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NEXT WEEK

The double-size issue commemorating the Diamond Jubilee of Model Engineer will be on sale next week. Though it will be packed with items of historic interest it will be a gay issue with colour on many pages. The price will be two shillings but subscribers will not be required to pay the extra shilling

ONE SHILLING

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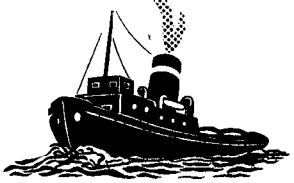
Smoke Rings



A WEEKLY COMMENTARY BY VULCAN

WHICH have been the more potent in giving an impulse to careers—the advertisement pages of ME or the Percival Marshall technical books which are a famous part of the ME service ?

To Edward James Galpin of Peacehaven, Sussex, this is rather like the classic question of whether the chicken or the egg can claim priority. As a reader of MODEL ENGINEER half a century ago, Mr Galpin spent many a profitable sixpence on the PM handbooks which were advertised in its pages. With the aid of *Small Spark Coils* he took a car ignition coil to pieces and reassembled it. He then offered it for sale in these pages, the insertion costing five shillings.

Having sold the coil within a week and made a useful profit on it, Mr Galpin bought another, repaired it, and inserted a second small advertisement with the same happy result. In this way, he says, Galpin's Electrical Stores were born. Mr Galpin carried on the business in London for 47 years, retiring a little while ago.

Spark a yard long

" The largest spark coil that passed through my hands," he writes, " weighed ¾ cwt and gave a 36 in. spark. Though my dynamos were small—up to 3 cwt—I bought and sold transformers with an output voltage of as much as 150,000 volts, for X-ray work. Spark coils were always in great demand and still are."

In a year of ME memories all this is especially interesting. Coils for sparks and shocks were a kind of cult among our readers in the early days when ME served the amateur electrician as well as the amateur engineer.

" Forty or fifty years ago the advertisement columns of MODEL ENGINEER were, as they are now, a wonderful medium for the amateur," Mr Galpin continues. " My favourites, apart from sales, were swops, such as the exchange of a gas engine for a small locomotive or a useful lathe. Some of the ' jobs ' that turned up certainly gave me room for thought, and after I had spent many hours in the workshop were again in ME for sale or swop."

It would be amusing to hear from readers of some of the exchanges which were made in this way and of their consequences. Among adults, as among schoolboys, the articles swopped can be weirdly unrelated to each other !

Although Mr Galpin was of great service to modellers for nearly half a century, he only once attempted a model himself. This was a 4 in. screwcutter, made with a set of cuttings from Arthur Firth's Atlas Works at Cleckheaton. Mr Galpin hand-scraped the bed, had the lead-screw cut, and spent three years of his spare time on the rest. He had used the lathe for only a short period " when 1914 came and that was that."

Admiralty model

CALLING at Admiralty the other day I found a group of naval officers gathered in front of a ship model: the survey ship HMS *Vidal* constructed at ⅛ in. scale by shipwright apprentices at Chatham Dockyard. " A credit to them, I think," said Captain E. G. Irving who has command of the vessel.

The Royal Navy Survey Fleet consists of *Vidal*, *Dampier*, *Dalrymple*, *Owen*, *Cook*, *Scott* and *Shackleton*, together with six 72 ft motor launches. While most shiplovers are acquainted with their work or the final results of it, few are aware of the various stages from the actual survey at sea to the published chart. The whole of this process was clearly outlined by a small Admiralty exhibition which ought to be taken outside for the public—and especially the youngest members of it.

Smoke Rings . . .

Place for craftsman

Instead of dropping a lead, the hydrographer of today uses an echo-sounder. But in this field as in others the latest electronic devices do not eliminate the final element of human skill. There is still a place for the craftsman in hydrography whether he work in copper or in the easier media of enamel zinc, glass and plastics. After being plotted on a chart which does not pretend to artistry, the soundings are transferred to a compilation chart by a mixed civilian and naval staff at Cricklewood. Another staff, at Taunton, deals with printing and publication. Some of the finest craftsmanship emanates from individuals who work at home, devoting months to a single map.

"It's rather like making models," said Capt. Irving after showing me around. "You begin from nothing and end with something which is accurate and very good to look at."

Captain Irving will give all needed facilities to any ME reader who cares to model *Vidal*. Meanwhile craftsmen everywhere cannot but admire the men who make these maps which are perpetual best-sellers all over the world.

Pennants

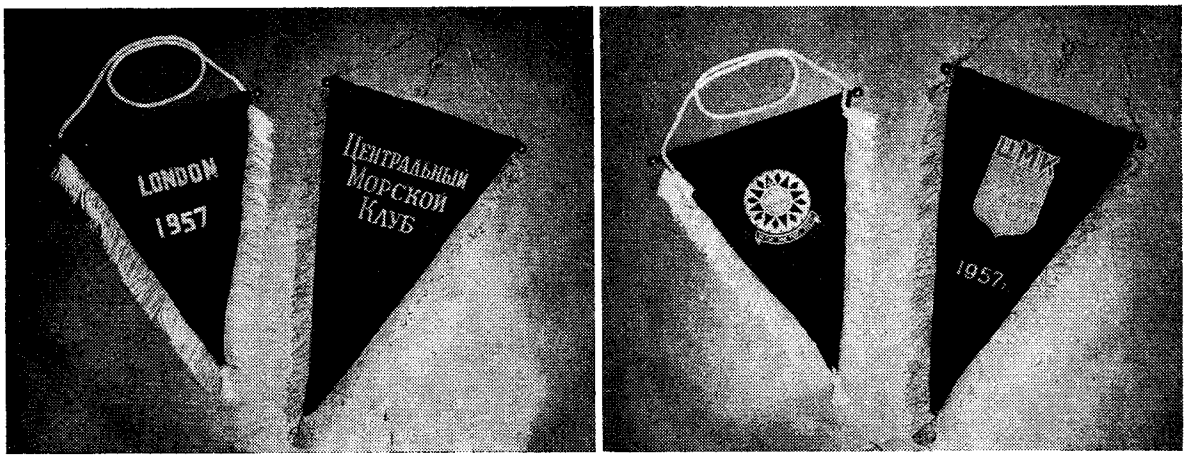
EVERYWHERE that the Russian modellers went in England last year they made news. They are still making it. Those arriving in Manchester for the ship model societies convention, held as part of the Northern Models Exhibition at the Corn Exchange, saw the pennant which the Metropolitan Ship Model Societies—ten groups in the London area—promised to Alexander Bliznakov and his friends during their visit.

When the four Russians came to London for the ME Exhibition members of the MSMS had the pleasure of discussing ship modelling with them, and at the end of these talks Mr Bliznakov, on behalf of the Central Marine Club in Moscow, presented a handsome pennant to three British clubs. There was also an exchange of badges.

Since then the MSMS has produced a pennant for Moscow. As can be seen from the picture, both emblems are beautifully designed and made. Their background colours may be thought appropriate, the Russians using red velvet and the British royal blue! The Moscow lettering, which means "Central Marine Club," is in gold and the English lettering in white.

Cover picture

Trows on the King's Highway of Severn. A. E. Field on page 517 begins a description of his scenic model which was seen at last year's Model Engineer Exhibition.



The two pennants (showing both sides) which Russian and British ship modellers presented to each other

First ME clock ?

MY note about the ME Musical Clock [March 20] has brought news of several examples which are quite well advanced.

I am indebted to Mr S. Belsey, of Maidstone, for sending me a cutting from the *Horological Journal* to which Mr S. W. Carr contributed a letter on the question of the ME Musical Clock. In it he says that he has succeeded in adjusting the clock to a cumulative error of about a quarter of a second in five days.

"For the first three days, you could not distinguish between the ticks and the Greenwich pips, the sixth one coming right 'on the dot'—it was uncanny and a good example of beginner's luck," wrote Mr Carr.

Mr Carr's musical clock is nearing completion. I wonder whether his will be the first.

Despite our care . . .

I AM sorry to say that in a short article in the issue of 13 March 1958 an error crept in which is much regretted. In "The Emperor's Snuff-box" the owner of the historic relic was given as Mr B. Binyson; it should have been spelt B. Binyon. A silly slip—the more annoying because several members of the staff are acquainted with Mr Binyon.

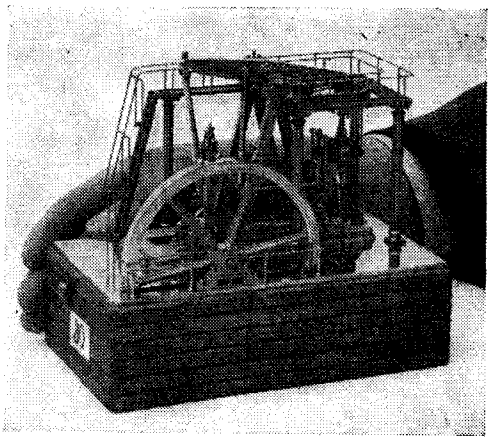
While I am on the question of mistakes, let me explain that each article is read for errors by (1) the printers (2) the Editor and/or assistant Editor (3) a Technical Editor and (4) the author. Sometimes there is not time to submit an article to the author but generally it is possible. In addition, pages are more often than not read by at least two members of the staff but despite these elaborate precautions a mistake does occasionally creep in.

If it is any consolation, let me say that they annoy us far more than they do the reader.

NORTHERN MODELS EXHIBITION

WORTHY, but where was the ZIP?

asks Joseph Martin



THERE was something wrong with the porridge that I had in Manchester. It looked like porridge, it smelt like porridge, and porridge it undoubtedly was. But I could not at first account for the taste. Adding sugar, stirring, and adding more sugar made no difference; the flavour remained as it was—less a flavour than the absence of one. Then I realised what was the matter. Someone in the hotel kitchens had forgotten the salt.

I found the same to be true of the three-day Northern Models Exhibition only a few minutes walk from the hotel. The tenth annual display arranged by the Northern Association of Model Engineers presented a good deal of solid, painstaking and honest work. It contained much that was enormously commendable and a fair amount that was by any standards excellent. But it lacked that extra quality, the quality that would have transformed a worthy show into a vital one.

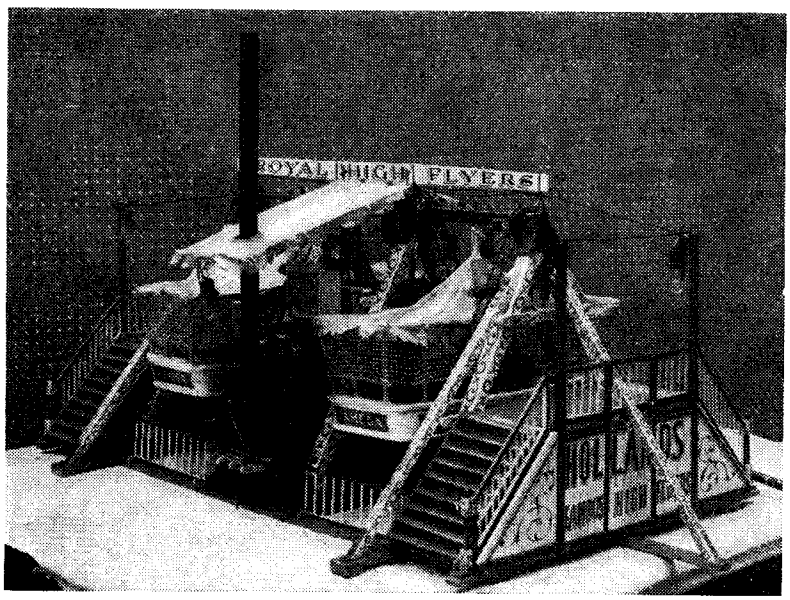
Many of the models had been seen before, and one looked in vain for a single exhibit that was both new and exciting. Several classes had had very few entries, and more than one winner had the dubious distinction of leading a pretty dull field.

Yet none of this, taking the exhibition as a public event in Manchester, mattered quite so much as the absence of any special attraction. Nothing had been introduced since last year to give the 1958 exhibition a firm place in one's memory. It was far too much like the exhibition of 1957, which, in turn, did not differ strikingly from the one in 1956.

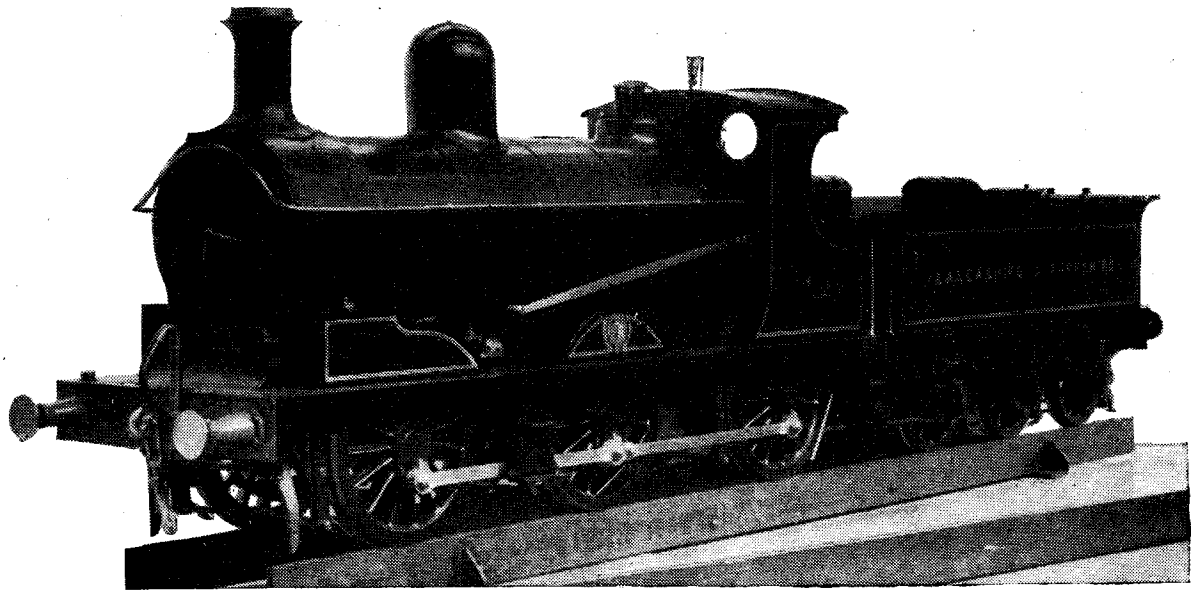
These impressions were not confined to myself. Three well-known modellers, two of them resident in the North, confessed their frank disappointment while some of the ordinary members of the public seemed rather like people who had heard a dull thud when they expected a bang.

This may also have been the response of the Northern press. I heard it complained that the newspapers were interested only in a story. But what else could a newspaper want? The press exists for the public, and its aim since the time of Defoe has been to publish whatever is most likely of interest a tremendous variety of human beings. A model engineering exhibition, though important to model engineers, is not automatically of interest to thousands of people any more than a discussion on early Finnish folk-poetry, a subject fascinating to some, is automatically of interest to modellers.

Every public exhibition should be undertaken as though it were the first. A show which can be considered satisfying item by item is not enough. Such an attitude leads to mere repetition until the event becomes for the newspapers no more than the usual, expected thing to be acknowledged with a picture or a fairly cursory report. It is, in short, taken for granted; and ultimately the interest of the public, instead of being



Top right: This miniature beam engine won second prize in the general engineering class for its builder, J. Sharp, of Cockermouth. Above: Popular with the public was this pair of steam-driven swing boats exhibited as a loan entry by their maker, R. Fish, of Manchester



The Myford Trophy for the best model in the exhibition and the "Evening Chronicle" Trophy for the best model in the locomotive classes were won by L. R. Raper for this 0-6-0 *goods engine*

kept warm, cools to a half-indifferent respect.

While this may not have happened yet in Manchester, there is a clear danger of its happening. If the next South Wales exhibition is anything like the last I hope that some of the NAME organisers will see it.

Great vigour and enthusiasm lay behind the Manchester show—but only behind it. Models were working and individuals were busy, yet very little seemed to be doing; whereas the Cardiff show was like a non-stop three-ring circus. People stopped in the street, for instance, to watch little aircraft curving over the City Hall.

Had the work on view at the Corn Exchange been uniformly poor, a listless atmosphere could have been expected. As it was, we had exhibits that could have stood in any company, and many more of which the builders could be justifiably proud.

The locomotives, in particular, made a handsome display. Louis Raper's Lancs and Yorks engine, winner of the *Manchester Evening Chronicle* Trophy for the best locomotive model and of the Myford Trophy for the best exhibit in the show, is already recognised as a classic, but there was hardly a miniature locomotive in the hall which could not have flanked it without shame.

W. Tucker's Caledonian chassis, first in its class, stood out from a good number of locomotives in progress of construction. These were more noticeable among the loan exhibits than among the competition entries, where only three were listed. Indeed the loan exhibits, besides being the making of the show, gave the best possible proof of the loyalty commanded by the steam railway in the region of its birth.

The other engines, too, showed the old loyalties enduring. It was a beam engine which gained R. A. Barker, of Sheffield, the NAME Trophy for the best general engineering model; while another beam engine won second prize for J. Sharp, of Cockermouth, and a Cornish pump engine in its familiar engine-house brought a third to Frank D. Woodall, of Shipley. Sputniks or phutniks, our model engineers are never far from Trevithick !

I was surprised, though perhaps I should not have been after last year's Model Engineer Exhibition, to find not a single traction engine among the competitive road vehicles in the catalogue. The class was headed, deservingly, by L. Tatlock, of Kearsley, with his exquisitely detailed 3 in. Francis Barnett Falcon. Where, we may ask, are all those traction engine models ?

The Prophet Hughes, author of *Traction Engines Worth Modelling*, had set up his Allchin shrine at the Corn Exchange, but what had happened to his legions of faithful that they should allow an infidel motorcycle to romp home in glory ?

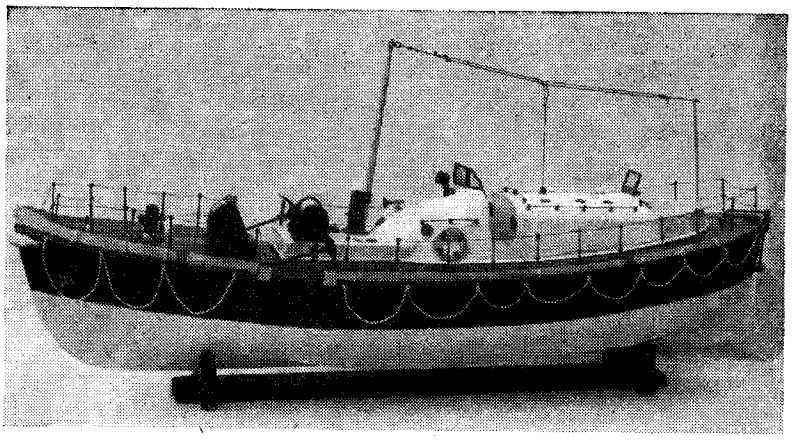
Behind the Falcon came an estate car built by R. Swindells of Manchester, with electric drive; and behind that, in turn, a Leyland Beaver lorry by J. E. Birchall, of Bramhall.

Allchins are being built, I know, but can it be that the average traction engine enthusiast is more interested in the prototypes and their lore, in seeing them and reading about them, than in constructing miniatures ? I seek enlightenment.

In general, the ship models were not especially inspiring. This was the more regrettable in that the Metropolitan Ship Model Societies, clubs in the London area, were holding a convention in the same hall, as an outcome of the NAME visit to the Model Engineer Exhibition. Fortunately, the NAME exhibition manager had had the bright idea of offering the visitors a free room in return for a selection of their models, and an array of beautiful work had arrived from the South.

Harrow and Wembley Society sent a group of delightful models, including a Norwegian brigantine built by Captain Moroney, the society's chairman, who is an American. From J. L. Bower, a Wembley naval architect, came the *London Splendour*, of 1953, at 1 in. to 100 ft. scale; from P. A. Bailey, of Wembley, a Formosa raft with the first-class passenger seated luxuriously in a barrel; from J. Hardy, a Wembley tobacconist, a Hangchow Bay junk; and from such modellers as George Draper, E. C. Freeston, H. W. Beesley and W. Cook (Mr Beesley is a Hammersmith company director and Mr Cook a Hammersmith shopkeeper) examples of meticulous craftsmanship at small scale.

Jason added a charming coracle of



This scale model Plymouth lifeboat won two awards for W. Marriott, of Salford —first prize in the radio-controlled models class and second prize in the working steam class

the kind described by the monks at Melford Abbey.

P. A. Waddington not only upheld the name of Wirral; he also showed the North, through his West Highland coaster *Sealight*, how attractive ship modelling can be to the worker in metal. I discovered from Jack Denton, one of the judges, that the average Northerner tends to think of ship modelling in terms of wood, to him an alien material. "But now," Mr Denton added, "I'm almost converted!"

I foresee the day when Mr Denton will build his Great Iron Ship, while F. T. Nuttall, of Whitefield, the solitary entrant in the class for yachts and sailing ships, continues to model happily in wood. Let us hope that the Metropolitan models will encourage the ship men of the NAME.

Some of them now may be indifferent to the importance of certain details: camber and sheer, the significance of a flag in indicating speed, and the niceties which distinguish a ship's sail from a pillow-case on the clothes line. But everything must have a beginning, and the promising work on the stand of the Lancashire and Cheshire Ship Model Society—close to nautical paintings from the Middleton and District Society of Arts—showed what could be done by a young society with enthusiasm.

No enthusiasm

Strangely enough, enthusiasm was almost entirely absent from the class in which apprentices were invited to exhibit models. The catalogue recorded one entrant—British Railways at Crewe, whose $\frac{3}{4}$ in. *Duke of Gloucester* won the prize for F. T. Jones.

As the best exhibit in the apprentices' section, F. G. Whitfield's milling machine received the Carlton Anderson Trophy. The response from the apprentice engineers was not what one anticipated of Manchester, and neither was the quality of some of the work, the emphasis being noticeably on finish rather than on plain accuracy.

Philip Symond, the exhibition manager, told me that the organisers were disappointed. But how can the seniors look for enthusiasm from the young when the general class for tools and workshop appliances drew only five catalogued entries? Edward Hinchliffe was the winner here, with a power hacksaw.

The young are air-minded, and it was N. Davis's 5 ft span aircraft which received the Lawton Trophy for the best exhibit by a junior. W. S. Neild, of Cheadle and District MAC flew off with the Aeromodeller Trophy against plenty of competition. One of the prizewinners in aircraft was a police constable, N. H. Lees, of Wythenshawe. Another policeman—or member of the Northern Flying Squad?—exhibited a Hawker Hunter. He was R. C. Clapham, of Heywood.

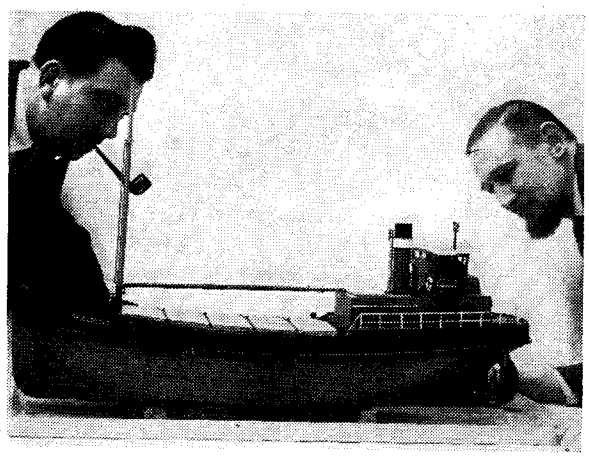
Mrs E. A. Barrett, who took the Ladies Prize, gained her success with a Fokker D7. Last year we knew of her as Miss Whiston, which seems to prove that marriage need make no difference when a girl is really set on modelling.

W. S. Neild came first in the class for radio-controlled aircraft—not a large class, although the crowd in front of the Manchester IRCMS stand suggested a lively interest in this form of modelling and some of the local enthusiasts are sufficiently advanced to construct their own radio equipment. The Society of Model Aeronautical Engineers had a stand representing their 40 clubs in the North West Area which covers Cheshire, Lancashire, Westmorland and North Wales.

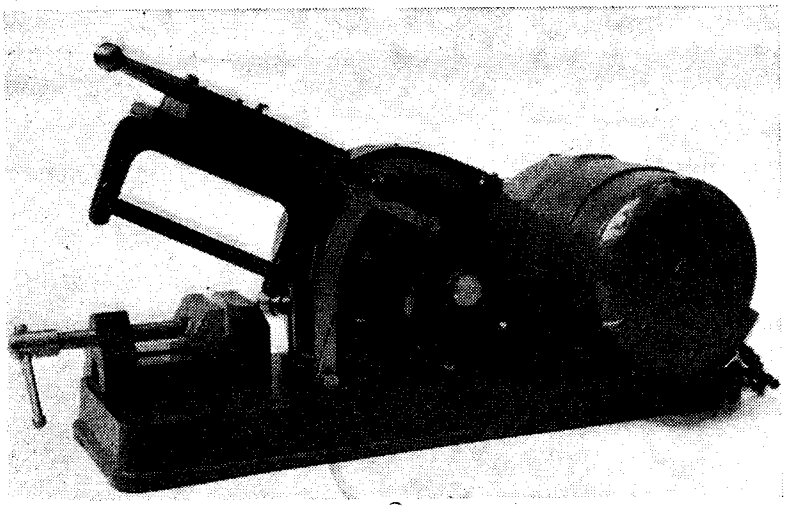
Unfortunately, the Manchester area is by no means ideal for those who want to send their models skyward. For this reason the Sale Model and Aero Club has changed its character. During the war, members combined the flying of model aircraft with the spotting of prototypes, but they have since turned to electric car racing, with what success we were again able to see. The portable track has been extended since last year. As Graham Barnes, the secretary, explained to me, it is intended to be a varied track rather than a fast one.

Blackpool and Fylde Model Car Club, which was represented, has cars capable of speeds close to 100 m.p.h. I was told that the devotees in Manchester are hoping for the help of Urmston Council, which intends to build a track for the model aircraft people and may, perhaps, be persuaded to make it flat enough for model cars. Given a track, the nucleus of three or four would be joined by about 18 others.

The Sale track was a centre of



Two ship model enthusiasts from London scrutinise the West Highland coaster which took first prize in the uncompleted marine models class for P. A. Waddington, of Wirral



This power hacksaw secured for E. Hinchliffe, of Rochdale SME, the Harper Trophy—awarded for the best entry in the tools and workshop appliances section

enthusiasm. I also discovered signs of encouraging vigour among the younger folk of Urmston. Colin Cave, for example, is a traveller in steel who decided two years ago to see what he could do with metal besides selling it. Since then he has built a fire-tube boiler and begun work on his Titfield Thunderbolt, a 5 in. gauge *Lion*. "I like to get on with the job," he told me; and my impression is that he is getting on with it very well indeed for a comparative beginner of 26.

Alan Green, who is five years Colin's junior, contributed a 3½ in. gauge Duchess. These young men work in harmony with the older or more experienced members, such as Bill Dodd, the Urmston president, and Sid Rowlands, a locomotive modeller with the fairly rare distinction of learning about his engines from the footplate. The miniatures run on a track which is being relaid in aluminium alloy and should be finished in about two months.

Leonard Formilli, of Sale, is very much a veteran and his keenness takes the extreme form from Colin Cave's. For nine years he has been working on a showman's engine, building it bit by bit with infinite patience.

He gave me his progress report for 1957: the generator and generator mounting, nameplates, clack valves, guard for main drive, second reduction shaft and gears, differential, final drive, connecting-rods and crossheads—all completed, with the rods and crossheads occupying the most time.

Next to Herbert Slack's famous roundabout, the gayest thing in the show, stood a much smaller model inspired by the fairground: the Royal High Flyers built by Robert Fish, of Manchester. It took Mr Fish about two and a half years to make these attractive steam swingboats with the engine between them. The engine, which has a tall chimney to carry the sparks away, reproduces the original by Savage's of King's Lynn.

Here, I thought, was yet another example of the contribution which model engineering perpetually makes to local and national history. Modellers are sometimes criticised for looking back too long and lovingly towards the past. But the best aspects of the past need to be preserved, and the modelling craft can keep many of them alive, in their three-dimensional actuality, to the profit of present and future.

Many fine things from yesterday were ranged along the club stands—those excellent stands from Urmston, Rochdale, Crewe, Sheffield and Stockport—which gave substance to the exhibition.

Besides all these exhibits that I have mentioned we had most of the usual attractions, from the workshop staffed by Stockport members to the especially notable models which appear again and again.

All in all, the show displayed a quiet integrity of craftsmanship not always immediately obvious but easily detected by Edgar T. Westbury (the chief judge) and his alert colleagues. Many worked hard behind the scenes—not least Eric Axon, who has the great gift in an exhibition secretary of being clear-minded about every detail. But I hope that next time they will add some salt. ▣

THE RESULTS

Locomotives: 1 L. R. Raper, Wakefield SME, Lancs and Yorks engine; 2 D. Woolfenden, Rochdale, ¾ in. LMS Pacific *Duchess of Buccleuch*; 3 J. H. Hatherley, Sheffield, ¾ in. 0-4-0 *Juliet*. Uncompleted locomotive or parts: 1 W. Tucker, Caledonian class chassis.

Marine models, working steam or power boats: 1 A. L. Gwynn, Alderley Edge, 1 in. to 3 ft scale drifter-trawler; 2 W. Marriott, Salford, Plymouth lifeboat; 3 D. Elce, Sale, ½ in. Thorneycroft air-sea rescue launch. Hydroplanes and speed boats: 1 G. M. Tipton, Manchester IRCMS, radio-controlled hydroplane. Working yachts or sailing ships: 1 F. T. Nuttall, Whitefield, 36 in. racing yacht. Uncompleted: 1 P. A. Waddington, Wirral, West Highland coaster; 2 D. Cornwell, Sale, steam drifter; 3 C. Redfern, Bury MYC, racing yacht.

General models: 1 R. A. Barker, Sheffield, beam engine; 2 J. Sharp, Cockermouth, beam engine; 3 F. D. Woodall, Shipley, Cornish mine pump. Mechanically-propelled road vehicles: 1 L. Tatlock, Kearsley, 3 in. Francis Barnett Falcon; 2 R. Swindells, Manchester, estate car; 3 J. E. Birchell, Bramhall, Leyland Beaver lorry.

Radio-controlled models, except aircraft: 1 W. Marriott, Salford, Plymouth lifeboat; 2 G. M. Tipton, hydroplane; 3 F. T. Nuttall, Whitefield, range safety launch. Silver plaque: R. Swindells, estate car.

Tools and workshop appliances: 1 E. Hinchliffe, Rochdale, power hacksaw; 2 W. R. Charles, Rochdale, Cowel ⅜ in. capacity power drill; 3 G. J. M. Catley, Newbridge, Mon., micro lathe.

Juniors, any example of work except aircraft: 1 S. Glover, Jnr., Manchester, Florida cabin cruiser; 2 P. J. Clarkson, royal barge; 3 P. Spurrier, Risley, galleon. Aircraft: 1 N. Davis, Heywood, 5 ft span aircraft; 2 M. Strutt, Bury, Chief A2 class glider; 3 A. Bonson, Manchester, Hawker Tempest fighter.

Aircraft, power-flying models except rubber-driven: 1 W. S. Neild, Cheadle 66 in. span model, own design; 2 J. O'Donnell, Pendleton, 36 in. span jet model *Peter Pan*; 3 B. Worthington, Middleton; 37 in. span free-flight contest model *Teal*. Rubber-driven: 1 J. O'Donnell, 42 in. span duration *Deterrent*; 2 D. I. Tinker, Heywood, 45 in. span lightweight, *Maxie*. Flying scale models: 1 N. H. Lees, Wythenshawe, De Havilland Tiger; 2 E. A. Horwich, Salford, 65⅛ in. span Aeronca Sedan; 3 Mrs E. A. Barrett, Urmston, 20 in. span Fokker D7.

Sailplanes: 1 L. Whalley, Cheadle, glider *Lucifer*. Scale model control-line models: 1 W. S. Brown, Urmston, North American P51 Mustang; D. S. Nuttall, Accrington, Tempest II; P. A. Dunkerley, Altrincham, Messerschmit: BF109 G-16 (all first). Control line, not scalet 1 L. Whalley, Toreador stunt model. Static scale: 1 H. Parrish, Denton; 2 J. M. Hards, Southport, Curtiss P6-E Hawk; 3 H. Parrish, German Albatross C5 (1917). Radio-controlled: 1 W. S. Neild, 66 in. span own design; 2 L. Gabriels, Hollinwood, 40 in. span Piper supercruiser; 3 J. Cope, Whitefield, Junior 60.

Apprentice engineer competition, models of equipment, etc.: 1 British Railways, Crewe (F. T. Jones), ¾ in. *Duke of Gloucester*. Tools and workshop appliances: 1 F. G. Whitfield, milling machine; 2 D. Irwin, power saw; 3 L. J. Turner, Pentridge, scribing block.

Trophies: Myford and *Evening Chronicle*, L. R. Raper, Wakefield SME; NAME members' and general models, R. A. Barker, Sheffield and District SMEE; NAME marine, A. L. Gwynn; Harper, E. Hinchliffe, Rochdale SMEE; Lawton, N. Davis; *Aeromodeller*, W. S. Neild, Cheadle and District MAC; Ladies, Mrs. E. A. Barrett, and Carlton Anderson, F. G. Whitfield.

Awards were distributed by Dr J. H. Lamble, president of the Manchester Association of Engineers. W. S. Wingit of Lancaster was the winner for handicrafts and E. S. Hoskins of Cheadle Hulme the winner for marquetry.

Marking tests for gears

WORKSHOP HINTS AND TIPS

By GEOMETER

PRECISE though gears may be in themselves, satisfactory operation follows only when they are aligned and meshing correctly and set at designed centres or with specified backlash. Alignment is dealt with in another article, and marking tests for tooth contact areas, in conjunction with verification of backlash, together reveal if the best setting obtains.

Checking contact areas of a pair of gears is straightforward enough. Both should be clean and dry; and into a few teeth of one of them a marking compound should be lightly brushed. Then they are rotated together—in one direction, then the other, and contacts are shown on the flanks.

In normal operation, one gear is usually the "driving" one and the other the "driven." When the driving gear applies drive, pressure is on the "drive side" of the teeth. But when drive eases off, and the driven gear continues by momentum (as in car transmission), there is over-run and pressure comes on the "over-run side" of the teeth.

Checking in both directions leaves marks on both sides of the teeth, and unless one gear is specified as that to be turned in tests there can be two tests, applying drive from one gear then from the other. The compound employed can be marking blue ready made up, or powdered red lead mixed to a thin paste with engine oil.

Backlash is movement present when one gear is held stationary and the other oscillated. It is play at the pitch line, from a tooth being fractionally narrower than the space into which it fits. In general, it increases by setting gears away from one another, and within limits decreases by bringing them together. It is important, but not by itself an answer for meshing without marking tests.

In checking accurate gears like pinions and crown wheels, which are made in pairs and should never be mixed, both tests are essential. That for backlash, as at *A*, can be made with an indicator clipped to the casing flange.

Holding the pinion shaft stationary, backlash can be read, and the amount specified may be anything from 0.003 in. to about 0.008 in. With the indicator at an angle, a somewhat "high" reading should obtain, but with an arm giving a straight push, the reading should be spot on.

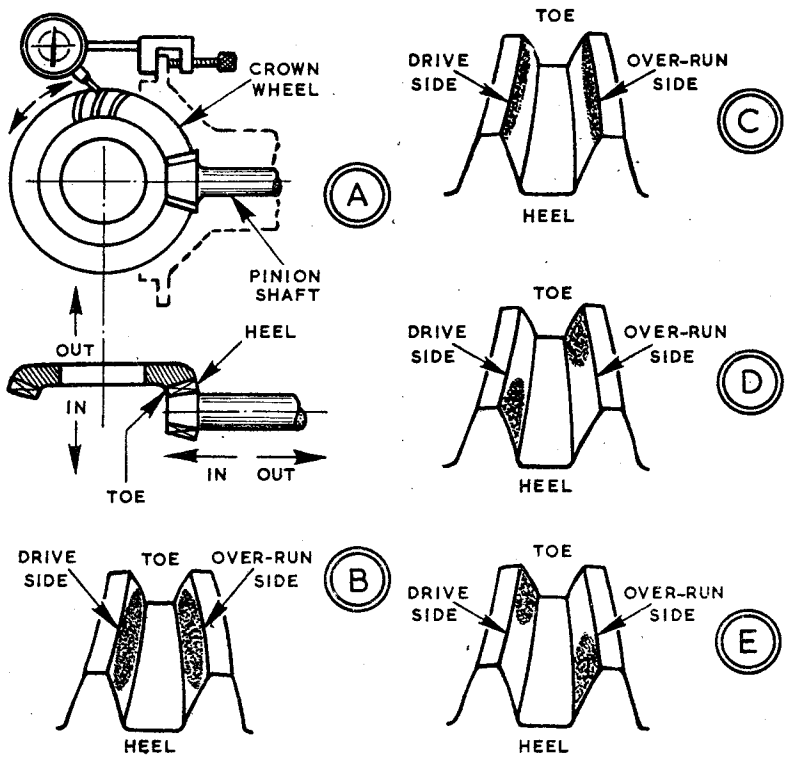
The outside diameter of crown wheel teeth is the "heel" and the inside the "toe" and by adjustments both crown wheel and pinion can be moved in and out, to obtain correct markings and backlash. Rotating the crown wheel and lightly braking the pinion shaft by hand, ideal markings are as at *B*, broad and central on both drive and over-run sides of the teeth.

Divergences from ideal markings indicate incorrect setting, and while the gears would still function, they would certainly be noisy either on drive or over-run. Typical divergences are heavy contact at the tips or root of the teeth, and heel-and-toe contact of one form or another.

Heavy contact at the tips of crown wheel teeth, as at *C*, indicates the pinion is too far out of mesh. It should be moved in towards the crown wheel, then moved out to adjust backlash. The opposite condition—heavy contact at the root of the teeth—reveals the pinion is too deeply in mesh. So it should be moved out, and the crown wheel in (if necessary) to maintain backlash.

With a heavy marking at the heel on the drive side and the toe on the over-run side, as at *D*, the remedy is to move the pinion out and the crown wheel in. For the converse condition, a heavy marking at the toe on the drive side and the heel on the over-run side, as at *E*, correction is made by moving the crown wheel out and the pinion in to maintain backlash.

Means of moving the pinion and crown wheel vary. Shims are often used at the pinion housing flange, crown wheel adjustment being threaded rings with locking devices. ▣



JUBILEE

This article begins the constructional details of this 3½ in. gauge 2-6-4 LMS tank. Mainframes, buffer beams and hornblocks are dealt with

By MARTIN EVANS

Continued from 10 April 1958, pages 441 to 443

As usual we kick off with the mainframes, for which two pieces of bright or blue mild steel approximately 3 ft long and 3¼ in. wide × ⅛ in. thick will be needed. I don't like black steel for frames myself, though I know some people use it.

By the way, although 3¼ in. wide is a commercial size, as so much of this material is a shade under the nominal size and often has rough edges as well, I strongly recommend purchasing 3½ in. wide and sawing off the surplus. Yes, I know, it's a lot more work, but it's well worth it !

The first thing to do is to file the bottom edge of one piece of the steel straight and true. This can be done by eye or with a straight edge or by using the lathe bed and a feeler gauge. Clean up one side and coat with a suitable marking out liquid.

First mark out the outline of the frames and the vertical centres of the cylinders, pony wheels, driving wheels and bogie. To obtain the correct inclination of the cylinders, mark the centre of the driving axle in its normal running position (this is 11/16 in. above the bottom edge of the frames) and join this to a point ¾ in. above the bottom front corner of the frames.

Having completed the marking-out satisfactorily, drill about four of the No 27 holes, clamp to the second frame plate, run the drill through again and bolt together firmly with 4 BA steel screws. Alternatively drill ⅛ in. dia. holes to start with and use ⅛ in. copper rivets (the heads can be chiselled off quite easily after the frames are completed).

The next item is the drilling, and it is a good plan to start all holes with a small h.s.s. centre drill, then follow up with a No 34 drill, finally opening out where necessary as shown on the drawing. Note that there are five holes just to the rear of the trailing coupled wheel which are only required in the left-hand frame (these are actually for the reversing gear) and there is also a difference in the No 27 countersunk holes ahead of the drivers which are required to support the water pumps between the frames.

Regarding the large holes for the steam and exhaust pipes, readers may find it easier to drill a row of small holes inside a scribed circle, and break into these with an Abrafile or similar weapon, rather than drilling normally.

Particular care should be taken to accurately locate the holes just in front of the driving axle, as these determine the position of the weigh-shaft and the expansion link. The hole for the former should be reamed for preference.

The next job will be the drilling all round each wheel arch and the curved corners at the top rear end of the frames, and, of course, the straight row of holes across the top of each hornblock slot. If a drill about 3/32 in. dia. is used first these can be opened out very carefully so that each part can be broken out with hardly any pressure at all.

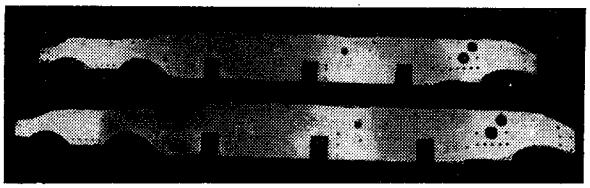
There are two 4 BA tapped holes just in front of the trailing coupled wheels, these are for the brake hanger pivots. If a nut was used here it would probably foul the sides of the firebox.

Coming now to the sawing, if you are cutting your frames from 3½ in. or wider material, as I suggested, it is, perhaps, best to tackle the long cut right along the top first of all (while you are still fresh !) After the first four inches or so, it becomes necessary to turn the blade at right-angles in the hacksaw frame, so that the back of this clears the locomotive frame however deep one goes.

Sawing this way is rather tricky as one cannot get much weight on the blade, but take things steadily and use plenty of cutting oil and the job won't be too irksome. The remainder of the sawing should not take very long; as a matter of fact it took me only four hours to do all the sawing on my own frames, and I wasn't getting too hot and bothered !

The cleaning-up of the frames should be straightforward enough. I like a partly-worn 10 in. second-cut for most of the work, following up with flat and half-round 6 in. second-cut and smooth files.

The frames can now be parted and the necessary countersinking done and all the burring removed. It is a good plan at this stage to examine the frames carefully for warping; this often takes place with some of the bright steel we get nowadays and can be an awful nuisance ! The cure is usually judicious use of a hide hammer or careful bending at the appropriate points.



The mainframes ready to receive hornblocks

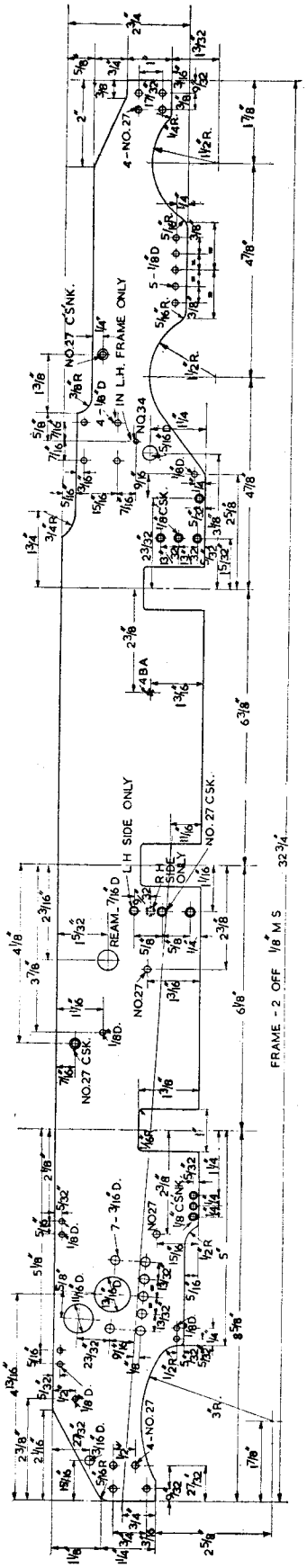
BUFFER BEAMS

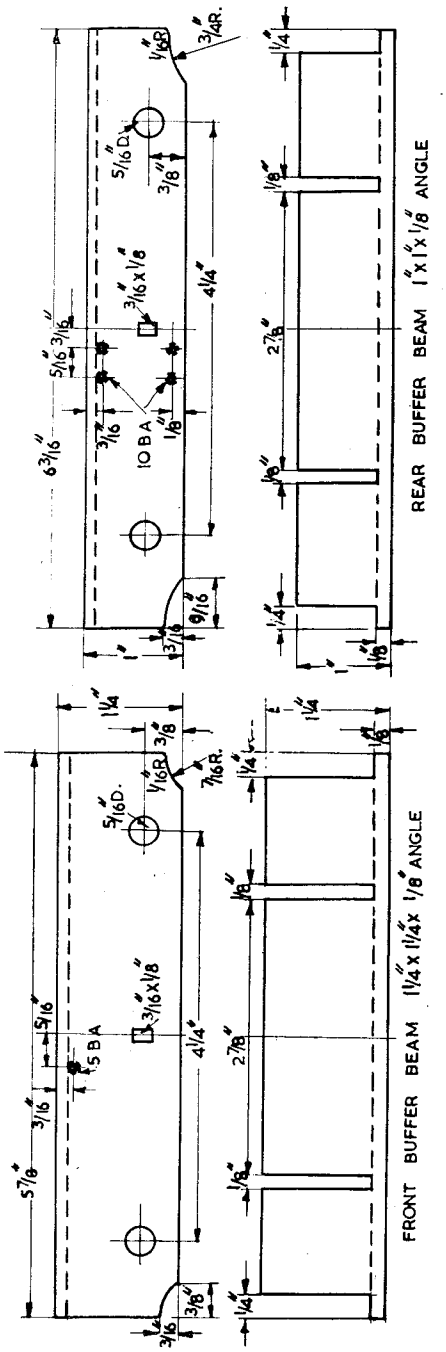
I understand that some advertisers supply castings for these, but as we need 1¼ in. deep material for the front beams and 1 in. deep for the rear, it may be better to stick to the more usual bright steel angle. Be warned here—some of the bright steel angle in circulation at the moment is by no means square, and as it's very difficult to straighten the angle, it usually means some hard filing.

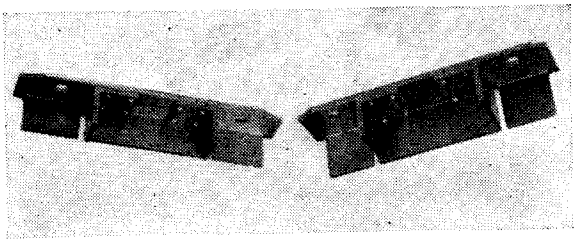
Cut off the two beams, square up the ends and mark out the centre line on each side, the slots for the frames,

Left: Details of the mainframes

Below: Dimensions of the two buffer beams and hornblocks







The front and rear buffer beams

Frames complete with hornblocks and both beams

and the positions of buffers and couplings. If a suitable milling machine is available, the frame slots can be cut with an $\frac{1}{8}$ in. milling cutter about $3\frac{1}{2}$ in. dia.

They can also be cut this way in the lathe, but it must be remembered that it takes a fair amount of power to drive a $3\frac{1}{2}$ in. cutter. The cutter arbor should be supported by the tailstock, the lowest speed should be used and plenty of cutting oil. The two beams should be clamped together, so that the slots cannot help but be in line, either on the cross slide or under the toolholder, according to the type of lathe.

However, it's not at all difficult to cut them by hand, either using the top of the vice as a guide, or by making two cuts to each slot with a No 1 metal fretsaw, cleaning up with a thin flat file.

The holes for the buffers are drilled $\frac{5}{16}$ in. dia. and the slots for the couplings are best made by drilling a No 31 hole and opening out with a small square needle file.

Both beams have cut-aways on their lower outside corners and these can be done with the hacksaw and half round files.

The fixing angles are made from 1 in. steel angle, four 3/32 in. iron snaphead rivets being used to each angle, with the heads on the inside and countersunk on the outside.

My drawing shows tapped holes in each beam which are intended to support the vacuum brake pipes. These will only be dummy, so if you don't intend to fit them, there is no need to put in these holes.

I used the standard hot pressed type main hornblocks, obtained from one of our advertisers, and I strongly recommend these in preference to ordinary castings. Clean them up on the side next to the frame so that they bed down nicely. Drill for rivets with a No 42 drill, using eight 3/32 in. snaphead iron rivets per hornblock, also drill a $\frac{1}{16}$ in. dia. hole through the top flange (inside the frame) which may come in useful later on for lubrication purposes.

Each horn can now be clamped to the frame in turn, and the No 42 drill run through, afterwards countersinking the frame on the outside. I prefer to hold the horn to the frame with two or three 7 BA screws and nuts while riveting up, which prevents any possibility of the horn shifting.

Clean up on the outside of the frames and then bolt the frames together, back to back, ready for milling out the horns for the axleboxes. However, as it is easier to clean out the horns to match the axleboxes than vice versa, I will tackle the latter next.

● *To be continued*

NEXT WEEK'S SOUVENIR ISSUE

By VULCAN

NEXT week's issue of the MODEL ENGINEER will be a special Diamond Jubilee issue to mark 60 years of continuous publication. It will consist of 84 pages and will contain many special features written by some of the contributors whose reputations are known wherever model engineering is carried out.

There will be the first part of a constructional feature for an outstanding electric clock specially commissioned to mark the occasion and this will be followed by full instructions for making the clock and case. LBSC will write of the locomotives which he has built in the 33 years he has been writing for the magazine, with pictures of some of the occupants of the locomotive sheds to which reference has often been made.

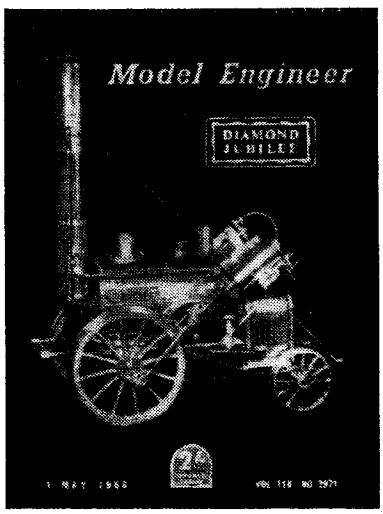
The story of power boats in the past 60 years will be described by E. T. Westbury and A. E. Bowyer-Lowe writes about the development of tools for the home workshop. J. N. Maskelyne discourses on the growth of the model steam locomotive hobby, while the progress in models of stationary steam engines is outlined.

A special feature of the issue is the centre-page spread of full coloured plates of four outstanding models—the locomotive *Como* by the late Dr Bradbury Winter, the locomotive *Majestic* by A. P. Campbell, the traction engine *Supreme* by S. Harris, and the clipper *Norman Court* built by Alderson.

There is a constructional feature on a high power monocular telescope and a description of steam cars in an American museum, in addition to many of the normal features which appear in MODEL ENGINEER.

It is a double issue and will cost 2s. Although extra copies are being printed, it is essential that early reservations should be made with the newsagents. If readers experience difficulty in obtaining extra copies, it might help to tell the newsagent that further supplies are available at his wholesaler.

I feel that many will want to keep the issue as a souvenir of the growth of model engineering and that they may wish to send copies to friends or relatives who have an interest in the hobby. But it must be emphasised that unless reservation is made of these extra copies some people may be disappointed.



Hints for accuracy and good finish on metalwork

By OLD HAND

MANY beginners—and even some experienced craftsmen—tend to waste time, energy and materials owing to inaccurate marking out and insufficient care in such simple matters as hole drilling and finishing. For those to whom this applies, here are some tips which have proved to be " good business " in many years of general engineering as well as model making.

MARKING OUT

Careful marking out is very important, and if accurately done will eventually save time and temper, for errors have a habit of accumulating as the work proceeds.

When marking out always bear in mind the old adage: " measure twice and cut once." Work in a good light and always use needle point dividers and scribers in conjunction with a scribing block and surface plate; keep the points sharp and protect them when not in use.

Inaccurate centring for hole drilling often causes a lot of trouble. Do not use a centre punch; it cannot be placed on a scribed line or intersection with absolute accuracy, and will inevitably be a few thou off the desired point.

The accumulation of such errors, even though small in themselves, will lead to an appreciable amount of error or inaccuracy over the whole job.

ACCURATE DRILLING

The most accurate method of locating the drilling point is to prick off the required location with the scriber point and then to work up the centre with a flat V or diamond pointed drill which has been ground (on the flats) to a needle point. The drill point should be placed at the required spot and then rotated between finger and thumb, applying pressure at the same time. In this way an accurately located centre is obtained.

All holes should be started with a small Slocombe combination centre drill. Never start a hole with an ordinary drill for it will almost certainly wander. Another aid to accuracy is to drill holes in two stages —a small drill first, then the required size.

Where absolute accuracy is not important a spring-loaded centre punch with an accurately ground point is better than using a punch with a hammer.

Never force a drill, as this will cause it to wander and drill oversize. If a drill needs forcing it is either inaccurately ground or it needs grinding. Always keep drills sharp and accurately ground; an inaccurately ground drill will always produce an oversize hole.

For this reason never assume that a hole will be the size for which the drill was originally intended; drill a test hole in a piece of scrap first. This care is especially necessary when drilling small holes in preparation for tapping fine threads.

DRILLING IN THE LATHE

A hole drilled in a lathe may not be accurate, as a drill will wander as it goes deeper into the workpiece.

The best and most accurate procedure for drilling large holes in a lathe is to first centre with a Slocombe and drill the hole under size. Next, bore out the front of the hole dead size, finally using a D-bit to complete the hole to the desired size.

This type of drill will correct any error in the original drilling and will produce an accurate smooth hole.

FINISHING

Be very sparing in the use of emerycloth for finishing surfaces—it is liable to scratch, tends to round off corners and it is not conducive to preserving flat surfaces. For preference use dead smooth Swiss files or a scraper. Always use new files on brass first and mark them so that they do not become mixed with older files.

CARE OF TOOLS

Keep drills in a drill block so that the cutting edges do not become damaged. Files should be carefully handled too, if their ability to produce a good finish is to be maintained. Never store them or place them on a bench so that one can rub on another; this damages the teeth and will cause scratches on the work. And do not allow them to become rusty, as this will also spoil the cutting edge.

Use a piece of copper rod to remove chips from the teeth. If a file is greasy or clogged, soak it in petrol and then brush with a file card.

Protect the divider and scriber points when not in use by pushing them into corks.

All this may seem to be a lot of trouble, but experience has taught me that it is well worth while. Time spent in doing things carefully and taking care of tools will be well repaid—accurate parts will be produced, parts that will *not* require scrapping or even " adjusting." ▣

ALUMINIUM

LEARNING METALWORK WITH ALUMINIUM by J. C. Older (Temple Press) Price 12s. 6d.

ONE of the most important metals in the modern world—and one which is increasingly used for models —was discovered in its virgin form 100 years ago and effectively developed for the first time early in the present century. Americans know it as aluminum. This is what Humphry Davy called it, but Davy was a Cornishman and the English have perversely insisted on an extra vowel.

As Wilfred Deacon of The Aluminium Development Association says in his foreword to J. C. Older's book, alloys based on aluminium can be used even when the need is for a strength like that of steel. The title of this generously illustrated book explains its purpose: to demonstrate the suitability of aluminium as a material for the amateur or beginner. Mr Older has written a school textbook for the present age and a guide to all who are learning to manipulate metal.

A mixed bag

Read on ! The answer to your problem may be here

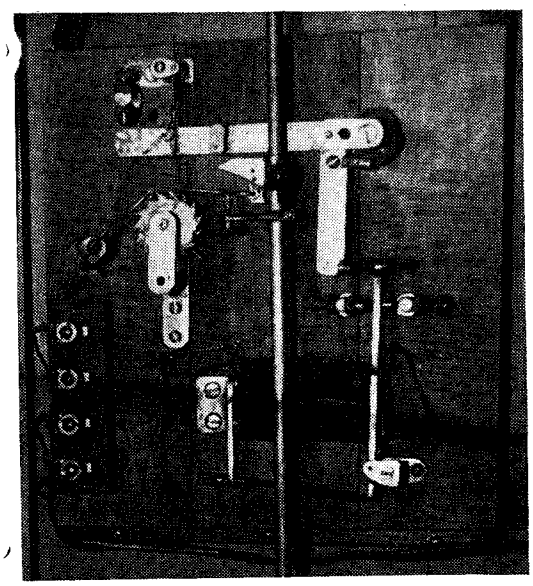
Synchronome clock from scrap

By building separate units out of $\frac{1}{8}$ in. × $\frac{1}{2}$ in. c.r.s. and using a pair of magnet coils from old telephone relays, cost was kept to a minimum. The base is constructed of $\frac{1}{2}$ in. hardwood and the units are attached to this. The base is screwed to a frame welded up from $\frac{1}{2}$ in. × $\frac{1}{2}$ in. × $\frac{1}{8}$ in. angle iron.

A feature, which is extremely useful in setting the height of the trip wire, is the adjustable stop which is secured to the pendulum below the pallet. The count wheel runs in two small bronze bushes, which are screwed in. Soft leather bumpers, fitted to the stops, help to reduce noise. Soft leather was found better than rubber or felt for this purpose.

The most satisfactory contact materials have been found to be silver platinum (a motor-cycle contact breaker point saved for about 15 years). This clock has been running well since 1946.

FRED MASSEY.



The mechanism o, Mr Massey's clock

A $\frac{1}{4}$ in. sensitive drilling machine

Having long felt the need for a small drilling machine I came to the conclusion that something must be done immediately, but it had to incorporate the following features: 1 be fabricated from mainly stock bright and black m.s. sections; 2 have a rack and pinion feed; 3 have a non-tilting table; 4 be self-contained if possible; and 5 all machining to be within the capacity of my 3$\frac{3}{8}$ in. Zyto.

A start was made by obtaining a straight piece of $\frac{3}{4}$ in. i.d. × 1 in. o.d. bright m.s. tube 18 in. long, and also another piece of the same tube 4$\frac{1}{8}$ in. long. I was originally going to make up the drilling head complete and fit it to the column in the usual way but I decided this was unnecessary so I fabricated the head, as shown, integral with the column.

By careful tacking and checking before finally welding up I was able to get the column and housing surprisingly square in both directions. A slot to accommodate the pinion was cut in the housing tube before welding up.

At this juncture 1 was fortunate in obtaining an old factory sewing machine motor. This was a series type which required an overhaul but which I thought might develop just enough power to run the drilling machine. Anyway the motor was put to one side after marking out a motor fixing plate and welding this to the column at right angles to the head as shown.

The base and table were constructed by welding suitable collars to two pieces of 3$\frac{1}{2}$ in. × $\frac{1}{2}$ in. m.s. black laboriously sawn to shape. The holes were reamed and the working surfaces filed flat. The table was provided with a split clamp as shown and the base drilled and tapped for an Allen grubscrew. Care was taken to see that the base and table were square with the column in both directions.

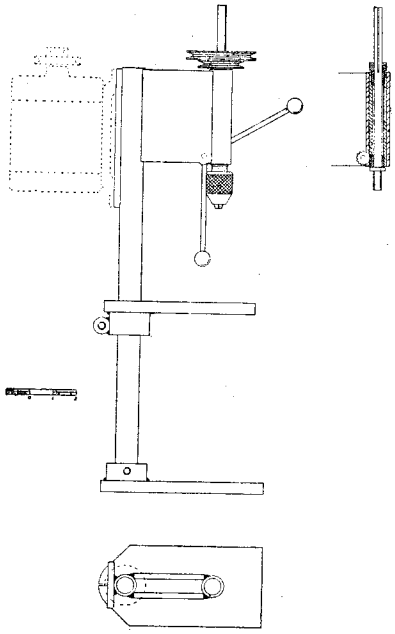
Returning to the head, after careful "miking" I was able to select a piece of $\frac{1}{2}$ in. i.d. × $\frac{3}{4}$ in. o.d. bright m.s. tubing which after a light polish in the lathe was a very satisfactory sliding fit in the housing which had previously been reamed.

This sliding sleeve was bored to take two $\frac{3}{8}$ in. bore self lubricating bushes, also 16 t. at $\frac{1}{8}$ in. pitch were cut straight across the back by shaping in the lathe. The 20 t. pinion was next tackled, again by shaping in the lathe, and the pinion spindle was machined to suit the holes drilled and reamed in the head.

The sliding sleeve, pinion, etc., were then assembled and after a certain amount of initial stiffness they worked up and down quite smoothly.

The reader will probably note in this design that I have not attempted to incorporate a return spring or sliding weight, as in practice it has not been found necessary, the sleeve being just stiff enough to remain where put. I did think that it might have been necessary to employ a small grubscrew in the housing working in a small groove cut in the sliding sleeve to prevent the torque turning the sleeve slightly and jamming the pinion, but again this has not been found necessary.

I decided that as most of my drilling involves the use of fairly small



General arrangement of the sensitive drilling machine

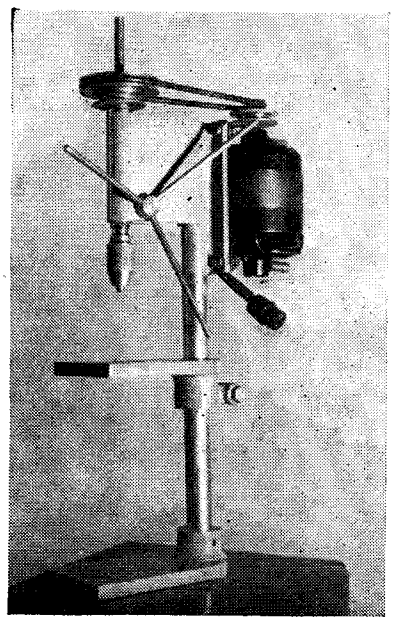
drills, a Jacobs' type drill chuck would not be necessary, and therefore the spindle was designed accordingly. The nose was screwed to fit a ¼ in. spring type chuck and the top end keyed for the pulley. At the same time a small retaining collar with grubscrew was made to fit the spindle at the top.

A pair of pulleys were produced to enable the drill spindle to run at motor, and half-motor speed. These were produced in mild steel to provide a flywheel effect to the spindle since the motor was obviously not going to be as powerful as I would have liked.

The motor, meanwhile, was stripped and the commutator cleaned up, the plain bearings pushed out and replaced with self lubricating bushes, then it was assembled and mounted, the drive being transmitted by a short length of ¼ in. dia. Whiston plastic belt.

The finished drill has been a complete success and although the methods used in its construction will not meet with everyone's approval, nevertheless I do feel they were justified when time and money are at a premium. Incidentally, the machine has been instrumental in enabling me to fulfil another long standing ambition, namely, to build a horizontal steam engine from a set of Stuart castings.

W. HEARD.



The assembled drill

Operation gap-tooth

THE latest requirement in my programme being a ship's steering wheel clock, I looked out a handsome, roundcased veteran (see *a* in the drawing) which had gravitated to the scrap box, intending to repair it and build a nice mahogany wheel around it.

I am no clock expert, but dislike seeing them—or anything else for that matter—lying around dead, and have resuscitated quite a few, from grandfathers to alarms.

My chosen one in this instance was quite inanimate through a broken mainspring and several other ailments, but luckily, the spring from another old-timer was available. Much rock-and-roll in the bearings had to be taken-up also.

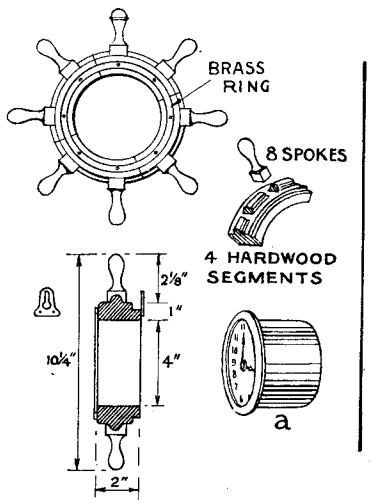
But the teeth of the largest spur-wheel (the primary one, bearing the spring and winding mechanism) threatened at first to put a full stop to the proceedings, because they looked exactly as I have drawn them at *b*. No improvised wheel dentistry can do much with teeth as decayed as these were, and no replacement wheel could be found among the scrap.

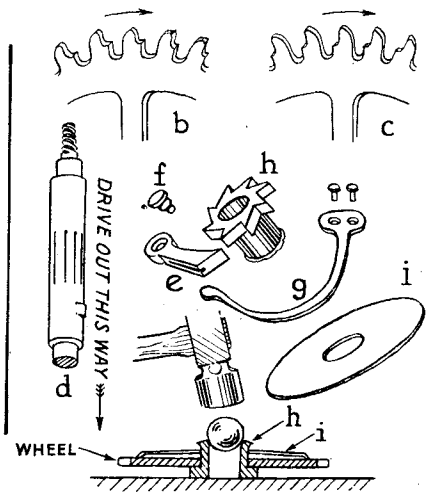
Then it dawned upon me that, if this worn wheel could be reversed on its shaft, the undamaged backs of the teeth would bear on the pinion, and the job be as good as new, *c*.

I don't know whether this back-to-front business is a new thing, or not. All I know is, it works. And, in case any other clock reviver should find it useful, here is a short description of the operation.

First, I drove out the winding-shaft *d* which is vertically scored to ensure a tight fit in the brass hub of the ratchet; then I removed the pawl *e* which is free to move about a countersunk, shouldered rivet *f* pressed into a hole in the wheel spoke and lightly riveted at the back; a tap with a small punch freed both.

The pawl-spring *g* was anchored by two tiny rivets to another wheel spoke, and the punch removed this also. The ratchet *h* was a little more difficult, its hollow brass hub going through the wheel and also a steel disc *i* behind it, the two being secured together by being slightly trumpet-mouthed as shown, when they are free to revolve independently during winding. (I turned off the splayed-out part of the brass hub in the lathe by a cautious touch with a hand tool





just sufficiently to allow the disc to be pried off.)

To reassemble this handful of parts, I turned the wheel over, slipped the brass hub of the ratchet through the central hole and put the steel disc in place at the back of the wheel (which used to be the front !) The whole lot was stood on a flat steel surface (ratchet downwards) and a ball-bearing of slightly larger diameter was balanced in the hole in the hub.

I held the disc in place with my fingers, one on each side of the ball, then gave the ball-bearing a cautious crack or two with a small hammer, splaying out the brass just enough to keep the disc from slipping off again.

Making sure that the ratchet and disc assembly turned freely in the wheel hub, I refitted pawl and pawl-spring by pressing their rivets into the original holes, ensuring the pawl worked positively with teeth of the ratchet when turned.

Lastly, the winding shaft *d*, threaded end first, was entered into the ratchet hub (pushing it in from the side upon which is the steel disc). The spring was fitted, making sure the catch engaged with the centre of it, and the primary wheel was good for many more years of service.

The steering wheel itself needs little description, as it can be varied in design to suit individual taste, but I made mine to the size and proportions shown in the drawing. A lug must be fixed at the back for wall mounting, and the old clock, shipshape once more, should be able to carry on well into the atomic age.

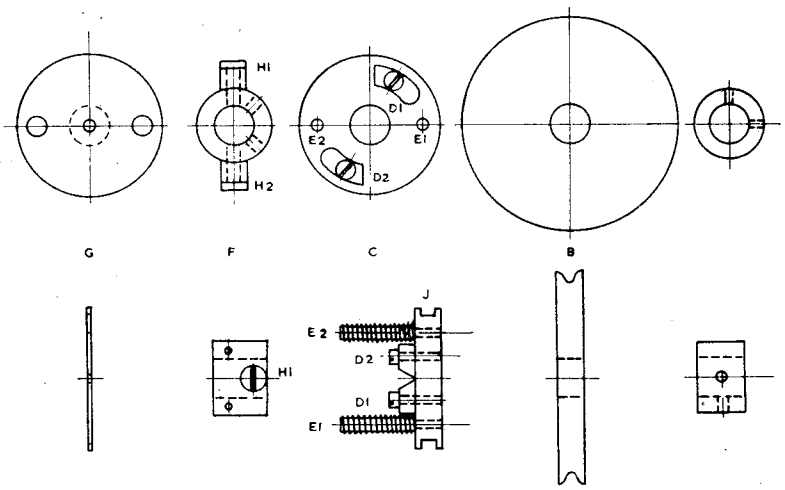
F. C. COXON.

A Simple friction clutch

HAVING made a small clutch to fit between my motor and bench drilling machine I am enclosing sketches of the parts in case they might interest readers.

A collar is fitted to the spindle by two screws, separated from the driven pulley *B* by a friction washer. *C* is what might be called a clutch or catch plate and on the side which goes against the pulley is fixed a friction washer. I used a rubber heel.

Pins *E*1 and *E*2 are riveted or screwed into *C* and are guides for light springs which push *C* against *B*. Wedge shaped parts *D*1 and *D*2 are screwed to *C* so that when *C* is pushed against pulley *B* while it is being driven, they are taken round and wedge between *H*1 and *H*2 which are rollers fitted on collar *F*. In turn this is taken round and, being fixed to the spindle by two screws, takes the spindle with it.

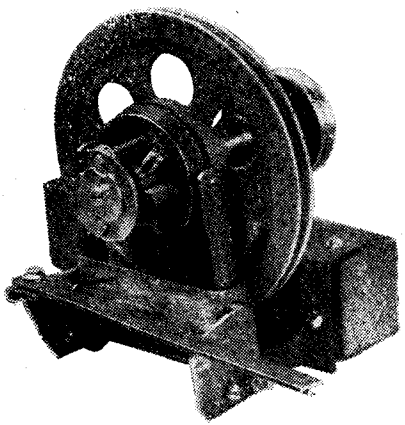


A plate *G* is screwed to the end of the spindle, and has two holes through which pins *E*1 and *E*2 slide, the holes being much larger than the guide pins so that it is necessary to have washers between the springs and plate *G*. The holes must be larger than the pins in order to allow the clutch plate *C* to become unwedged when the pulley is freed.

The pulley is freed by plate *C* being pulled from it. *J* is a groove round plate *C* in which two shoes on the ends of rocker arms ride, the rocker being the means to free pulley *B* or allow the clutch plate *C* to be pushed up to the pulley by the springs on pins *E*1 and *E*2.

This particular clutch was made for driving anti-clockwise but could be made to work either way by fitting two more wedges.

P. STANLEY.

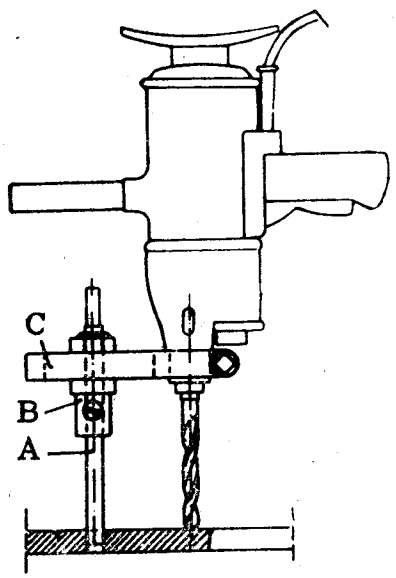


Top: Details of the simple friction clutch and, above, the assembled unit

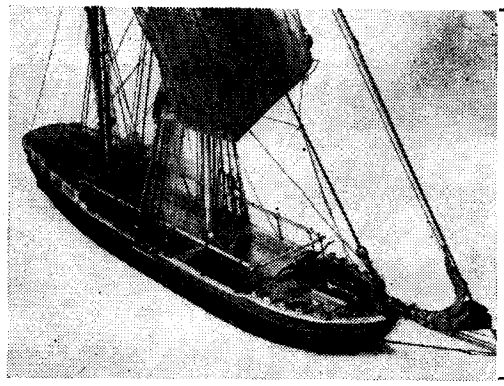
Modified drill for equidistant holes

A SERIES of equidistant holes can be hand-drilled quickly and accurately using a simple distance gauge which clamps on to the drill. This avoids the need for preliminary marking out and punching, and also avoids inaccuracies through the drill running.

The gauge is a bolt *A* held in a guide *B*, which itself is held in a clamp holder *C* clamping on to the drill. The bolt is inserted into the first hole while the next is being drilled.



Digested from "Handbohtmaschine mit Lochdistanz Anschlag" in "Technica" (Switzerland) 1 February, 1957.



Modelling Severn trows

In this introductory article A. E. FIELD features his ME Exhibition scenic model which depicts late eighteenth century trows against the background of a typical Severn-side quay

BEFORE describing my methods for making these models I propose, for the benefit of newcomers to this most absorbing branch of the hobby, to discuss the prototypes.

The word trow, apparently derived from the Anglo-Saxon word trog—meaning long hollow vessel—has always been associated with the open holded craft of the River Severn. The trow was developed through the centuries to suit the requirements and conditions peculiar to the river, in the same way as the Thames barge, Humber keel, Mersey flat, etc., were devloped on those other well known rivers.

Before the opening of the Severn Valley Railway in 1862, the majority of the Midland counties' imports and exports was shipped up and down the river in trows, between Bristol and Pool Quay in Montgomeryshire, a distance of 155 miles. The river had been known for centuries as The King's Highway of Severn, and the towns situated on the river were, in fact, inland ports.

In the eighteenth century there were two types of cargo vessels in use on the Severn—the larger ones being trows of from 50 to 105 tons, having lengths of from 60-75 ft between perpendiculars, breadths of 12-19 ft and depths varying between 3 ft 9 in. and 5 ft. The trows were mainly used between Bristol and Bewdley, in Worcestershire. In the upper navigable reaches of the river between Bewdley and Pool Quay a smaller trow (sometimes called a barge or frigate, having a length of 30-40 ft) was employed.

The small trows or barges had one mast with square sails while some of the larger trows had a single mast and others two masts. The main and mizen masts were stepped in tabernacles to enable them to be lowered for passing under bridges. This was accomplished by means of a stout forestay having at its lower end a heavy tackle attached to the stemhead, the fall from the tackle being led to the winch on the fo'c'sle.

The trows were flat bottomed with no external keel. A detachable keel was slung by chains under the larger trows when sailing in the deeper and wider sections of the lower part of the river. In the upper reaches of the river steering was assisted by long oars or sweeps.

So much for the actual craft, the building of which was carried out in yards at many places on the river.

I have not heard of any contemporary plans or lines of eighteenth or early nineteenth century trows; I believe these were built from experience without shipwright's plans, or passed down from father to son, in the various trow building yards. Detailed plans of trows at present available are, therefore, either reconstructions or lines that have been taken off the vessels long after they were built.

Work on research

From the foregoing it will be seen that anyone wishing to make a reasonably accurate model of one of these interesting craft must be prepared to devote considerable time to research. This is but one of the many interesting sidelines which the keen ship modeller has to undertake and which, he often finds, is as absorbing as the actual building of the models.

In my particular case I was very fortunate in being able to call on the considerable knowledge and data gathered by M. Grahame Farr, who is, I think, the acknowledged authority on Severn trows. Mr Farr's paper "Severn Navigation and the Trow" published in *The Mariner's Mirror*, Vol. 32, No 2, should be read by anyone requiring information on these craft.

Considerable time was spent in studying old publications in reference libraries and, more particularly, in copying old prints of views of the River Severn (see Fig. 1), many of which are in the private collection owned by Mr and Mrs J. F. Parker, of Tickenhill, Bewdley, and whose assistance is gratefully acknowledged.

From such information, and dimensions which can be obtained from the Mercantile Navy lists, it is possible to prepare reasonably accurate drawings from which to make a model.

Pictorial evidence makes it apparent that in the latter part of the eighteenth century certain variations were present in the larger trows. Some had the normal D type of stern while others had what was known as a tuck stern. And some had the topmast fidded behind the head of the mainmast.

I decided to show some of these variations, and for this reason made models of two large trows—*Britannia*

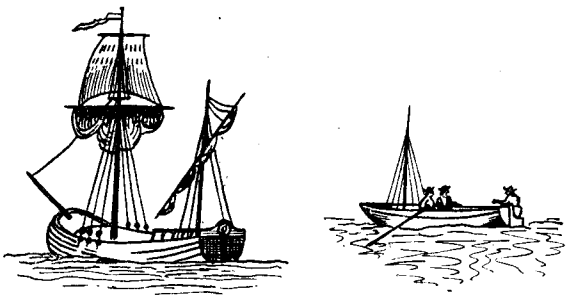


Fig. 1: The two-masted trow and wherry copied respectively from p. 45 and p. 407 of Atkyns' "State of Gloucestershire," published in 1712

and *Birmingham*. Other craft included in the scenic setting are a barge (or frigate), a passenger wherry (of which there were many on the River Severn) and a towboat, which was an important part of the equipment of a trow.

The methods used for making the models of the *Birmingham* and *Britannia* were the same, so a description of one will serve for both.

A simple sheer plan and deck plan was drawn to the scale of $\frac{1}{4}$ in. = 1 ft, the main dimensions of length, breadth and depth having been obtained for me by Grahame Farr from the appropriate Mercantile Navy lists. Careful study of the copies of contemporary illustrations that I had made decided the shape of the hull. Owing to lack of essential measurements it was not possible for me to make a body plan and it was, therefore, impracticable to build up the hull on frames as in the case of the *Alma* model. The desired result was obtained in the following manner:

Two pieces of yellow pine slightly longer and wider than the dimensions of the hull were planed up square and true all over. One block was laid on top of the other, positioned carefully and secured together fore and aft with wooden dowels.

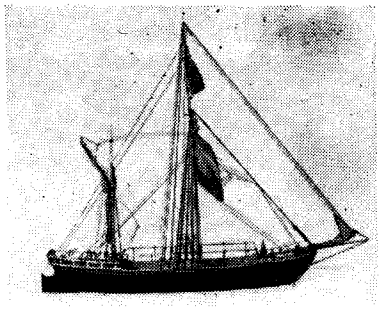
The sheer plan of the hull, *less* the stem and sternpost with deadwood, was traced on both sides of the assembled blocks, and the centre line was carefully marked along the top and bottom and down both ends of the assembled blocks. Slots were cut at both ends for insertion of the stem and stern post (Fig. 2).

A series of transverse saw cuts was made in the top block, the depth of these being controlled by the sheer line already traced on the sides of the block. The wood above the sheer line was then cut away with a chisel, a spokeshave being used for the final cleaning up.

The centre line was again drawn in and the deck plan traced on the curved top of the block. The outside was then roughly sawcut to the outline of the deck and sheer plans.

Up to this stage the work was straightforward and easy, but greater care was now called for as the final shaping of the hull had to be made without the use of station marks and templates. From prolonged study of the old prints I knew the shape I wanted and the assembled hull blocks were carefully pared away with a sharp chisel and block plane until the correct shape was obtained, care being taken to ensure symmetry.

The blocks were then separated and the top one cut out for the open hold with a keyhole saw. The thickness of the wood remaining at the sides of the hull was the equivalent scale thickness



Broadside view of the model trow BIRMINGHAM

of the frames. Square holes were also cut in the top block at the position of the hatches in the fore and aft decks.

The bottom block was now hollowed out with a chisel and gouge, finally finishing with a rotary file in the drilling machine until the open hold coincided with, and was the same thickness as, the top block. The fore and aft decks were carefully pared away to obtain a slight camber before the planking.

The stem and the sternpost, together with its deadwood, were cut with a fretsaw from "quarter cut" limewood which had been reduced to the required thickness. A rabbet to accommodate the hull planking was cut on both sides of the stempiece. The two blocks were now glued and dowelled together and the stem and sternpost with its deadwood glued into position. These two items projected a full 1/32 in. below the bottom of the hull.

The trows had internal keels and keelsons which were now prepared from suitably sized strips of wood, placed one on top of the other, and then glued and dowelled in position along the bottom of the hold.

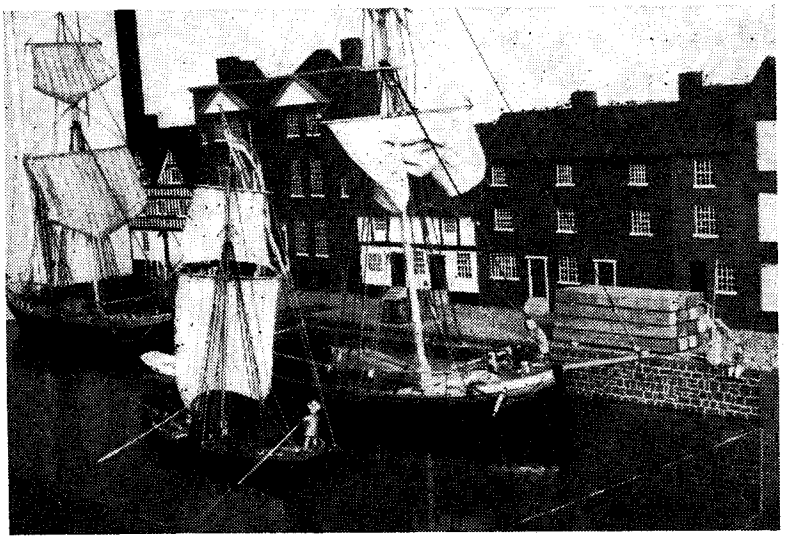
Bulwark stanchions for *Britannia* were cut from stripwood. Small slots were cut in the sides of the hulls in the appropriate positions, fore and aft, and the stanchions and frame projections glued and dowelled into them. The joints were covered by the external planking of the hull, which was then begun.

The hulls were planked inside and out with miniature planks made of limewood which, I find, is a beautiful timber to work with and is ideal for this purpose.

The thin strips from which the planks are cut can be made by sawing and planing a piece say, 2 ft long × 2 in. wide and 1/32 in. thick. If you possess a lathe, I recommend you to adopt the method evolved by Mr F. A. A. Pariser, which is very quick and successful.

Insert an endmill or face cutter of about 1 in. in the chuck. For best results the endmill or cutter must be sharp.

Mount an angle plate or, better still, the vertical slide on the cross slide. Fit a bolt in one of the T-slots



The scenic model featuring the trows BIRMINGHAM (*left*) *and* BRITANNIA *with the barge—or frigate—in the foreground. On the quayside* (*extreme right*) *can be seen a couple of fishermen*

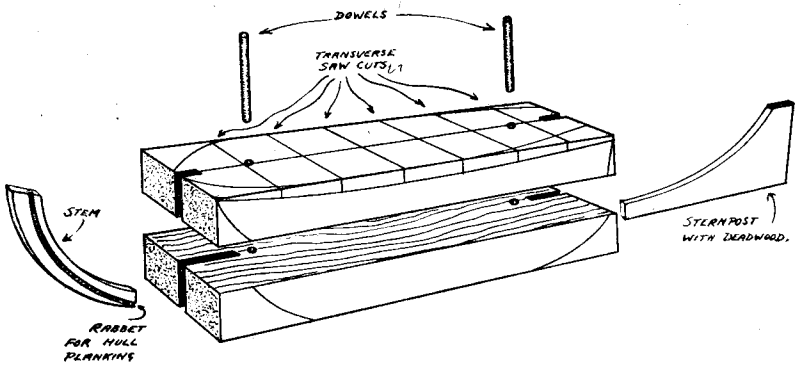


Fig. 2: Hull blocks marked out and ready for shaping and hollowing

for supporting the timber and, having sawn the lime into pieces about $\frac{1}{16}$ in. thick, feed the wood between the vertical slide and the endmill with the lathe running at top speed.

Take off about 0.015 in. at a cut and if the tool is nice and sharp, a clean finish is obtained that requires only a light rub over with glasspaper. Turn the wood over, advance the cross slide towards the chuck 0.015 in. and pass the wood through again. You will now have a strip of wood 1/32 in. thick, which, if checked with a micrometer, will be found to be very even in thickness. And now a word of warning: *keep your fingers clear of the revolving endmill.*

The resulting pieces can now be cut with a razor blade or sharp knife and straight edge into strips slightly less than $\frac{1}{4}$ in. for the hull planking and slightly under $\frac{1}{8}$ in. for the deck planking. It will be found that these strips can be bent to fit the curves of the hull without steaming, but must be glued and dowelled into position. I used liquid glue.

Hundreds of small wooden dowels were used and these were made in the following way:

Prepare a suitable wood—boxwood, degame, bamboo or any hard straight-grained timber, saw into pieces as long and wide as the wood will allow and reduce to 0.040 in. thickness. With a sharp knife and straight edge cut into strips about $\frac{1}{16}$ in. wide.

Now make a drawplate from a piece of sheet steel about $\frac{1}{16}$ in. thick, drilled with a series of holes from $\frac{1}{16}$ in. reducing to 0.040 in. Draw the strips first through the $\frac{1}{16}$ in. hole, then through a No 54 hole, next a 56 hole followed by a 58 and, finally, a 60 hole. The numbers refer to Morse drill sizes.

The finished product will be lengths of round dowel rod 0.040 in. dia. (Fig. 3).

I made a good number of lengths of dowelling at one sitting; some were shorter than others owing to breaking when pulling through the drawplate with the pliers, but they were all used.

To proceed, I next cut the planks for lining the hold One side of a length of plank was then glued and held in position against the internal keel, and a hole was drilled with a No 59 drill at one end of the plank, the drill passing into the hull. The end of a piece of dowel rod was dipped into the glue and pushed into the hole and broken off. Holes were then drilled at regular intervals along the plank, as they would be if they were attached to proper frames, and the glued dowels inserted.

Planking of the hold was continued by securing a plank first on one side, then on the other. Some of the planks had to be reduced slightly in width fore and aft. The fore and aft bulkheads were planked next with vertical planks, cut to fit accurately the bottom of the hold. These planks covered the end grain of the pine blocks from which the hull was made.

Horizontal planks were now fitted on the transom stern on either side of the sternpost and the ends were filed down flush with the hull.

The external hull planking was now begun by fitting one plank along the

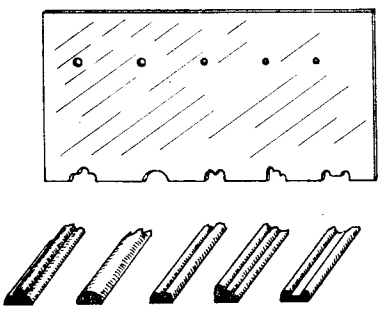
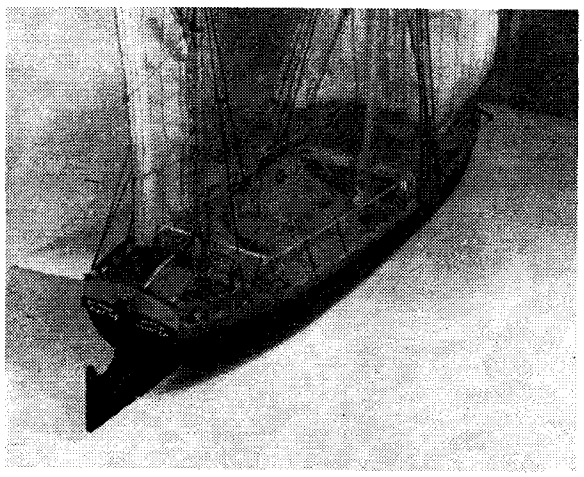


Fig. 3: Drawplate for making small diameter dowel rod, with the edge filed out for creating various types of moulding

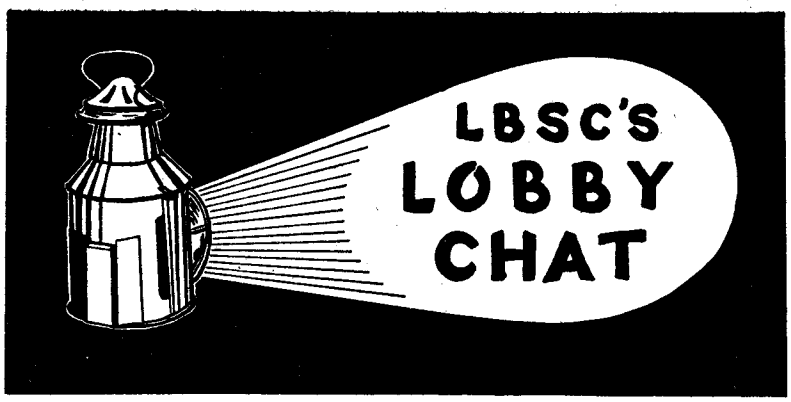


Stern view of BRITANNIA

centre line at the bottom of the hull with its ends butting against the after side of the stem piece and the fore side of the deadwood at the stern. I had left them projecting a full 1/32 in. below the hull for this purpose. The planks were tapered in width as necessary at bow and stern, and fitted in pairs, first on one side, then on the other. At the bow the planks were cut at an angle to fit the rabbet cut in the stem.

The planks were shaped like a very elongated banana, and to determine the approximate amount of taper fore and aft I measured the distance from the edge of the centre plank at the bottom of the hull to the sheerline at the top of the hull, at various positions along its length.

● *To be continued*



While getting out further drawings for the 5 in. gauge pannier tank engine LBSC fills the gap with a few interesting topics spiced with reminiscences

A LETTER received from a puzzled correspondent not long ago recalled an amusing incident which happened in the early days of these notes.

The correspondent in question bought up a job lot of castings from a friend who was going abroad, and among them were cylinders, wheels and various other parts for a 3½ in. gauge Great Western *Gooch*, from a set which was marketed by one of the trade firms in days gone by. This engine was very similar to the *City of Truro*, with double frames and outside cranks, and the correspondent wanted to build a 3½ in. gauge copy of that old veteran, utilising the castings.

The designer of the 3½ in. gauge *Gooch* specified Joy valve gear, and castings for the slide shaft and the various rods and links were included in the set. What puzzled the correspondent was that the casting for the two inside cylinders had two bosses on each end, and he wondered what they were for. It was that which raised a smile.

The foundryman who did the moulding apparently didn't know the first thing about locomotive cylinders —the castings should, of course, have had coreholes in them. Instead of this, they were cast solid, coreprints and all ! As well as being amused, I was rather surprised that the firm hadn't spotted the mistake and had it rectified before offering the sets for sale.

In the early nineteen-twenties when I was able to do a bit of locomotive work for friends, a certain party worried me to build for him a locomotive of a special type. I can't recollect the exact details after this lapse of time, but special castings were needed, and I happened to mention the matter to my friend Driver Bill Irvin. Bill immediately said: " I know a chap in Clerkenwell who would do them for you at a silly price, and as clean as if they were die-cast. He does a lot of work for the clockmakers. If you're going up town next Monday, I'll meet you and we'll call on him."

I already knew Harry Sturla and the Starling brothers, both of whom would have made any castings I needed (Starlings did the castings for *Ayesha's* cylinders), but I saw no harm in taking a look at the handiwork of Bill's friend, so I met him as suggested.

The foundryman was a real artist, and the clock and other small castings he showed me were absolutely the cat's whiskers. Bill explained what I wanted, and the foundryman said that he would be only too glad to oblige a friend, and if I could make clean patterns he would do the castings in clock bronze at the trade rate.

I promptly got busy and made metal patterns for all the castings needed for the job, and when Bill called about a fortnight after he took them away and duly delivered them to the foundryman. A few days after, he telephoned that he had got the castings and would bring them down on his next visit, which he did—and then we both had a good laugh !

When making the patterns I clean forgot that the foundryman knew just about all there was to know about clocks and small intricate casting work, but nothing at all about little railway engines, and so wouldn't know which were coreprints and which were chucking-pieces on my metal patterns. I just polished them up and did not paint or otherwise distinguish them, so the foundryman just cast the lot as I sent them, and didn't know anything was wrong until I called and paid him for his excellent job.

Then he, too, saw the funny side, and explained that if I painted the coreprints red on any future patterns, there would be no more errors in the castings. Neither were there, as he did some more special jobs for me, all OK. Unfortunately he was taken ill with an internal complaint and died after an operation very soon after.

The correspondent's cylinder block with two bosses at each end reminded me of the similar casting in the lot mentioned, which also included a chimney casting with a spigot at each end instead of a hole through it, and various other unfamiliar items. I just sawed off all the unwanted bits and drilled holes as required, so there was very little loss of time. Anyway, if any reader gets hold of a small casting with a " chucking-piece " at both ends, he will know that an unenlightened foundryman has probably slipped up !

Referring to the suitability of the *Gooch* set of castings for a *City of Truro*, they are quite all right. There is no need to use the Joy valve gear parts if the builder objects to a Joy gear on a Great Western engine of this type, and the correct link motion can be substituted. At the same time, the Joy gear is easier to fit up, and gives an excellent steam distribution, though personally I should fit steel rods and links instead of using the cast ones supplied.

The connecting-rods in the set were also cast, and in this case also steel rods would be far more satisfactory. The link motion that I shall be specifying for *Pansy* could be used, if the rocking levers are fitted above the expansion links instead of below them. As the cylinders are horizontal, the steam chest can go on top without interfering with the smokebox.

Lubricators on Rainhill

On page 299 of March 6 issue there is a query from a reader about lubricating the cylinders of my old-timer *Rainhill*. In my original description of the building of this engine I specified an oil cup with a screwed cover to be attached to the top of each steam chest, and showed it on

the drawings. If this is done, and the cups replenished at frequent intervals, there will be no trouble arising from lack of lubrication.

Heavy black cylinder oil should be used, of superheater grade. At the moment I am using Edgar Vaughan's Cyltal 80S, having bought my last supply when restrictions on the sale of oil were in force, and the suppliers were not allowed to sell a smaller quantity than five gallons. I bought a 5 gal. drum, and the contents will probably now last as long as I shall ! All the big oil companies market heavy-grade superheater oil, and an obliging garageman can get a one-gallon can for anybody who needs it.

Before the introduction of hydrostatic and mechanical lubricators, all locomotives had oilcups on steam chests, or cylinders, or both. It was part of the fireman's job to keep these supplied, and the favourite "dope" was melted tallow.

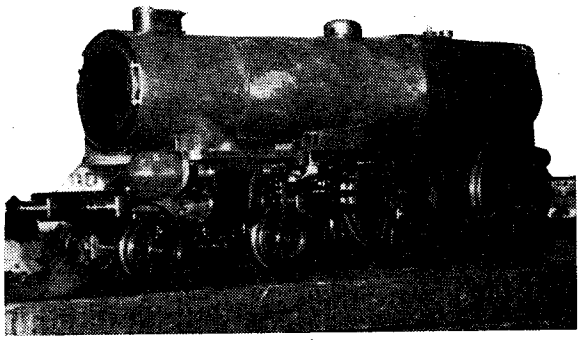
Although the Stroudley engines on the LBSCR had displacement lubricators, mostly on the side of the smokebox but sometimes in the cab, they all had two brass cups on the front of the smokebox just below the door. These had screwdown valves operated by cross handles, and before starting a trip were filled with a mixture of melted tallow and cylinder oil. When coasting down a long grade, or when the driver shut off steam after a fairly long run, the fireman went around to the front end and opened the valves, so that the cylinders got a good dose of the "cough-mixture."

This dodge kept the valves, port-faces and pistons in good condition, and it was seldom that we had a case of blowing-by. When Bob Billinton took over, he specified Furness lubricators fitted to the sides of the smokebox near the bottom, one for each cylinder. These were glorified oil cups with a ball valve at the bottom, which opened automatically when steam was shut off, and oil was sucked down by the pumping action of the cylinders when the engine was coasting. For running with steam on, ordinary displacement lubricators were used.

Useful tip—don't try the "Brighton" mixture of tallow and cylinder oil on any engine with bronze, gunmetal or brass cylinders. It is all right for cast-iron cylinders, but the acid in the tallow will corrode non-ferrous metal, and the cylinders and valves will become pitted when the engine stands idle for any length of time; also the green deposit which usually forms is poisonous if it gets into a cut or abrasion on the skin. Safety first !

The Holcroft "Super-Schools"

It isn't often that a full-size locomotive engineer, and a widely-experienced top-ranker at that, gets down to the job of designing a 3½ in. gauge engine with novel and special features, but that is exactly what Mr H. Holcroft has done. Roy Donaldson is building her, and progress to date is shown in the accompanying photographic reproduction.



Roy Donaldson's "Super-Schools" partly constructed

As I mentioned in the notes about the Schools class engine built by Mr R. P. Holdstock, there is a limited load gauge on the Tonbridge-Hastings section of the SR and the full-size engines had to be specially designed to clear it. The engine illustrated will be a small reproduction of what the big engines could have been, if the full clearances had been available.

The boiler is bigger, with a Belpaire firebox of the GWR type, plus a double chimney and blastpipes like those now being fitted to the Kings and Castles. It has some interesting internal arrangements which have yet to be tested and proved, so I won't dilate on them until the engine takes the road. The valve gear is something entirely new, and has never before been fitted to any engine large or small.

The gear for the outside cylinders is based on the Baker gear, but the reverse yoke is replaced by an arrangement incorporating a curved guide and die-block. The conjugation for operating the inside valve is just about Mr Holcroft's winning shot. Most of the conjugated gears, especially the 2-to-1 type as used on the Gresley Pacifics, give slightly inaccurate distribution with syncopated exhaust beats. Various means of correction have been tried but with little success.

If all goes well, I shall be able to offer drawings of the complete valve gear later on. Suffice it to say for the time being, that I have seen the chassis working under air pressure, and the valve events are as near perfect as could be wished for. The beats are absolutely even, no syncopating, and remain so when the gear is notched up to very early cut-off.

As soon as the boiler is ready for steam, the engine is coming for a trial run on my line, and I am pretty certain that she won't disappoint her eminent designer. The photograph was taken by George Barlow of the Romney Hythe and Dymchurch Railway.

The Eaton Hall Railway

May I thank those correspondents who commented on my notes on the EHR in March 6. Methanides is quite correct; my sketch of *Katie's* boiler was merely intended to be diagrammatic, not a drawing, and the actual internal arrangement was as he shows it. Incidentally I built an experimental locomotive-type boiler with a similar firebridge in the early days of these notes. Somebody had built a locomotive with a marine-type boiler, the kind with a single flue and cross watertubes, fired by a blowlamp in the tender. It wasn't a success, and the builder asked if I could fit a coal-fired locomotive-type boiler to it. This sort of thing always amused me, and I took it on.

The builder had planted the feed pump right in the place which would normally be occupied by the firebox of a locomotive-type boiler, and so the whole of the new boiler had to be above the top of the frames. I managed this by making up a boiler with a wide firebox, the foundation ring of which was in line with the bottom of the boiler-barrel. The grate was about ½ in. shorter than the length of the firebox, and level with the bottom row of tubes, and the firebridge was fitted on the end of the grate, extending about halfway up the firebox.

The ashpan was arranged so that it could be pulled out from the back like a drawer, and it was furnished with a baffle which, when the ashpan was in place, prevented cold air being drawn up between the firebridge and the tubes; all the air had to pass

through the fire. The arrangement worked all right, and the boiler steamed well; the only drawback was that the grate couldn't be dumped, and the residue in the firebox after a run had to be tipped out through the firehole.

I am glad to have Mr Steel's comment that my drawing was a fair representation of *Katie*, as it is about 60 years since I saw her, and as I mentioned in the article, have never seen a drawing of her. As to the valve gear, this again was only intended to be diagrammatic, to show the layout.

The Maskelyne 4-8-2

The interesting article on a 5 in. gauge 4-8-2 by Mr J. N. Maskelyne in February 27 issue rang a bell, and maybe the following additional information will help to complete the tale. I don't mention personalities without permission, and Sir Aubrey Brocklebank was averse to publicity, but as Mr Maskelyne has mentioned his name, there is no harm in my now saying that he was one of my few personal friends of days gone by.

He got in touch with me (soon after *Ayesha* made her little bit of history) through the late Mr Percival Marshall, and made his first call at my old Norbury home in company with the late Mr J. C. Crebbin, whom he jocularly referred to as his "guide, philosopher and friend." It was also he who first brought the GWR CME, Mr C. B. Collett, to see my workshop and locomotives.

Sir Aubrey was one of those genial folk who always made one "feel at home" in a manner of speaking. He told me about the fleet of useless 2½ in. gauge locomotives with which he had been supplied by the "junk merchants," and asked if I would care to tackle the job of rebuilding his favourite, a 4-6-0 named *Valour*.

I did it, and nobody was more surprised than he when it pulled him easily on my line. Previously it could barely pull its own tender. It was a watertube boiler job fired by a spirit lamp. He then told me, that he had already sent the lot to Frank Baldwin for attention, but after what I had done to *Valour*, he would like me to do the rest !

I was nonplussed at this, to say the least. Frank Baldwin was doing the job for a living, and I certainly would be the last person to take his bread and butter. However, Sir Aubrey assured me that there would be no question of that. He wanted a 5 in. gauge engine, and if he gave Baldwin the order for that, he would have no time to tackle the 2½ in. jobs, so I could tackle them with a clear conscience. He said he would fix the matter, and did so, for during the next week I received a note from Frank saying that Sir Aubrey wanted him to build a 5 in. job in a hurry, so could I relieve him of the little ones !

Meantime, Sir Aubrey had sent me a working drawing of an American 4-8-2 which he himself had re-dimensioned for 5 in. gauge and asked if I would design a British-type locomotive of the same kind with similar dimensions. I just hated drawing (still do !) and I had quite enough in hand as it was, so I explained matters and suggested that he should ask Mr Maskelyne to get out the design. Knowing Mr Maskelyne's skill with the working tools of the draughtsman, he agreed. What passed between them I don't know, but the next I heard was that Baldwin had started on the 4-8-2.

Frank made a wonderful job of it considering that his workshop was a little back room in Highclere Street, Sydenham, and his sole machine tool an ancient foot-driven Barnes lathe. He didn't even have a decent chuck for it until I gave him a 4 in. three-jaw of Canadian make which I had bought "surplus" and never used.

He had no facilities for building the big boiler, and I understood that this was made by Tom Goodhand, the well-known boilermaker of Gillingham. The engine certainly had a hand pump, because I recollect seeing the extension adorned with a file handle.

Anyway when the chassis was finished, Sir Aubrey asked me to go over and check the valve setting. Again I demurred, as it was no business of mine to butt in on the job, and again Sir Aubrey exercised his diplomacy, as Frank sent me a note asking if I would call and go over it with him. I did, and was accompanied by Mr Crebbin, for whom Baldwin had done plenty of locomotive work. We got fairly good valve events, though not as I would have liked, as the valve gear was different to my own practice.

Sir Aubrey was well satisfied with the job. He sold all the 2½ in. locomotives and rolling stock to a director of the Henderson steamship line, and concentrated on 5 in. gauge. I often wondered what happened to the 4-8-2 after his untimely death from meningitis, and I was pleased to see it reappear in the pages of this journal. Mr Maskelyne was right about the boiler; with a proper superheater it certainly would have steamed four big cylinders, and the engine would have astonished the natives !

Incidentally, I might mention that I was asked to design the engine for the railway at the Dudley Zoo by Mr R. Saunders of Stourbridge, but passed on the job to Mr Maskelyne, as I have always preferred putting locomotives on the track to putting them on paper.

That reminds me—the writer of the letter about the undertype engine in the Science Museum (page 374, March 20 issue) omitted to state that the engine was *not* built by Mr Greenly, who put engines on paper but not on the track ! ▣

Electric drill's safety device

EFFICIENT earthing is essential with the use of an electric hand drill operating on mains voltage, but however careful one is there is always the possibility of an earthing failure while the drill is in use.

Even so there might be no immediate danger, but should one have been drilling metal and laid a fine covering of metallic dust over the drill, especially over the internal electrical connections, then danger would lurk, especially if the drill were being operated in proximity to an earth situation.

Though it is unlikely that these three conditions could arise simultaneously without some warning indication, it is not entirely improbable and, realising this, Bridges have introduced a new safety factor in their new power drill.

At the head of the drill, just behind the chuck, is a small neon light. All the while the earthing connections are in good order this light remains on, but as soon as a fault occurs the light goes out.

I have had one of these on test and I can vouch for the efficiency of this little light. With a connector in the earth lead I tried it out. As soon as earth contact was broken the light went out, though the drill span merrily on.

With this warning light—it is only a tiny glow, by the way, and does not interfere with observation of the work—an earthing fault is detected immediately and the necessary repairs can be undertaken.

I found this drill, which sells at £7 19s. 6d., a powerful and willing tool with many applications in the workshop and home. Bridges supply a host of accessories for use with their power drill which will convert it into a grinder, polisher, saw, sander and a host of other machines.

I have one minor complaint, which concerns the trigger switch. With no guard beneath it I found a tendency for the drill to slip down, especially when my hand was perspiring, and this made delicate control of the switch difficult.—L.H. ▣

This free advice service is open to all readers. Queries must be of a practical nature on subjects within the scope of this journal. The replies published are extracts from fuller replies sent through the post: queries must not be sent with any other communications: valuations of models, or advice on selling cannot be given: stamped addressed envelope with each query. Mark envelope clearly "Query," Model Engineer, 19-20 Noel Street, London W1.

READERS' QUERIES

DO NOT FORGET THE QUERY COUPON ON THE LAST PAGE OF THIS ISSUE

Coil for electric clock

Among the Percival Marshall books which I had given to me last Christmas was *How to make an Electric Clock* and I am now making this clock. The instructions are most explicit and helpful—in fact they could not be put into more simple and practical language—but I am anxious, if possible, to depart from them in one respect, i.e. the size of enamelled wire to use for the coils. I want to make the *battery* driven clock for which 750 turns of No 28 wire are stipulated but I wish to use No 36 wire (specified for the mains operated clock with a 40 watt lamp in series) and should like to know how many turns of this thinner wire I shall need to achieve the correct results.—E.C., Cranbrook, Kent.

▲ *The windings for mains and battery supply respectively have been arrived at by careful experiment and there are some difficulties in adapting other sizes of wire. Calculations are rather complicated and it is not by any means certain that identical results can be obtained when using wire of different sizes than those specified. There is, however, some flexibility in the power of the electro-magnet, as the clock may be operated equally well by a relatively small magnetic impulse operating at frequent intervals or a larger impulse at longer intervals. The contact governing mechanism controls this automatically. The power of an electro-magnet depends upon ampere turns, that is to say, the current in amperes and the number of turns of wire on the magnet coil. Current is governed by two factors, first of all the voltage of the supply, whether mains or battery and the resistance of the wire.* 28 *gauge wire is* 0.0148 *in. in diameter giving a resistance of* 139.5 *ohms per* 1,000 *yards.* 36 *gauge wire is* 0.0076 *in. in diameter giving a resistance of* 529 *ohms per* 1,000 *yards. If the same number of turns of the smaller wire as specified for the original coil are employed, it is obvious that the current will be reduced and thus the magnets will be proportionately less powerful, but if the number of turns are increased to compensate, this resistance will also be increased in the same proportion, so that with a given input voltage it will not be possible to obtain the same power. It would be possible to connect the two magnet coils in parallel instead of in series, which might help matters in this respect, but the problem will have to be regarded as an experimental one.*

"Princess Marina"

I am constructing *Princess Marina* in 3½ in. gauge and would like inside admission piston valves instead of slide valves to the cylinders. What alterations, if any, will have to be made to the valve gear ?—J.S., Ripley, Derbyshire.

▲ *Reverse the connection at the top of the combination lever so that the centre-line of the radius rod is above the centre-line of the valve rod instead of below it. Shift the return crankpin* 180 *deg. so that it lies* 90 *deg. behind the main crankpin instead of* 90 *deg. ahead of it. This will give a fair steam distribution, but to obtain a really accurate distribution it will also be necessary to raise the point of swing of the expansion link until the radius rod lies parallel with the horizontal centre-line of the motion when in mid-gear. Such attention will entail re-designing the expansion link to obtain the correct "backset" for the point of attachment of the eccentric rod, which will also be of different length. These alterations should be set out on the drawing board. In either case it is essential to make sure that there is still clearance at all positions of rotation for the parts of the valve gear that have been altered. Further information can be obtained from the handbook* Walschaerts Valve Gear *obtainable from booksellers price* 3*s.* 6*d.*

Heating and forging small tools

In my small home workshop I am handicapped for forging and tempering small tools. That is anything from ¼ in. to ½ in. In my workshop there is a fireplace, in the house my slow burning stove. I am at a loss where to begin, and how. What do you advise ? 1 To deal with silver steel. 2 To deal with high speed steels; and there is no mains gas, but it is an area where one can get Calor gas. Going round to the local smith is a slow business and I am wanting something inexpensive.—F.L., Northallerton.

▲ *It is quite practicable to use ordinary fire or a slow combustion stove to heat tools, provided that the fire is kept clean and bright, but control is not by any means so easy as where a gas torch or a blowlamp is employed, and there may be more risk of scaling or local overheating.*

1 *Silver steel may be hardened by heating to a medium red (usually defined as cherry red) and quenching immediately in water. This produces rather more hardness than is desirable for most purposes and to temper the steel it should then be cleaned up bright and re-heated some way back from the edge until the colours begin to change. When the required colour is obtained at the tip, they are immediately re-quenched. For most cutting tools, a medium straw colour is satisfactory but for tools which have to stand impact, such as chisels or punches, a deeper straw or dark blue would be preferable.*

2 *High speed steel varies a good deal in composition and the precise treatment for a particular sample can only be obtained from the makers. Usually it is necessary to heat the steel to a bright yellow and in some cases the steel must be quenched out in oil—in other cases cooled in an air blast. The great majority of high speed steels now employed in lathe tools and for similar purposes, are not intended to be heat treated, as they are supplied in a tempered condition and need only to be ground.*

Press-fitting loco wheels

In a previous answer concerning locomotive wheels, you stated usual practice is to use a press fit. Is this a straight press fit, or slightly tapered ? What is the difference in thousandths between a locomotive axle and the hole through the locomotive wheel for 3½ in. gauge., 5 in. gauge and 7¼ in. gauge. Or to word it differently what is the press fit allowance for each of the above gauges ?—W.F.W., Miami Beach, Florida.

▲ *When press-fitting locomotive wheels on to their axles, the axle wheel seat should be parallel, but may be very slightly tapered for a length of not more than* 1/5*th just to enable the wheel to "start." A suitable press-fit allowance would be:*

0.001 *in. for* 3½ *in. gauge.*
0.0015 *in. for* 5 *in. gauge.*
0.00175 *in. for* 7¼ *in. gauge.*

Driving wheels should also be keyed in these gauges.

'BLAST THOSE PLUGS!'

And blast, says J. NIXON, is the operative word if you want continued plug efficiency. Equally important, the blasting is something you can do. All you need—apart from average skill—is a small screwcutting lathe

You are driving your car, one in a long line of traffic, carefully observing all the rules as laid down in the Traffic Code—you slow down to circle the point duty policeman to take a right-hand turn—and your engine stalls! There you are, stuck in the middle of the road with a red face; the line of traffic behind you audibly disapproves, the bobby slumps into an attitude of martyrdom, and the passing urchin rudely advises you to buy a bike.

Not all "stalls" are due to dirty plugs, of course, but quite a number of troubles can be traced to this simple cause. This magazine is hardly the vehicle in which to lay down a learned dissertation on the causes and effects of faulty plugs; they constitute only one of the many crosses one inherits with the down payment on a car, new or secondhand.

It is sufficient to say here that oiled or carboned plugs can cause weak sparks, incomplete combustion, bad starting, loss of power, poor performance, and petrol wastage—which, perhaps, is enough to be going on with!

Broadly speaking, from the point of view of plug hygiene, there are two kinds of plug—those which can be cleaned by dismantling, and those which cannot. Quite often a dirty plug will give reasonable service after the points have been scraped. But eventually there comes a time, particularly with the latter class, when something more than superficial scratching becomes necessary. Literally, they need to be blasted.

The appliance about to be described will do this very thing as efficiently and thoroughly as the more elaborate and comprehensive machine installed in garages; the cost of the raw material is almost negligible and it can be made in a few hours by anyone possessing average skill and a small screwcutting lathe.

My pictures and drawings will suffice—I hope—for the more experienced of interested readers, but a word or two on the construction of the appliance may be of assistance to the rising amateur. It should become clear by a glance at the drawings that almost any dimension is capable of reasonable variation, with, of course, compensatory adjustment to adjacent or dependent parts.

The body is a length of w.i. or m.s. tube 1½ in. o.d. screwed at both ends. Thickness is not important, so long as the tube will take a thread, as it is not subjected to any undue pressure or stress.

The threading of the ends may constitute a minor difficulty owing to overhang, but this may be overcome by driving wooden plugs into the ends and using the tailstock to support the free end during the operation; alternatively, a fixed steady will take care of the operation.

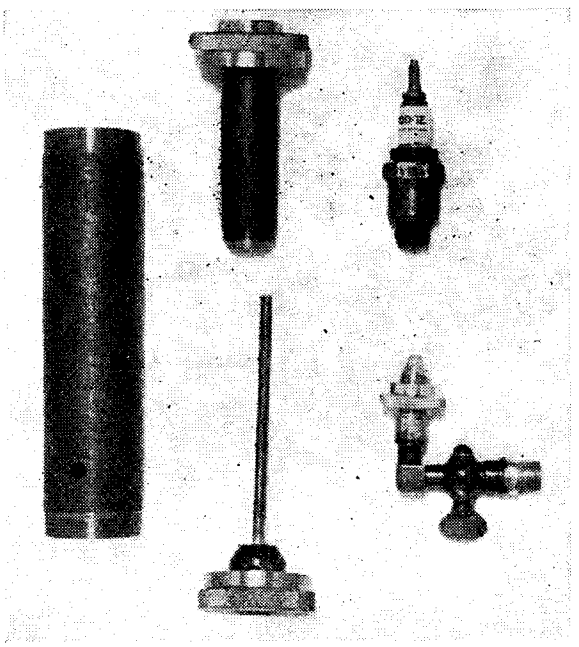
As a last resort your local plumber will get you out of the difficulty. But don't forget he will probably use 19 t.p.i. dies, which may leave you with a worse headache if your lathe does not handle this pitch.

The caps are almost identical except for the centre holes. The blanks are mounted in turn in the s.c. chuck, where they are bored and threaded to suit the screwed tube.

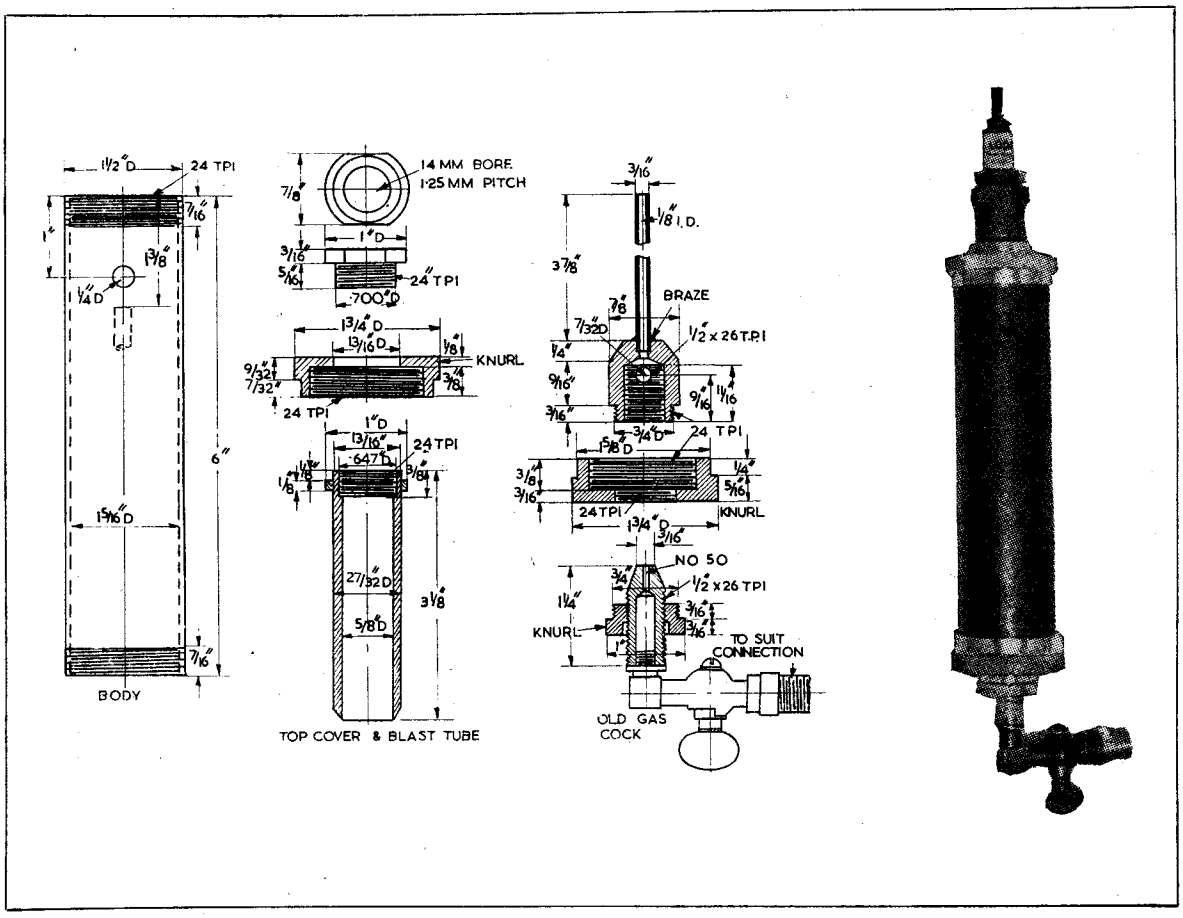
To finish off the outside surfaces the caps may now be mounted on a screwed mandrel made from a waste piece of the original tube, plain turning, knurling and boring the centre hole being a logical sequence.

In the top cap the brass insert acts as a nut to secure the blast tube and also as a bush to hold the plug undergoing treatment. The common or garden sparking plug end has a nominal o.d. of 14 mm. and is threaded to a pitch of 1.25 mm.

Not every lathe is rigged to cut a thread like this, but in this instance the thread in the bush does not need to be a precision job and the plug



The components of the author's plug blaster



can be quite a loose fit without drawback. Therefore, if you are unable to cut the correct thread you will find that one of 20 t.p.i. will be near enough for the purpose.

Strictly speaking, the threading tool should be ground to an included angle of 60 deg., but again this is not vitally important.

The previous rig, i.e. the cap screwed on to the tube mandrel, can be used for the threading operation on the hole in the brass plug after the latter has reached this final stage.

The processes for producing the lower cap and fittings are very similar to the one stated and, therefore, need no detailed description. The veteran gas cock is set at right angles to the centre line of the apparatus with deliberate intent.

Set in a straight through line, the blasting grit naturally falls into the cock as soon as the air supply is shut off, resulting in rapid deterioration of the internal parts. The right-angle set-up avoids this trouble to a large extent.

The blasting medium is the fine-grade abrasive grit used in commercial cleaning and testing outfits, and it can be bought for a few pence in sufficient quantity to last for a very long period; a depth of about 1 in. in the container is all that is necessary.

The setting of the jet in relation to the nozzle should be determined by trial, but there does not appear to be a sharply defined optimum position.

Compressed air is required, of course, and a pressure of about 25 p.s.i. is ample; an application of approximately a minute will clean anything but the foulest of plugs, leaving the points and the centre insulator with the spotless matt sheen of new plugs. *Do not* be discouraged if you don't possess an air compressor, for, believe it or not, a good motor tyre pump will produce equally good results, although it may take a little longer.

It is hardly necessary to warn you not to mount the thing near your lathe or any other machinery for which you harbour any sort of regard. The air escaping from the vent hole near the top of the container carries with it a certain quantity of the finer particles of grit although the actual amount is surprisingly small.

A rubber or cork washer slipped over the end of the sparking plug before the operation will prevent grit from escaping round the thread. If the plugs are oiled up they should be given a preliminary wash in petrol and then dried off before blasting. For this operation a metal polish, or similar tin can is half filled with petrol; the plug is inserted in the neck of the can which is then shaken vigorously for a few seconds.

After the blasting process, the plug should again be washed out as motor engine cylinders are particularly allergic to abrasive grit ! After checking and re-setting the spark gap, the plug is ready for service once more.

It should be noted that in the picture on page 524 the body is upside down, the vent hole being at the top in the working position. ▣

Fine feed drive for a small lathe

The third article of this series by EXACTUS deals with the details of the apron, split nut for the leadscrew and rack and pinion traverse

THE apron shown in the drawing differs slightly in appearance to the one illustrated in my article of April 3. That was taken at the successful conclusion of the experimental stage and the drawing is the result of all the trials and errors that were incurred.

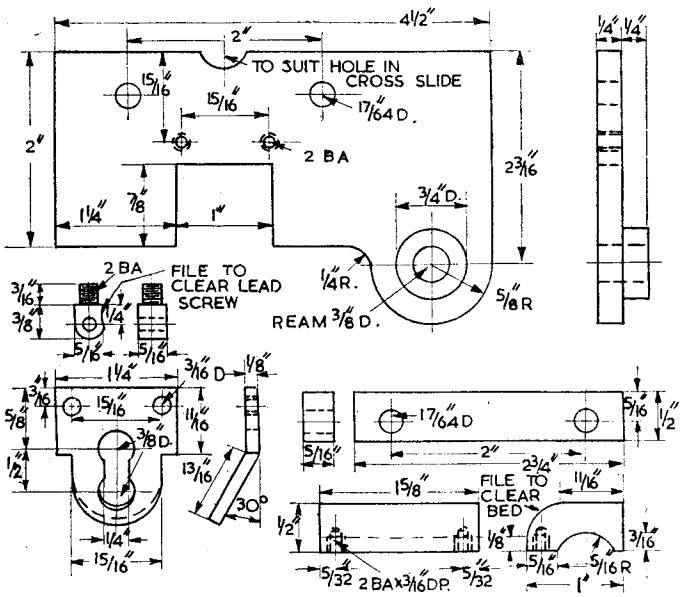
As I have already mentioned, I carried out these improvements on the EW lathe, but there is no reason why they should not be adapted to other lathes in the smaller range. What I have aimed at is to keep all the machining operations within the scope of the machine for which the parts are intended.

It will be noticed in the drawing that I have not fitted a phosphor-bronze bush for the pinion shaft; I found in practice it was not necessary, but if you prefer one you can fit one without any bother. Where I have shown a $\frac{3}{4}$ in. × $\frac{1}{4}$ in. boss silver soldered on the apron plate I suggest that the hole be marked out in the normal way and drilled $\frac{1}{2}$ in. dia.

Turn a bush from a piece of phosphor-bronze to fit the hole and make the head of the bush the same size as the mild steel boss that I have specified. To make the apron you will need a piece of bright mild steel 3 in. × $3\frac{1}{2}$ in. × $\frac{1}{4}$ in. or if the lathe is smaller than the EW you will, of course, only need a smaller piece of material.

So that your scribed lines really stand out (it will make the job a lot easier when it comes to the sawing and filing), coat one side of the mild steel with a marking out solution, such as Talbots blue or Spectra colour. Mark out the shape and the position of all the holes including the one for the pinion shaft.

Drill the two holes at the top of the plate 17/64 in. to clear a $\frac{1}{4}$ in. screw.



This is for securing it to the saddle so check with any existing screws on your lathe to see if they are the same size. Any difference will mean using another drill to suit your screws. The two holes just below are drilled No 26 and tapped 2 BA. These are for holding the plate to which the lever for engaging or disengaging the leadscrew is positioned.

When you drill the position of the pinion shaft use a small drill about $\frac{1}{8}$ in. or $\frac{3}{16}$ in. but not an odd size for which you cannot find a piece of rod the same diameter. When you have run the small drill through leave it for a moment; don't follow up and open it out to $\frac{3}{8}$ in. yet.

The plate is increased in thickness to $\frac{1}{2}$ in. to give more support to the shaft. This is done by silver soldering on a boss $\frac{1}{4}$ in. thick × $\frac{3}{4}$ in. dia. Any odd piece of $\frac{3}{4}$ in. dia. mild steel will do for this.

Grip it in the three-jaw, face off the end and drill a hole up the centre the same size as the one drilled in the plate. Take the drill $\frac{3}{8}$ in. deep, which is plenty, then part off. Clean up the face that has been parted off and chamfer the corner a $\frac{1}{16}$ in. at 45 deg. to allow the silver solder to nestle in and make a good fillet.

To keep the boss in its correct position while running the silver solder, place a short piece of silver or mild steel, the same diameter as the drill, in the hole in the plate and locate the boss over it. When the boss is silver soldered and the plate cleaned up, open up the hole to $\frac{3}{8}$ in., first with a letter U or 23/64 in. drill then a $\frac{3}{8}$ in. reamer. By following the small pilot hole the $\frac{3}{8}$ in. hole should be nicely concentric with the boss.

Two final points about the plate when shaping it up. The cut-out at the bottom ($\frac{7}{8}$ in. × 1 in.) of the plate is for the leadscrew nut and it must be a good fit. Only use the 1 in. dimension as a guide; file the actual slot to fit the nut. Removing too much

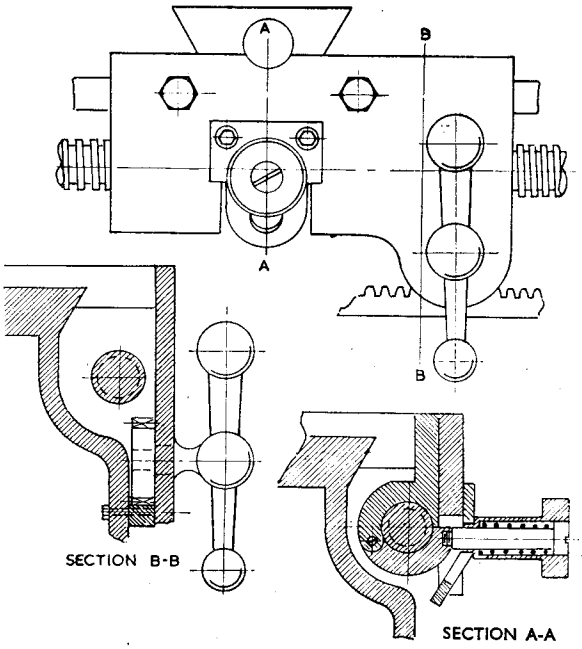
and making the nut slack would give a similar effect to a nut taking up backlash when the drive commences.

But what is more important in this particular case is that the drive should not be taken to the saddle by this plate, for due to excessive slackness it would find its way through the lever and stop plate that engages the screw. This is not a strong part and is not meant to perform in this way and it would soon lead to a breakdown. So take care that the nut fits snugly in the apron.

The other point is only a small one. I have not dimensioned the small cut-out at the top of the plate for clearing the screw of the cross slide. This is because it is one of those jobs that is easier done on assembly.

Before the apron can be attached to the saddle a spacer is required and this is incorporated in a fabricated fitting. This fitting forms the top half of the leadscrew nut, but is minus the threads. That may sound a bit peculiar but it was done so that it would be easier to build.

There is plenty of thread in one half of the nut for driving purposes, so the top half is in the form of a pad for the leadscrew to rest against, and it has proved entirely satisfactory in practice. I fabricated the fitting entirely from phosphor-bronze but if you are a bit short of this material brass or mild steel can be used for the spacer and the lugs of the hinge.



The plan and elevation of the assembled drive

Making the pad

For the centre piece, the pad which the leadscrew runs against, use phosphor-bronze. The whole job can be silver soldered quite satisfactorily although in the drawing I have shown the lugs with threads on for those who prefer this method.

There is very little to do to the first piece for this fitting, the spacer. A piece of brass, phosphor-bronze or mild steel $\frac{1}{2}$ in. × $\frac{5}{16}$ in. × $2\frac{3}{4}$ in. with two 17/64 in. holes drilled in to correspond with the holes in the plate is all that is required.

There's a little more to the next part though, the pad for the leadscrew. As I have already stated the threads are omitted and a $\frac{5}{16}$ in. radius is machined into the pad in its place. If you have a piece of phosphor-bronze 1 in. square and $1\frac{5}{8}$ in. in length handy, this will fit the bill admirably. Other than that you will need a piece 1 in. × $\frac{1}{2}$ in. and a piece of some other material, mild steel or brass, the same in size.

When the two 1 in. faces are held together you will have a piece 1 in. square. To make things easier for marking out and boring, tin these two faces with soft solder and sweat them together. Square up one end either with a file or in the four-jaw chuck ready for marking out the position of the $\frac{5}{8}$ in. hole.

When starting to mark out the position of this hole as dimensioned in the drawing, those who fabricate their block from two pieces of material should take care that the largest part of the hole is in the piece of material that is not required.

Set the job up in the four-jaw chuck and adjust the jaws until the centre of the hole to be bored is running true. Start off in the usual way with a centre drill and then a small drill for a pilot hole. Open up with your largest drill and remove the remainder with a boring tool.

When the hole is finished remove the work from the lathe and those with the fabricated block should unsweat the two pieces. The others with a solid piece will have to part it with a hacksaw and clean up the face with a file.

Looking at the block as it will be positioned on the lathe, the top back corner will have to have a radius filed on it to clear the lathe bed. This is best done next, as the block can be placed on the leadscrew, resting on what is left of the $\frac{5}{8}$ in. hole, and filed until the front face is at right angles to the top of the lathe bed.

When that is satisfactory, mark off the positions of the two lugs for the bottom half of the leadscrew nut to swing in. If you intend to screw in the lugs drill the holes No 26 and tap 2 BA. For silver soldering drill $\frac{9}{16}$ in. The lugs are made from a piece of $\frac{5}{16}$ in. square material, either brass, phosphor-bronze or mild steel. In the absence of any square material $\frac{3}{8}$ in. round will do and the flats can be filed on.

To get the correct position of the flats screw the pieces into the block, making sure they are right home, then mark the position of the flats with a file. For those who used a piece of 1 in. square material for their block they could incorporate the lugs as part of the job when cutting away the unwanted material, making it one solid piece.

Drill a $\frac{1}{8}$ in. hole in the lugs for the hinge pin in the position shown on the drawing. The pieces can now be silver soldered together and when cleaned up fit the part to the saddle together with the apron.

The small plate screwed to the apron for positioning the engaging lever of the leadscrew is quite a straightforward job. It is shaped from a piece of bright mild steel $1\frac{1}{2}$ in. × $1\frac{1}{4}$ in. × $\frac{1}{8}$ in. Mark out the positions of the holes and the gate for the lever to go through. Drill the two holes at the top $\frac{9}{16}$ in. to clear a 2 BA screw and $\frac{3}{8}$ in. for the locking position of the lever.

Join the two $\frac{3}{8}$ in. holes up as shown in the drawing by drilling a $\frac{1}{8}$ in. hole between them and finishing with a file. After shaping the plate set it back 30 deg. from the shoulder. It will quite likely be found that this may have to be slightly adjusted when assembling the lever to the leadscrew nut.

● *To be continued*

POSTBAG

The Editor welcomes letters for these columns, but they must be brief. Photographs are invited which illustrate points of interest raised by the writer

SENSITIVITY

SIR,—In the issue of March 6 I observe a paragraph by Vulcan on the matter of sensitivity.

I remember many years ago reading in the *American Machinist* a story of how the well-known Professor Sweet of (I think) Columbia University was having lunch with two manufacturers, one a maker of ball-bearings. This man was boasting about the perfection of his products and produced a ½ in. ball from his pocket, which he claimed to be accurate to 1/10,000 of an inch. Sweet took the ball and rolled it around in his fingers and presently said:

"You know this ball has an equator in one position, which is definitely bigger in diameter than the rest of it." The manufacturer was very indignant and a bet was made there and then that Sweet was wrong.

To settle the bet they went up to Columbia University to test the ball in the highly accurate testing machine which they had there; they found that Sweet was quite right and he repeatedly indicated by feel the position of the large diameter on the ball. The bet was paid and Sweet remarked: "Not only is this equator bigger than the rest of the ball, but there is a high spot on the equator itself." So it was again checked in the measuring machine and Sweet once again was found to be correct.

I cannot, of course, vouch for the truth of this story, but Professor Sweet was a well-known man and the *American Machinist* has always been a reliable magazine.

Stourbridge. CECIL C. BRINTON.

DE-SCALE

SIR,—If F.R.P. [Readers' Queries, March 27] wishes to de-scale his boiler surely one of the proprietary compounds sold for de-scaling kettles is quite satisfactory.

The answer surely is not to use tap water. Three alternatives to this are distilled water from a chemist or garage of infrequent small quantities are all that is needed; rainwater if it can be caught; or the water obtained when de-frosting a refrigerator. We have used the latter in a domestic steam iron for a couple of years without trouble after it had had its tank replaced because tap water had rapidly ruined it.

Chemical purifiers are available at quite a modest price. One is supplied by most motorists' suppliers. The makers will probably spring instantly to most motorists' minds as they make a large range of do-it-yourself service and repair materials.

I believe that similar preparations can be obtained from photographic suppliers. These are intended to enable batteries to be topped up or developers to be mixed with hard tap water.

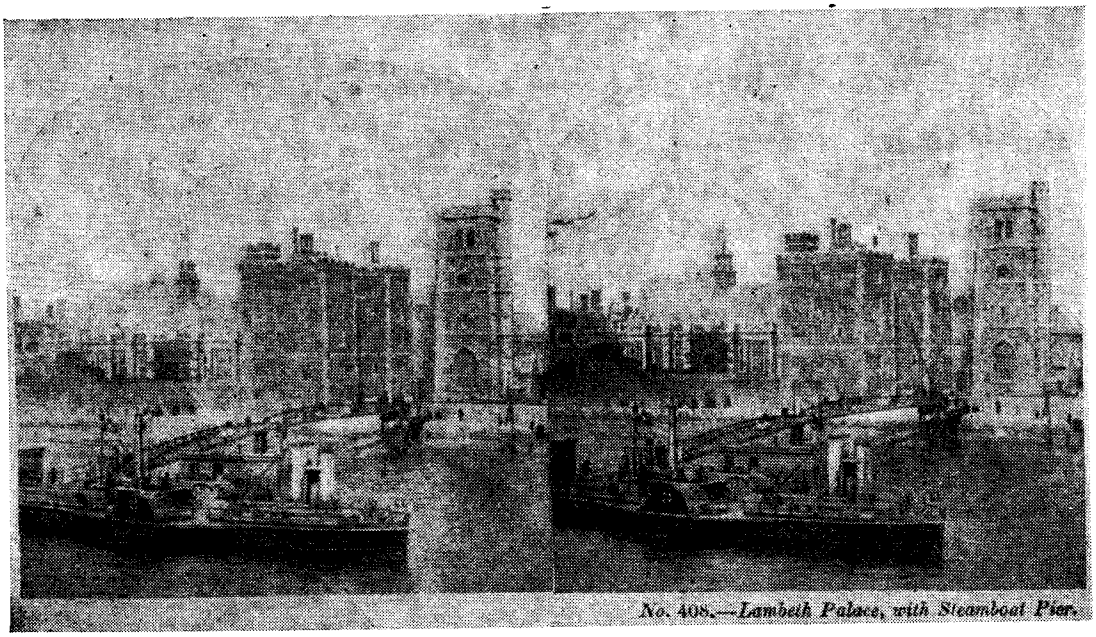
Now can some expert say whether a constant viscosity motor oil can be used in a steam engine? If not, why not?

East Ham, A. E. CLAUSON.
London E6.

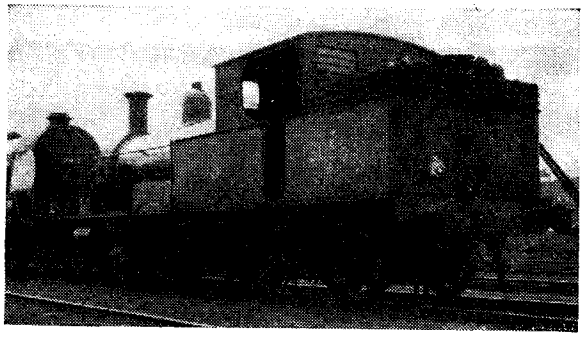
LOCO TRIALS

SIR,—The article on No 7007 *Great Western* was very interesting. I think the Castle class locomotives are the most beautiful engines I have ever seen.

There must be many like myself who know nothing about the 1924



An early stereoscopic view of Lambeth Palace, with the steamboat pier. Mr H. W. Holmes, who sent it, would like some information on CITIZEN, *the paddleboat in the foreground*



A view of an LSW tank, No 30583

Caldicot Castle trials at Swindon or the exchange trials between No 4079 *Pendennis Castle* and the LNER Pacific No 4474 in 1925, nor the trials in 1926 of *Launceston Castle* between Euston and Carlisle; and I feel an article on these trials would prove interesting reading to many of us.

Trowbridge, Wilts. W. H. SHORE.

ADAMS TANKS

SIR,—I was interested in the Readers Query re L. S. W. Adams tanks.

I enclose for that gentleman's information a photograph of No 30583. He will notice that the balance weights are over five spokes at the rear and seven spokes at the front.

Gloucester. R. F. G. PORTER.

STROUDLEY TERRIERS

SIR,—I was very interested in the drawings for cylinders for a 3½ in. gauge Terrier [ME, March 13], and only wish these had been available before I commenced my *Leadenhall* (page 532, 17 October 1957).

The correct arrangement of the valve chests between the cylinders is ingenious. In my model the cylinders are in the middle, with the valve chests against the frames. This was done because I foresaw the difficulty of accommodating four eccentrics in the distance of $\frac{13}{16}$ in. between the crank webs, and it looks as if only that space is available in the drawing in question.

The eccentric rods will of necessity be out of line with the valve spindles, and even then there will be little room for the links and forked eccentric rods to clear the connecting rods.

I hope LBSC will continue with his drawings and let us have the layout of the rest of the motion. The second reason for my arranging the valves as I did was the prospect of having to set valves by poking bent wire under the buffer beam into steam ports which I would not be able to see.

In *Leadenhall* the valve chest covers pass through slots cut in the main frames. These are in the nature of inspection covers, and permit visual setting of the valves. The arrangement, however, created other difficulties.

In the design by LBSC there do not appear to be any loose covers at all for the steam chests, and I would like to ask how it is intended to set the valves.

This problem of the Stroudley inside motion, with a somewhat uncanny solution, was dealt with by LBSC in connection with *Grosvenor* (page 646 of the issue for 7 November 1957). I had no kindly apparition from Elysium to advise, but only a diabolical visitant from Peenemunde to destroy.

My garden workshop was wrecked, and for days the blitzed model lay in the rain, the frames pitted with marks I have never been able to efface.

I notice your contributor's advice to take care to drill the screw holes in the cylinder covers so that they miss the steam passages, but the draughtsman has made the same mistake as I did. The bottom screw holes will run dead into the holes for the cylinder drain cocks. These holes and the steam passages are at 90 deg., and I would ask how readers contrive to space out six holes equally and miss both of them.

I have only one other observation to make on LBSC's excellent design. I do not know what working pressure is proposed, but if it is high I should hesitate to stand in front of a ¾ in. scale locomotive in steam knowing that the cylinder covers were secured only by 8 BA screws.

London SE25. H. V. STEELE.

MODEL TAKEN

SIR,—A model disappeared from the stand of the Glasgow SME at the recent Schoolboys' Exhibition, during the night of the 22-23 March 1958.

The model is an ½ in. scale model of the Polar exploration ship *Magga Dan*, 30 in. overall. It is constructed in wood, and is a working model with provision for radio-control. It is electrically powered. The hull is bright red, decks green and superstructure white. The forward mast is hollow and has the radio aerial within it. The workmanship is of the highest order.

The Marine Division of the Glasgow City Police has been notified.

If any reader can be of assistance in locating this model, he should contact the local police or myself, at 71 James Nisbet Street.

As far as I know this is the only completed model of the *Magga Dan* in Scotland, and I doubt if there are many more models of this ship in the whole country. The evidence points to the fact that whoever took it had his or her eye on it as four other ship models on the stand were passed over to remove it.

Glasgow SME. ANDREW HALL, HON. SEC.

TRACK SHOT

SIR,—I enclose a photograph of my track. The ¾ in. scale Atlantic was travelling at her usual lively speed when the picture was taken.

This driving position is, I find, much the best—corners can be taken faster than when sitting upright and, of course, backhead can easily be seen.

Winchester. P. G. M. TALBOT.

Mr Talbot behind his ¾ in. scale Atlantic

D1 CLASS TANKS

SIR,—Reading Mr Maskelyne's article on the D1 Class Tanks LBSCR [ME, March 20] I was struck by an anomaly in the tube heating-surface figures for the two series of boilers fitted to these engines. It is stated that the barrel lengths were identical at 10 ft 2 in., the earlier boilers had 175 tubes 1¾ in. dia. and the later ones 207 tubes 1⅝ in. dia. The former is said to give 952 sq. ft h.s., and the latter 924.57 sq. ft.

But 175 tubes 1¾ in. dia. have a total circumference of 80.1 ft as near as makes no matter, while 207 tubes 1⅝ in. dia. have a total circumference of 89.6 ft.

To give 952 sq. ft heating surface, as stated, the 1¾ in. tubes would have to be 11 ft 9 in. long, a figure quite out of consonance with a 10 ft 2 in. barrel ! For the 1⅝ in. tubes to give 924 sq. ft h.s. would require a length of 10.6 ft, which would appear to equate quite well with a 10 ft 2 in. barrel

So far as I know, these engines were fitted with crosshead driven feed-pumps and no injectors. At the time these locomotives were built the injector had become a reasonably reliable piece of apparatus and to refuse to utilise it, as Stroudley did, indicates a chink in his armour.

That his pumps worked is not questioned, but as originally made, much trouble was experienced with burst feed pipes, as pressures in excess of 3,000 p.s.i. occurred in them. Subsequent modifications reduced this to around 900 p.s.i., but even this seems excessive to feed against 150 lb. steam pressure.

Can anyone say what were the last locomotives built for a British railway to have crosshead feed-pumps ? The last engines I can find so equipped were H. A. Ivatt's 0-8-2 tank engines for the old GNR built around 1904-06.

Rustington, K. N. HARRIS.
W. Sussex.

CPR No 29

SIR,—I fear that Mr Holcroft (Postbag, 13 February) errs in concluding that CPR No 29 has outside-admission valves. They are in fact of normal inside-admission type.

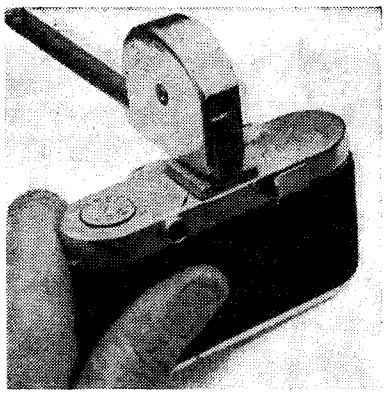
This engine was built in 1887 at the CPR shops, Montreal, with balanced flat valves and was re-cylindered and superheated 35 or 40 years ago.

Richardson balanced flat valves became general in North America somewhat earlier than Mr Holcroft assumes. Original drawings of a Grand Trunk 4-4-0 built in 1873, supplied to me by the Canadian National Railways chief of motive power, show balanced valves, 5½ in. travel and " tallow-pot " lubrication !

As valve travel of 5 to 6 in. was already standard, No 29's Stephenson gear would not require alteration other than cutting new keyseats in eccentric sheaves to enable resetting with the appropriate sign of advance to deal with inside-admission valves when the new cylinders were fitted. In fact, Mr Massey took a third photograph, side view with cranks on bottom quarter, motion in reverse, and valve rocker clearly in rear half-travel, indicating that admission must be internal.

Some American lines did convert to outside-admission piston valves by fitting new valve chests bolted to existing cylinder port face and having steam and exhaust passages to register with the original ports.

Windsor, H. S. GOWAN.
Ontario.



Mr McRobbie's measuring aid for ensuring accurate focusing when using extra lenses on the camera

HE DOESN'T AGREE

SIR,—I disagree with Vulcan [Smoke Rings, March 13] and take the side of his colleague. I look to MODEL ENGINEER for modelling of all kinds; if on the other hand I wish to read or study precision tools or machine tools I read *Machinery*.

I can imagine the percentage of your readers who could take a deep interest in J. Nixon's " Theme for a Workshop " [November 14] to be very low.

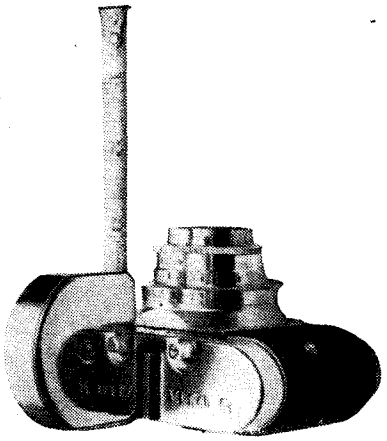
Can any reader give me any information on the Geo. Benny Rail Plane of some years ago as I wish to make a working model of it.

Letchworth, C. E. SPRINKS.
Herts.

LATHE QUERY

SIR,—Could anyone help to identify my lathe ? The only markings on the lathe are REVX and OEW III7.

Newport, Mon. L. MEADE.



MEASURING AID

SIR,—My photographs may interest some of your readers. They show a simple measuring aid to ensure accurate focusing when using extra lenses on the camera.

This is simply a tape rule with a strip of brass soldered to the bottom; the whole thing made a good sliding fit in the camera accessory shoe.

Close up photographs can be taken with the camera held in the hand at exhibitions, etc., if you can get permission. Simply set the rule at the distance you wish to focus on—the distance should coincide with front lens mount on the camera, sight the subject through the viewfinder, bend the rule up out of the field of view with the left forefinger and make the exposure with the right.

Some tape rules on the market have buttons in the centre of the case to return the rule to the case after use. If you use a rule like this I don't advise using the return button when the rule is fixed to the camera, as there is quite a solid jerk when the rule springs back. This could damage the shutter mechanism.

Ayr. D. H. MCROBBIE.

THERMOCOUPLE

SIR,—In a letter from Mr R. G. Davis [Postbag, March 20, page 376] there is reference to buying " construction " wire for a thermocouple.

Since the making of a thermocouple involves nothing that it would be natural to describe as " construction," I venture to suggest that this may be a misprint for " constantan," of which one leg of a thermocouple is commonly made, the other often being copper

In case any of your readers should be interested, constantan is a nickel-copper alloy, of about 40-60 per cent, with a very high specific resistance that does not greatly change with variations in temperature; it is, therefore, much used for accurate measurement involving resistance.

Edinburgh 5. G. STRUAN MARSHALL.

Will Peel Act bear fruit?

JOSEPH MARTIN'S diligent researches into the thorny question of club rates reveal that one club has been granted exemption on the basis of an 1843 Act

LIKE a shaft of spring sunlight, good news shines through from the West-country to cheer the rate-depressed modelling clubs. While some are losing hope of a place within Section Eight of the 1955 Rating and Valuation Act, the Andover and District Model Engineering Society has been granted the relief that it wanted.

"I have to advise you," writes the Town Clerk of Andover to secretary John Martin, "that the council have now decided to accept your representations, and instructions have been given to the borough treasurer accordingly."

A formal notice under the Section allows Andover Borough Council to discontinue the special concessions after three years if they so desire. Another point, which could equally be taken for granted, is that the privileges of Section Eight will apply to the club "only for so long as the premises are occupied for the purposes for which they are at present used."

As soon as the news was received, the Andover secretary communicated it to secretary S. L. Sheppard of SMEE. Mr Sheppard told last year's conference at the Model Engineer Exhibition, when rates were discussed there, that his society was willing to keep other societies informed of its progress. At that time SMEE had found a good kind lawyer who appeared to think that the society had a sporting chance. Here, then, was hope.

Official attitude varies

Unfortunately there are few signs of consistency in the official attitude to Section Eight. While Andover rejoices, Hitchin sighs. We have a borough council in Wiltshire which apparently acts on its own initiative, and we have a Parliamentary Secretary in Whitehall who says that only the courts can decide.

Quite a long time ago the Hitchin and District Model Engineering Club received, through Martin Maddan, MP, another negative reply from the Ministry of Housing and Local Government.

"I am afraid," wrote J. R. Bevins, the Parliamentary Secretary, "that I must decline to express a view as to whether the club's premises are covered by the section. It is true that Duncan Sandys was responsible for introducing the provision, but this is now part of an Act of Parliament which does not empower the Minister to interpret its provisions. Constitutionally, therefore, only the courts can interpret the provision and decide whether a particular property comes within it; and it would be neither useful nor proper for me to attempt to usurp that function. I ought, perhaps, to add that in interpreting an Act of Parliament the courts have no regard to what may or may not have been in the mind of the Minister who introduced it into Parliament; their concern is with the wording of the Act as it stands."

Why the distinction?

Secretary G. J. Clark of Hitchin had mentioned in his letter the lucky bowling club which I cited here in March of last year ("The Key to Section Eight," ME March 7). Why, I asked, should a bowling club, whose primary aim is the pleasure of its members, be allowed relief from rates when a modelling club, often (as at Hitchin) with a track for children in a public park, is denied this privilege?

"I can only assume," replied Mr Bevins, "that the local authority has regarded the bowling green as a 'playing field'—defined in the section as 'land used mainly or exclusively for the purpose of open-air games'... the section is not limited to social welfare organisation."

Playing fields are covered by the third and last clause of Section Eight, following a similar provision for almshouses. The part which concerns us, the introductory clause, refers to "any hereditament occupied for the purposes of an organisation (whether incorporate or unincorporate) which is not established or conducted for profit and whose main objects are charitable or are otherwise concerned with the advancement of religion, education and social welfare."

This looks simple enough, but nothing is ever simple in the eyes of the law. What, for instance, is the exact meaning of "profit"? How is "charitable" to be defined? And (returning to a question with which I have dealt before) what limits are to be placed on this broad term "social welfare"?

It would seem from the case of the Inland Revenue Commissioners v. Peeblesshire Nursing Association, 1927, and from the case of the Commissioners v. Falkirk Temperance Cafe Trust in the same year, that an organisation may be defined as non-profitmaking even when it makes a profit on some of its activities—provided that the profits enable it better to serve the purposes for which it is conducted. Can there be any doubt that the profits made by a model engineering club are put to precisely that use?

The interpretation of "charitable" is more difficult. "Charity" and "charitable" are words with a particular legal meaning. From an official definition which I have found in *Halsbury's Laws of England*, they apply to trusts for the relief of poverty, the advancement of education, the advancement of religion, and "other purposes beneficial to the community." Here again we are faced with one of those large general conceptions which sometimes prove to be less accommodating than they appear.

Dictates of logic

Commonsense tells us that a modelling club with a permanent track in a public park, or with a portable track which is erected at garden fetes for hospitals and the like, is a benefit to the community directly and indirectly: directly by providing pleasure for the young, and indirectly by bringing in money for causes usually described as deserving. Besides these benefits, which are obvious and are nearly always recognised by the local council, we find others of a kind still more valuable. Every club, whatever its size and equipment, provides a centre for the exercise of craftsmanship—of skill developed for its own sake, as model engineering uniquely develops it, without regard for utilitarian ends.

There is a correspondence here with pure mathematics. "May it never be any damned use to anybody!" says the Cambridge toast; and at the same time it is, by a happy paradox, of use to us all. Model engineering

might be described as the pure mathematics of craftsmanship, able to be turned at any time to uses less pure.

Although an Act must be taken as it stands, a local authority which cannot quite make up its mind may, perhaps, attach some weight to what was said in the House of Commons when the 1955 Rating Bill came up for debate. It was introduced, as Mr Bevins' letter reminds us, by Mr Duncan Sandys. Speaking in June 1955, Mr Sandys said that all Members shared the objective of finding some way of ensuring relief and security to "deserving public-spirited organisations on a fair and even-handed basis." Taking this too as it stands, it suggests that Andover Council has done no more than act in the spirit intended.

The Act says that a rating authority in a rating area "shall have power to reduce or remit the payment of any rate charged in respect of a hereditament to which this section applies for the first year of the new list or any subsequent year, including power further to reduce or to remit the payment of any rate in the case of which the amount chargeable is required to be reduced by virtue of the preceding provisions of this section."

Sir Robert Peel Act

Note the words "rating authority in a rating area". They mean, and are carefully intended to mean, a local rating authority. It is not until a claim has failed locally that a decision needs to be sought in the courts. The Andover claim has succeeded with the local council, and there, for Andover, the matter happily rests.

Early in Queen Victoria's reign societies of various kinds were trying to make sense of a new Act which exempted some of them—but which? —from rates on their property. The Act of 28 July 1843, Anno Sexto et Septimo Victoriae Reginae, Cap. xxxvi, when Sir Robert Peel was Prime Minister, relates to county, borough, parochial and other local rates on land and buildings occupied by scientific, literary or fine arts societies. To qualify, a society had to be supported wholly or in part by annual voluntary subscriptions, to be free of any profit motive for its members, and to have a certificate from a barrister, stating that it was entitled to the benefit.

I have a copy of this Act—the Literary and Scientific Societies Act, as it is known—in front of me. It was sent to MODEL ENGINEER by a reader in New Zealand, H. E. Clow of Farndon Corner, Clive, Hawke's Bay.

"I have been much perturbed," writes Mr Clow, "by the very high rates that the various societies are being asked to pay in the Old Country, especially after reading your article 'Forward to 1890' in the 15 August issue."

Chairman's initiative

It is this kind thought for the societies in Britain which has inspired Mr Clow to dig out the 1843 Act. What makes the Act of great interest, and perhaps of great importance, is his recollection of what happened in Manchester before the last war. At that time, he says, the Manchester SMEE, to which he belonged, was faced with rating difficulties until the society's "very live chairman" produced a copy of the 1843 Act and made successful use of it.

Mr Clow explains that he is relying on memory. He kept a copy of the Act, took it to New Zealand 11 years ago, and found it, during a weekend search, in a huge pile of MEs. His memory has not tricked him. Secretary H. Stubbs writes from Stockport to tell me, in reply to my query, that Manchester SMEE was listed with the Registrar of Scientific Societies in 1938 and again in 1949 when one of the rules was changed. Having thus been designated a scientific society, it was exempted from payment of rates. It is still registered, but as the monthly meeting place is now a room rented for two hours the question of rates no longer arises.

Requirements of Registrar

"I believe," adds Mr Stubbs, "that the Registrar requires a copy of the rules of each society. One of the objects of this is to make sure that the society is run on a purely voluntary basis."

He shares my hope that the information will be of help to other societies. If Manchester SMEE was able to register as a scientific society, what is to prevent other societies similarly constituted from trying their luck with the same claim?

I mention luck because it may be fairly easy to convince one barrister and impossible to convince another. Despite all efforts, the English language seldom yields completely to the precision tools of the lawyers. While a club should have no difficulty in proving that it is supported by voluntary subscriptions and that it does not make any "Dividend, Gift, Division or Bonus in money into or between any of its Members," the primary task of establishing a scientific identity could be much more formidable.

Learned opinion may well differ on what precisely constitutes a "scientific society"; it might indeed be argued that modelling, and especially the modelling of ships, comes as close to being a fine art as to being a science.

These points need to be studied but they should not deter a club which has the spirit to look after its own interests. Mr Clow may be on the right track. Since the arrival of his letter the Institution of Mechanical Engineers, whose headquarters is at Birdcage Walk in London, has invoked the Act of 1843, failed at the first stage, carried the matter further —and won.

Lands Tribunal ruling

When the Institution claimed that it was exempt under the Act, the Central London Local Valuation Court rejected its contention and confirmed an assessment of £6,000 gross, £4,997 rateable value. Had nothing more been done the rates on the premises would have had to be paid accordingly. As it was, an appeal was brought before the Lands Tribunal in London and the tribunal, ruling against the decision of the local valuation court, decided that the IME was entitled to exemption.

I read this report after I had begun this article. As I had already written of the fine arts aspect of modelling, it was interesting to find Sir William Fitzgerald, the president of the tribunal, making a similar comment on engineering at full-scale. Sir William said that the word "science," used in relation to mechanical engineering, meant applied science, and in all applied science there must be an element of art. Whether his following remarks can be applied to model engineering is a question on which opinions may vary.

"I accept the contention," he said, "that the promotion of the development of mechanical engineering means the increasing of scientific data, so that you can do things in mechanical engineering by the application of discovered scientific principles rather than by intuition or guess." He held that the IME was founded for the purpose of science exclusively.

Can any of this argument be advanced in favour of our modelling clubs? To what extent does the development of model engineering mean the increase of scientific data? Much depends, I suggest, on whether one takes a broad or a narrow view. Various individual instances could be quoted of amateur models which have proved, sometimes unintentionally, of scientific value—such as miniature locomotives embodying new and profitable ideas with a bearing upon full-scale practice in the science of live steam.

But more important than these rather isolated contributions is the

actual craft which the clubs foster. Nearly every science uses models; nearly every new project or idea is tested in model form. Murdoch built a model locomotive to work out his ideas, George Stephenson began with a model at Killingworth Colliery, and the Russians and Americans are using models all the time in the latest science of all, the rocket conquest of outer space.

No one builds a full-size machine at a cost of thousands of pounds or millions of dollars without first trying it out in miniature if such a trial is at all possible. In the atomic age when a single project may be of tremendous size and costliness, when its success or failure may vitally affect the prestige, policy and safety of a whole nation, the craft of modelling is of greater value than ever before.

To this craft, to its development and perpetual encouragement, every club contributes in the normal course of following its own interests. The club serves the skill, and the skill in turn is of daily service to science. On the same broad view it may also be said that a model is useful to science when it preserves or demonstrates anything which is of scientific interest. What are all those things in glass cases at the South Kensington Science Museum ?

" It is hoped," writes secretary P. Wake of the Harlington Locomotive Society, " that something will be done at a high level to obtain a satisfactory review and satisfactory reductions. After all, we are ' educational and recreational '—definitely the former."

On the whole, it is better to do something on a lower level first. Hitchin has tried hard, and can be forgiven a feeling of pessimism despite an official assurance that it will be granted the general industrial relief of 20 per cent. " Doubtless others, like ourselves," writes Mr Clark, " have been further disheartened by gloomy forecasts of a heavy rise in 1961 of non-domestic rateable values."

Nevertheless, Mr Clark ends on a positive note. " We have read reports," he says, " of a proposed official inquiry into the anomalies of Section Eight, and we appeal, therefore, to all clubs to bring the facts to the notice of their MPs without delay. They may care to mention that we have written to Mr Martin Maddan."

The need for a public inquiry gained emphasis from the rating of the London Library in which, of course, many influential people are directly interested. After having lost in the Local Valuation Court, the London Library is proceeding to the Lands Tribunal, not under Section Eight but under the 1843 Act. To scholars, writers and ordinary readers the library is more of a boon than the British Museum Library itself as the books may be taken away instead of having to be read on the spot. Every reason exists for treating it as an admirable public service except its inability to live on air !

Will the committee to deal with rates prove just another sad little committee—or will it dare to risk an inrush of commonsense where all is arid law ? ▣

A simple rule holder

By S. U. BELSEY

HERE is a description of a very simple rule holder for use in setting a scriber. It will be seen that the rule is held truly vertical and is completely unobstructed by any form of clamp.

The device was made from a piece of $2\frac{1}{2}$ in. $\times$ $2\frac{1}{2}$ in. angle iron $2\frac{1}{2}$ in. long (see diagram). The outer faces and all edges of the angle iron were machined true on the lathe faceplate.

An essential part of the holder is an Eclipse pot magnet. These little magnets are very powerful and stick like limpets. The one I used was $\frac{5}{8}$ in. in diameter and had a hole tapped 2 BA in the base. The magnet was gripped in the three-jaw chuck and the base was skimmed-up flat.

An odd piece of rod was put into the chuck and drilled No 26. It was tapped 2 BA and a piece of 2 BA rod was screwed in, leaving about $\frac{3}{16}$ in. protruding. The pot magnet was screwed on to this and screwcut 32 t.p.i.

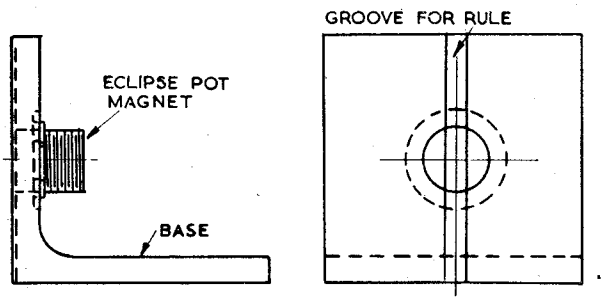
The piece of angle iron was centre-punched on one of the inner faces, equidistant from the ends and $1\frac{3}{16}$ in. up from the angle apex. The punch mark was set to run truly central after the angle iron had been clamped to the faceplate once more.

The angle was then drilled $\frac{3}{8}$ in. and opened out to $\frac{5}{8}$ in., less twice the thread depth which, of course, is $2 \times \frac{640}{32}$ thou, or 0.040 in. The hole was internally screwcut until the pot magnet would screw smoothly into place, and a spot face was turned around the hole to make a seating for a standard locknut.

Now the device, looking slightly more like a tool and less like a piece of superannuated mangle, was clamped to the vertical slide. A groove $\frac{3}{16}$ in. wide was milled across the centre of the hole from the outer edge to the apex of the angle, as shown in the diagram, to take a standard depth-gauge rule. The depth of the groove was only enough to allow the face of the rule to stand proud of the machined angle iron.

To assemble the rule holder, the rule was first placed on edge in the groove, and the magnet screwed in from the inside until it was just clear of the rule. The magnet now held the rule firmly in the groove, which in turn kept it vertical when it was set face-outward. Setting the scriber was simplicity itself, as the whole of the rule face was accessible.

To make the job look as if it belonged in the same workshop as the lathe the unmachined angle iron faces were given several coats of cellulose enamel, which were duly rubbed down with emerycloth between applications. ▣



Showing how the magnet attaches to the piece of $2\frac{1}{2}$ in. angle iron