its position in the slot of the expansion link, and the driver controls that. Also, when the die block is in the middle of the link, only a small amount of travel is given to the valve rod and, as for Walschaerts gear, the inlet port in the steam chest is not uncovered. (There are, in fact, small variations of this and on some engines a small amount of steam due to lead is admitted).

The position of the eccentrics on the axle is important, because, like our old friend the return crank, they provide not only the amount of travel of the valves via the gear's system of levers, but determine when this should happen, i.e. the *timing* of the events. You'll remember the pin on the return crank was offset in relation to the centres of crank and axle, in Stephenson's gear the centres of the eccentric sheaves are similarly offset, which is why the radius of the expansion link slot is different to what you might expect it to be.

The fact that there is this difference in the radius of the expansion link means that there is a slight variation in things happening at the valve. The *lead*, which is that small amount of pre-admission steam you'll recall, varies according to the position of the die block in the expansion link, unlike in Walschaerts gear where it is a fixed amount. The most common arrangement in Stephenson's gear is for the lead to increase as the gear is notched up, i.e. the die block moves nearer the centre of the link. Because lead can become excessive the nearer the die gets to the mid-gear position, the eccentrics are usually set so that, in *full gear*, the port is still closed at the commencement of the piston stroke and the valve has to travel just a little more to open to steam, by which time the piston has moved back slightly and this setting is known as *negative* lead; as the gear is notched up, it becomes *positive* lead.

model news

Brighton Model Railway & Engineering Exhibition March 21st-23rd 1980 at The Brighton Centre

The Venue

The Brighton Centre is a new purpose-built exhibition and conference centre and is one of the largest buildings of its type in the country outside London. Facing the seafront, it is near the main shopping centre and has several multi-storey car parks nearby. It is well known as the venue of the Toy Fair and many other exhibitions and conferences. The main hall is about 20,000 sq. ft. in area with the foyer hall adding a further 10,000 sq. ft. Large access areas can also be used for exhibition purposes and so space is the least of our problems. As part of the complex there is an excellent restaurant, overlooking the English Channel, serving a wide selection of meals, together with three bars and refreshment areas elsewhere in the building, of which, The Foyer Bar will be set aside for exhibitors use only so there will be somewhere to rest the feet and talk modelling away from the bustle of the exhibition. The whole complex is fully air-conditioned and employs a full-time security staff on duty 24 hours a day.

With the port of Newhaven being only 10 miles away and the new Seajet service between Brighton Marina and Dieppe the exhibition looks set to have an international flavour, already we know that a party of Dutch model engineers will be visiting the show. Circulation of newsletters and publicity includes the European Clubs and Societies.

The Exhibition

The exhibition will be the second organised by the Sussex Association of Model Railway Clubs in conjunction with Bright Borough Council. The first joint exhibition followed a number of very successful shows organised by the Association at various venues in Brighton and in spite of only having three months to organise a large exhibition nearly 9,000 visitors came to the show, making it a modest success. This time with the longer period for organisation and the wider publicity, the sky's the limit. By combining the undoubted popularity of model railways, together with the interest in model engineering exhibits, the exhibition will be a draw for many thousands of people in the South of England and all model railway and engineering clubs in the South are included in the mailing lists. A visit to the show could be coupled with a visit to the Brighton and Hove Engineerium, the Brighton Aquarium and Dolphinarium which is only 10 minutes walk away and popular with the children or you can park your wife at the excellent shopping centre nearby (a very expensive suggestion).

What will you see at the exhibition? Well, people come to see models and there will be plenty of those. Model railway layouts of most scales and sizes will be shown by members of the Association and these prove popular with children of all ages.

The model railway trade will be providing valuable support and most of the main manufacturers will be exhibiting, showing all their current products and we hope some of their future plans. The retail trade will be able to provide everything from a screw to a complete train set. The live steam track is always popular and will be in use throughout the exhibition. The indoor boating pond was of great interest at the last show and will be again in the main hall. A new feature for the Brighton Exhibition will be a film theatre showing railway films during the period of the show, so that visitors can rest their feet for half-and-hour. For the model engineer we hope the trade will be providing castings, drawings and machine tools to whet the appetite.

There are many other ideas and features being planned and we want to provide an interest for the enthusiast and general public alike, there is plenty of room so if any club or individual wishes to put on a display of their work we will be only too pleased to hear from them even if it is only one or two models.

This exhibition is being staged by enthusiasts for enthusiasts and looks set to become an annual event for the South of England but this can only happen with your support.

Enquiries regarding the exhibition should be made to:

G. F. Collins, Hon. Chairman, S.A.M.R.C., 10 Marden Close, North Woodingdean, Brighton, BN2 6NJ, Sussex.

or D. Rebbetts, Hon. Secretary, S.A.M.R.C., 35 St. John's Road, Burgess Hill, Sussex.

Club officials take note!

One of the most time-consuming and usually thankless tasks of being an official in a club is the search for and purchase of trophies or plaques for the season's competitions. Wooden or plastic plaques have become popular during recent years, yet to our knowledge no manufacturer can provide suitable centres for modelling activities. Happily that sad state of affairs has now been remedied by **Brian J. Bowman Trophies,** 'Anela', Lower North Street, Cheddar, Somerset. Four centres are available, (a) a tri-part featuring a cabin cruiser boat, racing car and a monoplane, (b) same centre as (a) but with the words RADIO CONTROLLED surrounding it, (c) a *King* Class locomotive and (d) a musketeer surrounded by the words MILITARY MODELLING and WAR GAMING. Prices are very reasonable and vary slightly according to numbers ordered. Full details are available from Brian at the above address.

Evening Classes

The Darlington College of Technology, Cleveland Avenue, Darlington, run Evening Classes in practical machining every Thursday. Commencing the 10th of January 1980 for a 10-week course. For further details contact Mr. Sledge at the College.

N.B.—With government cuts this class is in danger of closing unless it gets more support (8-9 people attending at present).

Surrey Society of Model Engineers

Surrey S.M.E. are a small Club of Model Engineers founded in June 1978. To date the lease of our proposed land has not been signed, but we have high hopes of this being achieved in the next week or two, and track design has been under way for some months.

We have planned for a raised track 14 in. high for 2½ in., 3½ in. and 5 in. gauge together with a ground track for 5 in. and 7¼ in. gauges. Our Chief Engineer and his Deputy are J. D. (Robbie) Roberts (of New Zealand Cup fame 1978 winner) and Jeff Pearse, respectively, who head a very formidable Committee.

We have a few vacancies for prospective members and should you be interested we meet at the Baptist Church Hall, Lower Road, Great Bookham, Surrey, but please contact the Hon. Secretary Mr. John Cook, 27 Vallis Way, Hook, Chessington, Surrey, KT9 1PX (tel: 01-397 3832) before going.

Mamod Steam Engine Test

Dear Sir,

I was most interested to read about the mamod Steam Engine Test carried out by Dr. Keith Sherwin and reported in the October *Model Mechanics.* The testing of small steam engine and locomotives under controlled conditions has been sadly neglected over the years. Yet it is the key to improvement and objective comparison. Dr. Sherwin is therefore to be congratulated on his effort.

Although tests were conducted at two steam inlet pressures (10 and 15 p.s.ig.) there is no mention of the degree of superheat, if and I wonder if Dr. Sherwin carried out tests at different superheat values. If not, it might be interesting to carry out additional tests to investigate this aspect.

Congratulations on your excellent magazine. It certainly covers my interest, particularly simple steam engines, very well.

C. D. WILSON

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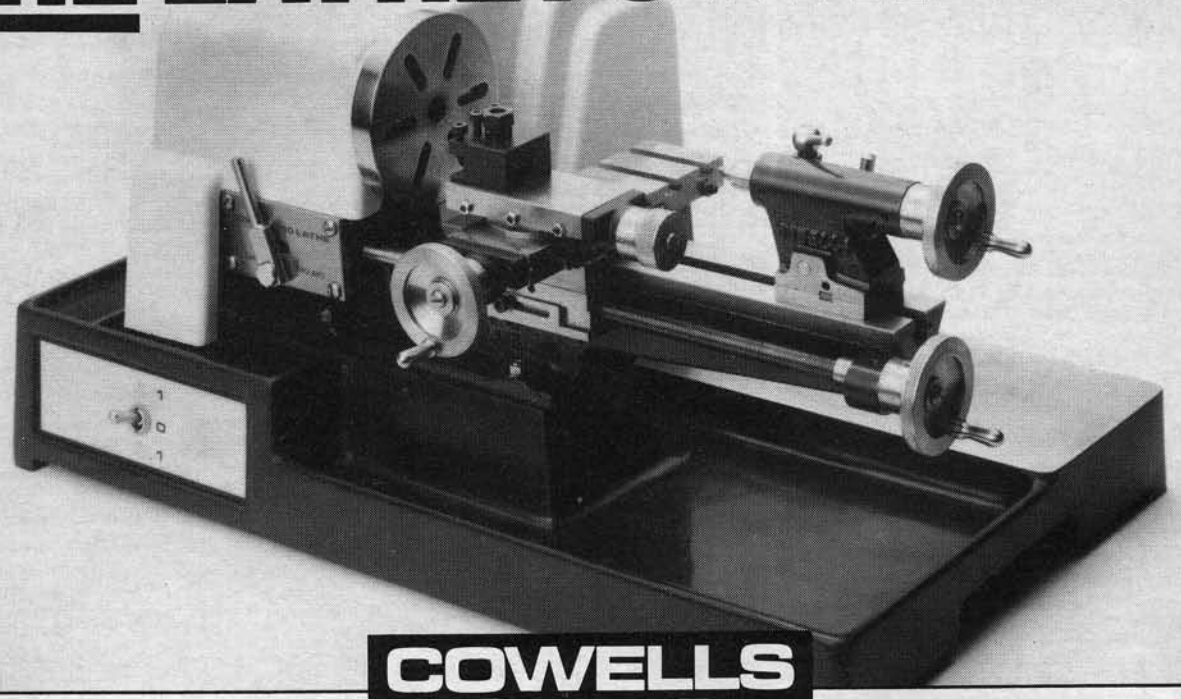

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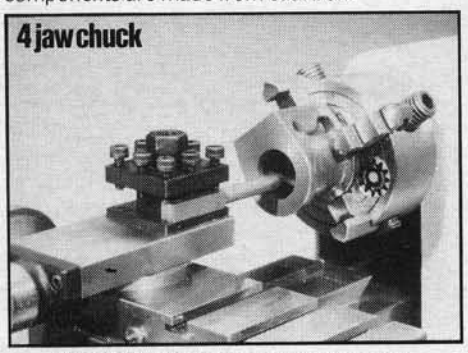

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