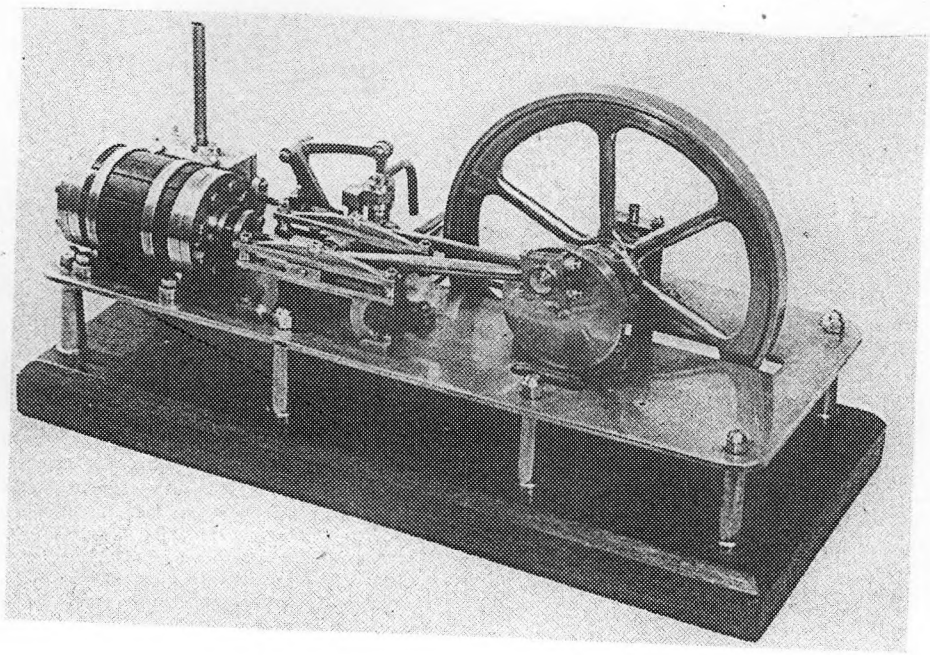
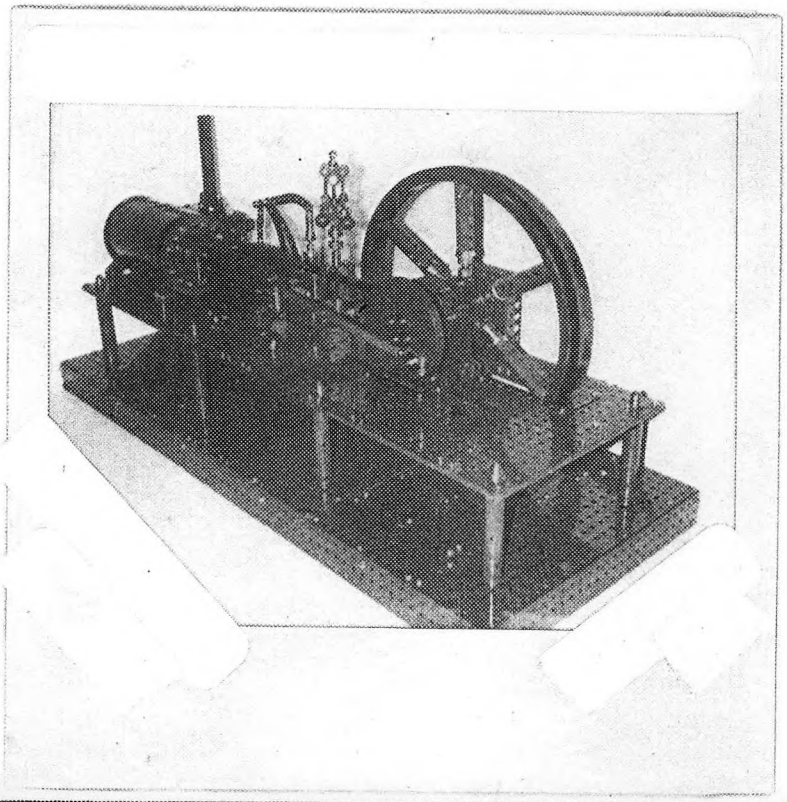
No44

A MODEL OF A MODEL.

A WORKING MODEL MILL ENGINE WITH HEAVY CRANK DISC.

Instructions with diagrams and photo-copy prints. Colour snaps are obtainable direct from me at cost-specify the size required. The model uses non standard size flat plates and the new longer sleeve pieces-obtainable from MW Models and the Exacto agent in Bradford,Yorks.The model is made from Red/Green components and also has a replica channel ring flywheel-not essential-flanged rings can be utilised-or your own built up flywheel.





SHEET ONE. A WORKING MODEL OF A MODEL. MODEL BUILT AUG 1992

I make no apologies for yet another steam project from the Devon Ironworks-but it is an eye-catching construction which works well and is relatively simple to assemble. The motor used in a mains brush type which has provision for speed control-so the model can be started and gradually increased in speed for maximum effect. Note that the flywheel has been made up from two circles of replica channel rings-these have been drilled to give a six spoke layout and this also entails the drilling of two face plates likewise.

However-not essential-as two flanged rings will give a good flywheel-albeit with eight spokes and slightly under scale. Or it is feasible to construct a flywheel to the larger dimensions from standard components-and you would not require expensive channel segments either. The model is arranged on a flat top plate which is secured to the base plinth by eight feet-these consist of sleeve pieces with screwed rods down their middles-each leg topped with a 3/4" flanged wheel. The transmission for the model could not be simpler-just a length of black flat "knicker elastic" joined by a Bambi stapler. From the motor spindle to the flywheel rim-but not too tight. The model is complete with a heavy built up crank disc and a connecting rod that is increased in diameter with a plastic gun barrel-as is the valve connecting rod. A working governor has been added-'tho not on the original-and a working boiler feed pump actuated from the valve rod through linkage. The cylinder is made from two 4" circ plates joined by 5½x½" double angle strips and covered with flexible plates and edged with plastic strips cut from old plates. Note the solid appearance due to all exposed holes being filled or covered. The crosshead needs care but functions well-the slides being rods fitted to threaded couplings at each end and with 1½x½"double angle strips as crosshead guides-the space between the lugs being filled with couplings,collars-free to slide on the rods. The main bearings are re-inforced with double arm cranks secured to bearing supports made from layers of 2½x2½"flat plates secured to 3½"angle girders on the top platform. This platform is made up from various flat plates-the whole being edged with long strips and these are tripled in thickness along the four edges to give a firm top. The base plinth is larger and edged with various 1½"wide flat plates-obtainable as Exacto parts-or from MW Models. Dimensions are given on the final page of these instructions. The main criteria for a good working model-is to line up the crankshaft with the cross-head guides-and also the cylinder. Washers are used for adjustments and great care should be exercised in this area.The valve eccentric is a made-up unit which utilises a 1½" pulley and several stepped curved strips-an 1½"corner bracket-and a single arm crank which is bolted to the 1½" pulley to give the off-throw required. The pulley MUST run smoothly between the inner curvatures of the stepped strips and should be well lubricated.A coupling is secured to the 1½"corner bracket-it's centre tapped hole holding a rod socket for the valve rod.See diagrams later in the text. The boiler feed pump is quite a simple affair-but careful linkage is required for the unit to work well-see diagram. The "Big end" of the connecting rod consists of two couplings spaced apart by long bolts to enable a miniature pulley with no boss-to ride inside the square thus formed. This pulley passes over the shank of a threaded adaptor that is tightly screwed to outer holes of the crank disc 4" circ plates. The centre tapped hole of the front coupling holds the connecting rod-and you will need an old type threaded pin with no shoulder-a long rod-and a rod connector. The plain shank of the pin is pressed TIGHTLY into the rod connector-and the long rod into the other end-also tightly.The tapped portion of the pin screws into the centre tapped hole of the coupling and should be tightened.A plastic gun barrel-or couplings etc-should then be passed over the rod-the crosshead end having a large fork fixed with the lugs sideways. These lugs pass over the short rod that

P.T.O.

divides the crosshead slides-or you can use a short coupling here and a large fork on the piston rod-the coupling lying between the lugs of the large fork-a matter of choice. Note there are separate instructions to build the special flywheel as used in this model-but you require several sleeve pieces-six socket couplings and six small flanged wheels-plus rods and rod and strip connectors as well as the SMALL bolts from keyway rod collars for spacing purposes.

The governor drive is taken from a 1½"pulley by a rubber belt to the governor plinth and another smaller pulley. Two same size bevels transmit the drive to the vertical shaft which is a long rod holding the working governor arms and weights. The weights are large hooks with their hooks removed-and bolted to small miniature collars held on each arm. Linkage is provided by two 1½"narrow strips pivoted to four hole collars with shoulder bolts. See diagram of this governor which has been used in other applications for steam engines.

The top plate is secured by eight nuts on the tops of each leg and is easily removed for access to the motor and base.

This completes the general description of the model and I will now proceed with detailed instructions of the various units.Refer to any diagrams where indicated-and remember-you should select your best rods that should be STRAIGHT. Bosses of wheels and gears should have good grub or set screws while the top plate should be as flat as is possible. I use strips as packing where girder edges are "proud" of the plates and all built up discs and wheels should run TRUE with no wobble or distortions. Normal care will result in a good display model that will operate for long periods without attention-apart from some lubrication. If you do NOT have a suitable mains motor-other motors can be utilised-but allow for a correct speed-not too fast-so select the right ratio if a gearbox motor is used. A clockwork motor that is suitably geared down-will work the engine-but space is limited between the top and bottom plinths. It is now possible to buy extra long sleeve pieces from MW Models-but they are expensive and not really essential.

THE CRANK DISC.We will make a start with this built up unit-and you will need SEVERAL flat 4" circ plates-enough to give almost a ½"width -next select four long bolts and place them in opposite holes in a eight hole wheel disc-pass the shanks through the circ plates and then secure a 8 hole bush wheel against the inner side of the plates. Fit two set screws to the boss and pass a short straight rod through the centre-before tightening the four bolts. Make sure the wheel runs true -if not-select other circ plates that are flat. To one of the outer radial holes-bolt a threaded adaptor that lies flat against the circ plates. Screw this TIGHTLY as it is the crank pin and takes all the strain of the connecting rod. Try out on a rod and adjust as required.

THE ECCENTRIC.Built around the curvature of a 1½"pulley-and you need three curved stepped 2½" strips and a 1½" corner bracket. Form the parts around the rim of the pulley-but not tight as yet-another layer of curved strips and cnr brkt is built up and spaced from the first by collars on the holding bolts-this is to give bulk to the eccentric -but only one pulley groove is required which must run around freely between the inner curvatures and the edge of the cnr brkt. Use one of the slotted holes in a curved strip for better fit. Each edge of the curved strips must be in the same plane to run in the pulley groove

A single arm crank is bolted to the pulley so that it's boss is offset to allow a rod to pass through and into one of the radial holes of the pulley. Space with washers to ensure the groove runs around in the curved strips easily without any binding. Oil the pulley groove for better rotation and adjust the holding screws to allow free movement.The apex of the cnr brkt has a spacing collar with a tapped hole forward-this tapped hole holds the end of the valve rod which has a rod socket attached at one end-the shank is held in the tapped collar hole.

Continued on sheet three.

THE CYLINDER. You will require two 4" circ plates, two wheel flanges, three 5½x½"Double angle strips, four couplings-and a quantity of eight hole wheel discs. Also-four 5½x2½" and two 5½x1½"flexible plates-the sort with ROUND end holes are best. Bolt one of the long D/A strips between opposite holes of the circ plates at the outer ring of holes-but space the lugs from the plates with one washer on each holding bolt. This allows the flex plates to lie between the circ plates without distortion to their sides. Take two 5½" flex plates and bolt them together end-wise to the d/a strip so that the plates can then be curved around the periphery of the circ plates-and be attached to further d/a strips bolted between the circ plates-but at one hole in from the extremities of the flex plates. Repeat with the other side-leaving a gap between the flex plates which is filled with the two 5½x1½"flex plates-also bolted around to the two d/a strips at the sides. This arrangement leaves a gap at the bottom of the cylinder so you are able to put your hand inside the cylinder. To the front end of the cylinder(facing the crank)-bolt a wheel flange with a wheel disc at it's centre-use long bolts which also hold a wheel flange and some wheel discs-spaced from the other wheel flange by four couplings held on the long bolts. Do NOT tighten these bolts until you have selected a STRAIGHT rod to pass into the cylinder via the wheel discs and wheel flanges. If totally free from binding-tighten the four long bolts. The other end has another wheel flange capped with a conical disc attached to a wheel disc at the centre of the plate. Make sure the covering flex plates are contoured to the circ plates before tightening bolts. Fill any blank holes with bolts and washers to give a solid appearance-or use plastic strips cut from old plates as cylinder straps. The four feet for the cylinder are 1"x½"double brkts attached to the bottom corners of the cylinder-by the bolts holding the flex plates to the d/a strips-two holes in from their ends-but flush against the end circ plates. These brkt lugs have four ½x½"double brkts bolted to them by SHORT set-screws-and they are used for attachment of the cylinder to the baseplate with threaded bosses as spacers and for lining up purposes.

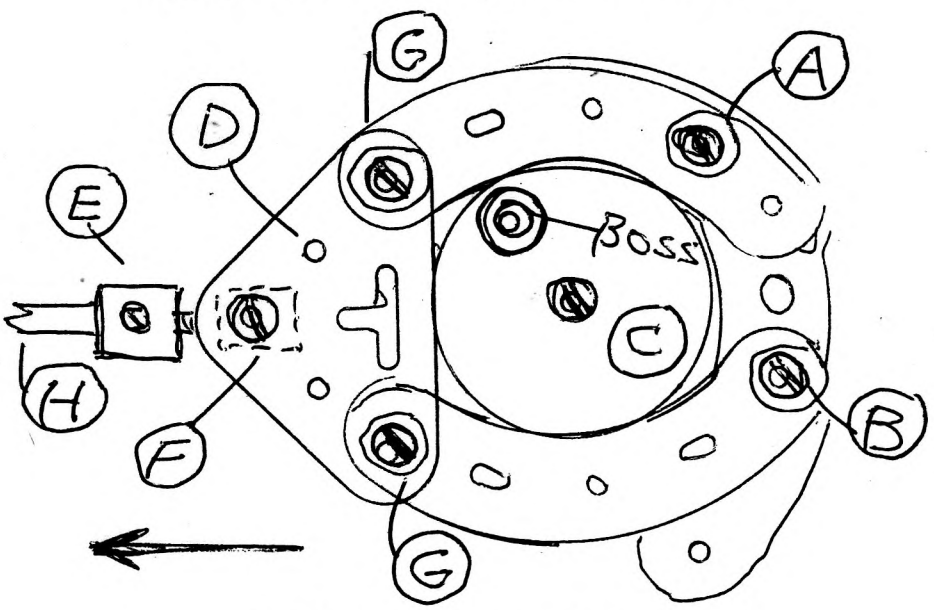
THE VALVE CHEST. This is a separate unit-3½"square x 1½"width and made from angle girders and flat plates(3½"and 1½"angle gdrs are used for corners and supports). The valve rod is the same height as the cyl centre line-approx five holes up from the table top. Attach a d/a crank to two wheel discs with long bolts to the front of the box-and on the inside-place two couplings on the bolt shanks and another wheel disc. Pass a rod through before tightening the holding bolts. The top of the valve box has a chimney adaptor at it's centre which holds the exhaust pipe-and another chimney at the offside directly in line for the feed pipe from the boiler. Other brassware can be added as embellishments as shown in prints with these instructions. The box is bolted to the top plate at the centre of the cylinder-and as close to it as possible by means of the slotted holes in angle girders at the bottom edges of the box. I have used 3½x1½"flat plates for this box-either from Exacto or MW Models-you can emply other means of filling the ends and sides according to your stock of parts.

THE BOTTOM PLINTH. This unit is 30" in length by butting together a 24½"and 5½" angle girder-by 12½" width-and 1½"height. Cross girders are 12½" long-but allow for the flywheel slot in your choice of covering flat plates. This slot is 25" in length x1½" width-five holes in from the flywheel end-and 1½" from the side. The top plate is 28½" long by 9½" width and edged with various flat strips-but with some a/girders underneath to support the crankshaft bearing plates.

continued on sheet four---

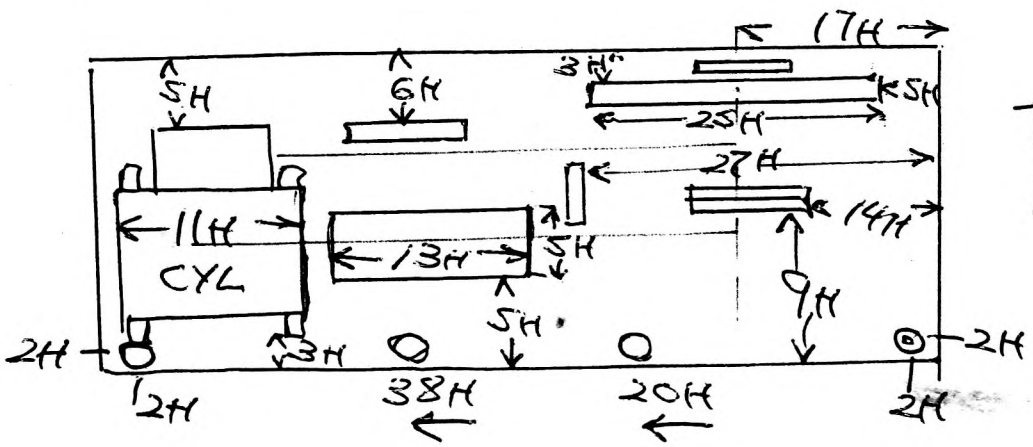
MILL ENGINE AMENDMENTS.

Note that reference to the TOP plate means the motion plate and BASE PLINTH-the bottom rectangular base which holds the motor and the eight legs. The flywheel slot is in the TOP plate-and not as described on sheet three under "BOTTOM PLINTH". This top plate is 28½" in length by 9½"width-and is smaller than the bottom plinth. The wheel slot is in the top plate and is 25"long by 1½"wide-see sketch of position. I would advise a thickness of at least three strips all round the edge of the top plate for strength-the eight legs will support this plate and the motion but do NOT overlap strips or plates-keep it FLAT and support bearings under the plate by different angle girders. The cross-head long angle girders have their round hole sides inwards on each side-the slotted holes used for attachment to the threaded couplings. Note also that 5½"curved strips DO NOT match eleven holes properly for attachment-but use bolts carefully to attach them to the round holes of the 6½" a/girders. The sketches also show the correct way to build up the eccentric-follow the sketch carefully. Choice of rods for the valve and cylinder depends on your stock but you can join any with rod connectors as long as they hold the rods TIGHTLY. The main bearings for the c/shaft must be supported by angle girders(3½") for added strength and use several 2½" plates together for the crank disc bearing. The pump body has a threaded boss screwed into a bottom hole -the boss holds the sleeve piece in position by a screw passed into it from under the top plate. Steam pipes consist of other sleeve pieces pressed onto the chimney adaptors fixed to the valve chest at top and offside.



A-B THREE HOLES APART
C-1½" PULLEY (ONE)
D-1½" CNR BRKT
E-ROD SOCKET
F-COLLAR
G-HOLDING BOLTS HAVE SPACING COLLARS ON SHANKS
H-VALVE ROD

TWO RINGS REQUIRED



TOP PLATE
H=HOLES

THE GOVERNOR.Please refer to sketch which shows the complete unit built up. Select a straight rod of 8" length-and fit a handrail coupling to the top. A four hole collar has two 1" cnr brkts bolted to it by their apex holes-but spaced from the collar by a washer on each SHORT screw. The outer holes of the brkts also have four hole collars-pivoted between the cnr brkts by short shoulder bolts-so that the collars are free to move.Each collar has a rod fixed in the bores and these hold the weights at their bottom ends-attached to the tapped holes of MINIATURE collars(if you have these) by very short screws-the weights must be tightly fixed. Two ordinary collars are also on these rods and have 1½" NARROW strips pivotally attached by shoulder bolts as shown. Next-attach a coupling to the large boss of a socket coupling so that BOTH are free to slide on the vertical rod. The ends of the 1½" narrow strips are then also pivoted to the coupling tapped holes-and NOT to the socket coupling as shown in the sketch. A compression spring-held by a collar-is placed above the coupling. As the governor rotates-the weights fly outwards and raise both the coupling and socket coupling. Linkage from the socket recess can be made to operate a valve on the inlet steam pipe-not shown in the sketch. The vertical rod is held between two 3½x½" d/a strips that are bolted to the top plate -these also have the pair of bevels and small pulley to take the belt from the c/shaft pulley.

THE FEED PUMP.The sketch shows the general construction-but you need to double the curved strips and the trunnion for added strength. The slotted strip has another short strip behind it to give the six hole length as shown. The pivot bolt screws into a collar held on the valve rod-through the slot of the 2" strip. Note the end and swivel bearings above the pump body to give freedom of movement.The position of the pump depends on the pump rod and must be free in the small flanged wheel held in the longer sleeve piece.

THE ECCENTRIC.Note that TWO rings of curved strips and cnr brkts are required-spaced by collars on their longer bolts-but only one ring runs in the groove of the 1½"pulley. As these are stepped curved strips-make sure their edges run true in the groove of the pulley and put some oil around this groove-makes all the difference to it's free running. Adjust carefully.

THE PUMP.Two cranks are bolted back to back at the apex and the slotted arm is to the front-the pump arm to the rear of the two crank bosses. When all has been completed-connect the motor to it's supply and start the model. Oil all moving parts and make any adjustments that may be necessary. Colour prints will be available showing general views from front and back and larger prints will also be available at cost if required.

------ finis------

THE CROSSHEAD FRAME. Both sides of this unit are identical-so I will only describe the nearside frame with the cylinder on the left. Because of the long throw of the crank-disc, the slide supports must be at least 6½" in length-and I have used Exacto angle gdrs and strips of this size. However-you can use Meccano parts quite easily-but make allowance for joins in the strips and girders.

The top of the crosshead is an angle girder to which several 5½"curved strips are bolted centrally-one on top of the other to give bulk-and to the round holes of the girder.
The bottom of the guide is a 6½" flat strip-to the ends which are secured threaded couplings by their tapped holes. Drilled holes take a rod(straight) which is held in place by grubscrews-this rod holds the piston rod slide supports. The bolts holding the threaded couplings also hold short angle gdrs by their round holes-slotted holes down at each end. To these short angle girders-layers of stepped curved strips are attached(three for strength) but do not tighten them at this stage. The tops of the threaded couplings hold clock kit pallet pins-their threaded portions holding the top angle girder by nuts and washers. The pins are held by grub screws in the threaded couplings. Repeat this construction for the other crosshead as a mirror image. Each crosshead is five holes apart and the bottom lugs of the curved strips are attached to 1½"angle girders bolted to the table top in front of the cylinder-and to their slotted holes to allow for adjustments later.
CROSSHEAD SLIDES. Made from 1½x½"double angle brkts(2) with 1½"flat girders and double arm cranks attached. Use short bolts as the shanks must not foul the slide rods. Fit grub screws to the bosses of the cranks in the tops of each boss. Next-assemble the crosshead with a short rod between the two bosses of the cranks-the middle of this rod also having a short coupling loose-it's longer part to the rear-and also the lugs of a large fork. This fork holds the piston rod into the cylinder bearings. You can now adjust the crosshead curved strips so that the slide rods are lined up with the piston rod-and parallel to it. The slots in the a/girders allow for this and MUST be done with care. I have used layers of flat brkts as built up "feet" for the crosshead on the flanges of the short angle gdrs bolted to the top plate.
THE BOILER FEED PUMP. Made from several 4" curved stepped strips-a flat trunnion-1½"strip-and cranks. The curved strips are formed as shown in the sketch and attached to the apex hole of the trunnion which is also attached to the 3½"angle girder bolted to the top plate. Two cranks-boss to boss-are bolted to the apex of this curved bracket-to take a short rod. This rod also holds a slotted strip on the inner side-bolted to a crank arm-another crank has a 2½" un-cranked curved strip attached to it which holds the pump rod. I have used a 2½"sleeve piece as the pump body-fitted with a small flanged wheel at the top-and to a threaded boss at the bottom-this boss being screwed to the top plate so that it stands upright on the table top. The short pump rod has a swivel bearing attached by it's collar-and an end bearing above it. The lug of this bearing is pivotally attached to the end of the pump arm by a bolt and nut -and is free to move as the arm rises and falls. The slotted strip previously referred to-has a pivot bolt passed through the slot-and tightened to a collar on the piston rod-directly in front of another swivel bearing on the valve rod. As the valve rod reciprocates-the arm of the pump is also actuated via the pivot bolt held in the slot of the 2" strip. See sketch of this unit. Also details of the fixtur of the pump on the top plate-and position.
THE GOVERNOR. Consist of two 3½x½"d/a strip joined at the top by a double arm crank-boss upwards. The lugs of the d/a strips holding the crank-the bottom lugs being bolted to the top plate. The drive consists of two equal size bevels each side of the middle drilled hole of a coupling on a short rod held in the d/a strips-a vertical rod holds the governor unit.

See next page----

GOVERNOR UNIT-continued.
The drive to the bevels is taken by rubber belt from a 1½" pulley on the crankshaft-between the crank disc and the valve eccentric-to a small pulley on the flywheel side of the bevels. The size of the pulleys used is not crucial-but allow for a suitable belt to stretch across-and not be too tight. The position of these various ancilliary units is shown on a sketch of the top plate-as are the details of the working governor.

MAIN CRANKSHAFT BEARINGS.There are two bearings-one just behind the crank disc-the other on the offside of the flywheel. The one nearest is made from two flat 2½x2½"plates bolted to a pair of 3½"a/girders by their round holes-the girders lying back to back to allow a firm fixture to the top plate. It is a better plan to use at least FOUR flat plates for strength-all bolted together-the top centre holes of the plates holding the crankshaft-and giving clearance to the crank disc when fitted. The rear bearing is a 3½x2½"flanged plate bolted lengthways to the edge of the top plate-on the offside of the flywheel-and fitted with a double arm crank as a bearing for the crankshaft.

Note also-a slot just below the crank disc-this only needed if the circ plates touch the top platform. The crankshaft-the piston rod-and the crosshead rods-MUST all line up correctly so that various adjustments may be required.Various brassware is used for the bearing plates to represent oil cups etc.

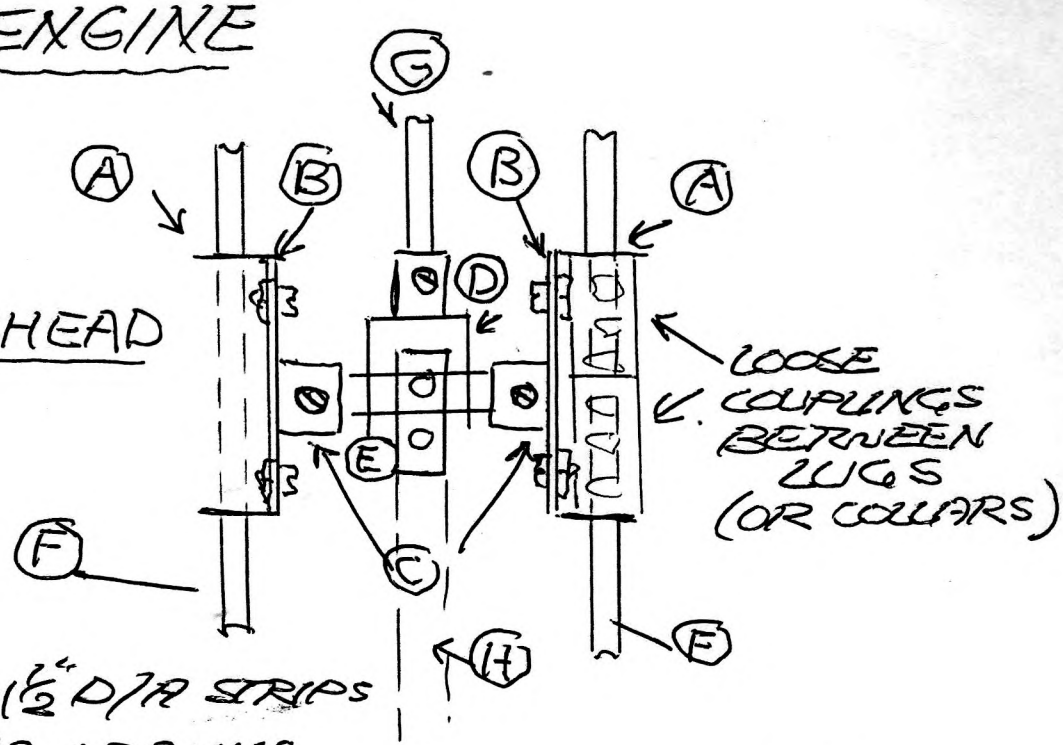
MOTOR DRIVE. The mains motor I have used is a brush gear type with speed control and is situated on the bottom plinth directly in front,and in line,with the flywheel rim. A belt of elastic is passed around the rim of the flywheel onto a suitable wide motor pulley-either a coupling or a long faced pinion will do the job in this application. The motor spindle MUST be in line with the flywheel rim and I recommend a belt of around a quarter inch width-joined by a Bambi stapler-and not too tight.

PLATFORM LEGS.
I have used the new sleeve pieces(8) for the legs-but you can join pairs of std sized sleeves-held on screw rods to the base plinth-each leg topped with a small flanged wheel.The tops have ½"pulleys with bosses held down by tight nuts all round. The sleeve pieces I have used in the model are 3½" long under part No163b MW from MW Models current list. If you use pairs of 163-use chimney adaptors for the joins before passing down the holding screw rods. Two will give 3" legs joined end to end. This completes the model-other than embellishments-and you will find the model runs well and does not require much power-any motor you have will operate-provided you use reduction gearing. Now refer to the various sketches-and always contact me should you experience any difficulties with the construction. I can also supply EXACTO Red/Green parts at a discount if you need any-and a parts list.These parts are produced in Argentina and are excellent and to be recommended.Details of the flywheel construction are also included-but not essential.

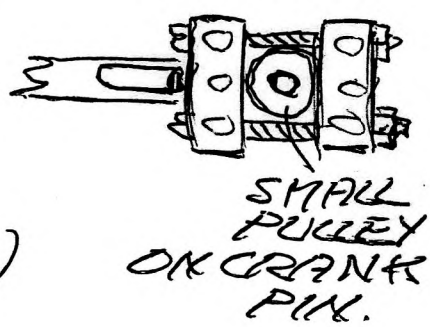
FINIS

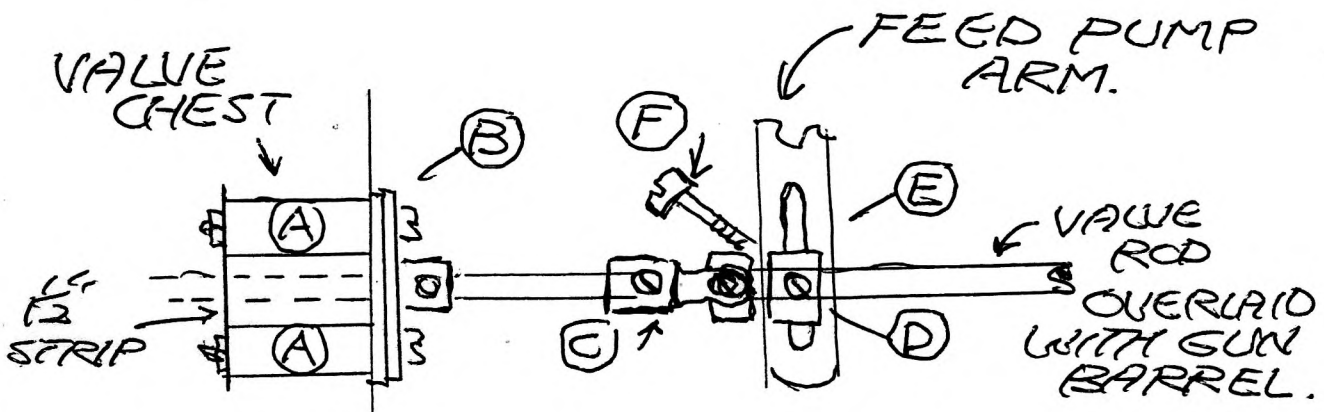
MILL ENGINE

CROSSHEAD



A = ½ x 1½" D/A STRIPS
B = D/A CRANKS
C = ROD FOR CRANKS (FIXED)
D = LARGE FORK
E = SHORT COUPLING.
F = SLIDE RODS
G = PISTON ROD.
H = CON ROD (OVERLAID WITH GUN BARREL)



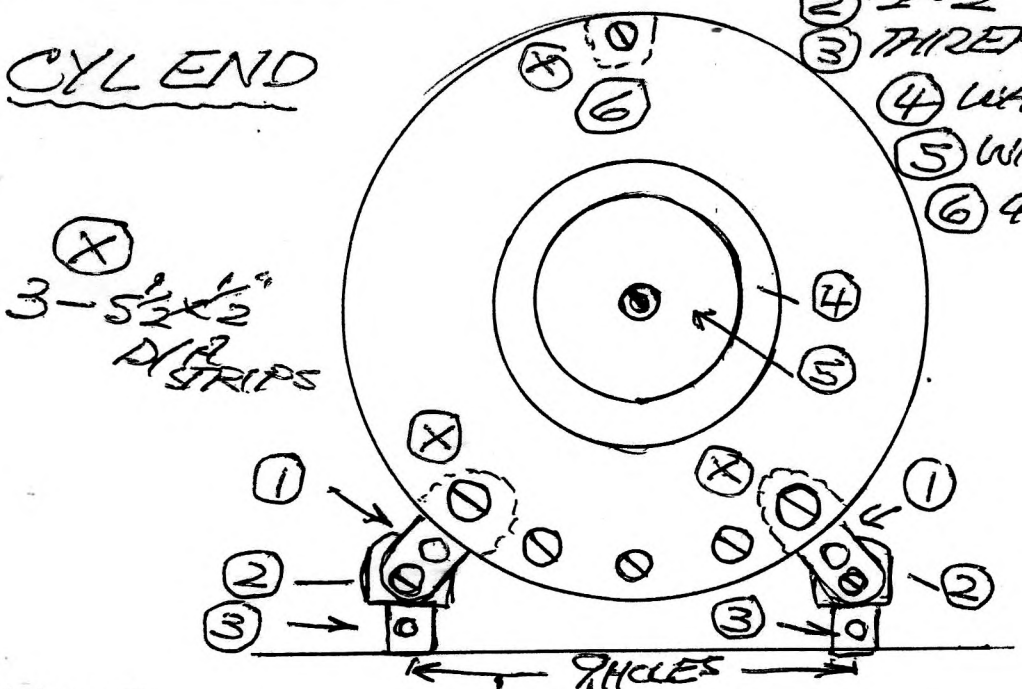


A = SPACING COUPLINGS
B = WHEEL DISCS & D/A CRANK
C = SWIVEL BRG.
D = COLLAR WITH (E) PIVOT BOLT
E = SLOTTED STRIP.

MILL ENGINE (NEW)

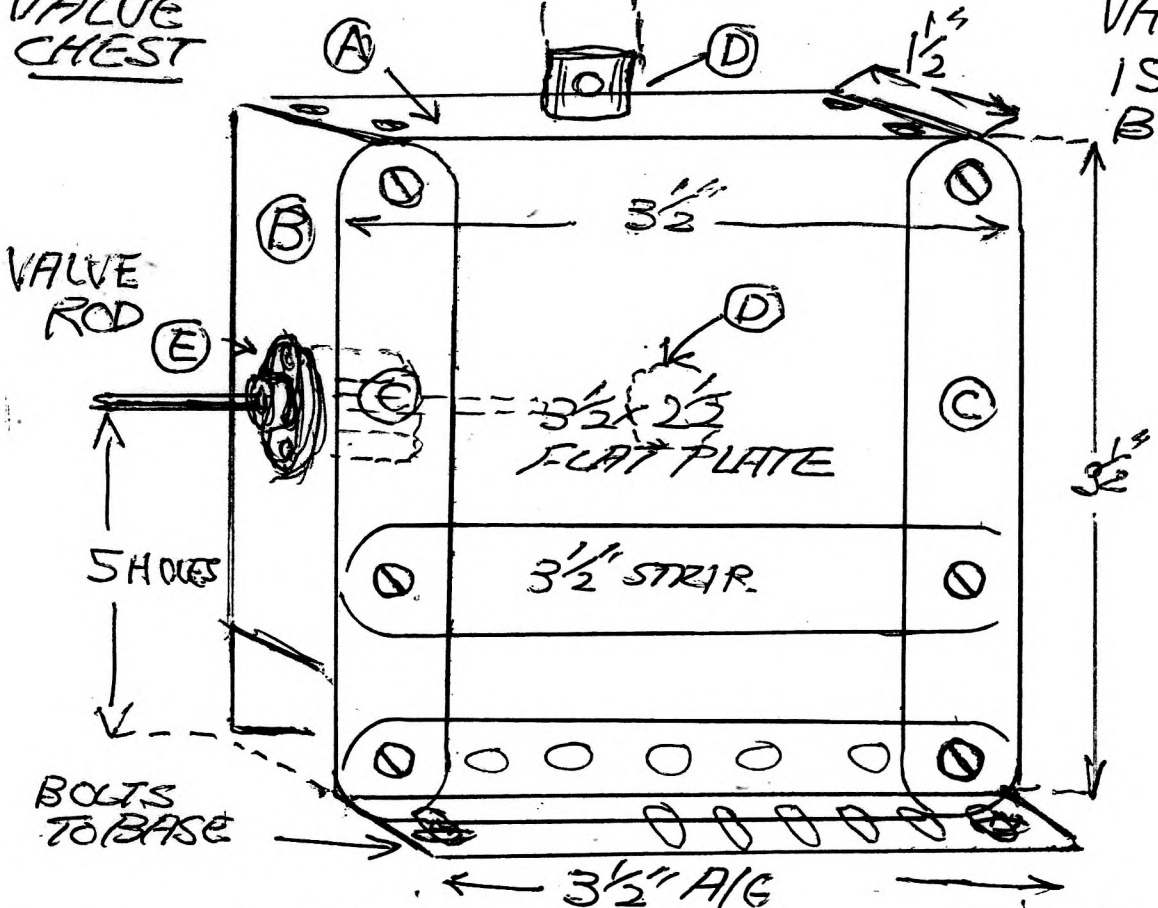
1. 1" x 1/2" DOUBLE BRKTS. (4)
2. 1/2" x 1/2" PITTO (4)
3. THREADED BOSS (4)
4. WHEEL FLANGE
5. WHEEL DISC.
6. 4" CIRC PLATE

CYL END

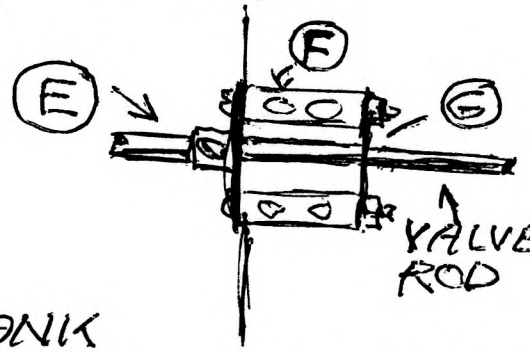


VALVE CHEST

VALVE BOX IS 3 1/2" SQ BY 1 1/2" WIDE

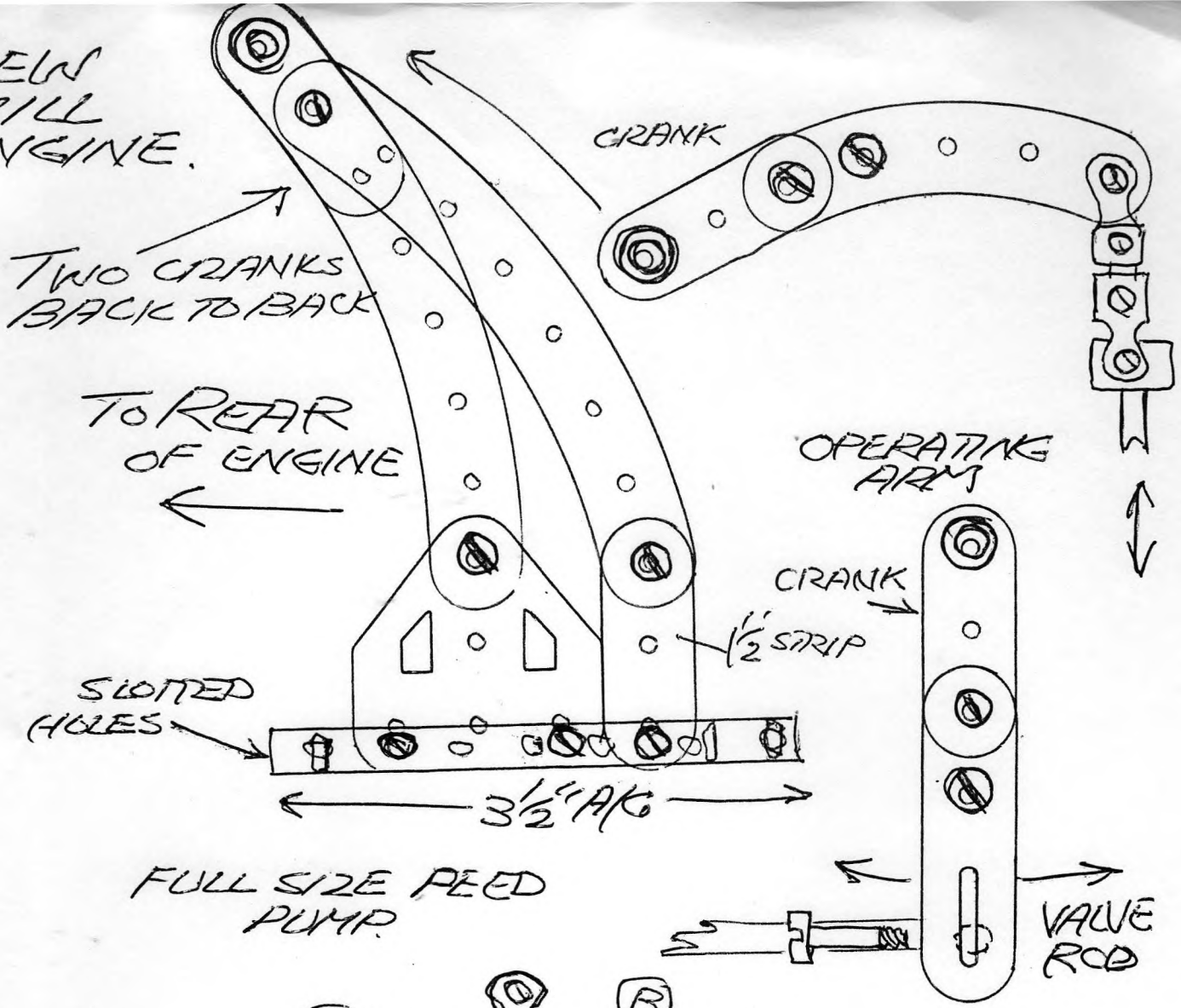


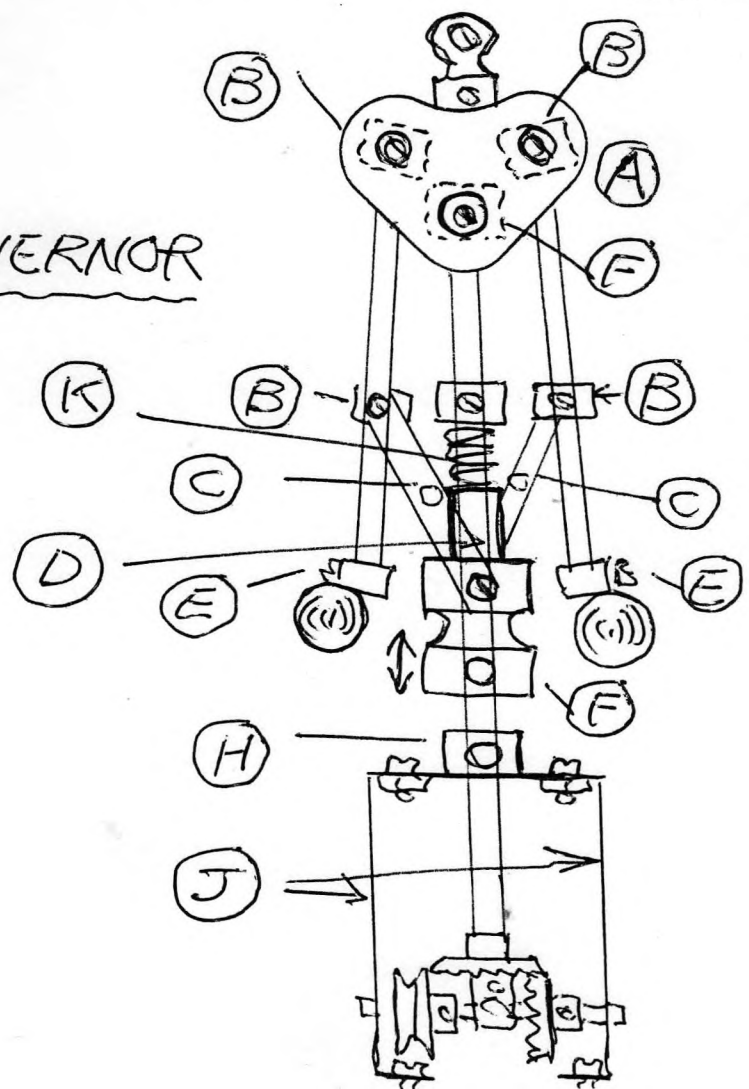
A = 3 1/2" x 1/2" FLAT PLATE
B = 3 1/2" x 1/2" " "
C = 3 1/2" A/G.
D = CHIMNEY ADAPTOR
E = WHEEL DISCS (BW) OVERLAID WITH D/A CRANK
F = SPACING COUPLINGS
G = 1 1/2" STRIP



SEPT 92

NEW MILL ENGINE.





A - 1" CNR BRKTS (2)
B - 4H COLLARS
C - ½ N. STRIPS (2)
D - COUPLING.
E - MINIATURE COLLARS (2)
F - SOCKET COUPLING.
G - FIXED COLLARS.
H - D/A CRANK
J - 3½" D/H STRIPS
K - COMPRESSION SPRING.