4-17 May 1979 First and Third Friday Volume 145 Number 3608 40p
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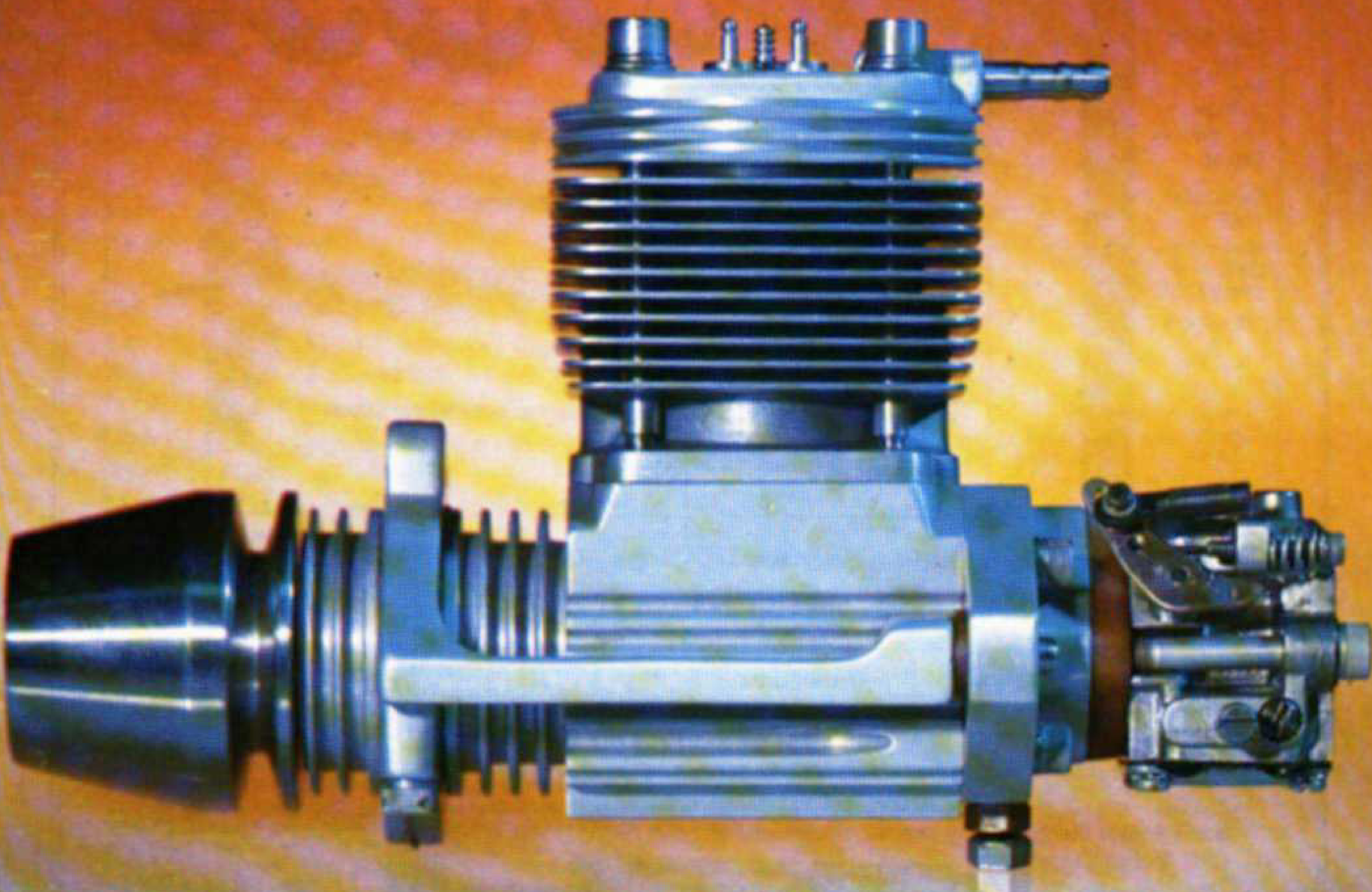
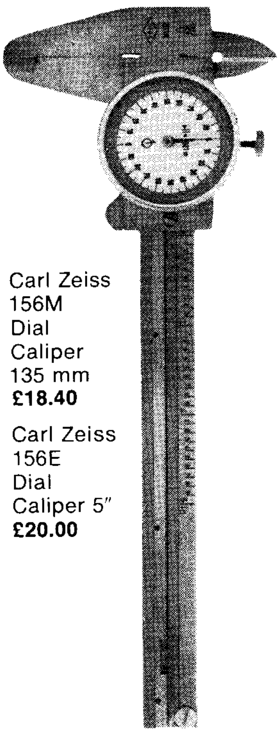
MAP HOBBY MAGAZINE

Model Engineer



I.C. Engines at the M.E. Exhibition

MEASURING EQUIPMENT
by CARL ZEISS SUHL



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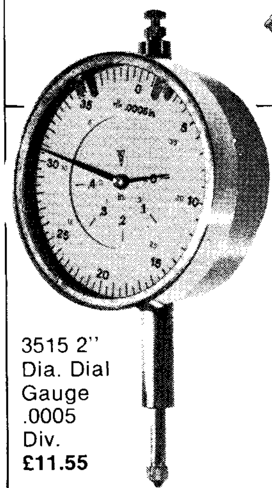

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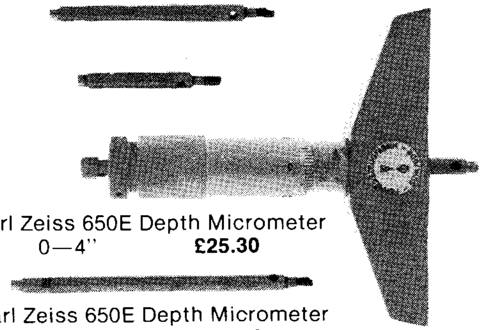

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4 May 1979

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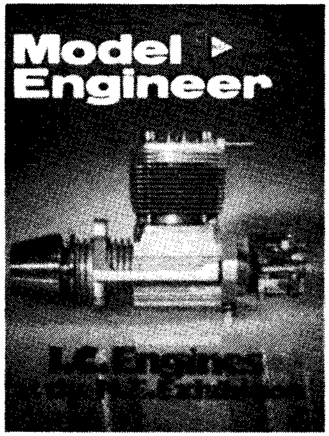

COVER PHOTO

Peter Allen's 15 cc internal combustion engine. Photo by R. Trory.

NEXT ISSUE

A full scale marine launch engine.

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M.E. QUERY COUPON
MAY 1979

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10	10C	No 10 Blade Pk 5	75p
11	11C	No 11 Blade Pk 5	45p
12	12C	No 12 Blade Pk 3	80p
14	14C	No 14 Blade Pk 3	1 00
16	16C	No 16 Blade Pk 5	45p
17	17C	No 17 Blade Pk 5	55p
18	18C	No 18 Blade Pk 5	55p
19	19C	No 19 Blade Pk 5	45p
21		No 21 Blade Stainless Steel Pk 5	65p
22	22C	No 22 Blade Pk 5	80p
23	23X or XC	No 23 Blade Pk 3	1 15
24	24C	No 24 Blade Pk 3	45p
25	25C	No 25 Blade Pk 3	75p
28	28C	No 28 Blade Pk 3	95p
29	B29	No 29 Blade Pk 2	60p
30	B30	No 30 Blade for Spokeshave Pk 2	60p
31	No 1 Asst	No 1 Blade Assortment Pk 5	55p
32	No 2 Asst	No 2 Blade Assortment Pk 5	60p
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102	0102 C	Woodcarving Bld Str Edge Pk 2	65p
103	0103 C	Woodcarving Bld Convex Pk 2	65p
104	0104 C	Woodcarving Bld Concave ¾" r Pk 2	65p
105	0105 C	Woodcarving Bld Concave 1½" r Pk 2	65p
106	0106-C	Woodcarving Bld Small Concave Pk 2	65p
122	122-C	No 122 Pocket Knife Bld Pk 2	80p
131	16031 C	Punch No 31	65p
132	10632 C	Punch No 32	90p
134	A-4Asst C	Gouge Assortment	1 95
135	A 5Asst C	Router Assortment	1 65
137	2007C	Woodcarving Bld Assortment Pk 5	1 80
151	16051-C	A-Chisel Gouge 3/16" Pk 2	80p
152	16052-C	B Chisel Gouge ¼" Pk 2	80p
153	16053-C	C-Gouge 3/16" Pk 2	80p
154	16054 C	D-Gouge 3/8" Pk 2	80p
155	16055 C	E Gouge 3/8" Pk 2	80p
156	16056 C	F Gouge 3/32" Pk 2	80p
157		G-Gouge 1/16" Pk 2	80p
160		W Router Pk 2	1 00
161		X Router Pk 2	1 00
162		Y Router Pk 2	1 00
163		Z-Router Pk 2	1 00

BLADES – CARDED

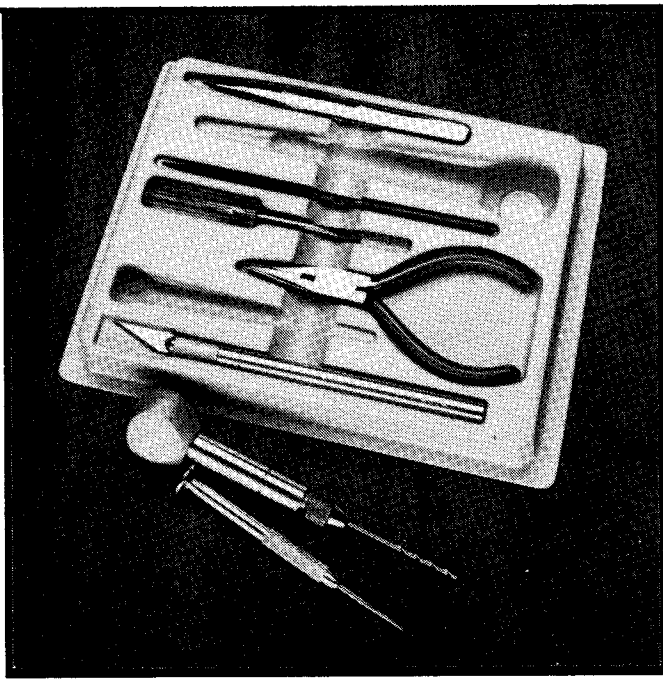
213	13C	No 13 Saw Blade Pk 5	90p
215	15C	No 15 Saw Blade Pk 3	80p
226	26C	No 26 Blade Pk 3	60p
227	27C	No 27 Saw Blade Pk 3	90p
233	33C	No 33 Blade Pk 2	1 00
234	34C	Razor Saw Blade 4½"l x ¾"d	90p
235	35C	Razor Saw Blade 4½"l x 1"d	90p
236	035C	Razor Saw Blade 5½"l x 1¼"d	1 15
239	30C	Razor Saw Blade 5½"l x 1¼"d	1 25
241	0841C	Craft Swivel Blade Pk 2	65p
251	0851C	Professional Swivel Blade Pk 6	1 75
261	0831C	Acrylic Blade Pk 3	65p
292	099 2C	Heavy Duty Utility Blade Pk 5	65p

BLADES – DISPENSERS – CARDED

410	1010	Dispenser No 10 Blade	1 50
411	1011	Dispenser No 11 Blade	90p
416	1016	Dispenser No 16 Blade	90p
419	1019	Dispenser No 19 Blade	90p
421	1021	Dispenser No 11 Stainless Steel Blade	1 30
422	1022	Dispenser No 22 Blade	1 60
424	1024	Dispenser No 24 Blade	90p
492	1092	Dispenser Heavy Duty Utility Blade	1 30

BLADES – BULK PACKS

608	8 100BP	No 8 Blade Bulk Pk 100	7 50
610	0 100BP	No 10 Blade Bulk Pk 100	11 50
611	11	No 11 Blade Bulk Pk 100	7 50
616	16	No 16 Blade Bulk Pk 100	7 50
617	17	No 17 Blade Bulk Pk 100	7 50
618	18	No 18 Blade Bulk Pk 100	7 50
619	19	No 19 Blade Bulk Pk 100	7 50
621	21	No 21 Stainless Steel Blade Bulk Pk 100	11 75
622	22	No 22 Blade Bulk Pk 100	11 75
624	24	No 24 Blade Bulk Pk 100	7 50
691		Modified No 11 Blade Bulk Pk 100	7 50
692	0992 3	Heavy Duty Utility Blade Bulk Pk 100	8 50



SAW BLADES CARDED

734	44R	Coping Saw Blade Pk 5	1 10
735	44S	Spiral Saw Blade Pk 3	65p
741	16241 C	Jeweller's Saw Blade No 8 0 Pk 12	1 85
746	16246 C	Jeweller's Saw Blade No 6/0 Pk 12	1 85
752	16252-C	Jeweller's Saw Blade No 2/0 Pk 12	1 85
753	16253 C	Jeweller's Saw Blade No 3 Pk 12	1 85
755	16255-C	Jeweller's Saw Blade No 5 Pk 12	1 85
759	16259 C	Jeweller's Saw Blade No 14 Pk 12	1 85

KNIVES

3001	1ST	No 1 Knife in Tube	70p
3002	2ST	No 2 Knife in Tube	1 00
3005	5ST	No 5 Knife in Tube	1 25
3006	6ST	No 6 Knife in Tube	1 75
3009	9RX	No 9RX Knife Boxed	2 65
3021		No 1 Knife with Safety Guard Boxed	1 35
3022	2SGK C	No 2 Knife with Safety Guard Boxed	1 75
3051	X-3051	Professional Swivel Knife Boxed	11 35
3201	1C	No 1 Knife Carded	70p
3202	2C	No 2 Knife Carded	1 00
3203	3C	No 3 Pen Knife Carded	1 25
3204	4C	No 4 Stencil Knife Carded	70p
3205	5C	No 5 Knife Carded	1 25
3206	6C	No 6 Knife Carded	1 75
3208	8RC	No 8R Utility Knife Carded	50p
3209	9RXC	No 9RX Knife Carded	2 65
3211	3111C	Super No 1 Knife Carded	2 00
3216	6LC	No 6L Skiving Knife Carded	2 75
3221	SGKC	No 1 Knife with Safety Guard Carded	1 35
3231	3031C	Acrylic Knife Carded	90p
3241	3041C	Craft Swivel Knife Carded	2 25
3261	3061 2	Woodcarving Knife Carded	2 00
3266	66C	No 66 Pocket Knife Carded	1 15

KNIFE AND TOOL SETS

5010		Plastic Modeller's Set Boxed	4 75
5052		Professional Swivel Knife Set Boxed	11 95
5055		Professional Graphic Art Set Boxed	15 65
5066		Professional Artists Set Boxed	7 45
5071	7 1	Deluxe Model Railroad Tool Set Boxed	14 75
5076	1076	Craft Tool Chest Boxed	8 25
5081	81	Triple Knife Set Boxed	3 75
5082	82	Knife Chest Boxed	4 75
5083	83	Deluxe Knife Chest Boxed	5 65
5085	85	Deluxe Knife and Tool Set Boxed	18 25
5086	86	Knife and Tool Chest Boxed	13 95
5087	87	Knife and Tool Chest Boxed	21 00
5088	88N	Hobby Den Tool Cabinet	36 50
5089	89	Deluxe Hobby Tool and Knife Cabinet	43 50
5099	99	Super Set Tool Cabinet	60 00
5101		Relief Plaque Carving Set Bxd	5 00
5175	75	Carving Chest Boxed	6 75
5177	77	Woodcarving Set Boxed	4 35
5179	79	Carving Tool Set Carded	9 45
5201	5201 C	Craft Swivel Knife Set Carded	2 95
5202	5020-C	Deluxe Craft Swivel Knife Set Carded	4 75
5211	51 C	No 1 Knife plus 5 Blades Crdd	1 15
5212	52 C	No 2 Knife plus 5 Blades Crdd	1 55
5251		No 1 Knife plus Dispenser of 10 No 11 Blades Carded	1 55
5262	62 C	Double Knife Set Carded	2 75
5272	72 C	Modeller's Tool Set Carded	8 00
5284	84	Knife and Tool Set Carded	12 75
5302	5102 C	Whittler's Set Carded	5 45
5303	5103-C	Deluxe Whittler's Set Carded	12 75
5331	33001	Country Carving Kit Carded	3 75
5920	920	3-in-1 Leathercraft Tool Set	6 35
5921	921	Revolving Head Punch	5 25
5923		Steel Square	2 00
5924	924	Lignumvitae Mallet	4 75
5990	90L	Leather Tooling Set	4 75
5991	91L	Leather Swivel Cutter Set Crdd	3 75
5998	98L	Complete Leathercraft Tool Chest	53 00

TOOLS

7003	4003C	Small Plastic Clamp 2 per card	1 25
7004	4004C	Large Plastic Clamp 2 per card	1 55
7040	40C	Block Planer Carded	1 55
7041	41C	Sander 1"x5" Carded	80p
7042	42C	Sander 2"x5" Carded	90p
7043	43C	Adjustable Jeweller's Saw Carded	5 25
7044	44C	Coping Saw Carded 1	2 75
7045	45C	Spoke Shave Carded	1 10
7047	47C	Hand Drill Carded	4 00
7048	48C	Balsa Stripper Carded	1 75
7050	50C	Hammer Set Carded	4 00
7056		Mini Hammer and Anvil Carded	7 95
7057	4057C	Mini Hammer Carded	2 45
7058	4058C	Anvil Carded	5 95
7065	365C	Jeweller's Screwdriver Set Carded	1 85
7070	70C	Interchangeable Screwdriver Set Carded	2 25
7100	0-C	Needle Point Oiler Carded	90p
7110	110	T Square and Mat Beveler Boxed	9 50
7144		Pin Vice Set Carded	2 75
7162	5162C	File Set Carded	5 25
7163	5163C	Heavy Duty File Set Carded	5 95
7315		Push Drill Carded	6 15
7321	321DC	Precision Chuck Set Carded	3 00
7322	210C	Pin Vice Carded	1 55
7336	36C	No 36 Tweezer Carded	95p
7337	37C	No 37 Tweezer Carded	90p
7338	38C	No 38 Tweezer Carded	1 25
7343	343C	Bent Nose Tweezer Carded	2 55
7345	4005C	Angular Tweezer with Magnifying Glass Carded	3 35
7348	348C	Soldering Aid Kit Carded	3 35
7351	351C	Contour Sanders Carded	3 75
7356	605C	Needle File Assortment Carded	8 95
7358	60C	File Set Carded	7 75
7360	360C	Universal File Handle Carded	1 10
7361	361C	Needle File Set Carded	5 25
7365		Miniature File Set in Pouch	4 75
7366		Needle Raps in Pouch	5 45
7370	370C	Mini Vacu Vice Carded	3 75
7372	371NC	Illuminated Magnifier Carded (Batteries not included)	2 00
7376	376C	Cordless Power Drill (Batteries not included)	6 00
7380	380C	Partpicker Carded	1 55
7417	417C	Rubber Roller 4" Carded	1 10
7446	46C	C Clamp Set 4 per card	4 00
7450	450C	Mini C Clamps 3 per card	2 50
7456	256C	Cross Action Clamps 3 per card	85p
7484		Box Joint Pliers Long Nose Side Cutting Carded	5 45
7485		Box Joint Pliers Diagonal Cutting Carded	5 45
7486		Box Joint Flat Nose Carded	5 45
7489		Box Joint Pliers Long Nose Carded	5 45
7492		Box Joint Pliers Needle Nose Carded	6 00
7493		Box Joint Pliers Bent Needle Nose Carded	6 00
7504	1504C	Utility Pliers Long Nose Side Cutting Carded	3 50
7505	1505C	Utility Pliers Diagonal Cutting Carded	3 50
7506	1506C	Utility Pliers Flat Nose Carded	3 50
7507	1507C	Utility Pliers Snipe Nose Carded	3 50
7508	1508C	Utility Pliers Combination Nose Carded	3 50
7509	1509C	Utility Plier Long Nose Carded	3 50
7510	1510C	Utility Pliers End Snip Carded	3 50
7511	1511C	Utility Pliers Bent Nose Carded	3 50
7512	1512C	Lineman's Pliers Carded	3 35
7513	513C	X-tra Hand Carded	4 45
7514	514C	X-tra Hands Carded	6 25
7515	515C	Alligator Clip 3 per card	65p
7516		Magnifier Carded	6 00
7517		X-tra Hands with Magnifier Carded	8 75
7530	53C	Razor Saw Set Carded	2 65
7531	531C	Deluxe Razor Saw and Knife Set Carded	4 75
7532	532C	Mitre Box Set Carded	4 00
7533	533C	Mitre Box Carded	2 00
7535	4055C	Extra Fine Razor Saw Set Carded	2 25
7701	4001C	Ball Burnisher 1/16" Carded	1 35
7702	4002C	Ball Burnisher 1/8" Carded	1 35
7703		Spoon Burnisher Carded	1 00
7704		Burnisher Set Carded	3 75
7740	4040	Mat Cutter Carded	4 75
7753	4053C	Precision Compass and Swivel Knife Carded	3 75
7754	54BC	Beam Compass and Circle Cutter Carded	5 45
7778	378 220	Soldering Iron Hot Knife 220V Carded	6 95

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6368	16368	Needle File Knife 12 in tube	7 95
6369	16369	Needle File Round 12 in tube	7 95
6370	16370	Needle File Square 12 in tube	7 95
6371	16371	Needle File 3 Square 12 in tube	7 95
6372		Needle File Equaling 12 in tube	7 95
6373		Needle File Barrett 12 in tube	7 95
6374		Needle File Crossing 12 in tube	7 95
6375		Needle File Flat 12 in tube	7 95
6376		Needle File Marking ½ Round 12 in tube	7 95
6377		Needle File Slitting 12 in tube	7 95
6378		Needle File Round Edge 12 in tube	7 95
6379	16379	Rasps Round 12 in tube	7 95
6409	9D C	No 9 Drill Asst 12 Assted No's 55-80 Carded	5 00
6410	10D C	No 10 Drill Asst 12 Assted No's 45-60 Carded	4 00
6411	11D C	No 11 Drill Asst 9 Assted Sizes 1/16"-3/16" Carded	3 15
6412	12D C	Drill Set with Stand Carded	8 50

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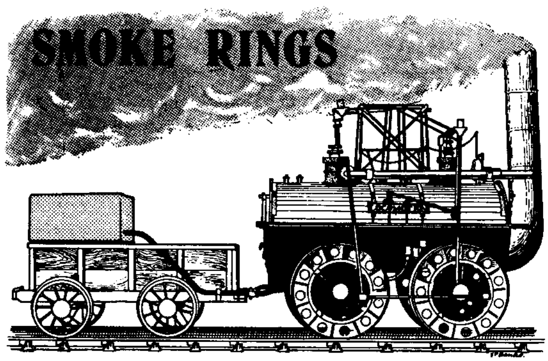


A Commentary by the Editor

Our Front Cover

For I.C. engine enthusiasts here is a little more information on the 15 cc. glow plug engine by Peter Allen which appears on the front cover and which, of course, was awarded a Very Highly Commended Certificate at this year's M.E. Exhibition. As you can see, it is over square, having a bore of 1¼ in. and a stroke of 3/4 in. with a compression ratio of 9:1. Fuel induction is by rear drum valve and the carburettor is designed to operate in any attitude — an obvious requirement for offshore racing for which the engine was designed. Both cylinder and piston are taken from a small industrial engine but relevant modifications have been carried out as can be expected. What cannot be seen are the water-cooled exhaust manifold and tuned exhaust system. Visitors to Wembley in January may also have seen Mr. Allen's specially tweaked Fox engine which should be described in *M.E.* before long.

Selkirk plus . . .

More information on the C.P. Selkirks and Texas types has arrived from Allan Craig, secretary/treasurer of Ottawa Valley Live Steamers and Model Engineers. Allan tells me that 5900 to 5959 C.P. Selkirks were 2-10-4s and not 2-10-0s and that C.V. 700s were also 2-10-4s and Texas types as stated. The C.N./C.V. roster classification was T-3-a but also called Texas types on the C.N. loco data sheets.

Brunel fans

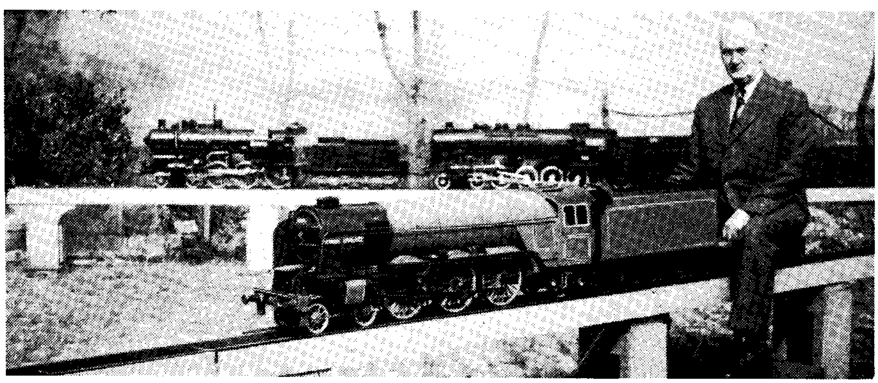
An attractive wall chart concerning the life and work of I. K. Brunel has been published by Brunel University — originally as a publicity exercise but since then as an item of interest to all of us who admire the great man. The chart measures 594 mm x 419 mm which is A2, and costs 60p, which includes post and packing, from Mrs. Marianne Bevis, Department of Building Technology, Brunel University, Uxbridge, Middx. If you order 50 or more the cost is 40p each, a nice thought for fund raising on Open Days.

Injectors

A postscript to our review on Don Young's injectors which raised a comment from Laurie Lawrence in "Post Bag" has arrived from Don himself and ought to put the record straight. Gordon Chiverton, who designed the injectors, publishes no literature on them himself and so is not subject to the hazards of the Trades Descriptions Act; this is the responsibility of Don Young Designs, sole outlet for the injectors. As to the design of these, Don tells me that they are of the lifting pattern, guaranteed as being so, and he now has 120 variants to choose from.

Steam engine designs

Michael E. Leek, Lecturer in the School of Technical Illustration, Bournemouth and Poole College of Art, is looking for detailed designs of such engines as marine launch, compound, triple and quadruple expansion so that his students may use them to prepare elaborate cut-away perspective illustrations. This could have a double benefit of teaching students and, I hope, of allowing some to be published in *M.E.* It is my firm belief that illustrations of this nature are very instructional and rewarding to the engineer. If anyone can help Mr. Leek in his search, please write to me and I will pass the message on. Remember the designs must be of actual engines, not of simplified working models.

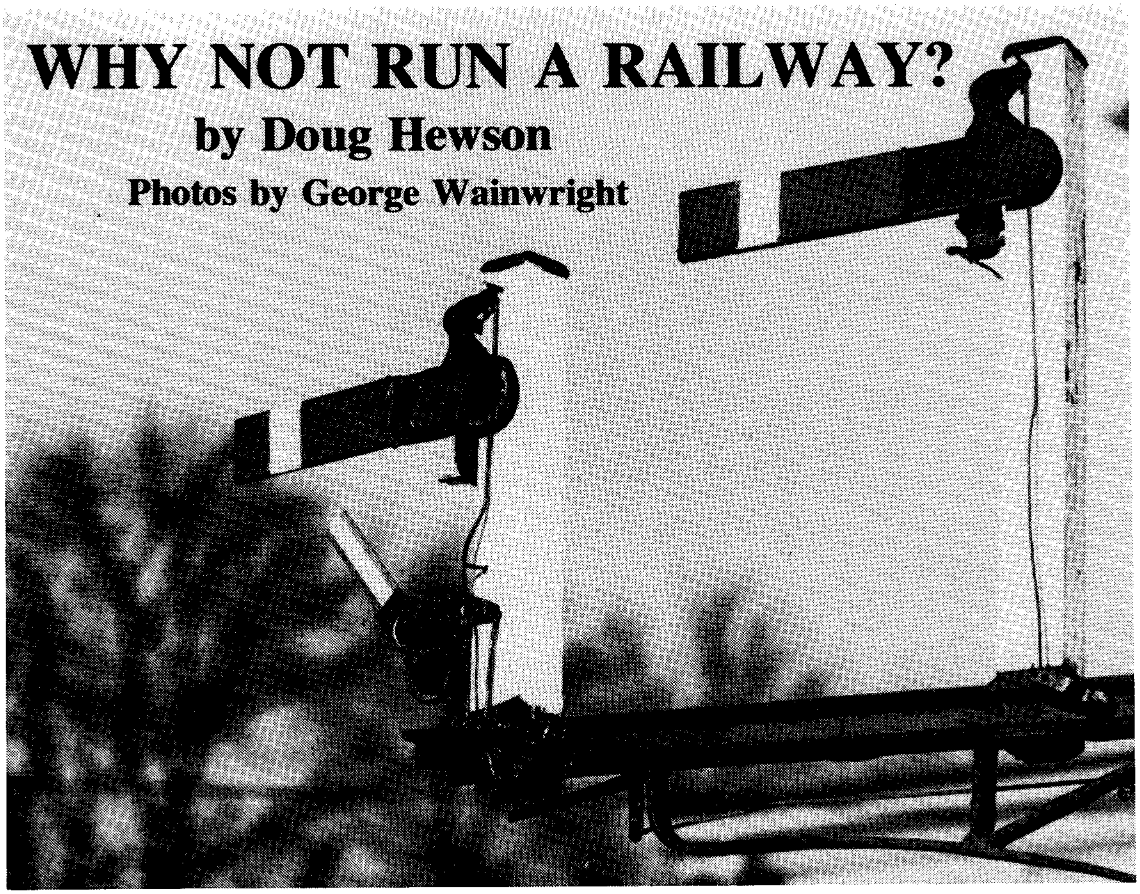


Dr. Alex Varga, Chief Councillor of the Hungarian State Railways, with three of his locos. That in the foreground is a 4-6-2 Patrick Stirling *following the L.N.E.R. prototype and is the climax of 50 years of modelling by Dr. Varga. The locos in the background are Hungarian — a 4-6-0 and a 4-8-0.*

WHY NOT RUN A RAILWAY?

by Doug Hewson

Photos by George Wainwright



Part III *From page 402*

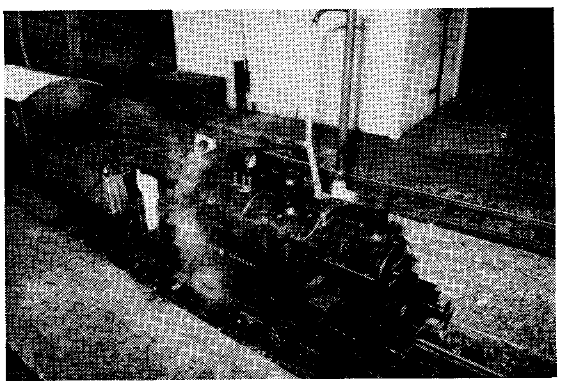
The concluding part of the series covers rolling stock and the signal and telegraph department

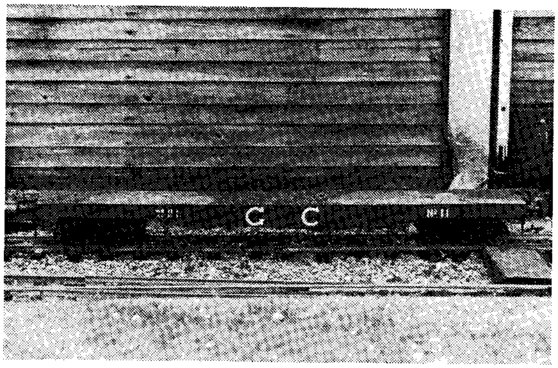
Development of Rolling Stock for Gresley Central

Back in the days of the Festival of Britain on the old tear drop layout the driving was more a question of a balancing act as the locos were driven from a kneeling position on a bogie flat. But, we have had an enthusiastic driver called Henry who had an accident one day. What happened was Henry backed into the tail then set off forwards on what he thought was going to be a left hand circuit. Ron had changed the points so the engine went to the right and Henry having already prepared his metabolism to go left went left, the engine jumped the points, ran across the lawn, wagons and all, and only stopped when it hit the apple tree at the far side of the lawn. Henry stopped when he hit the concrete footpath!

Henry's fortunate accident (poor Henry) had a two-fold advantage in that it brought about the first interlocked signal (more of which later) and a search for some better driving position.

As a realistic approach was paramount an experimental six-wheeled G.C. brake van was built with small footboards at solebar level so that one could sit on the roof, for comfort the chimney was omitted! This was quite a success though there was nowhere to hold coal and for most people the vehicle was rather on the short side for comfort as one had to drive a bit "hunched up". From these promising beginnings came the long bogie vans (running numbers 1, 2 and 3).



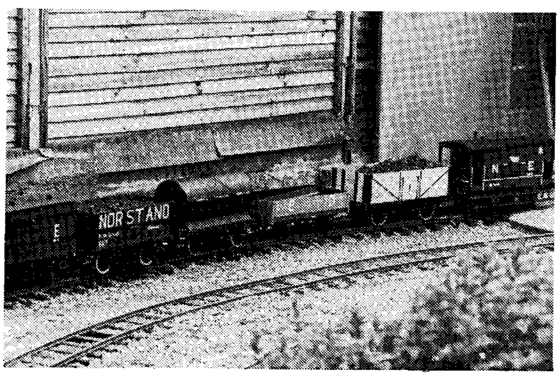


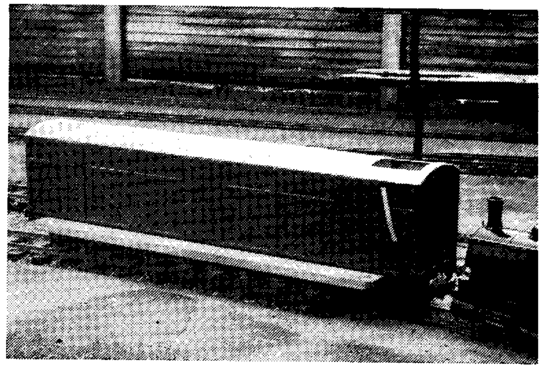
Left. Bracket number 17: the Holton main up starters and branch calling on arm pulled off.
Above. The original flat for kneeling driver, now replaced by the driving/riding van with integral coal hopper, shown right.

These vehicles are built from ⅜ in. marine ply as they used to stand outside, and have a coal bunker in the roof, one even has a mesh bottom to sieve the dust out. The funny thing is that no one has seen any coal dust on the track and the vehicle tare weight has to be altered (upwards) at every repaint! These vans serve a two-fold purpose as they are used to carry four or five children at fetes etc. on the portable ground level track and have lids to cover the coal bunkers for such occasions.

In a further quest for realism in the rolling stock department the next vehicles to come were the three bogie well wagons. Each one seats two children, one over each bogie with their feet in the middle. When not in use for passenger work the "croquet hoop" handles can be removed. The one drawback with these three vehicles is that sometimes the child facing backwards wants to turn round to see the engine and can cause a capsize.

Left. Taking water outside Holton Main Box at night.
Below. Scale stock including the North Eastern brake van.
Right. The bogie well wagon and G.C.R. 6-wheeled brake van.



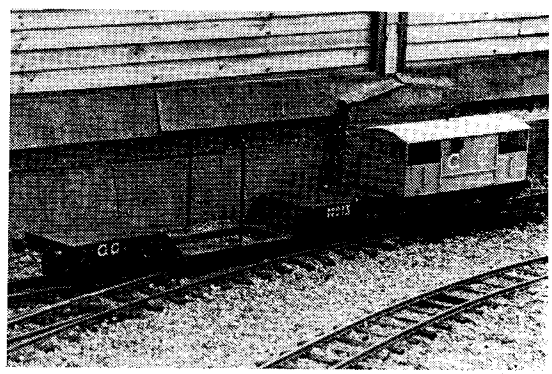


In 1964 the L. and Y. Pugs came on to the 5 in. gauge scene and it was found that from the bogie van driving trucks the cab was rather inaccessible. This led to the next development which was the bogie hybrid vehicle half van, half wagon. These are very comfortable to drive from and can house a water tank in the van section, the coal being carried in the open part. For driving a tender loco the wagon is turned round and a footrest placed through the tender frames.

Having acquired an old copper fire extinguisher the next item of rolling stock to appear from the Gresley Central works was a more or less scale four wheel tank wagon. This was built to carry water and piped with dummy vacuum pipes to carry the water through the driving truck, also piped through, for testing locos before tanks or tenders were built.

Around the same time a steel bodied open wagon was built similar to the sixteen ton all steel mineral wagons except with no side doors. The main use for this wagon was to hold a supply of coal for the vertical boiler used for works heating. The first job for a learner driver on steaming days was to take the wagon down to the coaling plant to fill it and return it to the workshop spur, now replaced by the turntable.

This operation is now defunct as when a wire was poked through to clean the bottom gauge glass fit-



ting out on the boiler it ended up visible through the firehole door! The wagon body has long since rusted away and been replaced with a scale seven plank mineral wagon body.

During the last few years a range of scale rolling stock has been built including two more brake vans. One is a model of the G.N.R. eight-wheeled van and the most recent addition is the N.E.R. 20 ton brake van.

Now that evening running is becoming commonplace the locos, brake vans and driving trucks are all being fitted with lamp brackets, not just ordinary ones but live ones. They are made from two insulated laminations of brass and electrified from a small battery either inside the van or in the loco tool box or cab. The lamps are fitted with light emitting diodes and pick the electricity up through the bracket.

To make up a reasonable train length further vehicles have been added including seven-plank private owners' wagons which have been painted in the liveries of local companies who used to own similar wagons.

The sole scale van on the line is a model of a G.N.R. eight ton goods van with double opening doors.

All the scale vehicles have working brake gear and really do need them pinning down when left unattended.

Signalling

As mentioned in the previous section, Henry was one of the main causes of the signalling installation but the other reasons for adding them were to allow more prototypical running and to add an attractive splash of colour to the railway scenery.

The first signal was a splitting home interlocked with the only point. To give the signal a scale appearance the articles on signals in the *M.E.* by O.S. Nock were delved into and a scale drawing prepared. To operate the arms, solenoids from the headlamp dippers of an old Morris car were used. The arms were scale models of the G.N.R. somersaults and the spectacles being glazed using coloured glass and lit from behind with a 12 volt bulb in a scale lamp housing.

As the layout grew so did the signalling system, all being interlocked with the pointwork. Eventually a lever frame had to be constructed and is now incorporated in Holton Main signal box. To save levers, signals working over one turnout are operated by one lever and the setting of the road determines which board goes off. You will see from the track diagram that there are three signals numbered eight but the one which goes off depends upon how crossovers 11 and 12 are set.

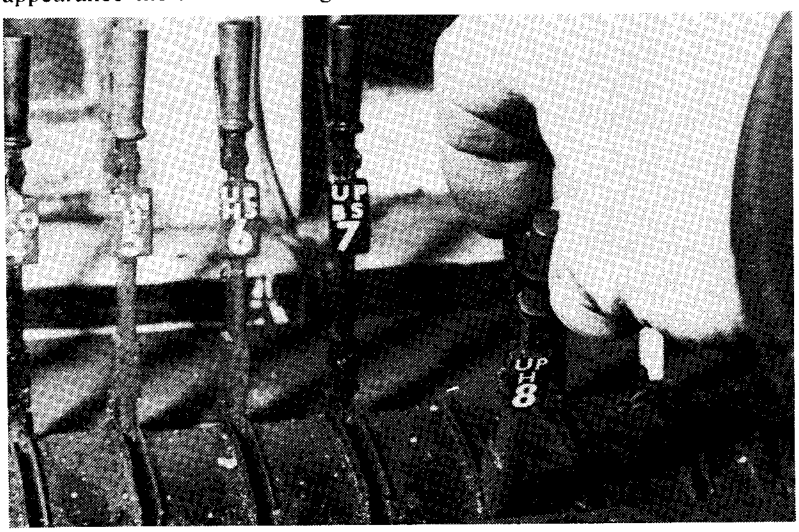
The leverframe at Holton Main is modelled as near as practicable to scale and has 24 levers including four spares. Bankside has ten levers with no spares.

All signal levers are electrically interlocked with the point levers and other conflicting signal levers, but there is no mechanical interlocking, in other words a wrong lever may still be pulled but it will not affect anything.

All pointwork operated from Holton Main is electrically operated but apart from the main junction turnouts three and nine all the pointwork at Bankside is rodded mechanically.

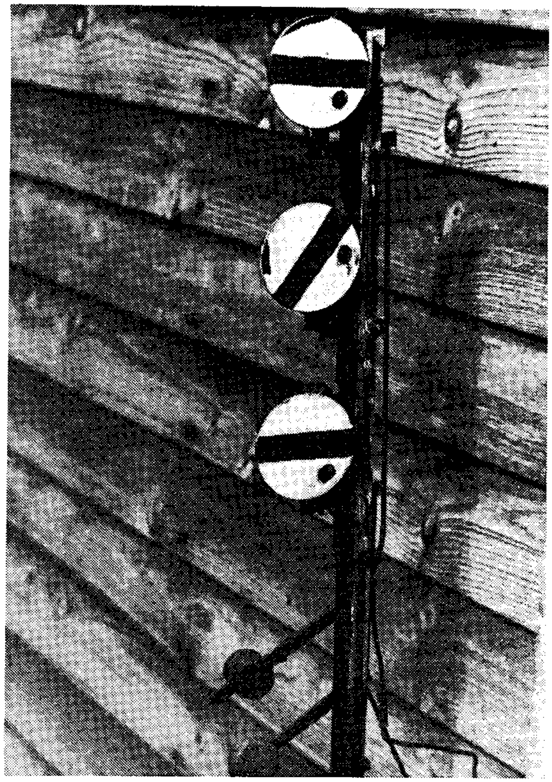
The signals controlling Bankside junction Nos. 13 and 14 are dual operated from both boxes. When only one signalman is available for duty Bankside is closed but when in operation he overrides the signals 13 and 14. The turnouts Nos. 3 and 9 at the junction are further protected by lever collars in Bankside Box so that it is unlikely that a signalman would pull one under a passing train by mistake.

There are three main types of signal in use on the



Left. Bankside Box frame: placing a collar on the lever to protect a loco standing at the signal.
Right. Wiring for the solenoid motor and interlocking switches for turnouts.

The ground discs controlling shunting at Holton main.



present layout. As mentioned earlier there are G.N.R. somersaults but there are also a number of G.C. lower quadrants and a few standard L.M.S./B.R. upper quadrants. In addition to this there is a stack of three circular dolls to control reversing movements on the down main at Holton Main, the top one is used to cross from down to up main, the centre one is used to reverse on the down main and the lower one is the down main to M.P.D. signal.

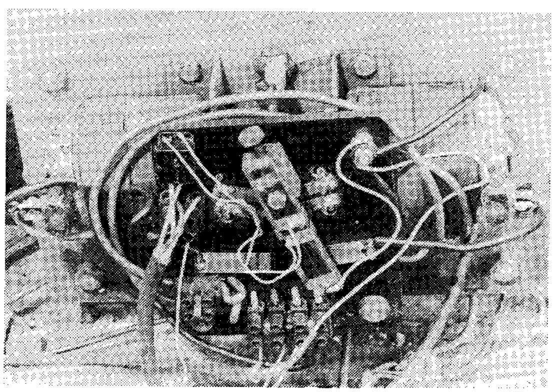
The only colour light signals on the layout are Holton Main down main outer home and the up advanced starter. The colours are changed by relays in the nearest point motor box. The only other oddity is No. 9 at Holton Main which is a calling on doll under the No. 8 gantry which is used for engine changes. A down train can be brought to a stand on the up line and the loco uncoupled and called on to the short length of track outside the box. The replacement engine is then brought out of the M.P.D. and backed across No. 11 crossover on to the train and away. The original loco can then be put over the road into the yard.

The two signal boxes are connected by block bell and telephone and both have internal lights for night working.

The job of the signalman is an absolute work of art if there are more than three engines in steam and particularly at night one has to remember where the locos are and make sure that they are kept apart.

Just to take you on a mental journey around Gresley Central we will imagine beginning at Holton Main station on platform three. We will be taking water at the column and giving the fire a once over as we wait for the up starter, the centre board on No. 17 bracket which is on the corner of the M.P.D.

Once the right away is given we pass over the points on to the single line section and rumble past the colour light advanced starter No. 18, by which time the engine is notched up and settling down to a steady beat. As we approach the first sharp curve



we are also on a rising gradient so down two notches and a good blast round the curve and into the shrubbery. Here the line begins to fall again so we can notch up through the trees, and put the pump on for a spell. On emerging we cross the spring points on to the double line section under No. 23 and away towards Bankside Junction.

The next board to look for is Bankside Junction home signal protecting the junction. Here we pass Bankside box and sidings on the left then over the points and past the carriage sheds on the right. Here again the curve is sharp and the gradient rising once more, so open the bypass, put the reverser down two notches again and round the curve past the second carriage shed and coaling plant.

As we come out of the curve we are looking to see which No. 6 board is off as this tells us which platform we are being directed into. No. 6 is Holton Main up home and for normal running we take the left hand road back into platform 3.

Well I hope you have enjoyed this series of articles and I hope that the article has provoked people into thinking seriously about laying ground level lines in the future, apart from the sheer enjoyment of being able to run the thing as a proper railway the track must be easier and cheaper to lay than one on trestles. Finally, if a derailment occurs the engines and passengers can only fall as far as the ballast.

48th Model Engineer Exhibition

The Hot Air Engine Competition

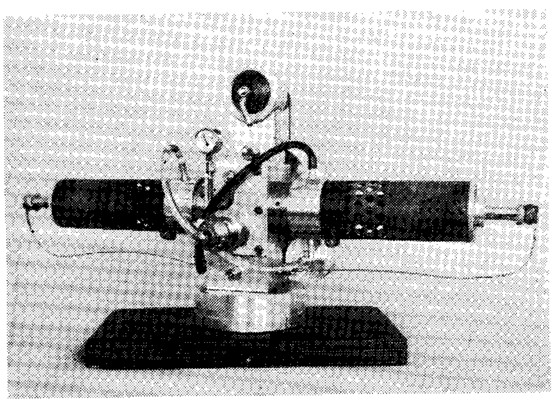
by Prof. D. H. Chaddock

THANKS TO THE GENEROSITY of a second donor, Wilson & Kyle of Brentford, Middlesex, who very kindly doubled the prize money already offered by Mr. A. N. Clark of Houthalen, Belgium, it was possible to divide the Hot Air Engine Competition into two classes and to offer substantial first and second cash prizes in each.

Class "A" limited engines to 5 cc per cylinder but allowed any number of cylinders to be used. The recorded power output was, however, to be divided by the number of cylinders so that single cylinder engines competed on equal terms with multis. Class "B" was open to any type of engine, single cylinder or multi, having a total cylinder capacity not exceeding 50 cc. The criterion here however was on a power to weight basis and the awards would go to the engines showing the best performance in terms of watts per pound or, as I suppose it should be in these days of metrication, watts per kilogram.

Torque was measured as in previous years by a friction brake with calibrated lever arm and weights and speed by mechanically driven revolution counter and stop watch. Power in watts (mechanical) was calculated from the measured torque and speed.

Unfortunately and in spite of the increased prize list the number of entries was not large and one, on account of the terrible weather conditions, failed to turn up, a great pity. However all were old friends who had taken part in previous competitions so very much of a club atmosphere prevailed.



First off the mark was Mr. F. Brian Thomas with a twin cylinder horizontally opposed rhombic drive engine. This engine, shown in Fig. 1, is really a twin cylinder version of his earlier engine with a single rhombic drive actuating pistons and displacers on opposite sides of the engine — not as simple as it sounds because a straight connection results in one engine going in the opposite direction to the other. The engine drives its own pressure and water circulating pumps and, for demonstration purposes, a small dynamo although when the power tests were being run this was disconnected.

Like all Mr. Thomas's engines it did best when it was given its head and allowed to run at considerable speed. It did best pulling a load of 3.5 oz/ins at 2,260 r.p.m. representing a power output of 5.85 watts (mechanical). This had to be divided by two of course because of the twin cylinders but at 2.93 watts/5 cc the engine took First Prize in Class "A".

It is of interest though to compare this result with that obtained last year when a very similar single cylinder engine turned in 3.71 watts at 1670 r.p.m. It would seem therefore that the added complication and friction of twin cylinders have not improved the overall performance and a really successful multi-cylinder hot air engine has yet to be developed.

Second in this class came a really delightful model by Mr. T. H. Mallett of a Denney Ericsson Pumping Engine. Although not intended as a power producer at all, the model had been fitted with a temporary return crank so that the friction brake could be attached and the power measured. With its rocking beam and nodding bell crank, counterweighted against the weight of the non-existent pump rods, as is to be seen in Fig. 2, the model presented a delightful appearance when in motion.

Mr. Mallett intends to complete his model actually to pump water and I do hope he will replace the

Fig. 1. The winner in Class A, F. Brian Thomas' twin cylinder horizontally-opposed rhombic drive engine driving its own pressure and water circulating pumps and, for demonstration purposes, a cycle-type dynamo.

rather inappropriate spirit lamp by a real solid fuel fire. These engines take so little heat to run them that I am sure that a gently glowing charcoal or smokeless fuel fire will keep it in stately motion with the added attraction of having to stoke the fire from time to time!

On its power test it really did quite well pulling 0.75 oz/ins at 698 r.p.m. representing a power output of 0.39 watts, which of course did not have to be divided because the engine was a single cylinder of 5 cc capacity. More importantly in view of its intended use as a pump the engine held its torque over a considerable speed range and even at 411 r.p.m. was still turning out 0.30 watts.

Class "B" was of course open to all these competitors and the results could not be determined until all the engines had been tested. The dark horse here was Mr. M. Collins' single cylinder 6 cc displacer engine "Phoelix". Originally built as a very simple engine to test the wearing properties of a P.T.F.E. cup-washer type piston in an "as drawn" brass cylinder, the engine was of the simplest possible construction and incorporated a low power, maximum 100 watt, electrical resistance heater for the hot cylinder. In this form it could be left running, virtually unattended, for hours, days and weeks and when it reached the exhibition it had already reached the incredible total of over 6000 hours running! 'Phoelix" we can only suppose is an alternative spelling of "Felix"!

Like its famous namesake and still running it was put on brake test, with the cycle dynamo which is its normal load disconnected, and returned a very respectable 2.00 watts at 763 r.p.m. The surprise came however when the power to weight ratio was calculated, it dead-heated with Mr. Thomas's engine, 2.0 watts for 1 lb 6 ozs and 5.85 watts for 4 lbs respectively both giving, within the limits of experimental error, a power to weight ratio of 1.45 watts/lb.

At the suggestion of the Judge and to which both competitors willingly and sportingly agreed it was decided to give the First Prize in Class "B" to "Phoelix", particularly as several thousand hours earlier in its career it had recorded 2.5 watts which would have made it a clear winner. During the rest of the exhibition it continued to run on the S.M.E.E. stand from opening to closing time each day, thereby logging up a mere extra 80 hours to its already impressive total.

Because this engine was electrically heated it was very easy to estimate its overall thermal efficiency. With 100 watts going in and 2.5 watts (in the earlier tests) coming out, the thermal efficiency was clearly 2.5 per cent; better than any of the much larger steam engines tested in the IMLEC trials. Indeed it is questionable whether any steam engine of 6 cc capacity could even be made to run on a heat input of no more than 100 watts — a not very large electric lamp in the firebox!

Hot Air Engines are thermally efficient, the only problem is to get them to absorb more heat and in doing so produce more power in relation to their size.

We were very glad to see a former competitor, Mr. D. Urwick, who had made a special trip from Malta with his latest engine. Only completed just before the trip, it was barely run-in and no time had been available for tuning up or development. As may be seen from Fig. 4 it is a most ambitious project with no less than 12 power cylinders and six moving regenerators all driven by a single "nutator" or "Z" crank.

The exact cycle on which the engine works has been the subject of some discussion among the experts. Is it a Stirling or a Rider? Each moving regenerator has coupled to it a "cold" piston thereby avoiding the "hot" cylinder of the normal Rider. Such an arrangement would of course produce no power so each "cold" cylinder is connected by an air passageway to another at 90 deg. phase angle to it, i.e. the 12 o'clock cylinder is connected to the 3 o'clock cylinder, the 1 o'clock to the 4 o'clock and so on, the nett result being three sets of connections inside and three outside the circle of cylinders.

Six gas burners heat the regenerator cylinders

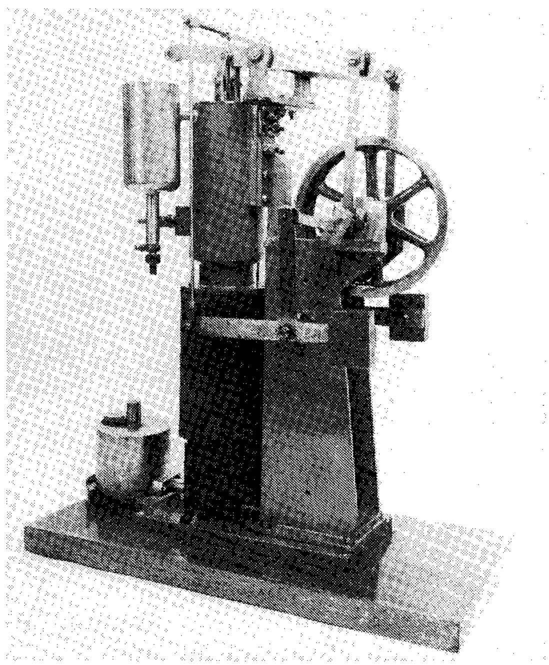
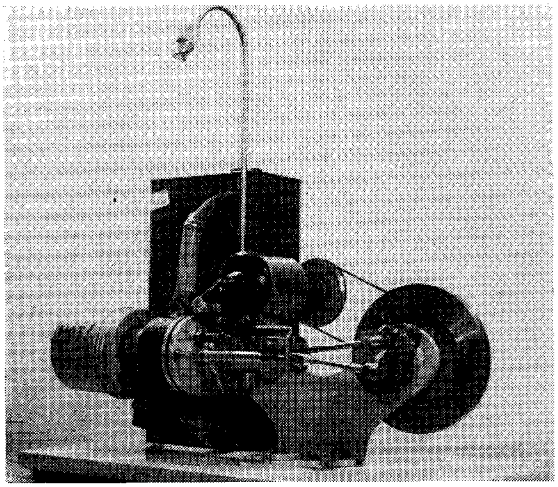


Fig. 2. Runner up in Class A, T. H. Mallett's Denney Ericsson pumping engine. The pump was not yet fitted and a temporary return crank was attached to the crankshaft for power tests.



and the engine is designed to work with a sealed and pressurised crankcase, there being no unbalanced gas forces on any of the pistons. That such a complex engine should run at all at the first time of asking is no mean achievement in itself, but not yet pressurised or even fully run-in 0.89 watts at 480 r.p.m. and a free speed of 960 r.p.m. was a promising start.

In view of the originality of the concept and the amount of work put into its realisation the engine was awarded the Edgar T. Westbury Memorial Trophy, a decision which I am sure would have delighted the heart of the late E.T.W. with his interest in experimental work of all sorts and hot air engines in particular, although it did not win an award in the hot air engine competition *per se*.

Fig. 3. Phoelix, *the winner of a tie in Class B after running more than 6000 hours on test.*

Rules for the 1980 Model Engineer Hot Air Engine Competition

To be held at the 1980 Model Engineer Exhibition

A FOURTH COMPETITION to encourage the design and building of model hot air engines will be held at the 1980 Model Engineer Exhibition. Prizes have again been generously donated and Professor D. H. Chaddock, C.B.E., will again conduct the Trials and act as Judge. In order to continue a wider range of development the competition will again be open to two Classes of entry, the rules of which will be as follows:

1. 5 cc. Class 'A'. The swept volume of a single working cylinder shall not exceed 5 cc. Multi-cylinder engines, i.e. engines having more than one complete and separate working space, shall not exceed 5 cc. per cylinder and the total recorded power shall be divided by the number of cylinders in assessing the results. Double acting cylinders shall be treated as multi-cylinders provided that the working spaces are entirely separate.

2. 50 cc. Class 'B'. Any engine, single or multi-cylinder, having a total capacity not exceeding 50 cc. The Prize will be awarded to the engine having the highest power to weight ratio, that is to say power divided by weight. The weight of the engine will not include any fuel or water tanks, radiators, fans or circulating water pumps if not built into the engine, nor any base or sub-frame upon which the engine may be mounted for test purposes. It will, however, include burners and flame guards which must comply with the regulations, flywheel and, if it is essential to the operation of the engine, any built-in air pump.

General regulations applicable to both Classes

3. The engine entered must be the unaided work of the competitor.

4. No entry will be accepted from a professional model maker.

5. The decision of the Judge/s will be final.

6. Engines may operate on an open or closed cycle. The working fluid may be other than air and may be pressurised to a static pressure not exceeding 100 p.s.i.g. Engines may be pressurised either by:

(a) An air pump continuously driven by the engine, but no allowance will be made for the power absorbed in so doing.

(b) From an external source, foot or hand pump, at least one hour before the start of the trial, after which they will be disconnected and no further topping-up or re-pressurisation allowed.

(c) Externally driven pumps and/or the permanent connection of the engine to a reservoir or container other than that of the engine itself will not be allowed.

(d) All engines intended for pressurisation shall be equipped with accurate pressure gauges and safety valves or blow-out discs set to act at not more than 10 per cent above the maximum cyclic pressure.

(e) Before running, all engines intended for pressurisation shall be subject to a cold static pressure test to twice the maximum cyclic pressure or a certificate to the effect that such a test has been carried out shall be submitted.

7. Internal combustion and liquid/vapour cycle engines will not be accepted.

8. In engines having two or more pistons connected to the same working space the swept volume shall be the difference between the maximum and minimum volumes of the working space.

9. Working fluids other than air may be used but inflammable and explosive gases such as hydrogen

And so another year has come and gone and there will definitely be another competition next year. The rules will be much the same because I think they have encouraged development along the right lines, maximum power per cc and maximum power per pound weight with engines of reasonable size and bulk. Now that hot air engines have shown that they can produce usable amounts of power a new class might be introduced for hot air engine generating sets or pumps in which the useful output would be measured by the amount of electricity generated or water pumped. Both would be very easy to measure accurately and would make attractive models which "did" something instead of turning round idly. Suggestions to me care of *Model Engineer* please!

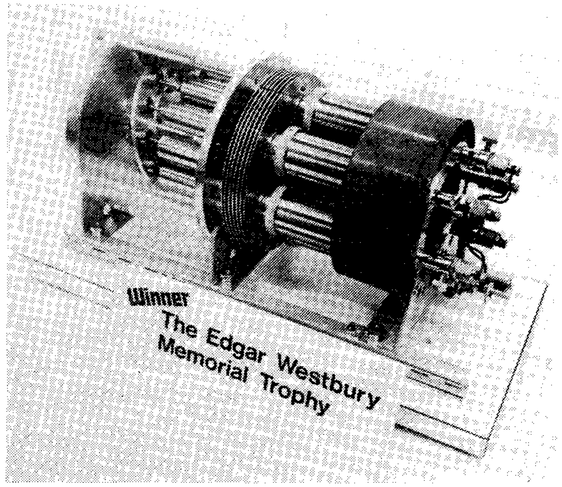


Fig. 4. A 12-cylinder, 6 moving regenerator engine by D. Urwick.

will not be permitted. In engines pressurised with air, or other gas containing oxygen, hydro-carbon lubricants which might evolve explosive vapours when heated shall be excluded from the working space.

10. The fuel tanks of engines fired by liquid fuels, methylated spirit, paraffin, petrol etc. shall not contain more than 100 cc. (3½ fluid oz. approx.). The tanks must be made of brass or copper with all joints silver soldered or brazed. Tinplate tanks with soft soldered joints will not be permitted. All tanks must be readily removable from the engine and fitted with screwed stoppers so they may be filled and closed outside the exhibition area.

11. Engines fired by butane, propane, Calor gas, Camping gas etc. shall be connected to the supply cylinders by copper pipes and screwed unions or by commercially available and approved flexible pipes with screwed unions. Push-on plastic or rubber tubes will not be permitted. Preferably standard commercially available Camping Gaz containers and fittings shall be used but other commercially available fittings and containers may be used. Modifications to manufacturers' equipment will not be permitted.

12. For engines not equipped with their own gas supply the connection to the burners shall terminate in a male union with a ¼ in. x 40 t.p.i. thread and an internal conical seating of 60 deg. included angle for connection to gas supplies which will be provided by the organisers.

13. All engines shall be equipped with furnaces or flame guards so that no external flame is visible when the engine is running. Stop cocks, dampers or the like shall be provided so that the flame may be rapidly extinguished in emergency.

14. The power output of the engine will be measured by a friction brake with a lever arm and weights.

15. Speed measurement will be by revolution counter and stop-watch.

16. All engines must have a standard output shaft 5/32 in. dia. and approximately ¾ in. long.

17. All engines will be scrutinised by the Judge/s before being allowed to take part in the competition and may be refused permission to run if in their opinion the design, workmanship or construction might constitute a hazard to safety. The Judge/s may also order a trial to be terminated if in their opinion a hazard to safety has or might develop.

18. Competitors have the option to run their own engines themselves under the scrutiny of the Judge/s.

19. Competitors not intending to run their own engines should submit with their entry notes for the Judge/s regarding lubrication, firing, warming up procedure, maximum and minimum speed at which the engine should be run, etc.

20. The duration of each run shall be left to the discretion of the Judge/s.

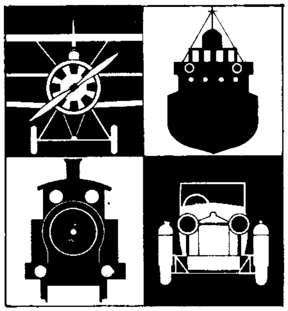
21. Winners will be required to submit details, photographs and drawings of their engine to the Editor for publication in *Model Engineer*.

22. Although every care will be taken the Organisers will not be held responsible for any damage to the engines during the trials.

23. Details of entries must be sent to the Exhibition Manager, M.A.P. Ltd., not later than 26 October 1979. Entry is free.

Prizes

1. A first prize of £50 for the engine developing the highest horsepower per cylinder in Class "A".
2. A first prize of £50 for the engine developing the highest horsepower per pound weight in Class "B".
3. In the event that either or both of these classes are won by engines not operating on air a second prize of £25 in each class for the best engine using air as its working fluid will be awarded.



48th Model Engineer Exhibition

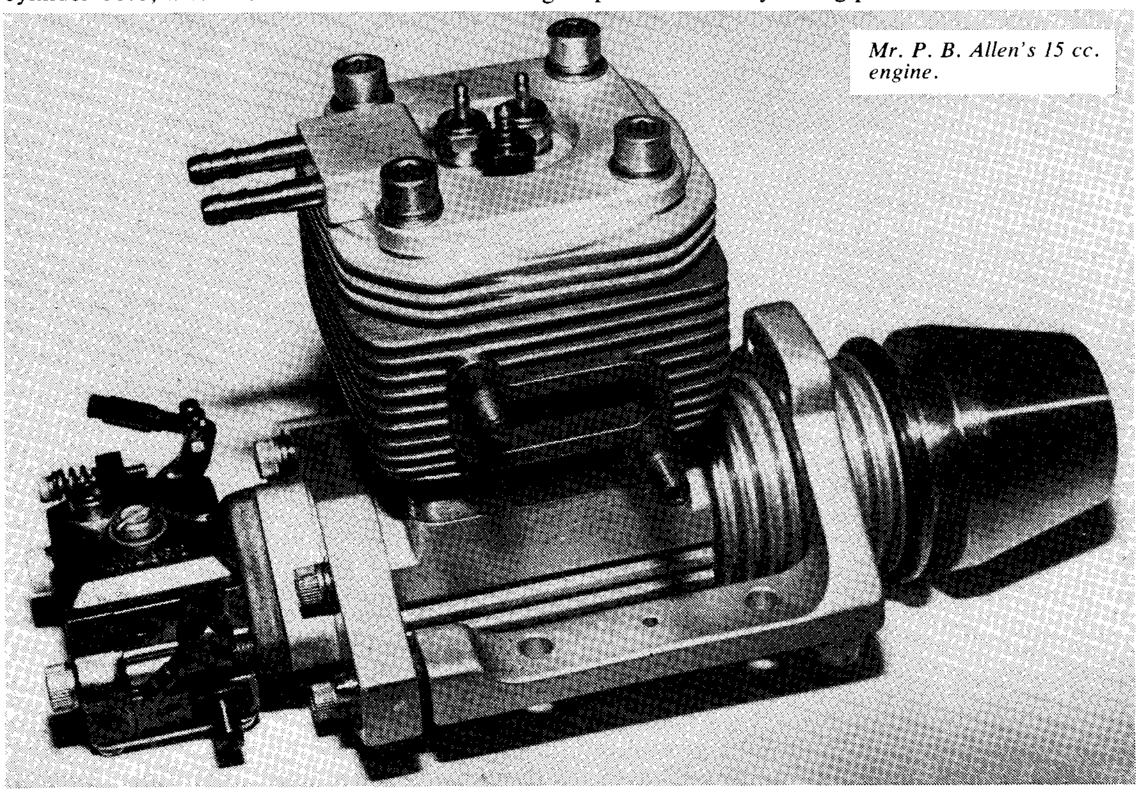
Class K, Internal Combustion Engines, and the Students Cup by Prof. D. H. Chaddock

THE ENTRIES in Class K this year were disappointingly small, only two in fact made the show benches and were eligible for competition but, as both were from that master craftsman and designer Mr. P. B. Allen, the quality was of the highest. Like all his engines they were built entirely from scratch, incorporate many novel features and materials in their construction and are designed for arduous power boat racing conditions.

The 15 cc. engine, for example, seen below is not only very much over-square but has an air-cooled cylinder and a water-cooled head incorporating no fewer than three glow plugs. The resulting combination of lavish porting and multiple ignition gives the engine an outstanding turn of speed and power which is safely handled by a chromium plated cylinder bore, a stainless steel crankshaft running on a single roller race and a ball bearing and needle rollers throughout. The entire engine is mounted in an anti-vibration sub-frame.

The 3.5 cc. was an even further development of these ideas and in addition incorporated some quite new ones for which on account of the novelty of design, excellence of workmanship and suitability of material they were Very Highly Commended.

Also on display by Mr. Allen but not in competition was an example of a Fox Twin 22 cc. engine which has been the subject of a series of tuning-up exercises. As these will shortly form the subject of a series of articles by Mr. Allen in *Model Engineer* it would be premature to describe them now except to say that they enable the owner progressively to raise the performance of his engine from touring to sports and finally racing performance.



Mr. P. B. Allen's 15 cc. engine.

The Students Cup

Two of our most regular contestants appeared once again in the Students' Cup, namely the apprentices of the Westinghouse Brake and Signal Co. and Thomas Mercer Ltd. This year victory went to Chippenham for a very fine 5 in. gauge, 4-6-0, *Torquay Manor* to Martin Evans' design. This was a very considerable piece of work indeed occupying some 23,140 hours, 11½ man/years, in its construction so that one wonders how time was found to do anything else unless, as was probably the case, it was the work of many hands over a long period of time. In any event they had made a splendid job of it and there was no indication anywhere of less than an exceptionally high standard of workmanship.

From St Albans we have come to expect the highest standard of the instrument maker's skill and this year's entry was a perpetual calendar, that is to say a calendar which not only shows the year, the month, the day of the week and the date but corrects itself for the length of the month, leap years and, wait for it, no leap year at the end of a century. Although this can and has been done mechanically, Mercer's apprentices had chosen the simpler and more straightforward electro/mechanical solution.

Although in keeping with what would certainly be modern practice this reduces the visual appeal which was not enhanced by a plain rectangular wooden case of rather unpleasing proportions with the various alpha-numerics peeping through unadorned rectangular holes. In fact the most interesting display was from the back which had been encased in "Perspex" and through which the motion — when it occurred — was visible and the whole entry would have been much more interesting if it had been driven by a slave timer giving "day" impulses say every second so that in less than a minute's watching one could see that it really did account for long and short months and, with a bit more watching, leap years.

Chew Valley School entered a 7¼ in. gauge, 0-6-0 saddle tank locomotive which although it was soundly built and reasonably well finished did not come up to the standard of *Torquay Manor*. It, together with the perpetual calendar, were, however, both Highly Commended.

CLUB DIARY

Dates should be sent at least five weeks before the event to ensure publication. Please state venue and time. While every care is taken, we cannot accept responsibility for errors.

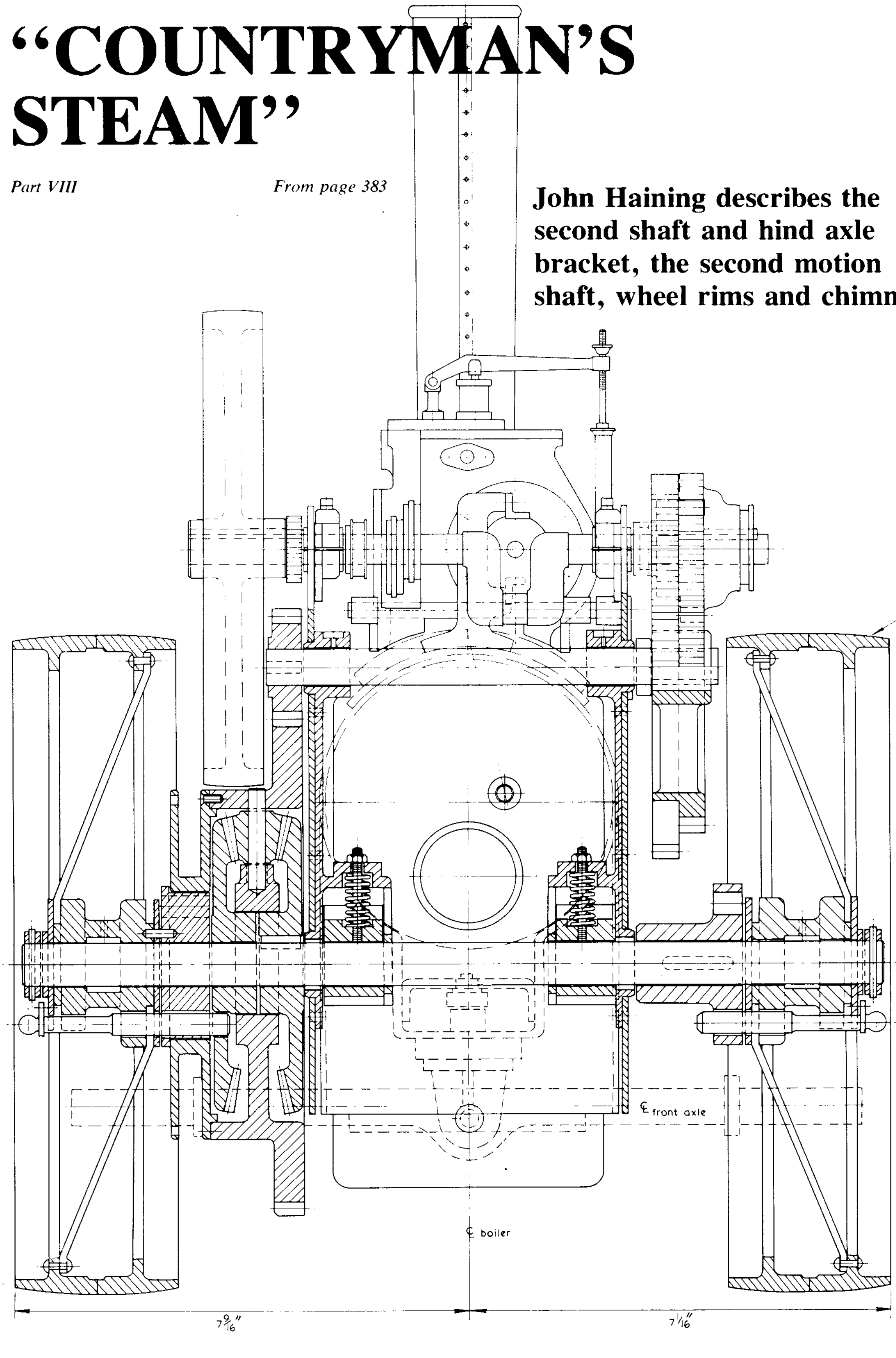
MAY

4 Model Engineers' Society (Northern Ireland). Monthly meeting in Cregagh Library, Belfast. 7.30 p.m.
4 Stockport & District S.M.E. Bits and Pieces.
4 Romford M.E.C. Competition night.
5 S.M.E.E. Headquarters Clean-Up.
5 Ickenham & District S.M.E. Public Track Run at Ickenham.
5 Ilford & W. Essex M.R.C. Annual Open Day. Admission Free. Venue adjoining Chadwell Heath (B.R.) Railway Station. 10 a.m. to 5 p.m.
5-6-7 Bala Lake Railway Society. "Wren Weekend" Steam Gala.
5-6-7 King's Lynn & District S.M.E. Walpole Traction Engine Rally — Track and Exhibition.
6 Malden & District S.M.E. Public Running Days.
6 Andover & District M.E.S. A.D.M.E.S. Open Day at Red Rice, Andover.
6 Cannock Chase M.E.S. "Steam Up" Cannock Park. 2 p.m.
6 Guildford M.E.S. First Running Day for Members at HQ, Stoke Park.
6-7 Howard Halesworth M.E.S. A Model Engineering Bonanza at Agricultural Museum, Alexander Wood Farm, Sotterly, Nr. Brampton, Beccles, Suffolk. 11 a.m. to 6 p.m. daily.
7 Whitchurch & District M.E.S. Members' Day at Highfield Road.
7 Malden & District S.M.E. Public Running Days.
7 Peterborough S.M.E. Bank Holiday — running day.
7 City of Leeds S.M.E.E. Ravenglass & Eskdale — A film show given and arranged by Mr. Bell.
7 Clyde Shiplovers and M.M. Society. Open Night. Partick Halls, Burgh Hall Street, Glasgow. 7.30 p.m.
8 Guildford M.E.S. Executive Committee Meeting.
9 Cannock Chase M.E.S. Meeting Lea Hall Club — "Types of Valve Gears", W. Childs. 7.30 p.m.
9 Historical Model Railway Society. Talk by R. W. Miller — "The Architecture of the Cheshire Lines Committee". Venue The Y.M.C.A., Olad Palace, Vicar's Lane, Chester. 7.30 p.m.
9 Harrow & Wembley S.M.E. Loco Meeting — St. Andrew's Hall.
10 Leyland, Preston and District S.M.E. Meeting.
12 Historical Model Railway Society. Talk — D. Rowland on "Improving the Breed". Venue The Railway Engineering School, corner of London Road/Ascot Drive, Derby. 2 p.m.
12 Witney & W. Oxfordshire S.M.E. Annual Open Day.
12 Andover & District M.E.S. Visit to "Bluebell Railway" coach trip.
13 Harlington Loco Society. Public Open Day. 2-6 p.m.
13 RM & RIOR Yachts. Bawsey 20p Points Races. 10.30 a.m.
13 Romney Marsh M.E.S. Visit (by coach) to Steam Museum at Fawley Hill, Henley-on-Thames.
13 King's Lynn & District S.M.E. Club Meeting Night.
14 Peterborough S.M.E. Meeting Lincoln Road Clubhouse. 7.30 p.m.
14 Historical Model Railway Society. Talk by D. J. Hyde and A. Atkins on "G.W. Wagons". Keen House, 4 Calshot Street, London N1. 7.30 p.m.
15 Milton Keynes Model Society. Start of the summer season with the first meeting outside at the flying field, Old Wolverton Road, Wolverton.
16 Andover & District M.E.S. "Steam Up" evening at Red Rice.
16 Bristol S.M.E.E. On the table.
16 Historical Model Railway Society. Talk on "The Electrical Side of Railway Modelling". The Golden Lion Hotel, Worcester Road, Bromsgrove. 7.30 p.m.
16 Guildford M.E.S. Final Bits and Pieces Competition at HQ, Stoke Park. 7.45 p.m.
17 Hull S.M.E. Archery — A talk by Charles Smith, Trades & Labour Club (Room 3), Beverley Road, Hull. 7.45 p.m.

"COUNTRYMAN'S STEAM"

Part VIII *From page 383*

John Haining describes the second shaft and hind axle bracket, the second motion shaft, wheel rims and chimney



THE CROSS-SECTIONED VIEW on the hind axle shows the nearside hind wheel slightly offset to allow for the width of the compensating gear and winding drum. This was a not uncommon feature of a number of engines, particularly when allowance had to be made for a wide flywheel as well.

The drawing also shows the rather unusual type of hind wheel hub, with the usual pear-shaped lobe formed on the inside spoke housing flange only, the outer one being to allow the driving pin to pass through. The hubs are relieved on the inside bore but I have not shown them bushed; there is enough metal thickness to allow for this to be done if anyone wants to insert a couple of hard brass bushes either when building the engine or later on, to take up any wear which may have occurred. Obviously there should not be much wrong on this score anyway.

The small road-gear pinion on the nearside end of the second-shaft meshes with the final drive gear which is formed in one with the compensating gear housing. To the outer end of the housing is bolted the winding drum, removal of the nearside driving-pin freeing the nearside bevel wheel of the compensating gear and allowing the winding drum to rotate with the final drive gear, while the offside hindwheel remains stationary through the action of the compensating gear bevel pinions running around the nearside bevel wheel.

A disadvantage of this type of winding drum drive is the inability of the drum to spin freely when paying out the wire rope. Only the inner bevel gear wheel is keyed to the axle shaft. This transmits the drive via a circular drive-plate keyed to the axle shaft just behind the offside wheel, the driving pin of which engages with the drive-plate to transmit motion to the hub.

The wheels will be fully detailed in a later article but I have included a drawing showing details of tee rings for both front and hind wheels.

These rings are machined from heavy gauge steel tube supplied by T. I. Markland Ltd., Bolton, Lancs., who will supply rings to any required width. Allow about one-eighth of an inch each side for cleaning up to finished width.

Two points to note for those builders who want to get ahead with this turning work; firstly, the hind wheels normally consist of two tee rings joined together by the steel strakes, and sometimes fitted with an additional inner plate ring between the legs of the two tees. It seemed a pity to go to all the trouble of parting-off two separate rings for each wheel, particularly as once joined up together they will never be taken apart again, so the whole of each wheel is turned as one piece with just a 1/32 in. groove cut on the outside, as shown on the drawing to simulate the division between each vee ring. This makes a good strong job.

Secondly, the front wheel tee rings (a single tee to each wheel on this engine) have the tyre turned in one with the ring. Machining off material from the outside of each tee ring only to have to add it again in the form of a separate tyre seemed wasteful, particularly in this age of expensive material and ever-rising costs of everything connected with the workshop.

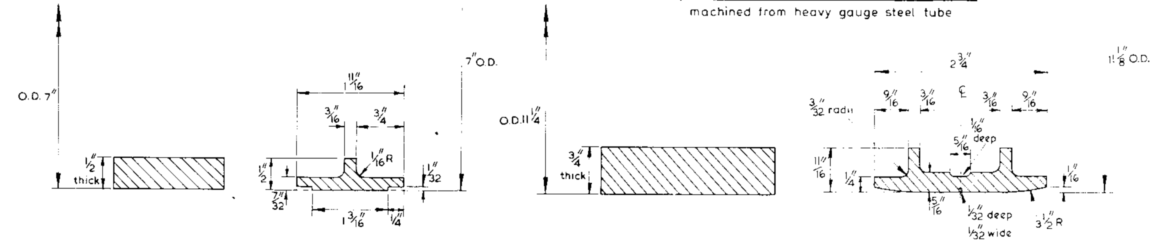
My wheel drawing will show the positions for the diagonal cuts across the raised tyre section to represent joints in the attached tyre. These heavy gauge steel tube sections are first class material and I have used them for the 2 in. scale Ransomes steam tractor as well as for this engine and some 2 in. scale Fowler implements as well. Anyway, this should give the wheel builders a nice bit of turning to get on with while I finish the drawings covering the four wheels and the front axle.

Looking again at the cross-sectional view of the engine, I have shown an alternative arrangement for the nearside, omitting the compensating gear and driving direct from the hub of the final drive road gear which is keyed to the shaft to provide drive to the offside driving-plate and wheel.

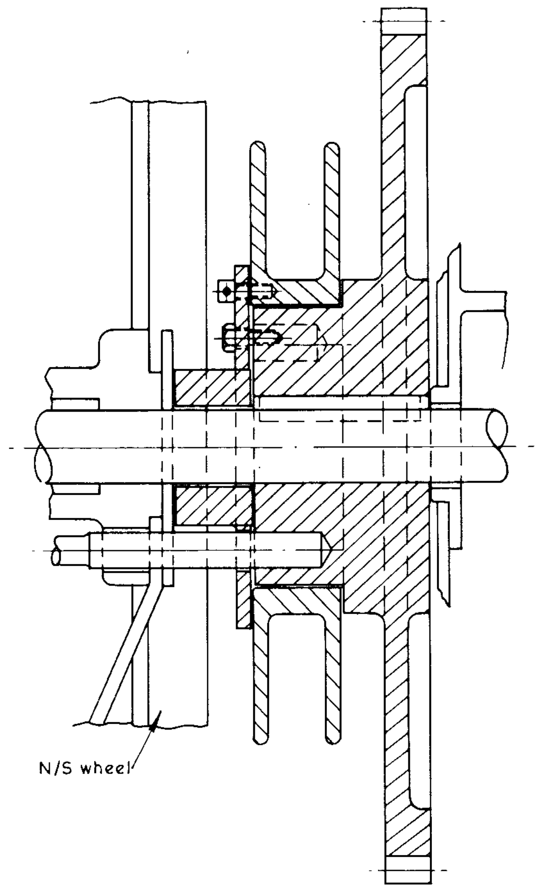
This alternative method is included for those readers who don't want the extra expense and/or work of the compensating gear, two bevel wheels and three bevel pinions plus housing, etc. This also has the advantage in that the winding drum can be freed entirely by removal of one small pin, for running out the wire rope, but is balanced by the disadvantage of having to remove *both* driving pins

TEE RINGS FOR ROAD WHEELS

machined from heavy gauge steel tube



SECTION THRO' STEEL TUBE — SECTION THRO' FRONT WHEEL TEE RING — SECTION THRO' STEEL TUBE BEFORE MACHINING — SECTION THRO' HIND WHEEL TEE RINGS



ALTERNATIVE ARRANGEMENT OF HIND AXLE ROAD GEAR & WINDING DRUM, WITHOUT COMPENSATING GEAR.

instead of just the nearside one, to use the drum. The second motion shaft and hind axle are also detailed on the drawing; when assembled the hind axle ends should lie 1/8 in. inside the edge of each wheel.

The key securing the small road gear pinion to the nearside end of the second shaft is the only one which is not inset and contained in its keyway. It is also shorter than I would like, as there is very little space to spare between each end of shaft and inside of flywheel rim.

Mine is already fitted to the shaft, but in hindsight this would be better as a 1/4 in. key, and should preferably be pinned into the keyway or at least bonded in place with Loctite.

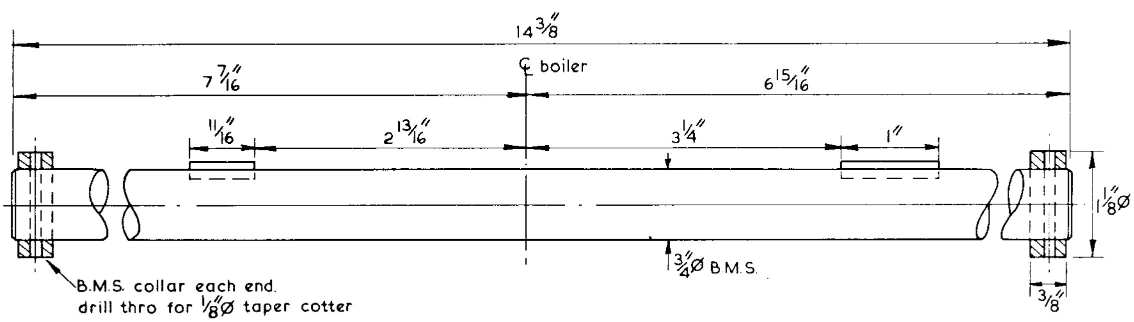
The engine is spring mounted on the hind axle only, the amount of up and down movement being limited in order not to allow any chance of disengagement between the road gear teeth, or excessively deep engagement. All road gears are 8 D.P., which gives a correct scale reproduction of the full-size gear tooth form, and a total tooth depth of .27 in. so it should not be possible to disengage teeth even with maximum spring movement.

The second motion shaft and hind axle combined bracket, to quote its full and sonorous title, is shown fitting inside each hornplate, with a 3/16 in. deep spigot, projecting into and registering in the two holes in each hornplate.

An axlebox, bored a running fit with the axle shaft, fits between the horns of each bracket. It is free to slide vertically a total distance of 1/16 in. above and below the horizontal centreline, the weight of the engine being supported by a single coil spring above each axlebox, with a No. 2 BA centre tie-stud screwing into the top of each box, and fitted with a hexagon nut and washer at the top where it passes through the boss of the bracket horns.

This early form of spring-mounting, while very simple and uncomplicated, does leave a lot to be desired when applied to a gear-driven road engine; careful adjustment will be needed to obtain the cor-

Keyways in both shafts to be B.S. standard rectangular 3/16" wide
Max. width of keyway = ·1875"
Min. depth on ℄ = ·0935"



HIND AXLE SHAFT

rect initial gear tooth meshing and spring loading. The most likely hazard is that of overmeshing if the spring is of too low a rating. I am experimenting with a bracket and axle box, using different springs and varied loadings in order to determine whether the springs I have already obtained are going to be satisfactory under all conditions. More about this later in the series. Even if rather "nominal" in action, this layout of axlebox and spring has the advantage of being very easily convertible to solid mounting by substituting a steel sleeve for the spring and locking the axle on the correct gear centreline.

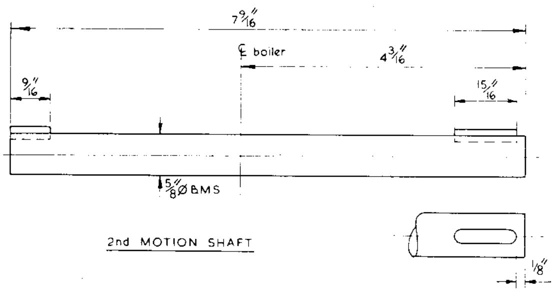
As a boy, I remember an old yard engine used by a local contractor with a similar springing layout on the hind axle. When traversing rough ground the road gear teeth, worn to a dull silver colour by neglect and lack of lubrication combined with badly adjusted or broken springs, would alternatively over-mesh with a fearsome grinding sound or temporarily bounce out of mesh with a noise like a gigantic football rattle. Even with this ill-treatment that old engine survived until the late 'thirties, which says something for the old cast gears with un-machined teeth, run-in before being fitted, on a mixture of sand and water or oil.

The bracket and axlebox — identical for both off and near sides — will be produced as a casting, but both lend themselves to fabrication as an alternative method. If building-up and fabricating, cut the flat area out first, leaving it as a 2 in. wide strip. Drill 7/8 in. dia., insert and silver solder the top (second shaft) boss, which should be turned from a length of 1 in. dia. bar but left unbored at this stage.

Check for flatness of the plate, and then silver solder in place the top piece of the hornblock, complete with boss, following this with the 1/8 in. thick by 3/16 in. deep rib running from the top boss down to the top of the hornblock. Check again for bowing or distortion before finishing off with the hornblock side pieces. Cut out the two lengths each side of the 2 in. wide plate to form the waist.

To line-bore both together — this applies whether fabrication or castings are used — clean up the outer faces and bolt together with two pieces of 3/8 in. packing between, starting with a pilot drill through the two bosses after mounting on the vertical slide. Follow this by finish boring the bosses before moving onto the bottom elongated axle-shaft hole. Be careful not to exceed the 1/16 in. off-centre each side of the horizontal centreline when elongating the 3/4 in. dia. hole. The axleboxes must slide freely but not sloppily in the vertical horns and cleaning up the inside of the hornblock to obtain a good finish for the axlebox to slide in is, I'm afraid, going to be a filing job.

When fitting the offside bracket, use countersunk head screws in way of the reach-rod, with nuts *inside*, to avoid fouling the reach rod where it passes outside the hornplate and behind the double gearwheels on the second shaft.



2nd MOTION SHAFT

Like many engines of the period, the chimney was tall and capped only by a rim of half-round iron beading; it sat on a cast-iron base, the bottom flange of which finished almost level, at the front, with the edge of the smoke-box.

I have included the chimney on a later drawing but several readers have rung me to say that they are ready to try a steam test, so some advance information may help.

The chimney is 9 in. long from face of flange to top, and tapers from 1⅝ in. O.D. at bottom to 1¾ in. O.D. at the top. The bottom flange forms an upstand 1/2 in. high, the top 1/4 in. of which is turned down to fit inside the chimney bore, while the lower 1/4 in. length is turned to match the outside diameter of the chimney. The flange carries two lugs which are spaced to sit *outside* the hinge lugs shown in size as does the flange O.D.

I've shown a chimney rolled and riveted down the length of a lap joint, using 3/32 in. dia. round head rivets.

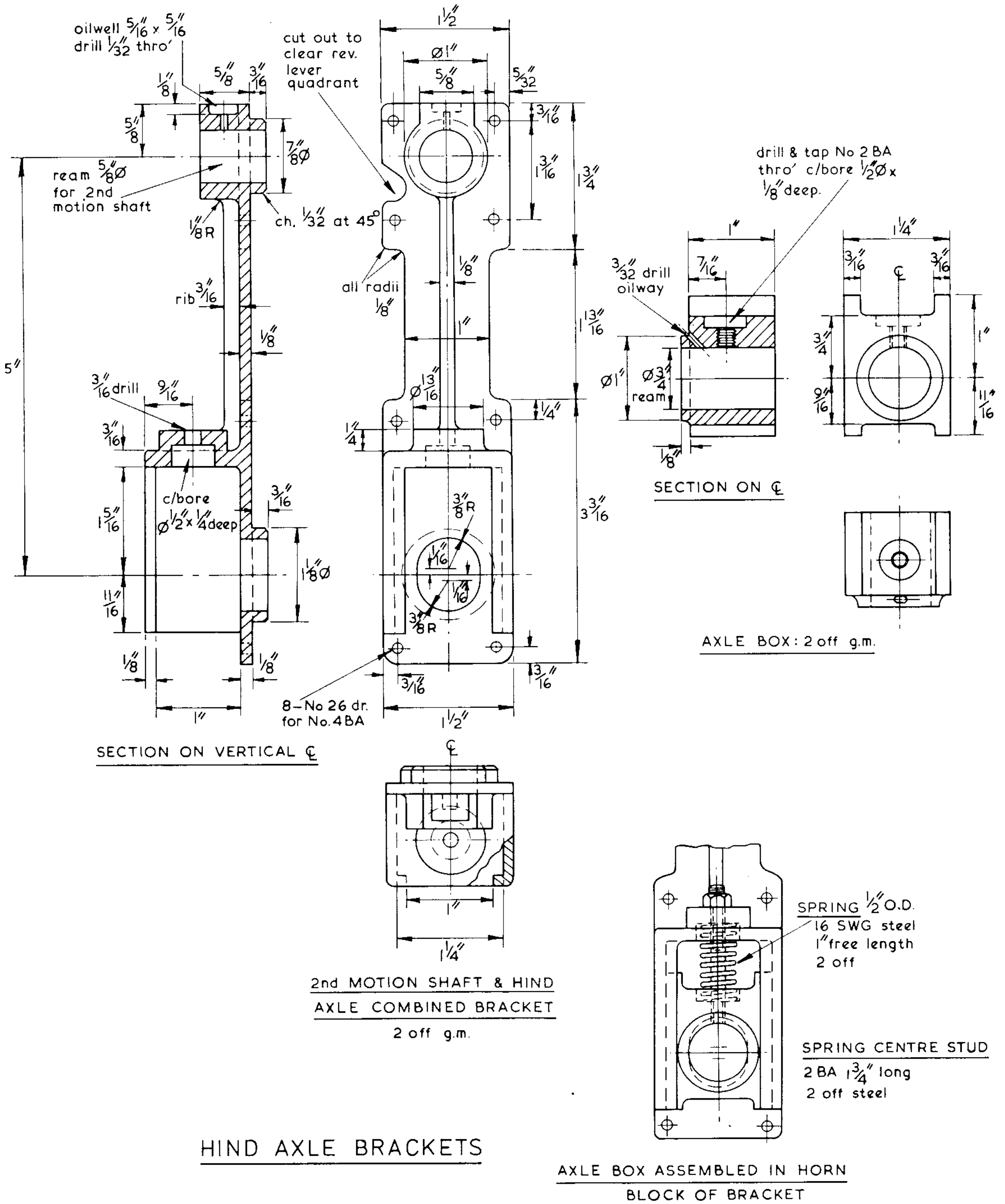
As these rivets are virtually impossible to get at inside the chimney, I think it will be a better plan to use a narrow strip, say 1/4 in. wide by 3/32 in. thick, extending down inside the length of the chimney, with four or five tapped holes matching up with the holes in the lap joint, with round head screws (fill the slot in with solder afterwards) screwing through the lap joint and into the strip. The remaining holes should have rivets tightly inserted and riveted over inside just where they can be reached, at each end.

The top of the rolled chimney is finished off with a ring of 3/16 in. half-round beading secured in place with three small countersunk-head rivets. The material for the rolled chimney should be 18 to 20 s.w.g. thick steel sheet, and a length 8¾ in. long by 5¾ in. wide will allow for cutting to shape and a ¼ in. wide lap.

The alternative to the above method is to taper turn the whole chimney, including the top beading, from a length of heavy gauge hydraulic steel tubing. The most suitable size of tube is to British Standard 778 table 7, 1 9/32 in. inside dia. by 1 29/32 in. outside dia.

Unfortunately chimneys burnt through with relentless frequency, especially on short-smokeboxed engines, and replacement cast-iron ones such as those supplied by John Allens (Oxford Steam Ploughing Co.) were often fitted, as they tended to last longer. Polished brass chimney caps of various shapes could be purchased to replace plain beading or to fit to new plate chimneys, and there must still be many engines existing today fitted with a stylish chimney cap supplied by that well-known firm George Thurlow of Stowmarket, Suffolk.

To be continued



HIND AXLE BRACKETS

A Versatile Dividing Head

Part III *from page 465*

George Thomas continues his description of the main body

NOW SET THE CASTING up on the vertical slide as shown in photo 9 and mill the top pad, using an end-mill or small shell mill. After that, turn the casting the other way up and face off the end of the spindle-clamp boss, using the side of an end-mill. (Photo 10.)

We next mark out for the remaining work, using a surface plate and angle-plate. It will be seen in several of the photos that the boring operations were carried out with the front of the casting facing the headstock but the total amount of setting up involved would have been reduced had the casting been set up the other way round, i.e. with the "back" end facing the headstock.

The reason for this is that the 1⅜ in. spigot for the banjo has to be machined concentric with the main spindle bore and if the casting is set up back-to-front this machining can follow on after the boring and without moving anything. I had to remove the casting and set it up again the other way round and then pick up the bore with a clock until it was truly in line with the lathe axis — a waste of time due to faulty planning.

So, when you mark out for the two main bores be sure to do so on the back end. A scrap of sheet brass was Araldited across the end of the cored hole and the centre of the main bore was marked on this — largely as a check on the rest of the marking out.

The two vertical cotter holes were produced with a No. 2 centre-drill followed by 3/16 in. and "Q" drills and a 3/8 in. machine reamer, all under the drilling machine. Between these two holes, a 1/4 in. BSF hole was drilled and tapped. To produce the hole for the spindle lock, the casting was bolted to an open-ended angle plate and the hole started with a centre-drill followed by a 1/4 in. drill. The hole was then opened to 1/2 in. using a 1/4 in. to 1/2 in. counterbore for about 1/4 in. depth. This was followed with a 31/64 in. drill and, finally, a 1/2 in. machine reamer.

The reason for using the counterbore for a short way will be apparent to all those who have essayed to open a 1/4 in. hole to 1/2 in. With the spindle stationary, we lower the 31/64 in. drill into the 1/2 in. recess, lock the quill, start the machine and, with one hand on the feed lever, unlock the quill and proceed to feed downwards without all the gyrations and polygonal holes that can happen the other way. The long way round is so often the quickest and best.

The two parallel bores now demand our attention and as we shall have to do some accurate squaring from the left-hand side of the boring table, it would be as well to make sure that it is perfectly flat and free from burrs and bumps. After numbering them and their holes, drop in the two cotters (3.15) and clamp them down with a bar and 1/4 in. BSF screw. Set the casting down, squaring one edge off the side of the boring table.

Pick up the centre of the 5/8 in. bore with a sticky-pin and lock the cross-slide (photo No. 11). The white patches which show up so clearly in the photographs are produced by the marking-out fluid — *Opaque White* by Spectra Chemicals; excellent for castings. Centre, drill through about 5/16 in. then open to 9/16 in. or 19/32 in. (photo No. 12).

The hole is finally bored to size; a close fit on a piece of 5/8 in. PGMS. My steel was dead to size and I preferred not to use a reamer but to complete the hole by boring which took longer but resulted in a really good fit. From photo No. 13 it will be observed that I used the small boring head together with a 3/8 in. bar having an inserted HSS bit (see p. 1032, Vol. 144). Without a boring head the job could be done with a similar small bar held in a 4-jaw chuck, the cuts being put on by adjustments

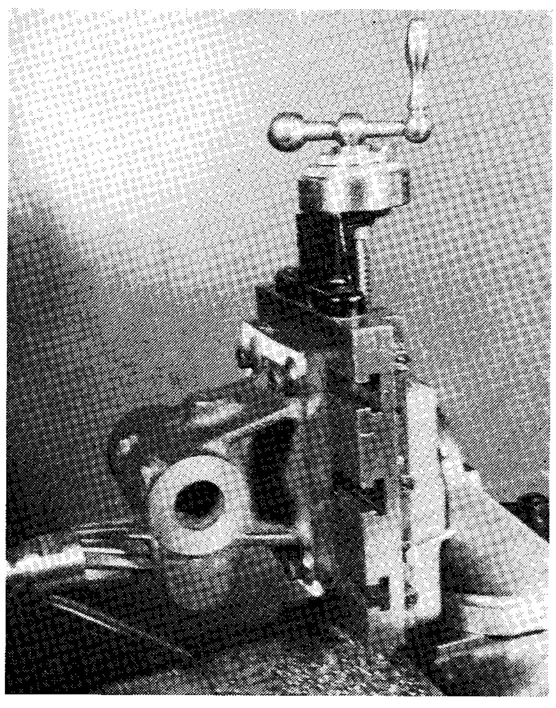


Photo 9. End-milling the face of the pad for tailstock cutters.

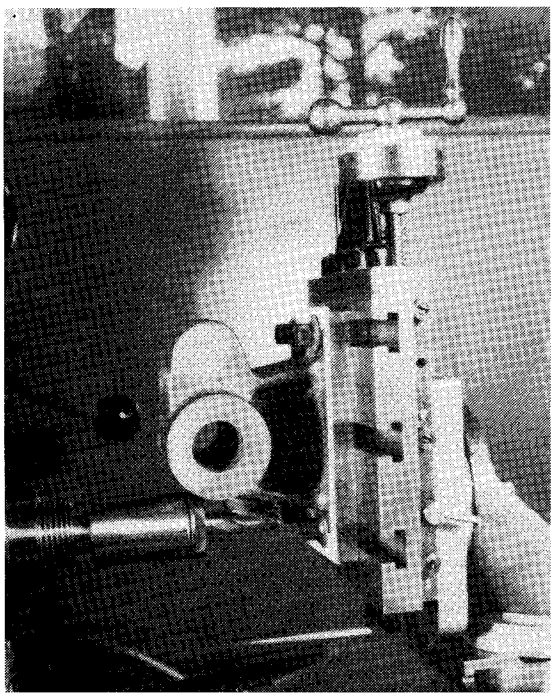
of the jaws. Alternatively, a shortish 1/2 in. bar between centres would do it.

In either case it would be as well to finish to size with a reamer, even if the resulting hole is a thou oversize; the cotters will always pull the bar into the same position which is the important thing.

We now move over to the main bore by withdrawing the cross-slide (the photos are the other way round) by 13 turns and 13 thou, i.e. 1.313 in., but anywhere within about 5 thou. will be good enough. We clean out the 5/8 in. bore, slip in the PGMS bar leaving about 1½ in. to 2 in. standing out at the front, remove the clamp from the cotters, fit them with nuts which should be pulled up tightly. Next fit the tailstock body (3.17) to the bar and bring its centre-line level, using a centre-height finder or some such means, after which the 7/16 in. drilled hole will be on the lathe axis.

Clamp the tailstock firmly to the bar, using the already finished locking pads and a 2 BA cap screw. The second pair of pads has already been fitted prior to drilling the 7/16 in. hole. Once again the small boring head was used, as can be seen in photo 14. The drilled hole was opened up until it would just accept a piece of 1/2 in. silver-steel tightly. Speed, 425 r.p.m., .005 in. feed.

The tailstock and bar can now be removed and the decks cleared for boring the main spindle hole, but first we must insert the brass blank (3.12), backed up with the steel slug (12a), into the 1/2 in. hole. These parts are clamped firmly in place with a toolmaker's clamp across the body (see photo 15).



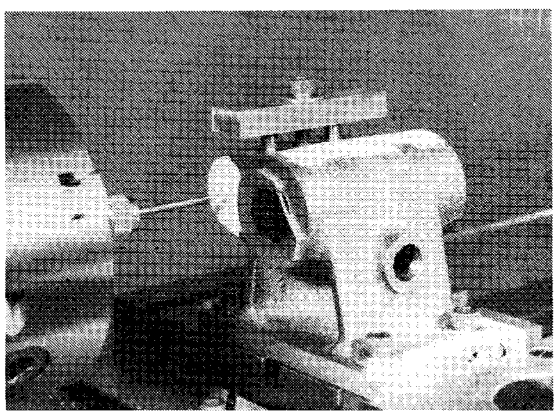
It will probably be found necessary to slip a short scrap of 3/8 in. steel bar in the angle under the tailstock boss in order to provide a proper seating for the clamp.

A start was made with a 5/8 in. bar which was used to bring the bore up to 1 in. dia. or so, after which it was changed for a 7/8 in. bar made in accordance with the design on p. 169, Vol. 143, a description and photos of which appeared in the issues of 17.6 and 1.7.77. This was the first occasion that I had to use the bar, which has more refined means of adjusting and locking the cutter than are usually to be found. The bore was soon opened up to size, nominally 1 1/16 in., but there is no object in trying to make the size exact as the spindle will, in any case, be turned to suit. Mine is 1.065 in. diameter.

There remains the last operation on the casting — turning the 1.375 in. spigot to fit the bore in the banjo. An awkward proposition. None of my numerous angle-plates would handle the job without hitting the bed or something so I was left with the choice of turning it on a special mandrel between centres or carrying out the job by running the tool round the stationary work. Having a "Dore" head, which was described recently under the heading "Boring Heads" (15.9.78), I decided to use this with a slightly special bar about 3 in. long.

In the absence of any of the facilities mentioned, it would be perfectly feasible to carry out the work by means of a toolbit held at an angle in the facing-cutter bar (2.1a), in which case the cuts could be put on by moving the bar endwise by means of the chuck jaws. If something on these lines is adopted, then it might be better to machine the casting *before* boring the hole in the banjo arm and make the latter to suit. The same advice would apply to anyone using a standard "Dore" boring head which pro-

Photo 10. Left. Machining the face of the boss for the spindle lock.
Photo 11. Below. Picking-up the centre for the tailstock bar using a sticky-pin. (Notice the clamp holding the two cotters in position.)



vides no indication of cutter movement or, at best, a rough one.

In other words, let the size be what it is, within reason, and make the hole to suit.

When making up the toolbit for "external turning" bear in mind that it must be a mirror copy of a normal boring tool. Photo No. 16 shows the operation in progress at 80 r.p.m. and a roughing feed of about .007 in. which was reduced to .003 in. for a final, very fine, cut. The cutter should leave a radius in the corner but it must not be too large for the chamfer in the banjo to clear.

I don't know whether I have mentioned the two small (2 or 4 BA) tapped holes in the top of the barrel. They have their grub screws removed once a year for the annual drop of oil. The body is now complete except for a few spots of tidying up. A reasonable-looking radius should be filed on the corners of the foot, all sharp edges broken etc. before filling and painting. Mine was just painted — two under and one top coat of grey enamel (Valspar).

The Spindle

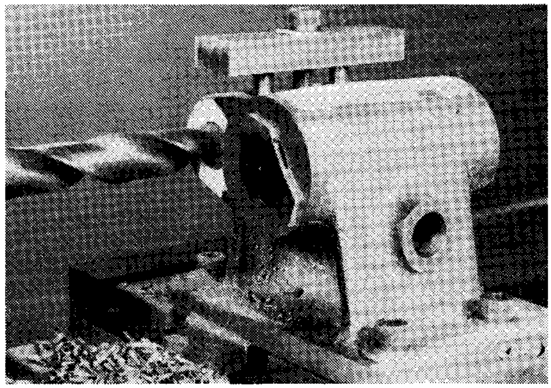
The detail drawing which was reproduced in part II shows the preferred form of spindle with the parallel bore but it is possible that some workers might favour something different. Those having a good range of collets capable of being accommodated within the limiting dimensions might prefer to use them. I have a set of about 18 Myford dead-length collets and another set of Marley collets but neither of these could be fitted in.

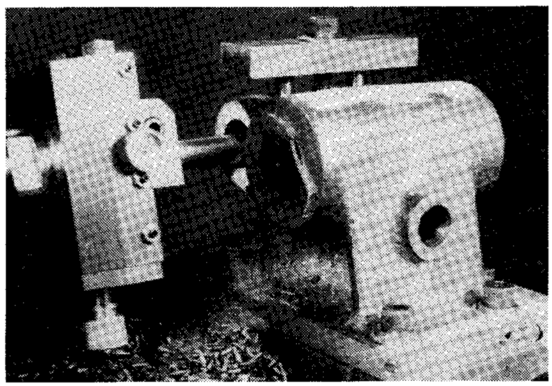
On a sheet of drawings (Fig. 8) I have shown an alternative spindle to take Crawford No. 327 collets with a maximum capacity of 1/2 in. which are the type supplied for Boxford lathes. 8 mm. collets can, of course, be used in suitable adaptors and these are included under accessories. Some readers will insist on a Myford, or other, type of screwed nose and others will demand a Morse taper bore, any of which can be incorporated, but in my view these features will all impose unnecessary limitations.

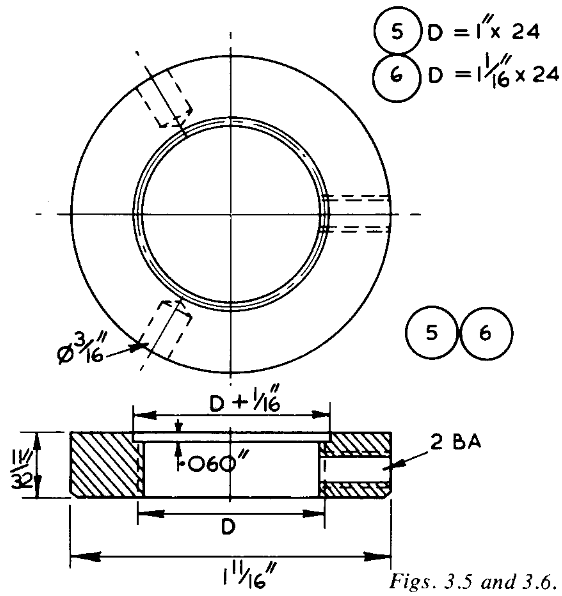
If a nose to accept lathe chucks is deemed to be necessary, then it can be provided in the form of an adaptor as shown in Fig. 1 and detailed at (8.2). I made such an adaptor and it was used when I drilled the division plates, as will be shown later. Incidentally, this adaptor will fit the arm of the staking tool and so will enable me to mount chucks etc. on it if desired.

Before we turn the spindle there is one decision to be made — to make the nuts (3.5) and (3.6) before, or after, the spindle is completed. For myself there is only one way; the nuts come first. When a tap is available for the final sizing of the thread, such a decision is an obvious one but when, as in this case, there are no such taps, the decision will rest on one's known ability (or otherwise) to screwcut the threads to a tolerable degree of accuracy by what I call *dead reckoning*. If one can

Photo 12. Drilling a 9/16 in. hole for the tailstock bar. Photo 13. Below. Opening up the 9/16 in. hole to .625 in. using a small boring head.







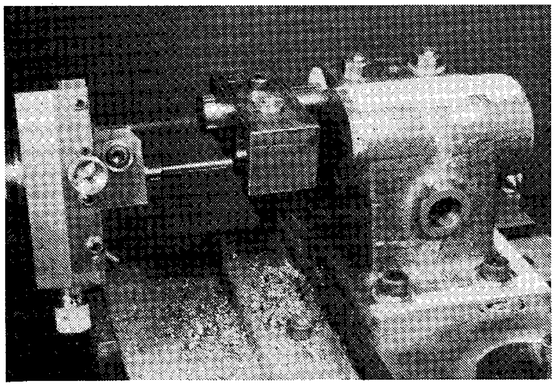
Figs. 3.5 and 3.6.

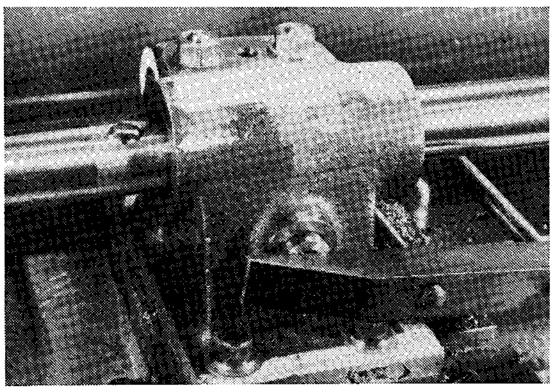
make a bore to a given size within a thou either way and if one can grind up an internal screwcutting toolbit to the correct profile and with the correct *width of flat* at the tip, then the rest of the job is as easy as falling off a log.

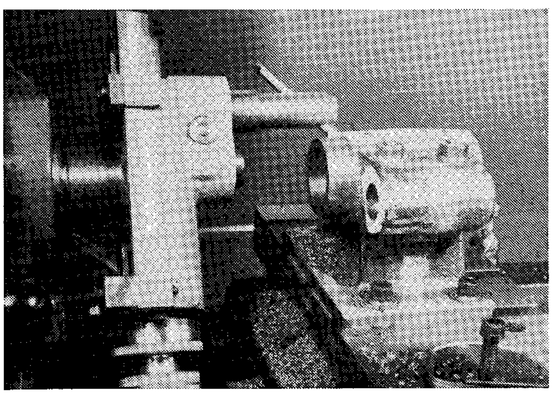
I am strongly tempted to launch out into a lengthy dissertation on screwcutting which must be resisted; I shall try to confine myself to the making of the dividing head and assume that everyone knows how to cut accurate threads — an assumption which, I have reason to believe, has no foundation in fact.

For four or five years I have planned to write an article on screws and screwcutting and the folder for it is now bulging like a schoolgirl's satchel, but before this is written I should do something to carry out my promises to describe a tool-grinder which is so desirable for preparing the tool-bits. For the benefit of those who would appreciate a little guidance, I shall offer a few notes on some of my methods in an appendix or possibly a supplementary article to follow shortly.

Photo 14. Below. Boring the .500 in. dia. hole in the tailstock before machining the main spindle bore.
Photo 15. Middle. Boring 1 1/16 in. dia. for the spindle. Note the toolmaker's clamp holding the locking pads in place.
Photo 16. Bottom. Turning the spigot for the banjo arm.







Apart from the screwcutting there is little to be said about the two nuts (5) and (6) except that it is important that the larger one (6) is quite parallel in thickness and that the thread is turned away to a depth of about 1/16 in. on one side of each nut. These two recessed sides face each other on assembly and provide some clearance for the two ends of the key which is shown on Fig. 6. Each nut is fitted with a 2 BA Allen grub screw bearing on to a soft copper pad. These latter were parted off from 5/32 in. copper rod at about 1/16 in. thick and subsequently annealed.

In making the spindle we must maintain absolute concentricity between the outside diameters and the bore and this is best achieved by first creating the bore, mounting on a true mandrel and then turning the outside between centres.

The following has been expanded from my few planning notes.

(1) In 4-jaw face one end.

(2) Re-set with only 5/16 in. gripped by the jaws; set to run true at both ends, make a good centre and support the free end on a tailstock centre.

(3) Rough down to 1.1 in. dia. leaving a full 3/8 in. for the flange at the chuck end.

(4) Turn round and set true in the 4-jaw flange outwards, leaving about 5/16 in. clearance between the end of the job and the mandrel nose. Drill 5/16 in. right through — lengthen a drill if necessary. Clear the chips *very frequently* by sliding the tailstock back, brushing off the drill and giving a squirt of soluble oil up the hole and then pushing the tailstock back again.

(5) Open up the hole with an 11/16 in. drill (see photo No. 17).

(6) Bore out to .750 in. minus two or three thou, using a 1/2 in. boring bar, and finally size the bore with a 3/4 in. m/c reamer which will probably leave the bore .001 in. to .0015 in. over-size. (A new 3/4 in. reamer is .001 in. oversize to start with.) The fact that the bore will be a little oversize is of no consequence because all accessories will be made to suit.

(7) Skim up the 1½ in. flange and face the front.

(8) With a small boring tool in the top-slide, set round to 30 deg., turn a 60 deg. chamfer, about .03 in. to .04 in. wide, in the mouth of the bore.

(9) Remove from lathe, clean out the bore, slip on to the mandrel and clamp up.

(10) Set up between centres, turn the 1 1/16 in. dia. parallel, to a good finish and a close fit — quite without any trace of shake — in the body. Follow with the 1.000 in. dia. — a tight push or "twist-on" fit in the gear; form the undercuts .030 in. deep and .062 in. wide.

(11) Screwcut the two threads to a very good fit in their nuts which can be hung, in turn, on the tailstock centre where they will be ready for offering up.

(12) The keyway is cut with a 5/32 in. slot drill (not an end-mill). The spindle can be set up in a vice on the vertical slide for this job. The key, shown in Fig. 6, is filed up from 5/32 in. square silver-steel if your stock is tight in the keyway as mine was, but if not, then it will have to come out of larger material. The ends are rounded to fit into the ends of the keyway but the height is reduced at these points to clear the threads in the nuts. It should not be necessary to remark that the key must be a tight fit in the spindle and in the gear — the gear must push into place with no trace of play.

Comments on the above

The turning arbor is shown at (2.2a). The 3/4 in. dia. is turned parallel and to a very good fit in the spindle; the shoulder is turned to an angle to match that in the mouth of the spindle. A fine thread was cut on the end and a nut and collar made to suit.

Centres. If you are not absolutely certain of your soft (headstock) centre, skim it up in position. For the tailstock I like to use a ball-bearing, revolving centre whenever possible because they do not damage the centres in the work, *but* they are never quite true.

For a few of the items of this dividing head where maximum attainable concentricity was desirable, I used the revolving centre almost to the end of the job in order to preserve the work centres but changed to a dead centre for the final sizing of the important diameters. The spindle, for instance, was finish turned to the 1.000 in. and 1 1/16 in. diameters using a tungsten carbide tipped dead centre and a moly lubricant.

Taper Bores

Does your lathe bore parallel or taper? If the latter, which way does the taper run? If large at the front, not to worry, but if large at the back, the boring should be carried out with the tool upside-down and cutting at the back, i.e. being fed *away* from the operator. This will reverse the taper, making the bore large at the front and the reamer will size the hole right through whereas, if it were large at the back, it is not only difficult to measure but the reamer might fail to clean it up. I mention this point because *well-worn* lathes do all manner of things that they shouldn't.

To be continued

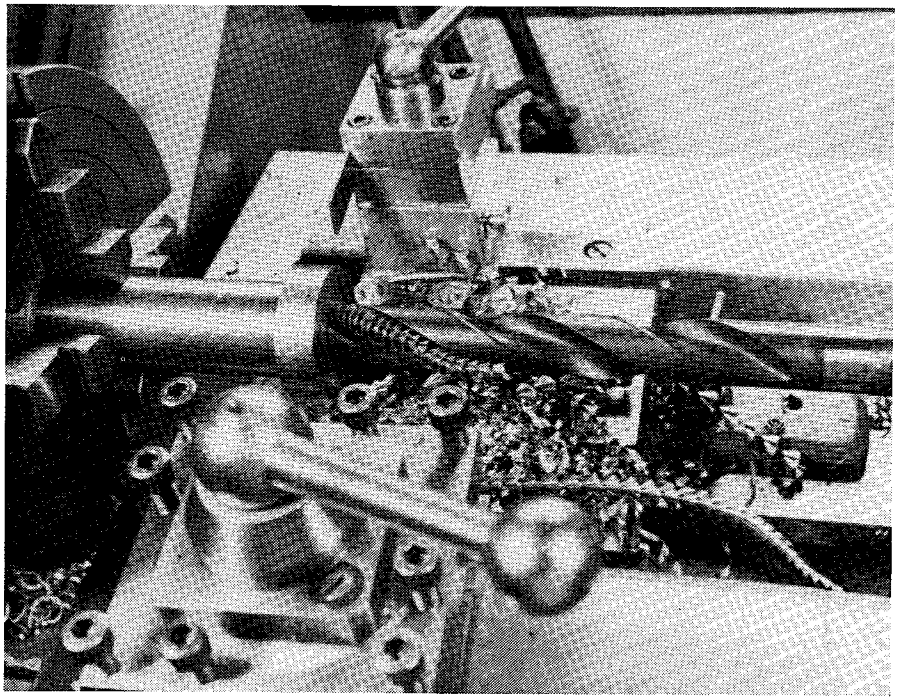
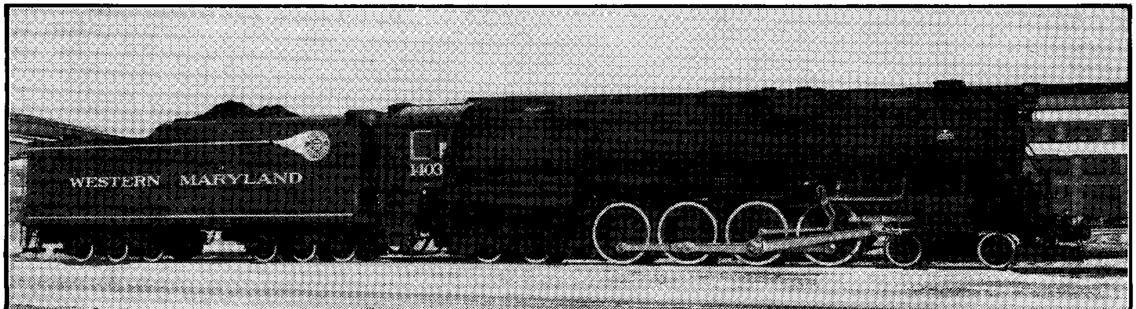


Photo 17. Drilling the main spindle with the 11/16 in. drill.



"COLUMBIA"

A 3½ in. gauge 4-8-4 locomotive based on a Baldwin prototype

Part VII

From page 393

by Martin Evans

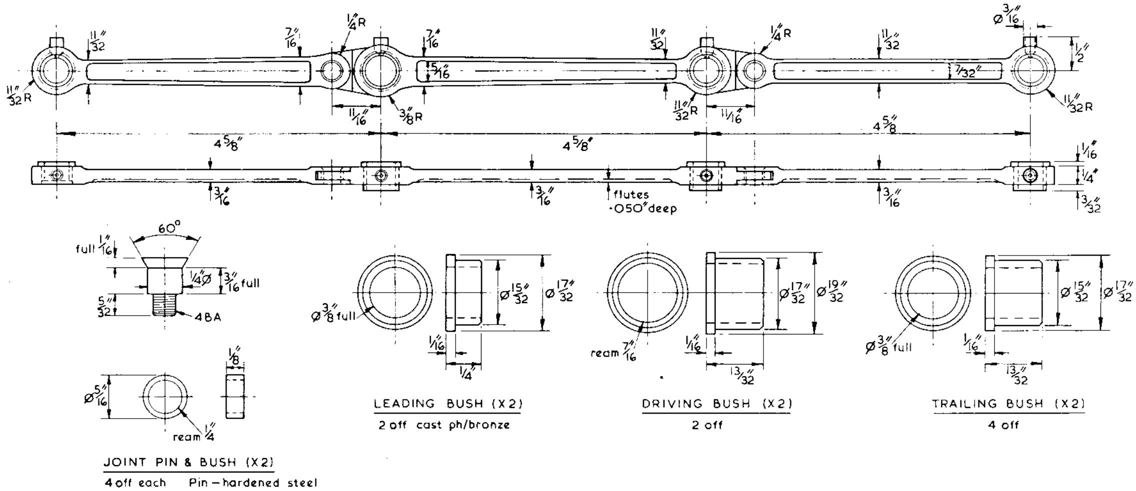
CONTINUING with the boiler for *Columbia,* the silver-soldering of the foundation ring and the backhead, and especially around the firehole ring, requires more heat than any other part of the boiler. When using propane blowpipes, it helps a great deal if coke is packed all around the firebox, the boiler being laid on its back and the coke heaped up to within an inch or so of the foundation ring. The inside of the firebox also can be blanked off from the flame by some pieces of asbestos sheet, which will help to protect the ends of the tubes.

Easyflo No. 2 is the stuff to use here, as this melts at a dull red heat. After thoroughly fluxing, work the silver-solder all around the foundation ring, giving the blowdown bushes a taste on the way, if these have not been fitted previously. Then, while the boiler is still hot, up-end it as quickly as possible and concentrate on the backhead and the firehole ring, leaving a nice fillet of the solder all around.

Firebox stays

With such a large grate area, there should be no difficulty in getting the propane blowpipe to function properly inside the firebox, so I would recommend silver-soldering all the firebox stays, both

> The first sheets of plans for *Columbia,* L.O. 954 are now available from the M.A.P. Plans Service. Sheet 1 comprises the general arrangement, frames and trailing truck. Sheet 5 includes boiler details. Both are priced £1.35 + 20p post — overseas readers contact their nearest agent.



COUPLING ROD (L.H.drawn) & BUSHES

inside and out. 3/16 in. copper rivets may be used, but my own preference is for gunmetal or monel metal screwed stays, threaded through both plates and nutted on the inside. Although threaded stays are of course much more work, they have the advantage that they prevent either the outer or the inner wrapper from bulging or becoming distorted in any way while the heat is applied.

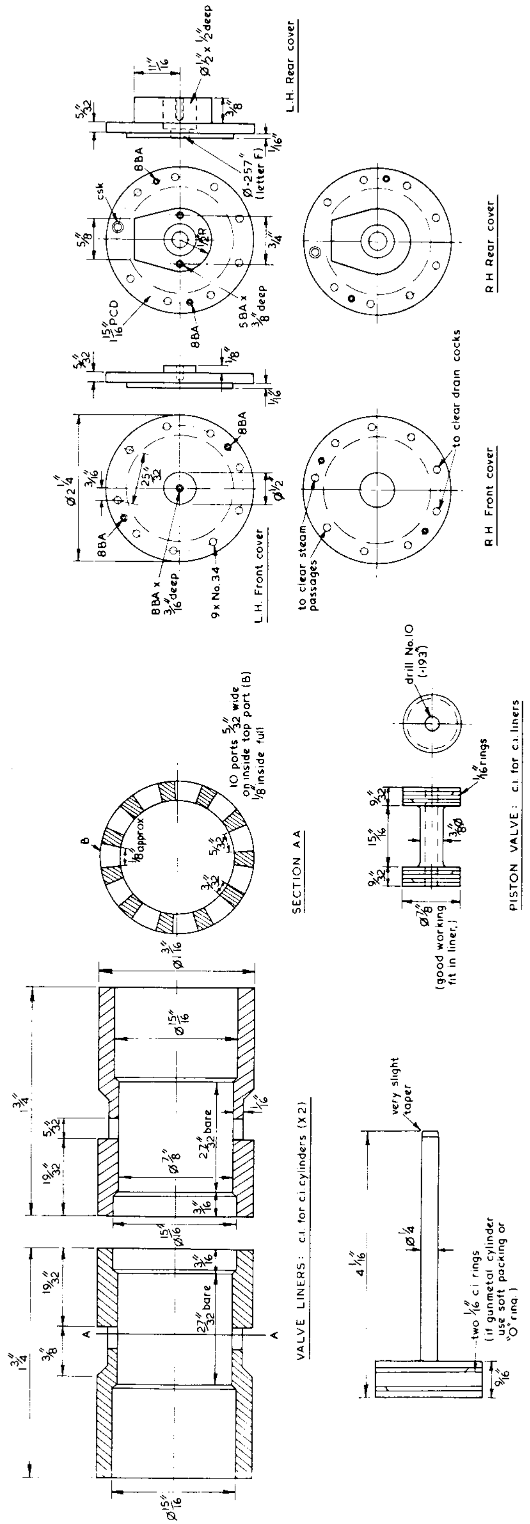
Builders will notice that on my drawing, I have positioned the front vertical row of firebox stays as near to the front end of the firebox as possible. This was necessary as there is rather a large area of the outer wrapper that cannot easily be stayed, owing to the slope of the throatplate. If using threaded stays, this front row could be made from 5/16 in. A/F hexagon gunmetal, so that a good-sized "head" is left to help to support the outer wrapper. The other stays could be machined from 1/4 in. A/F hexagon gunmetal.

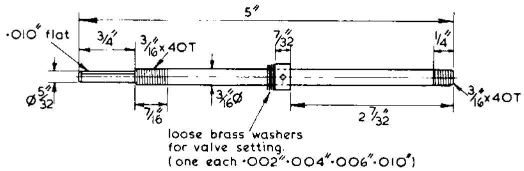
There are two longitudinal stays, one solid and one hollow, for the blower steam. As these stays are unusually long, I thought it wise to make them larger in diameter than usual — at 5/16 in., the blower tube being 5/16 in. x 16 s.w.g.

The solid stay is fitted by means of the usual type of nipple, threaded 1/2 in. x 32T externally and 5/16 in. x 32T internally. I am often asked what is the purpose of using threaded nipples on these stays, rather than silver-soldering them direct to the plates at both ends. The answer is simply that nipples enable a broken stay to be replaced very easily. However with stays of 5/16 in. dia. it is most unlikely that a breakage could occur, so builders can safely dispense with nipples. The blower stay of course is a different matter as we fit the blower valve at the backhead end, and a nipple with a union connection at the smokebox end.

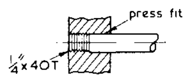
Having completed the staying, a hydraulic test can be carried out. If any bushes have been drilled and tapped right through, these will have to be plugged with brass plugs threaded to suit and screwed in with a touch of plumber's jointing. To blank off the large dome bush, a steel disc can be turned up, which can later act as a drilling bush for the dome cover proper. Six 6 BA screws, gunmetal or stainless steel, will be ample to hold down the dome; don't use ordinary mild steel or brass!

A large pressure gauge reading to at least 300 p.s.i. will be required (I hope no-one will be tempted to use one of the small "model" gauges, even if this should read high enough!) and a hand pump of some kind, the latter being connected to any convenient bush in the backhead. The boiler should be completely filled with water, all air being excluded. A few strokes of the hand pump will send the needle of the pressure gauge soaring, and it should be possible to hold the test pressure — 160 p.s.i. — for at least a quarter of an hour without any leakage or bulges. However, those making their first boiler

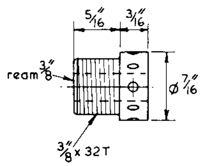




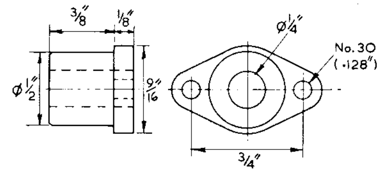
VALVE SPINDLE: 2 off stainless steel



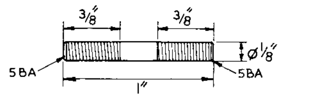
PISTON & ROD: piston—c.i. for c.i. cylinder
rod — stainless steel



VALVE SPINDLE GLAND: (x2)



PISTON ROD GLAND: (x2) 2 off ph/bronze



STUD FOR PISTON ROD GLAND (x2)
4 off stainless steel

need not be discouraged if they find a few tiny "weeps" on first test. But make sure first that these are not coming from one of the plugged bushes. The remedy for leaks must obviously depend on their position, but very often they can be permanently cured by drilling and tapping a small hole, say 10 BA, and screwing in tightly a short piece of gunmetal rod, threaded to match and treated with plumber's jointing.

This is a good moment to deal with a query that comes up every now and then — boiler builders who are not members of any model engineering society who wish to have their boiler tested and a test certificate issued. Some readers seem to be under the impression that boiler test certificates for our model boilers are issued by insurance companies. This is not so; they are normally issued by model engineering societies, the actual testing being carried out in most cases by two competent members of the society.

The obvious answer to those boiler-builders who are not members of any club is — join the nearest club! However I appreciate that this is not always possible for one reason or another, but I think most model engineering club members are ready to help the "lone hand"; a small contribution to club funds not being out of place!

Coupling rods

Let us leave the boiler shop now and concentrate once more on some of the chassis parts, starting with the coupling rods. As I mentioned earlier, the rods on some of the later Baldwin engines were of unusual shape, in that they tapered towards the driving crankpin, which was larger in diameter than the leading or trailing crankpins; we can follow suit.

I will leave to builders the decision as to whether the making of a drilling jig for the coupling rods is worthwhile. But jig or no jig, I think it wise to make up the intermediate joints first, before dealing with the rest of the rods. The material required is 1 in. x 1/4 in. b.m.s. Note that this time, the oil boxes are separate turnings, pressed into the rods, which will be easier to shape on account of this. (The full-size locomotive used roller bearings in coupling rods and connecting rod big-ends.)

I think it is worthwhile hardening the intermediate joint pins, and use a phos/bronze bush (cast material for preference) as for the main bearings. The bushes for the driving crankpins can be reamed to a close working fit, but the other bushes will need opening out to at least 10 thou larger than their respective crankpins.

Cylinders

The cylinders are of the piston valve type and will be supplied in iron, so that they can be fitted with rings, both in the main bores and on the valve heads. Of course there is nothing to prevent builders fitting gunmetal cylinders, as I expect at least one of the *M.E.* advertisers will be able to supply them in either metal. But if gunmetal is preferred, the piston valve heads could be made with two or three fine oil grooves instead of using rings, while soft packing could be used in the pistons.

Looking at *Columbia's* cylinders from the front, one will notice a large gap between the back of the steam chest and the cylinder bolting face. The idea of this was to accommodate an exhaust manifold, which can be bolted to the back of the steam chest, thus giving a better "run" for the exhaust pipes. Incidentally, this idea saves a great deal of metal in the cylinder itself and makes the end-milling of the exhaust passages much easier.

As the machining of piston valve cylinders was dealt with in my last article on *Enterprise*, I don't think I need to say much about it here. I expect most builders will decide to bore their cylinders with the castings bolted down on the cross-slide, using a boring bar between centres, one end of the castings being finished by fly-cutting.

Regarding the front and rear cylinder covers, the unusual and irregular spacing of the bolt holes will be noticed. This is to ensure that the cover screws or studs don't run into either the steam passages or the tapped holes for the drain cocks. The nine 6 BA screws specified will be found adequate as the maximum pressure of the covers is not likely to exceed

200 p.s.i. Two 8 BA tapped holes are provided in each cover for forcing screws.

Screwed glands are shown for the valve spindles, but studded glands for the piston rods. Some builders don't bother with glands on the valve spindles on the grounds that these are only subject to exhaust pressure. Nevertheless, as we have plenty of room for glands on these big cylinders, we may as well fit them.

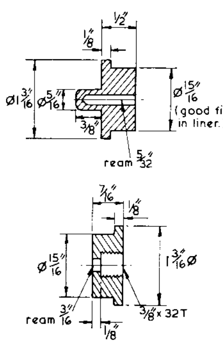
The end covers for the steam chest can be made a hand push fit in their liners and secured by a couple of gunmetal screws about 6 BA. In fact the front covers should not be made too tight as they have to be withdrawn when setting the valves. As I mentioned in the *Enterprise* article, it is a mistake to make the liners too tight a fit. If the usual press-fit interference is adopted, the liners will be compressed and will need reaming or lapping out. Of course this compression would not matter if it was equal right throughout the liners, as the valve heads could be made to suit, but the trouble is that when being pressed into the cylinder, the liners invariably become distorted. If any builder accidentally turns his liners *too* slack in their cylinders, don't scrap them, but clean them thoroughly and smear with Loctite "Hot strength" before pushing them in; then secure with a couple of gunmetal screws, say 4 BA, put in where they won't show.

One question that may arise is how to machine the bolting face of the steam chest. The bolting face of the cylinder as a whole can of course be machined by fly-cutting, the casting being bolted down on the cross-slide, but fly-cutting cannot be used on the steam chest. Depending on the lathe in use, this face could be machined by a side-and-face cutter on a stub mandrel, the casting being clamped on the cross-slide but packed up to the desired height, so that it is only necessary to put the feed on by moving the saddle towards the lathe spindle.

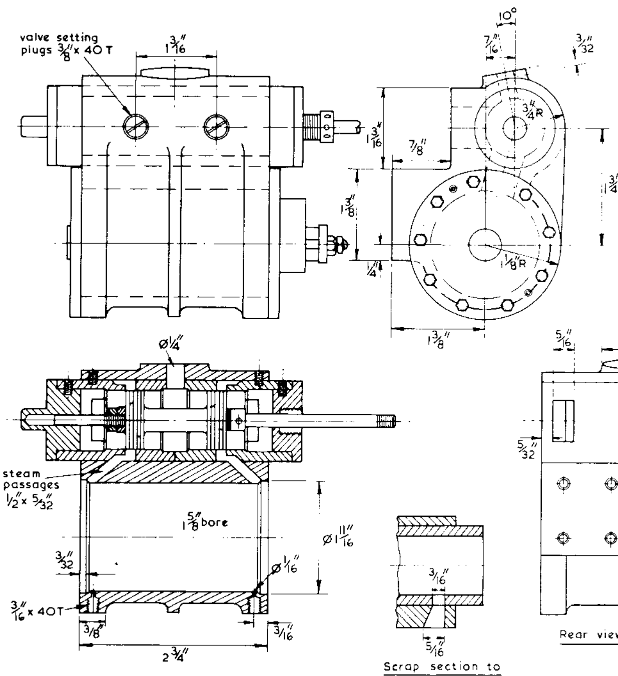
Another method would be to clamp the casting on an angle plate bolted to the vertical-slide, and use an end mill in chuck or collet. If this method is used, the exhaust passages can be cut at the same set-up, though to save wear and tear on the end mill, a drill about No. 14 can be used first, drilling three holes close together, then following up with a 3/16 in. end mill.

For the adjustment of the valve on its spindle, I am showing the same idea as described for *Greene King* recently — a collar fixed permanently on the valve spindle on the rear side of the valve, and a series of thin washers of varying thickness put between this and the valve. By withdrawing the valve chest cover, the valve can be drawn out from its spindle and washers removed as required, without disturbing the rear cover. For the actual valve setting, as most builders I believe prefer to do this "visually", two tapped holes are provided, drilled from the outside of the cylinder. These can be plugged after valve setting is completed and will be covered by the usual cleading sheet.

To be continued

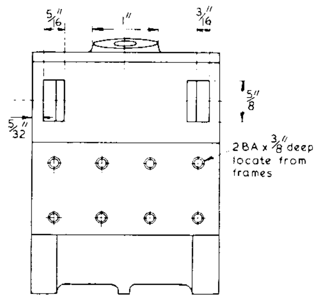


VALVE CHEST END COVERS
2 off each



CYLINDER: L.H. drawn c.i.

Scrap section to show exhaust ways



Rear view of cylinder

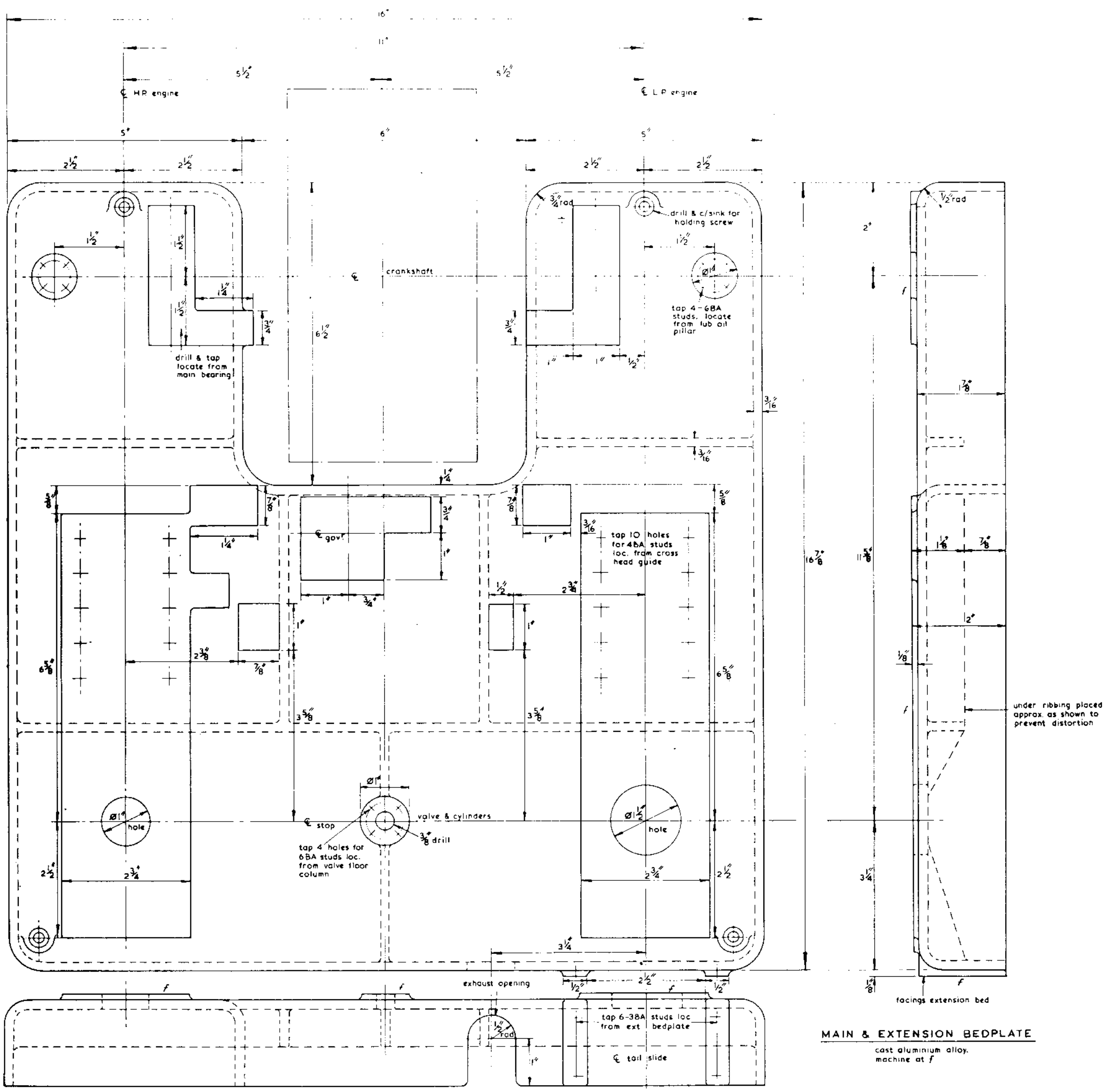
THE PISTON DROP VALVE ENGINE

by A. Haworth

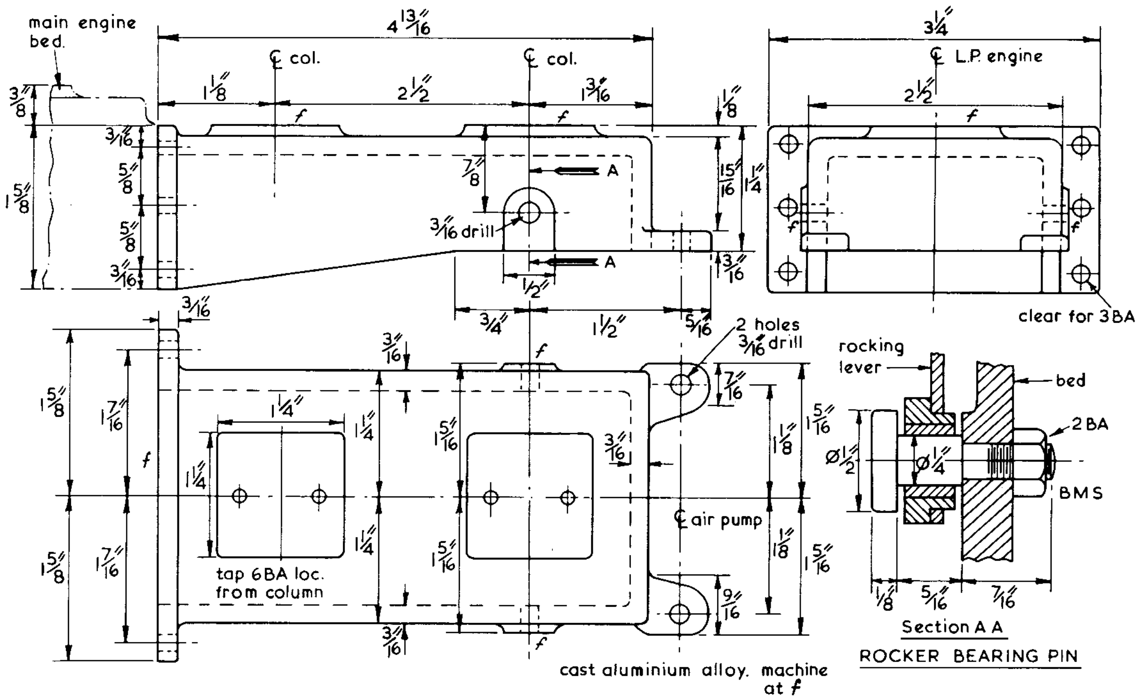
Part XIII

From page 388

THE COMPLETE ENGINE bed consists of two separate castings, the main engine bed and the extension bed which carries the L.P. tail slide. This is done deliberately for two reasons. The first is that this makes the main bed less cumbersome and easier to handle, and the second is that the addition of a joint at this

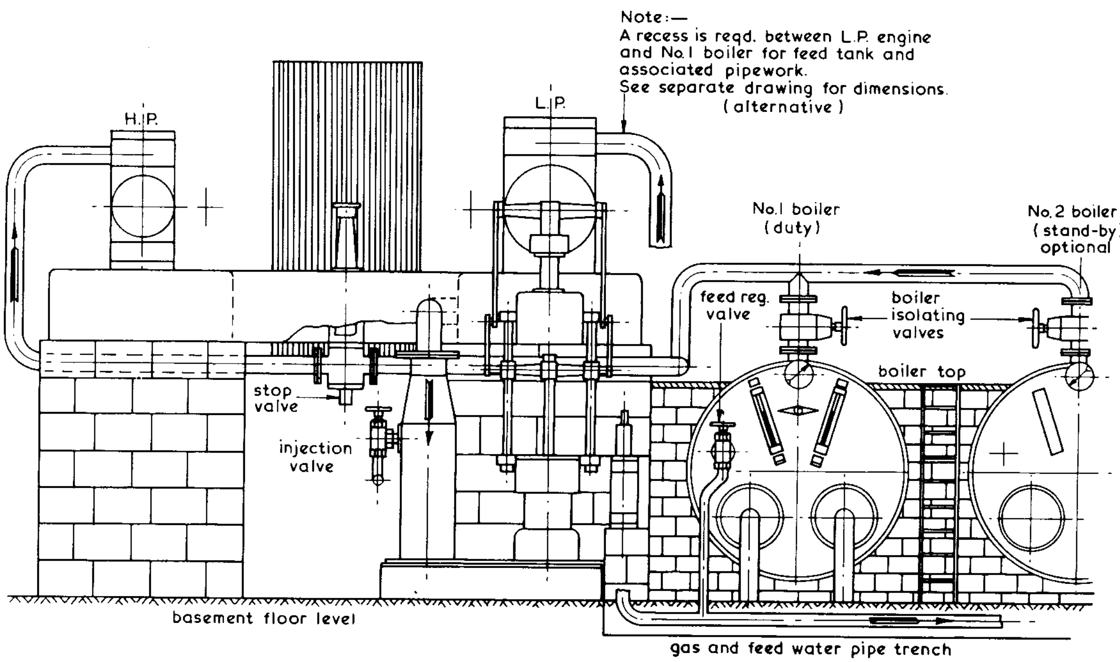


MAIN & EXTENSION BEDPLATE
cast aluminium alloy, machine at *f*



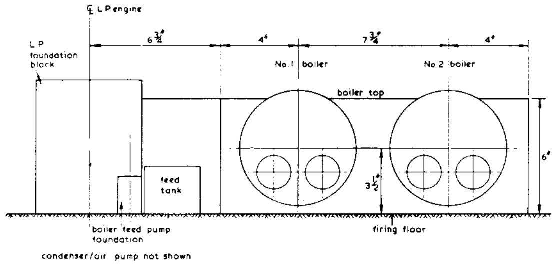
ROCKER BEARING PIN

EXTENSION BED FOR TAIL-SLIDE



PLANT ARRANGEMENT OF ENGINES AND BOILERS

(feed tank in front of L.P. block)



PLANT ARRANGEMENT OF ENGINES & BOILERS (ALTERNATIVE)
(feed tank alongside L.P block)

point provides some measure of adjustment in an area in which it is particularly useful. The machining of this item is that of planing, and drilling.

The first process will pose a problem to the average model engineer, since his resources are generally somewhat limited in this respect. It may well be that the suppliers of the castings are prepared to supply these already machined, except of course for drilling and tapping. If not, it must be the local machine shop, technical college, or engineering society.

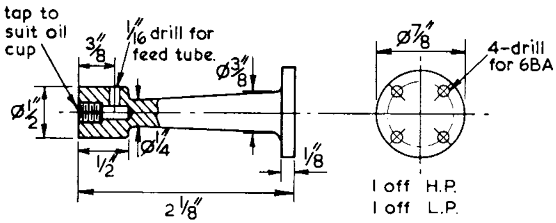
The bed for the tail slide is not entirely cantilevered, it receives a considerable amount of support from the air-pump guide bars at its furthest extremity. The underside of the bed requires no machining as such but it must be reasonably flat and level. Check this on a surface plate and file where necessary. The bed is secured to the foundation simply by suitable countersunk wood screws. In full-sized practice the holding down bolts were 6-8 ft. long going well down into the block and emerging into *chases* cut into the block and secured by steel backing plate and nuts. It is hardly worthwhile to model such an arrangement.

It is seen that there are two circular facings on the crankshaft centre line opposite to the main bearing facings. These support the pillars of the centrifugal oiler for the lubrication of the crankpin. It is strongly recommended that these be fitted.

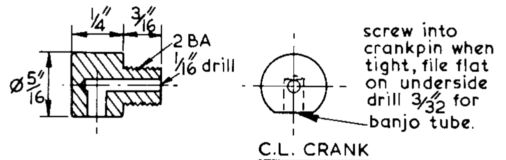
I have shown two elevations of the finished plant with alternative positions of the feed tank. It should be clearly understood that the provision of No. 2 boiler (stand-by) is purely optional. A single boiler is capable of steaming the engine but I have attempted to portray a typical installation of the time. The siting of the feed tank in any case, is largely a matter of choice and convenience. The principal aim is to keep the piping runs as short as possible. I would suggest that the boiler isolating valves are identical to the engine stop valves.

The cylinders are best lubricated by oil displacement lubricators. These are standard fittings and may be purchased complete from any model engineers suppliers. They should be placed as close as possible to the cylinder (see drawing). It is fitted at right angles to the steam flow. In operation its action is continuous and requires no attention other than keeping it filled with oil. It contains a filling cap, a drain and a steam valve.

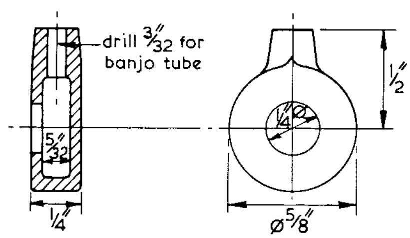
It works on the following principle. The unit, being outside the steam pipe, is at a lower temperature. Upon opening the steam valve, steam enters and condenses on the surface of the oil. The water, being heavier than oil, sinks to the bottom thereby



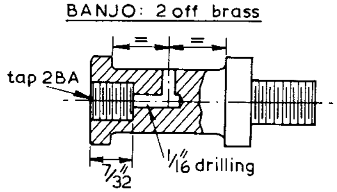
LUBRICATOR COLUMN b.m.s.



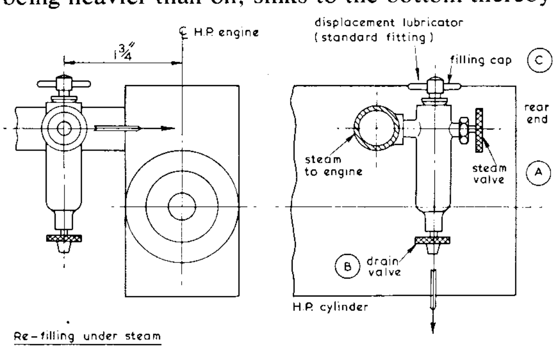
CRANKPIN ADAPTOR: 2 off brass



BANJO: 2 off brass



DETAILS FOR CRANKPIN OILING



Re-filling under steam

1 Close A
2 Open B and drain
3 Close B when drained
4 Remove C and fill
5 Replace C
6 Open A

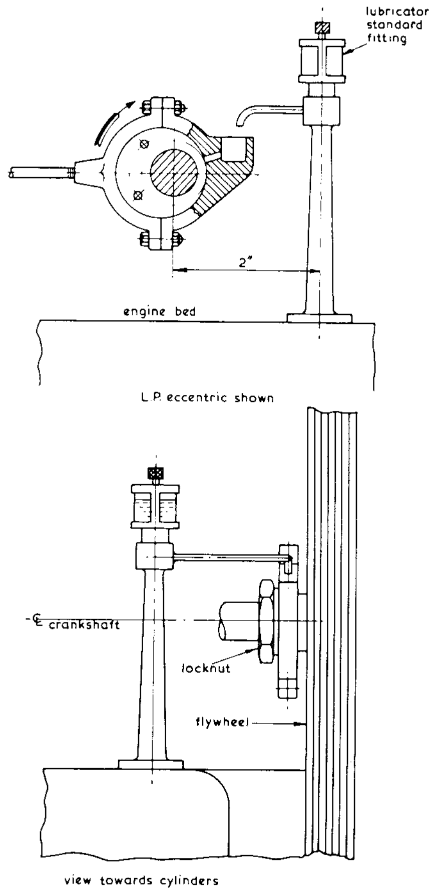
LOCATION OF ENGINE CYLINDER & VALVE LUBRICATOR raising the level of the oil and allowing it to flow into the main steam line and the result is a mixture of steam and oil.

In other words, oil is displaced by water, hence the term displacement lubricator. It may be re-filled whilst the engine is still running, as follows. First and *very* important, the steam valve *must* be closed. Next after a short pause, open the bottom drain *carefully* and allow the water to drain completely. The water will probably flash into steam. When drained, close drain valve. Now unscrew and remove filler cap. Re-fill and replace filler cap. Again re-check that cap and drain are tightly closed. Now you may open the steam valve and you are once again back on steam.

The oil must be of high quality made for the job. Any old motor oil just will *not* do. You would not put sewing-machine oil in your car, would you? These fittings of brass are usually beautifully made and enhance the appearance of any model engine. Some of these fitments have a sight glass incorporated in the body and these are worth searching for as the advantage is obvious. They are a trifle more expensive but certainly worth the extra.

Having lubricated the valves and cylinder continuously, we now turn our attention to the crankpins. This is an area in which efficient and continuous lubrication is essential. Fortunately this can be achieved relatively simply.

In the trade, this arrangement of oiling was always known as the "Banjo", and it will be obvious as to why it is so called. It consists of a pillar which carries a large size sight feed oil cup. Here



DRIP-FEED LUBRICATION TO EXHAUST ECCENTRICS

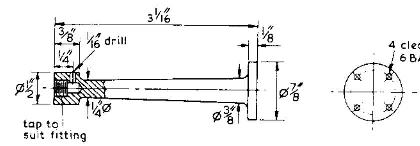
again, these are standard fittings which may be purchased from model engineers suppliers. It should be of the type in which the drip feed can be regulated. It must be higher than the centre line of the crankshaft, since the oil must flow by gravity into the banjo.

The crankpin is drilled both axially and radially for the oil to reach the crankpin bearing while the end of the crankpin is tapped to receive the adaptor into which is soldered the banjo oil pipe. The bottom end of this pipe is soldered into the banjo. The centre line of the banjo must be spot-on the centre line of the crankshaft, not for any mechanical reason, but for the sake of appearance. Nothing looks worse than a banjo that is running like an eccentric!

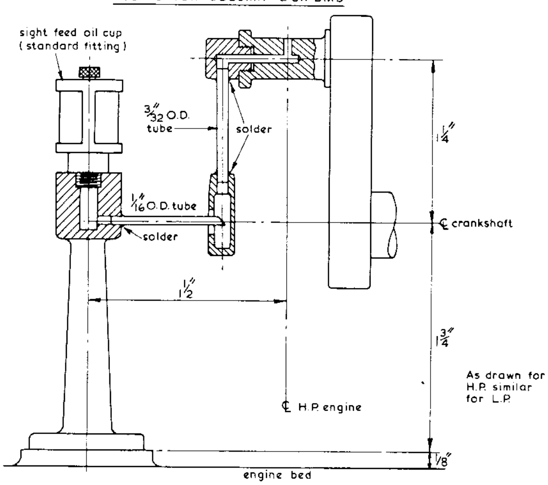
In full size practice the banjo pipe was fitted with a screwed coupling simply to give a correct length. This can hardly be done on the model as the pipe is too small. Accurate workmanship is the answer.

Oil flows from the lubricator into the trough of the banjo. Centrifugal force does the rest. Experience will teach you how to regulate the feed of the lubricator. All that is necessary is to keep it "topped up". If you would like to experience a seized-up crankpin, just allow it to become empty and keep on running.

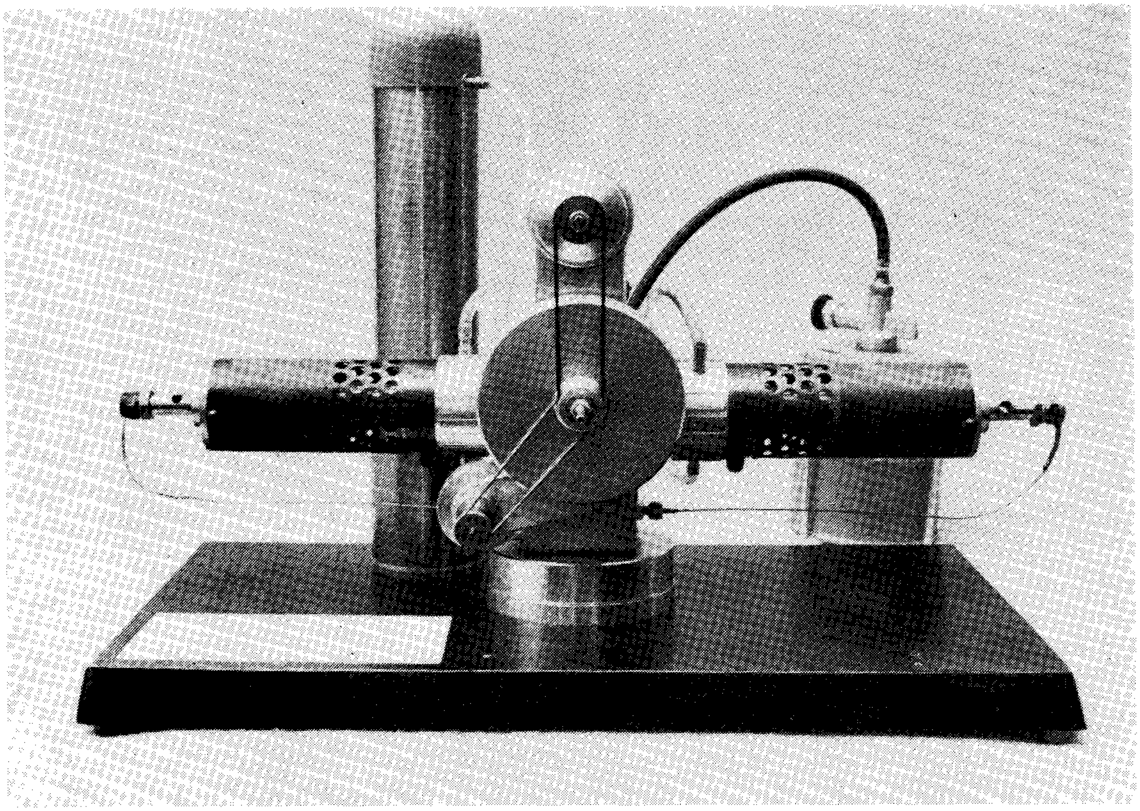
To be continued



LUBRICATOR COLUMN 2 off BMS



CENTRIFUGAL TYPE (BANJO) CRANKPIN LUBRICATOR



A HORIZONTALLY OPPOSED TWIN CYLINDER STIRLING ENGINE

F. Brian Thomas describes his engine which won "Class A" of the Hot Air Engine Competition at the 1979 Model Engineer Exhibition

WHEN THE *M.E.* ANNOUNCED that another Hot Air Engine Competition would be held during the 1979 M.E. Exhibition I decided to compete once again. I thought that I would try and build a horizontally opposed twin cylinder Stirling Engine with rhombic drive as I was sure that this layout had not been tried before. This was a dangerous assumption to have made. I had in mind what seemed to me to be a very elegant plan (Fig. 1).

Regular readers of the *M.E.* will be familiar with the articles on Stirling Engines written by Mr. Andrew Ross of Columbus, Ohio. It was Andy Ross who introduced me to the Philip's Rhombic Drive. I had built his Stirling Engine (*M.E.* Nos. 3542, 3543, 3598) and after that two engines of my own design incorporating rhombic drives. So I felt that I knew most of the problems connected with this rather complex piece of machinery.

I was pleased with the simplicity of my basic plan (Fig. 1) and what I particularly liked about it was the fact that the engine would have been perfectly in balance; each power piston would move outwards with its opposite number and the displacers would do the same. I sent a sketch plan of the proposed engine to Andy Ross for his comments as he and I correspond regularly on Stirling Engine ideas and problems.

While waiting for his reply I made a cardboard model mock-up of the rhombic motion and this gave me a rude shock — each half of my planned

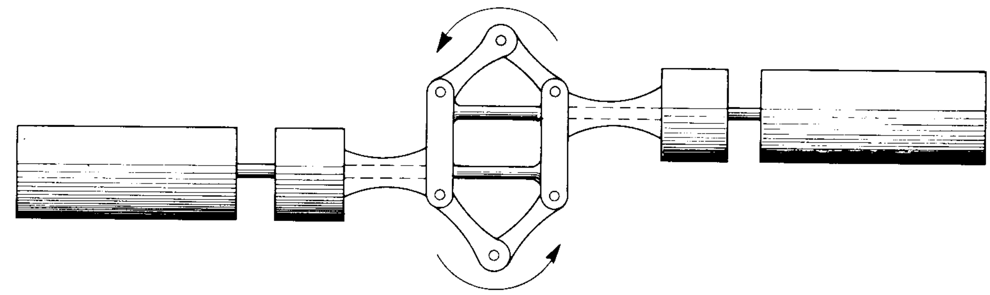


Fig. 1

engine would revolve in a direction opposite to the other half! The cardboard model provided the obvious solution — both power pistons must be connected to one rhombic yoke (cross-head) and both displacer rods to the other yoke. But this arrangement would lack balance.

Then a letter from Andy Ross arrived enclosing a copy of a diagram from a Philip's Technical Review (Fig. 2).This showed one of the Philips opposed piston engines. So my original idea was not original after all — it had been done before. This astounding Philips Engine developed 115 b.h.p. at 3200 r.p.m. and it was designed for underdeck mounting in a boat. The diagram made it obvious that the power pistons and displacers were connected to their yoke as my cardboard model told me I must do. But the drawing did not indicate how the piston and displacer rods are connected up within the crank case.

My cardboard mock-up revealed further interesting facts. I already knew that the rhombic drive motion was particularly suited to the Stirling Cycle. On the out-stroke the power piston and the displacer move almost exactly together until the displacer has nearly reached top dead centre.

In my horizontally opposed twin mock-up this ideal motion occurred in the cylinder in which the piston was directly connected to its yoke (No. 1, Fig. 3). In the second cylinder the piston was at bottom dead centre when piston No. 1 was at top dead centre. This meant that the ideal motion occurring in cylinder No. 1 did not occur in cylinder No. 2. In this cylinder the piston and displacer remain together for the in-stroke but on the out-stroke they only come together momentarily (No. 2, Fig. 3). Thus, in theory, only the No. 1 half of my engine could hope to be truly efficient.

My cardboard mock-up revealed another remarkable and totally unexpected fact. No. 1 cylinder needed to be nearly 1/4 in. shorter than cylinder No. 2, but, in spite of all these snags, I was determined to get ahead with making this machine.

Perhaps the most difficult problem was working out how the double piston and displacer rods could be connected to the two rhombic yokes. With No. 1 and No. 2 cylinders in the same axis there seemed no reasonably simple way of solving the problem. I

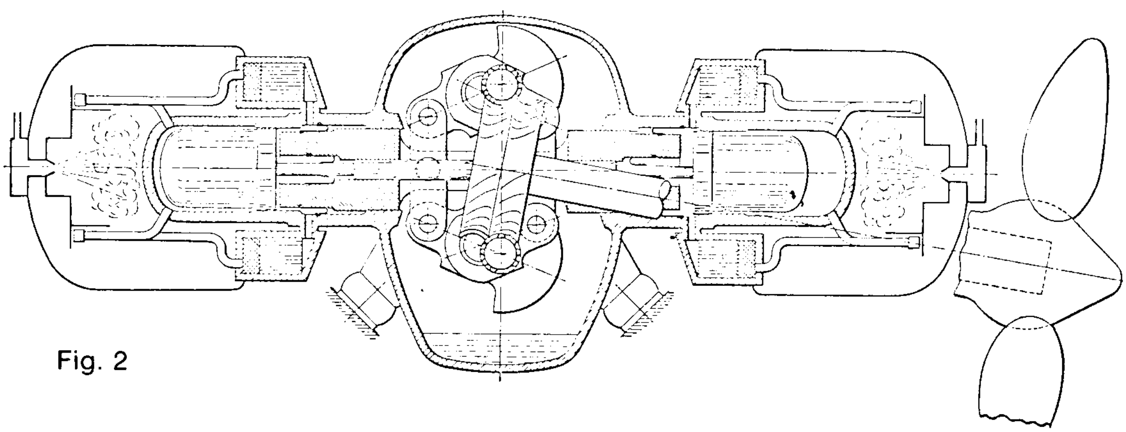


Fig. 2

decided to offset the cylinder by 3/8 in. in the horizontal plane and this provided me with the answer. The *exploded* diagram (Fig. 4) shows how everything was finally linked up. This plan had its snags but its great advantage was that the whole mechanism could be put together and taken apart easily. It also provided for easy adjustment of the positions of the power pistons and displacers.

The 5 cc. single cylinder engine that I entered for last year's competition had its two rhombic gears outside the crank case, and this meant that two crankshaft pressure seals were required (*M.E.* No. 3585 May '78). That engine had its own built-in engine driven air compressor. For my H.O. Twin I thought it would be better to put the gears inside the crank case. This needed only one shaft seal and because of this I hoped I would be able to dispense with an engine driven compressor.

I intended to pre-pressurise the engine using a bicycle tyre pump and this proved to be the right decision. When the engine was finally finished, and all leaks cured, it would hold its pressure for a week or more with several periods of running within this time.

Because of the difficulty in depicting the offset cylinder arrangement I felt that a detailed general arrangement drawing would not be helpful. However, I hope that Fig. 4, together with the photographs, makes the mechanism clear. Most of the components of the engine are screwed together and all the sealing is done with '0' rings. These were made up using the Loctite '0' ring splicing outfit. All the rings are 0.073 in. cross section diameter (1.6 mm.) and all the '0' rings grooves are 0.062 in. deep and 0.093 in. wide. Now for a few details.

Displacer Cylinders and Displacers

These are all made of stainless steel which has low heat conductivity. The displacer shells are 0.826 in. with 0.015 in. wall thickness. The displacer cylinders are 0.856 in. dia. with 0.020 in. wall thickness except at the hot end. The wall thickness at the hot ends is 0.030 in. and the hot ends are finned to increase the heat pick-up area. Overall outside length of No. 1 cylinder is 2.622 in. and No. 2 cylinder is 2.843 in.

The end caps or bases of the displacers are turned from aluminium alloy rod and epoxy cement was used to stick them in to their respective displacer shells. This caused troubles. On several occasions the engine became overheated enough to soften the epoxy cement, and the bases blew out. If I rebuild this engine I will fit stainless steel end caps, silver soldered into the displacer shells.

The annular regenerative gap between the displacers and their cylinders is 0.015 in. and this small gap is necessary for good performance at low pressures. If high pressures are used a large annular gap could prove necessary. With regard to the machining of these thin-walled stainless shells and cylin-

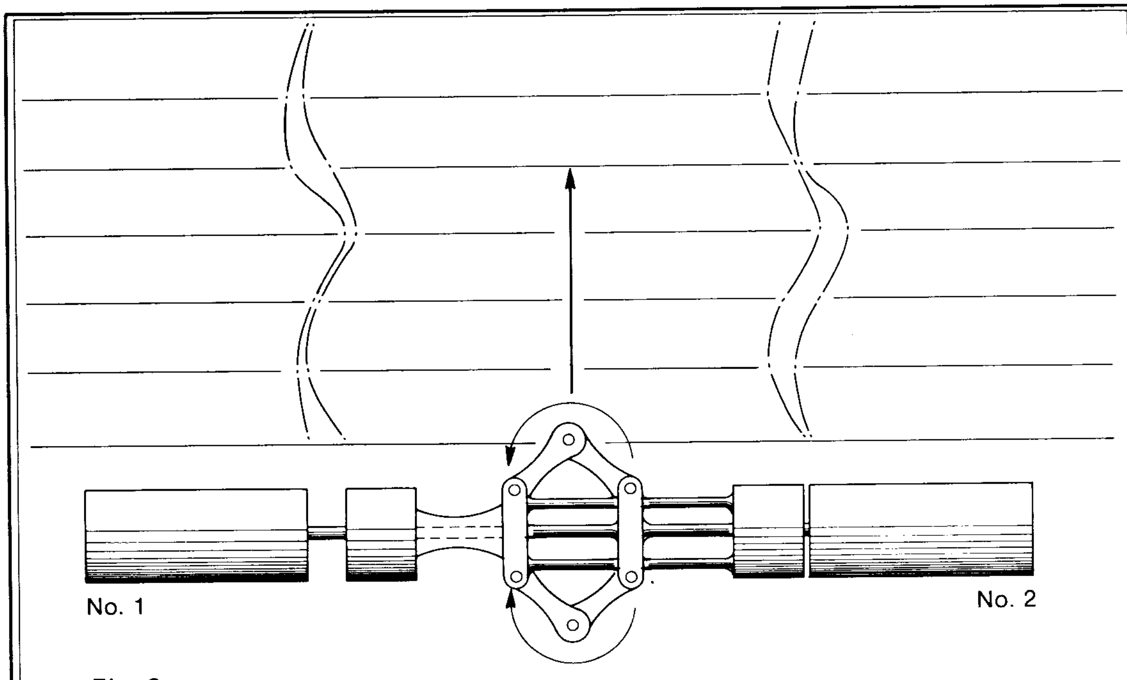


Fig. 3

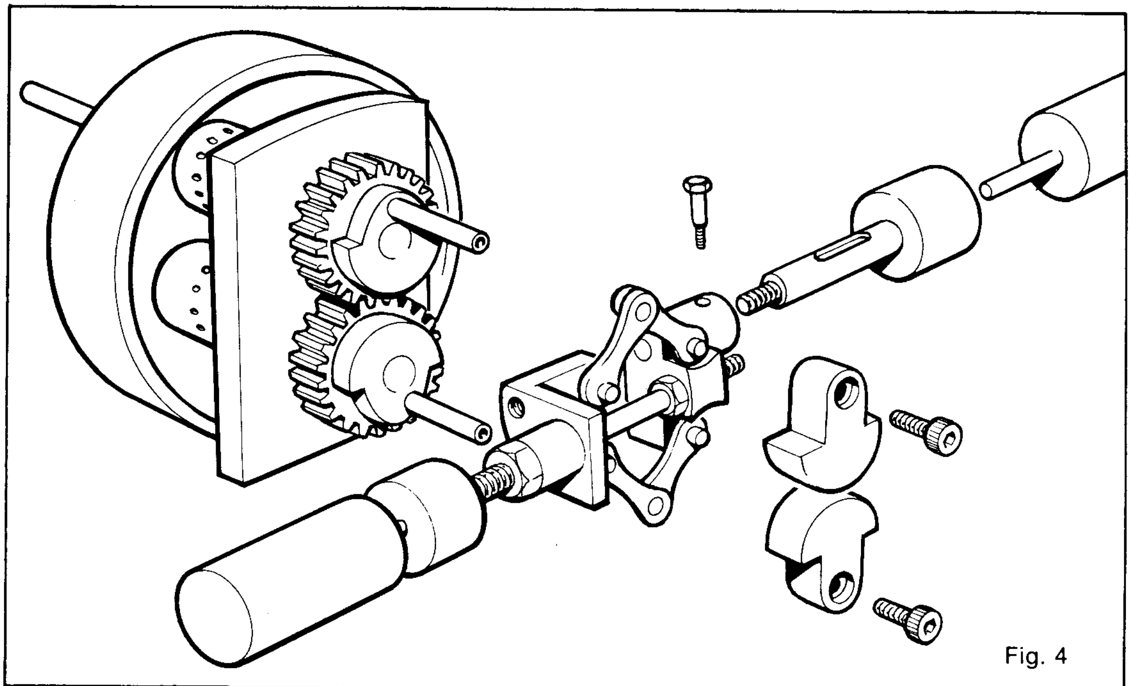


Fig. 4

ders I would like to quote from my article in *M.E.* No. 3585. "The machining of these very thin-walled cylinders may appear daunting but it is, in fact, very easy.

The first thing to do is to make two mandrels, one for the displacer and one for the displacer cylinder. I used aluminium alloy rod for these mandrels, which must be turned to the exact internal diameter of each cylinder. Before removing from the chuck, the end of each rod is centre drilled and is then parted off about 1/4 in. longer than each cylinder to be machined. Each cylinder in turn is drilled and bored to receive its appropriate mandrel which showed to be an easy sliding fit in its cylinder. A tailstock centre is engaged in the centre drill hole at the end of the mandrel and the outside of the cylinder is then turned to size.

With the aluminium mandrel inside the cylinder bore there is no difficulty in turning down the thin walled displacer and displacer cylinder because the mandrel within the cylinder supports its wall against deformation by the tool".

Power Cylinders and Pistons

These are made of cast iron. For finishing the cylinder bores (0.856 in. dia.) I made an aluminium alloy expanding lap. An external lap was made for the pistons and a really good smooth fit was achieved. Remember to machine the oil grooves on the pistons before finally lapping them to size.

When the engine was finally finished and running well I re-read the article by Mick Collins in *M.E.* No. 3565 (July '77) in which he described his "MO S_2 — loaded P.T. F.E. pistons with cup-washer sealing lips and bottom". This was the point at which my trouble really started!

Imagine what goes on inside a Stirling Engine with conventional plain pistons, which are a good but not perfect fit. The engine is started at atmospheric pressure and after running for a while, some of the contained air, expanded by heat, leaks away to atmosphere past the power pistons. This results in a slight drop in the mean pressure. In the past, engines were often fitted with a snifter valve to admit extra air to make up the pressure lost.

Assuming our engine is designed to be pressurised, we will now start increasing the pressure in the crank case. If this is done slowly the extra pressure will leak past the pistons to reach the hot ends. The engine will speed up and produce more power as soon as the pressure on either sides of the pistons becomes equal. If the crank case is pumped up to a higher pressure too quickly, the engine will stop or slow right down, until pressures equalise.

Performance — both power and r.p.m. — go on improving with increasing pressure, but on all my engines power starts to fall off at pressures above 30 p.s.i.g. Space does not allow me to make an analysis of the reasons for this — *The 30 p.s.i. Barrier*.

In place of the cast iron pistons I fitted a pair of plain P.T.F.E. pistons, with a cup-washer lip seal around their crowns. The idea of this was to allow air to pass from the crank case to the hot ends, but not vice versa. Then peculiar things started to happen. At atmospheric pressure the engine started readily, ran for a minute or so, after which it gradually slowed down and stopped. After some thought, the reason for this dawned on me. My pistons were now behaving like bicycle tyre pumps, increasing the pressure in the hot ends while the crank case remained at atmospheric. The unequal pressures on either side of the pistons made running impossible. So I fitted by-pass passages in the power cylinders.

A port was uncovered in the cylinder wall when the crown of the piston was at B.D.C. and this allowed the excess pressure in the hot ends to leak back into the crank case via the ports and by-pass passages. The ports and passages were only 1/32 in. dia. — too small, as events proved. The engine went like a bomb with the crank case pressurised to 30 p.s.i.g. It soon started to slow down, however, and then to my horror I saw that the red-hot flat tops of the displacer cylinders were bulging, and had become convex.

What was happening was that the pistons were still working as a bicycle pump. With increased pressure, the engine produced more power. But the transfer ports and passages were too small, and pressure was still building up in the hot ends, sufficient to make them bulge. I then tried similar pistons made first of *Rulon* and then *Crossflon 905* but with similar results. I also tried plain P.T.F.E. pistons with a second cup-washer lip seal round their skirts. Still the same problems so I returned, with a sigh of relief, to the plain cast iron pistons after closing off the bypass passages and ports.

Other Components

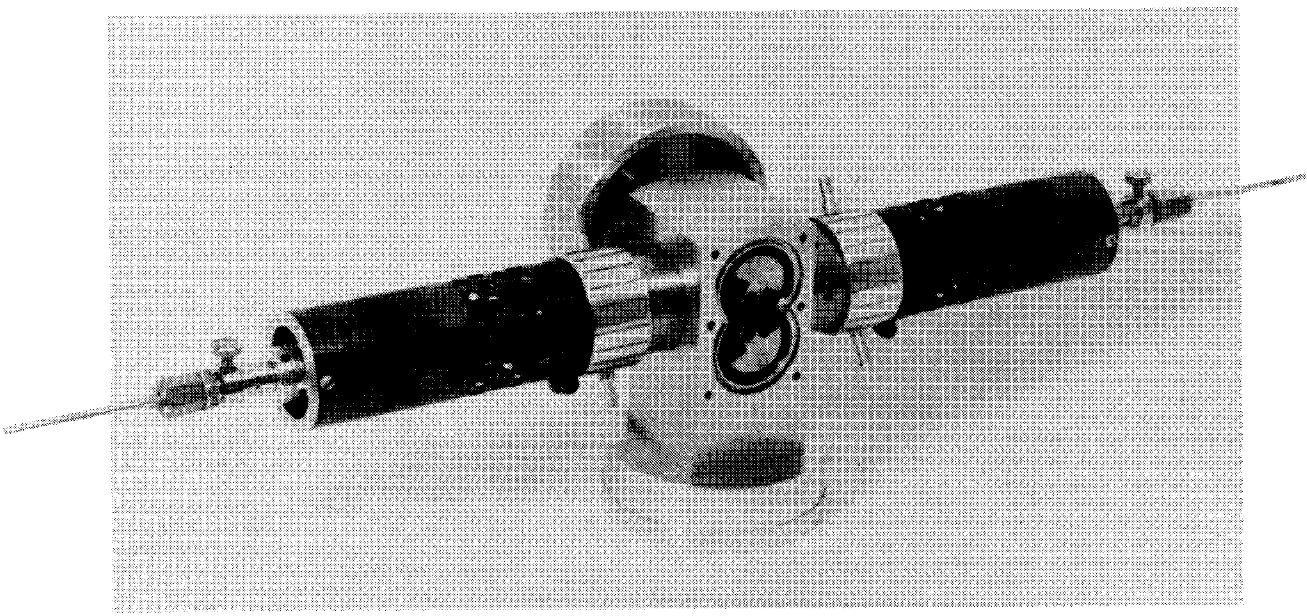
The two burners are standard *Labogaz* and are butane gas fired. These burners (with the exception of the jets) are made of stainless steel and they do not seem to mind being overheated. The photograph (p.522) shows the burner mounting rings with their large air intake holes. The flame tubes are made from a thin walled mild steel tube "blued" in my wife's pottery kiln. The centrifugal cooling water pump has a six-bladed impeller which is belt driven at engine speed. Also driven from the flywheel hub is a bicycle dynamo.

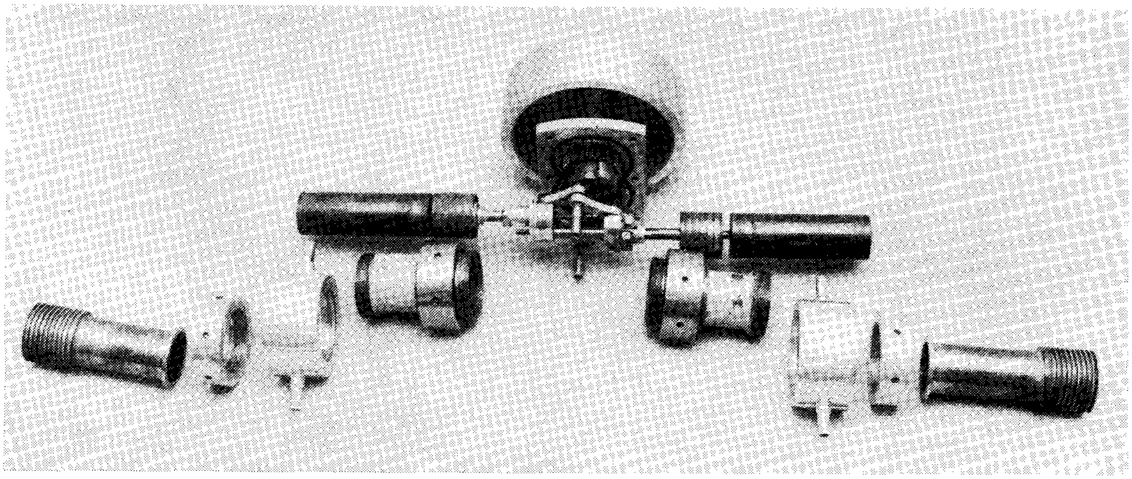
Performance

Small Stirling engines can be highly temperamental and my H.O. Twin proved to be more temperamental than most of them. On its best days it will do 3200 r.p.m. running free without load. When I saw Mick Collins' engine *Phoelix* driving a cycle dynamo I resolved to fit one to my H.O. Twin. The idea was firstly to make it do a bit of useful work and secondly to prevent it from over-revving. Driving the dynamo the r.p.m. drop to 2000 and the dynamo lights up brilliantly a 5.5 volt 0.3 amp bulb.

The best power reading I managed to get from the engine was 8.31 watts at 1800 r.p.m. and 30 p.s.i.g. When I got this result the engine was being cooled by running tap water, and was not driving its own water pump. When tested at the M.E. Exhibition by Prof. Dennis Chaddock the engine was driving its own water pump but not, of course, its

The engine partially assembled.





An exploded view of the engine.

dynamo. It produced 5.85 watts at 2,259 r.p.m. at 30 p.s.i.g.

This means that the water pump was absorbing nearly 2½ watts. Had I appreciated this before the competition I could have had the pump revolve more slowly by fitting a larger pulley on it. It is possible with this engine to light up only one burner, so that only half of the engine does the running. The other half is driven.

I expected cylinder No. 1 to be much more efficient than cylinder No. 2 (see Fig. 3). In point of fact there is very little difference. I find this impossible to explain. This kind of happening once again shows the fascination of these engines, they can always do the unexpected thing.

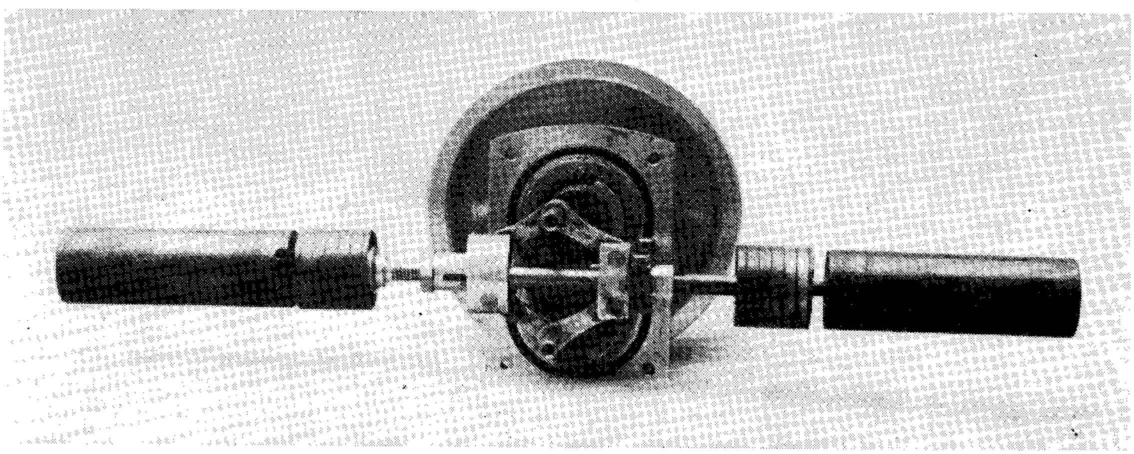
The first hot air engine competition held three years ago attracted seventeen entries and the diversity of the designs was remarkable. The number of entries for the competition last year and this year has been disappointingly few. If another competition is held next year I hope that more model engineers will be stimulated to enter.

The designing and building of these engines does not of necessity call for the skills of a trained engineer. Any model engineer of average competence should have a go. I myself, a Surgeon by profession, only acquired a lathe five years ago, knowing nothing about how to use it. All I have learned has been from the various books on lathe work and workshop practices published by Model and Allied Publications Ltd.

Engine Data

Bore. 0.856 in.
Stroke. 0.522 in.
Power pistons' swept volume. 9.426 cc.
Flywheel. Aluminium alloy 3.450 in. dia.
Crankshafts. 1/4 in. dia. silver steel, running in two ball-races to each shaft.
Rhombic timing gears. M.S. 32 teeth 1 in. p.c.d.
Rhombic connecting rods. 5/8 in. between centres. Held in place on *wrist* pins by circlips.
Crankshaft lip seal. Virgin P.T.F.E. (see *M.E.* No. 3585).

The pistons and their linkage to the flywheel.



INSULATING YOUR WORKSHOP

by Gunnar Hogberg

FROM LETTERS TO "POSTBAG" I understand that problems with condensing and rusting on tools, material and machinery, coldness in the winter and too much heat in the summer, are very common in many English model engineers' shops. As a Swede, used to a much colder climate, I am a little astonished by that. Where I live, in the central part of Sweden, about 300 km. (185 miles) north of Stockholm, the autumns are rainy and the winters sometimes bitterly cold, but my workshop is always warm and dry, with no signs of rust on the equipment. It is housed in a 150 odd years old timber building, which I believe was once used for storing grain.

I have insulated my walls, floor and ceiling according to normal Swedish practice, and I think the same methods can be used for any kind of building. I understand that English houses often have brick walls, or walls of asbestos and similar materials, but the principles remain the same, whatever your walls are made of.

There are a few main rules to remember — the insulation must be thick enough to reduce the heat losses through the walls, roof and floor, all surfaces must be windtight to prevent cold draughts, and the insulation material must be protected against moisture, both from the outside and the inside. Besides all that, the building must be ventilated to get rid of moisture produced by the inhabitants.

Whatever kind of walls you have, as long as they are watertight, you can begin your work by nailing or screwing a framework on them, consisting of 2 x 4 in. uprights and rails. In a house that already has a framework on the inside, use it as it is. If your walls are only wooden panelling and nothing else, you must first waterproof them with sheathing paper, nailed to the inner side of the panel. It is important that the outer walls stop the rain, but permit damp air to escape to the outside.

When a sturdy framework is completed, you can start insulating. Use mineral wool or similar material in slabs. Cut it a little oversize and press it in between the framework members. Do not fall for the temptation to use all the small pieces you cut away. The fewer joints, the better insulation! The slabs must have the same thickness as the framework.

If you live in a place where you estimate that 2 in. of insulation will be thick enough, use a 2 in. x 2 in. framework. If you leave any empty space in the wall, air will circulate and cool the inside panelling. On the inside of the insulation, there must be a moistureproof covering. Use plastic foil and nail or staple it over the framework. Make the joints with generous overlapping (8-10 in.), and let the foil go round the corners wherever possible to prevent draught and heat losses between the different elements of the building.

Now the workshop is well insulated, and all that remains is to cover your work with inner walls of your own preference — wooden panelling, chip boards, gypsum boards, or whatever you like. Make all joints over the uprights, and mark the positions of all uprights, even where there are no joints on them, so that you can use them for fixing of workbenches and heavy shelves.

My sketch shows the basic principles, and from it you can see that the floor and ceiling can be insulated in exactly the same way as the walls. If you have unheated spaces under the floor or over the ceiling, please remember that they must be very well ventilated, or the timber will rot.

The windows must of course have double panes to avoid condensation on the inside. If you now have windows with single panes, you can easily make extra frames of the same size, glaze them and place them an inch or two from the inside of the original windows. Use some kind of sealing around the new frames to prevent draughts.

Do not forget to arrange some form of ventilation. The damp air inside the building must be able to escape. One possibility is to have a vent at floor level in one side of the building, and another near the ceiling in the opposite wall.

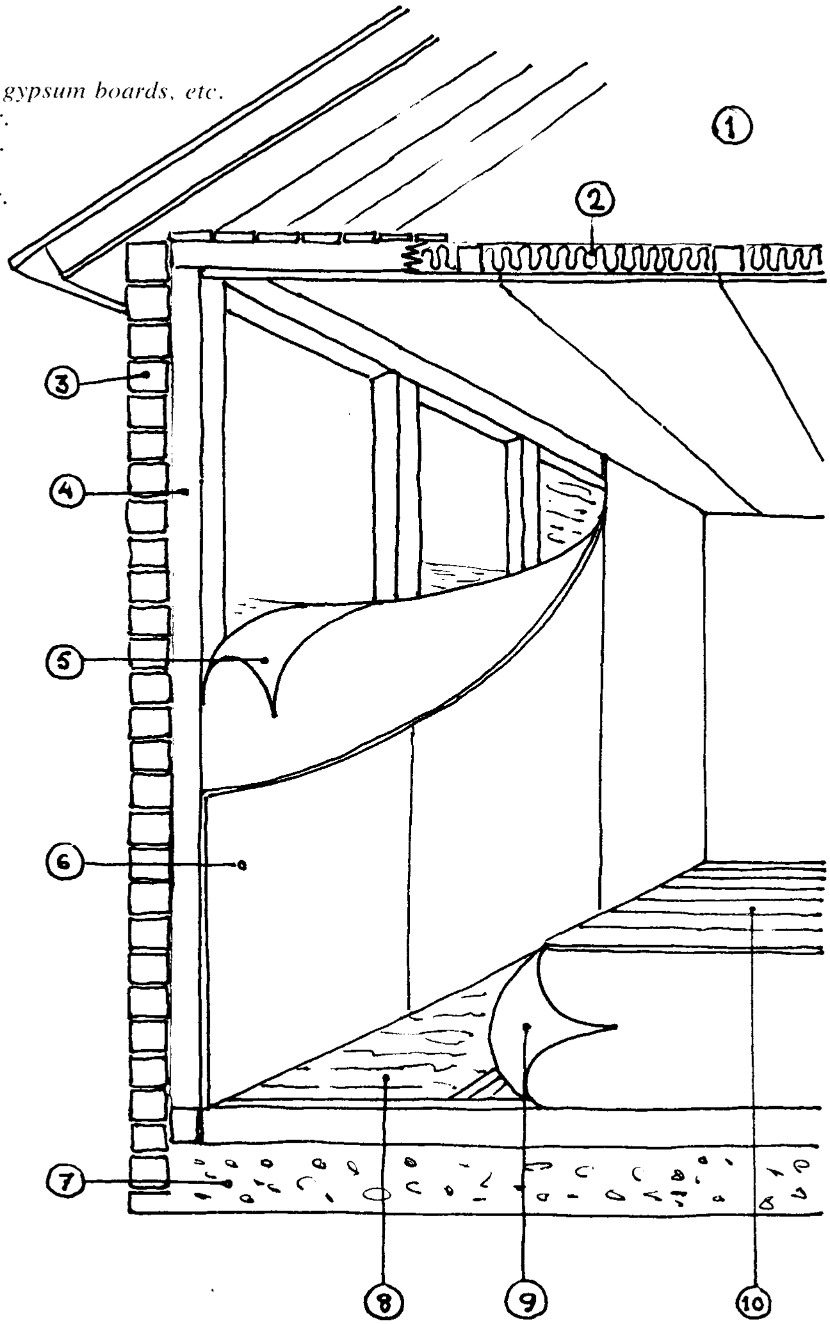
For heating there are many alternatives, but electric heating with thermostatic control is one of the simplest methods. In central Sweden, with temperatures down to −30 deg. C (−22 deg. F), 100 watts per square meter (about 10 watts per square foot) is a normally accepted value for keeping a well insulated house warm all winter. In a milder climate, I am sure a much smaller wattage will be satisfactory.

If you prefer some kind of open fire for heating, please do not forget that you have now a very tight house, and will have to make arrangements for providing combustion air — or there will be no oxygen left for your own use.

The tips I have given here are of course not in any way exhaustive, but in combination with the English common sense and resourcefulness, I believe they will help you to build a nice and warm workshop, where no rust will ever spoil your valuable models and equipment.

LEGEND TO THE SKETCH

1. *This space must be well ventilated.*
2. *Insulated in the same way as the walls and floor.*
3. *Existing wall.*
4. *Framework.*
5. *Plastic foil.*
6. *Chip boards, gypsum boards, etc.*
7. *Existing floor.*
8. *Mineral wool.*
9. *Plastic foil.*
10. *Wooden floor.*



Club Chat... with the Editor

No changes in committee at **Andover & District M.E.S.** except among the minor posts and the year of 1978 was a busy one on and off the track. The 17th February this year saw the annual Club Dinner which was well-attended, trophies being awarded to Rick Edwards, John Turner and Ralph Armstrong. Open Days at Red Rice — one day someone will tell me how that name came about — are 6 May and 2 September. A model exhibition is planned at the Andover Traction Engine Rally on 9/10 June at Baulkesbury Hill, Salisbury Road, Andover, and if any reader wishes to exhibit he can contact Hon. Sec. R. Hammond at 1 Wilmott Way, Basingstoke, Hants.

At **North Staffs. Models Society** the AGM on 7 February saw the election of Mr. S. A. Baker as President, Mr. V. Barnes as Chairman, Mr. N. Taylor as Treasurer and Dr. J. B. Hollins as Secretary. Dr. Hollins lives at 166 Leycett Road, Scot Hay, Newcastle, Staffs. (Tel. 0782 624497). Track running begins this month on Sunday afternoons in Brampton Park, Newcastle-under-Lyme on the 700 ft. track. It could be that in September the National 2½ in. Gauge Association will hold their rally on this track but more of that later.

Saturday, 5 May, is when the **Ilford & West Essex Model Railway Club** hold their annual Open Day from 10.00 until 17.00. The club's 7¼ in. gauge *Excalibur*, built in 1919, will give rides to the public and there are other entertainments such as a Bring and Buy stall, small gauge layouts, etc. The venue adjoins Chadwell Heath B.R. Station and admission is free.

On 16 June **The Historical Model Railway Society** holds a Social Meeting from 2 p.m. to 6 p.m. in the Stratton Suite of the Wiltshire Hotel, Fleming Way, Swindon. It will give visitors and members of the Society an opportunity to discuss relevant topics and view models. If you wish to attend you are encouraged to bring along drawings, models, etc. for display. As you may well appreciate, accommodation is limited so contact Mr. S. Adam of 97 Priors Dean Road, Harestock, Winchester first, in fact before 1 June. A nominal charge will include tea and biscuits.

The AGM at **Model Engineers Society N.I.** saw Mr. T. D. Wilson elected to the position of Hon. Sec. Mr. Wilson lives at 97 Rosepark, Donaghadee (Tel. 888113).

Kinver & West Midlands S.M.E. Ltd. has suffered recently from the unwelcome attention of a few camels and elephants. Now dogs I can understand. However the aforesaid animals are the property of a visiting circus which tethered them to the concrete fence posts belonging to the club. It appears that when the animals left they pulled the post with them or at least they caused £200 worth of damage — other clubs take note. The circus, of course, cannot now be traced and the club has to foot the bill. It's just as well that the club has a healthy balance sheet. The AGM was on 30 March so no details as yet. I mentioned the Steam Gala earlier but for those who missed it, the date is 17 June and the club is combining with the Staffordshire Building Society for the necessary arrangements. I mentioned that this Building Society wishes to display Kinver's models in its branch windows prior to the show. Well there are 14 windows to fill in the area around Kinver and the club is looking for more models.

St. Albans & District M.E.S. now has its own track at St. George's School, Sun Lane, Harpenden, which was only recently completed in 3½/5 in. gauges. The Grand Opening was on 31 March when a Social Evening was also organised for the event. The portable track is still very much in demand and so far there are five engagements booked, one hospital, three schools and one at Elliotts at Boreham Wood. Those of you not knowing the secretary of this club make a note. He is Peter Lambert of 6 Molescroft, Farm Avenue, Harpenden. On 3/4/5 May the club is holding an Exhibition of Models at the Public Hall, Harpenden; admission will be 30p for adults, 15p for children, OAPs free. All the usual types of models will be there with, of course, a fair proportion of steam.

The February meeting at **North London S.M.E.** was a Bits and Pieces evening and the first item of discussion was the Southern Federation Handbook. This gives me the opportunity to remind club members, and in particular secretaries, that this small booklet is a mine of information regarding member clubs of the Southern Federation and is a must for serious clubmen. The cost is only 25p.

At the **Otago M.E.S. Inc.**, the 25th Festival Week Exhibition is now over and Chairman A. R. Johnston tells us that everything ran satisfactorily. This included the outside track, small gauge, slot cars and traction engine. The weather seems to have been on the club's side with rain only on the last Saturday — would that we could make the same boast on our occasions. This club holds its own steam trials so we may hear more about those later.

John Arrowsmith, Hon. Sec. of what used to be called Hereford Live Steamers, has written to tell me that they are now called **The Hereford Society of Model Engineers.** This is due to a very healthy growth in membership of which several have interests apart from just steam. On this matter, one of the members is laying a 3½/5 in. track in his garden and the club is considering its use by the loco chaps, but we must await further information on that. John's address is 1 St. Paul Road, Tupsley, Hereford.

Harlington Loco Society held its AGM on 18 January but all officers were re-elected and Mr. V. Clark is still Hon. Sec. He can be found at the club's HQ in the High Street, Harlington, Middx.

The officers were also re-elected at **Wigan & District M.E.S.** where the AGM was held on 20 January. Mr. R. Haydock is the Hon. Sec. and he lives at 28 Chester Avenue, Duxbury, Chorley, Lancs.

May 19/20 sees the Open Week-end at the **Tyneside S.M. & E.E.** track behind the Science Museum in Exhibition Park. Visitors are, of course, welcome. The AGM of this club was held on 7 March and we have yet to hear of any changes.

Secretary of **Bracknell Railway Society,** who held their AGM on 26 January is Dave Ranson, Great Oaks, Brockenhurst Road, South Ascot. Dave is also Entertainments Officer.

The AGM of **Bristol S.M. & E.E.** was held recently. Hon. Sec. is Ken Summerill who I had the pleasure of meeting with three of his colleagues recently, and he lives at 17 Sandhurst Close, Patchway, Bristol (Tel. Almondsbury 612217). I see from the Newsletter that the club now has 246 members and from my knowledge of some of them the interests are very diversified, which is all to the club's advantage. Visitors to IMLEC in July will appreciate the efforts in track laying when they see the progress in the 7¼ in. track now being built alongside the raised 3½/5 in. track. And a very pretty spot it is at Ashton Court.

Lucky **Taunton Model Engineers** have just been granted £1144 by the Taunton Deane Leisure and Recreation Committee for the construction of a 3½/5 in. track in

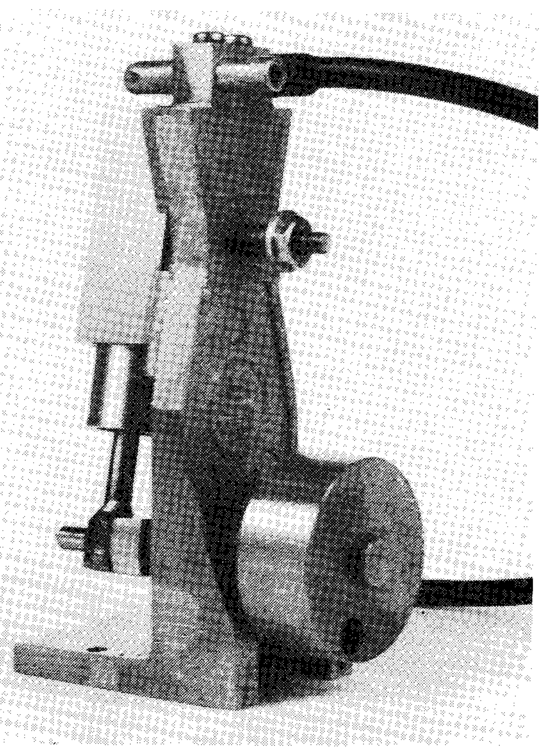
Vivary Park. The club has a portable track but like most societies a more permanent installation was required to satisfy an ever-growing number of locos in the area, many of which had to be taken to the other clubs in the area for proper running. Originally plans were put forward to erect a track around the running track at the Youth and Community Centre in Tangier but although planning permission was granted there was a problem over the lease. So, Vivary Park was offered and accepted for the 450 ft. track but until the new track is laid, the portable will continue to give its all from Easter to late September. Meetings are held on the first Tuesday of the month at the Rugby Club and on the third Tuesday at the Youth and Community Centre. All this info. comes from Mr. S. P. Bowditch, Information and Publicity Officer, at 13 William Street, Taunton (Tel. 76252).

The **Swansea S.M. & E.E.** cannot compete with Bristol when it comes to club membership but the eight or nine stalwarts have at last managed to complete the track which started back in 1974 at Heol-Y-Gors, West Glamorgan. Actually, the first loco went round in 1977 but as everyone must know it takes more than just fixing the rails to be able to call a track a track. It is 700 ft. in length and still requires the steaming bays to be connected and other jobs to be done, but what the club really wants is members. The eight or nine meet on the first Monday of the month at 3 Gloucester Place, Swansea, which was made available by Friends of the City of Swansea Maritime and Industrial Museum, and visitors are welcome. Before you take a loco along at a week-end, better contact secretary Mr. L. C. Turner first. He lives at 24 Ash Grove, Killay, Swansea (tel. 27233). Better still, all you readers in that area still "going it alone", why not swell the club's ranks?

History is made in this issue by reporting on the first Newsletter of the **Didcot & District S.M.E.**, a club which was formed by members of the Great Western Society about two years ago. A site for the proposed 1000 ft. 3½/5 in. raised track was agreed adjacent to the new carriage sheds within the GWS compound and the only condition laid down was that all members of the Didcot club had also to be GWS members. The site has been levelled and so far 100 ft. of track laid despite the problems of soil — "rabbit holes joined by cinders" — and Ken Price with his 5 in. gauge *Manor* has taken fare paying passengers on this stretch. For any other members of the GWS who wish to join the club, the sub. is £1 per annum (50p for OAPs and under 18s). Meetings are held on the site most summer week-ends and in the Dragon Hotel monthly during winter. Contact the Hon. Sec., Alan Christie, at 48 North Street, Swindon, Wilts. You can join the GWS for £4.

WHAT'S IN STORE

Where possible, the items reviewed are seen and tested by "M.E." staff. However, where this is not possible reviews are given solely on the information received from the manufacturers and we cannot accept responsibility for products which do not measure up to the claims made for them.

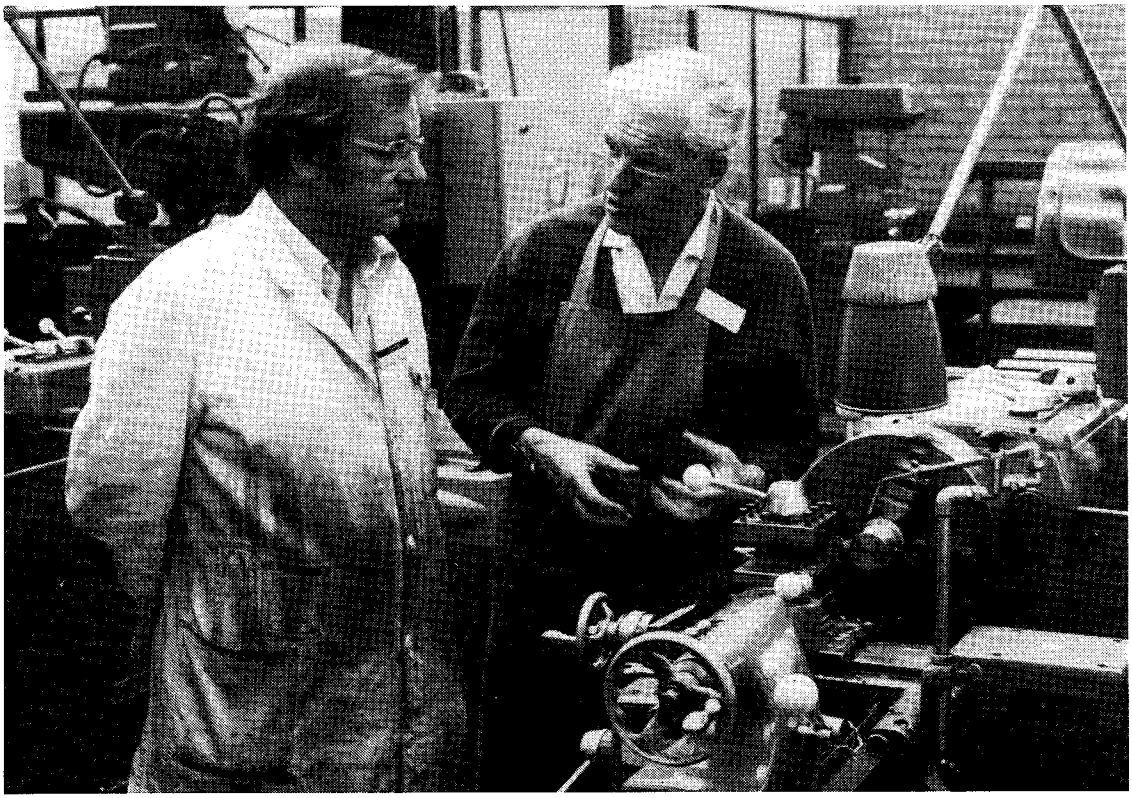


Small oscillators

The advertisement for Unit Steam Engines (41 Church Street, Twickenham, Middx.) has been seen for some time now but only recently have we been able to have a close look at these kits and try them out. We received the No. 2 kit which requires machining — the No. 1 kit is ready to assemble — and Colin Rattray, Associate Editor of *Model Mechanics*, used the small Sherline lathe to do the necessary. An air line on the finished engine soon had this 8 mm bore, 19 mm stroke oscillator buzzing round. The maching and assembly operations, which are fully described in the kit, will be published in *Model Mechanics* in the near future and a special offer to readers of that magazine will be made in the June issue. A special advantage of the design of the Unit Steam Engine is that two or more can be joined together in virtually any configuration — even a V8 if required. There is no doubt that the quality of castings is high and all stock material is included, there being nothing else to buy except paint. One or two of the machining operations, such as the drilling of the 2 mm ports call for accurate setting up but nothing in the assembly should be beyond the capabilities of a determined beginner. The company also offers boilers, a complete steam plant based on the Unit engine, pop-pop power for boats and a steam boat kit which uses the pop-pop principle. Prices start at £2.95 but if you are a reader of *Model Mechanics* they will be considerably cheaper, a very nice start to model engineering.

Instant Maintenance

Several developments have been made in the line of penetrating fluids which chase away water, removes rust, and generally protects metal and non-porous surfaces against corrosion. The latest product to reach us comes from the STP range which of course, enjoys a high reputation, and is called AP75. This liquid, which can be obtained in aerosol or larger quantities, will clean stainless steel, chrome, etc., remove oil deposits from engines and dirt from electrical contacts. It is a penetrating fluid which will ease rusted nuts, cables and linkages and at the same time lubricate the moving parts. It then gives protection against further corrosion. AP75 is available through general outlets and is marketed by Link Hampson Ltd., Bone Lane, Newbury, Berks.



THE M.E. WEEK AT LOUGHBOROUGH UNIVERSITY

by Mr. J. A. Margary Photos by Prof. K. McCarthy

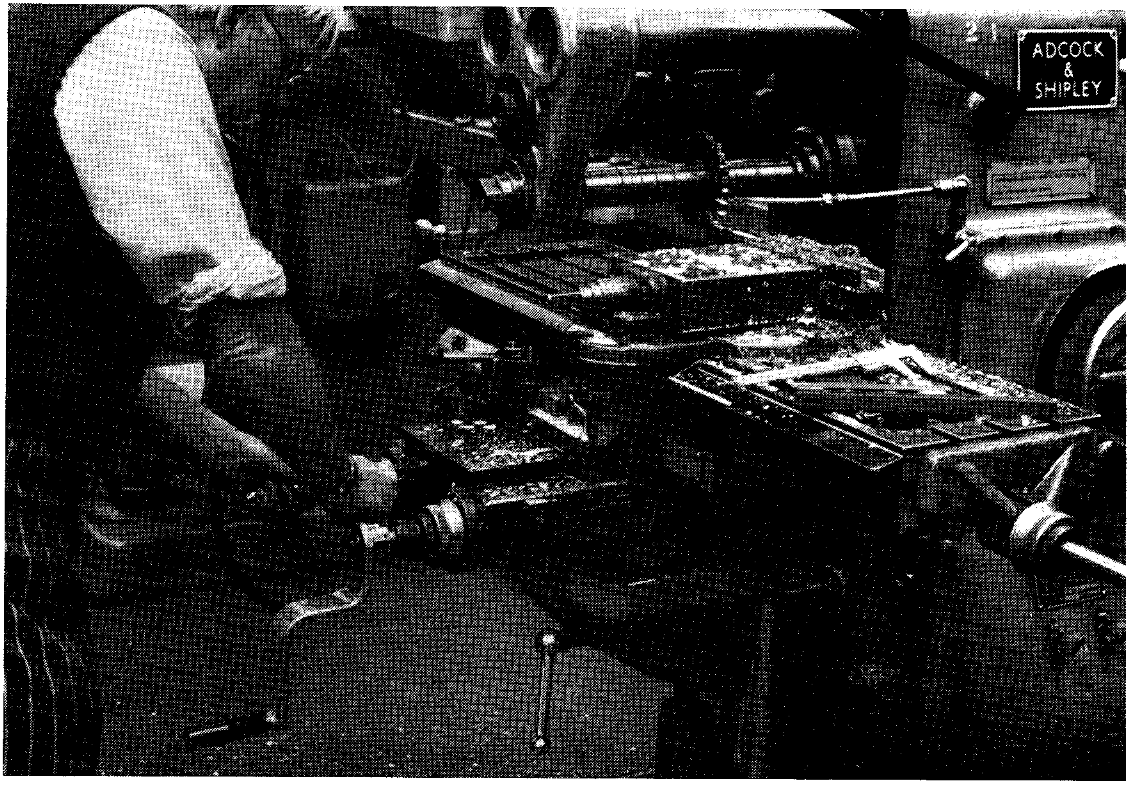
WHEN I NOTICED the Editorial Note in issue No. 3582 I had barely heard of Loughborough University of Technology, still less of their Centre for Extension Studies (C.E.S.). With such imposing titles I could not resist enquiring further. Thus it was that my wife and I arrived on the very wet evening of Sunday 23 July at the C.E.S. Reception after having, of course, chosen the wrong entrance which involved us in a tour of the University's very extensive area over a road infested with rather fat (and bumpy) "sleeping policemen".

At Reception we received an envelope bearing a map of the Student Village and containing additional helpful information. Refusing help with our bags, we left the car in the nearby park and trudged through the rain up the hill to find *Faraday 15* which was said to contain our rooms. This proved to be one of a large number of small modern blocks each containing about twelve single rooms. The rooms were a pleasant surprise each with bed, washbasin, desk, easy chair etc. But take your own kettle if you like early morning tea!

By now it was, according to the details provided, time for the evening meal. Accordingly we set out in search of Rutherford Dining Hall which we soon found about 150 yards away. Any fears we may have had about the likely standard of the meals were quickly disposed of since we were treated to a cold meat salad (and all the trimmings) with sweet, cheese and coffee of a standard and quantity which our local "best" hotel would have found it hard to beat. I should add that this standard was fully maintained throughout our week, though it is hard to imagine how this was achieved.

At 8 p.m. we repaired again to the Dining Hall each wearing the name and course badges which had been provided. There we split into the relative groups, she to *Antiques* and I to *Model Engineering* where we met our Instructors and other *Coursees* and were handed yet more literature and a useful green plastic folder in which to keep our notes etc.

After a short welcoming speech from the Direc-



Left. A discussion between a participant and his tutor. Above. An Adcock and Shipley horizontal miller was one of the delights in store!

tor of C.E.S. we were all conducted by our instructors to our respective class rooms which in the case of the *M.E.s* comprised Building No. 6 in the Technical College. This was situated about one mile from the student village and consisted of a large single storey building containing lecture rooms and drawing offices with a large machine shop and stores.

There were about ten 6 in. lathes and several much larger ones; several vertical and horizontal millers, boring and grinding machines of various types, shapers, band saw, tool and cutter grinder, gas torches and welding equipment and the most solid double-ended grinder I had ever seen.

After looking round these, with some little awe on my part, we were sent off to our own devices which consisted for me of a short spell in the vast Students' bar and then off to a somewhat uncontrollable hot shower and a good and needed night's sleep.

Up betimes next morning for a short walk round the Campus (why does that word irritate me?) to try and get one's bearings with the aid of yet another map, this time provided in the green folder. Breakfast, good and most (too?) ample, was followed by a drive round to Building No. 6 to deposit one's current workpieces, etc. I had resolved to eschew the car as much as possible because it was already apparent that the food intake would surely make an even worse mess than usual of one's waist line and so it was important to take exercise.

At 9.15 a.m. the prescribed start time for the first day, the shop was already a hive of activity. There were 17 of us and as many different types and interests. It was a real pleasure to meet so many charming people and all with our, no doubt eccentric, common interest. It is my opinion that the great pleasure I discovered during the week was due very largely to the company not only of the *M.E.* course members but also of the many other people with whom one came into contact all the time.

Our instructors, Don Taylor, Stan Esmond and Derek Draper were all very pleasant and helpful as also were the several storekeepers. I am sure they all wondered what kind of crackpots they were in for, as this was the first *M.E.* course to be held in the eleven years' existence of the C.E.S., but I believe they soon found we were all quite responsible and in no time we were all getting on very well.

Stan Esmond was in charge of materials which were supplied at reasonable cost. In particular he had stocks of excellent continuously cast grey iron in a range of sizes. A piece of this is now well on the way to becoming the tool head index on my Quorn Grinder and many of the others made use of it and indeed certain cars looked rather down on the springs at the end of the course!

A treat was in store for us on the Tuesday afternoon when Professor Chaddock gave us a most interesting talk on tool and cutter grinding. He explained that the need for his Quorn machine arose from shortcomings in his earlier equipment and his need to make tiny end mills for his *working* 15 cc. V-8 B.R.M. engine replica and other, possibly even farther out, projects.

By Wednesday evening just about all of us, including the instructors, were suffering with feet and back pains arising from excessive standing. So it was a great pleasure after supper to take a seat in a bus and enjoy a motor-boat trip down the river from Trent Bridge and watch the sun setting. This was an evening to remember.

All too quickly it was Friday afternoon and time to return all our *borrowings* to stores, and get ready for the combined Course Dinner and exhibition of work. It is surprising how little gets done in a week in spite of the effort put in. All the same the *M.E.s* managed to put on a creditable display apart from yours truly whose efforts were mainly finished inside only and so were labelled *rough turning!*

The Dinner was excellent, a mere seven courses, with wines, and after a short session in the bar it was a pleasure to get to bed.

What did I learn during the week? From the practical angle, that a *baby's bottom* finish can best be obtained with a round nosed tool, a fine feed and as slow a speed as can reasonably be managed and that old Bendix washing machines contain a useful amount of cast iron in the form of weights! The more important lesson, however, was that the social aspects of such a venture are of the greatest value to all concerned.

The *Antiques* course was of great practical value and interest and numerous helpful points came out of what is really a vast subject.

I certainly hope to attend Loughborough C.E.S. again and strongly recommend it. Those with children, young or teenagers, need have no qualms. The arrangements are excellent for them and the youngsters seemed to enjoy themselves more than anyone.

In case this report seems too glowing — there was one minor irritation. The weather had turned very warm and since the place boasted some three swimming pools the thought of an evening swim was attractive. I found that, with the walking involved and the short time between *knocking off* and the evening meal, there was not really time to fit this in. The only evening when this would have been feasible was the last one but then the pool opening time had been put back to an unpublished 6 p.m. so a swim was still not really possible. The answer must be to take the necessaries with one and nip in immediately after finishing and on the way back to base, but it takes a little time to learn the ropes.

Loughborough University is running a similar course in July and August this year. The 1979 course will be in two parts with one given over to general machine shop work and the second week specialising in boiler construction. The visiting lecturers will be Prof. Chaddock and Martin Evans. Enquiries to Mrs. Olive Jones, CES(ME), University of Technology, Loughborough, Leics. LE11 3TU.

Another milling machine in use.

Before the Marathon.

MARATHON AT MALDEN

by John M. Tulloch

I SHOULD HAVE KNOWN it was a "con" when Wilf first started talking about a 24 hour endurance trial. The idea was to run his 7¼ in. gauge 0-4-2T loco *Winifred* for 24 hours non stop, served by a team of four mental defectives (you have to be mad to agree to it!), record each lap mechanically and calculate from that the distance travelled, average speeds, etc.

So it was then, that the date was set for Saturday, 12 August 1978, and the preparations begun. The run would be made on the raised track of Malden D.S.M.E. and Wilf Grove, the owner of *Winifred,* would be joined by John Tulloch, Chris Brown and Roger Kempster as the team. Wilf organised food, and a 5 gallon oil drum brazier for "fry ups" and kettle boiling, and somehow all the rest of the support paraphernalia came together.

A digital lap recorder actuated by a bar attached to the train, signal flags and lamps, oil cans, water cans, tools, coal, 12 volt vacuum cleaner, batteries and so on. The routines were agreed by the team for various activities from changing drivers to filling the lubricator and clearing the smoke box, and so we were ready.

8.30 a.m. Saturday morning in a drizzle of rain saw Wilf and I getting *Winnie* "off shed" and down to the raised track where the fire was lit and she was left blowing up whilst the water wagon was got onto the track. This was an 8 ft. bogie wagon which carried a large box for coal and tools, behind which was mounted a 35 gallon water tank, a flexible rubber pipe from the tank was led alongside the driver's car and attached to *Winnie's* injector feed.

We were soon joined by Roger and Chris and by 10.30 we had backed on and coupled up the water wagon, tried a couple of laps and set the lap counter. *Winnie* was just whispering through her safety valves anxious to be off when Wilf simply said *go!*

The routines, as yet unpractised soon fell into place and throughout the morning the miles began to mount. Drivers changed over, the water wagon was replenished, coal changed hands and so on until the 70th lap when disaster struck! The securing pin on the ashpan worked loose and bang, down went the fire. Disappointed but nevertheless stoic we drilled the bar and split pinned it, then re-read the lap recorder and started again.

After only 13 laps misfortune again struck when *Winnie* just would not steam. Her tubes were clear, and smokebox ash was minimal, but the blower ring had been moved and was obstructing the blast pipe. Rectifications were made but still no joy. Several unrecorded laps were tried but no, she just did not want to play. A little clinker was found in the firebox bottom, the chimney "crud" reamed out without success, and time was now running out. We decided regretfully that the 24 hour run was now hopeless and we would have to abandon the idea, and just try a couple of laps to get pressure back.

It was a rather unhappy looking Chris who climbed on and pulled out of the station with only 25 lb. on the clock. After one circuit he had worked up to 50 lb., and then suddenly she came round the next time roaring like a banshee with both safety valves blowing like geysers.

It was now 6.30 p.m. so it was agreed to try for a 12 hour run instead, and the mood changed. The lap recorder was re-read and Wilf even got back into the mood for cooking. Roger took over from Chris and slowly the miles began to mount. Unfortunately Roger had to leave at 9 p.m. due to another engagement, so the three remaining idiots decided we would still bash on through the night. Even *Winnie*, now utterly reformed, went to it with a will, and *did she go!*

Most of my driving was done in 15 per cent cut off with half regulator, opening the regulator to three-quarters as I hit the bottom of each gradient. If she started to blow off the injector was put on, and the firing done on the basis of "a little and often", with vigorous poker work to keep the clinker down.

Running through at about 10.15 p.m. I shouted instructions for fried egg sandwiches and received a signal from Wilf, now grinning from ear to ear, which either meant "Would you like two?" or "Victory is possible".

And so it went on until midnight with water, fried egg sandwiches, coal, tea and all sorts being exchanged on the move, not to mention oiling up and clearing the smokebox. This was achieved by sitting backwards on a car complete with battery, 12 v. vacuum "sucker", oil, etc., and then shoving off as the driver entered the station. He would then pick up the moving car and having been coupled up, push it round until the work was complete, then shove ahead at the top of the bank and shut off whilst the car and cleaner shot ahead and were removed from the track.

12.30 p.m., the half-way point arrived and the lap recorder showed we had done 295 laps non stop, some quick work with a calculator — "98.33 miles", I announced. Wilf was trundling very slowly through the station whilst Chris and I oiled the motion and topped up the water wagon a couple of laps later, when one of those idle thoughts came to mind, "Do you realise that 98 miles out of Kings Cross is round about Stoke Box, 5 miles outside Grantham?" and, after a very short silence, a roar from *Winnie's* exhaust as Wilf disappeared into the darkness.

I think we all began to relate in our own way after that, either Paddington-Plymouth or Kings Cross-Edinburgh, or whatever one's own favourite piece of nostalgia happened to be (and I'm not saying what mine was and starting a new readers' letter page!).

By 2.30 a.m. the long slog was beginning to tell, the night had turned very cold indeed and we were all pretty tired, so at Wilf's suggestion I tried for a couple of hours' shuteye lying on a park bench by the brazier, roasting on one side, cold on t'other. The next thing I remember was Wilf shaking me awake at 4 a.m. "Your turn John, take over from

At speed somewhere en route.

Chris next time round." A quick swig of tea which was actually foul, but tasted like nectar, and Chris was running into the station already changed to riding side saddle, in full forward gear with just a smitten of regulator on, then he was off and *Winnie* was puttering towards me like a gun dog coming to heel. Chris had just completed a magnificent 2-hour stretch and was walking like rigor mortis had set in! Like an automaton I dropped into the driver's seat, opened the regulator, checked the gauge glass and pressure gauge, notched up, looked at the fire and the station lights vanished astern, *Winnie* and I were alone again and it was *freezing!*

By then we had covered 155.68 miles; or just passing Doncaster; or Honiton from Waterloo. *Winnie* was on top form, fresh as a spring chicken and tossing the occasional half-dozen sparks into the trees.

The fire had earlier changed from red to yellow, but now it was a searing, brilliant white and quite large pieces of coal were consumed like the kiddies' ice cream. The coupling chains were bar taut and a steady rhythmic roar issued from the chimney. Throughout the previous afternoon several club members had dropped in to offer helpful advice or raucous comments; what a pity they couldn't see her now!

By now we knew the road so well we could drive on the exhaust note or rail noises out in the darkness, for despite clamping a good headlight onto her front buffer beam, when the firebox door was opened believe me you were blinded!

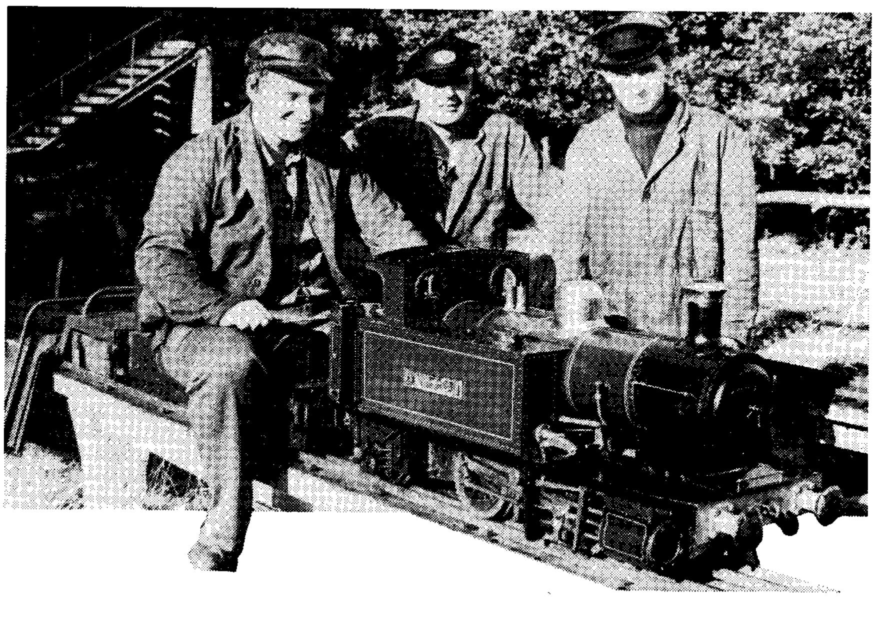
Slowly at first, then more frequently I found I could read the pressure gauge without a torch, dawn was breaking and what a dawn. I shall long remember climbing the bank huddled up behind *Winnie*, a layer of white mist lying 3 ft. deep over the ground and her exhaust streaming away behind like a banner. What *must* it have been like to cross the Yorkshire Moors in January on the footplate of a Stirling single? At 4.30 a.m. I passed Shaftholme Junction or Pinhoe, 3 miles from Exeter, and by 5.30 had reached and passed the 180 mile post.

My usual cautionary driving pattern had vanished some time during the night and here I sat, dog tired, rocking and swaying as scenery blurred past on both sides, still in 15 per cent cut-off, and *Winnie* barking like a sea lion each time I opened up to climb the banking. But it did have its humorous moments as well. Have you ever tried to take a fried egg sandwich from somebody at 25 m.p.h.?

At 6 o'clock I turned over to Wilf for the last half hour, barely able to jump out of the driver's seat from the cold, eyes full of cinders and aching in every limb I made straight for the brazier to thaw out. We were then at mile post 188½. There could be no relaxing however, for earlier in the night *Winnie's* mechanical lubricator had packed up with a broken pawl, so rather than stop we had decided to turn it over by hand every ten laps, using the same routine as a smokebox clean.

So it was that Wilf flogged away for the last half hour, and at 6.30 a.m. Sunday 13th, Chris and I jumped onto the water wagon for a "lap of honour".

In a 12-hour non stop run *Winnie* had covered 196.66 miles at an average speed of 16.38 m.p.h. Our total distance for 24 hours (including stops, which could have been adverse signals) was 224.33 miles, or exactly Paddington to Plymouth or Kings Cross to "not quite Darlington". So there we were, three black and white minstrels, with blistered fingers, aching muscles, eyes full of cinders and bruises in various places, who put *Winnie* back "on shed", cleared up the mess and with difficulty got ourselves home for a good hot bath. Would we do it again? Not for all the tea in . . . . and yet . . . if a loco is well prepared . . . ?



Another view of our heroes before the run began. Needless to say, there were no pictures taken after the marathon!

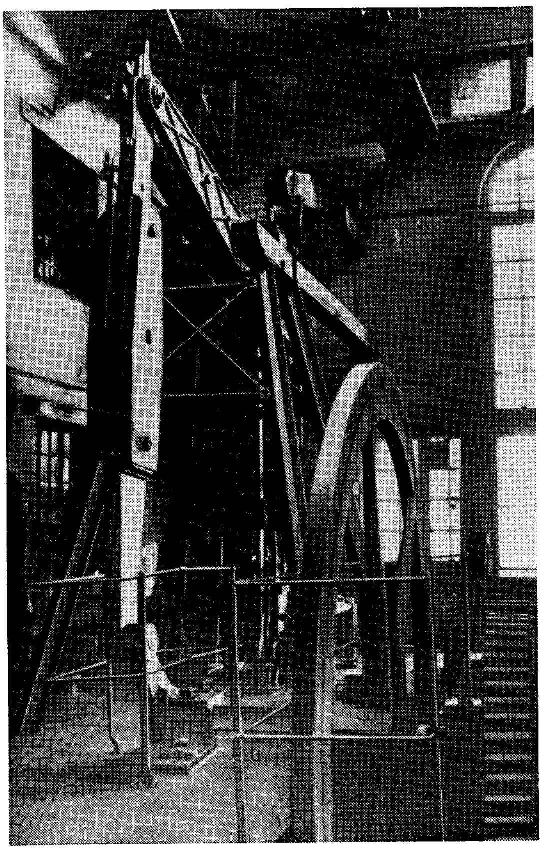
JEYNES' CORNER

AN ENGINEERING CURIOSITY

FOLLOWING MY RECENT article on the "Dudley" atmospheric colliery winding engine in *Model Engineer* 2nd June 1978, a reader, Mr. J. K. Outram sent me a photograph of another old atmospheric engine, which had also put in over 100 years of service, winding coal, and pumping water from mine workings; telling me that on the back of the original photograph, was a note, saying that the engine was dismantled and sold to the Henry Ford Museum in U.S.A.

As I correspond with the associate Curator of Power and Shop Machinery there, I queried this, and received confirmation that the engine was indeed installed there in close proximity to the "Dudley Windmill End" engine I mentioned above. He also sent me several Xerox copies of photographs showing it as installed in the Museum.

Top Right. A photo taken by Mr. J. K. Outram in 1974. The tree has since been removed.
Below. The Moira engine in its working days. Note the corbels below and on each side of the wooden beam projecting through the wall.



He also mentioned that there had been some controversy regarding the actual age of the engine; the date 1821 is cast on the beam, and one school of thought has it that this cast-iron beam, was a replacement for an even earlier wooden beam. However, the cast-iron framework supporting the beam trunnions, appears to be in keeping with the 1821 beam.

After studying the photograph of the engine as it was installed in its working days at Moira, I am of the opinion that the rotative part of the engine was added to an existing Newcomen pump. It will be noticed that there are two wooden corbels built into the wall below, and on each side of the wooden pumping beam protruding through the wall, these are the ends of the beams which support the trunnions of the wooden pumping beam, and the purpose of their being extended through the wall was, I think, to support a "Spring Beam", a feature of Newcomen engines provided to prevent the piston striking the bottom of the cylinder, should the pump load be suddenly lost; at least that is my theory, but of course I may be wrong.

Here are a few particulars I have of the engine; the piston is guided, and the cylinder has the dished bottom peculiar to Newcomen pump cylinders and to which the jet condenser is directly attached. Again like the Dudley engine, there is a massive weight to ensure the piston is brought to the top of the cylinder, ready to be brought down by the vacuum. The cylinder bore is 30 in. and the stroke 5 ft. The engine was formerly powered by steam provided by two "Balloon" or "Haystack" boilers which blew off at 2½ lb. per square inch. The flywheel had 6 spokes and was mounted on a square crankshaft. The cylinder was open topped and used a water seal on top.

To be continued

Post Bag

The Editor welcomes letters for these columns. Pictures, especially of models, are also welcomed. Letters may be condensed or edited.

Single Tooth Lathe Clutches

SIR, — In the article Martin Cleeve Reflects (6.10.78) he deals with lathe screwcutting and mentions a letter from Mr. A. F. Austin, the date, by the way, when this was published was 5.8.77, which he did not make clear.

Such articles as Mr. Cleeve's cause me to check up on such matters against any information I may have.

He mentions that if a lathe is fitted with a single tooth clutch between the lathe spindle and lead screw and means for disengaging this at the end of the cut and also a carriage stop on the right hand of same, a thread chasing dial hardly seems necessary. However, on looking up a Henley catalogue they must have thought differently. Their cone head machines were not so fitted but their 12 in. to 20 in. swing geared head lathes could be supplied with a chasing dial as an extra and this is especially mentioned in the text but no suggestion why they might consider it necessary.

I think the Hendy Machine Co., were among the first, if not the first to adopt the single tooth clutch idea. I have an illustration of one of their lathes so fitted built in 1892.

Wembley, Middx. J. H. Davis

Workshop Safety

SIR, — The letter from R. D. Needler (*Postbag,* 15 September 1978) should be heeded by everyone who uses workshop equipment. His experience with safety glasses which as far as I have seen only have side protection is certainly not ununusual — after an identical injury I took to wearing a peaked cap when using the lathe.

It would seem however that a better solution should be found, most likely a face screen would provide complete protection with the minimum of inconvenience and cost. As yet however, the commercial units I have seen are in need of further development to improve comfort, performance and convenience.

Could it be that a competition organised through *M.E.* would produce a better solution than currently available?

Victoria, Australia. K. A. Hague

Casting Problems

SIR,—Can any of your readers help me with a problem, please?

For a goodly number of years I have produced castings in bronze etc. for my own use and fellow club members by the time honoured method of coke and crucible furnace melting. This system is ideal for the larger type of casting such as cylinders and when a large number of items are needed. If only one casting is needed, say a chimney or dome etc., this method is both time consuming and wasteful. I have therefore experimented with propane with no success. The problem being the same as trying to silver solder inside a firebox on stay heads, i.e. lack of oxygen in the furnace results in the burner going out.

Can any reader supply me with details of a small furnace capable of melting about 3 or 4 lb. of bronze fined by propane in say 30 minutes? Any expense incurred (within reason) will of course be met. A suitable furnace is already on the market made by a well-known Swedish firm but alas, with a three-figure price tag, is not a viable proposition.

The problem of manufacture will be non-existent, formers, moulds and refractory material present no problems at all due to having the skills of a time served patternmaker together with 30 years' experience at the trade.

Crewe, Cheshire. F. S. Clarke.

Grinding Wheels

SIR, — Re: letter 4 August 1978 (p. 920). I read Mr. McIntosh's plea for information regarding sources of supply for grinding wheels with some sympathy because I have had similar difficulties, added to which I have received numerous letters from readers asking for some information.

After a certain amount of digging and delving and a lot of correspondence I have found a firm on my own doorstep and of whose existence I was unaware. I have visited their warehouse which carries a large stock of abrasive wheels and have had a conversation with their Sales Director, Mr. Bartlett who assures me that they are ready and willing to supply one-off of any stock grinding wheel provided the total invoice amount is not less than £3. By stock wheel is meant any wheel listed by Universal Grinding Wheel Co., Ltd., in their comprehensive catalogue and designated *Shelf Stock* of which there are some 1400 different items.

It must be understood from the start that it is perfectly useless to send an order — or to try to purchase anywhere — a wheel to a specification which has been dreamt up to meet one's own particular requirements, particularly when special shaped wheels, such as cup wheels, are involved. The grit-grade-bond-etc. specifications for any given size or shape of wheel are strictly limited and are based, presumably, on average industrial requirements but it should be possible, out of the wide range of wheels listed, to find a suitable article. There are very few 5 in. wheels compared with 6 in. and there are even more at 7 in. dia.

There are, of course, several manufacturers of grinding wheels other than "Universal" and it is probable that there are stockists for each of these. The cost to the stockist of any given wheel depends on the number he orders, therefore wheels in popular demand will be cheaper than others.

I will endeavour to compile a "short-list" of available wheels likely to be useful to readers and submit this to the Editor, but in the meantime, if any reader would care to send me, c/o the editorial offices, details of any desired wheel — stating the requirement as broadly as possible — together with a S.A.E. I will let him know the nearest available wheels.

The firm in New Milton (in which I have no interest, financial or otherwise) is: Southern Abrasives Ltd., Gore Road Industrial Estate, New Milton, Hants. and for those readers in the West Country there is another stockist: Devon Abrasives Ltd., of Newton Abbot who, like the New Milton firm, will be found to be very helpful.

New Milton, Hants. Geo. H. Thomas

Water Gauge Safety

SIR.—The subject of water gauge glass bursting and arrangements made by Mr. Gladstone (21 April 1978) to prevent sudden steam emission, also the subsequent remarks and reservations on pure water made by Mr. Shimmin (15 Sept. 1978), has made me "dig out" a small tapered D bit which I must have made many years ago to use on water gauge bottom fittings.

The device was described in the *M.E.* by the late LBSC as a means of closing-off the bottom fitting in the event of a burst glass. The danger of hot steam from the top fitting does not appear to be so serious, due to it being directed downwards.

I have the D-bit in front of me. It is a piece of 5/16 in. dia. silver steel about 3 in. long, with one end taper turned off to 3/16 in. dia. over a 1/2 in. length. A slight radius is formed at the end so as not to leave a sharp corner and consequently a stress raiser at the bottom of the fitting bone. The tapered end is filed across to form a D-bit and hardened.

In use, the bottom fitting is held in the chuck and recessed by the D-bit held in the tail stock. This in effect forms a clack valve, but the taper causes the ball, when fitted, to roll away from the seat under normal conditions. Of course the ball is retained by a 1/32 in. cross wire at the end of the fitting recessed bore.

Provided a magnetic rustless ball is used its freedom can be tested audibly with a magnet held against the fitting. This point should satisfy Mr. Shimmin's reservation on efficiency.

Yeovil, Somerset. J. B. Escritt

Holtzappfel Lathes

SIR. — The letter from John Emery (*M.E.* No. 3597) is of much interest.

There is an entry in the Holtzappfel register of Sales (now in the Guildhall, London) which reads:
£45, 837, 4 in. Common, Mr. Perigal, Nov. 13th, 1815.

It appears possible that Mr. Perigal was Henry Perigal, F.R.A.S., who lived 1801-1898, and would thus have been 14 at the time of the sale of what would have been a most suitable "first lathe" for a young man. The word "common" in the entry refers to that type of headstock which has a point centre at the left and a taper bearing at the right (mandrel nose) end, as distinct from a headstock with two parallel bearings.

Perigal was of the type of *Scientific Amateur* of the 19th Century to which our later world owes so much in providing the groundwork of discovery and analysis for our modern science to build upon. He was a member of no less than 19 learned societies.

I thoroughly endorse Mr. Emery's remarks re the use of the treadle, although my own machine has an electric motor now I still use mine for some work. Heavy treadling is out with varicose veins, and I'm lazy anyway, but there are jobs where the speed control of the treadle is ideal.

It is a matter for remark that the coverage of *M.E.* is so great. Here is an answer to a letter of two years ago since when I have moved to a larger workshop. Oh yes there is a house as well — nearly forgot that sleeping is necessary!

In view of Mr. Emery's penultimate paragraph, I wonder if there is a demand for a well-built plain lathe to be manufactured of similar simple form to the basic Holtz again?

Coulsdon, Croydon. Roger Davies

Drummond Lathes

SIR. — May I add some information to the recent correspondence concerning 5 in. Drummond lathes?

The source of my information is, firstly, *Engineering* September 20th 1907 pp. 394-5 and pp. 398, illustrations appearing on the latter page. The article in question is entitled *Drummond's Screwcutting Lathes*. It seems that these machines were designed for use in garages and small workshops in boatyards since the article states "Repairs to motors and motor-cars is the particular class of work for which it has been designed", *it* being the lathe in question. The article goes on to state that "The object aimed at during its construction was to supply a machine that would enable an ordinary mechanic to undertake special work so that he need send no repairs away from his own shop. Such particular work, for instance, as the re-boring of a pair of twin (steam engine) cylinders can easily be done upon this machine . . . "

The illustrations are identical to those published in *Model Engineer* by Mr. Smith. The foregoing description would surely be a good specification for a lathe useful in mobile Army workshops and in the Engineering Branch of the Royal Navy at the time. It also forms an equally good description of a lathe eminently suited to model engineering, then, as now

My example of this robust and handsome machine has the serial number 7. I put its date at 1907 or earlier since *Engineering* states: "Drummond's machines have not been on the market for more than three or four years, but during that time their merits have become widely recognised". I am still in the process of restoration, but I doubt whether my skill is equal to the task of reproducing the original performance. To quote *Engineering* yet again "... it will, in rough hard cast iron, with the scale on, easily take a cut 1/8 in. deep with a coarse feed, and 1/4 in. cut with a fine feed, in pieces 14 in. dia. worked either *by treadles* (my underlining) or power; and, although capable of this, its extreme accuracy for light work remains unimpaired". Easily? With a treadle? They must have been joking!

My other reference is *Model Engineer* itself, 1909 Volume 21 p. 448, 4 November. An illustration of Messrs. Drummond Bros. stand at the Model Engineer Exhibition of that year shows one of these machines in the foreground along with other machines which would grace any amateur workshop today.

I hope the information above will be of interest to those, who, like myself, are fortunate enough to own one of these superb machines.

Loughborough, Leics. M. J. Rooth

"Satin" Chrome Plating

SIR,—Regarding the item about "Satin" Chrome Plating in Martin Cleeve's article in *M.E.* October 6th, perhaps the following may be of assistance.

In the British Intelligence Objectives Sub-Committee report No. 1437 of 1947 about the manufacture of the *Leica* camera, information of the Satin Chrome process is given; the process is:

Sandblast; Hot cleaner without current; Cold cleaner with current; Cold rinse; Hydrochloric dip; Copper flash; Cold rinse; Sulphuric dip; Cold rinse; Bright nickel plate; Warm rinse; Hydrochloric dip; Bright chrome; Drag-out rinse; Cold rinse; Hot rinse; Dry.

The bright nickel tank was approximately 6 ft. x 2 ft. x 2½ ft., six de-polarised anodes being employed. The voltmeter and ammeter on the resistance control board were all moving coil pattern and the tank was worked at 2 volts 25 amps. No agitation of the electrolyte.

The chrome tank was approximately 4 ft. x 2 ft. x 2½ ft., 28 strip anti-monial lead anodes being employed. Moving coil volt and ammeters were also fitted on the resistance board and the tank was worked at 5½ volts, 300 amps. The time for a satisfactory chrome deposit was exactly three minutes.

Hatfield, Herts. R. Nixon

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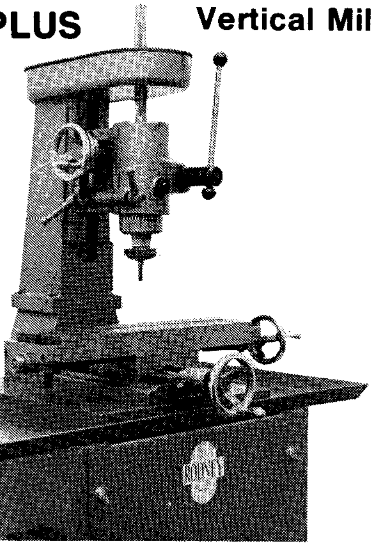

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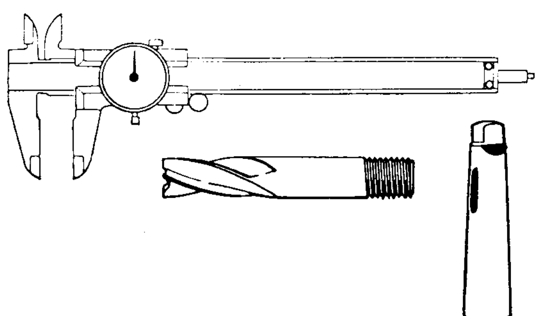

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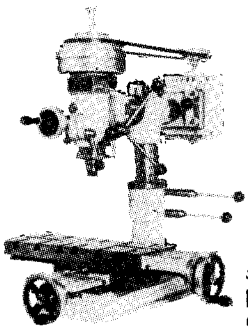

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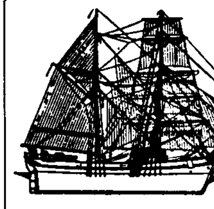

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