Another Splendid Working Model

A Printing Machine that Actually Prints!

AGES ago the Chinese learned the art of duplicating letters or designs by the use of carved blocks of wood smeared with ink and stamped in reverse on lengths of cloth or parchment. For hundreds of years this slow and laborious method was used, and even after the invention of iron type by a Chinese, Pe Ching, and the subsequent introduction of printing into Europe in the twelfth century, little or no alteration was forthcoming for nearly 200 years. About the year 1400, however, in the city of Mainz, Germany, Johann Gutenberg was born, and it is from him that the present-day idea of printing with type under pressure has grown. For over 20 years Gutenberg was engaged in secret research work, and during this period he perfected his new method of printing, which included the moulding and composition of type, the construction of a suitable printing press, and the making of a correct grade of paper. This method of printing was introduced into England by William Caxton about the year 1474, and for many years printing was carried out by it. It was not until 1802 that the first definite step towards modern printing was taken. In that year Frederick Koenig of Eisleben, Saxony, introduced a printing press with a movable printing carriage and automatic inking rollers.

As is usual with almost every invention, little notice was taken of this, and it was not until Koenig came to England that he began to reap the fruits of his labour. While in England he met a well-known printer, Thomas Bensley, with whom he formed a partnership and, after many years of experimenting, a printing machine was constructed that derived its motion from a steam engine. This machine was operated on what is known to-day as the platen principle, but while it was being constructed and sold commercially Koenig hit upon the idea of a rotary printing press, the principle of which has remained unchanged even in the latest presses of the newspaper world. This amazing machine, with the aid of two men, made it possible to take 800 printed impressions in an hour, and although as compared with the capacity of modern machines this figure appears small, it must be remembered that previous to this five men were required to take less than 100 impressions in the same time. To-day, with the latest all-electric rotary presses, it is possible to print more than 100,000 complete newspapers in one hour, all cut and folded ready for delivery.

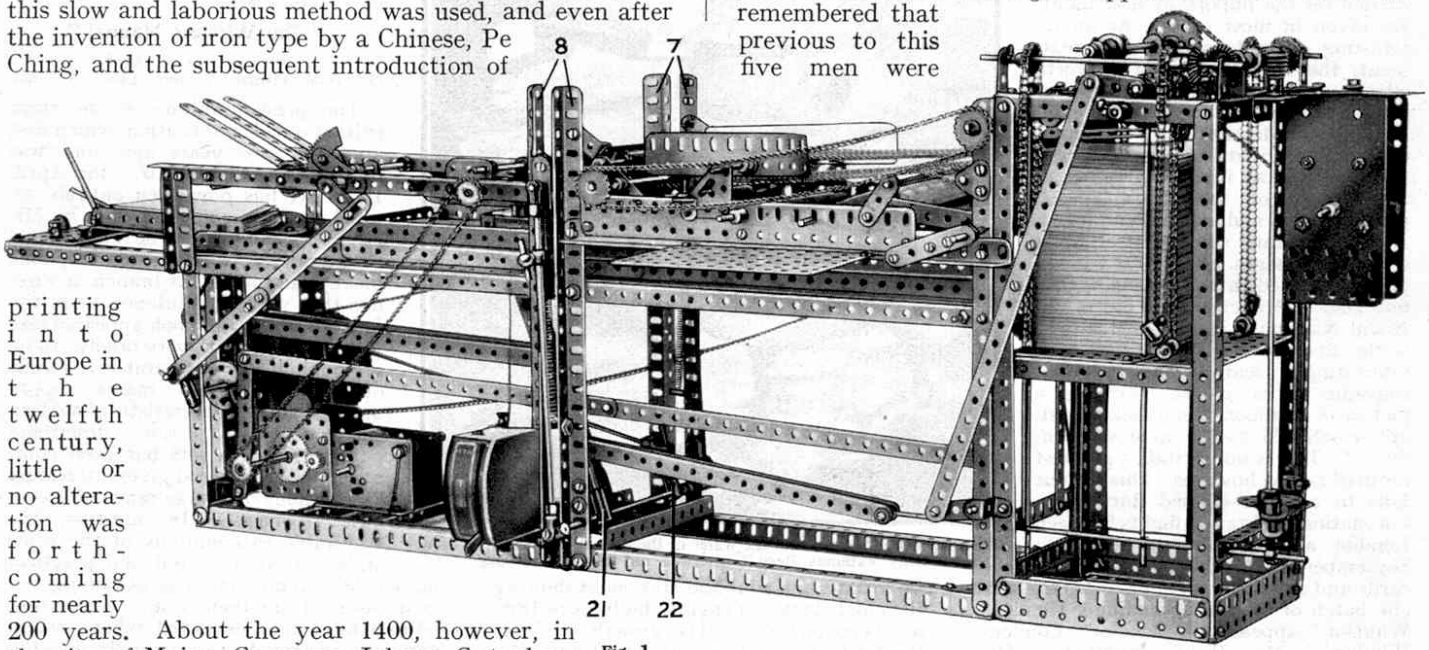

Fig. 1.
A Meccano Printing Machine that is capable of turning out 1,200 printed sheets per hour! It is entirely automatic, and after a pile of paper has been placed in the machine all that is necessary is to start the Electric Motors.

The Meccano model incorporates all the main movements found in a modern printing machine. The unprinted paper, when placed in the machine, is automatically delivered to the impression roller by means of a suction fan and endless belt. The sheet thus taken is then passed over the face of the type and receives the impression, after which a delivery arm deposits it, printed side upward, on to the delivery pile. During the short period when no paper is passing under the impression roller the type is automatically inked, the ink being taken from a duct at the rear of the machine and passed through spreading and tearing rollers prior to being smeared on the type. It is interesting to note that on test this machine printed 1,400 visiting cards in an hour.

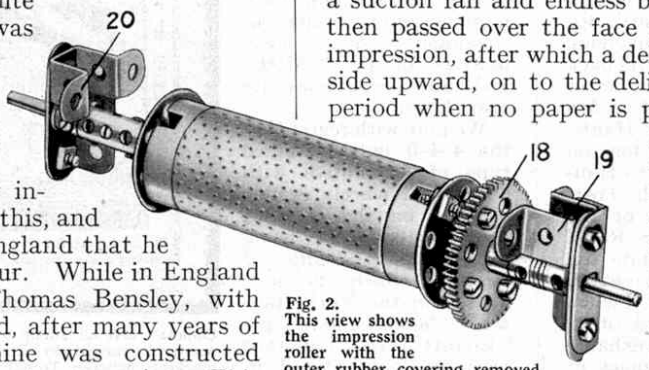

Fig. 2.
This view shows the impression roller with the outer rubber covering removed.

Building the Meccano Model!

The Framework. The base consists of two channel section 24½" girders each of which is formed of two 24½" Angle Girders (see Fig. 3). These are connected together

at each end by means of two 5½" Angle Girders 1 and 2, the required rigidity being gained by the use of four Corner Brackets. Four further 5½" Angle Girders 3 and 4 are now bolted across the base, in the positions shown in Fig. 3 and two 2½" Angle Girders are secured to the Girders 4.

Vertical members, consisting of two 7½" and two 12½" Angle Girders, are now secured to each of the four corners of the base, and to these are bolted the girders of the upper portion of the framework. Each of these latter girders is of reversed angle section and is built up from one 24½" Angle Girder 14, to one side of which is secured a 12½" and an 18½" Angle Girder. These two latter Girders are bolted in place so that their inner ends touch, and this weak point in the construction of the girder is strengthened by bolting a 7½" Angle Girder across the gap. It will now be noticed that a single girder protrudes beyond the built-up sections of the reversed angle girders, and the ends of these extensions carry an insulated switchboard, a 5½"×3½" Flat Plate. A 5½" Angle Girder 5 is now fitted, and this supports two 7½" Angle Girders 6, the lower ends of which are bolted to the Girder 1.

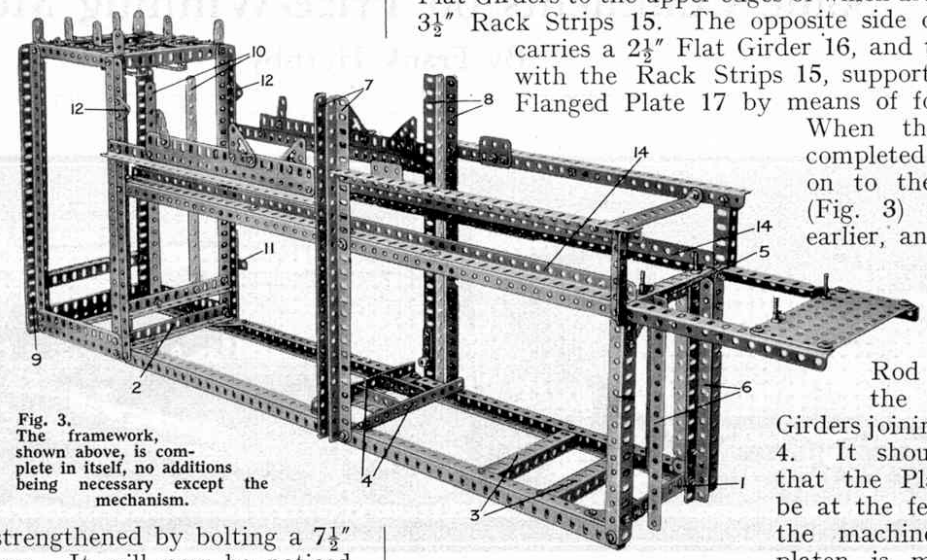

Fig. 3. The framework, shown above, is complete in itself, no additions being necessary except the mechanism.

The impression roller slides 7 and 8 are now secured in place, and these support four horizontal 12½" Angle Girders at their inner ends. The outer ends of the two right-hand girders are bolted to the top of 3" Angle Girders, and the two left-hand girders are secured at their outer ends to the vertical Angle Girders forming the uprights at that end of the model. These last-mentioned horizontal 12½" Angle Girders carry 9½" Flat Girders to which are secured the Corner Brackets and 1½" Strips shown in the illustration.

The framework for the pile delivery may now be built, and this consists of a square skeleton frame 12½" high and 5½" square at its ends. One corner of the frame is fitted with an extra 12½" Angle Girder 9, and the lower portion of this section of the model is fitted with three 5½" Flat Girders for strengthening purposes. The top of the frame is fitted with a suction fan and a separating mechanism for the paper, and the construction of these movements will be described later.

The pile delivery may now be bolted to the main framework, after which two vertical 9½" Strips 10 are secured in place on their horizontal 5½" Angle Girder. A ½" Reversed Angle Bracket 11 is also fitted, together with two 1" Triangular Plates 12.

The Platen and Impression Roller. Fig. 4 shows an underneath view of the platen or type bed, which consists of a rectangular framework filled in with four 4½"×2½" Flat Plates. One end of the plate so formed is fitted with two 1"×½" Angle Brackets that carry a 1" Rod on which is pivoted two 5½" Strips. The free ends of these Strips are secured by means of a 1½" Rod to a square section girder 13, constructed from two 7½" Angle Girders joined together by means of two ¾" Bolts and fitted at their outer ends with Cranks.

The lower face of the platen is fitted on each side with a 9½" Angle Girder that slides on one of the Angle Girders 14. One side of the platen is fitted with two 9½" Flat Girders to the upper edges of which are bolted three 3½" Rack Strips 15. The opposite side of the platen carries a 2½" Flat Girder 16, and this, together with the Rack Strips 15, supports a 3½"×2½" Flanged Plate 17 by means of four ¾" Bolts. When the platen is completed it is placed on to the Girders 14 (Fig. 3) as described earlier, and the end of the girder 13 is secured on a 3" Rod mounted in the 2½" Angle Girders joining the Girders 4. It should be noted that the Plate 17 must be at the feeding end of the machine when the platen is moved to its fullest extent in that direction.

The impression roller shown in Fig. 2 is formed from a Sand Roller (part No. 106a) covered with a length of hard rubber tubing. This tubing is 3½" long, 1¼" internal diameter, and 1½" external diameter, without the canvas covering, and is similar to that used on motor cars as a connection between the radiator and cylinders. It is particularly suitable for the Meccano model, as it is reasonably hard and durable and remains unaffected by printing ink. The Sand Roller is mounted on an 8" Rod, in place of the somewhat shorter rod supplied, but it must be free to rotate on the Collars fitted at each end. One end of the Rod is now supplied with a Bush Wheel and two 57-teeth Gears 18, all of which are secured together by means of two short Bolts and two ¾" Bolts, as shown in the illustration. The protruding ends of the ¾" Bolts engage with the slots cut in the end of the Sand Roller, and in this way a rigid connection is made that prevents any slipping between the two parts while the machine is working under full pressure. The Grub Screws of the 57-teeth Gears 18 are taken out of their bosses and a Collar and three Washers are placed on the Rod, after which a slide is secured in place. This slide consists of a Double Arm Crank 19, to which are bolted a Double Bent Strip and a 1½" Angle Girder. Care must be taken to see that a space is left between the Double Bent Strip and the Angle Girder.

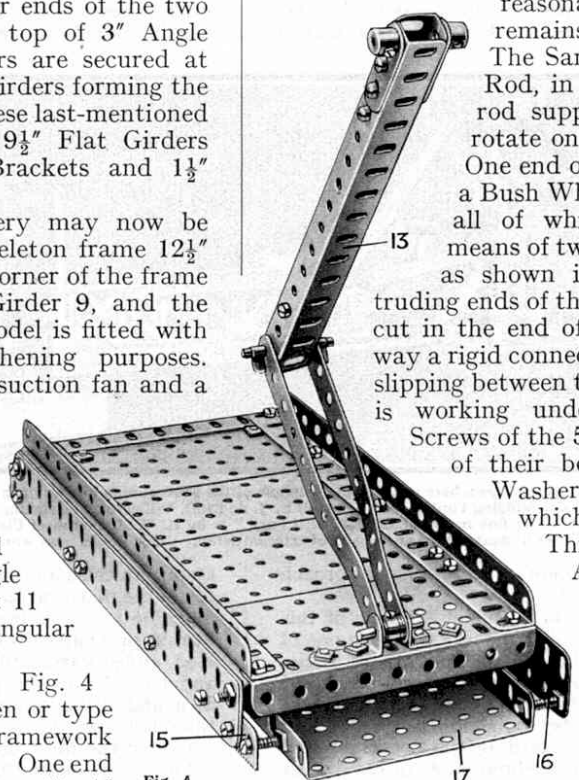

Fig. 4. This underneath view of the platen shows its construction and also the method of operation.

The opposite side of the Rod carries a loosely mounted Bush Wheel, and a fixed Coupling and slide 20, this last being constructed similarly to that on the opposite end of the Rod. It will now be seen that on turning

(Continued on page 558)

Stamp Advertisements cont. from p. 556

Photography—(*Continued from next page*)

exposed to the light falling upon the subject to be photographed, and a note is made of the time taken by the paper to darken to the same shade as that of a sample tint alongside it. When this time has been found, the correct exposure is quickly calculated for the particular plate or film in use according to the instructions issued with the meter.

Exposure calculators differ from meters in that there is no actual measuring of the strength of the light. Simple tables are provided for each month of the year, the time of day, and the general weather conditions. One of the most reliable calculators of this type is that incorporated in the Photographic Handbook published by Messrs. Burroughs Wellcome & Co. This calculator is remarkably simple to use, and will save many times its cost in plates or films in the course of a season.

In using a calculator judgment is really only required in regard to the subject. This is made a perfectly simple matter with the Wellcome calculator, for the various types of subject are illustrated so clearly by a series of small photographs that it is almost impossible to go wrong.

Roadless Transport—(*Continued from page 507*)

a district of sand dunes covered with scrub, which had proved impassable to ordinary heavy motor vehicles. In spite of the difficult ground conditions and a 3-ton load, however, the six-wheeler crossed the soft sand without difficulty and maintained an average speed of 11 m.p.h. until the foothills of the Andes were reached. Here the sandy ground gives place to soil of a more clayey nature, with occasional patches of lava. During the rainy season this soil is readily carried away, and as a result the track in places is washed into ruts 2 ft. to 3 ft. deep. The six-wheeler therefore left the track and travelled across country, and arrived by a roundabout route at the one ranch in the district five days after leaving Colonia, having covered nearly 400 miles of difficult country.

The return was made by the direct route and the distance of 124 miles was covered in about 10 hours, whereas the native mule carts drawn by six mules take 10 days to accomplish this journey. The tour proved the value of six-wheeled vehicles in opening up new districts where there is at present no satisfactory means of transport and insufficient traffic to make the construction of good roads or branch lines profitable.

Working Model—(*Continued from page 535*)

the Gears 18 the impression roller is also rotated, but the slides 19 and 20 remain stationary. The roller is now placed in its position on the machine by passing the slides over the double Angle Girders 7 and 8 and lowering the entire roller until the Gear 18 engages with the teeth of the Rack Strips 15 (Fig. 3). In this way the movement of the roller is synchronised with the movement of the platen during printing operations.

The impression mechanism (Fig. 1) is operated in the following manner. Each end of the 8″ Rod carrying the impression roller is fitted with a Small Fork Piece that is prevented from slipping by means of a Collar secured on the Rod between its jaws. The Fork Piece carries a Vertical 8″ Rod, the lower end of which is fitted with a second Small Fork Piece carrying a Coupling. This Coupling is attached to one end of an 8″ Rod, journalled in the bosses of Cranks secured to the Girders 7 and 8; and this carries two further Couplings 21 and 22, the purpose of which will be described later. The necessary compression is given to the impression roller by means of two Springs, one of which is fitted to each 8″ side Rod by means of a Collar. This Collar is held in place on its Rod by a Handrail Support fitted with a 1″ Rod. The lower end of the Spring is connected to the frame by means of a ⅜″ Bolt. By securing the Springs to their respective Rods as indicated it is possible to alter the amount of compression on the impression roller quickly and easily, and small file notches in the Rods will assist in retaining an even pressure on both sides of the roller. This, of course, is necessary, as different types of printing require different pressures.

An Efficient Pocket Microscope

We have received from Mr. H. A. Crowhurst, F.S.M.C., Victoria Road, Surbiton, a pocket microscope that is about the size of an ordinary fountain pen, and is provided with a clip to enable it to be carried in the pocket or in a holder. In spite of its small size the microscope is highly efficient, for it has a magnification of 25, and the simple but effective focussing device incorporated produces a perfect image.

The instrument will be particularly valuable to those who are interested in nature study. It is sufficiently powerful to show clearly the forms of the stamens, pistils, etc., of even tiny flowers, and the wonderful structure of the wings and other parts of insects. The microscope will be exceedingly useful also to readers who are interested in stamp collecting, where minute differences between apparently similar specimens are frequently encountered.

The instrument undoubtedly will prove a constant source of delight to any keen Meccano boy, and readers interested are referred to the advertisement on page 570.

Meccano Printing Machine

Constructional Details (Continued)

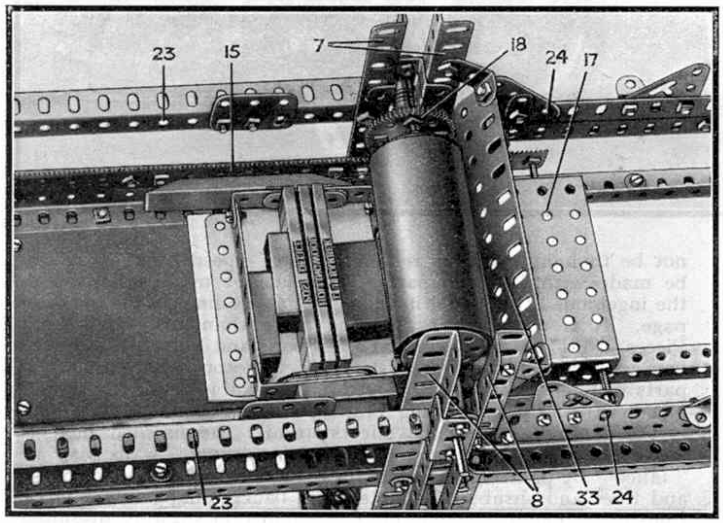

Fig. 1. Plan view of the platen, showing the forme with type in position.

LAST month we described the construction of the impression roller. When this is secured in place, and the 57-teeth Gears 18 have been found to mesh correctly with the entire length of the Rack Strips 15, the Motor may be installed on the Angle Girders 3. This Meccano E1 Electric Motor, Fig. 2, drives the main mechanism of the model and is controlled by a rheostat 27. The pinion on the armature shaft engages with a 57-teeth Gear Wheel carried on a 2½" Rod, the opposite end of which is fitted with a ½" Pinion that meshes with a second 57-teeth Gear Wheel carried on the 4½" Rod 28. This Rod, carried in two 2½" × 2½" Flat Plates secured by four ⅜" Bolts to the Motor side plates, is fitted with a ½" Pinion meshing with a 57-teeth Gear Wheel 29. The Rod on which this Gear is carried is fitted with a ¾" diameter, ¾" width Pinion that is in engagement with two 3½" Gears. It should be noted that the extra wide Pinion may be replaced by two ¾" diameter ¼" face Pinions if necessary, but the Pinion used forms a very strong part at this stage of the transmission. The two Gears rotate in the direction indicated in Fig. 2.

The two large Gears are carried on 2½" Rods each of which carries a Bush Wheel, fitted with a Threaded Pin, between its two supporting Girders. One of these Bush Wheels 30 actuates the lever 32 and the other the lever 31. The Rod carrying the latter Bush Wheel supports on its outer end a Coupling (see Fig. 1 of the previous article) that carries a 1½" Rod in its longitudinal bore. This Rod is attached pivotally, by a Threaded Pin and Collar, to a connecting rod built up from two 4½" Strips and a 2" Slotted Strip. The slot in this Strip carries a sliding ⅜" Bolt that is secured rigidly to a Crank mounted on a 1½" Rod the other end of which is provided with a second Crank. This Crank is set at 180° to the first Crank, and it has a Rack Segment secured to it that meshes with a 1" Gear. A 6½" Rod carries this Gear together with a delivery arm, the construction of which was reproduced last month in the general view of the model. Thus as the Coupling is rotated the delivery arm is swung from one side to the other, and the slot in the 2" Slotted Strip allows a considerable pause to be made at the end of each movement.

The two 3½" Gears are connected together by a Coupling that is free to turn on its two supporting bolts. The centre hole of the Coupling is fitted with a 4½" Rod attached at its lower end to the bottom holes of the 5½" Angle Girders of the Girders 6. The upper end of the Rod carries a Coupling that is attached by two 12½" Strips to the square girder 13. The rotation of the 3½" Gears in this manner imparts a quick return motion to the platen.

The movement for operating the impression roller is actuated by the Bush Wheel 30, a Threaded Pin in which causes the member 32 to be rocked backward and forward alternately. The upper end of 32 carries an End Bearing that is provided with an 11½" Axle Rod, and this is connected at its opposite end to the Coupling 21 by a Swivel Bearing and 2" Rod.

The action of the three movements, platen, impression and delivery, is as follows. When the platen is at the driving end of the model, the Coupling, actuating the delivery arm, must point downward in a vertical direction, and the Threaded Pin on the Bush Wheel 30 must just be starting to force the arm 32 forward. With these positions, as the platen moves forward the impression roller is lifted clear of the type, and the last paper passed under the roller is lifted by the delivery arm on to the delivery pile.

The guide strips, one of which is shown half size in

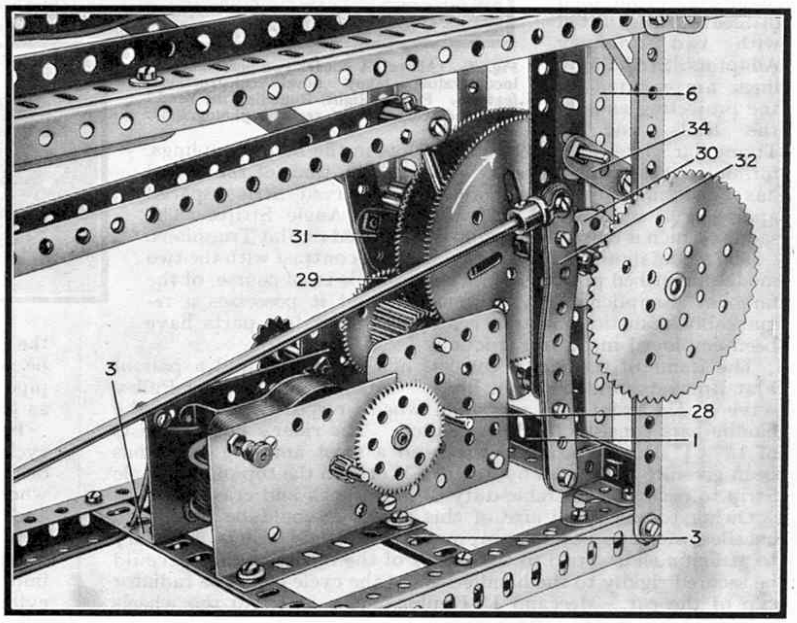

Fig. 2. This view gives a good impression of the robust construction of the motive unit.

Fig. 4, are now made. Each of these consists of a strip of thin sheet metal $\frac{1}{2}''$ in width and, by enlarging Fig. 4 to full size, the exact shape of the strip will be gained. At the point where the strip passes through the delivery rollers it is reduced to half width for a distance of half an inch. The gap so formed accommodates a portion of the delivery rollers and by this means the paper, on passing through the machine, is accurately guided into the delivery arm without smudging the recent impression. The two strips are carried on two 8″ Rods 25 and 26. The Rod 25 is journalled in the two holes 23 of the upper girders of the machine, and the Rod 26 is similarly supported in the holes 24, on the opposite side of the impression roller. Care should be taken to see that the strips are spaced apart sufficiently to miss the face of the type, but they must not press too hard on the underside of the impression roller, as this is liable to mark the smooth surface of the rubber.

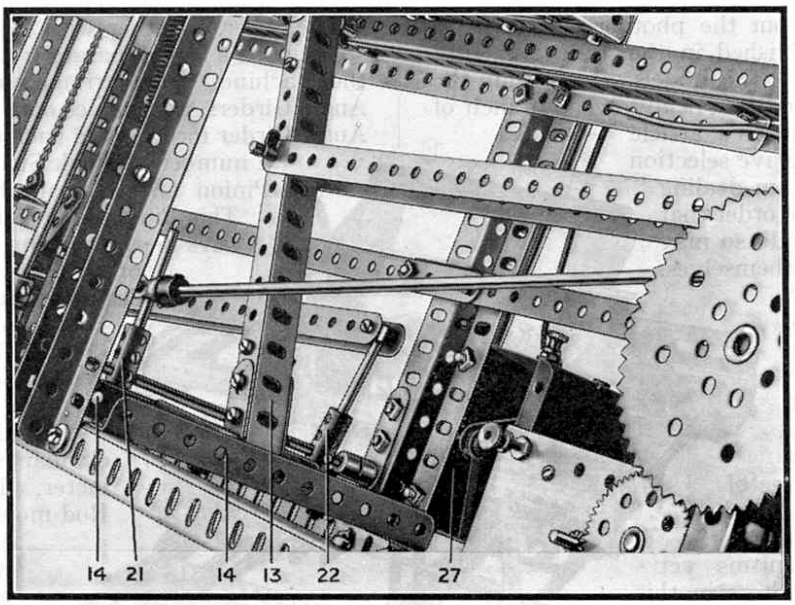

Fig. 3. Sectional view showing the connecting rods to the various movements.

The paper is guided under the impression roller by a $5\frac{1}{2}''$ Flat Girder 33 attached to the vertical girders 7 and 8 by $1''\times\frac{1}{2}''$ Angle Brackets. The Angle Brackets are pulled out to the extremity of their slots, and the Flat Girder is so arranged that its inner edge almost touches the roller. By means of this fitting, the paper, on entering the machine, is forced down on to the type.

It is now advisable to make the forme and set up the type. While carrying out this stage of the construction the Crank 34 carrying a Threaded Pin is forced into a horizontal position. In this way the impression roller is permanently raised while the machine is in operation.

The forme is a frame in which the type is set for printing, and in the model it consists of two $3\frac{1}{2}''$ Angle Girders placed parallel to each other, and connected together by two $2\frac{1}{2}''\times\frac{1}{2}''$ Double Angle Strips. The type shown used in Fig. 1 is linotype, which is cast in the form of slugs on a linotype machine. It is the simplest type to use for the model, and is very suitable for printing visiting cards. The printing face is mounted on a white metal block measuring about $3\frac{1}{2}''$ in length and $\frac{7}{8}''$ in depth, with a width corresponding to the size of the type. For visiting cards, what is known as " 12 point " type is most usual. Slugs with the required lettering may be obtained from any printer who has a linotype machine.

The three slugs used in the model are spaced apart by thin strips of metal known as " leads," and the complete block of type is placed in the forme. The type is then fixed firmly in position by means of small wedge-shaped pieces of wood, and the spaces between the ends of the slugs and the forme are filled in with short Strips in order to prevent side movement.

The forme, which may now be moved into any desired position without fear of the slugs falling out, is now placed on to the cardboard face of the platen, and a length of narrow " furniture " is placed between one of its ends and the side of the platen. The other end forms a pressure surface for two keys that are forced tightly into the space between the platen and the forme. The keys must be tightened up as firmly as possible so that the forme will not slip when it is passing under the impression roller. It may be found necessary to cut the length of furniture securing the forme because of a number of Nuts and Bolts in the side girders of the platen. This should be carried out carefully with a file, for on no account must the wood be split.

A trial impression may now be taken before proceeding with the remainder of the machine. This is accomplished by smearing printing ink over the face of the type with the aid of a rubber roller, and care must be taken to see that this is done evenly without using too much ink. The Crank 34, Fig. 2, may now be released and a sheet of paper held so that its leading edge is under the impression roller. The electric Motor driving the model is then switched on so that the platen commences to travel toward the roller at its maximum speed. At this point it is advisable to rest the paper on the guide strips in order to prevent smudging, for as the type face passes under the impression roller the paper is taken with it, and as it emerges on the opposite side it is lifted off the type by the curve of the guide strips. The Motor is then stopped and the paper carefully lifted, and if everything has operated correctly a perfect impression will be seen.

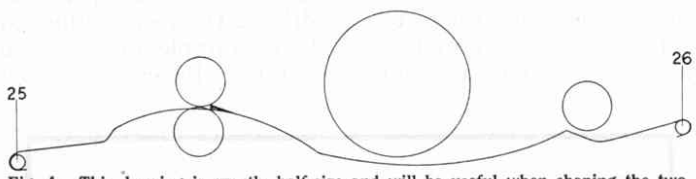

Fig. 4. This drawing is exactly half-size and will be useful when shaping the two guide strips for the model.

It is possible that the impression is clearer on one side than on the other, and this may be rectified by placing thin sheets of paper under the slugs at that point. If this is not found to correct the fault, the impression roller must be examined by holding the edge of a ruler along the rubber covering at different points. Any deep depressions will be easily located in this manner, and must be filled in. This is accomplished with the aid of rubber solution, similar to that used in mending cycle punctures. Fine grade glass paper will also be useful for giving a smooth finish.

Care must also be taken to see that the pressure of the Springs on each side of the impression roller is equalised. This is necessary in order to produce an evenly inked impression. The tension of these springs should be sufficient to prevent the roller from being lifted by hand without considerable effort.

Meccano Printing Machine

Constructional Details (Concluded)

THE previous articles dealing with the construction of the Meccano Printing Machine gave details of the general structural features of the model, and also of the construction of the platen and forme. This month the inking mechanism, pile feed and pile delivery will be described, of which movements the inking is the first consideration. Fig. 1 gives a good idea of the various inking rollers and their respective positions in the model.

In an actual printing machine the ink is smeared on the first of a series of rollers by means of a duct, or ink container, but in the model a movable roller is fitted that carries out the same duties, but for a somewhat shorter time. This roller is represented by a Wood Roller carried, at each end, on a Threaded Pin mounted on a $3\frac{1}{2}$" Strip. These two Strips are attached by Cranks to an 8" Rod that is journalled in the two end vertical girders of the frame. The Rod is mounted so that one of its ends protrudes for a distance of $1\frac{1}{2}$", and on this end is fitted a Crank 35 carrying a $2\frac{1}{2}$" Strip, in the end hole of which is mounted a $\frac{3}{8}$" Bolt engaging with a Threaded Pin on the frame of the model. When the $\frac{3}{8}$" Bolt engages the Threaded Pin, in the position shown, the Wood Roller is in a lowered position and is ready to receive its coating of printing ink. When the Crank 35 is lifted, and the $\frac{3}{8}$" Bolt in the end of the $2\frac{1}{2}$" Strip is rested on the flange of one of the main horizontal girders, the Wood Roller must lightly touch the $3\frac{1}{2}$" $\times 2\frac{1}{2}$" Flanged Plate 17 forming the inking slab, thus transferring the ink from the roller to the slab.

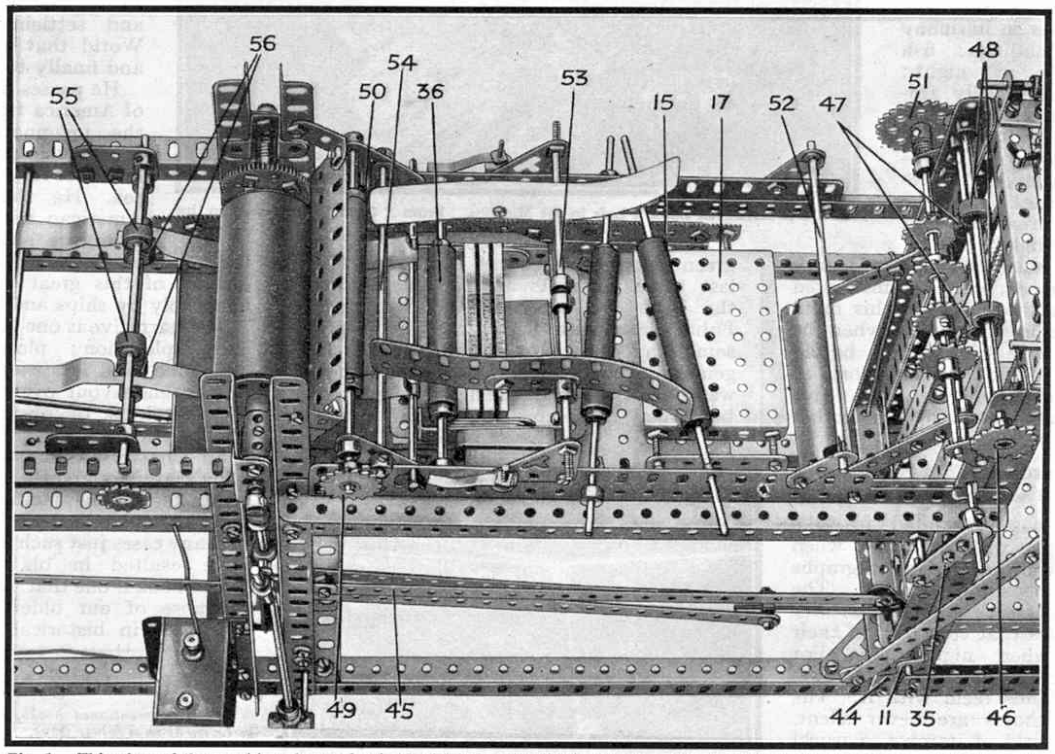

Fig. 1. This view of the machine shows clearly the inking and delivery rollers. The delivery chains have been omitted in order to show the arrangement more clearly.

The ink on the slab is smoothed out, while the machine is in motion, by two $\frac{1}{2}$" diameter rollers each of which is 3" long. The core of these rollers is built up from Collars, Couplings and Washers, and the rubber covering consists of suitable lengths of rubber tubing of $\frac{1}{2}$" external diameter and $\frac{3}{8}$" internal diameter. This tubing is used on all the delivery and inking rollers used on the model, and it may be obtained from almost any hardware stores. The two rollers used for smoothing the ink are set so that they run in opposite directions diagonally across the inking slab, and sufficient side-play must be left at the ends of the Rods carrying the rollers.

A third roller 36, built in a similar manner to the diagonal rollers, is fitted, and this transfers the ink from the slab to the type face. This roller is held in contact with the type face by means of two Pendulum Connections, each of which is secured to a $\frac{1}{2}$" $\times \frac{1}{2}$" Angle Bracket on the main frame by a 6BA Nut and Bolt. It should be remembered that printing ink hardens very quickly, and for this reason the rollers must be cleaned with paraffin oil at the end of each run, and then dried with a cloth.

The pile feed mechanism may now be built into the already constructed framework. A plan view of this section of the model is shown in Fig. 2, and from this it will be seen that the pile of paper is carried on a vertically sliding platform controlled by four chains loaded at their free ends and passing over $\frac{3}{4}$" Sprocket Wheels at the top of the frame. The chains are not shown in Fig. 2, but the arrangement will be seen from Fig. 1. The Sprocket Wheels over which the chains pass are slowly rotated by a gear train consisting of a 57-teeth Gear 37 that is operated by a Pawl pivotally mounted on a 2" Slotted Strip 38. This Slotted Strip is bolted to a 2" Strip, the two parts overlapping each other two holes. The 2" Strip is mounted on the vertical Rod carrying the Gear 37 and is rocked backward and forward by a Threaded Pin working in the slotted hole of the Strip 38. The Threaded Pin is secured by a Collar to an $11\frac{1}{2}$" Rod that is connected to the Coupling 21

(see Fig. 3 of last month's article) by means of two 9½" Strips. Thus, as the impression roller is actuated, the pile of paper to be fed into the machine is raised.

The paper, which is held between the four movable 11½" Rods 39, is lifted sheet by sheet by means of a Fan rotating at a high speed. The direction of rotation of this fan is so arranged that it causes a powerful suction immediately above the paper. The power for rotating the fan is derived from a 6-volt Electric Motor secured in place as shown in the illustration, and the drive is taken from a 1½" Sprocket Wheel on the armature shaft, by means of Sprocket Chain, to a second 1½" Sprocket Wheel 40. This latter Sprocket is carried on a 5" Rod, journalled in two 1"×1" Angle Brackets, that carries a ¾" Contrate meshing with a ½" Pinion on the fan shaft. The 1"×1" Angle Brackets and the fan shaft bearing, a Double Arm Crank, are supported by doubled 5½" Strips that are bolted across the top of the feed framework as illustrated. It should be noted that each 1"×1" Angle Bracket is spaced away from the doubled 5½" Strips by means of two Flat Brackets.

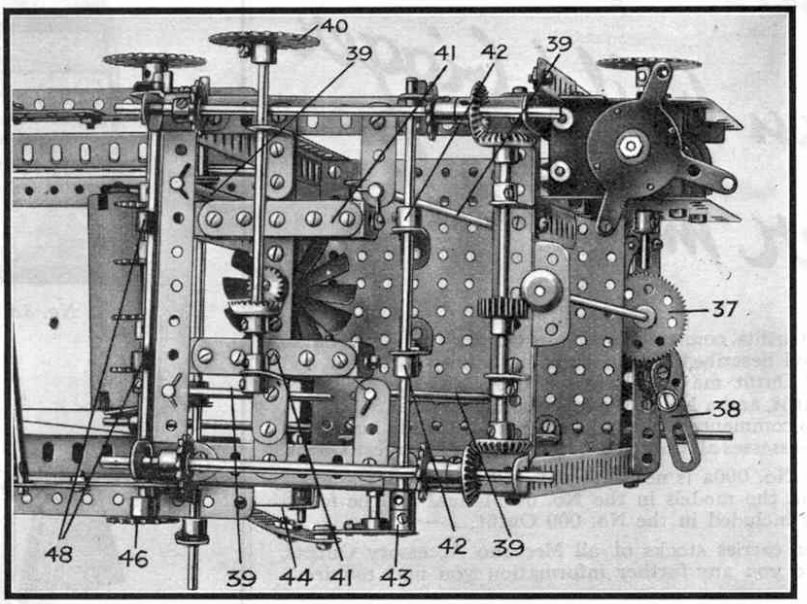

Fig. 2. A plan view of the suction feed mechanism showing the method adopted for raising the pile of unprinted paper.

In order to prevent the sheets of paper from becoming entangled with the fan, two projections 41 are fitted, each of which is built up from a 2½" Strip fitted at the ends with 1"×1" Angle Brackets. The lower holes of these Angle Brackets support a 2½"×½" Double Angle Strip.

Each pusher arm 42 is constructed from a Crank carried on a 6½" Rod and fitted with a Corner Angle Bracket at its lower hole. One pusher arm carries a right-hand Corner Angle Bracket and the other a left-hand part. The Rod carrying the arms is fitted at one end with a Crank 43, and this is attached by a pivotally-jointed connecting Rod to a second Crank 44. This Crank is carried on a 1½" Rod journalled in a hole of one of the main vertical girders and also in the Reversed Angle Bracket 11. This Rod is connected by a Crank and link 45 to the top of the lever 31 (see Fig. 2 of last month's article).

The belt feed mechanism and timing rollers are next fitted. The 1" Sprocket Wheel 46 is carried on the upper of the two Rods carrying the small rollers 47 and 48, and is driven by a length of Sprocket Chain from a second 1" Sprocket Wheel 49. This latter Sprocket is mounted on an 8" Rod carrying the lower of the two timing rollers, and also a ½" Pinion 50. This Pinion is rotated by a second similar Pinion that meshes with the rack 15, fitted to the side of the platen. The upper timing roller is similar to the lower roller, and both are carried in Corner Brackets fitted to each side of the frame of the model. Care must be taken to see that the lower timing roller does not touch the face of the type when the machine is in motion.

It will now be seen that, as the platen moves from the feed end of the machine towards the impression roller, the timing rollers rotate in a direction that enables a sheet of paper to be drawn in towards the impression roller, at the same moment as the platen commences its stroke. Thus, if the type is set in its correct position on the platen, the paper will have passed a short distance under the impression roller before the impression has commenced to be taken. While the timing rollers are rotating in this direction the rollers 47 and 48 are turning in an opposite direction. When the platen reaches the end of its first stroke, however, and commences the return stroke, the movement of the rollers is reversed, thus preventing any paper from passing the timing rollers but allowing the paper to pass through the rollers 47 and 48. At this point the pushers 42 are forced forward by the arm 31, thus pressing one edge of the next sheet of paper against the rollers, and in this manner immediately passing it forward on to four chains, the drive of which will be described later. These chains are shown in the general view of the model and they are

(*Continued on page 726*)

The parts required to build the Printing Machine are as follows:

4	of No.	1	2	of No.	9b	3	of No.	17	2	of No.	45	1	of No.	81	1	of No.	129
4	„ „	1a	2	„ „	9c	4	„ „	18a	1	„ „	46	20	ft. „	94	8	„ „	133
1	„ „	1b	2	„ „	9d	4	„ „	18b	1	„ „	48	3	„ „	95	6	„ „	136
7	„ „	2	3	„ „	9f	4	„ „	24	3	„ „	48a	1	„ „	95b	1	„ „	147
8	„ „	2a	8	„ „	10	1	„ „	25	1	„ „	48d	8	„ „	96	1	„ „	147a
4	„ „	3	1	„ „	11	5	„ „	26	4	„ „	52a	5	„ „	96a	1	„ „	157
8	„ „	4	18	„ „	12	6	„ „	27a	1	„ „	53	6	„ „	103	1	„ „	165
4	„ „	5	12	„ „	12a	2	„ „	27b	2	„ „	55a	4	„ „	103a	2	„ „	172
1	„ „	6	6	„ „	12b	1	„ „	29	63	„ „	59	1	„ „	103f	7	„ „	302
4	„ „	6a	8	„ „	13	4	„ „	30	14	„ „	62	2	„ „	103h	7	„ „	303
6	„ „	7	7	„ „	13a	1	„ „	31	2	„ „	62a	1	„ „	106	11	„ „	304
2	„ „	7a	13	„ „	14	1	„ „	32	4	„ „	62b	3	„ „	110	11	„ „	305
17	„ „	8	2	„ „	15	31	„ „	35	13	„ „	63	12	„ „	111	2	„ „	306
4	„ „	8a	2	„ „	15a	279	„ „	37	4	„ „	64	10	„ „	111c	2	„ „	308
6	„ „	8b	7	„ „	16	34	„ „	37a	1	„ „	70	9	„ „	115	1	No.	6
22	„ „	9	3	„ „	16a	200	„ „	38	2	„ „	72	4	„ „	116a	Electric Motor		
2	„ „	9a	2	„ „	16b	2	„ „	43	3	„ „	77	1	„ „	125			

The following parts are not included in the No. 7 Outfit :—

1 E1 Electric Motor
1 Resistance Controller
17" of Rubber Tubing (⅜" internal diameter).

Putting the Sun to Work—(*Cont. from page 675*)

parabolic cross-section. By means of this the Sun's rays were brought to a focus on a pipe 2¼ in. in diameter that ran the full length of the heater. The pipe contained oil, and its two ends were connected to the top and bottom respectively of a large tank that acted as a reservoir. The oven was built into the tank in such a manner that the oil could circulate freely round it.

As our illustration shows, the heater was placed in a sloping position with the tank above it. When the oil in the pipe became hot it made its way upward in the reservoir in exactly the same manner that water heated in the boiler of a domestic hot water system rises into the storage cylinder. Cold oil flowed to the lower end of the heating pipe to take its place, and thus a regular circulation was set up that maintained the oven at a sufficiently high temperature for slow cooking. The oven, the oil pipes, and the back of the mirror were covered with thick layers of non-conducting material. The result was that the heat produced during the day was retained throughout the night by merely closing taps that restricted the circulation of the oil, and next morning the oven was sufficiently hot to cook breakfast cereals.

A glass cover was used to exclude dust from the polished metal surface of the reflector. It was difficult to keep this sufficiently clean to allow the Sun's rays to enter without loss of power, however, and the mechanism that tilted the trough to make it point towards the Sun at all hours of the day was not very efficient. In spite of these drawbacks good work was done with the oven, and it is said that its fortunate owner was the envy of his neighbours, for it was situated in the open air and in consequence its surroundings were very cool and agreeable.

One difficulty encountered by Dr. Abbott was that of adjusting the temperature of the oven, but this problem was partially solved by introducing a second return pipe leading from the middle of the oil reservoir. Valves were fitted to both return pipes, and the oil could then be passed back to the heater after descending through the upper half of the reservoir only, leaving the liquid at the bottom unaffected. By providing an alternative oil circulation in this manner the heat could be concentrated in the upper part of the oven when necessary.

There is no doubt that further experiments will be made on the direct utilisation of the heat of the rays of the Sun, both for heating purposes and for the production of power. Unless a new principle is discovered, however, it is scarcely likely that the present methods of generating heat and power will be displaced on a large scale for a considerable time, owing to the greater cost of direct methods.

Railway Speed-Up—(*Continued from page 683*)

sterling achievement. They had done their work supremely well and given us an exhibition of the very perfection of engine running. They had made no attempt at record-breaking. Their aim had simply been to keep their exacting schedule and arrive to time in spite of delays, and most ably had they achieved their purpose. The four service slacks at Great Bridgeford, Stafford, Polesworth and Rugby were observed with scrupulous care, and at no point was there any risky running. The early checks and the Boxmoor slack had taken fully 10 min. out of an already very tight schedule; yet in spite of all Euston was reached before time, and the net time from Liverpool was but little over three hours.

It is interesting to recall in this connection that almost 100 years ago, when the Liverpool and Manchester Railway was in successful operation and the London and Birmingham and Grand Junction Railways were under construction, Dr. Dionysius Lardner, in his book on "*The Steam Engine*," expressed his belief that "on the completion of the line of road from the metropolis to Liverpool we may expect to witness the transport of mails and passengers in the short space of three hours." The prophecy of this learned writer—who was also a clergyman—has had to wait a long time for its fulfilment, but almost any day may witness it now.

More accelerations are promised for September, and many already fast trains will be speeded up. In the Liverpool services, the 11.50 a.m. from Euston is to be accelerated by 20 minutes, the 2.35 p.m. by 16 minutes, and the 4 p.m. by 18 minutes. The popular 5.55 p.m. non-stop is to be altered to leave at 6.5 p.m. and reach Lime Street at 9.40 p.m.

These are but a few of the many accelerations arranged for September. Is it not abundantly evident that 1932 will be a red-letter year in the history of railways and that a new standard of express speed has come into force? Apparently full use is to be made of the capabilities of modern locomotives on our perfectly-aligned permanent way.

Printing Machine—(*Continued from page 693*)

rotating continually at a high speed. In this manner the paper is passed to the timing rollers a few moments before the printing stroke of the platen commences.

A 3" Sprocket Wheel, on the crank and camshaft at the driving end of the model, is connected by a long length of Sprocket Chain to a 1½" Sprocket Wheel 51 that is carried on a 6½" Rod together with four 1" Sprocket Wheels. These 1" Sprockets each carry one of the four feed chains, each of which passes over the Rods 52 and 53 and round the Rod 54. The Rod 53 consists of three separate pieces, two of which are Pole Pieces and the other a 3½" Rod. The Pole Pieces are carried at their outer ends on Corner Brackets and at their inner ends are fitted with Threaded Cranks. These Cranks carry guides built up from 5½" Flat Girders curved to the shape as shown in the illustration, and the 3½" Rod, mentioned previously, is then fitted in place. Two Collars on this 3½" Rod space the two inner chains apart the required distance.

One more movement remains to be fitted. This is the drive for the pick-up rollers 55 and 56, which are used for taking the sheets of paper from the impression roller and depositing them upon the delivery arm. These rollers are built up in an exactly similar manner to rollers 47 and 48, but it will be noticed that the lower rollers fit into spaces cut in the guide strips. The rubber tubing for the upper rollers is carried on Collars, but that for the lower rollers is fitted on Couplings. A ¾" Sprocket Wheel on one end of the shaft carrying the lower rollers is connected by Sprocket Chain to a similar Sprocket secured on the Rod 28 of the Electric Motor.

When the various movements have been synchronized the motors may be connected to their respective switches. One wire from the motor driving the fan is taken the full length of the model to a switch fitted on a 5½" × 3½" Flat Plate at the end of the model; the other wire is taken to a terminal on the same Plate as the switch. This Plate is shown clearly in the general view. One wire from the main driving motor is taken to a second switch on the Flat Plate and the other to one terminal of a Resistance Controller, the remaining terminal of the Controller being taken to the terminal carrying the wire from the fan motor. The controller will be found useful for finding the most efficient speed of the printing machine, and also for taking trial impressions while experimenting.

While any adjustments are being carried out, the Crank 34 should be in a horizontal position, thus preventing the impression roller from becoming covered with printing ink. It is also advisable to start the fan motor first in order that a good suction may be obtained before the machine is set in motion.