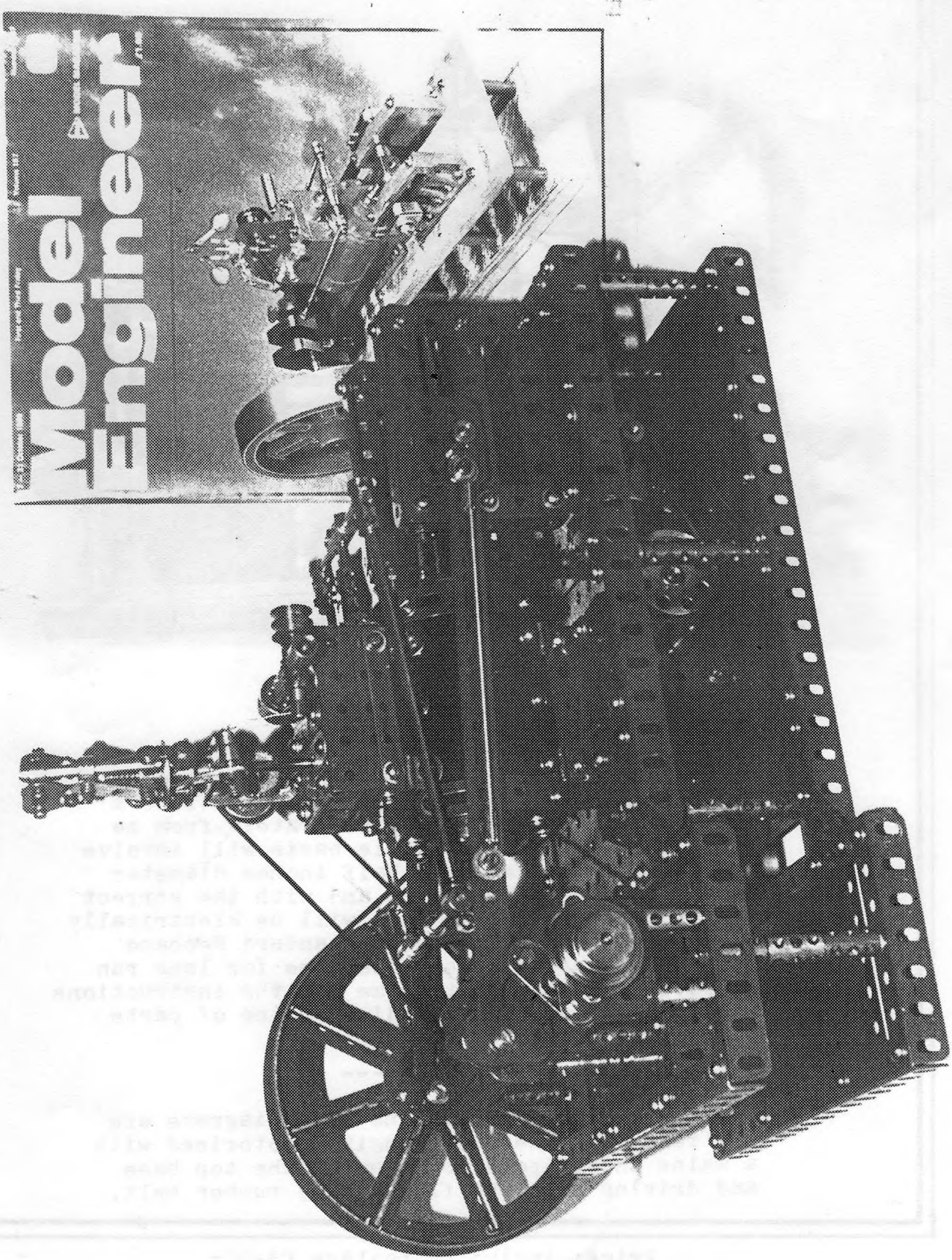
THE BRAY SIDE-ROD ENGINE.

Full building instructions with diagrams and photographs are now available direct from me-see list at front of this book. The flywheel shown has an eight spoke layout but I have details of a similar one with the correct six spokes. Operated by a small Induction motor with belt drive to the flywheel-Meccano motors can also be utilised as required.The gearbox type is the best unit.



THE BRAY SIDE-CRANK ENGINE.

Modelled from a front page of the October 1986 "Model Engineer" with further details from the magazine article coverage. Made from Red/Green/Black Meccano components but Zinc 2" strips and 1"Bush wheels are used in certain applications. The 2" strips have a centre hole and are used for the Governor bearings. The model is motorised-but this can be carried out with the use of standard Meccano motors-or-as in this model-with a small mains unit of the shaded pole type of motor. The choice of motor is not important as the speed is low and requires little effort to operate provided instructions are followed carefully. Choice of straight rods is most important for the built-up crankshaft and certain couplings must have their transverse holes at correct angles for the valve mechanism. The model is about 14" overall in length by 10" width over the Flywheel. A very interesting model to construct and operate.

THE FLYWHEEL. Made from two Hub discs joined by EIGHT longest bolts through layers of wheel discs and two eight-hole Bush wheels. No bolts are used in the spoke portion as I have overlaid the Hub discs spokes with short rods held in rod and strip connectors. First of all-fit eight 1½"rods in rod and strip connectors so that each overlay reaches the rim of the Flywheel when bolted to the Bush wheels. A certain amount of dexterity is required to fit the spokes but here is a good method:- Fit two grub screws to a Bush wheel and pass EIGHT long bolts through the radial holes with the boss of the Bush wheel outwards. Place FOUR only rod and strip connectors on the inside of the Bush wheel with the slots of the R/S connectors inwards. These four rods are at opposite positions radiating from the Bush wheel so that the outer ends of the rods just touch the inside rim of the Hub disc. Next-place THREE wheel discs on the eight bolt shanks and finally the other FOUR R/S connectors with their rods. The slots of these R/S connectors are to the front of the wheel and OPPOSITE to the other four. Space all the overlay rods evenly on the hub disc spokes. Turn the wheel over and place as many wheel discs and a further Bush wheel-as the bolts will take. The bush wheel on the inside of the wheel is spaced with thin washers from the final wheel discs to allow for the peened over boss. Place nuts on the eight bolts and hand tighten only. Pass a rod through the whole boss of the wheel and then tighten ALL the holding bolts so that the wheel runs true. If you have plenty of R/S connectors-you can overlay the rear of the Flywheel in the same manner as the front side. You now have a heavy wheel that should run true when properly adjusted. Fit two grub screws to the outer bush wheel also. Cover the rim of the wheel with coloured linen adhesive tape-obtainable from DIY shops and cut to width of wheel(tape is supplied in rolls of 2" width in many colours). Set the Flywheel to one side when completed.

THE CYLINDER. You will need eight hinges for this unit. Also three Black/Ylw/or Red 3½"x2½" PLASTIC plates. Join two face plates with four 3½x½"D/A strips. Face-plate at Flywheel end has it's boss inwards and the other face-plate has boss OUTWARDS. Join the face-plates by their ROUND holes. The three plastic plates are joined edge to edge longways-one at the bottom of the cylinder overlaps another on one D/A strip and again overlaps the third leaving an open space at the TOP of the cylinder. Each side of the cylinder has FOUR hinges bolted over the plastic plate joins to the four D/A strips 2½" apart on each side. Four formed slotted strips are also bolted around the cyl ends-but not on the underside. Use washers under the bolt heads in the slots of the formed strips. The four BOTTOM hinges have a 2½" A/girder bolted to their lugs

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The Bray Side crank engine. The Cylinder-continued.

by their round holes with the hinge lugs on the outside. The four top hinges have two 2½"flat girders bolted to them on each side-by their SLOTTED holes and 2½"narrow strips are also bolted over the flat girders to hide the slots. Four ½x½"A/brkts are bolted at each corner by their round holes inside the flat girders and 2" flat girders are next bolted to these angle brkts across the top of the cylinder at each end. The rear of the cyl does NOT have a 2" flat girder-but a 2" strip with a centre hole instead. This is to take the valve rod. A coupling is attached to this strip so that it's centre drilled hole lines up with the flat strip centre hole. The two holding screws for this coupling are inside the 2"strip. Another coupling is attached to the first one by means of a flat brkt-this coupling is attached by it's length to take a spindle through it's long bore and hence through a transverse bore of the other coupling. This forms a substantial bearing for the sliding valve rod. The top of the cylinder is filled in with two 2½" and two 2" angle girders forming a rectangle. The three hole space between these A/girders has a 2"strip at the middle-and two 2"centre-hole strips on each side. The front end towards the c/shaft holds the governor at it's centre hole-while the other 2" strip has a chimney adaptor bolted on it's side-the open end facing to the front. A coupling(threaded) is attached inside the chimney adaptor and forms the steam supply pipe and regulator from the governor. The governor support bracket consists of a 1½"x½" D/A strip bolted to the front 2"strip on the edge of the cylinder and another centre hole 2" strip is bolted to the top lug of the D/A strip with it's centre hole in line with the bottom one. This holds the governor spindle. The top plate of the cylinder is NOT bolted in place but is held over the flat girders by the "spring" action of the hinges 'tho short screw rods can be passed through if desired for a firmer fit. The governor is being described separately with the diagrams. The front end of the cyl has a 1½"pulley bolted to the face plate with boss outwards-the rear of the cyl having a chimney adaptor bolted over the boss of the face plate by ½" angle brkts suitably spaced. The top ends of the cyl are open but can be filled in with curved narrow strips if required. This completes the cylinder unit. The bearing for the governor drive is crucial due to space restrictions and you will need to snip off the two ends of a double arm crank so that it can be bolted INSIDE the lugs of the 1½"x½" D/A strip. The boss of the D/A crank holds a short rod with an 1" pulley on the outside-and a small contrate next to the boss of the D/A crank. The 1" pulley is fixed with it's boss outwards and spaced by a couple of washers.

PISTON ROD CROSSHEAD. Made from six 3½" A/girders and four 2½"A/G's to form a rectangle. The crosshead slides are two 3½"STRAIGHT rods held at their ends by rod sockets. These rod sockets are fixed at the rear to the upright 2½" a/gdrs and are in line with the piston rod in the cylinder. The height from the baseplate is 2" and it is essential that the slide rods and piston-are lined up correctly. See diagrams of the crosshead cradle.

THE BASE-PLATE. The cylinder and crosshead is positioned on a base made from 9½" and 4½" angle girders. Flat plates(4) are bolted under the round hole flanges of the two 9½"A/g's-starting from the rear and butted together throughout the length of the girders-leaving one run of nine holes at the front flat plate. A 7½"A/G is bolted to this run of holes with it's slotted holes resting against the ends of the side 9½" A/G's forming a "T" section. The crankshaft base is 3½" wide and is made with another 7½"A/G with a 3½"x2½"flanged plate bolted between the girders at the middle-slotted holes of A/G's down. Each end has a 3½" A/G bolted UNDER the round holes of the 7½" A/G's. To strengthen the join of the "T"-bolt 1½"corner brkts at each side for extra support(see diagrams at end of text).

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Bray side-crank engine.

Baseplate-continued. The 4½"flat plates are further supported by several 4½" A/G's bolted across the width of the base-under the plates and secured by the bolts holding the 9½"A/G's at the sides. The crankshaft end has 3½" strips bolted across at each end two holes in from the 3½"A/G end girders. As a temporary building base-bolt three flanged 2½x1½"flanged plates to the angle girders-one at the crosshead end-and two others under the crankshaft end to give a 1½"depth to the engine base.
CRANKSHAFT BEARINGS.Great care is required here as there are four sets of built up bearings. Starting from the Flywheel end-a channel bearing is bolted to the centre of the end 3½"A/G-but is spaced from the base by two couplings and thin washers to bring the top holes of the bearing in line with the piston rod in the cylinder-approx 2" high from the base. A double arm crank is bolted between the channel bearing by long bolts and these are lock nutted to the free side of the bearing. Remove any grub screws from the D/A crank and make sure a rod will pass through the whole bearing and be quite free to rotate. The tapped holes of the D/A crank are used for lubrication. The 2nd bearing in from the flywheel is a Trunnion-again with two couplings and spacing washers-bolted to a 1½"x1½"flat plate attached to a 3½"A/G bolted across the base five holes in from the flywheel side. The apex of the trunnion is inwards. Pass a long rod through BOTH bearings and true up. The third bearing is another channel bearing-spaced with two couplings and washers-bolted to another 1½"flat plate attached to a further 3½" A/G across the width of the base five holes in from the nearside of the engine. This bearing does NOT have a D/A crank fitted to it. The fourth bearing is constructed the same as the first with a D/A crank between the channel. Now pass a LONG straight rod into ALL the bearings and adjust for free running. Patience here will reap it's own rewards with a free-running engine. The centre line of the crankshaft is FOUR holes in from the front end of the base.
THE CRANK WEBS.Must be built up with great care. Select FOUR D/A cranks-two for each crank which are identical. Use very short screws(from swivel bearings)or short set-screws. Each web is made from TWO 1½"flat plates and TWO flat trunnions. Pass short screws through the holes in the D/A crank arms-these screws first holding two flat trunnions with their apex at the top-and then the two flat plates. The threads of the holding bolts should just be able to have nuts on them without any thread showing through. Counterweights consists of 1½"flat girders bolted to the flat plates by their SLOTTED holes flush up against the edge of the D/A crank. Use washers on the bolt heads so that there is just room for nuts to hold the completed web. Repeat for the three other webs and fit TWO grub screws to each D/A crank.
CONNECTING RODS.Use 9½"flat strips-one for each crank. The C/S end has two flat trunnions bolted at the 2nd hole in from the end of the 9½"strip with the apex of the two trunnions facing forward. The other end of the 9½"strip has one 1½"flat girder fixed at the 2nd hole in?the bolt also holding the lug of a rod and strip connector. A polished 5½"rod is.gripped by the R/S connector and also fixed by another R/S connector six holes along the strip from the crankshaft end. Use short screws (see sketches). The two webs for each crank are joined by 3/4"bolts firmly fixed to one web with washers each side of the connecting rod-and then lock-nutted to the other web. Repeat with the other crank EXACTLY. Pass a long straight rod through ALL the bosses and bearings and adjust each crank for straightness.Remove the long rod and you are now ready to make the crankshaft properly.

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Side crank engine-continued.

VALVE CARRIAGE AND DRIVE.

The valve spindle is a rod which passes through the two couplings at the rear of the cylinder. These couplings are joined by a flat bracket with short screws(see sketch). A further coupling is fixed at the end of the valve spindle with two short rods in each transverse bore. The valve cradle is made up from a 3"screw rod with two threaded bosses at each end(one at each end) so that they can be locked into position with nuts on their insides. Two 5½"rods are fitted with rod sockets and these rods are then screwed into the tapped side holes of the threaded bosses. The rear ends of these rods have couplings fixed and their transverse drilled holes pivot on the ends of the short rods in the valve spindle coupling.The rectangle thus formed with rods-must be adjusted carefully. The small eccentric on the crankshaft is fitted with an 1" corner brkt over a 1½"vertical strip. This strip end is passed onto the screw rod of the cradle and two nuts enable the screw rod to be locked into position when set up.The valve cradle must clear the side of the cylinder when in motion.

You are now ready to fit the crankshaft and you must select the STRAIGHTEST rods-starting from the Flywheel side:-

A 3" rod with the Flywheel is passed through the first bearing and secured in the boss of the first crank web.

A 3/4" bolt is fixed in the apex of this web with four or five thin washers on it's shank. Place the big end of one connecting rod next to the washers and then place a further four or five washers and a nut. Introduce the other crank web on the bolt thread and tighten with another nut. Next-pass a 3½" rod into the nearside bearings and place an 1" pulley with boss next to the Big end with it's boss inwards. Next,the small valve eccentric-and then the other two webs and big end as before.The third rod is a 3" one secured in the boss of the inside(nearside) crank web. Adjust the nuts on the big ends to give true rotation of the whole crankshaft and take time to do this. You can then lock the eccentric strap nuts on the screwed rod giving movement to the valve spindle. You must also pass a rubber driving belt over the 1" pulley BEFORE assembling the crankshaft. This belt drives onto the governor 1" pulley at the top of the cylinder.

To test the motion-fit a faceplate with a bolt to form a handle and place on the nearside rod in it's bearing so that you can rotate the crankshaft. Fit the Flywheel on the far end and test for ease of movement. The piston rod has a large fork at it's rear end. The lugs of this fork pass onto a short rod fixed between two couplings running on the slide rods and is fixed in position with grub screws in the couplings.

The connecting rods are journalled in 1" rods fixed to the outer ends of the sliding couplings and are retained by collars on the outsides of the connecting rods. See sketch. This completes the working parts of the model and the next item covers the motor drive and the crosshead frame.

The position of the crosshead cradle is on the secondhole in from the base rear-and the cylinder is twelve holes in from the rear end. Study the diagrams and note the position of the valve cradle in relation to the cylinder. The two nuts each side of the eccentric strap can be adjusted to lift-or lower-the cradle. ADD extra 1½"flat girders to the crank webs as necessary for ease of motion and to create a balanced operation for the engine. Points to watch are the in line position of the piston rod with the crosshead-and a straight crankshaft in all respects. The Governor weights are small hooks with the hooks removed so that they can be bolted to small aero collars(ordinary ones will be alright). See sketches of complete Governor build-up.

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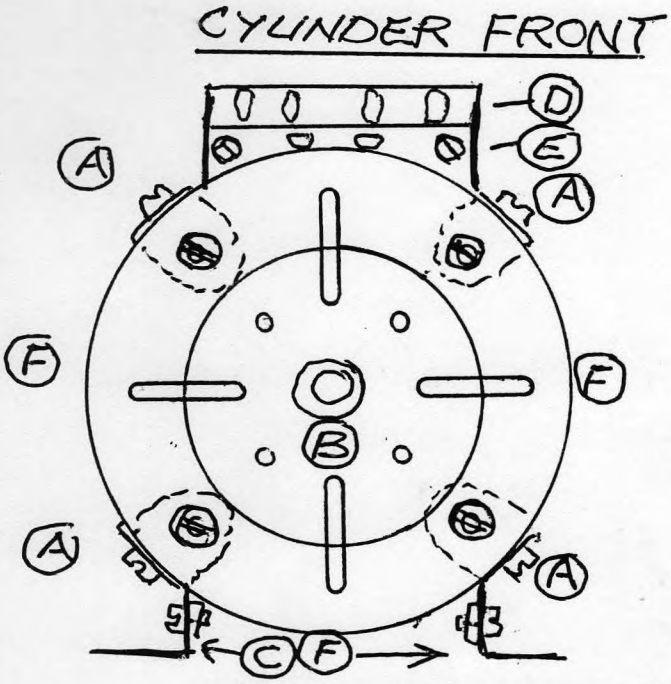
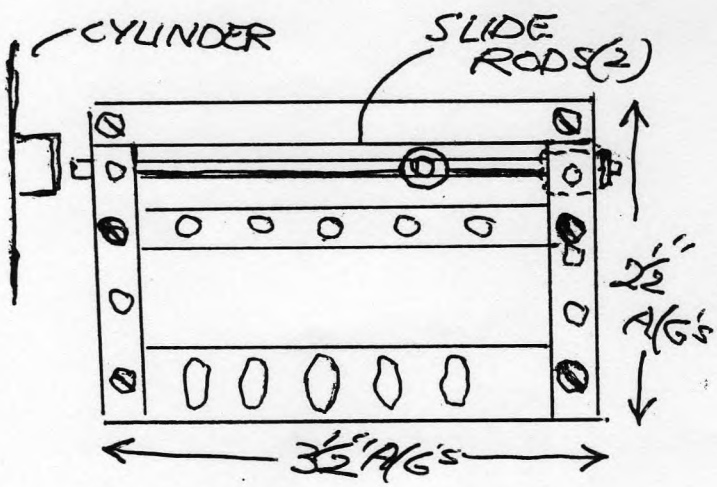
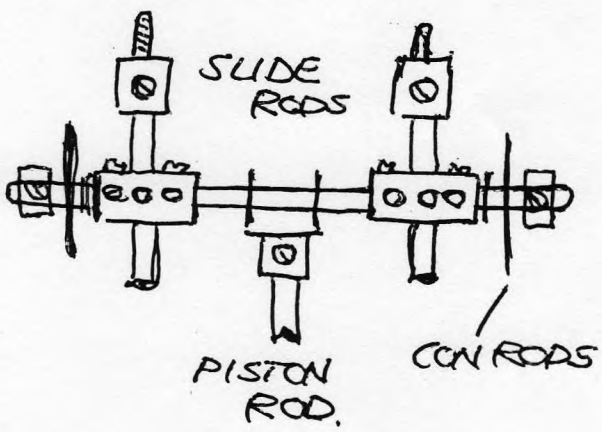
Side crank engine. Completed model with motor drive.

The bottom baseplate is exactly the same as the top plate and is separated by pillars made from 3" screwed rods which hold three couplings as spacers. This height is determined by the mains motor under the top platform. This motor is at the rear under the crosshead and has a coupling on it's take off spindle. A 5½"x2½" flanged plate is bolted across the baseplate near the motor and in a position to have a belt drive to the rim of the Flywheel. The motor drive is to an 1½" pulley with a reverse 1"to 1" gear drive on a long shaft through the flanged plate ends. A small ½" pulley on this shaft connects to the rim of the flywheel. The model seems to run better in a clockwise direction-hence the reverse drive from the motor which is anti-clockwise. If you utilise a Meccano gearbox motor-this can be directly connected to the flywheel by a long rubber driving band but select a suitable gear on the motor to give steady rotation to the engine. Lubricate all shafts and re-inforce bearings where desired.

Remove the handle faceplate from the crankshaft and replace with a conical pulley. Provided the model has been carefully built and all bearings are lubricated-the engine will run for long periods for display purposes. The space between each baseplate is roughly 2½" but can be raised or lowered to suit the dimensions of the motor employed. Photo-copies of the actual engine are supplied with these instructions. The ONLY non-Meccano part is the motor and the green adhesive covering for the flywheel.

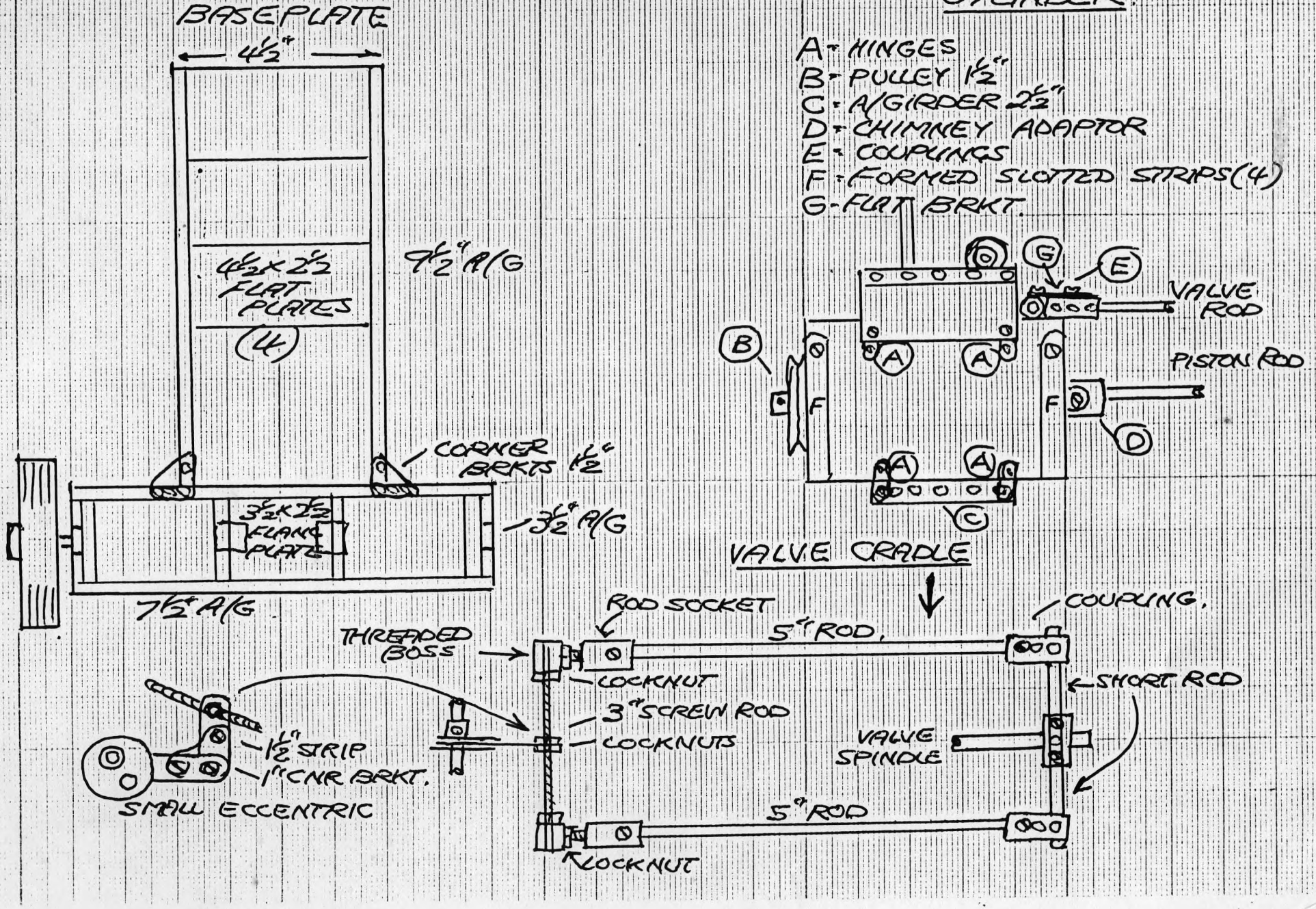




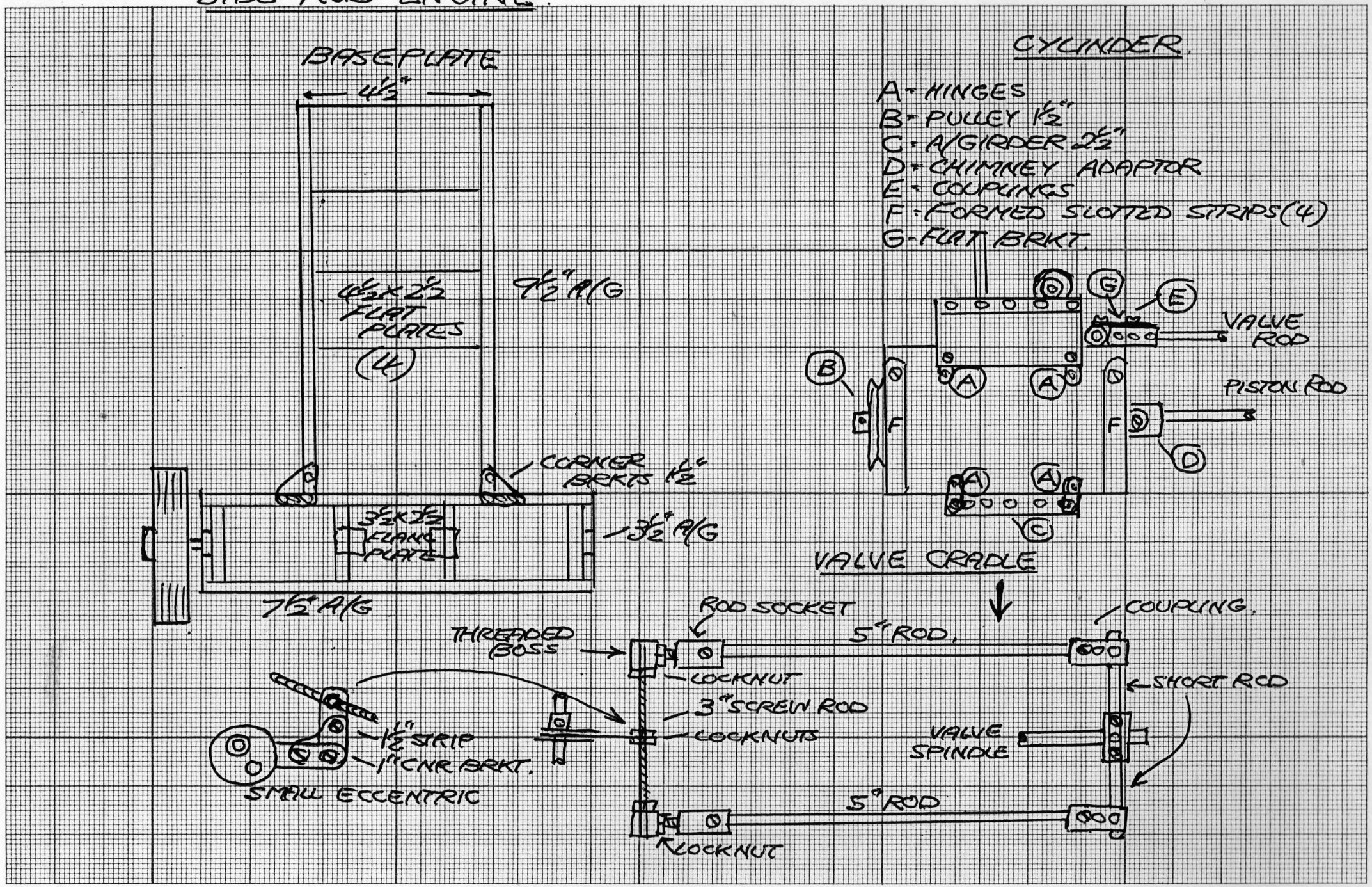


A = 3½x½ DIA STRIPS & HINGES
B = PULLEY 1½" DIA
C = 2½" A/GIRDERS
D = 2" A/G.
E = 2" STRIP
F = 3½x2½ PLASTIC PLATES.

SIDE ROD ENGINE.



SIDE ROD ENGINE.



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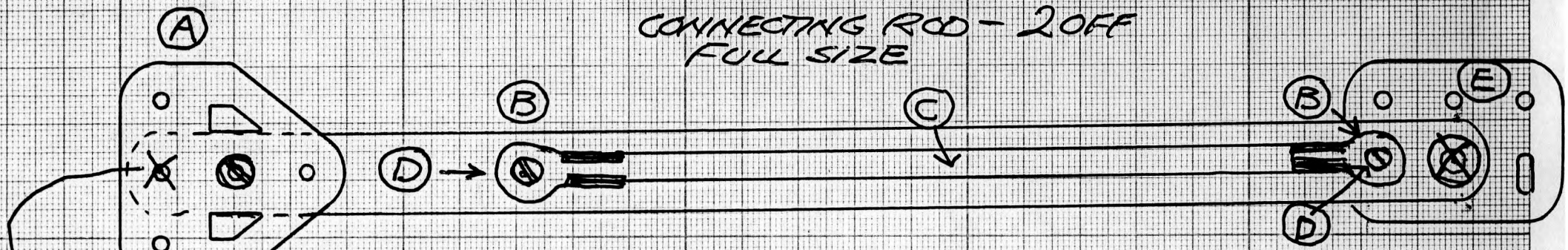
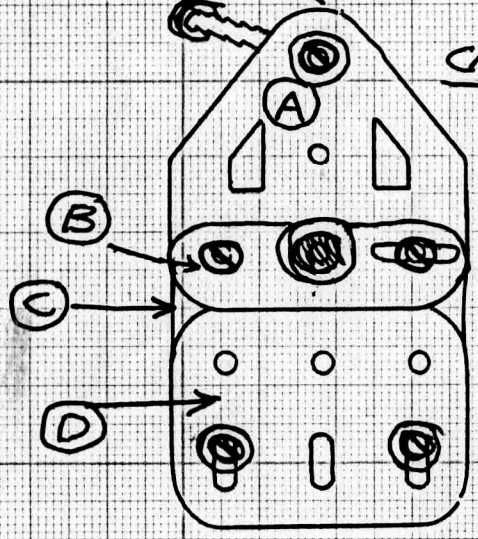
SIDE-CRANK ENGINE

CONNECTING ROD - 2 OFF FULL SIZE



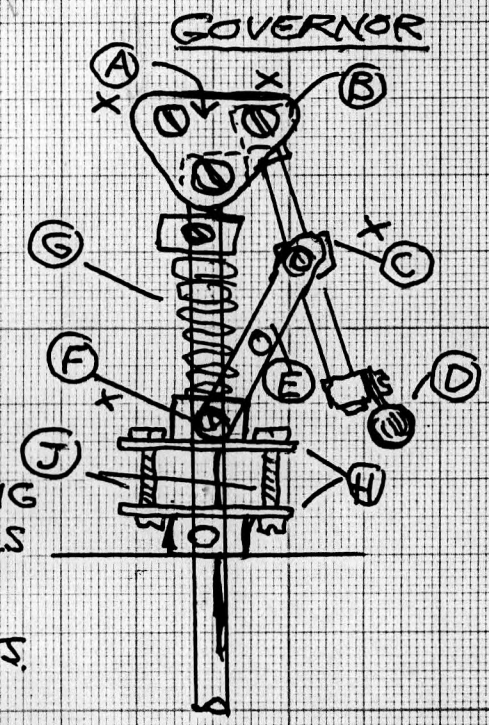
A = FLAT TRUNNIONS (2) X = PIVOTS
B = STRIP 9½"
C = ROD 5½"
D = RADS CONNECTORS
E = FLAT GDR 1½"

CRANK WEB (4)

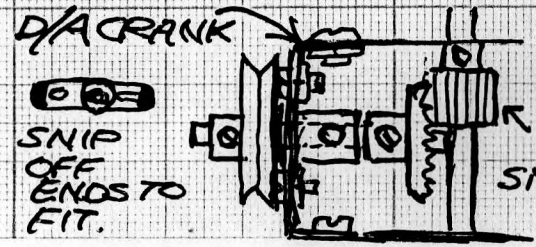


A = FLAT TRUNNION (2)
B = D/A CRANK
C = 1½" × 1½" FLAT PLATES (2)
D = ½" FLAT GDR (3 OR 4)

GOVERNOR



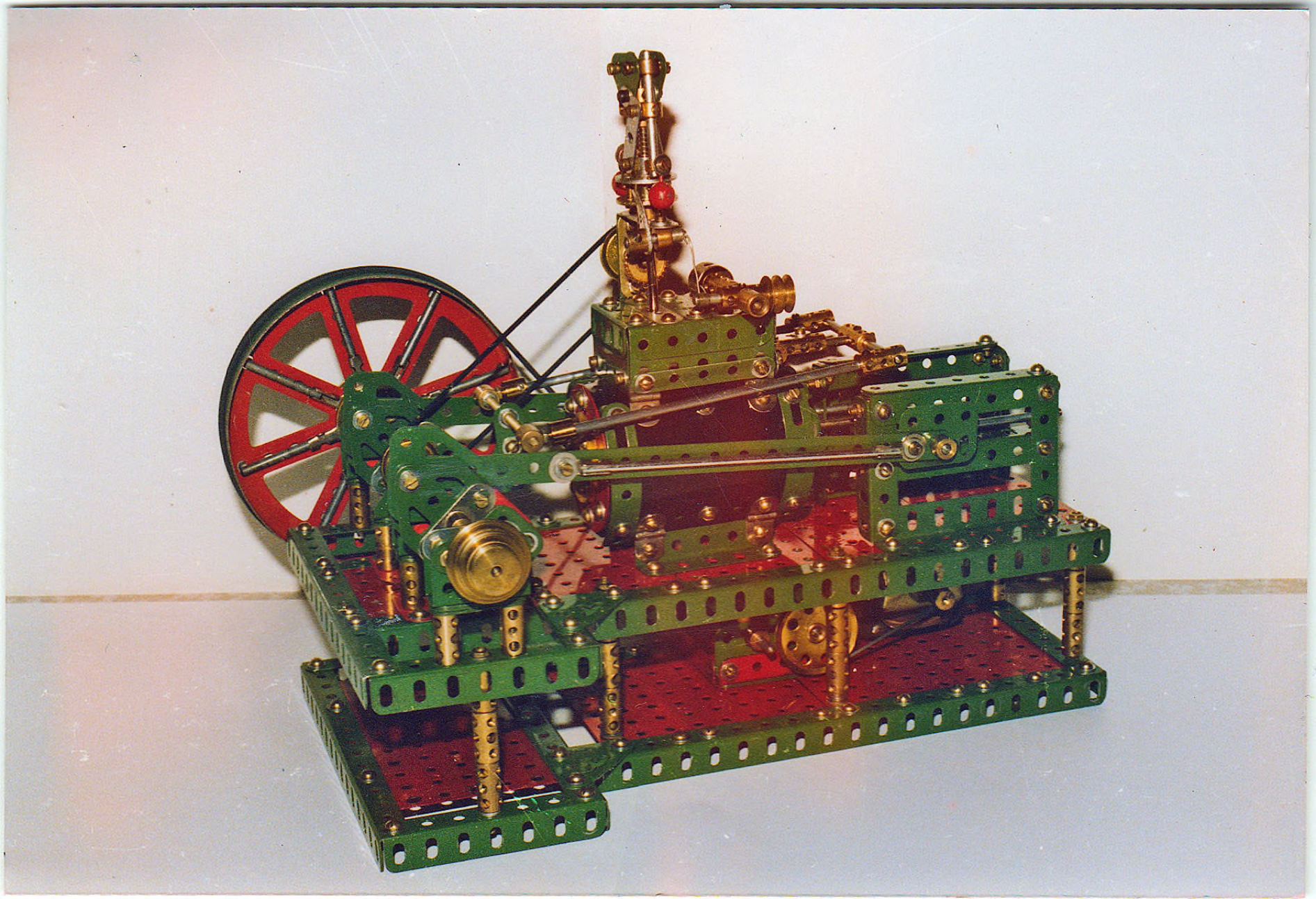
A - 1" TRIANG PLATE
B - 4H COLLARS
C - COLLAR FIXED
D - SMALL HOOK
E - STRIP 1½"
F - PIVOT
G - COMP SPRING
H - 1" BUSH WHEELS (NOT FIXED)
J - BOLTS.
X - PIVOT POINTS.



GOVERNOR DRIVE

1 STK PINION SMALL CONTRATE

SEE ALTERNATIVE FOR THIS.



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Model Engineer

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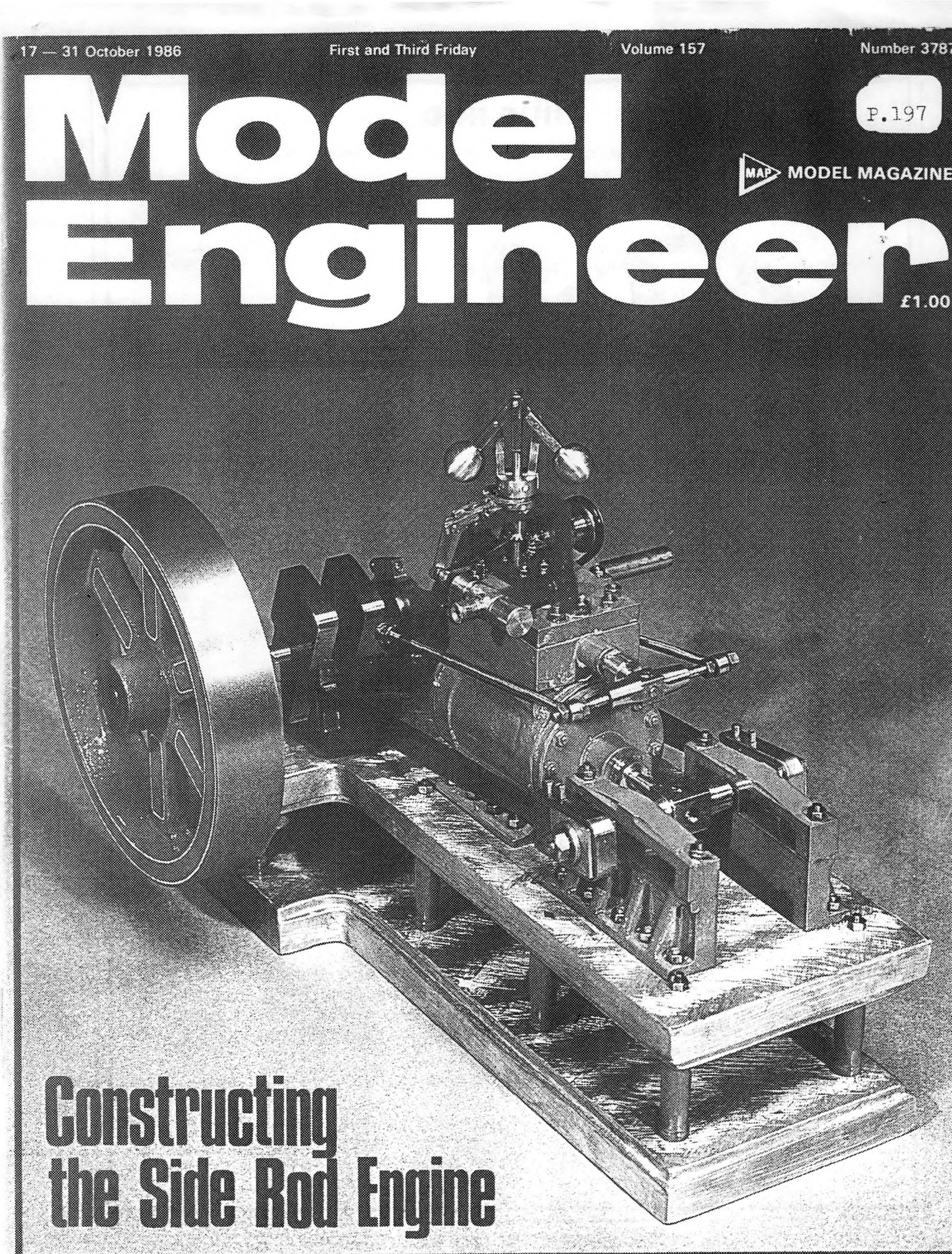
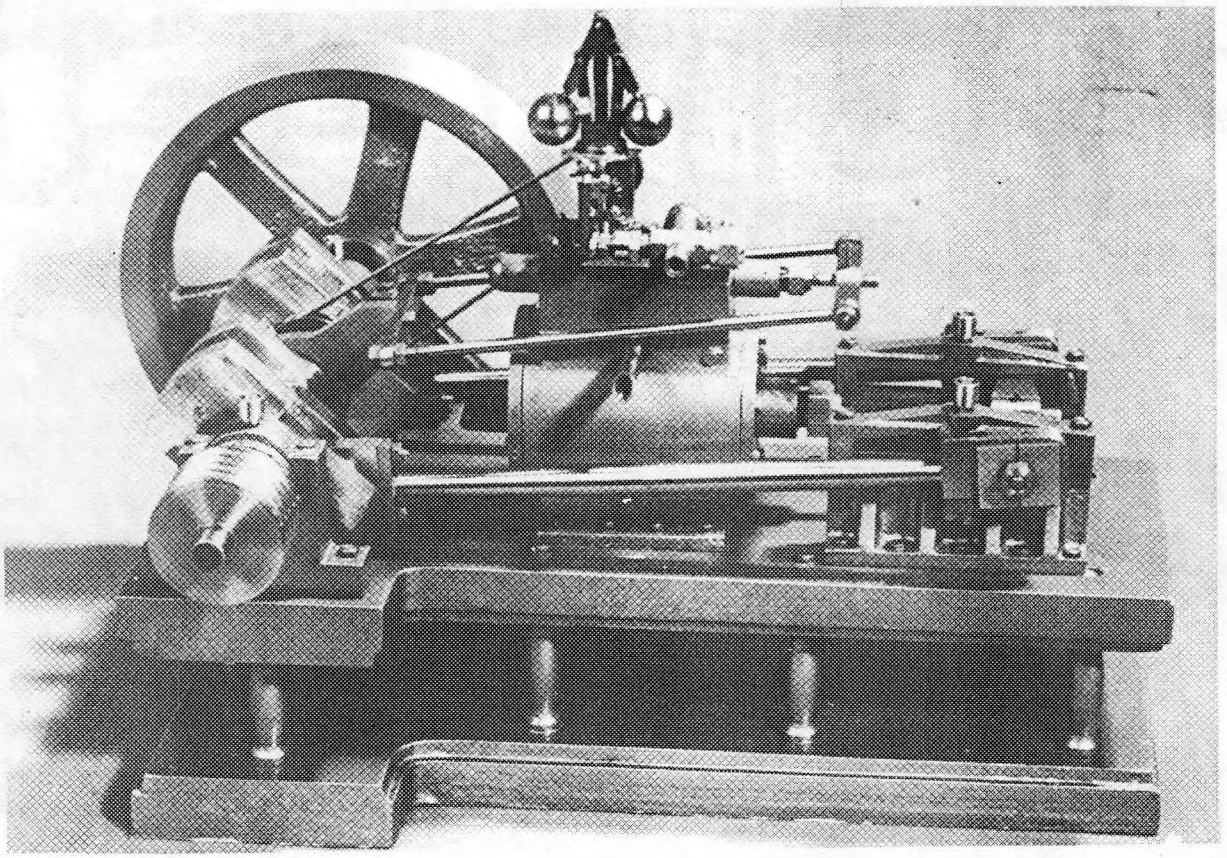


Constructing the Side Rod Engine

AN ARGUS SPECIALIST PUBLICATION

SIDE ROD

The same engine as shown on previous page.



This slide rod engine is now in the course of construction and full building instructions & diagrams will be available separately from me later this Autumn. The scale basis will involve a Flywheel of five and a half inches diameter made from circular girders and with the correct six spoke layout. The model will be electrically operated with a choice of a standard Meccano motor-or a shaded pole mains type for long run operation. Please contact me for the instructions and further details regarding choice of parts to be used.

November 1986. Instructions with diagrams are now ready for the above engine. Motorised with a mains shaded-pole motor under the top base and driving onto the flywheel by rubber belt.

Price: Including postage £3-00p