No. 883,949. PATENTED APR. 7, 1908.

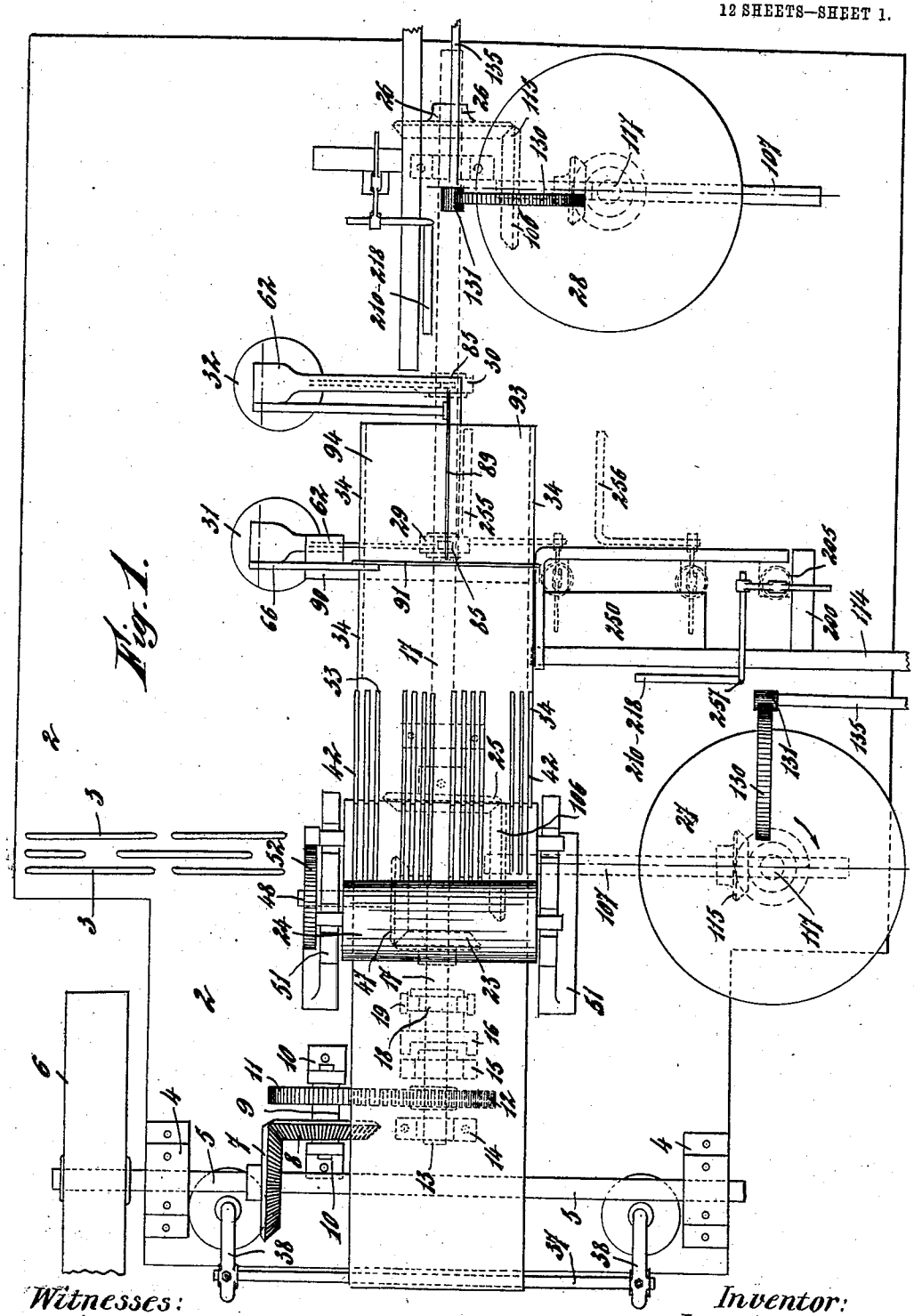
J. GOHY.

MACHINE FOR THE PRODUCTION OF PAPER TUBES.

APPLICATION FILED AUG. 5, 1905.

12 SHEETS—SHEET 1.

Fig. 1.



Witnesses:
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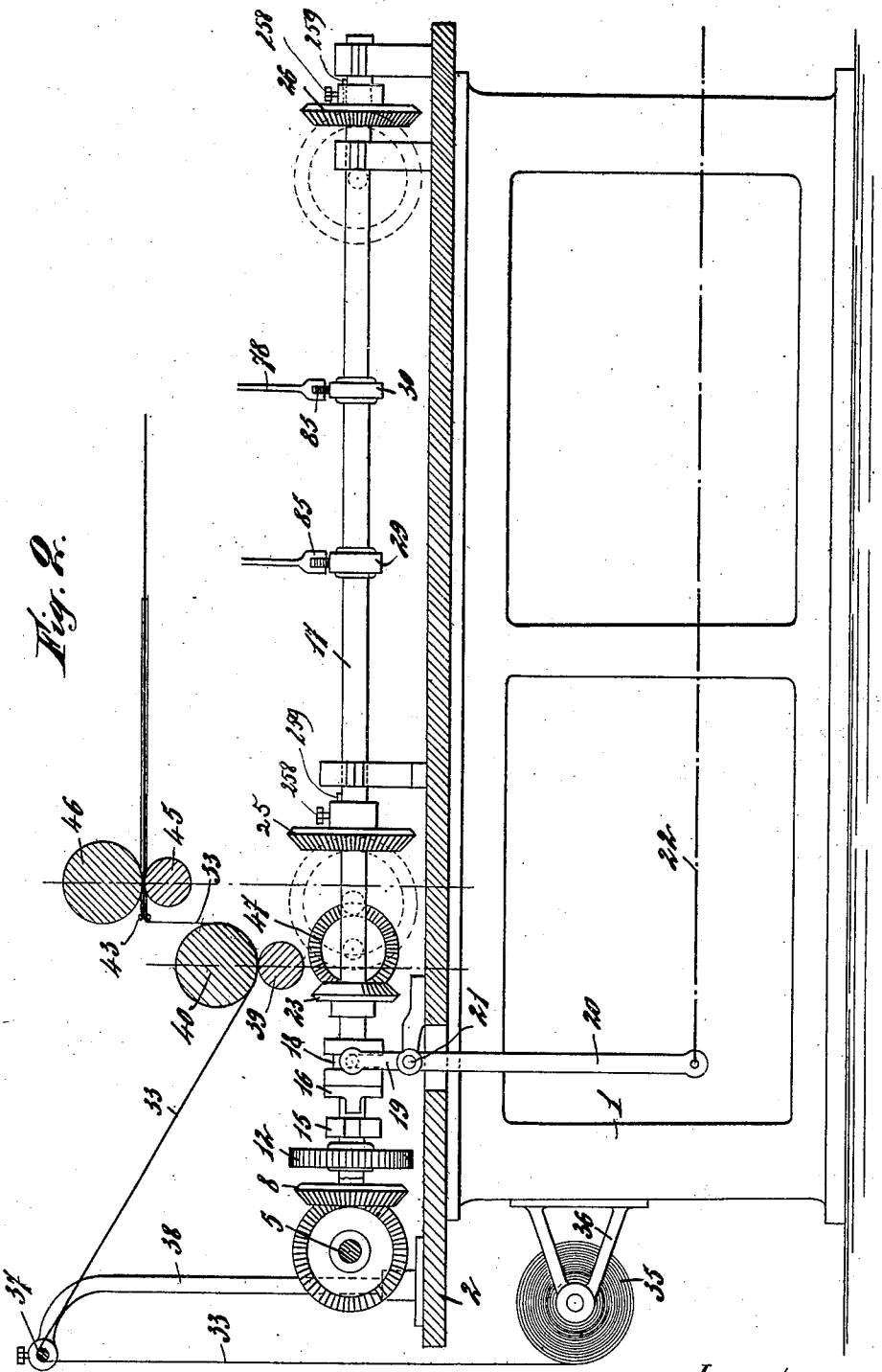
12 SHEETS—SHEET 2.

Fig. 2.



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12 SHEETS—SHEET 3.

Fig. 3.

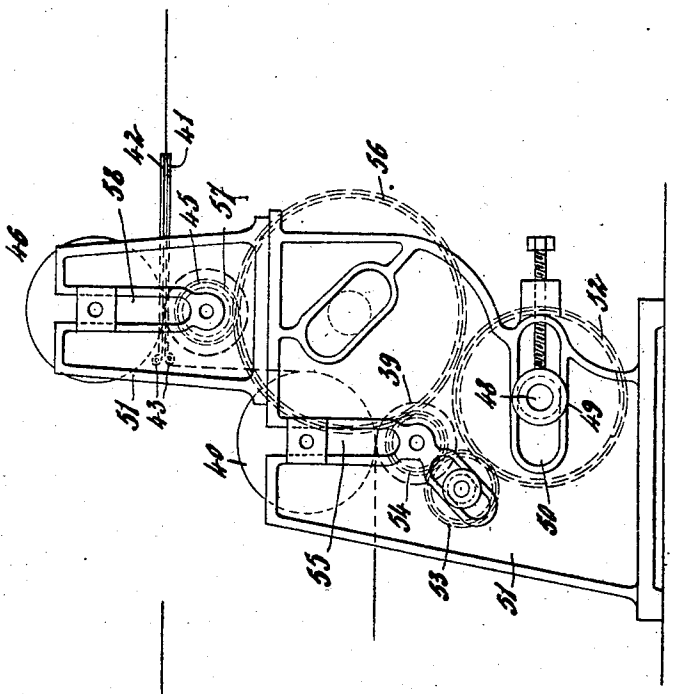


Fig. 4.

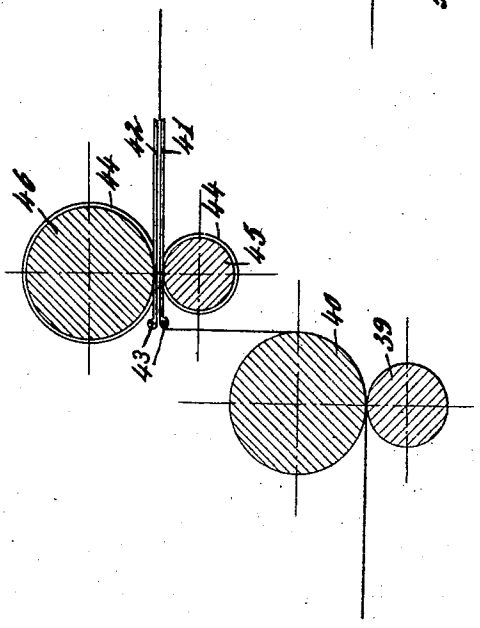
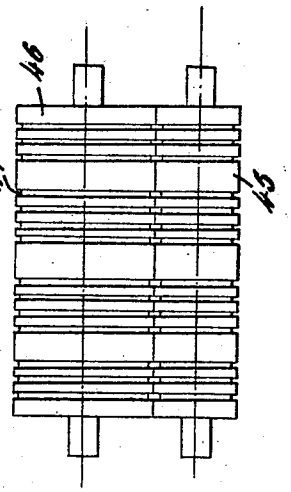


Fig. 5.



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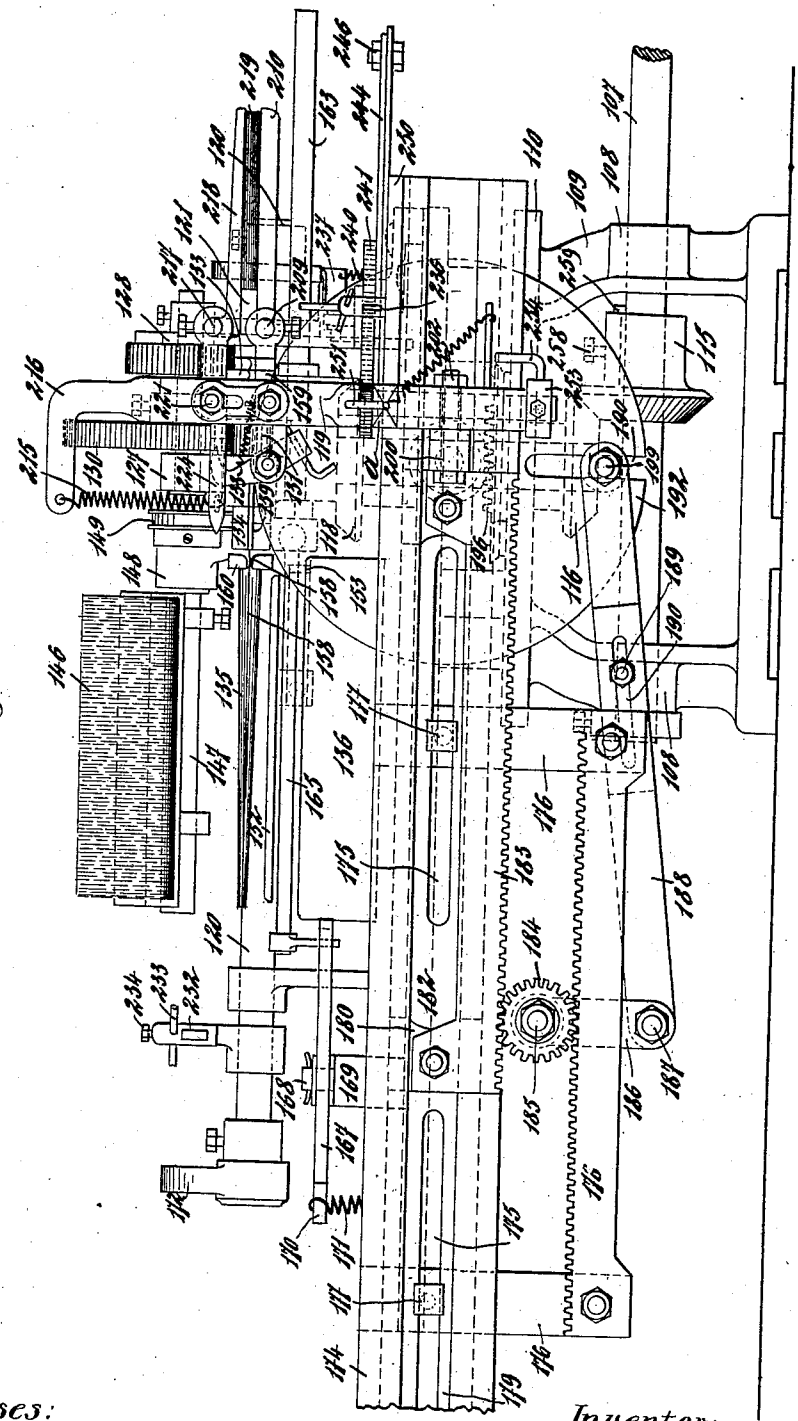
12 SHEETS—SHEET 4.

Fig. 6.



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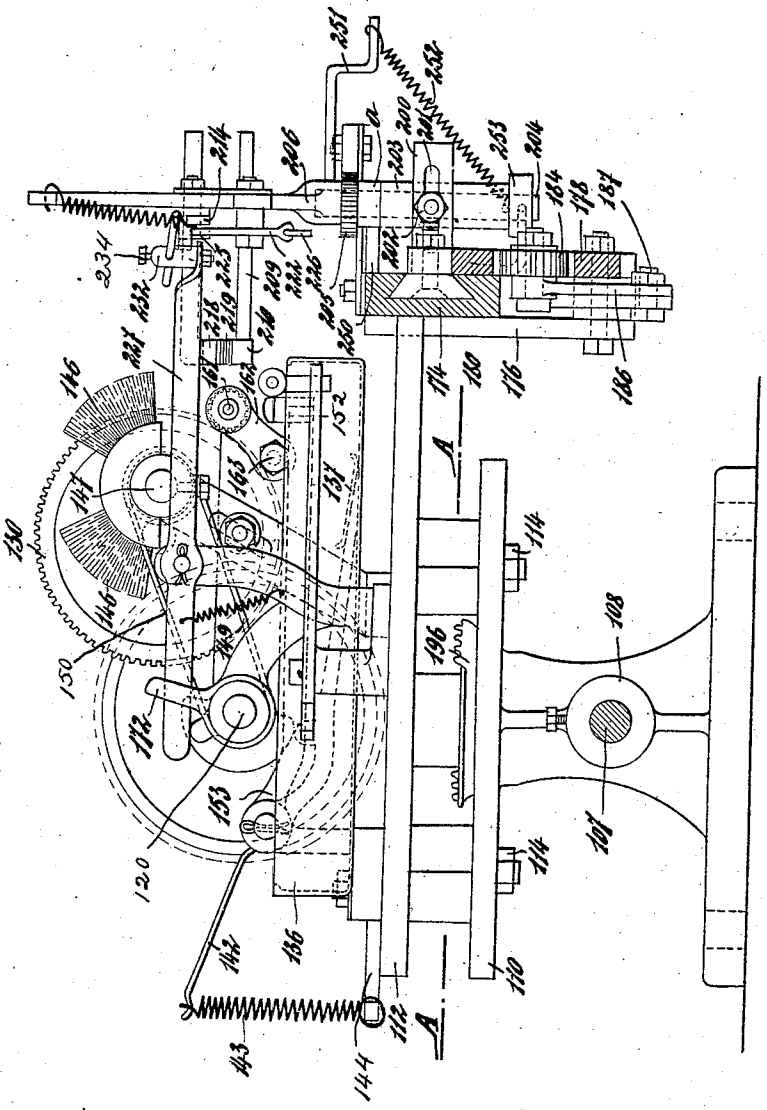
12 SHEETS—SHEET 5.

Fig. 7.



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12 SHEETS—SHEET 6.

Fig. 10.

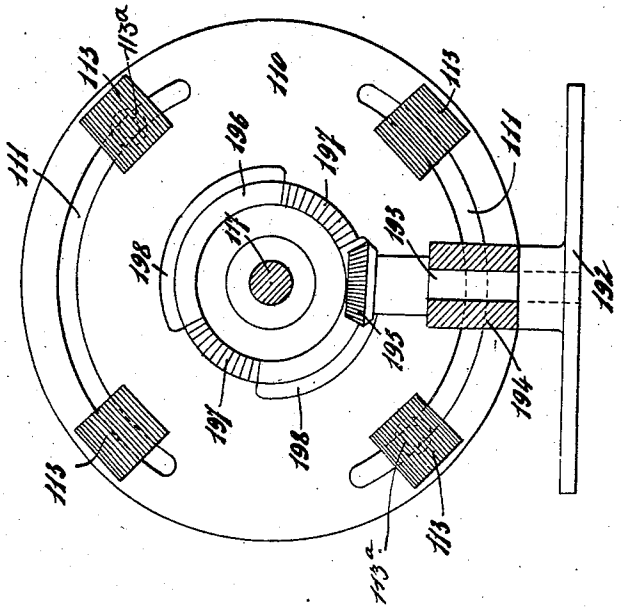
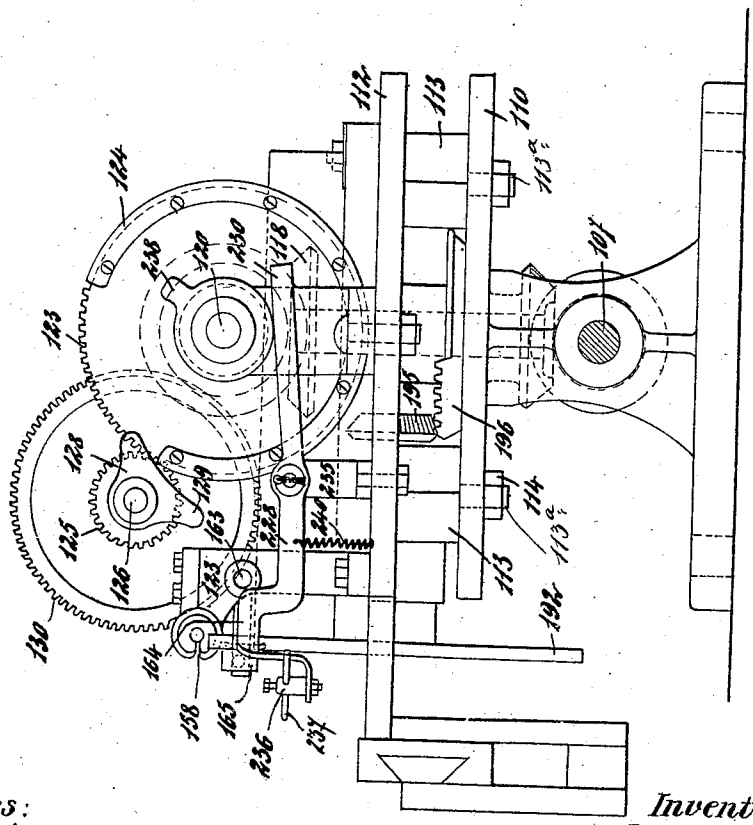


Fig. 8.



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12 SHEETS—SHEET 7.

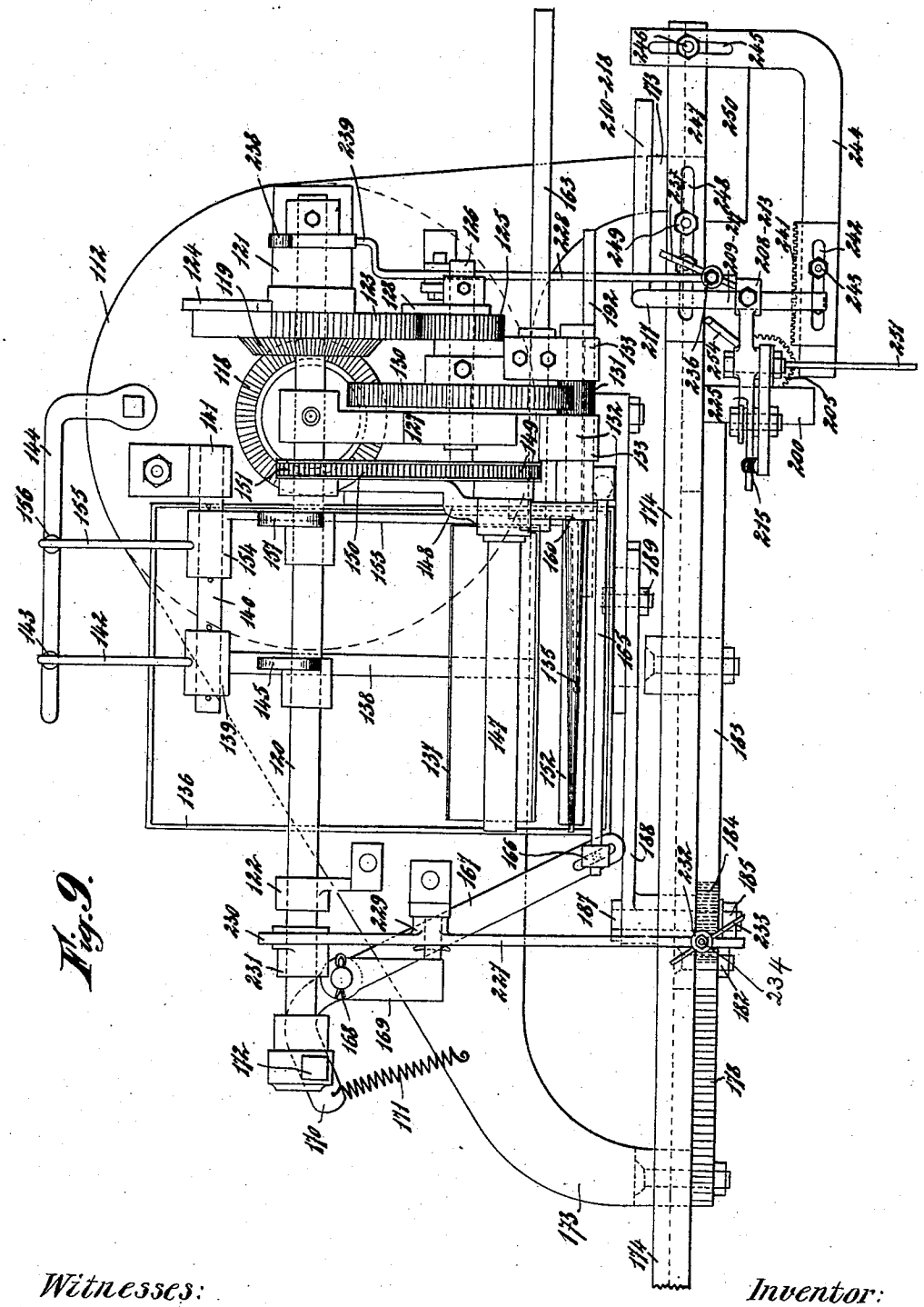

Fig. 9.

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12 SHEETS—SHEET 8.

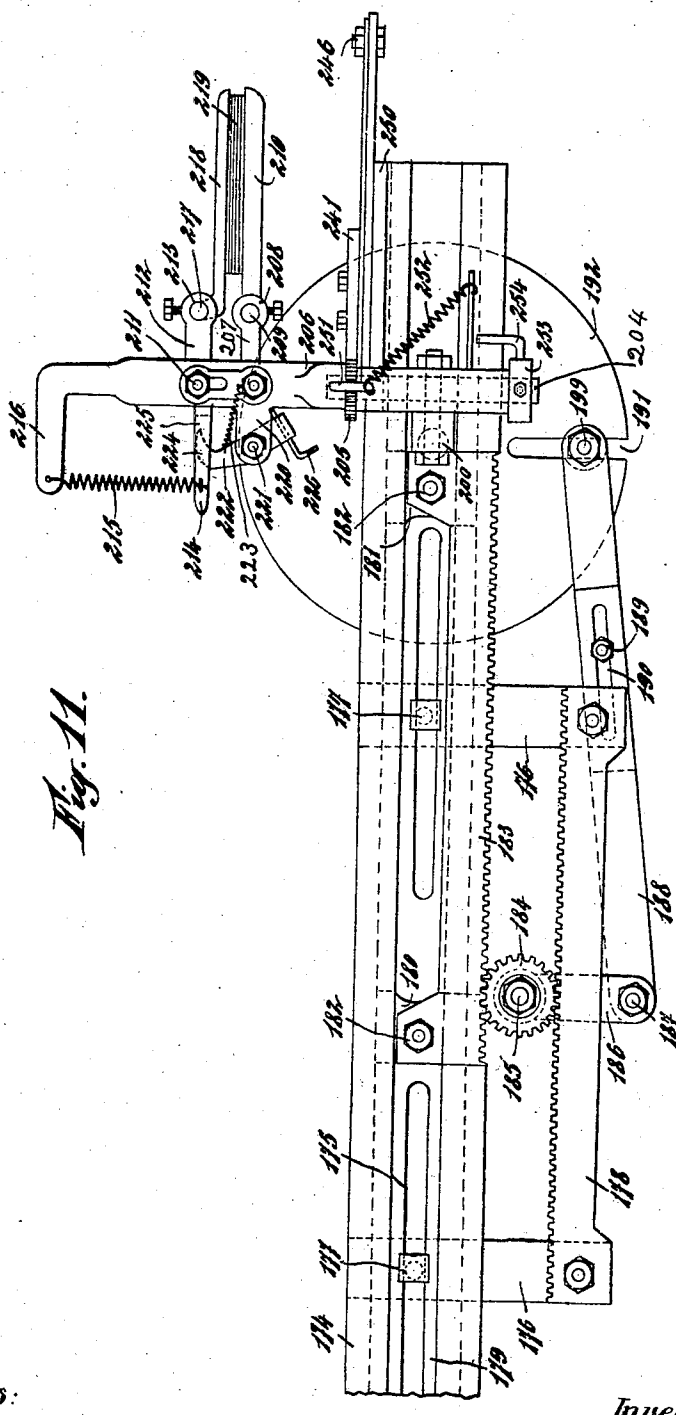

Fig. 11.

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12 SHEETS—SHEET 9.

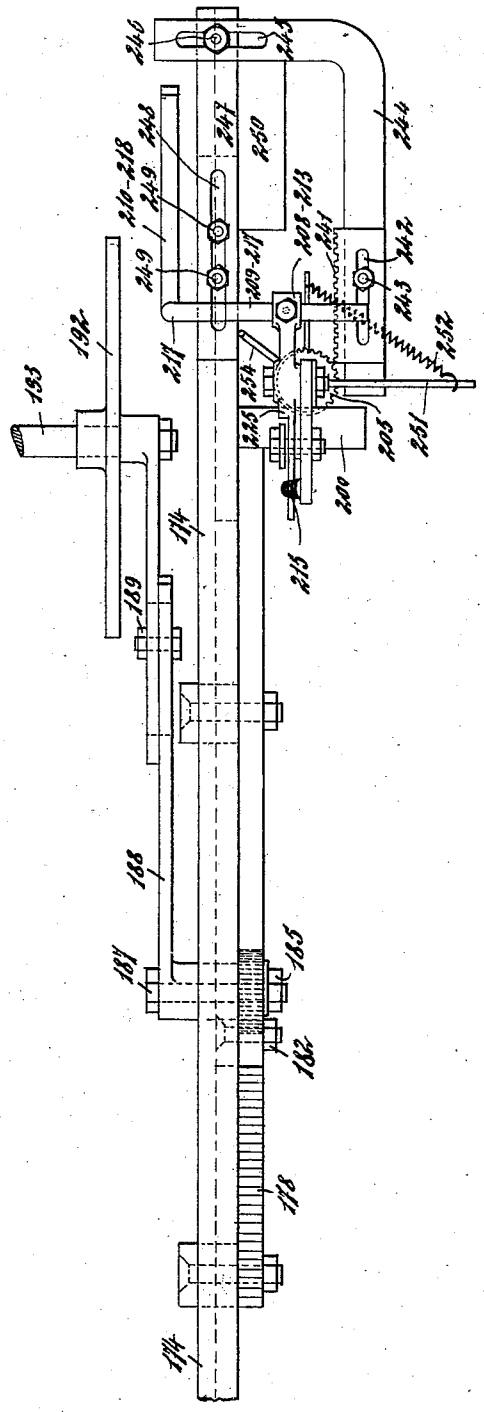

Fig. 12.

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12 SHEETS—SHEET 10.

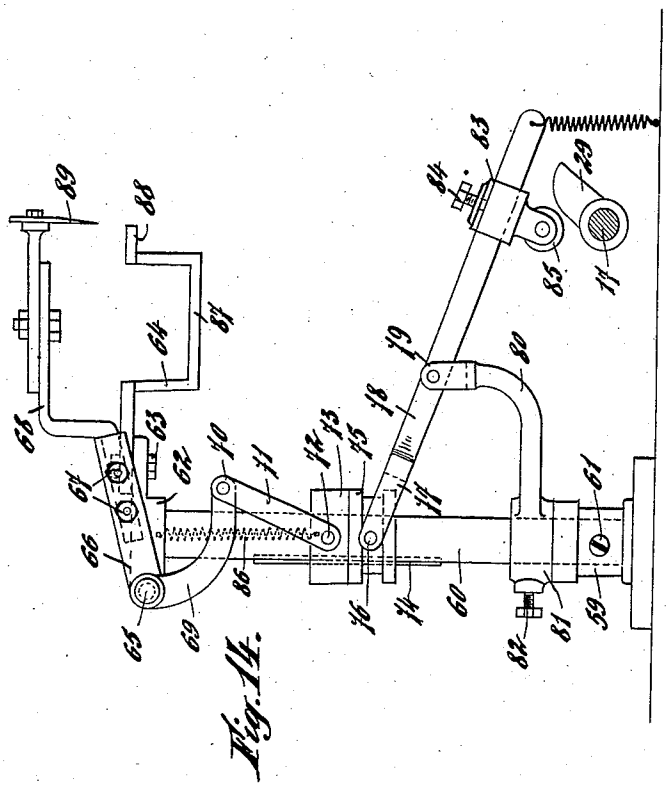

Fig. 14.

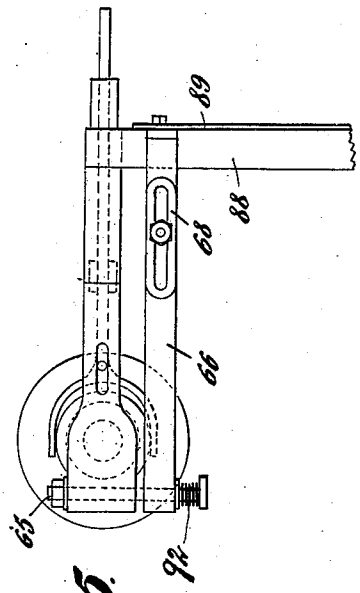

Fig. 15.

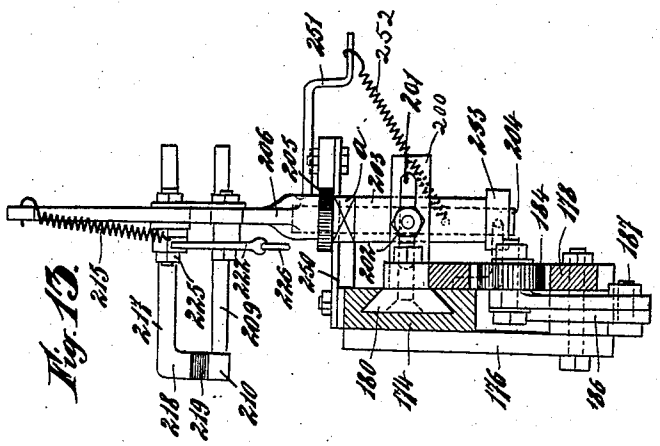

Fig. 13.

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12 SHEETS—SHEET 11.

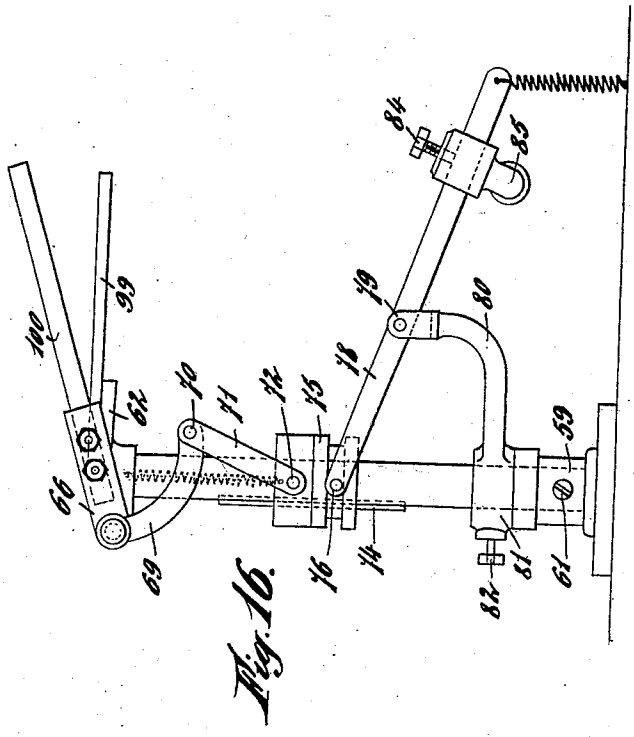

Fig. 16.

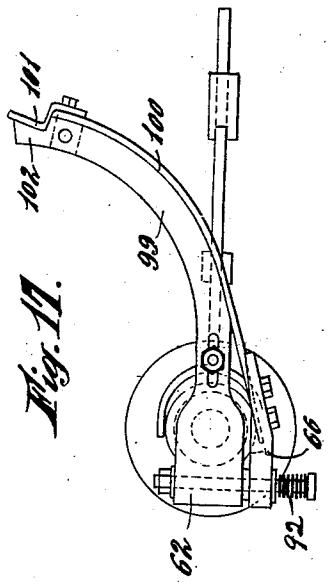

Fig. 17.

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MACHINE FOR THE PRODUCTION OF PAPER TUBES.

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12 SHEETS—SHEET 12.

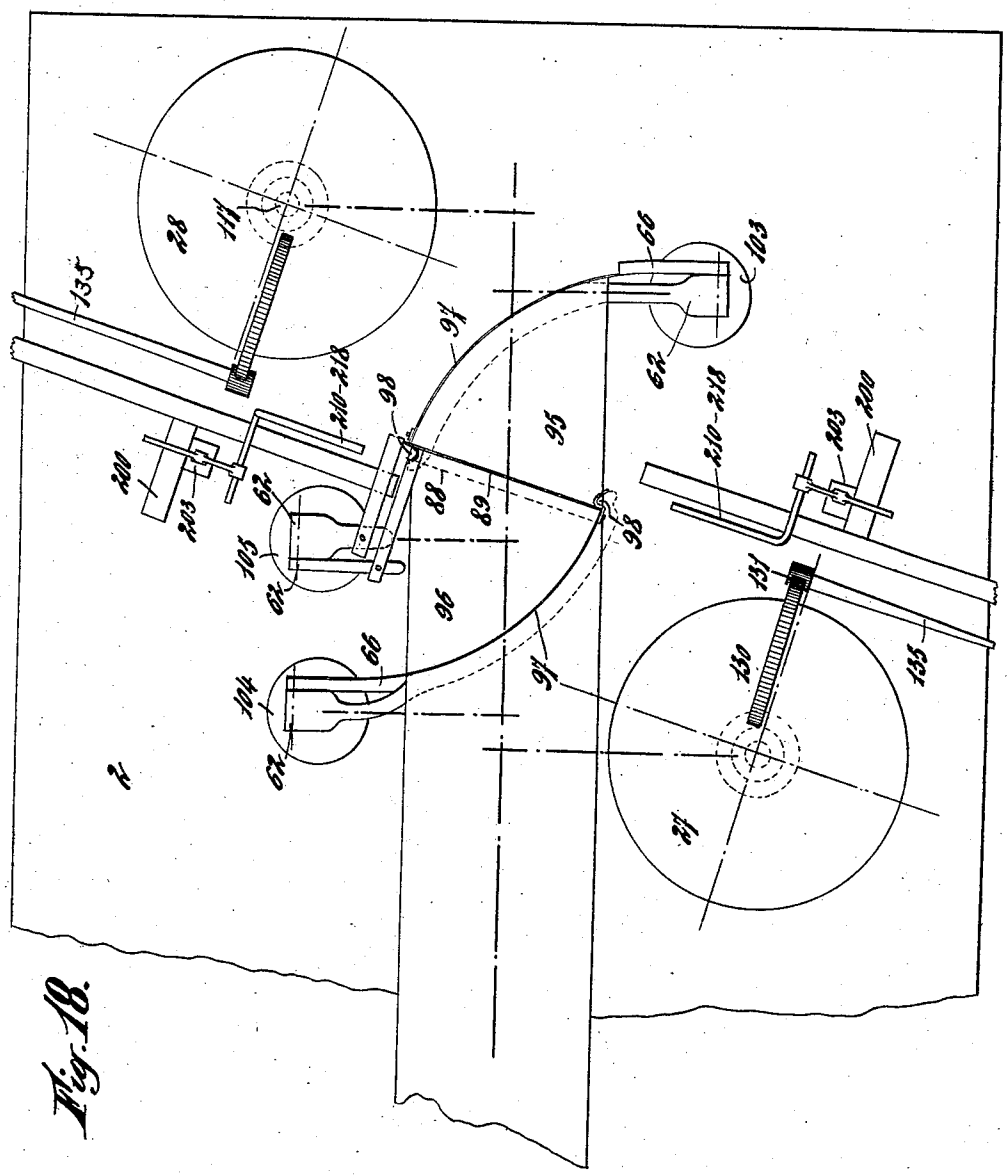

Fig. 18.

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UNITED STATES PATENT OFFICE.

JEAN GOHY, OF ENSIVAL, NEAR VERVIERS, BELGIUM.

MACHINE FOR THE PRODUCTION OF PAPER TUBES.

No. 883,949. Specification of Letters Patent. Patented April 7, 1908.

Application filed August 5, 1905. Serial No. 272,910.

To all whom it may concern:

Be it known that I, JEAN GOHY, subject of Belgium, residing at Ensival, near Verviers, in the Kingdom of Belgium, have invented new and useful Improvements in Machines for the Production of Paper Tubes, of which the following is a specification.

This invention relates to a machine for the production of paper-tubes such as are, for example, used under the name of cop-tubes for spinning or weaving purposes. The shape which must be imparted to tubes of this kind varies within fairly wide limits and is in some cases cylindrical, in other cases more or less conical, according to the purpose for which the tubes are required. Hitherto these tubes have been produced by means of machines, each of which was constructed to turn out a special type or pattern of tube, this being due to the fact that for producing each type or pattern sheets of paper of a certain shape must be used, and the variations in the shape of the paper involve variations in the action of the machine. Thus, for instance, for the production of a cylindrical tube one edge of a sheet of paper can be directly applied to the mandrel on which the tube is to be rolled, whereas in the case of a conical tube the shape of the paper necessitates, in the machines hitherto known, a certain amount of rotation of the sheet in order to place the paper on the mandrel in the desired position, and the paper must in some cases be fed to the point of the conical mandrel and in other cases to the base of the latter. The machine must be specially constructed for this purpose and must be provided with special paper-feed mechanism which involves the sliding of the paper in such a manner that a large amount of loss occurs through tearing, more particularly if the sheets have to be fed to the point of the mandrel.

In many cases tubes have to be manufactured from sheets of paper the borders or edges of which have been scraped and thus reduced in thickness to facilitate the pasting of the tubes; in such cases it is not possible to introduce the paper edgewise into the slot or groove with which the mandrel is provided, and the paper must be introduced according to a line of section in its plane, and for this purpose rotation is required in order to apply the edge of the paper to the stationary mandrel.

The object of the present invention is to remove these disadvantages and to provide a machine of comparatively simple and compact construction by means of which paper-tubes of any type or pattern used in practice can be produced, that is to say, cylindrical tubes or tubes which are more or less conical, the said tubes being manufactured from a strip or band of ordinary paper or paper with scraped edges, and the said paper being in all cases introduced at the base of the mandrel. These results are obtained by making certain parts of the machine adjustable and by exchanging certain parts when necessary, for instance mandrels knives and gear-wheels, the principal parts of the mechanism remaining, however, unaltered during the manufacture of tubes of all kinds.

As in the case of the machines hitherto known the improved machine comprises a paper-feed mechanism, a device or devices for cutting the paper, and mechanism for forming the tubes. An important difference lies, however, in the fact that the relative positions of the paper-feed mechanism and the tube-forming mechanism can be altered at will by means of simple adjustment, so that the paper can always be fed to the mandrel by means of a simple rectilinear movement, with a single angular displacement. In practice the altering of the relative positions of the parts referred to is preferably effected by arranging the tube-forming mechanism on a table or platform which is adjustable in the machine frame and which is also rotatable about its own central axis, so that the mandrel can be brought into any desired angular position with regard to the paper.

The invention is illustrated, by way of example, in the annexed drawing, in which

Figure 1 is a plan-view showing the principal parts of the machine in the position which they occupy for the manufacture of cylindrical tubes from paper the edges of which have been made thin in order to facilitate pasting. In this figure the tube-forming mechanism is only diagrammatically indicated in order not to unnecessarily complicate the drawing. Fig. 2 is a side-view, in partial section, showing the main driving shaft, the paper feed rollers and the mechanism for controlling the knives; the tube-forming mechanism not being shown in this figure. Fig. 3 is a side-view of the frame supporting the feed-mechanism. Fig. 4 diagrammatically illustrates the arrangement of the feed-rollers and guide-rollers by means

of which the paper is supplied to the cutting-mechanism. Fig. 5 is a front-view of two feed-rollers. Fig. 6 is a front-view illustrating the tube-forming mechanism comprising a guide, a mandrel, a paste-brush, a device for pressing together the pasted edges of the rolled sheets, and a device for removing the finished tubes. Fig. 7 is a side-view of the mechanism shown in Fig. 6, seen from the left, and Fig. 8 is a similar view seen from the right. Fig. 9 is a plan-view of the mechanism shown in Fig. 6. Fig. 10 is a horizontal section on the line A—A of Fig. 7 showing more particularly the arrangement which allows of controlling the angular position of the mandrel with regard to the paper-feed mechanism. Fig. 11 is a front-view of the gripper belonging to the tube-forming mechanism, shown in Figs. 6 to 9. Fig. 12 is a plan-view of Fig. 11, showing the arrangement used for rotating said gripper. Fig. 13 is a side-view, in partial section, of the mechanism shown in Fig. 11. Figs. 14 and 15 are respectively an elevation and a plan-view of the mechanism used for operating one of the knives; in these figures the mechanism is shown in connection with a straight knife. Figs. 16 and 17 are an elevation and plan view respectively illustrating the knife-operating mechanism in connection with a curved knife such as is used for the manufacture of certain types of conical tubes. Fig. 18 diagrammatically illustrates the positions of the tube-forming mechanism and paper-cutting mechanism during the manufacture of conical tubes with helically twisted outer edges.

As shown in Figs. 1 and 2 the machine comprises a frame 1 which supports a plate or table 2. The entire surface of the latter is slotted in the manner indicated, in Fig. 1, at 3, the purpose of the slots being to allow of adjusting the mechanism in different positions on the table. Bearings 4 fixed to the table 2 support a main-shaft 5 which is adapted to be driven by means of a pulley 6 and which drives, by means of bevel-gear 7 and 8, a shaft 9 arranged in suitable bearings 10. A toothed wheel 11 on said shaft 9 meshes with a toothed wheel 12 fixed to one end of a shaft 13 mounted in bearings 14. To the other end of the shaft 13 is fixed a clutch 15 adapted to coöperate with a clutch 16 which is axially movable on a shaft 17. The latter is supported by suitable bearings and extends through practically the entire length of the machine. A collar 18 is fixed to the clutch 16 and is engaged by the forked part 19 of a lever 20 pivoted at 21. The lever 20 is adapted to be operated, from either end of the machine, by means of suitable transmission-gear 22; the latter is diagrammatically indicated in Fig. 2.

The shaft 17 serves for operating the different sets of mechanism which the machine comprises. For this purpose the said shaft is provided with gear-wheels 23, 25 and 26 and with cams 29 and 30. The gear-wheel 23 drives the paper-feed mechanism, which is diagrammatically indicated by 24 in Fig. 1. The tube-forming mechanism diagrammatically indicated by 27 and 28 is driven by the gear-wheels 25 and 26, and the cams 29 and 30 serve for operating the paper-cutting mechanism 31 and 32, the latter being shown, in Fig. 1, in the position occupied during the manufacture of cylindrical tubes from a strip of paper, the edges 34 of which have been scraped or "thinned" to facilitate pasting. Paper-feed mechanism of any suitable construction can be used if, as in the example illustrated, the adjustment of the relative positions of the feed-mechanism and tube-forming mechanism is solely effected by displacing the latter.

The paper-feed mechanism illustrated comprises a roller 35 (Fig. 2) having bearing in brackets 36 fixed to the frame 1. The paper web 33 coming from this roller passes over a guide-rod 37 supported by standards 38 fixed to the table 2. From the rod 37 the paper-web passes to the feed-rollers 39 and 40. The roller 39 is positively driven by means of suitable mechanism, whereas the roller 40 serves merely as a pressure or guide-roller. From the rollers 39 and 40 the paper passes to the narrow plates 41 and 42, fixed to rods 43, which plates form guides and extend into grooves 44 provided in rollers 45 and 46. The roller 45 is positively driven and the roller 46 serves as a pressure-roller. The surfaces of the rollers 39, 40, 45 and 46 are not smooth but are provided with grooves 44 (Fig. 5) of suitable depth, which prevent irregular displacement of the paper.

The feed rollers 39 and 45 are intermittently rotated by means of the gear-wheel 23 already referred to. For this purpose only a segment of the circumference of the said wheel is toothed, as shown in Fig. 2, so that during a portion of the period of rotation the paper-web is stationary in order that it can be cut and applied to the mandrels. The wheel 23 operates a bevel-wheel 47 mounted on a shaft 48 carried by a bearing 49 adjustable in a slot 50 in a frame 51, the bearings of the rollers 39, 40, 45 and 46 being also arranged in the said frame 51.

The shaft 48 carries, outside the frame 51, a toothed wheel 52 connected, by means of a toothed wheel 53, with a pinion 54 at one end of the axle of the roller 39. The bearings of the roller 40 are slidable in slots 55 in the frame 51, and the said roller rests freely on the roller 39. The pinion 54 is connected by means of a toothed wheel 56 with a pinion 57 fixed to the axle of the roller 45. The bearings of the roller 46 are slidable in slots 58 in the frame 51. Each time the rollers 39, 40, 45 and 46 are rotated by the action of the toothed portion of the bevel wheel 23 the

paper-web 33 is moved through a certain distance and passes between the guide-plates 41 and 42. The length of the latter varies according to the position of the first cutting-device 31, by which the paper is supported after leaving the guides as will be described hereinafter.

Two cutting devices 31 and 32 are shown in Fig. 1, but a larger number can be provided if the nature of the cutting operation required renders it desirable. As regards the knives used, these can be of any suitable known kind, the cutting operation being effected in the ordinary known manner. Since the cutting-devices must be adapted to be adjusted on the table 2 in any desired position, by means of the slots 3, according to the manner in which the paper-web is to be cut, arrangements must be made to allow of operating the said devices in all positions by means of the cams 29 and 30 fixed to the shaft 17. The means adopted for this purpose are shown in Figs. 14 to 17, which represent two different kinds of cutters. Each of the cutting devices comprises a support 59 adapted to be bolted to the table 2 with the aid of the slots 3 and each support 59 carries a rotatable vertical shaft 60 adapted to be fixed by means of a set-screw 61. To the head 62 of the shaft 60 is bolted an angularly bent arm 64, and a second arm 66 is pivoted at 65 to the said head. To the arm 66 a plate or support 68 adapted to coöperate with the arm 64 is adjustably connected by means of bolts and nuts 67 the arm 66 being integral with a curved arm 69, to the end of which is pivoted, at 70, a link 71 which is pivotally connected at 72 to a sleeve 73 adapted to slide on the shaft 60. A spline 74 formed on said shaft 60 engages the said sleeve 73, which is provided with a groove or reduced portion 75 into which engage two pins 76 fixed to the end of the forked part 77 of a lever 78 pivoted at 79 to an arm 80. The latter is fixed to a sleeve 81 the position of which on the shaft 60 is adjustable by means of a set screw 82. The lever 78 carries a block 83, the position of which is adjustable by means of a set screw 84 and which is provided with a roller 85 adapted to coöperate with one of the cams 29 or 30 mounted on the shaft 17, the said roller 85 being held in contact with the cam by means of a spring 86 which is connected to the head 62 and sleeve 73 in such a manner that it tends to make the latter ascend.

When the operative cam-surface abuts against the roller 85 the latter is raised and the sleeve 73 is moved downwards on the shaft 60. The link 71 is thus caused to exert a pull on the movable arm 66, which carries a knife. It is obvious that owing to the connection between the groove 75 and the arm 70, which can be adjusted at any desired angle with regard to the head 62, it is not essential that said head and the lever 78 should be in the same vertical plane in order to operate the cutting-device. If the sleeve 81 is rotated on the shaft 60 the pins 76 slide in the groove 75, so that the arm 78 can always be brought into direction perpendicular to the shaft 17. The cam 29 or 30 can therefore, always operate the cutting-device, whatever position is given to the head 62 in order that the paper may be cut in the direction desired.

In Figs. 14 and 15 the cutting-device is shown in connection with a knife used for cutting the paper longitudinally at the center of the band, for the manufacture of cylindrical tubes. Fig. 1 illustrates the position of this knife and the operating gear, with regard to the paper to be cut. It will be seen that the cutting device is arranged laterally with regard to the paper band 33. The arm 64 is provided with a downwardly bent portion 87 in order to give passage to the guide or gripper of the tube-forming mechanism, as will be hereinafter described. A rectangular portion or blade 88 of the said arm extends underneath the paper and supports the latter longitudinally, in the direction of its axis. The arm 68 fixed to the movable arm 66 carries a knife 89 adapted to coöperate with said blade 88 for the purpose of cutting the paper. When the cam 30 acts on the roller 85 the knife 89 is depressed and cuts the paper along the edge of the blade 88 (Figs. 1, 14 and 15). If cylindrical tubes are to be produced from a paper-band, the edges 34 of which have been scraped or otherwise reduced in thickness, the paper must not only be cut longitudinally by the knife 89, but must also be cut transversely. For this purpose a second cutting-device is provided, which is adapted to be operated by the cam 29 and which is similar to the one already described, except with regard to the operative parts connected to the head 62 and arm 66. As shown in Fig. 1 the fixed head 62 carries a straight plate 90 which serves as a support for the paper leaving the guides 41 and 42, and the movable arm 66 carries a knife 91 adapted to cut the paper, by being depressed. In order to obtain sufficient friction between the parts 90 and 91 the movable arm 66 may be acted on by a spring 92 (indicated in Fig. 15, and shown, also, in Fig. 17), which spring tends to move the arm 66 towards the part 62 and thus insures a certain amount of friction between the parts 90 and 91, similar to that which occurs between the blades of a pair of scissors. It will be understood that the shape of the knives with which the cutting-devices are provided may vary within wide limits, according to the type or pattern of the tubes to be produced.

The two forms of construction described are suitable for cutting paper in the form of

two rectangular parts 93 and 94 (Fig. 1) for the production of cylindrical tubes from paper within thin edges. The position and shape of the knives or blades vary in accordance with the shape of the tubes to be produced. For producing, for example, a highly conical tube with a helically twisted pasted edge, the paper must, as is known, be cut in the manner indicated in Fig. 18, that is to say two triangular parts 95 and 96 with curved edges 97 and recesses 98 must be cut out of the paper-band. For this purpose knives of the known shape illustrated in Figs. 16 and 17 are used. As shown in these figures, the head 62 is provided with the fixed, curved blade 99, and the movable arm 66 carries the movable blade 100, the curvature of which corresponds with that of the blade 99. The blade 100 carries at its end a small supplementary knife 101 adapted to coöperate with a recessed blade 102 for the purpose of producing the recesses 98 at the apices of the triangles 95 and 96. For cutting out the triangles 95 and 96 three cutting-devices 103, 104, and 105 are used, arranged in the manner shown in Fig. 18; the devices 103 and 104 comprise curved knives similar to those shown in Figs. 16 and 17, and the device 105 comprises knives of the kind shown in Figs. 14 and 15, that is to say, provided with a straight blade 89 and a fixed blade 88 carried by angularly bent supports having approximately the shape shown in Figs. 14 and 15 in order to give passage to the guide or gripper which feeds the cut paper to the tube-forming mechanism. Generally speaking, therefore, the knives can have any desired shape, the arrangement of the cutting devices being such that the said knives can be operated whatever position is occupied by the head 62, with regard to the operating mechanism, and the lever 78.

The construction of the tube-forming mechanism will now be described without at present entering into details with regard to the manner in which the said mechanism coöperates with the cutting-devices and the feed-mechanism. It will then be explained how the special construction and arrangement of the different parts allows of producing, in a single machine, tubes of different patterns and types with the aid of simple adjustment and variation of the relative positions of the cutting-devices and feed-mechanism.

As has already been mentioned, each tube-forming mechanism is operated by means of one of the bevel-wheels 25 and 26, the latter being arranged in any suitable position on the shaft 17. Each of the said bevel-wheels operates a bevel-wheel 106 fixed to a shaft 107 (Fig. 1) of suitable length, mounted in bearings 108, the latter being fixed to a frame 109 secured by means of screws, and the slots 3 to the table 2. Each of the frames 109 supports a circular plate 110 which is provided with two slots 111 (Fig. 10) and on which is mounted a frame or table 112 supported by four blocks 113 arranged in pairs diametrically opposite each other; two of the said blocks 113 are provided with screw-threaded rods 113[a] extending through the slots 111 in such a manner that the said blocks can be fixed to the plate 110 by means of nuts 114. The other two blocks 113 rest freely on the plate 110 and merely serve as supports for the table 112. The latter can thus be arranged in any desired position with regard to the plate 110. Each of the frames 109 is so arranged that the respective shaft 107 is perpendicular to the shaft 17.

For altering the position of the table 112 it is sufficient to unscrew the nuts 114 and to displace the screw-threaded rods 113[a] in the slots 111. It will be shown hereinafter that this arrangement is highly important for the purpose and action of the machine. To each shaft 107 there is fixed a bevel-wheel 115 which meshes with a bevel-wheel 116 fixed to vertical shaft 117 arranged in suitable bearings concentrically with the plate 110. Above the table 112 the shaft 117 is provided with a bevel wheel 118 (Figs. 6, 8 and 9) which meshes with a bevel-wheel 119 (Fig. 9) fixed to a horizontal shaft 120 supported on the table 112 by means of bearings 121 and 122. At the sides of the bevel-wheel 119 there is arranged a wheel 123, a portion of the circumference of which is toothed (see Fig. 8). The wheel 123 is provided with a curved plate 124 and the toothed portion thereof meshes with a toothed pinion 125 (Figs. 6, 8, 9) mounted on a small shaft 126 arranged in bearings 127. The wheel 125 is fixed to a cam 128 (Fig. 8) which is provided with a circularly curved surface 129 of the same radius as the plate 124, so that when the toothed part of the wheel 123 is moved out of engagement with the pinion 125 the surface 129 of the cam 128 comes into contact with the projecting plate 124 and thus locks the shaft 126. To the latter, which thus receives intermittent movement, there is fixed a gear-wheel 130 which meshes with a small gear-wheel 131 mounted on an axle 132 (Fig. 9) supported by bearings 133 on the table 112. The said axle 132 carries a socket or chuck 134 (Fig. 6) into which is fixed a cylindrical or conical mandrel 135, the length of which depends on the length of the tubes to be produced.

It will be understood from the above description that the rotation of the shaft 107, which operates the tube-forming mechanism, imparts to the mandrel 135 intermittent rotation by means of the gear-wheels 118, 119, 123, 125, 130 and 131, the said mandrel being kept stationary, during the intervals between successive movements, by the locking of the intermediate shaft 126 due to the contact of the cam-surface 129 with the plate

124 fixed to the wheel 123. The number of revolutions performed by the mandrel 135 during each movement depends, of course, on the number of teeth with which the wheel 123 is provided, and on the ratio of the gear-wheels by means of which the movement is transmitted.

The table 112 supports, independently of the mandrel 135 and operating gear described, a vessel 136 of suitable size containing the adhesive substance which is required for pasting the tubes formed on the mandrel. In the vessel 136 there is arranged a plate or trough 137 carried by an arm 138 which is rotatable, by means of a sleeve 139, on a rod 140 carried by a bracket 141 fixed to the table 112. To an extension 142 (Fig. 7) of the arm 138 is attached a spring 143 connected with an arm 144 which is also carried by the table 112. This spring exerts a pull on the end of the rod or extension 142 and thus tends to raise the plate or trough 137 and to keep the arm 138 in contact with a cam 145 mounted on the shaft 120. During the rotation of the latter the said cam 145 depresses the arm 138, which is raised again by the spring 143 when the cam has cleared the arm. The plate or trough 137 is thus alternately raised and lowered, so that during each revolution of the shaft 120 a certain quantity of paste is transferred from the vessel 136 to a brush 146 (Figs. 6 and 7) mounted on a shaft 147 which is rotatable in a support 148 on the table 112. To the said shaft 147, which is shown separately in Fig. 9, without the brush 146, there is fixed outside the bearing 148 a sprocket-wheel 149 gearing with a chain 150, which passes over a sprocket-wheel 151 mounted on the shaft 120, so that during each upward and downward movement of the plate or trough 137 the brush 146 operated by the shaft 120 and the chain 150 is supplied with a certain quantity of paste, which it applies to the paper on the mandrel 135. The vessel 136 also contains a pressing device 152 Figs. 6 and 9 arranged below the mandrel 135 and carried by a lever 153 which is similar to the lever 138 and is also rotatable on the rod 140 by means of a sleeve 154. The latter carries a rod 155, which is acted on by a spring 156 in such a manner that the lever 153 is kept in contact with a cam 157 on shaft 120 so that the rotation of said shaft causes the device 152 to be depressed and removed from the mandrel until the cam has cleared the lever 153, whereupon the spring 156 moves the device 152 back towards the mandrel. The action of this part of the mechanism will be understood from the above description. The paper is fed to the mandrel by means of mechanism which will be described hereinafter, one edge of the paper being inserted into a groove 158 which lies in one of the generators of the mandrel and is in alinement with a slot 159 (Fig. 6) formed in the bearing 133 and the socket or chuck 134 which supports the mandrel. The paper thus applied to the mandrel is rolled round the latter when the toothed portion of the wheel 123 meshes with the gear-wheel 125. Simultaneously the rotation of the shaft 120 causes the brush 146 to be operated by the chain 150 and is supplied with paste by the plate or trough 137. The brush transfers the paste to the paper, so that the latter is pasted while being rolled and can be subjected to slight pressure by means of the device 152 when the tube has been produced and the rotation of the mandrel has ceased. When the pressing device is lowered by the action of the cam 157 the tube is finished, the rotation of the mandrel being prevented by the locking action of the surface 129 of cam 128 on the curved plate 124 fixed to the wheel 123; this locking-action takes place when the toothed part of the said wheel 123 is removed from the toothed wheel 125. The tube can then be removed from the machine, that is to say displaced from the mandrel 135.

The manner in which the removal of the tube from the machine is effected is as follows. Near the socket 134 the mandrel 135 is provided with a ring 160, having a slot 161 situated in alinement with the slot 158 which gives passage to the edge of the paper when the latter is fed to the mandrel. The ring 160 is fixed to a support 162 (Figs. 7 and 9) fixed to the end of a rod 163 adapted to slide in suitable guides formed in the bearing 133. To the rod 163 is fixed an arm 164 (Fig. 8) carrying at its end a rod 165 adapted to rock through a small arc in a horizontal plane. One end of this rod is connected at 166 (Fig. 9) with a lever 167 pivoted at 168 to a suitable support 169 mounted on the table 112. Beyond the pivot 168 the lever 167 is provided with a curved arm 170 to which is connected a spring 171. The arm 170 is adapted to be operated by a cam 172 fixed to the shaft 120. During each revolution of said shaft the cam 172 causes the arm 170, and the lever 167 to rock on the pivot 168, so that the said lever causes the rod 165 to rock on its support, the said rod having sufficient play for this purpose. The rod 165 is thus displaced according to the arc described by the pivot 166 on the lever 167 and displaces, by means of the arm 164, the rod 163, which moves in its guides and displaces, by means of the arm 162, the ring 160. By sliding along the mandrel the ring displaces the tube formed. When the cam 172 has cleared the arm 170 of the lever 167 the spring 171 causes the said lever to return to the position shown in Fig. 9, and thus to operate the rod 163 by means of the rod 165, and the arm 164, so that the ring 160 is moved back to its normal position. In the above description it has been shown that the gear controlling the

mandrel, the pasting and pressing-devices and the tube-removing device, forms as it were a single piece of mechanism mounted on the table 112, which is adapted to rotate on the vertical shaft 117 supported by the plate 110 and the frame 109. A special device for feeding the paper to the mandrel, after the cutting of the paper-band in the manner previously described, forms part of this mechanism.

The table 112 is provided with arms 173 which support a dove-tail guide 174 provided with slots 175. The latter allow of fixing to the guide, in any suitable position, vertical arms 176 supported by bolts 177 the heads of which are counter-sunk in the guide-way 179. The arms 176 carry a rack 178 projecting from the plane of the guide 174. Slides 180 and 181 (Figs. 11, 12 and 13) are movable in the guide 174 and support, by means of bolts 182, a rack 183 situated in the same vertical plane as the rack 178. The racks 178 and 183 mesh with a gear-wheel 184 mounted on an axle 185 fixed to an arm 186, to which a rod 188 is connected at 187, the said rod 188 consisting of two parts connected with each other by means of a bolt 189 which engages slots 190 in the two parts of said rod. The effective length of the latter can thus be varied at will.

One end of the rod 188 extends into a radial slot 191 in a plate 192 fixed to the end of a horizontal shaft 193 (Fig. 10) revoluble in bearings 194 supported by the plate 110 on the frame 109. To the shaft 193 is fixed a bevel-wheel 195 meshing with a bevel-wheel 196 which is fixed to the shaft 117 above the plate 110 and below the table 112. The wheel 196 is provided with two toothed parts 197 and with two smooth parts 198, so that during each revolution of the controlling shaft 117 the plate 192 is successively rotated, stopped, again rotated and again stopped. During its rotation the plate 192 operates, by means of the rod 188, the gear-wheel 184, so that the latter rolls on the rack 178, and transmits its longitudinal movement to the rack 183, which is guided in the fixed guide 174 by means of the slides 180 and 181.

It will be understood that owing to the engagement of the rod 188 in the radial groove 191, and to the variable effective length of the said rod, in combination with the adjustability of the racks 178 and 183 with regard to the gear-wheel 184, the travel of the rack 183 can be varied within wide limits without exchanging or replacing any part of the mechanism. The rack 183 controls the movement of the part which grips the cut paper and feeds the latter to the mandrel. For this purpose the slide 181 is provided with an angular arm 200 having a slot 201 into which a cylindrical or squared socket 203 (Fig. 13) is adjustably fixed by means of a bolt 202, said socket supporting a vertical axle 204 to which a gear-wheel 205 is fixed above the socket 203 and above a squared portion of the said axle. To the latter is fixed a vertical support 206 provided with an arm 207 which terminates in a socket 208 into which engages the rod 209 of a gripper 210 arranged at right angles with regard to the said rod.

To the support 206 is pivoted at 211, an arm 212 terminating in a socket 213 similar to the socket 208. A spring 215 is attached to an extension 214 of this arm and to the bent end 216 of the support 206. Into the socket 213 engages the rod 217 of a gripper 218 placed at right angles with regard to the said rod and situated in the plane of the lower fixed gripper 210. The gripper 218 is provided with a pad 219 of india rubber or other suitable material which normally bears on the gripper 210. In a lug 220 of the support 206 (Fig. 11) is pivoted at 221 a hook 222 under the action of a spring 223 and adapted to engage with its nose 224 a projection 225 on the extension 214 when the latter is lowered to a sufficient extent, for the purpose of opening the grippers that is to say, the movement of the gripper 218 away from the fixed gripper 210. The hook 222 is also provided with a tail carrying a rod 226 adapted to make contact with a suitable abutment so that the hook is rotated on its pivot 221 to cause the release of the nose 224 from the projection 225. When the extension 214 is lowered to permit the nose 224 to engage the projection 225, the gripper is opened by the raising of the part 218, but on the contrary, when pressure is exerted on the rod 226, the hook 222 is rotated in the reverse direction and is disengaged from said projection 225, whereupon the gripper 218 is lowered onto the fixed gripper 210 by the action of the spring 215. This opening and closing of the grippers 210 and 218 is effected by means of the levers 227 and 228 (Fig. 9) the lever 227 being pivoted on a support 229 (Fig. 9) mounted on the table 112 and serving for opening the gripper when the latter has introduced the paper into the mandrel. One end 230 of said lever 227 bears on a cam 231 mounted on the shaft 120 and the other end carries an adjustable support 232, in which is mounted a rod 233 the position of which can be varied by the rotation of the said support 232 on the end of the lever 227.

The effective length of the rod 233 can be adjusted as desired by means of a set screw 234 so that on the oscillation of the lever 227 under the action of the cam 231 the end of said rod can be caused to act on the extension 214 of the lever 213 of the upper gripper 218 (Fig. 11) and depress said extension sufficiently to allow the nose 224 of the hook 222 to engage the projection 225 previously mentioned. The lever 228 mounted at the other end of the table 112 in a support 235 is adapted to close the gripper at the moment when

it must grip the paper, as will be hereinafter explained. For this purpose the said lever 228 is provided at its end with a small axially rotatable support 236 similar to the support 232 above mentioned and carrying a rod 237 of adjustable length. This rod can be adjusted in such a manner as to be able to engage the tail rod 226 (Fig. 11) of the hook 222, when (after displacement of the support 206 with the rack 183) the hook 222 has cleared the end of the rod 237 which has at this moment been raised by the action of a cam 238 on the end 239 of the lever 228 said cam being on the shaft 120. Consequently at the moment when the gripper is displaced longitudinally with regard to the slide 174 by the rotation of the plate 192, the cam 238 depresses the end 239 of the lever 228 and raises the rod 237 to allow the passage of the gripper mechanism. As soon as this said mechanism has passed, the cam 238 leaves the end 239 of the lever 228, and the latter is then quickly returned by the action of a spring 240 (Fig. 8) so that the suitably adjusted rod 237 is caused to make contact with the rod 226 of the hook 222 and cause the latter to rotate for the purpose of disengaging its nose 224 from the projection 225 and thus release the upper gripper 218 which is thus lowered on to the lower gripper 210. It will thus be understood, that, when the socket 203 travels with the rack 183 the gripper is displaced in a direction parallel to the mandrel 135 and is opened when it is at the end of its travel near the point of the mandrel; it then remains open during the next period during which it advances towards the paper whereupon it is closed at the moment when the lever 228 acts on the rod 226 of the hook 222, and grips the paper carrying it along in its following rearward movement and at the same time introducing its edge into the groove 158 in the mandrel until the lever 227 acting on the extension 214 again opens the gripper. The paper is thus released and carried along by the mandrel to which rotary motion has been imparted in the manner above described.

In the previous description of the action of the gripper only the longitudinal displacement of said gripper parallel to the axis of the mandrel 135 has been dealt with; this movement is sufficient when the gripper can introduce the paper into the groove in the mandrel by a simple rectilinear displacement, but this movement is insufficient when the paper has to be introduced into the mandrel by an edge forming for example a right angle with regard to the direction of the mandrel as is for instance the case with the rectangular piece of paper 93 for the formation of cylindrical tubes under the conditions shown in Fig. 1. In this case the paper must be introduced into the mandrel 135 by the edge produced by the action of the knife 89 and it is consequently necessary to cause the paper to execute a rotary movement in a horizontal plane. This movement is produced by a corresponding rotation of the gripper by the action of the gear wheel 205 mounted on the vertical axle 204 integral with the support 206.

On the rectilinear movement of the socket 203 in which the axle 204 revolves, the gear wheel 205 engages (at a predetermined moment in the travel of the socket 203), a rack 241 adjustably mounted by means of a slot 242 and bolt 243 on an angular arm 244 also adjustably mounted by means of a slot and bolt 245 246 respectively on the end of a bar 247 forming a prolongation of the slide 174 and adjustably mounted on the latter by means of a slot 248 and bolts 249. Owing to this arrangement, when the gear wheel 205 engages the rack 241 the former is given a partial rotation which causes the axle 204 to revolve on its vertical axis and consequently also the support 206 of the gripper. The latter can, therefore, assume a determined angular position, according to the rotation of the gear wheel 205 by its engagement with the rack 241. If the work to be effected requires the gripper, after having made a determined rotation of for instance one quarter revolution, to also carry out a certain rectilinear movement, this result can be obtained by adjustment of the rack 241 and by combining with the arm 247 a guide 250 (Figs. 12 and 13) against which abuts the squared portion of the axle 204, below the wheel 205, so that said axle 204 is held in position after the gear wheel 205 has been disengaged from the rack 241. Fig. 1 shows diagrammatically the action of this arrangement relatively to the tube forming mechanism represented by 27. The support 206 is provided with a rod 251 to which is connected a spring 252 attached at any convenient part of the fixed socket 203. On rotation of the support 206, by the engagement of the gear wheel 205 with the rack 241 as described, the said spring 252 is tensioned and tends to pull back the rod 251 and consequently return the support 206 to its normal position, that is to say, that in which the gripper is parallel to the axis of the mandrel. In order to insure the gripper being held in said position the lower end of the axle 204 carries a collar 253 to which is connected a rod 254 forming an abutment and normally bearing against the lateral surface of the slide 174. Owing to this construction it is evident that on rotation of the support 206 the abutment rod 254 moves away from the surface of the slide 174, against which it is automatically returned by the action of the spring 252 when the latter acts to return the gripper into its normal position after the gear wheel 205 has left the rack 241.

It should be stated that the adjustable mounting of the sleeve 203 in the slot 201 of

the arm 200 combined with the displacement of the rods 209 and 217 carrying the grippers in their respective sockets 208 and 213 permits of giving said grippers any determined position with regard to the mandrels and with regard to the edge of the paper to be gripped and introduced into the mandrels. The rack 241 can also be adjusted in such a manner as to occupy a position corresponding to that of the gear wheel 205, that is to say, according to the position of the socket 203 on the support 200 and also in such a manner as to effect the rotation of the gripper towards the end of its course at any convenient moment when desired. The first adjustment can be obtained by displacing the angular arm 244 on the bar 247 by means of the slot and bolt 245 and 246 and the second by varying the position of the rack 241 on the arm 244 by means of the slot and bolt 242 and 243 or by longitudinally displacing the bar 247 on the slide 174 by means of the slot 248 and bolts 249.

It will be seen from the above description, that the whole of the mechanism represented in Figs. 11, 12 and 13 for feeding the paper to the mandrel is carried by the table 112 and forms as it were a complete tube forming mechanism adapted to be given any predetermined angular position with regard to the driving shaft 107, the direction of rotation of which must obviously always remain the same since it is determined by the direction of rotation of the main driving shaft 17.

As shown diagrammatically in Figs. 1 and 18 each machine usually comprises two complete forming mechanisms. It is owing to the adjustability of these complete forming mechanisms which may be given any position desired with regard to the feed mechanism that the machine can be adapted to the manufacture of tubes of any shape used in practice. Not only can each frame 109 carrying the table 112 be arranged at any suitable part of the table 2 by simply manipulating the bolts in the slots 3 in said table, but the rotary table 112 can also be given any angular position with regard to the longitudinal axis of the machine in such a manner as to permit the introduction of the paper into the mandrel by a simple rectilinear movement of the gripper combined, in some cases, with a rotation of said gripper by the action of gear wheel 205 and rack 241. Fig. 1 shows in this respect one of the most complicated cases to be met with in practice, viz: that of the manufacture of two cylindrical tubes by means of paper with "thinned" edges, this paper being cut into two rectangles 93 and 94 cut by the knives 89 and 91, these rectangles having to be introduced into the mandrels by the edge cut by the longitudinal knife 89 so that the thinned edge 34 of the paper after winding, is outside the tube for the purpose of being pasted. As previously explained the cutting device 32 is provided with supports of the kind shown in Figs. 14 and 15, the arm 64 having the downwardly bent part 87 which permits the passage of the gripper 210, 218, when it is displaced by its driving mechanism. For producing this kind of tube, as shown in Fig. 1 one of the forming mechanisms 28 is arranged in such a manner that the gripper can seize the paper rectangle 94 and introduce it in the mandrel 135 by a simple rectilinear movement. The other forming mechanism shown diagrammatically at 27 must, on the contrary, feed the paper to the mandrel firstly by a rectilinear displacement followed by a relation of the gripper and then by a second rectilinear movement. For this purpose the parts of the gripper together with the position of the rack 241 and of the guide 250 are so adjusted that at the end of its travel the gripper can be caused to occupy the position shown in dotted lines at 255, in Fig. 1, the gripper in this case seizing the paper at the desired distance from its edge cut by the knife 89. When the gripper commences its rearward movement for taking the paper to the mandrel, said gripper is first moved parallel to itself, the squared portion *a* of the axle 204 (Fig. 13) abutting against the guide 250 until at the moment when the gear wheel 205 engages the rack 241, said axle is rotated and the squared portion leaves at this moment the guide 250. Owing to the action of the rack 241 the gripper then passes from the position shown at 256 in dotted lines (Fig. 1) into the position shown in full lines in 257. In this position the gear wheel 205 is disengaged from the rack, 241, and the gripper is held with its parts 210, and 218 in a position parallel to the axis of the mandrel 135; the paper being then introduced into the mandrel during the continued rectilinear movement of the gripper.

By referring to Fig. 18 it will be seen how the same machine can be adapted to the production of absolutely different tubes for instance to the production of tubes formed of triangular pieces of paper as shown at 95 and 96. In this case the two forming mechanisms 27, 28 are arranged symmetrically with regard to the longitudinal axis of the machine and the rotation of the tables 112 on the plates 110 by the displacement of the table supports in the slots 111 permits of giving the mandrel any necessary angular position according to the inclination of the line of cut produced by the knife 89 and according to the edge by which the triangular pieces of paper have to be introduced into the mandrels. In this case the gripper is only given rectilinear movement and the rack 241 can be removed from its support or placed in such a position that it is not engaged by the gear wheel 205 during the reciprocating movement of the gripper. It is

evident that the rotation of the forming mechanisms around the vertical axis of the shaft 117 forming the center of the plate 110 permits of giving the mandrels a variable angular position within very wide limits and consequently in most cases of placing the mandrel in the prolongation of the line of cut produced by the knife 89 (Fig. 18), the position of which line may vary from a position perpendicular to the longitudinal axis of the machine or paper band 33 (when forming cylindrical tubes from paper having unscraped edges) up to a position more or less inclined and approaching the longitudinal axis of the machine according to the greater or less conical shape to be given to the tube.

The general action of the machine will be easily understood from the foregoing detailed description. The paper feed is effected by the feed mechanism diagrammatically shown at 24 in Figs. 1 and 2 as already described. The paper is held by the guide plates 41 and 42 the length of which may vary according to the position of the first cutting device, 31 (see Fig. 1). The grippers 210 and 218 are then caused to advance and seize the paper before the cutting is effected and are held stationary in this position during the action of the knives by the passage past the bevel pinion 195 of the plate 192 of one of the smooth parts 198 of the wheel 196 keyed on the shaft 117 of the forming mechanism.

After the cutting is effected the grippers retire, carrying with them the paper and guiding it to the mandrel. After the paper has been introduced into the mandrel the movement of the plate is again stopped and consequently the support 206 and the gripper carried by the latter. The gripper is at this moment opened under the action of the lever 227 and the paper is carried along by the mandrel which is rotated in the manner already indicated. The formation of the tube is then finished as previously explained in detail. During the removal of a completed tube, the grippers 210, 218 again advance to seize the fresh paper sheets which have in the meantime been fed by the feeding mechanism.

By comparison of Figs. 1 and 18 it will be seen that for the purpose of passing from the production of one form of tubes to that of an absolutely different form it is sufficient to replace the knives arranged on the cutting devices, by other knives having a profile suitable to the shape of cut to be produced on the paper, to then adjust the frames 109 on the table 2 and finally to rotate the whole forming mechanism on the vertical shaft 117 in such a manner as to bring the mandrels into the desired position either for the direct introduction of the paper into the mandrels by a simple rectilinear movement of the grippers or by such rectilinear movement combined with a rotary movement as is shown in Fig. 1 with regard to the forming mechanism 27. This adjustment of the machine must however be completed by a suitable adjustment of the position of the driving gears 25 and 26 of the forming mechanisms and by a corresponding adjustment of the position of the driving cams 29 and 30 of the cutting devices. These adjustments can be effected in the simplest manner, the said pinions and driving cams being adapted to be keyed in any suitable position on the shaft 17, for instance by means of a key 259 (Fig. 2) secured by a set-screw 258. Also the bevel pinion 115 of each forming mechanism mounted on the shaft 107 (Fig. 6,) can be keyed by the same means in any suitable position on said shaft that is to say, the shaft 107 can be slid axially in its bearings 105 in such a manner that the vertical shaft 117 of the forming mechanism can be approached more or less to the driving shaft 17 while the pinion 115 is still in gear with the pinion 116 (Fig. 6). The form of mandrel 135 must obviously be suited to the production of each special form of tube and must therefore similarly to the knives be considered as an element subject to be replaced, according to the form of tube to be produced.

As clearly set forth above the position and travel of the grippers which feed the paper to the forming mechanism can be easily adjusted according as desired for each case without necessitating the use of auxiliary or exchangeable parts. Whatever the form of tube to be produced by the machine it will be seen that the introduction of the paper into the forming mechanism always takes place at the bases of the mandrels thus obviating an important cause of waste in the machines hitherto known.

In the machine above described the particular details of mechanical construction shown can be replaced by equivalents without departing from the spirit of the invention.

I declare that what I claim is:

1. In a machine for producing tubes of various shapes, feed mechanism, cutting mechanism, tube-forming mechanism, and means whereby the relative positions of said tube-forming mechanism and the feed mechanism may be varied for the purpose of producing tubes of different shapes.

2. In a machine for the production of tubes, mechanism normally in a fixed predetermined position for feeding sheet material to a cutting mechanism, cutting mechanism adjacent to the path of said sheet material, tube-forming mechanism, and means for varying the relative positions of said tube-forming mechanism and the feed mechanism according to the shape of the tubes to be produced in the machine.

3. In a machine for the production of

tubes, a feed mechanism, cutting mechanism, and a tube-forming mechanism, said tube-forming mechanism being mounted on a table which is movable on a vertical axis, and means whereby the tube-forming mechanism may be shifted to various positions relative to the feed mechanism according to the shape of the tubes to be produced.

4. In a machine for the production of tubes of various shapes, a feed mechanism, cutting mechanism, means for varying the position of said cutting mechanism relative to the feed mechanism, a tube-forming mechanism, and means for adjusting the tube-forming mechanism relative to said feed mechanism and the cutting mechanism.

5. In a machine for the production of paper tubes, the combination of a supporting frame, a feed mechanism mounted on said frame, cutting devices adjustably mounted on said frame, forming mechanisms, a displaceable frame adapted to support said forming mechanisms and means for imparting rotation to said forming mechanisms on said displaceable frame, to cause them to occupy any desired angular position with regard to the feed mechanism.

6. In a machine for the production of paper tubes, the combination of a supporting frame, a feed mechanism mounted on said frame, cutting devices adjustably mounted on said frame, forming mechanisms, a displaceable frame, a table rotatably mounted on said displaceable frame and adapted to carry said forming mechanisms, and driving mechanism adapted to actuate said forming mechanisms in the various positions of said table on the displaceable frame.

7. In a machine for the production of paper tubes, the combination of a supporting frame, a feed mechanism mounted on said frame, cutting devices also mounted on said frame, forming mechanisms each comprising a paper winding device, a pasting device, a pressing device, a removing device, and mechanism for feeding the paper to said winding device, a displaceable frame, and a table pivoted on said displaceable frame and adapted to carry said forming mechanisms.

8. In a machine for the production of paper tubes, the combination of a supporting frame, a feed mechanism mounted on said frame, cutting devices also mounted on said frame forming mechanisms each comprising a paper winding device, a pasting device, a pressing device, a removing device and a reciprocating device for feeding the paper to the winding device by a single rectilinear movement, a displaceable frame, and a table pivoted on said latter frame and adapted to carry said forming mechanisms.

9. In a machine for the production of paper tubes, the combination of a supporting frame, a feed mechanism mounted on said frame, cutting devices adjustably mounted on said frame, a displaceable frame on the said supporting frame, a table adapted to rotate on said displaceable frame and a forming mechanism carried by said table, said latter mechanism comprising a paper winding device, a pasting device, a pressing device, a removing device, a device for feeding the paper to said winding device, and means for operating said feed device for giving thereto an alternate reciprocating movement in a straight line and a rotary movement about its own axis.

10. In a machine for the production of paper tubes, the combination of a supporting frame, a feed mechanism mounted on said frame, cutting devices adjustably mounted on said frame, a frame displaceable on said supporting frame, a table adapted to rotate on said displaceable frame and a forming mechanism carried by said table and comprising a paper winding device, a pasting device, a pressing device, a removing device, a device for feeding the paper to said winding device, and means for operating said feeding device for giving thereto a variable and adjustable rectilinear displacement and, also, a motion of rotation about its own axis.

11. In a machine for the production of paper tubes, the combination of a supporting frame, a feed mechanism mounted on said frame, cutting devices adjustably mounted in said supporting frame, other frames displaceable in said supporting frame, tables adapted to rotate on said displaceable frames, a forming mechanism carried by each of said tables and comprising a paper winding device, a pasting device, a pressing device, a removing device and a paper feed device, and mechanism for simultaneously actuating said feed mechanism, cutting devices and forming mechanisms.

12. In a machine for the production of paper tubes, the combination of a supporting frame, a feed mechanism mounted on said frame, tube forming mechanisms and cutting devices each of the latter comprising an adjustable support, a vertical shaft carried by said support, a knife carried by said vertical shaft, a movable arm adapted to oscillate at the end of said vertical shaft, a knife carried by said movable arm, a sleeve adapted to control said movable arm, and to slide on said vertical shaft, a lever operating said sleeve, and means whereby said lever may occupy any desired angular position with regard to the position of the knives.

13. In a machine for the production of paper tubes the combination of a supporting frame, a feed mechanism mounted on said frame, cutting devices adjustably mounted on said supporting frame, other frames displaceable on said supporting frame, tables adapted to rotate on said displaceable frames, forming mechanisms carried by said tables, a main driving shaft secondary driving shafts

carried by the aforesaid displaceable frames, a vertical shaft located in each displaceable frame and constituting a pivot for said table, and transmitting gearing between said vertical shaft and the forming mechanism carried by the table.

14. In a machine for the production of paper tubes, the combination of a supporting frame, a feed mechanism mounted on said frame, cutting devices adjustably mounted on said supporting frame, frames displaceable on said supporting frame, a main driving shaft, secondary shafts carried by said displaceable frames, a vertical shaft carried by each displaceable frame and actuated by the corresponding secondary driving shaft, a table adapted to rotate on the displaceable frame on said vertical shaft, forming mechanisms carried by said table and consisting of a pasting device, a pressing device, a removing device and a paper feed device, said various forming mechanisms being actuated by the vertical shaft which serves as a pivot for the aforesaid table.

15. In a machine for the production of paper tubes, the combination of a supporting frame a feed mechanism mounted on said frame, cutting devices adjustably mounted on said supporting frame, frames displaceable on said supporting frame, a main driving shaft, secondary driving shafts carried by the displaceable frames, a vertical shaft carried by each displaceable frame and actuated by the corresponding secondary driving shaft, a table carried by each displaceable frame and adapted to rotate on said vertical shaft, forming mechanisms carried by said table and adapted to be actuated by said vertical shaft in any position of the table on its displaceable frame, a paper feed device, means operated by said vertical shaft for giving to said paper feed device a reciprocating movement, and means for regulating the travel of said paper feed device.

16. In a machine for the production of paper tubes, the combination of a supporting frame, a feed mechanism mounted on said frame, cutting devices adjustably mounted on said supporting frame, two displaceable frames adapted to occupy any position on the supporting frame, a table adapted to rotate on each of said displaceable frames, a forming mechanism carried by each of said tables a main driving shaft extending longitudinally of the axis of the supporting frame and adapted to simultaneously actuate said feed mechanism, cutting devices and forming mechanisms, and means for actuating each forming mechanism in either of its adjusted positions relative to the main driving shaft.

17. In a machine of the class described, means for feeding material in sheet form, means for cutting said sheet material longitudinally and transversely, thereby producing tube-blanks, a plurality of tube-forming mechanisms in coöperative relation to the aforesaid cutting means and means for supplying said tube-blanks to the tube-forming mechanisms.

18. In a machine of the class described, means for feeding material in sheet form, a plurality of cutting mechanisms each having means for cutting the sheet material in two directions and thereby produce tube-blanks of the required shape and area, a plurality of tube-forming mechanisms, and tube-blank feed devices in coöperative relation to the aforesaid cutting mechanisms for receiving the tube-blanks subsequent to the operation of cutting them from the sheet material, said feed devices operating to deliver tube-blanks to the individual tube-forming mechanisms.

19. In a machine of the class described, means for feeding material to be treated, cutting mechanism adjacent to the path of feed and having means operating to cut said material in two directions for producing tube-blanks of the required shape and size, and a plurality of tube forming mechanisms in cooperative relation to said cutting mechanism; each tube-forming mechanism being shiftable to various positions relative to the line of feed of the material and adapted to operate on the different kinds of tube-blanks which are cut from the material by the cutting mechanism.

20. In a machine of the class described, means for feeding material to be treated, cutting mechanism operating to produce tube-blanks from the material, a plurality of tube-forming mechanisms adjustable individually to various positions relative to the path of feed of said material, and tube-blank feed devices in coöperative relation to the tube-forming mechanisms and operating adjacent to the cutting mechanism for feeding tube-blanks to the tube-forming mechanism.

21. In a machine of the class described, means for feeding material, and a plurality of cutting mechanisms for operating on said material, to produce tube-blanks therefrom, said cutting mechanisms being constructed for the production of oblong or arcuate tube-blanks, and a plurality of tube-forming mechanisms each adjustable as an entirety to various positions relative to said cutting mechanisms.

22. In a machine of the class described, feed mechanism for the material, a plurality of tube-blank cutting mechanisms mounted relative to the path of feed of the material and each having means operating to cut the material in two directions for producing tube-blanks which may vary in size and shape, a plurality of tube-forming mechanisms each adjustable to various positions relative to the path of feed of the material, and means whereby the cut tube-blanks are supplied to the individual tube-forming mechanisms.

23. In a machine of the class described,

means for feeding the material to be treated, a plurality of cutting mechanisms each having means for cutting the material in two directions, and producing therefrom at each operation a plurality of tube-blanks of a predetermined shape and size, and a plurality of independent tube-forming mechanisms adjustable individually to various positions relative to the cutting mechanisms.

24. In a machine of the class described, feed mechanism for the material, tube-forming mechanism, and means whereby the tube-forming mechanism may be shifted to a position parallel to the path of feed of the material or at an angle to the path of said material according as it is desired to produce cylindrical or conical tubes.

25. In a machine of the class described, feed mechanism for sheet material, tube-forming mechanism provided with a mandrel, means whereby the relation of the tube-forming mechanism to the path of feed of the material may be changed so as to cause the mandrel to be parallel or at an angle to the said path of feed of the material, and means for conveying material to the mandrel in either of its adjusted positions.

26. In a machine of the class described, mechanism for producing tube-blanks which are of different shapes, tube-forming mechanism provided with a mandrel, means for feeding said tube-blanks to said tube-forming mechanism, means for changing the position of the tube-forming mechanism relative to the line of feed of said tube-blanks, whereby said mandrel is adapted to lie substantially parallel to, or at an angle to, the path of feed of said tube-blanks, and means for conveying the tube-blanks to the base of said mandrel when it is either parallel or at an angle to the path of feed of said material.

27. In a machine of the class described, feed mechanism for sheet material, tube-forming mechanism, means whereby the relative positions of said feed mechanism and the tube-forming mechanism to one another may be varied according to the shape of the tube which it is desired to produce, means for producing from the sheet material different shapes of tube-blanks, and means whereby tube-blanks of predetermined shapes are fed to the tube-forming mechanism in either position thereof relative to said feed mechanism.

28. In a machine of the class described, feed mechanism for sheet material, tube-forming mechanism, provided with a mandrel, means whereby the relative positions of said feed mechanism and the tube-forming mechanism to each other may be varied according to the shape of the tube which it is desired to produce, cutting mechanism having means for producing from the sheet material different shapes of tube-blanks, and means for conveying tube-blanks of different shapes to the mandrel of said tube-forming mechanism.

29. In a machine for making cylindrical and conical tubes, feed mechanism for sheet material, tube-forming mechanism, means whereby the relative positions of the feed mechanism and the tube-forming mechanism may be varied according as it is desired to produce cylindrical or conical tubes, cutting means for producing from the sheet material tube-blanks which are either substantially square in shape or of approximately triangular contour, and means for conveying such tube-blanks to the tube-forming mechanism.

30. In a machine of the class described, feed mechanism for sheet material, a plurality of tube-forming mechanisms each provided with a mandrel, means whereby the relative position of the mandrel of each tube-forming mechanism to the path of feed of the sheet material may be varied according as it is desired to produce cylindrical or conical tubes, a plurality of cutting means for producing from the sheet material tube-blanks which are either substantially square in shape or of approximately triangular contour, and means for conveying tube-blanks of either shape to the bases of the mandrels of the respective tube-forming mechanisms.

In testimony whereof I have signed my name to this specification in the presence of two subscribing witnesses.

JEAN GOHY.

Witnesses:
I. T. Le Cost,
J. Leclerc.