Project No24. THE SWANNINGTON WINDING ENGINE.

Introduction. This large model has been copied from original photographs taken at the York Railway Museum-and also from two prints in my book "Stephenson's Britain" by Becker and published by David & Charles of Newton Abbot here in Devon. I have gone to some pains to reproduce the model exactly as the original and it was found necessary to use a non-Meccano size rod for the piston -and also to drill out a few wheel discs with a centre hole the same diameter as at the centre of a wheel flange or 4"circular plate. This is to maintain proportions and most Meccano rods are fitted with layers of couplings/collars/brass wheel bosses to this end. The model requires careful construction and you will need plenty of girders,flat plates,strip plates and small brassware-so be warned before you decide to go ahead with the construction ! You will need a fair size table or bench with all-round access-and plenty of light directly overhead. The motor I have used is a fractional HP Mains motor(with brush gear) and I have a speed control to enable the model to start and stop as with the original. The drive is simple-being by a belt from the motor spindle-directly onto the flywheel rim.This belt is a Green round profile type which is joined by the application of heat-giving a very firm bond. This belting was supplied by a Dutch enthusiast and may be difficult to obtain in your locality.

The width of the flywheel rim does no allow for a flat belt and I suggest you use elasticated cord or make your own from rubber strip joined with Loc-tite or similar instant glue.

The choice of motor is not crucial as very little power is required-provided you build the model with care and line up the bearings and avoid binding in the mechanism. The flywheel has the correct six spoke layout and is built up from six-hole Bush wheels at the hub. The diameter is approx 20" as 5½"curved strips are joined end to end to form a circle of this diameter(approx).

The main base plinth is NOT the same as for the actual engine-but simply as a pedestal to support the engine base and to accommodate the flywheel and motor drive. The colours used in my model are mid-Red/Green of the fifties-plus some Nickel and Black parts-but not essential. A few Yellow strips are used for over-laying the flywheel spokes,while Black strips are used on the four crosshead plinths to emphasize the Victorian scrollwork-all carried out with standard Meccano parts. The single valve eccentric is made from a 3" pulley and operates the simple "Gab"gear employed. Narrow strips are used in various length for the long eccentric strap and also several four-hole collars are used for cross-bracing attachments. I also use the small screws for keyway rods and the shoulder bolts from swivel bearings and universal couplings. All constructional bolt heads have thin non-Meccano plated washers under them-this safeguards the enamel and improves the general appearance of the finished model. You will also require a small Aero collar for the "Gab"gear(this has a smaller dia than the standard collar) and you may have to cut-down one long axle rod -but this will be explained later in the text. The model rests on several "feet" made from Action-pack plastic wheel hubs-but small pulleys fitted with tyres or rubber rings will have the same non-scratch effect. The model will now be described-starting with the main base plinth-I assume the model is being built with the flywhe to your right facing you-so all measurements will start from the RIGHT end-the flywheel on the offside. Some of the replica parts are obtainable direct from me-such as the Aero collar and the non-standard parts.

Building instructions now follow:----------

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The base plinth is a large rectangle 55½" in length by 12" width and 7½"in height. The length is made up from three 18½" angle girders-butted together end to end.The slotted holes on the outside-these slotted holes are overlapped with strips when the strip plates are in position. Several 7½"A/g's are used for the height and are spaced along the length to enable the strip plates to be bolted-the joins overlapped with flat girders of 7½" length. Where the long angle gdrs butt together -short angle gdrs are bolted to the ends on the inside for strength. The strip plates are bolted along from each end and the gap in the middle is filled with flexible plates. The top length of girders also trap several 5½x3½"flat plates bolted lengthways UNDER the long girder round hole flanges. The rear left end of the plinth top also has several 12½" A/G's bolted across the width so that the flat plates can be bolted to them across the 3½" width of the plates.The 12½"A/G's are bolted across the width in "U" sections at each plate end for good support for the engine base girders. The flywheel slot is 21" in length by 3½" in width allowing a gap of 2½" for the wheel. The girder support for the flywheel on the INSIDE of the wheel is a 18½"A/G extended by strips to 21".This compound length is bolted under the right end of the platform top-and also to a 12½"A/G across the width at the left end of the slot. This main girder carries the massive bearing which supports the flywheel, crank and eccentric-so is supported inside the plinth by further girders of 7½" and 12½" lengths(see diagram). The offside of the plinth top also has a run of 5½x3½"flat plates-bolted lengthways to the cross 12½"A/G's away from the wheel slot. Angle gdrs of 9½"length support the top platform in front of the wheel slot -but only in the positions shown in the diagrams. You will note there is a gap running the length of the top platform-this gap accommodates the recess for the main crank-and to allow access to the inside of the plinth under the cylinder and crossheads.

Support feet for the base plinth are at each corner and also halfway along the length. Action pack roadwheels are bolted to short A/G's at each corner-and to 12½"A/G's across the base width approx halfway. The right hand platform top has several plates of 5½x2½"(2)one 5½x3½"plate,and a 5½"strip to cover a 5½"long platform top section.The inner ends of the flat plates being bolted to a 9½"A/G across the width to the wheel slot. You will find that the various angle girders forming the base plinth rectangle-have to be manipulated to give a flat top and the side strip and flex plates MUST lie flush with the A/G's and are supported at their insides by more vertical 7½"A/G's.

The object is to build a STRONG base in rectangular form-to support the engine and flywheel without distortion.

The engine base is built up as a SEPARATE unit except for the flywheel. Once this has been achieved-it is a simple matter to place the engine onto the plinth and then to line up the crankshaft so that the flywheel runs true in a horizontal plain -and that the C/shaft is at right angles to the cylinder and crossheads. Note that the piston rod passes right through the cylinder with crossheads at BOTH ends-so it is IMPORTANT that all sliding areas are TRUE and free from friction.
The main engine bearing block is attached to the engine unit base girders-while the flywheel bearing is built onto the top side of the main base-allowances must be made for height variatic and the use of additional packing strips and washers is necessary

ENGINE PLINTH.Each side length is 1½"wide and joined across by 7½"strips and A/G's. Each side is 49"in length made up from TWO 24½"A/G's butted end to end on each side of the 1½"width .The centre run of the 1½" width is filled with 12½" strips supported by 1½"flat strips under the "U" sections.

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Engine plinth-continued. Note that there are two long "U" sections of 49" length-one for each side. Each section is three holes wide and are joined at each end by 7½"A/G's and 7½"strips.The end on the right(flywheel) has one angle girder bolted across the ends of the 49"compound girders-and one 7½"strip next to the girder. The other end also has a 7½"A/g and TWO 7½"strips next to it-giving a 1½"wide end. Further strips and angle girders are bolted across the compound girder width in the following positions-counted from the RIGHT end:-

24 holes along -one 5½"strip
53 " " one 7½" strip and a 4½" A/G under it.
71 " " one 7½" strip and a 4½" A/G under it.

The 4½" A/G's are bolted UNDER each 7½" strip with their slotted holes down and facing inwards. These two positions will hold the cylinder and the 4½"A/G's give added support for the cylinder. You are advised to study the diagrams with care. To support the joins where the 24½" A/G's meet-bolt four 2" A/G's UNDER the long girders at the joins on each side. The slotted holes of the long A/G'S are on the outside of the "U" and face down to the platform.

This finished rectangle of strips and girders will later be attached to the base plinth top by four holding long bolts only.

THE FOUR CROSSHEAD FRAMES AND GUIDES.

These are identical in construction and are 9½"long by 1" wide. I will describe one unit-the others are the same except for minor details. You will note the scroll-work on the side of each frame which is carried out with flat brkts,pawls(no bosses)rod and strip connectors,collars and other small brassware. To this end-the strips on each side are in BLACK-so that the Nickel and brass items have a good contrast and show up well in the model. First,take a 9½"A/G and bolt two further A/G's of 3" length at each end-all with their SLOTTED flanges INWARDS. To the side 3" gdrs-also bolt 3" flat gdrs -slotted holes also inwards. A 9½"flat gdr is bolted to the top gdr in a similar way. Next,bolt FOUR 9½" BLACK strips along the length at the top downwards,also trapping a 9½" braced girder which runs parallel with the bottom ends of the 3"girders. The rectangle thus formed-MUST be square. To the top two end holes of the 9½"flat gdr-bolt two flat brkts by their slotted holes and overlap the round holes in a triangular shape.Repeat for the other end. To the bottom two holes in the side of the 3"flat gdr-bolt a coupling so that it's central tapped hole is in a vertical plane.Repeat for the other end. A screwed rod is passed down through the apex holes of the flat brkts and into the tapped hole of the coupling. Allow for a length of screw rod to pass into the centre track of the base engine "U" girder and do the same for the other end of the frame. The two screwed rods must be free to pass into holes in the centre strips of the "U" base(the "U" is inverted of course). If the spacing does not allow for the rod to pass through holes-pack out the couplings with thin washers until the spacing is correct. These screw rods are the ONLY fixings for each crosshead frame. The crosshead slide consists of a FLAT-STRAIGHT 9½" strip bolted along INSIDE the frame two holes down from the top-and spaced from the frame by a coupling at each end.This strip will have the sliding crosshead working on it at both sides-and also at each end of the cylinder-there being TWO identical crosshead frames. Place the four frames to one side until the next phase of the model has been completed.

THE MAIN CYLINDER.The end cheeks are 5½"dia,but the cylinder body is of smaller diameter.Care is needed in it's construction and the use of tweezers or surgical forceps is recommended. The cylinder has to be FIRM on it's base and each end must be exactly in plane to acce the long piston rod. This rod is of a diameter to give a nice sliding fit through the centre hole of a 4" circ plate or a wheel flange. I have also drilled out a quantity of 8h wheel discs for the piston

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MAIN CYLINDER. This is 9½"in length and you will need a hub disc at each end. The outer face of each Hub has a 4" circ plate,a gear ring,a wheel flange-and two 8H wheel discs(drilled). The wheel discs are spaced from the centre of the hub disc by collars,one collar flush agaist the hub disc,and another collar between two wheel discs-all held on long holding bolts to the hub disc via the wheel flange and 4" circ plate. The gear ring bolts around the wheel flange,and a quantity of 2½"curved strips forming a circle-are bolted around the outer periphery holes of the hub disc. The bolts have their shanks OUTWARDS to enable threaded bosses to be screwed over each radiating bolt thread.

You can close in the whole end of the cylinder if you wish-by making a thin Aly disc the same dia as the Hub disc-but this is NOT essential 'tho improves the effect. Now take TWO STRAIGHT 9½" angle girders-bolt both under the flange of one hub disc to the slotted flange holes with a 2½"space (five holes) between each gdr end. One of the round Hub disc holes must be central between these gdrs on top. The slotted flanges of each girder are on the outside and face into the middle of the hub disc. Two more 9½" A/G's are also bolted to the slotted flanges of the previous 9½" ones-forming a step. This "step" is for the attachment of flex plates forming the inner circumference of the cyl and further stepped girders are placed lower around the bottom curvature of the hub disc to allow the curvature of the flex plates to be attached. Note that the bottom of the cylinder is partly OPEN to allow inner access to the cylinder-so that the flex plates need only be short ones of 4½"length. You can now fit the other hub disc with identical embellishments-to the ends of the 9½"A/G'S-BUT see diagram of cylinder before going ahead. The cylinder is held in position on the base by a bolt passed trough the bottom round hole of each hub disc-and then into 7½"strips with 4½"A/G's attached across the "well" of the engine base girders. DO NOT fit cylinder to the base as yet. Attachments for side support to the cylinder are required-and also the valve cylinder. The top two 9½" A/G's has a space between the round hole flanges and the valve cylinder is fixed to the gdrs by obtuse a/brkts -in the space between each hub disc. However-it is advisable to build the valve cylinder first. NOTE: The valve chest is fixed by ½"A/brkts,and NOT by obtuse ones as in previous text above. The valve chest is 5½" in length with extensions at each end formed by bush wheels with their bosses outermost and spaced from wheel flanges,also attached to the cylinder ends. You will require boiler ends,threaded bosses and long(2) threaded rods. The boiler ends are placed at each end with their contoured sides outermost. Flex plates of 5½x1½" and 5½x2½" are curved around and attached to the boiler ends by their flange holes-a 4½"flat strip also fixed along the top edge. The sides have 3½"strips which trap three pieces of Black plastic strip(cut from old flex plates) as a contrast. The two screwed rods pass right through the boiler ends in opposite positions and are retained by threaded bosses at each end of the cylinder-on the outsides of two wheel flanges-spaced from the boiler ends slightly and with washers as spacers. These are required because of the dome shape of the boiler ends. A bush wheel is spaced from the wheel flange at each end and MUST allow a long rod to slide through the whole cylinder and appendages. Four ½" a/brkts are bolted to the bottom edges of the valve chest in such a way that the lugs on each side can be fixed to the two 9½"A/G's at the top of the main cylinder. The spaces(1½") at each end of the main cyl top-are filled in wit 2½x1½"flex plates curved to the shape of the hub disc rims.

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VALVE CHEST-contd. The valve cylinder must lie central along the top of the main cylinder and the four lugs of the a/brkts are UNDER the flanges of the two 9½" girders and bolted in place. You will probably need tweezers-or a screwdriver that has been magnetized-as access is limited. The main thing is to form the valve cylinder to enable a Meccano rod to pass easily right through the ends without binding. The Offside of the valve cyl has two 1½x½"D/A strips attached to one 9½"A/G-these are for the steam inlet ports to be fitted-made from Zinc wheel hubs. (See diagram). Once the two cylinders have been built up-you are ready to fix them to the engine base-and you will note four made up stanchions-holding the main cylinder on each side.

The top ends of these supports are attached to angle brkts bolted each side of the main cylinder by their round-hole lugs. When the cyl unit is bolted onto the base girders-these side supports are adjusted and all four are bolted to the base engine girders in the positions shown in diagram. The cylinder unit should now be quite firm-AND-in direct line with the base girders. Provided you have used short flex plates for the main cyl curvatures-you should be able to get your fingers INSIDE both cylinders-with a bit of exertion. The valve spindle is actuated from a vertical framework just in front of the main cylinder-and comprises part of the "gab" gear from the eccentric drive. You can now fix the four crosshead frames in position each end of the cylinder-but they MUST be in line with the cyl bore. The piston rod should be 19½" in overall length and FREE to slide through the main cyl bore and appendages. Polish the rod and lubricate with fine oil. Each end of the rod is held in the large end bores of socket couplings and works well if care is employed with the securing screws in the couplings. The rod is of smaller dia than the socket bores-but setscrews will hold the rod ends with trial and error employed. The four crosshead frames are secured by their threaded end rods-held with 1½"strips under the inverted "U" base girders and will give a firm support.

Before we proceed further with the valve gear drive-I think it advisable to get the engine in a semi-finished condition with main bearings,flywheel,eccentric and crank. The first bearing is directly behind the built up crank and is an EXACT copy of the original with an unorthodox shape. This bearing is on the outer side of the engine base girders-and will co-incide with the centre position of the flywheel slot. The bearing has it's c/shaft hole six holes up from the engine baseplate girder-and 10 holes along from the right hand end of the engine base. It is best to refer to the diagrams for this bearing unit as it is made up in such a way as to copy the original and be very robust to take the weight of the flywheel and the crank and eccentric.

THE ECCENTRIC.Basically a 3" pulley fitted with a crank on the inside with it's boss level with an outer hole in the pulley. Bolt the crank through the pulley boss and another hole so that it lies flat and square with the pulley,Pass a short rod through the crank boss to achieve this. The outer strap is made from 4 3" curved stepped strips-passed round the groove in the pulley-and overlapped and bolted to allow the curvature to move easily around the pulley. The join in the curved strips faces forwards allowing three other joins to be at top and bottom and on the right side. ANOTHER ring of 3" curved strips is attached to the first ring-but stood off by three-4h collars by their opposite tapped holes. The top and bottom collars have a tapped hole on the surface for the attachment of the narrow strip compound strap going to the rocker arm. The length of the arms(there are two) from the fixing collars-is 20½"approx and the two far ends are bolted together.

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MAIN BEARING. --contd. The bearing is 1" in width and uses two face plates with both bosses inwards. These face plates are attached to 2½x2½"flat plates-so that the bosses of the face plates are six holes up from the base. The diagram will show the construction.

THE FLYWHEEL.Is approx 20" in diameter and you need 2x12 curved 5½"strips for both sides of the wheel. The rim is made by joining flat girders together end to end-and fixing to the curved strips by angle brkts-but ONLY where holes match up-you do this to get the best circular form.Note that one edge of the rim is filled with bolts and washers for added weight. The hub is made from two 6hole bush wheels as there are SIX spokes to the wheel as in the original.
Each spoke is given a square form by the use of 9½"strips and 7½"angle girders-some being attached right through the spoke thickness by long bolts. The bushwheel have their bosses outwards and are spaced from each other by short couplings or old bosses from road wheels. The outer ends of the spokes are attached to the rim curves at every two joins in the curved strips-this being correct for the 12 curved strips to each circle. I have used a pair of 2½" stepped curved strips at each outer end of the spokes-radiating from the spoke and under the wheel rim. Counterweights in the form of layers of strips are bolted to one outer spoke-directly opposite the throw of the crank when fitted. The clear portion of the wheel rim takes a green "sprung" belt direct to the motor spindle which is to the left of the flywheel and under the base plinth-bolted to cross girders in line with the flywheel rim. In practice-this driving method is good as there is a big reduction from the small motor pulley. It is important to use a jig(made from a Meccano frame-work) to adjust all the parts of the wheel to give a near-true rotation. The bosses of the two bush wheels must take the c/shaft and each bush wheel has two set-screws in their bosses for better grip.This applies to the crank and the eccentric-otherwise you will have slipping and the balance will be upset. The c/shaft is a STRAIGHT Meccano rod-but several brass parts such as collars are used to give a bigger diameter where the c/shaft is exposed. PROPORTION is the key to a successful model of this size.
The offside bearing is built onto the edge of the base plinth and MUST eventually line up with the other bearing.You may need packing strips to bring the c/shaft in line and the insertion of the flywheel in the two bearing gaps-will enable you to see that the rim of the wheel is in a horizontal plane. The offside bearing can be built up in several ways-I have used a 3½x2½"flanged plate in a vertical position with flanges outwards and edged with 3½" angle girders. Use a double arm crank for the bearing boss and add a lubricator-in fact-use more than one bossed bearing for support. Pack UNDER the flanged plate with strips etc to give extra height if needed. If the c/shaft is NOT true-uneven operatic will result so this is crucial. Once the flywheel is trued up-you can tighten all bolts and set the wheel aside.

CONNECTING ROD.Made from several sleeve pieces joined with some chimney adaptors-each end capped with a small flanged wheel. You will need a rod(compound will do) of 10½" which is passed through SIX sleeve pieces and the two end flanged wheels. Each end also has a rod socket securely attached.The con rod is now extended at the crank end by a 1"x½" angle brkt. The small lug is attached to the rod socket thread-but spaced with a few washers so that the shank of the socket does not foul the big end-made from 10-12 wheel discs(8h)-all clamped together. The slotted part of the angle brkt covers the centre hole of the wheel discs for the crank pin. Use four long bolts in the discs.

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Con rod-contd:- The other end of the connecting rod has the same arrangement of wheel discs attached to a 1x½" A/Brkt -the discs being clamped together with long bolts but also make sure the centre hole is clear for a rod without any binding.

THE CROSSHEADS(two). One for each side of the main cylinder and running between the crosshead frames. I will describe the one only as the other is identical. Bolt two double arm cranks to 1½"flat girders by theirslottedholes. The bosses of the cranks being inwards. Place two slide pieces on 1" rods so that the ends of the rods are flush with the slide piece inner part. These rods with the slide pieces are next placed in the end holes of the flat gdrs-but in the bottom run of round holes.Place compression springs on each short rod and retain with collars. Place the flat gdr with it's crank and slide pieces on the 9½"strip running down on one side of the crosshead frame. Do the same at the other side and join the two bosses of the cranks with a suitable rod. The four slide pieces should slide easily along the strips as the springs allow for some variation and the D/A cranks can be adjusted in the slotted flat gdr holes. This transverse rod accepts the small end of the con rod. A large fork is next built up from two 1" double brkts-both bottom holes being placed over a rod socket thread and locked with a nut on the inside of the double brkts. Next-bolt two or three layers of 2½" strips to the long brkt lugs by two bolts and also a ½"double brkt next to the 1" ones. The outer ends of the 2½" strips are allowed to slide onto the rod joining the slides-but with space for the clamped wheel discs between the 2½"strip arms.The fork is free to move either side and you next place large washers on each side of the fork and short plastic pieces from an Army kit to give proportion. Or layers of ordinary washers.

The cyl end of the fork has the rod socket boss and this holds one end of a socket coupling-which,in turn,grips the end of the piston rod by a setscrew in a tapped hole of the large bore of the coupling. The outer end of the con rod is next placed over the crank pin(the clamped wheel discs) & is retained on the pin by a collar. You can now see how the motion of the crank(to be described) is imparted to the piston rod. The inner end of the piston rod with it's socket coupling (at the rear of the cylinder)to another shorter fork made with a 1"x½"double brkt-the long lugs being placed over the crosshead transverse rod in a similar way to the front crosshead. Use large waskers on each side of the fork and two small flanged wheels also on each side with their bosses outermost. The slides are made the same way with springs and the 9½"slide strips.

Oil the piston road at both ends and test for ease of movement-through the cyl and discs and also the two sets of slides. The compression springs and the loose forks take up a lot of slack to ensure freedom of movement.

We next come to the position of the crosshead frames in relation to the cylinder-from the flywheel end-there is a gap of 9 holes between the screw rod fixing of the frame-and the cross girder under the end of the cylinder. The rear frame is 5 holes between the cylinder girder and the screw rod of the crosshead frame. Repeat for both sides and adjust the frames for good running. Embellishments in the form of bolted collars are placed along the tops of the four frames as shown-into the long 9½"flat gdrs by round and slotted holes. We next come to the valve operation framework in front of the main cylinder.

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FRAMEWORK FOR VALVE GEAR.The two vertical frames are positioned six holes towards the cylinder from the screw rod hole at the left side of the crosshead frame. Two 7½"A/gdrs are fitted with a 1½x1½"flat plate at the bottom-also a 1½"A/g by it's round holes. The 7½"A/G'S have their slotted holes outwards forming a "U" section. At the top-bolt another 1½"A/G with another one behind it-giving a 1½"xl"top flat to the girders. A channel bearing with two 1"x½" a/Brkts at each end-is fitted to the nearside 1½"A/gdr at the top of the 7½"gdrs.This channel brg holds the transverse valve actuating rod. Two 7½"flat gdrs are attached at each side of the vertical gdrs by one bolt for each flat gdr-and each one is bent outwards to accommodate two circles of plastic strip at the bottom sides of the vertical girders. These plastic strips can be bolted by their holes to the vertical and flat girders with a splayed out effect as in the real engine. This frame is then bolted to the MIDDLE row of holes in the engine base girders-as already mentioned-six holes from the crosshead frame screw rod holding. Repeat for the other frame situated opposite on the other engine base girder. Next,bolt two 1"cnr brkts to the slotted holes of the flat girders-four holes down from the top-so that one lug faces inwards. A rod and strip connector is fitted to the lug and the same applies for the other side. Two short rods are held in the R/S connectors,in such a way as to allow a coupling-fixed to each rod-has it's central bored hole free to take a sliding rod.This rod enters the valve cylinder-so the corner brkts have to be adjusted in the flat gdr slotted holes-to allow clearance for the valve rod into it's cylinder. The two channel bearings can be topped with brassware to represent lubricators-so a 1½"angle girder needs to be bolted to the open top side of the channel bearing. Both vertical frames MUST be in line with each other and built identically. Cross-brac the inner sides of the vertical girders with NARROW strips.
A long rod is passed through both channel bearings-in a correct plane-and this rod has layers of couplings for proportion-also the fork which operates the valve spindle.This fork is built up from two single arm cranks-placed in the middle of the transverse rod with their bosses outwards. Two 2½"NARROW strips are bolted to the cranks-one on each-with a coupling as spacer between with it's tapped holes used for the narrow strip fixings. The two stri hang down on each side of the valve rod. The valve rod holds two couplings by their middle bores-with two long screws or screw rods(2")turned into the tapped end holes-both ends of the couplin The two narrow strips go down between the couplings and these are prevented of turning over-by the long bolts in their tapped holes As the rocker arm actuates-the narrow strips push each coupling area in turn-too and fro-and they must be adjusted so that the two narrow strips impart reciprocating motion easily. The outer end of the valve rod also slides in the centre bore of the coupli between the vertical frames and previously referred to.
The eccentric strap imparts motion to an arm hanging down from the transverse valve rod-but has a slot at it's bottom end to allow the eccentric strap to drop over an Aero collar fixed to the hanging fork. A foot pedal raises the eccentric strap so that two pins on it's end-are lifted clear of the aero collar and ther fore does not actuate the valve. This is for hand starting of the engine in reality and the two handles are for the engineman to work the valve manually. Once the engine starts-the pedal is ther released which allows the eccentric strap to drop over the Aero collar-and work the valve for continuous rotation of the engine. See various diagrams of this important area.

We now come to the steam inlet and exhaust pipes and cocks-----

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MAIN CRANK-see diagram on separate page.

Select a good face plate with firm boss-to the outside with boss inner-bolt a 3"x1½"flat plate to give a seven hole gap between the boss and the crank pin boss. Top the plate with a wheel discs-and use washers for level packing. Two 3½"A/G'S are bolted at opposite positions by their slotted holes UNDER the face plate edge. Adjust the two A/G8s so that their outer ends can be bolted in a three hole position-under another wheel disc-and the lugs of a D/A crank-UNDER the top. The two A/G's have flat girders bolted to their round flange holes(the 3½"A/G'S) and the flat gdrs are fixed by their SLOTTED holes to the flanges. Inside the face plate-a Bush wheel is bolted in line with the face plate boss-but spaced from it by two couplings on the holding bolts. Pairs of formed slotted strips(four at the face plate end-and two at the pin end) are attached to the flat girders and also to the 1"x½"a/brkt at the middle edge of the face plate. The formed slotted strips need to be "formed" around the circumference of the face plate-and the same with the bush wheel at the crank pin end.
The crank pin is held TIGHTLY in the boss of the D/A crank-and in the bosses of the face plate and Bush wheel-use two set screws in each boss for better grip. So the finished crank is 1"wide and 5" in length with 3½"wheel centres. Rods passed through both bores MUST be parallel-so adjust accordingly before final fixture of the holding bolts. The connecting rod "big end" fits over the crank pin and washers are used to make sure the con rod is in a direct line with the cylinder bore. Retain the big end with a ½" pulley on it's outside. Note that the Big End is made from about 12 wheel discs(8h)-one of the holding long bolts also holds the long lug of an 1"x½"a/brkt on the inner side. The small lug has a rod socket attached-but use spacing washers to get the fixing nut between the disc edges and the brkt lug. Pass a rod through the stacked discs and tighten the holding screws when complete freedom of the rod is achieved. One flywheel spoke has counter-weights fitted OPPOSITE the throw of the crank.CARE with the construction will result in a good heavy crank.
THE MAIN BEARING.-diagram. This is 1"wide and consists of two face plates with their bosses INWARDS-attached to the top of 2½x2½"flat plates-so that the bosses of the face plates are over the top edge of the plates. The plates at their bottoms-are centrally fixed to the slotted holes of 3½"A/G'S and the round hole flanges both face inwards. Two sleeve pieces are bolted at an angle between the face plates by means of long bolts-each sleeve piece being capped with a chimney adaptor with a bolt shank protruding out from the tops. Formed strips fix to these bolt shanks-the centre hole of the formed strips holding a ½"pulley to represent a lubricator. The sides of the bearing are filled with various short A/G's and flat gdrs-but to leave the sleeve pieces at an angle-patience is required to get the desired formation.Note that the two face plates are held to the plates by two bolts only under the boss line.
The top edges of the face plates are filled in with small curved strips between the sleeve piece gap. The whole bearing is fitted to the engine base in line with the flywheel and offside bearing -but make sure it is FIRM and level. On the nearside girder to th crank-remember that the engine gdr is 1½"wide-the bearing 1"only.
All steam pipes consist of cylinders joined on their insides by NARROW strips-some are fitted with large flanged wheels for the boiler end fitments-while slotted strips are used at corners to hold pairs of wheel hubs in place. The four crosshead frames have layers of couplings,collars on their threaded holding rods.

contd/----

WINDING ENGINE.

THE MAIN CRANK WEB. This is a heavy built up unit and the diagram shows the constructional features. It is important that bosses have two set-screws fitted-and that the crank pin is PARALLEL to the crankshaft-otherwise uneven running will result. The crank well is simply some large flat plates secured by long bolts under the crank body and can be of any suitable size and fixing arrangement.

STEAM INLET AND EXHAUST PIPES. Carried out with Cylinders that are joined end to end with their seams in line-by narrow strips on the inside of the cylinders. Bends and ends are fitted and these are Zinc wheel hubs-painted Green and are attached as shown-either by long bolts or slotted strips. The large dia centre piece of the inlet pipe is made from two boiler ends and wrapped around with either Red plastic or metal-flexible plates. The exhaust pipe bend from it's vertical position-is carried out by means of zinc wheel hubs and an odd piece of plastic plate -cut and shaped as shown-this latter is NOT a necessary requirement. The support for the exhaust pipe is simply some short angle gdrs,curved strips,and triangular plates-formed as shown and bolted to the engine base and to the bottom curvature of the pipe. Topped with a boiler end or similar. The steam inlet pipe has two connections to the offside of the valve chest and the wheel hubs are attached to two 1½x1½"flat plates that are supported at the side of the valve chest via 1½"D/A strips and 1½"A/gdrs with cnr brkts to fill in the sides. Various fittings are on the steam inlet pipe-a lubricator and steam cock-and the outer end goes down to the base plinth of the model(or to the boiler house in actual practice). The exhaust would probably be led out through the roof of the engine house -or through a side wall to a vent pipe. Rails are fitted at the crank end as shown-carried out with rod sockets,couplings etc-and at the end of the wheel slot. The handle for the manual operation of the valve is shown in one of the diagrams. Below the handle-on the base plinth top-there is a foot pedal-which has an arm that LIFTS the eccentric strap clear of it's slot on the vertical arm-and dis-engages the gear. When the pedal is released-the strap is allowed to drop inside the vertical slot so that two adjacent threaded pins at the outer end of the strap-are allowed to drop over the Aero collar between the fork on the vertical hand operated rod-and thence the valve chest operating rods. Once the engine has started-the strap continues to rock the arm-and continue the rotation of the engine. This is a simple form of gear-called "gab" and is similar as used on the "Rocket"locomotive a few years previous to 1833. The engine drive to the winding drum would have incorporated a clutch arrangement-possibly near the winding drum outside the engine house and not seen near the engine proper. The eccentric strap must be of sufficient length to reach the vertical arm and consists of several NARROW strips bolted together-and clamped at their outer ends by the two threaded pins referred to.The slot must be of sufficient height and width to accept the narrow strip width-and to allow the pins to clear the Aero collar when lifted by the foot pedal. See diagrams of the pedal and the eccentric on another page.Four hole collars are used as attachments for the cross bracing on the strap.

Remember that access to the motor employed-is facilitated by a hinged door on the offside of the base plinth and fitted with a simple pawl catch.

contd/-----

CYLINDER END DIAGRAM.This shows how the four stepped pairs of 9½" angle girders are fixed INSIDE the hub-disc flanges-at the top they are 2½"apart-but further apart at the bottom to give access to the inside of the cylinder. Several flex plates (4½x2½") are bolted to the bottom step of the 9½"A/G's and curved around as shown. The side support angle brkts(4) are attached to the 4½"flex plates only. Some dexterity is needed for the attachment of the curved plates-and for the valve chest fixing under the top two flanges of the 9½"A/gdrs.
The pedal for lifting the eccentric strap is easily made from some strips attached to arms of cranks. One arm(the pedal) has two ½"A/brkts at it's end forming a foot pad-while the other end has a chimney adaptor held inside a 3/4" flanged wheel and allowed to turn on a long bolt-under the eccentric strap.

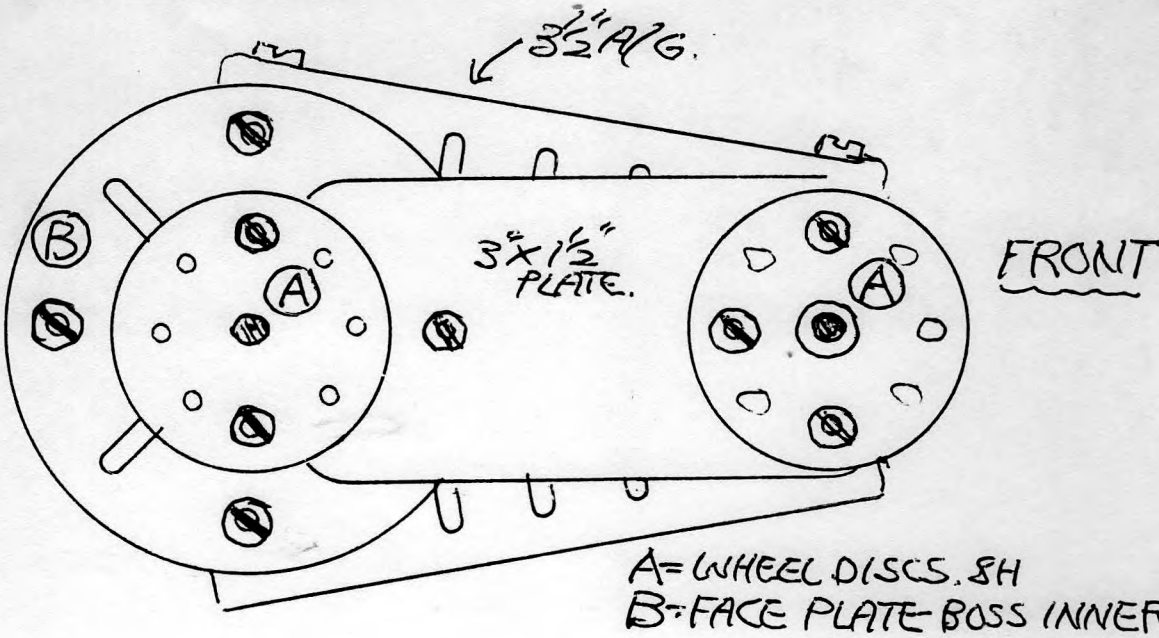
The cranks are pivoted between the lugs of a channel bearing attached to the plinth top near the valve drop arm. In such a way-that-when the pedal is depressed-the chimney adaptor and flanged wheel-contact the underside of the strap from the eccentric,and lift it clear of the slot with the Aero collar between the lugs. This concludes the main instructions -but you will note that ancillary items shown in the photo-copies-are not described being obvious.
The MAIN concern is to build all bearings,the cylinders,the crank,crossheads,eccentric CAREFULLY and line up all rods and select the straightest you have. Should you experience any difficulty-please contact me and I will help you.

Note that the piston rod has a large diameter to keep proportions-but would not matter if you only wanted to have the main functions of the model. Two Meccano rods joined with a coupling inside the cylinder-would work quite well.
The choice of motor depends on availability-but the model does NOT require much power to operate successfully.
THE FLYWHEEL RIM.Made from FOUR flat girders of 12½" and TWO of 7½"-all joined end to end by two nuts and bolts at each join. Inlet and exhaust piping-all carried out with Meccano cylinders joined with narrow strips. Wheel hubs are used for "corners" and have been enamelled green for the model-not necessary. Embellishments on the sides of the base plinth can be carried out to suit parts available-I have used Brass wheel discs that are centrally attached to strips forming rectangles at each panel. It is unfortunate that the main cylinder appears to be cluttered with ancillary items-but this is the correct layout as in the original. This concludes the instructions and I hope you will enjoy the model as much as I did.
PLEASE NOTE. I have certain colour negatives and can provide prints at cost. These are NOT supplied with the instructions-only photo-copies to avoid initial cost.

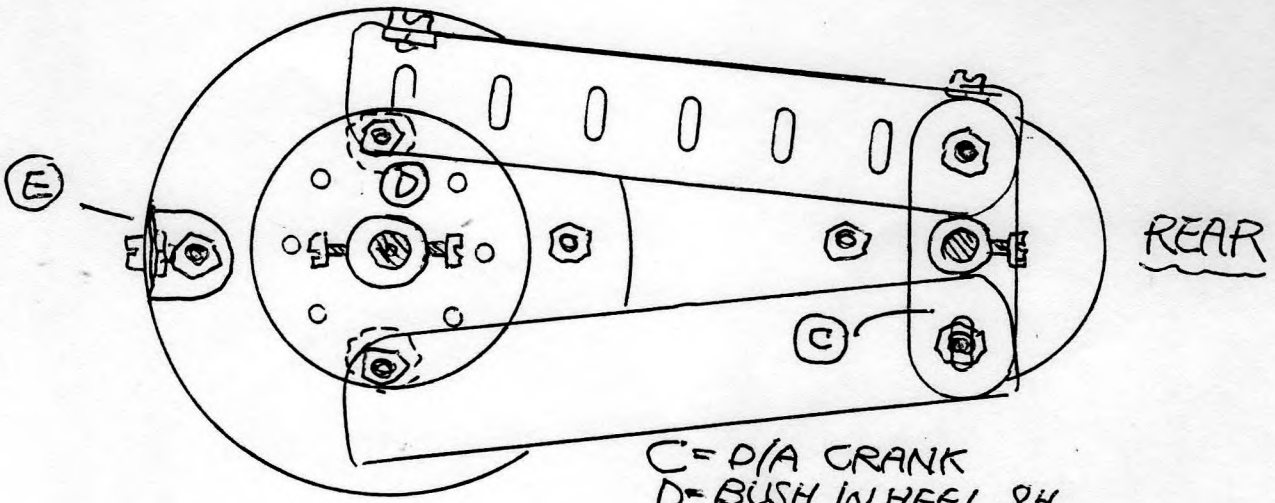
B.W.Rowe. Newton Abbot,Devon.
February 1989

PLEASE NOTE: Full colour prints(4"x6") are 40p each inc post. I am sorry I cannot include a set of prints with these instructions-but cost would be prohibitive.Contact me if you require help as the model is still in being here.

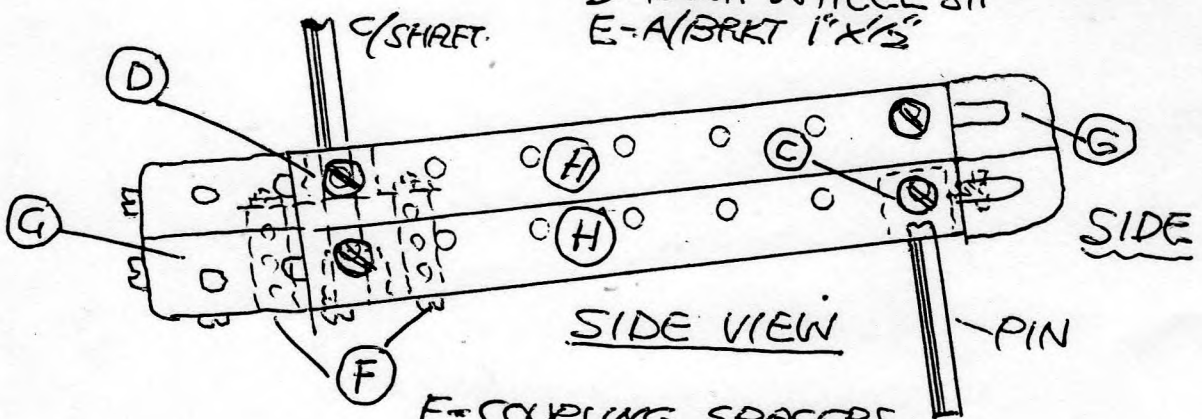
MAIN CRANK



A= WHEEL DISCS. 8H
B= FACE PLATE BOSS INNER.



C= D/A CRANK
D= BUSH WHEEL 8H
E= A/BRKT 1"x½"

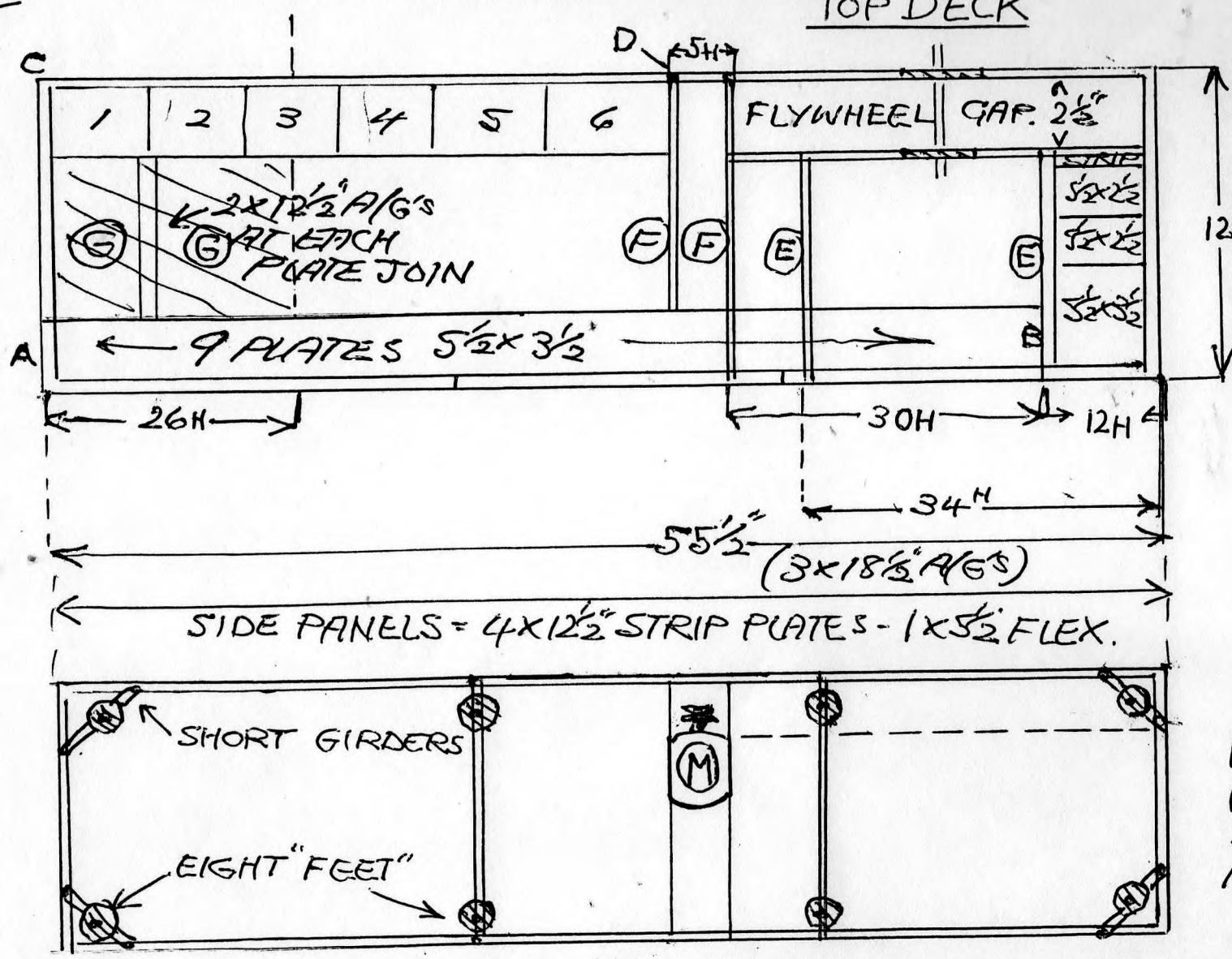


F= COUPLING SPACERS
G= FORMED SLOTTED STRIPS
H= FLAT GDRS 3½"

WINDING ENGINE

N°1

TOP DECK



A to B = 9 PLATES 5½x3½

C to D = 6 PLATES 5½x3½"

E = 9½ A/GIRDERS

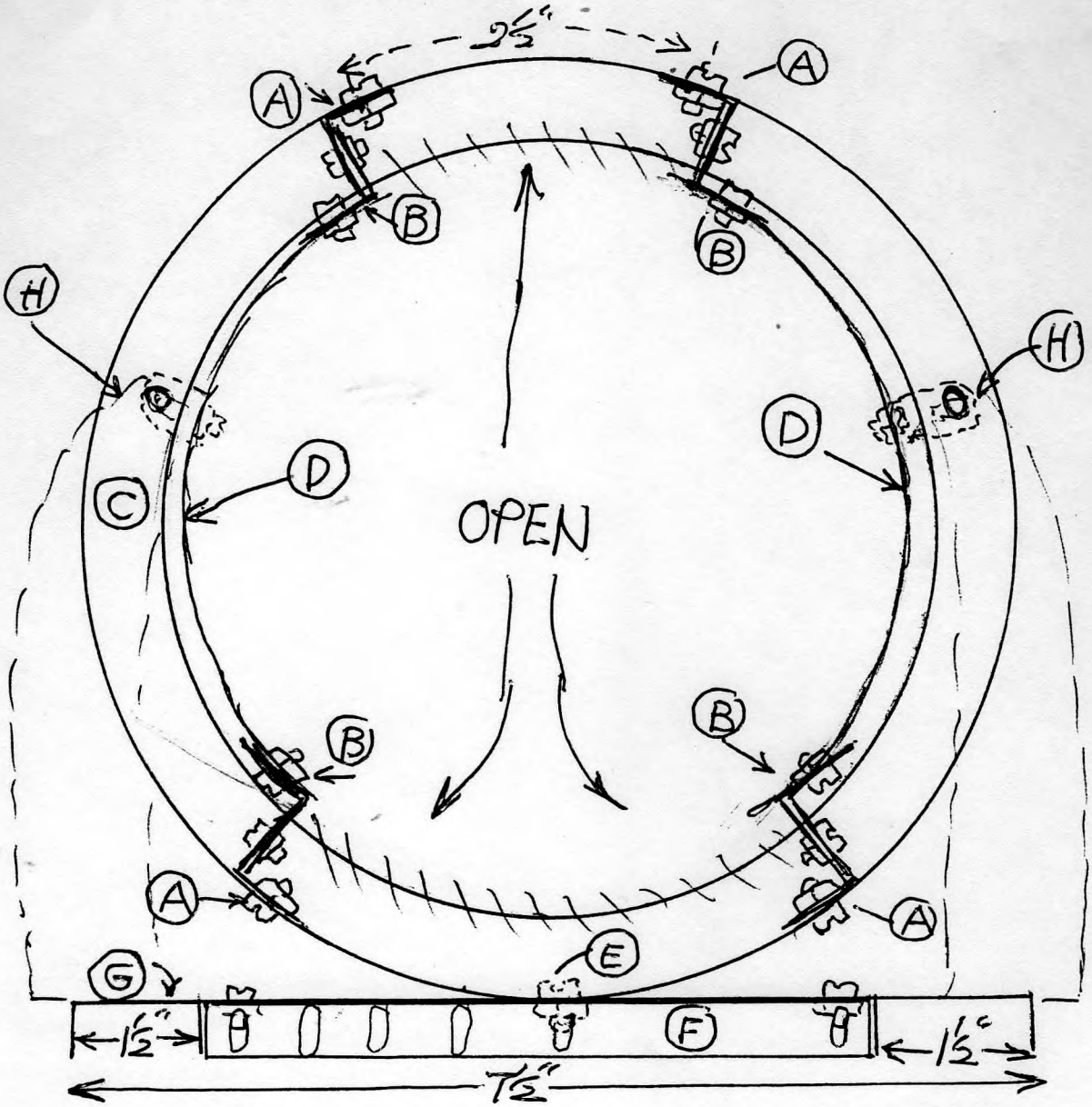
F = 12½ A/GIRDERS

G = FILL THIS AREA 26H IN WITH FLAT PLATES

BOTTOM OF BASE FRAME SHOWING FEET AND MOTOR POINT.

WINDING ENGINE

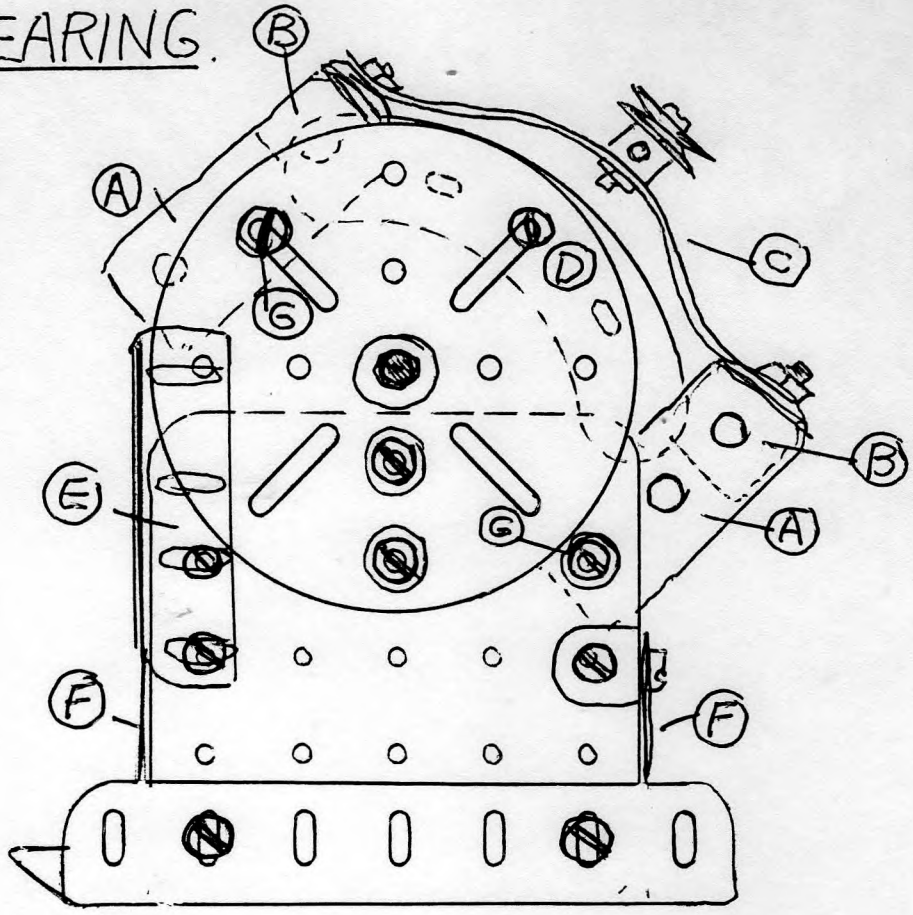
CYLINDER END VIEW.



A/B = STEPPED A/GIRDERS 9½" (8)
C = 5½" CIRC GDR/HUB DISC.
D = INTERNAL FLEX 4½" x 2½"
E = CYL FIXING BOLT (1 EACH END)
F = A/GDR 4½"
G = STRIP 7½"
H = A/BRKTS FOR SIDE SUPPORTS
CYL LENGTH :- 9½"
DIA CYL :- 5½" (ENDS)
DIA CYL :- 4½" (INNER)

WINDING ENGINE.

MAIN BEARING.

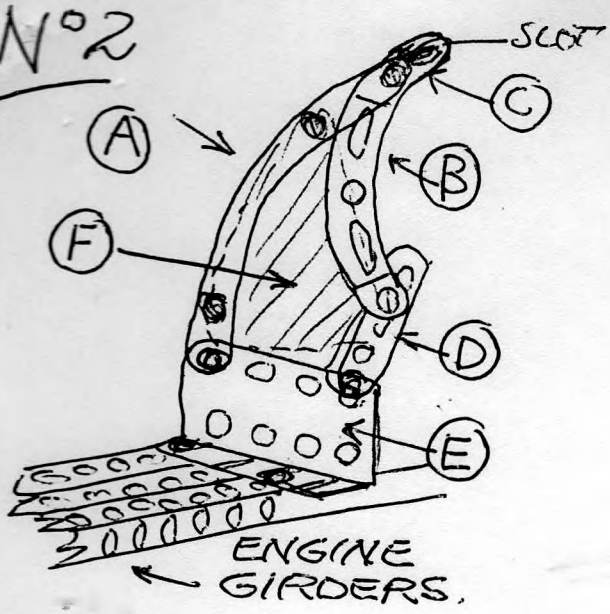


A = SLEEVE PIECES
B = CHIMNEY ADAPTORS.
C = FORMED SLOTTED STRIPS.
G = LONG BOLTS
D = CURVED STEPPED
E = A/G 2" OR GDR BRKT.
F = FLAT GDRS 1½"

The two sleeve pieces are held centrally on the long bolt shanks between the sides of the bearing. Curved stepped strips are then attached at each side of the sleeve pieces-to fill in the gap. Note the position of the sleeve pieces and the chimney adaptors fitted with bolts to attach the formed slotted strip-bent to shape. The middle bottom of the bearing is filled with 1½"flat gdrs attached to brkts at one side-and to the gdr brkt at the cyl side. The two face plates have their bosses INWARDS-but be sure they are in line. The slotted holes in the bottom 3½"A/G allows for some vertical adjustment. The bearing is 1"in width and is bolted to the base girders-to the crank edge and supported underneath by 1½"strips across the strip at the centre run of the base girder profile. The shape of the bearing follows correct original form(see photo-copies). Remember that there are two of each face plate,flat plate,and 3½"A/G for each side.The boss of the face plate is SIX holes up from the bottom-not five.

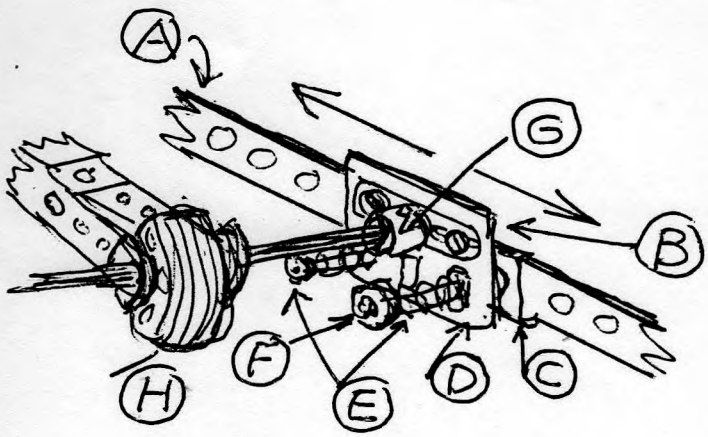
continued/----

N°2



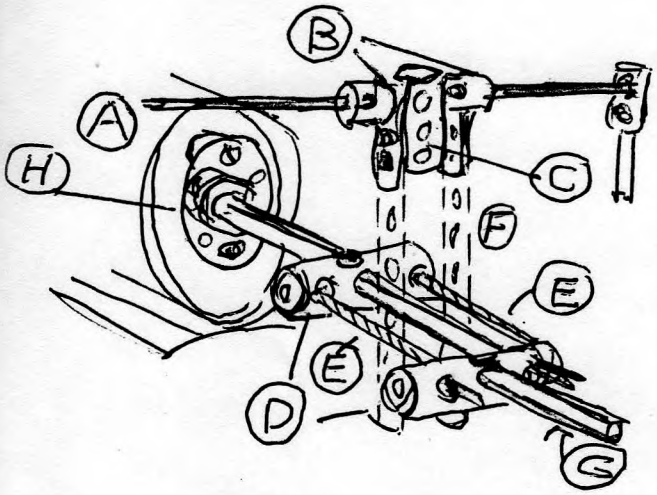
CYLINDER SUPPORT STANCHION (4)

A = 4" CURVED STEPPED
B = 3" — " — — " —
C = FLAT BRKT
D = SLOTTED STRIP 2"
E = GIRDER BRKT
F = 1½ × 2½' TRIANG PLATE



CROSSHEAD (4)

A = 9½" STRIP
B = 1½" FLAT GDR
C = SLIDE PIECE (2)
D = COMPRESSION SPRING (2)
E = COLLAR (2)
F = 1" ROD (2)
G = DIA CRANK
H = PACKED DISCS

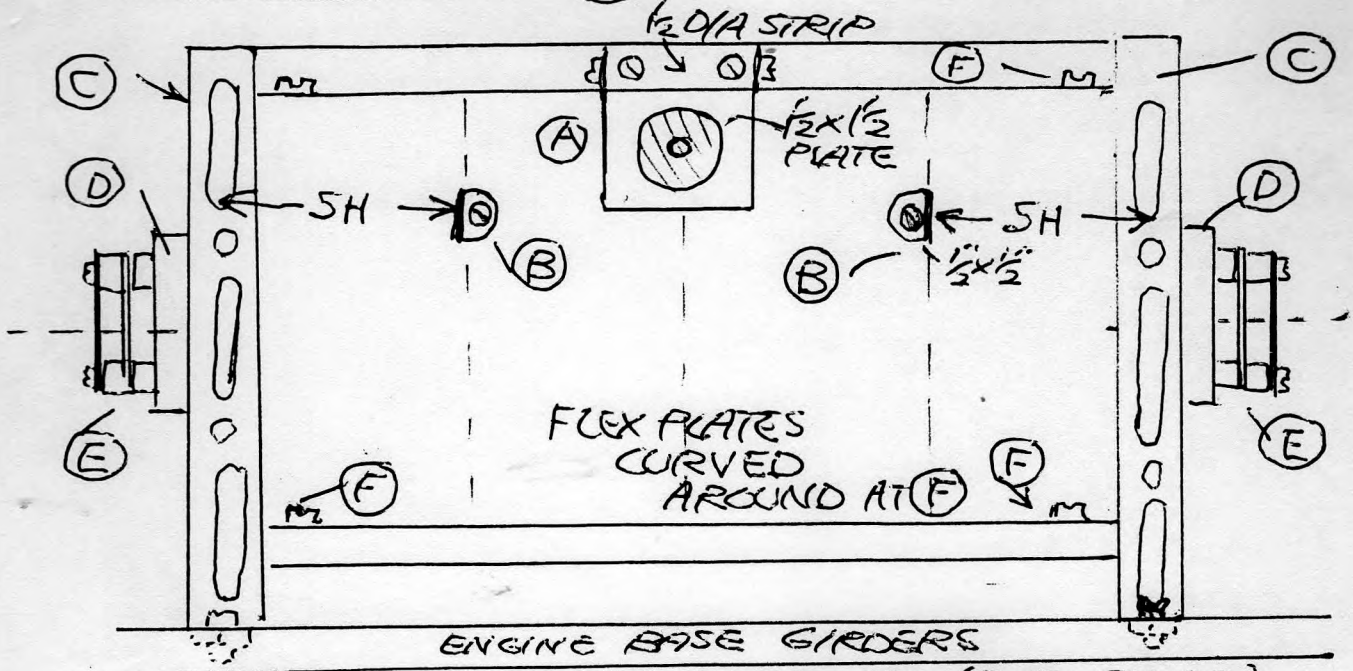


VALVE LEVER

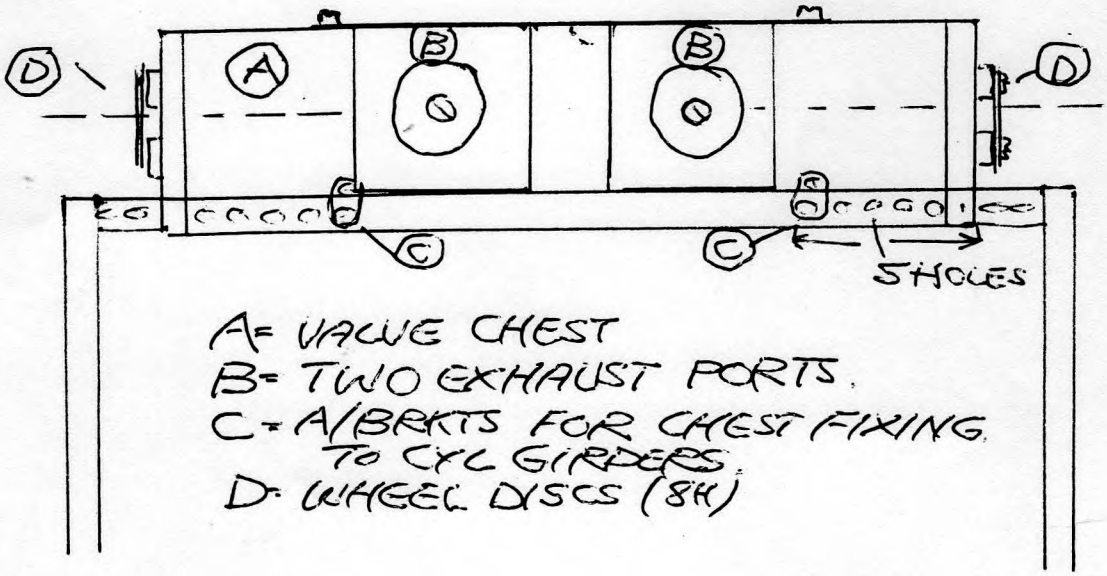
A = VALVE CHEST
B = CRANKS (2)
C = COUPLING.
D — " — (2)
E = LONG BOLTS (2)
F = 2½" N/STRIPS.
G = SPINDLE.
H = BUSH WHEEL.

WINDING ENGINE.

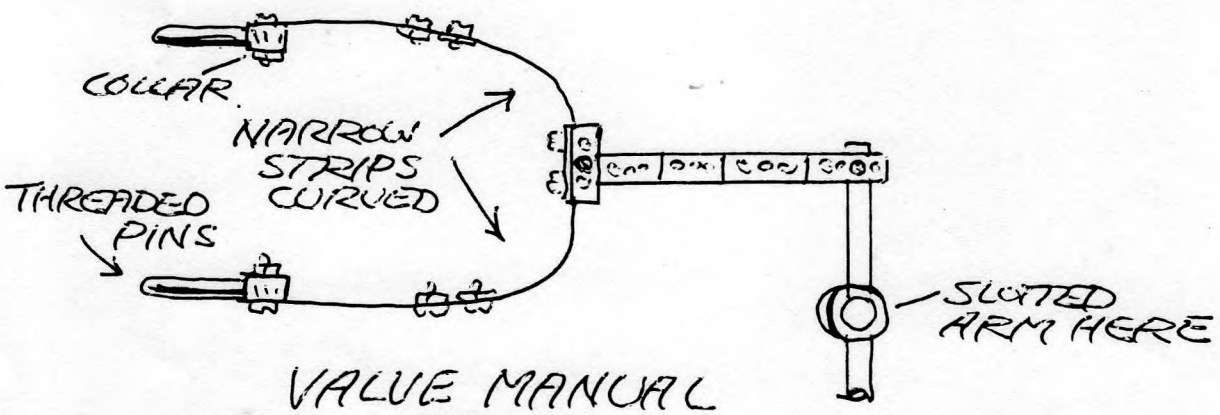
MAIN CYLINDER. (A) = STEAM INLET PIPE HERE



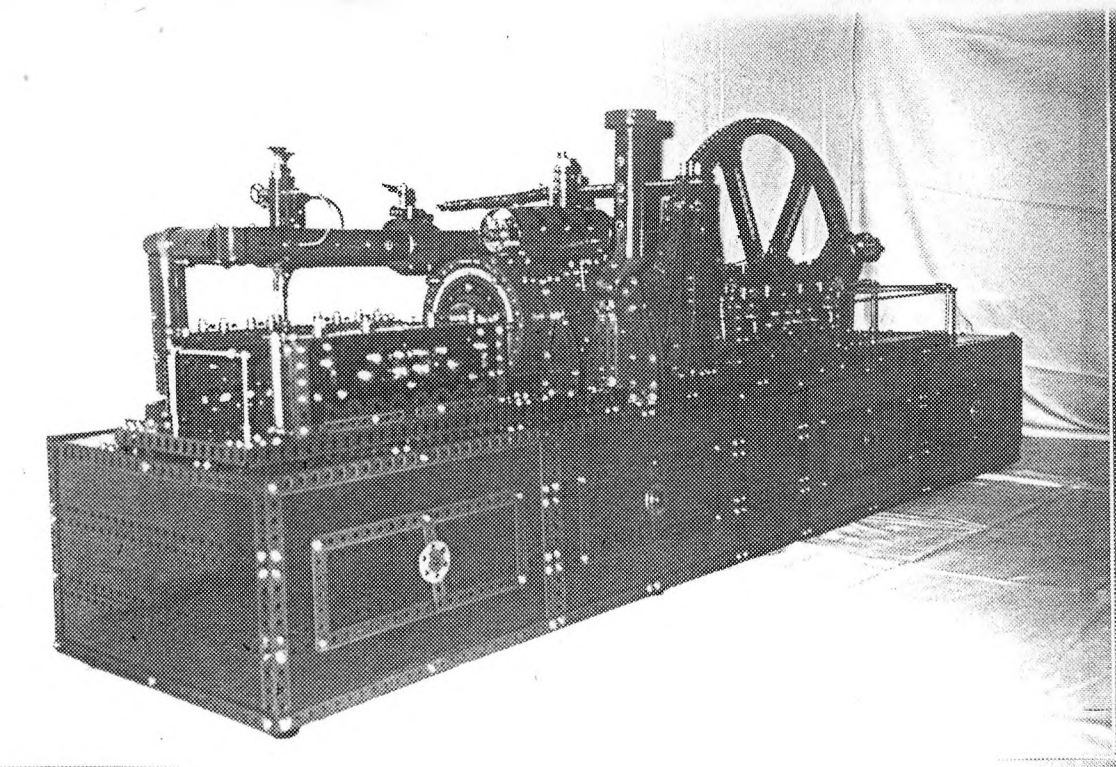
B= A/BRTS FOR SIDE SUPPORTS (BOTH SIDES)
C= HUB DISCS.
D= WHEEL FLANGES.
E= WHEEL DISCS (DRILLED) AND COLLAR SPACERS.

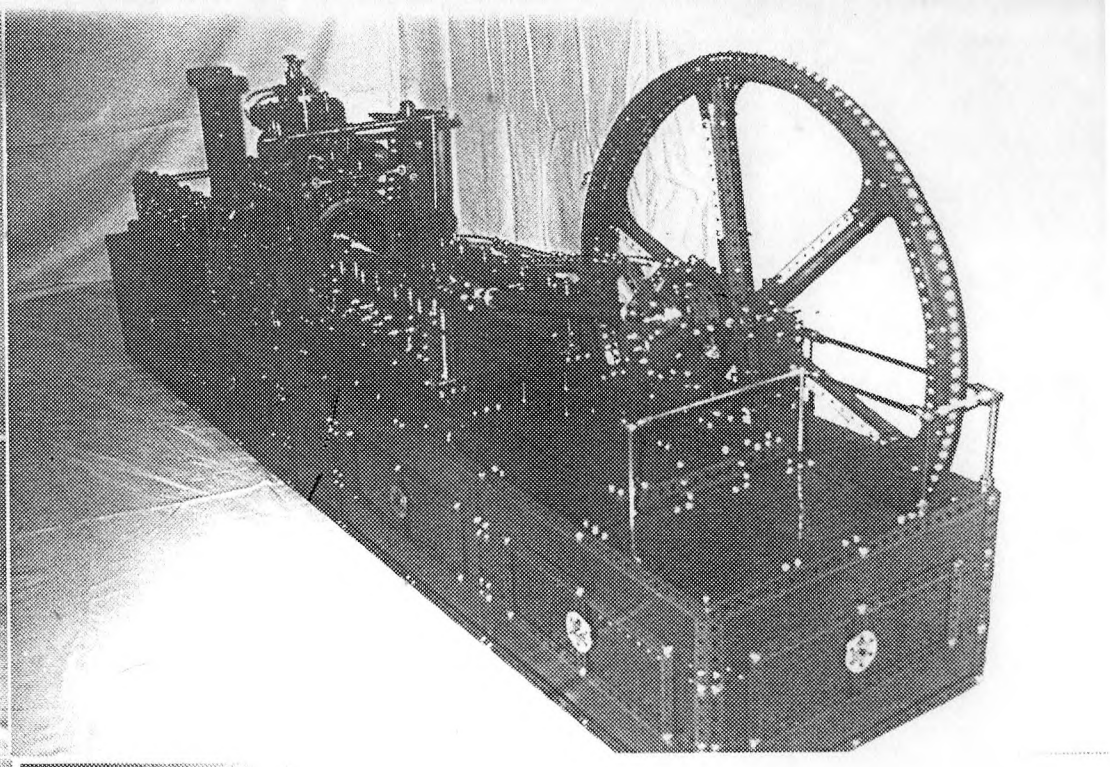


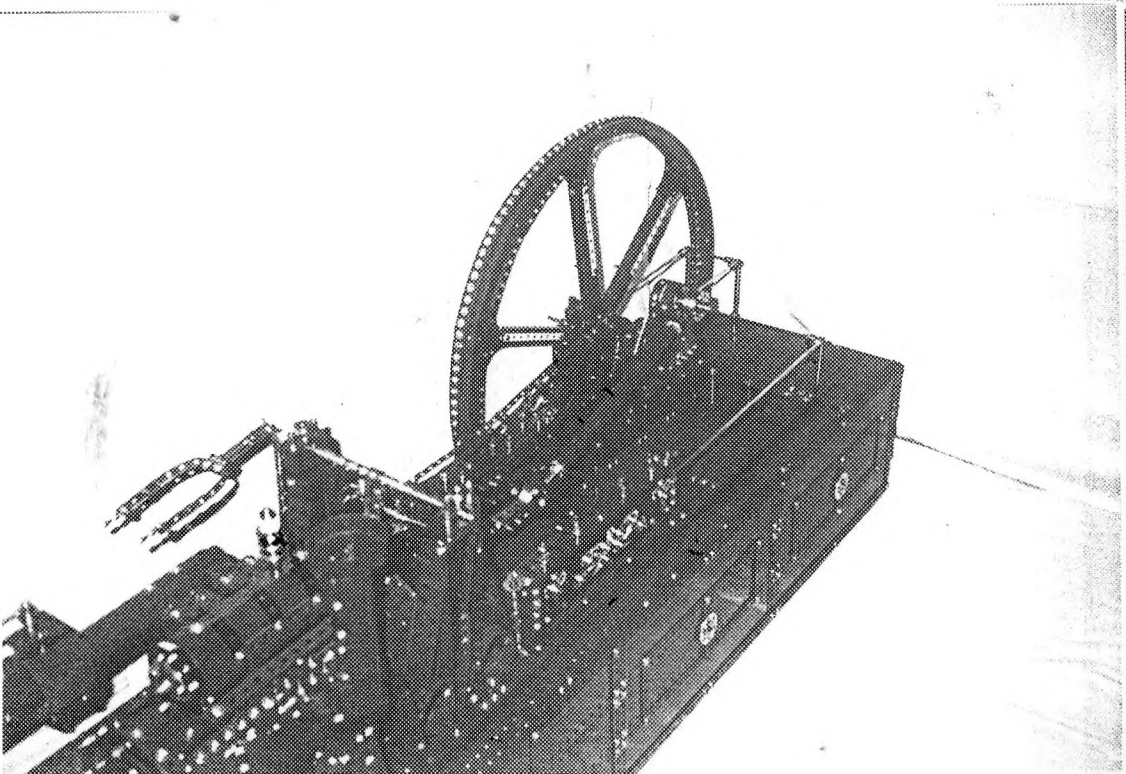
A= VALVE CHEST
B= TWO EXHAUST PORTS.
C= A/BRKTS FOR CHEST FIXING TO CYL GIRDERS.
D= WHEEL DISCS (8H)

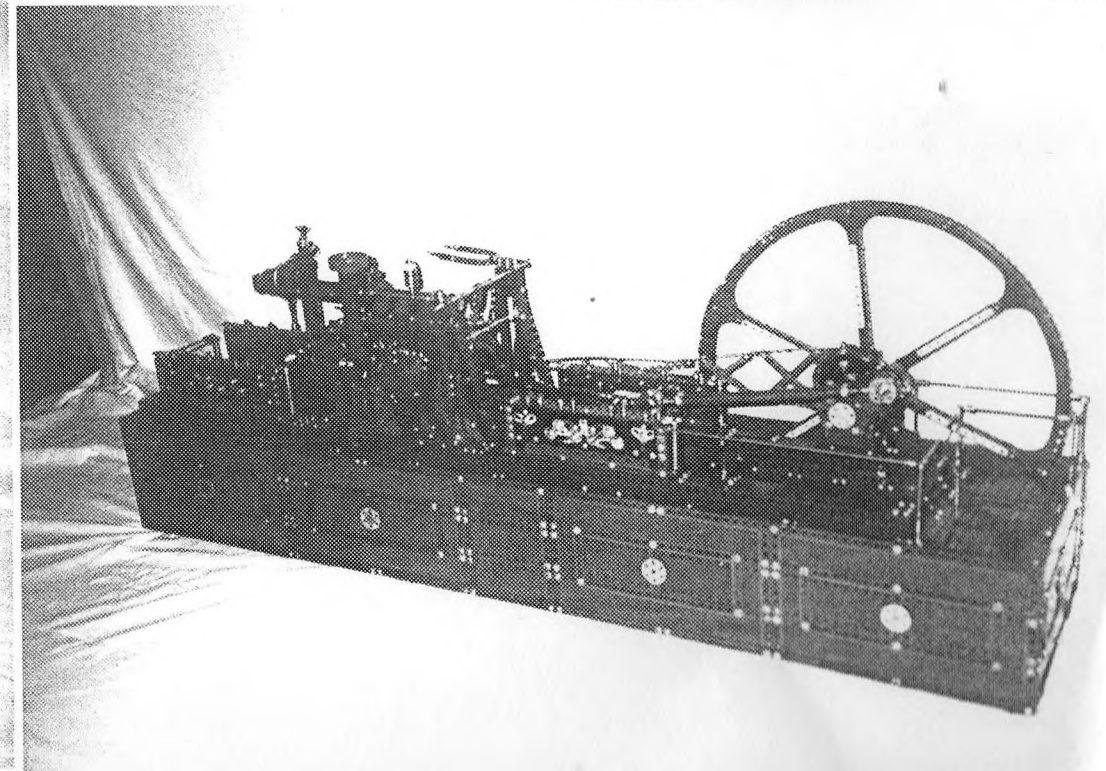


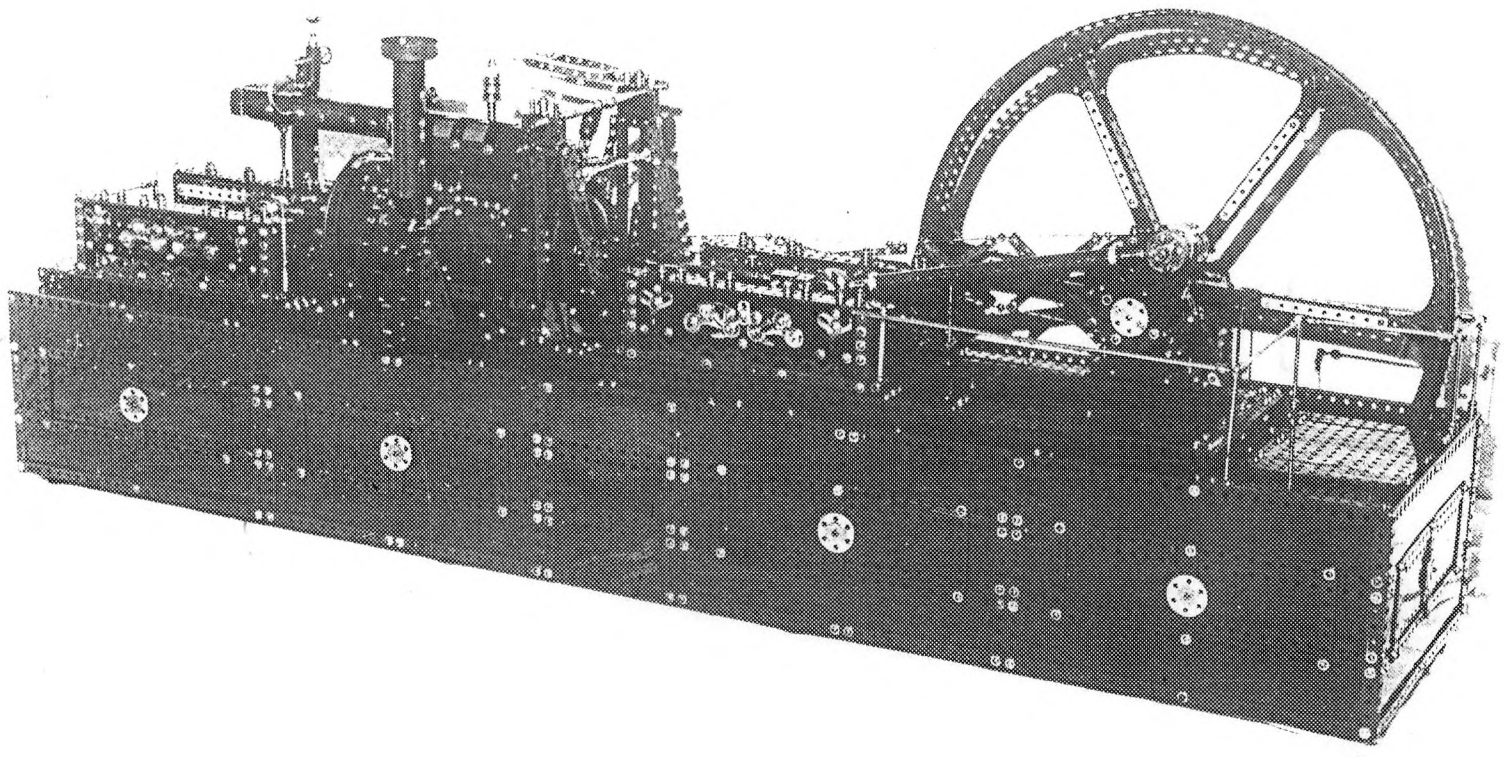
VALVE MANUAL HANDLE.

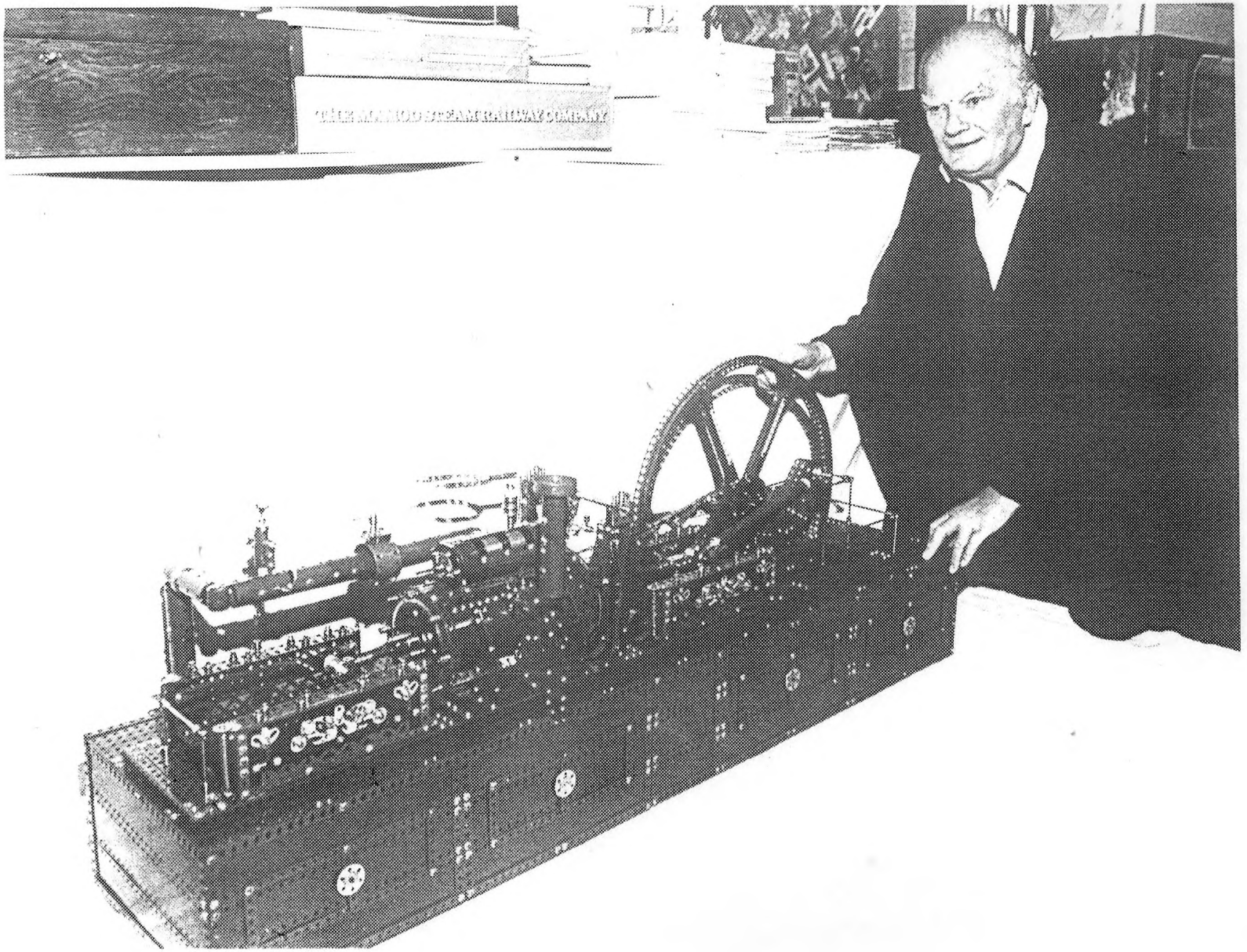


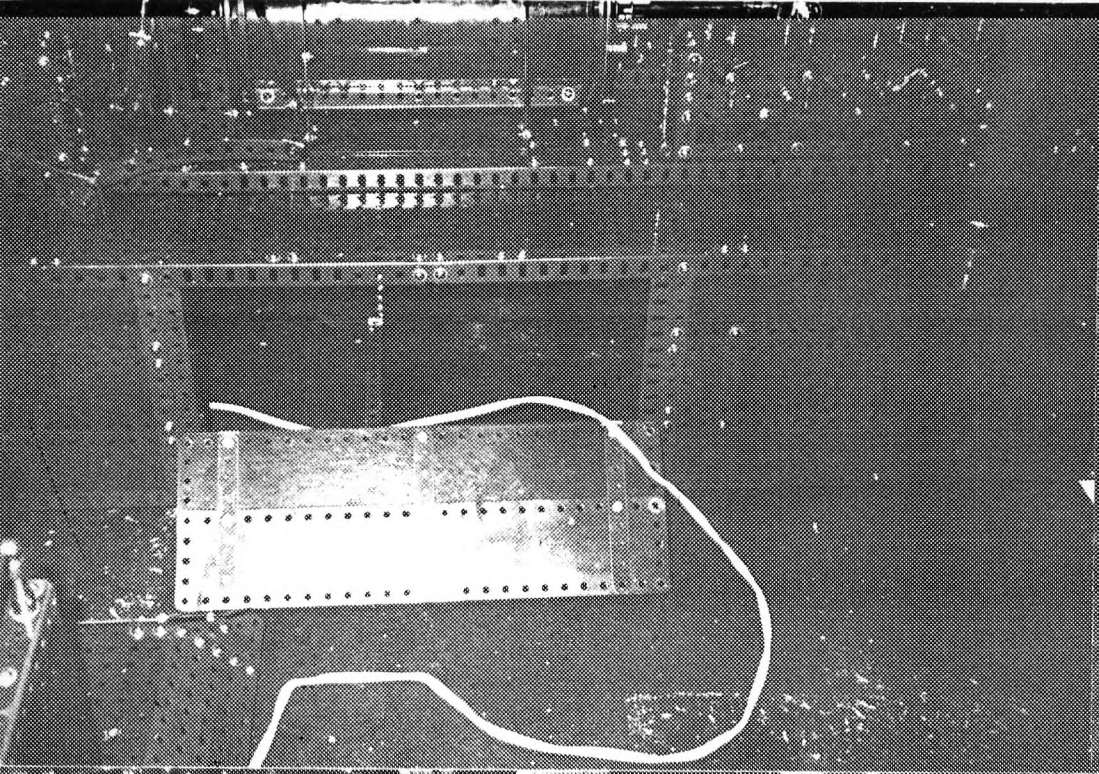


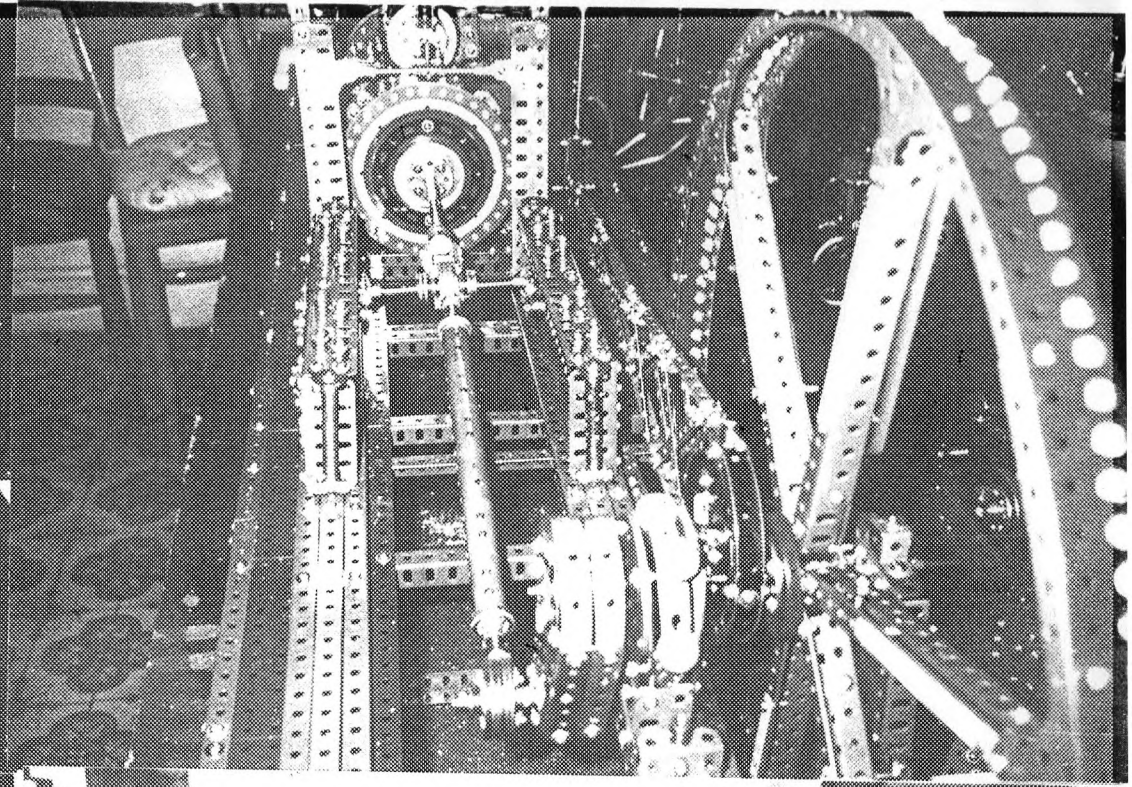


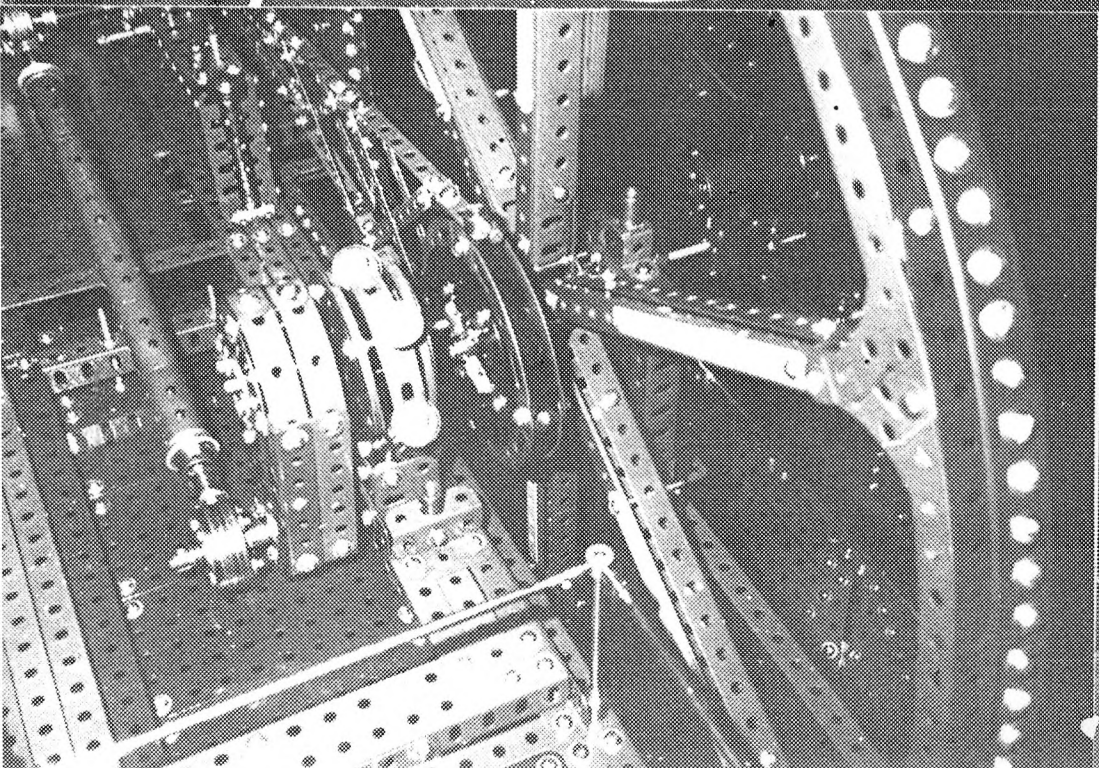


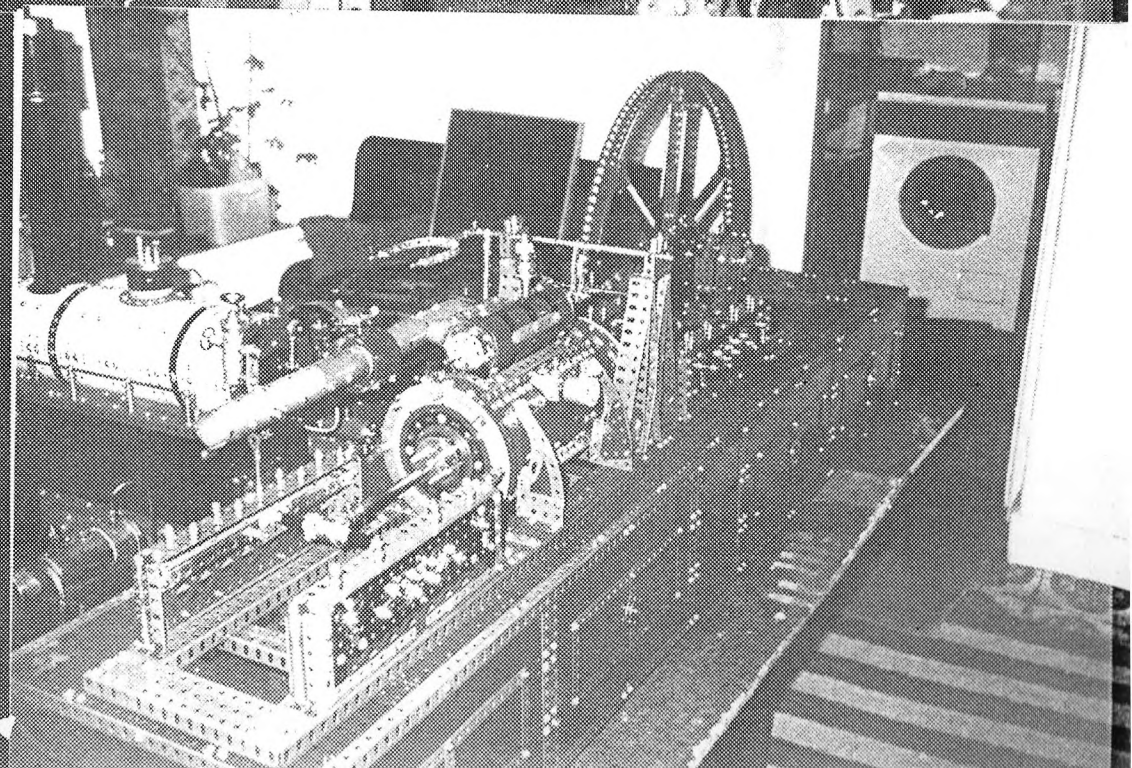


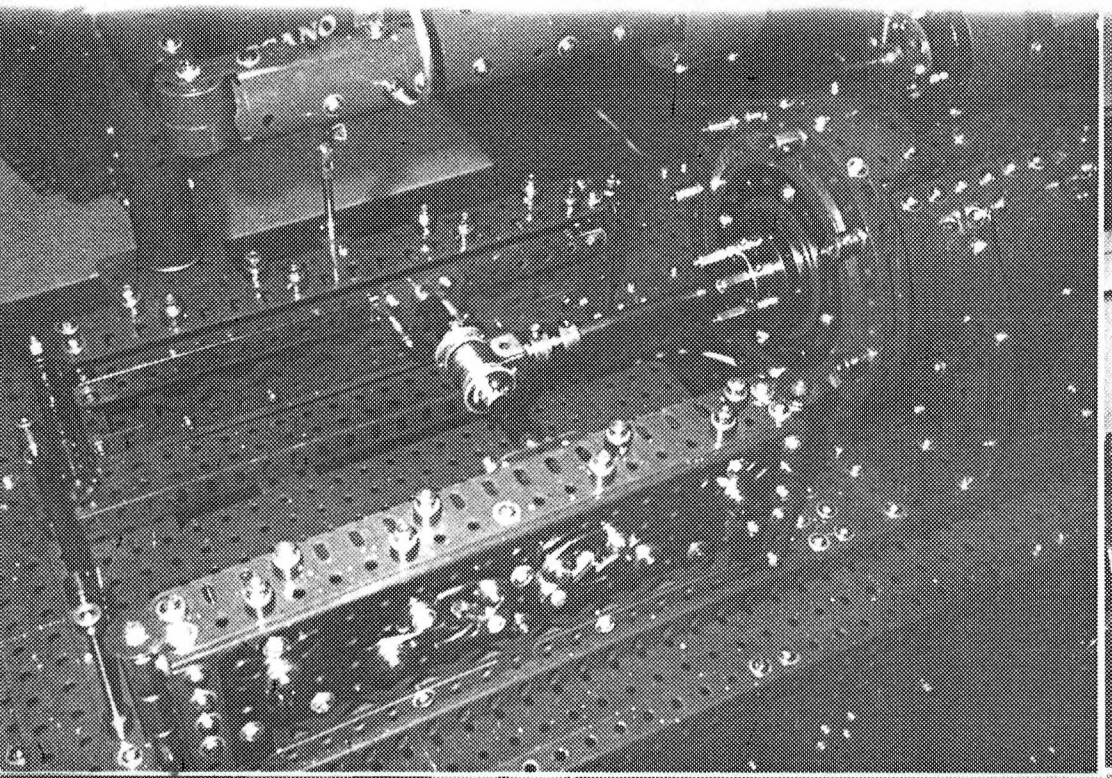


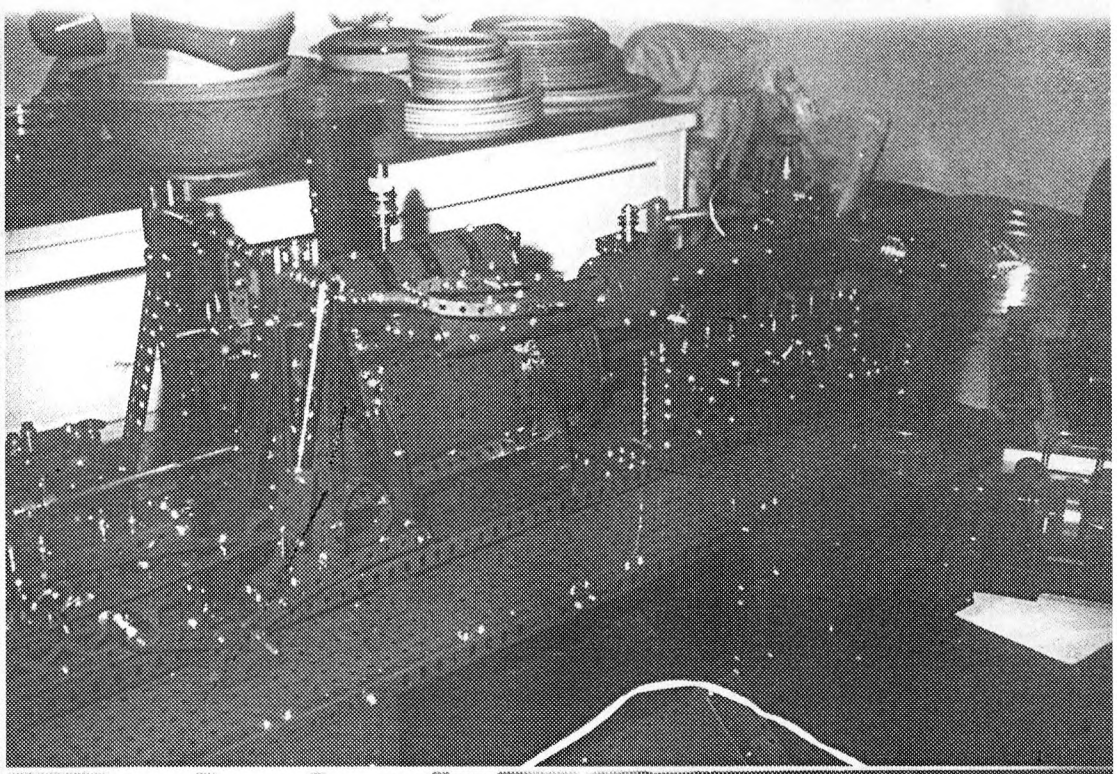


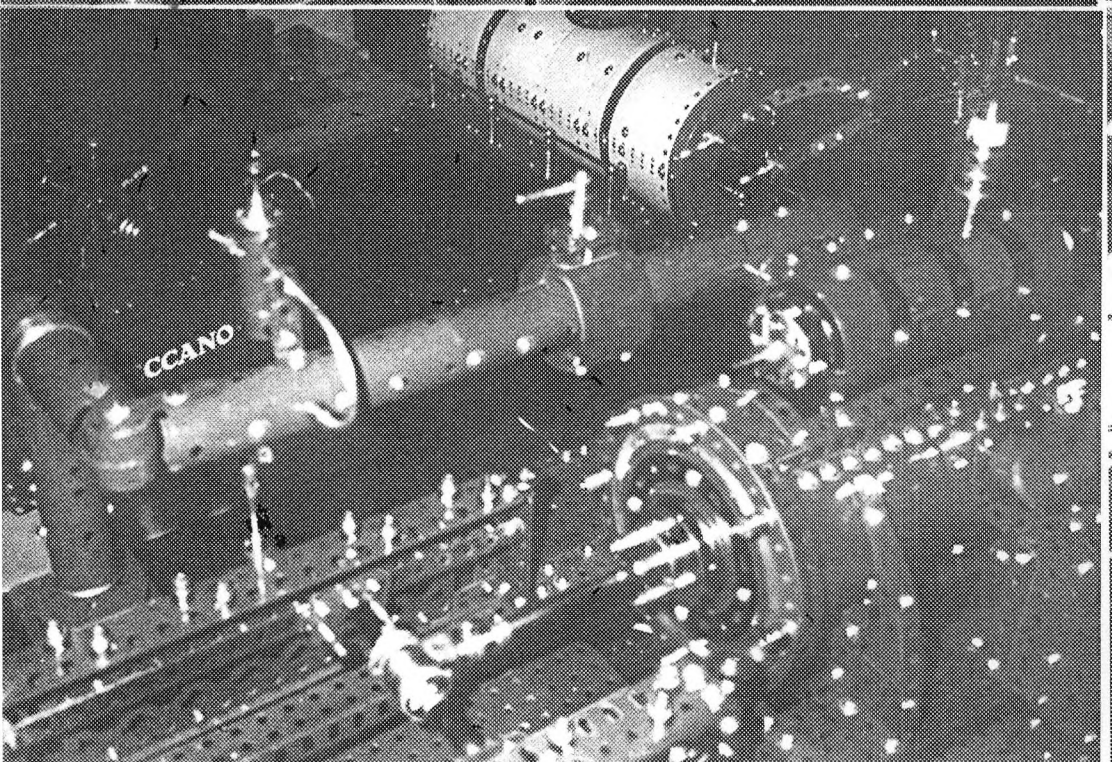







CCANO

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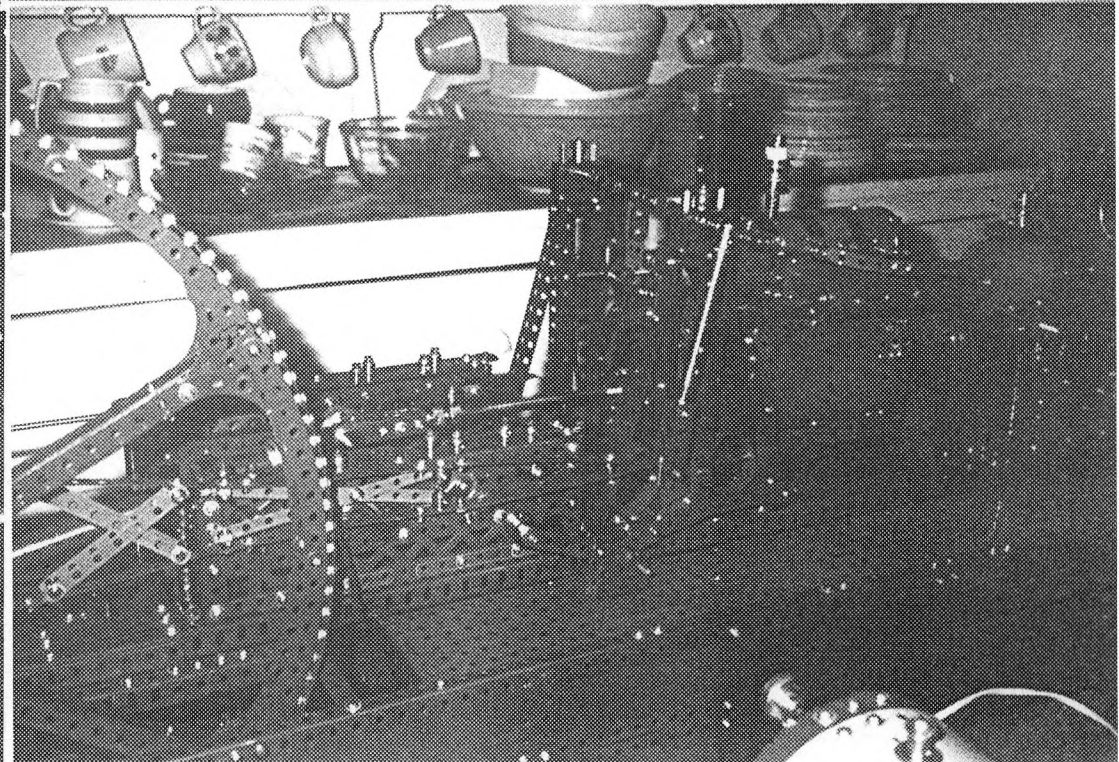

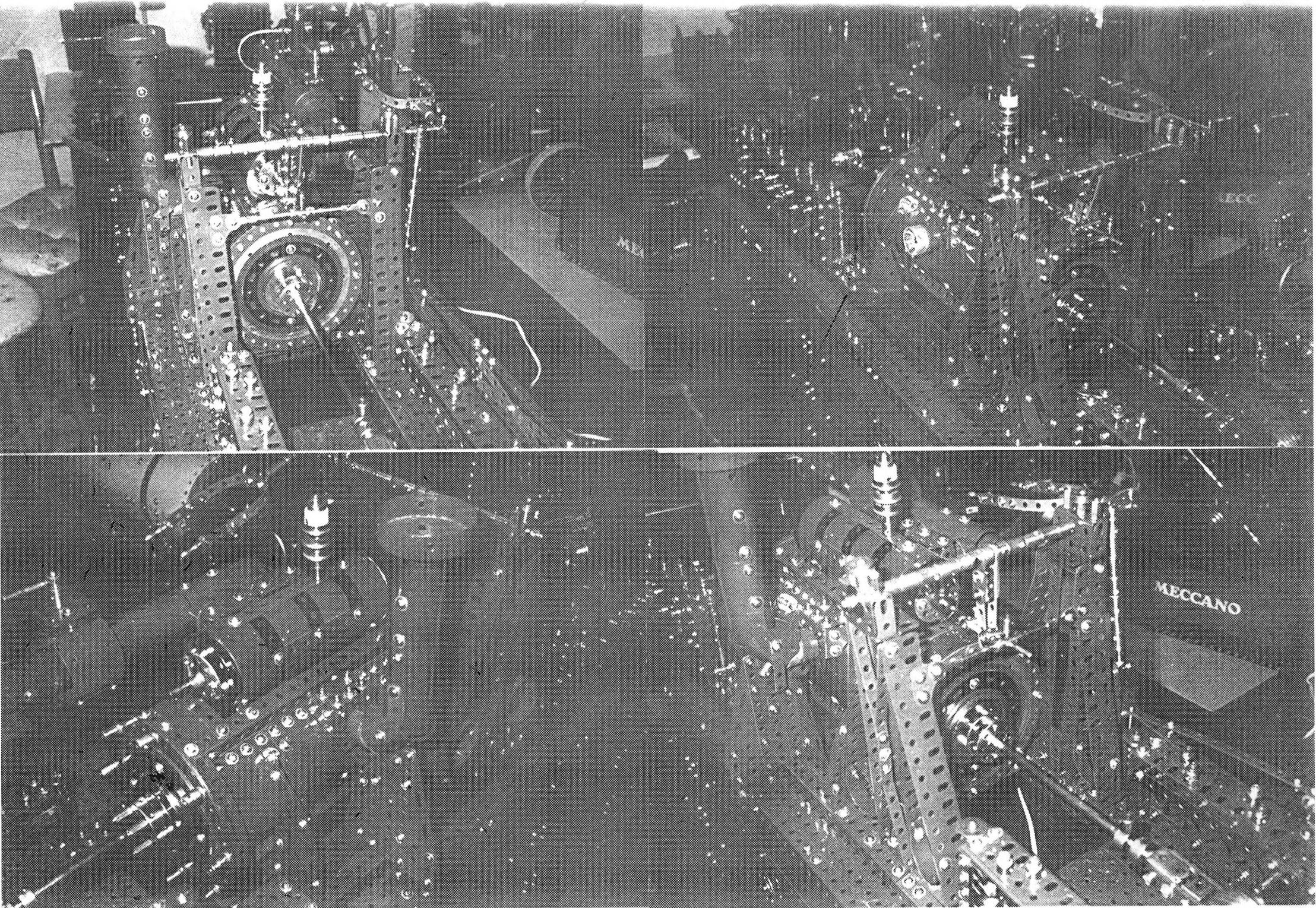
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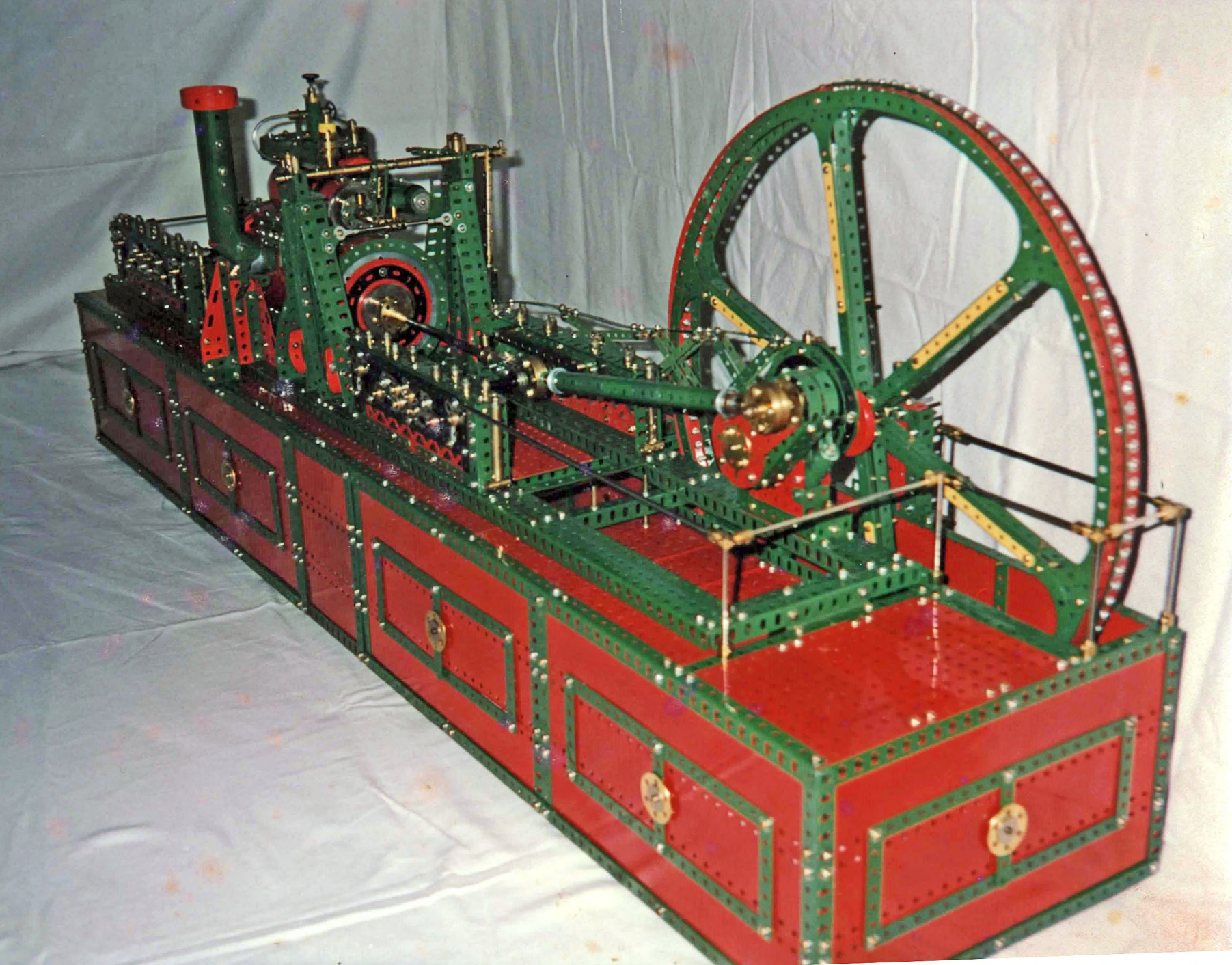

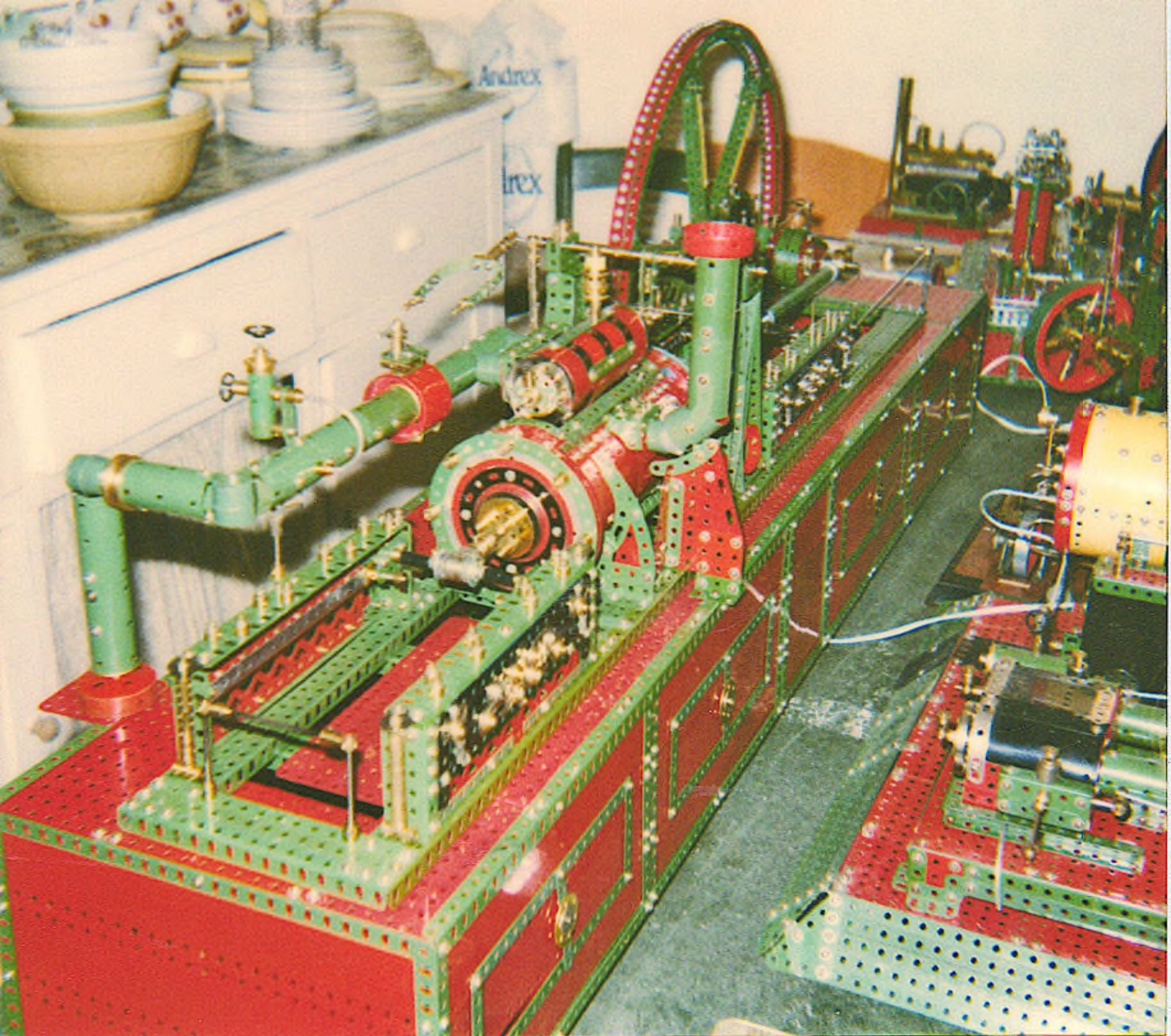
Andrex