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(54) **Improved method and apparatus for automatic packing of stockings.**

(57) Stockings is folded about a cardboard insert, embraced by a covering paper and enclosed in a film envelope while intermittently forwarded along a given path of travel by automatic operation of a series of assemblies arranged one after another along the path of travel.

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IMPROVED METHOD AND APPARATUS FOR AUTOMATIC PACKING OF STOCKINGS

Background of the invention

The present invention relates to improved method and apparatus for automatic packing of stockings, and more particularly relates to a fully automatic system for enclosing stockings, such as seamless stockings and pantyhoses, folded around a cardboard insert and wrapped by a covering paper in an envelope of transparent, thermoplastic material such as thermoplastic systhetic resin.

Although the following description is focussed upon application to stockings only, the present invention is more generally applicable to packing of a wide variety of substantially flat, relatively long, non-rigid and foldable articles.

Reverting to packing of stockings in an envelope, one cycle of operation usually includes the step of placing stockings in an extended state in position on a given

operating station, the step of placing a cardboard insert about the center of the extended stockings, the step of provisionally fixing the position of the insert relative to the stockings, the step of folding end sections of the stockings about the insert in a manner to cover the insert with the stockings, the step of wrapping the folded stockings with a covering paper for decoration and advertising purposes, the step of feeding an envelope to a prescribed stand-by position with its mouth open, the step of conveying the stockings wrapped by the covering paper to a prescribed position in line with the envelope resting at the stand-by position, the step of enclosing the stockings with the insert and the covering paper in the envelope, and the step of sealing the mouth of the envelope,

Various systems have been already proposed and used in practice for automatic packings of stockings. For example, a novel system of this sort has already been proposed by the inventor of the present invention as disclosed in US. Patent Application Ser. No. 185,630 filed on 10th September, 1980 (EPC Application No. 80850132.4 filed on 17th September, 1980).

In accordance with this previous system, stockings placed in position on a manual setting station is automatically passed to a conveyer assembly by a transfer assembly which is accompanied with an insert feeder assembly for periodically feeding a cardboard insert about the center of the stockings held in an extended state by the transfer assembly. The insert is then periodically fixed relative to the stockings by an insert gripper assembly. While the gripper assembly is in operation, both longitudinal end section of the extended stockings are folded together around the insert by a stockings folder assembly. The folded stockings is then released from hold by the transfer assembly and passed to a position in line with an envelope by a conveyer assembly. At the position, the stockings folded around the insert is packed in the envelope of thermoplastic material by a stockings encloser assembly.

The insert is generally made of cardboard and takes the form of a flat rectangular card or a foldable card composed of three sections boardered by folds, on section being usually provided with some advertising or other descriptive designs.

When the flat rectangular insert is used, however, no advertising or other descriptive designs are printed on the

insert since the insert has to be fully covered by the stockings before packing in the envelope. Even using such a blank insert, it is often required to give some advertising and/or decorative descriptions and designs for the stockings to be sold in order to what consumer's interest. Covering papers are additionally used to suffice this requirement on which such descriptions and/or designs are printed. Such covering papers are generally made of a thin material and wrapped around the stockings, which is folded about the insert, before packing in the envelope. As a consequence, preparation of packed stockings includes an additional step of wrapping such a covering paper around folded stockings, when such covering papers are used for the purpose mentioned above.

The above-described automatic packing system previously proposed by the inventor lacks in an expedient to carry out such automatic wrapping of each stockings with a covering paper.

Summary of the invention

It is one object of the present invention to provide

improved method and apparatus for carrying out, in packing of stockings, at least the steps from the initial placing of stockings in position on an operating station to enclosing and sealing the stockings folded about an insert and wrapped with a covering paper in envelope, in a fully automatic fashion.

It is the other object of the present invention to provide improved method and apparatus for carrying out such automatic packing of stockings without any damage on the quality of the stockings.

In accordance with the basic aspect of the present invention, a series of operation assemblies are arranged in succession on an elongated base plate along the path of travel of stockings. A covering paper feeder assembly is arranged at one longitudinal end of the base plate in order to periodically feed each covering paper to a prescribed position whereat end sections of the covering paper is folded upwards by a paper ends raiser assembly. After stockings in an extended state is manually placed on the center of the covering paper, a cardboard insert is placed on the center of the stockings by an insert feeder assembly and both longitudinal end sections of the extended stockings are folded

about the insert by a stockings folder assembly. After the folded stockings is pressed on the insert by a stockings pressor assembly, a covering paper folder assembly folds the raised end sections of the covering paper down on the pressed stockings which is then passed to a prescribed position by a stockings transferer assembly. Finally the stockings folded about the insert and wrapped with the covering paper is packed in an envelope placed at a stand-by position by a stockings encloser assembly.

Description of the drawings

Fig. 1 is a plan view of one embodiment of the apparatus in accordance with the present invention,

Fig. 2A is a front view of the upstream sections of the apparatus shown in Fig. 1,

Fig. 2B is a front view of the downstream sections of the apparatus shown in Fig. 1, mainly showing the stockings encloser assembly,

Fig. 3 is a section taken along the line III - III in Fig. 1, mainly showing the covering paper feeder assembly,

Fig. 4 is a view, partly in section, shown in the direction of the arrow IV in Fig. 1, mainly showing the covering paper feeder assembly,

Fig. 5 is a section taken along the line V - V in Fig.1, mainly showing the paper end raiser assembly,

Fig. 6 is a section taken along the line VI - VI in Fig. 1, mainly showing the stockings folder assembly,

Fig. 7 is a section taken along the line VII - VII in Fig. 1, mainly showing the insert feeder assembly,

Fig. 8 is a section taken along the line VIII - VIII in Fig. 1, mainly showing the stockings transferer assembly,

Fig. 9A and 9.0 are views for showing the sequential steps of the method in accordance with the present invention,

Fig. 10 is a plan view of the other embodiment of the insert feeder assembly advantageously usable for the apparatus in accordance with the present invention,

Fig. 11 is a sectional side view of the insert feeder assembly shown in Fig. 11,

Fig. 12 is a section taken along the line XII - XII in Fig. 12,

Fig. 13 is a plan view of the other embodiment of the stockings folder assembly advantageously usable in combination with the insert feeder assembly shown in Figs. 10 and 11,

Fig. 14 is a front view of the stockings folder assembly shown in Fig. 13,

Fig. 15 is a side view of the stockings folder assembly shown in Fig. 13,

Figs. 16a to 16D are simplified front views for showing the sequential operation of the stockings folder assembly shown in Figs. 13 to 15,

Figs. 17 and 18 are plan and front views of the other embodiment of the stockings encloser assembly advantageously usable for the apparatus in accordance with the present invention,

Fig. 19 is a section taken along the line XX - XX in Fig. 18, mainly showing the conveyer plate driving mechanism, and

Fig. 20 is a section taken along the line XX - XX in Fig. 18, mainly showing the envelope feeding mechanism.

Description of the prefered embodiments

As breifly described already, the appratus of the present invention includes, as its major components, a covering paper feeder assembly 101, a paper ends raiser assembly 201, an insert feeder assembly 301, a stockings folder assembly 401, a stockings pressor assembly 501, a covering paper folder assembly 601, a stockings transferer assembly 701 and a stockings encloser assembly 801.

In Fig. 1, an elongated, horizontal base plate 2 is mounted to the pedestal 1 of the apparatus and the covering

paper feeder assembly 101 is arranged on the one end, on the right end in the illustration, of the base plate 2. As later described in more detail, this feeder assembly 101 periodically feeds covering papers, one for each motion cycle, to a prescribed position on the base plate 2. The paper ends raiser assembly 201 is arranged next to the feeder assembly 101 in order to raise almost upright both end sections of each covering paper fed by the feeder assembly 101. This raiser assembly is followed by the insert feeder assembly 301 which, after stockings in an extended state is manually placed in position on the center of the covering paper, feeds a cardboard insert onto the center of the stockings. At a position close to the insert feeder assembly 301, the stockings folder assembly 401 is arranged on the base plate 2 in order to fold both end sections of the stockings on the cardboard insert placed thereon. After this folding, the stockings are pressed on the cardboard insert for shaping by the stockings pressor assembly 501. Next, the covering paper folder assembly 601 fold the raised end sections of the covering paper down on the pressed stockings in order to wrap the stockings with the covering paper. The stockings transferer assembly 701 is arranged on the downstream side of the covering paper folder assembly 601 in order to transfer the stockings wrapped with the covering paper to a prescribed position on the extension of

the center line of a synthetic resin film envelope which has already been fed to the stand-by position. This transferer assembly 701 is followed by the stockings encloser assembly 801 which, after receipt of the stockings wrapped with the covering paper, encloses same into the film envelope at the atand-by position, and discharge the envelope including the stockings onto a conveyer belt connected to the next operation station. This encloser assembly 801 is located on the other end, on the left end in the illustration, of the base plate 2.

A driving mechanism for the above-described assemblies is shown in detail in Figs. 2A and 2B. A cam shaft 3 is horizontally mounted to the pedestal 1 for rotation whilst extending in the longitudinal direction of the base plate 2, and fixedly holds a plurality of cams of different profiles. A pair of horizontal shafts 4 and 5 are secured to the pedestal 1 in parallel to the cam shaft 3, and carry cam levers each of which has a proximal end idly inserted over either shaft 4 or 5 and a distal end carrying a cam follower in contact with an associated cam on the cam shaft 3. Each cam lever is operationally coupled, by means of a connecting rod or the like, to an associated assembly which is thereby driven for operations at prescribed timings.

More specifically, the cam shaft 3 is connected, via a suitable reduction gear, to a given driving source (not shown) mounted to the pedestal 1. Upon rotation of the cam shaft 3, the cam levers are driven for swing motion about the shafts 4 or 5 by means of the cams and the associated cam followers in order to cause operations of the associated assemblies by means of the connecting rods or the like. The cam shaft 3 is accompanied with a suitable control mechanism (not shown) which causes intermittent 360° rotation of the shaft 3.

Covering paper forwarding mechanism

An opening is formed in the base plate 2 whilst extending in the longitudinal of the latter and a pair of parallel guide rails 7 are arranged in the opening whose top surfaces are flush with the base plate 2. A plurality of spaced forwarding members 6 are movable along the guide rails 7 for stable transportation of the covering papers. An elongated slot 8 is left between the pair of guide rails 7. An endless chain 12 is arranged under this elongated slot 8 and stretched for circulation a pair of sprockets 9 and 10 and an intermediate sprocket 11. The above-described forwarding members 6 are mounted at equal intervals to the

endless chain 12 in order to transport the covering papers along a prescribed straight path of travel on the base plate 2.

As shown in Fig. 3, each forwarding member 6 is made up of a base section fixed to an associated attachment 12' on the endless chain 12, an intermediate section accommodated in the elongated slot 8 between the guide rails 7, and a bifurcated top section projecting above the base plate 2. As the endless chain 12 circulates, each covering papers are caught by the top section of each forwarding member 6 and passed from assembly to assembly long the above-described straight path of travel on the base plate 2. As long as the covering papers can be transported stably, any different types of forwarding members 6 are usable for practice of the present invention.

The endless chain 12 is operationally coupled to the cam shaft 3 by means of a transmission gear mechanism 20 shown in Figs. 2A and 3 and thereby driven for circulation in the direction of an arrow Q shown in Fig. 2A. The transmission gear mechanism 20 includes a gear 21 coaxially fixed to the end sprocket 9, a gear 23 coupled to the gear

21 by means of a double gear 22, a ratchet wheel 25 fixed to the shaft 24 of the gear 23 and a swing lever 27 provided with a pawl 26 in meshing engagement with the ratchet wheel 25. The proximal end of the swing lever 27 is idly inserted over the shaft 24. The distal end of this swing lever 27 is connected, by means of a connecting rod 29, to the distal end of a cam lever 28 whose proximal end is idly inserted over the horizontal shaft 4. As shown in detail in Fig. 3, the cam lever 28 is provided with a cam follower 31 in surface contact with an eccentric cam 30 fixed to the cam shaft 3. This pressure contact is constantly maintained by a tension spring 32 arranged between the distal end of the cam lever 28 and the pedestal 1 of the apparatus.

As the cam shaft 3 rotates rotation of the eccentric cam 30 causes, by means of the cam follower 31, cam lever 28 and connecting rod 29, corresponding swing motion of the swing lever 27 about the shaft 24 and, thereupon, the pawl 26 held by the swing lever 27 rotates the ratchet wheel 25 in the counterclockwise direction, i.e. in the direction of an arrow R in Fig. 2A, over one pitch. This one pitch rotation of the ratchet wheel 25 is transmitted, via the gears 23, 22 and 21, to the sprocket 9 which in turn causes corresponding one pitch circulation of the endless chain 12. In

this way, one complete rotation of the cam shaft 3 reliably causes, via the transmission gear mechanism 20, corresponding one pitch circulation of the endless chain 12. The distance of this one pitch circulation is equal to the interval between adjacent forwarding members 6 arranged on the endless chain 12.

Covering paper feeding assembly 101

The construction of the covering paper feeding assembly 101 is shown in detail in Figs. 1, 2A, 3 and 4 and will hereinafter be explained in reference to these drawings.

The covering paper feeding assembly 101 includes a stacking mechanism 102 and a feeding mechanism 103. The stacking mechanism 102 keeps a lot of covering papers in a flat, stacked state. Whereas, the feeding mechanism 103 takes the uppermost covering paper of the stack and feed same to a prescribed upstream position on the path of travel of the forwarding members 6.

An example of the covering paper 40 is shown in Fig. 9A,

in which the covering paper 40 is square in shape and has a pair of spaced parallel fold lines 40a and 40b, which demarcate a center section 40d and a pair of end sections 40c and 40C.

Reverting to Figs. 1 and 4, the stacking mechanism 102 includes a reservoir 104 for the covering papers 40 which extends forwards from the pedestal 1 and is coplanar with the base plate 2. The reservoir 104 is made open on its front, top and bottom sides and accmmodates a supporting plate 105 for the stack of the covering papers 40 which is shiftable in the vertical direction. A vertical slot 106 is formed in the left side of the reservoir 104 almost over the entire length and a slider 108 is slidably coupled, through the slot 106, to a vertical guide 107 arranged outside the reservoir 104. This slider 108 fixedly carries the supporting plate 105 within the reservoir 104. The vertical guide 107 is secured to the left side of the reservoir 104 by means of upper and lower brackets 109 and 110.

On both lateral sides of the reservoir 104, a pair of horizontal brackets 111 and 112 are fixed to the pedestal 1 whilst extending forwards and the one bracket 112 further

fixedly holds a pair of auxiliary brackets 113 and 118 on its side face at positions between its proximal and distal ends. The front side auxiliary bracket 113 rotatably holds a rod 117 on which a worm gear 116 is fixed whereas the rear side auxiliary brackets 118 also rotatably holds a rod 119 on which a gear 120 is fixed. The two rods 117 and 119 are coupled one another at their mating ends by means of a clutch 121. A coil compression spring 128 is coaxially inserted over the rear side rod 119 in order to press the clutch 121 towards the front side rod 117 for constant connection between the two rods 117 and 119. A lever 122 is attached to the clutch 121 so that manual operation on the lever 122 presses the clutch 121 towards the rear side rod 119 against the repulsion of the compression spring 128 in order to cancel the connection between the two rods 117 and 119.

As shown in Fig. 4, a chain 124 in engagement with the gear 120 on the rear side rod 119 is connected at the one end to the slider 108 on the vertical guide 117 and at the other end to a weight 123. A horizontal shaft 114 is rotatably carried by the right side bracket 111 and the auxiliary bracket 113 on the left side bracket 112 and a worm 115 fixed to the left end of this shaft 114 is in

meshing engagement with the worm gear 116 on the front side rod 117. A ratchet wheel 129 is fixed to the right side end, i.e. the end closer to the right side bracket 111, of the horizontal shaft 114. An air cylinder 126 is mounted to the pedestal 1 with its piston rod 126a being coupled to the distal end of a swing lever 127 whose proximal end is idly inserted over the shaft 114. The swing lever 127 has a pawl 125 for meshing engagement with the ratchet wheel 129. A micro switch 130 is arranged over the reservoir 104 in order to control the operation of the air cylinder 126.

The feeding mechanism 103 includes a feeder arm 131 and a lifter arm 132 for causing vertical motion of the feeder arm 131. The feeder arm 131 catches by suction the uppermost covering paper 40 of the stack in the reservoir 104 and feeds same to a prescribed position on the path of travel of the forwarding members 6.

As shown in Fig. 1, the feeder arm 131 a horizontally L-shaped construction and its front section 131a is provided with suction mouths 133 which is connected to a given pneumatic suction source (not shown) for provisional holding of the covering paper 40. The feeder arm 131 is further

provided at its apex 131b with a roller 134 for rolling contact with the lifter arm 132. As shown in Fig. 3, the rear section 131c of the feeder arm 131 is pin connected to the upper end of a crank lever 136 whose apex is idly inserted over a horizontal shaft 135. The lower end of the crank lever 136 is coupled, by means of a connecting rod 137, to the distal end of a cam lever 141 whose proximal end is idly inserted over the horizontal shaft 4. This cam lever 141 rotatably carries a cam follower 140 which is brought into constant pressure contact with a cam 139 on the cam shaft 3 by means of a tension spring interposed between the cam lever 141 and the pedestal 1. As the cam 139 rotates over 3600, the feeder arm 131 is driven, via the connecting rod 137 and the crank lever 136, for reciprocation between the position just above the reservoir 104 (shown with solid lines in Fig. 1) and the above-described prescribed position on the path of travel of the forwarding members 6 while the roller 134 carried by the feeder arm 131 rolls on the lifter arm 132.

The lifter arm 132 extends horizontally in parallel to the rear section 131c by the feeder arm 131 so that the roller 134 om the feeder arm 131 can roll along its top

surface. A guide 142 is mounted to the pedestal in a coplanar arrangement with the base plate and provided with a guide slot running in the longitudinal direction of the lifter arm 132. The lifter arm 132 is provided on its bottom surface with a pair of guide rods 143 and 144 which extend downwards through the above-described guide slot in the guide 142. A swing lever 146 is pivoted at its distal end to a shaft 145 fixed to the pedestal and coupled at its distal end to the lower end of the one guide rod 143 by means of a connecting rod 147. This swing lever 146 is accompanied with a tension spring 148 which urges the lever to turn clockwise about the shaft 145 in Fig. 3. Another connecting rod 149 is pivoted at its upper end to the body of the swing lever 146 and, at its lower end, to one end of a cam lever 152 which is idly mounted to the horizontal shaft 5. The other end of the cam lever 152 rotatably carries a cam follower 151 in surface pressure contact with a cam 150 fixed to the cam shaft 3. As the cam 150 rotates over 360°, the lifter arm 132 is driven for two cycles of vertical motion via the swing lever 146, the connecting rods 147 and 149, and the guide rod 143.

The feeder and lifter arms 131 and 132 cooperate as follows. At the start of the operation for feeding the

covering paper, the feeder arm 131 is located above the uppermost covering paper 40 in the reservoir 104 as shown with solid lines in Fig. 1 and the lifter arm 132 rests at a level above the base plate 2.

As the cams 139 and 150 are driven for rotation over 360°, the lifter arm 132 moves downwards with the front section 131a of the feeder arm 131 so that the suction mouths 133 on the front section 131a approach and catch by suction the uppermost covering paper 40 in the reservoir 104. Then the lifter arm 132 moves upwards to its initial position above the base plate 2. Due to swing motion of the crank lever 136 caused by rotation of the cam 139, the roller 134 on the feeder arm 131 rolls on the lifter arm 132 rearwards. Accordingly, the front section 131a of the feeder arm 131 moves rearwards away from the initial position above the reservoir so that the covering paper 40 caught by the suction mouths is transported to a position above the prescribed position on the path of travel of the forwarding members 6. Subsequent lowering of the lifter arm 132 and cancel of the pneumatic suction on the suction mouths 133 allow falling of the covering paper 40 on the prescribed position. Thereafter, continued rotation of the cams 139 and 150 returns the feeder and lifter arms 131, 132

to their initial positions.

The feeder arm 131 is driven for the one cycle reciprocation during the two cycle vertical reciprocations of the lifter arm 132 for feeding of each covering paper. These cyclic movements of the feeder and lifter arms 131, 132 are controlled by rotation of the cams 139 and 150 on the cam shaft 3.

The air cylinder 126 (see Fig. 4) is energized in synchronism with the above-described feeding operation by the feeder arm 131 and lifts little by little the supporting plate 105 so that the uppermost covering paper 40 in the reservoir 104 should always be kept flush with the base plate 2 on the pedestal 1. More specifically, the air cylinder 126 causes, when energized, swing motion of the swing lever 127 about the shaft 114 via the piston rod 126a and, thereupon, the pawl 125 on the swing lever 127 rotates the ratchet wheel 129 over one pitch. This rotation is transmitted to the gear 120 on the rear side rod 119 via the intermediate elements 115, 116 and 121. Rotation of the gear 120 lifts the supporting plate 105 in the reservoir 104 via the chain 124 and the slider 108.

Preferably, one cycle operation of the air cylinder 126 causes lift of the supporting plate 105 over a distance corresponding to the thickness of each covering paper 40 which is usually equal to about 0.1 mm. Due to any malfunction of the air cylinder 126 and/or any external factors, one cycle lift of the supporting plate 105 may unexpectedly exceed this limit and the uppermost covering paper 40 in the stack may project from the top face of the base plate 2. The above-described micro switch 130 is provided for detection of this situation. The projecting top face of the uppermost covering paper 40 under such a condition contacts the micro switch 130 which thereupon disenables the air cylinder 120 when the next cycle feeding operation is carried out by the feeder arm 131. When the top face of the uppermost covering paper 40 has resumed the ordinary level flush with the base plate 2, the micro switch 130 cancels its control on the air cylinder 126 which is then enabled again.

When the stack of the covering papers 40 in the reservoir 104 is totally consumed after repeated feeding by the feeder arm 131, the lever 122 of the clutch 121 is manually operated in order to disconnect the rods 117 and 119 from each other and free the rod 119. Then, the supporting plate 105 moves downwards, due to its own weight, to the bottom of

the reservoir 104 whilst overcoming the load by the weight 123. New covering papers 40 are stacked on the supporting plate 105 through the front side opening of the reservoir 104 to an extent such that the top face of the uppermost covering paper 40 in the stack should be flush with the base plate 2. Guide plates 153 and 154 are vertically mounted to the base plate 2 for smooth and tidy introduction of individual covering paper 40 to the next paper ends raiser assembly 201.

Paper ends raiser assembly 201

The construction of the paper ends raiser assembly 201 is shown in detail in Figs. 1, 2A and 5. The assembly 201 includes a pressor 202 and a pair of raiser rods 203 and 204. The pressor 202 is adapted for provisionally pressing the center section 40d of a covering paper 40 to the base plate 2 whereas the raiser rods 203 and 204 are adapted for folding the end sections 40c and 40e upright along the folds.

As well shown in Fig. 1, the pressor 202 takes the form of a flat plate substantially coextensive with the center section 40d of the covering paper and longer edges are

somewhat chamfered and fixed to the distal end of a holder arm 205. The proximal end of the holder arm 205 is idly inserted over a horizontal pin 207 fixed to a bracket 206 mounted near the rear side of the base plate 2. A cam lever 208 idly inserted over the horizontal shaft 4 is connected at its distal end to the body of the holder arm 205 by means of a connecting rod 209. This cam lever 208 rotatably carries a cam follower 211 and is provided at its distal end with a tension spring 212 which puts the cam follower 211 into constant pressure contact with a cam 210 fixed on the cam shaft 3. As the cam 210 rotates over 360°, the holder arm 205 is driven for one cycle swing motion about the pin 207 so that the pressor 202 reciprocates in the vertical direction on the path of travel of the forwarding members 6.

The raiser rods 203 and 204 are located on the front and rear sides of the path of travel of the forwarding members 6 in parallel to the longer edges of the pressor 202. The front side raiser rod 203 is fixed to the upper end of a swing arm 216 pivoted to a horizontal pin 215 fixed to the pedestal 1 at a position below the base plate 2. The rear side raiser rod 204 is fixed to the front end of a holder arm 219 which is in turn to the upper end of the front section 218a of a bell crank 218. This bell crank 218 is pivoted at its apex to a horizontal pin 217 fixed to the pedestal 1 and its front section 218a is connected, by means of a connecting rod 220, to the lower end of the swing arm 216 for the front side raiser rod 203. A cam lever 221 is idly inserted at its proximal end over the horizontal shaft 4 and connected to the rear section 218b of the bell crank 218 by means of a connecting rod 222. The cam lever 221 is provided with a rotary cam follower 224 and a tension spring 225 to put the cam follower 224 into constant pressure contact with a cam 223 fixed on the cam shaft 3.

As the cam 223 starts to rotate, the rear side raiser rod 204 is driven to a forward movement along an arcuate locus as shown with an arrow S in Fig. 5 via the bell crank 218 and the holder arm 219. Concurrently with this, the

front side raiser rod 203 is driven for a rearward movement along an arcuate locus as shown with an arrow T via the bell crank 218, the connecting rod 220 and the swing arm 216.

Preferably, each raiser rod 203 or 204 includes a rigid core and a resinous sheath coaxially and rotatably inserted over the core for smooth rolling contact with the end sections 40c and 40d of the covering paper 40.

As a covering paper 40 is brought to the prescribed position by one of the forwarding members 6 advancing the above-described path of travel, the cam 210 moves the pressor 202 towards the covering paper 40 whose center section 40d is then pressed on the base plate 2. As a consequence the covering paper 40 is provisionally fixed relative to the base plate 2 and edges of its end sections 40c and 40d are forced to lift slightly. At this moment, the cam 223 forces the raiser rods 203 and 204 to contact the end sections 40c and 40d and fold them upright along the folds as shown in Figs. 9B and 9C. Thereafter, the raiser rods 203 and 204 return to their initial receded positions due to further rotation of the cam 223 and the pressor 202 lifts to free the folded covering paper 40.

Next, the covering paper 40 with the raised end sections is carried by means of the forwarding member 6 to the next prescribed position whereat prescribed operations are to be applied to the stockings and the cardboard insert. A pair of parallel guide plates 41 and 42 are mounted on the base plate 2 whilst extending from this second prescribed position to the terminal of the elongate slot 8 defining the path of travel of the forwarding members 6. The distance between the guide plates 41 and 42 is almost equal to the width of the center section 40d of the folded covering paper 40 so that the latter can be safely transported along the prescribed path of travel. The rear side guide plate 41 has a section 41a near its terminal which is bent horizontally forwards in parallel to the base plate 2 in order to fold in the one end section 40c of the covering paper 40 during its transportation.

When the covering paper 40 has arrived at the above-described second prescribed position, a stocking 60 is manually placed on the center section 40d of the covering paper 40. More specifically in Fig. 6, a bracket 61 is arranged near this second prescribed position on the base plate 2 in order to hold a horizontal operation table 62 over the base plate 2. A lot of stockings 60 are advancedly

stacked on the operation table 62. A guide 63 is fixed to the bottom of the operation table 62 so that a stockings tray 64 is slidably coupled to the guide 63. This tray 64 is operationally coupled to an air cylinder 65 horizontally mounted to the bracket 61 by means of a piston rod 65a. As the piston rod 65a reciprocates, the tray 64 advances from and recedes into the guide 63. In the illustration, the tray 64 projects from the guide 63 just over the path of travel of the forwarding members 6 at a position between a pair of folder plates 402 and 403 of the stockings folder assembly 401.

When the tray 64 is registered at this position, the uppermost stockings 60 in the stack on the operation station 62 is manually taken up and placed in an extended state on the tray 64 so that the center section of the stockings 60 is located on the tray 64 and the end sections are located on the above-described folder plates 402 and 403 of the stockings folder assembly 401. This condition is shown in Fig. 9D. Under this condition, a cardboard insert is automatically fed on the stockings in the second prescribed position.

Insert feeder assembly 301

The construction of the insert feeder assembly 301 is shown in detail in Figs. 1, 2A and 7. This assembly 301 includes an insert reservoir 302 and an insert feeding mechanism 303. The insert reservoir 302 stores a lot of cardboard inserts 50 in a vertical state and the insert feeding mechanism 303 takes away the foremost insert 50 out of the reservoir 302 in order to place it on the section of the stockings 60 which is located on the center section 40d of the covering paper 40.

The reservoir 302 is given in the form of an elongated box whose top, front and rear sides are left open. The reservoir 302 is sustained by a pair of poles 304 and 305 arranged on the rear side of the path of travel of the forwarding members 6 in an arrangement descending towards the above-described second prescribed position, i.e. towards the front end forming the exit for the inserts 50. Though not shown in the illustration, the reservoir 302 is accompanied with suitable means for constantly pressing the inserts 50 stored in the reservoir 302 towards the exit. The foremost insert 50 is sustained by a plurality of pawls (not shown) arranged at the exit of the reservoir 302 in

order to prevent its unexpected falling. Every time the foremost insert 50 is removed out of the reservoir 302 by the feeding mechanism 303, the above-described pressing means gradually moves forwards the remaining inserts in the reservoir 302 so that the next foremost insert comes into engagement with the above-described pawls.

The feeder mechanism 303 includes a stand 310 secured to the rear end section of the base plate 2 and having a pair of upright sections 310a and 310b which rotatably and slidably hold a horizontal shaft 311. About the half longitudinal section of this shaft 311 is formed as a spline shaft 311a over which a gear 312 is slidably inserted. At a position close to the gear 312, a rimed bracket 313 is secured to the shaft 311 and an L-shaped bracket 314 is secured to the front end of the shaft 311 projecting from the front side upright section 310a. This bracket 314 vertically holds an air cylinder 317 having a piston rod 317a which in turn holds a suction mouth 318 connected to a given pneumatic suction source (not shown). A bell crank 315 has at its top end a roller 316 in engagement with a recess 313a formed in the rimed bracket 313 on the shaft 311. A bracket 319 is mounted to the rear side upright section 310b in order to restrict sliding of the gear 312 along the spline shaft 311a. This bracket 319 is provided with a

vertical groove (not shown in the illustration) which slidably accommodates a vertical rack 320 in meshing engagement with the gear 312 on the spline shaft 311a. A pin 321, which extends in a direction normal to that of the shaft 311, is fixed to a horizontal section 310c of the stand 310 connecting the upright sections 310a and 310b. A triangular swing plate 322 is pivoted at its proximal end to this pin 321. This swing plate 322 is provided about its upper corner with a slot 322a which receives a pin 323 secured to the lower end of the rack 320.

A cam lever 325 is idly inserted at its proximal end over the horizontal shaft 4 and its distal end is connected to the lower corner of the swing plate 322 by means of a connecting rod 324. The cam lever 325 is provided with a cam follower 327 and a tension spring 328 which keeps the cam follower 327 in pressure contact with a cam 326 secured on the cam shaft 3.

As the cam 326 rotates over 360°, the swing plate 322 is driven for one cycle swing motion about the pin 321 via the connecting rod, the rack 320 performs one cycle vertical movement, and the shaft 311 with the spline shaft 311a is driven for one cycle reciprocal rotation. The amount of

the rotation of the shaft 311 is here dependent upon the profile of the cam 326 on the cam shaft 3. In Fig. 2A, the shaft 311 initially rotates in the counterclockwise rotation over 90°, and after a prescribed length of dwell, in the clockwise direction over 90° in order to resume its initial position.

The above-described bell crank 315 is pivoted at its apex to the pin 321 holding the swing plate 322. A cam lever 330 is idly inserted at its proximal end over the horizontal shaft 4 and connected at its distal end to the lower end of the bell crank 315 by means of a connecting rod 331. This cam lever 330 is provided with a cam follower 333 and a tension spring 334 which keeps the cam follower 333 in pressure contact with a cam 332 fixed on the cam shaft 3.

Upon 360° rotation of the cam 332, the bell crank 315 is driven for one cycle swing motion about the pin 321 via the connecting rod 331 and the shaft 311 with the spline shaft 311a is driven for one cycle reciprocation in the directions shown with arrows W in Fig. 7.

The insert feeder assembly 301 with the above-described constrcution operates as follows. First, the shaft 311 is driven for 90° counterclockwise rotation in Fig. 2A by rotation of the cam 326 in order to turn the air cylinder 317, as shown with an arrow U, into a horizontal position whereat the suction mouth 318 faces the center section of the foremost insert 50 in the reservoir 302. Next, the air cylinder 317 is energized to move the suction mouth 318 towards and away from the reservoir 302 so that the foremost insert 50 in the reservoir 302 should be caught by the suction mouth 318. Further rotation of the cam 326 makes the shaft 311 rotate clockwise over 90° so that the air cylinder 317 should resume the initial vertical position. Under this condition, the insert 50 caught by the suction mouth 318 is brought to a horizontal position. Subsequent rotation of the cam 332 causes advance of the suction mouth 318 holding the insert 50 in the direction of the arrow W towards a position right above the center line of the path of travel of the forwarding members 6, i.e. a position just above the section of the stockings 60 placed on the center section 40d of the folded covering paper 40. The air cylinder 317 is then energizied again in order to move the suction mouth 318 vertically towards and away from the stockings 60 placed in the second prescribed position. When the suction mouth 318 has descended close to the base plate 2, pneumatic suction

acting thereon is cancelled so that the insert 50 is deposited on the stockings 60 placed on the covering paper 40. After this feeding air over, the air cylinder 317 is brought back to its initial position shown in Fig. 7 by further rotation of the cam 332.

Stockings folder assembly 401

After safe placing of the cardboard insert 50 on the stockings 60, end sections of the stockings 60 have to be folded about the insert 50. This operation is carried out in the second prescribed position by the stockings folder assembly 401, which is shown in detail in Figs. 1, 2A and 6.

The stockings folder assembly 401 includes a pair of folder plates 402 and 403 separated from each other on the path of travel of the forwarding members 6 by a distance almost equal to the length of the cardboard insert 50. The folder plates 402 and 403 are located at a level above the base plate 2 not to hinder smooth travel of the forwarding members 6. The folder plates 402 and 403 further incline downwards towards the path of travel of the forwarding members 6.

A rotary shaft 405 is mounted to the rear side of the one folder plate 402 by means of a bracket 402a whilst extending normal to the path of travel of the forwarding members 6. A bearing 406 is mounted to the base plate 2 in order to rotatably support the rotary shaft 405 which securedly carries at is rear end a pinion gear 407. A bracket 408 is fixed to one side of the bearing 406 and provided with a vertical groove (not shown in the illustration) which slidably accommodates a rack 409 in meshing engagement with the above-described pinion gear 407 on the rotary shaft 405. A swing lever 411 pivoted at its proximal end to a horizontal pin 412 secured to the pedestal 1 of the apparatus, and provided at its distal end with a slot 411a which receives a pin 410 secured to the lower end of the rack 409. A cam lever 414 is idly inserted at its proximal end over the horizontal shaft 4, and connected at its distal end to the body of the swing lever 411 by means of a vertical connecting rod 413. The cam lever 414 is provided with a cam follower 416 and a tension spring 417 which keeps the cam follower 416 in pressure contact with a cam 415 secured to the cam shaft 3.

Rotation of the cam 415 over 360° causes corresponding vertical swing motion of the swing lever 411 about the pin

412 via the connecting rod 413, and further reciprocation of the rack 409 in the bracket 408. As a consequence, corresponding reciprocal rotation of the rotary shaft 405 causes reciprocal swing motion of the folder plate 402 about the axis of the shaft 405 as shown with an arrow X in Fig. 2A. Since the folder plate 402 supports thereon one end section of the stockings 60, one reciprocal swing motion of the folder plate 402 folds the end section about the cardboard insert 50 placed on the center section of the stockings 60.

In the same way, a rotary shaft 420 is mounted to the rear side of the other folder plate 403 by means of a bracket 420a. A bearing 422 is mounted to the base plate 2 and rotatably supports the rotary shaft 420 which securedly carries at its rear end a pinion gear 421. A bracket 423 is fixed to one side of the bearing 422 and provided with a vertical groove which slidably accommodates a rack 424 in meshing engagement with the pinion gear 421. A swing lever 425 (see Fig. 2A) is coupled to the lower end of this rack 424. A cam lever 426 is pivoated to the horizontal shaft 4 and connected to the swing lever 425 by means of a connecting rod 427. This cam lever 426 is provided with a cam follower 429 and a tension spring (not shown) to keep the cam follower 429 in pressure contact with a cam 428 on the cam shaft 3.

At a timing phased from rotation of the cam 415 for the folder plate 402, rotation of the cam 428 causes corresponding swing motion of the folder plate 403 as shown with an arrow Y in Fig. 2A via the connecting rod 427, the swing lever 425, the rack 424, the gear 421 and the rotary shaft 420. This swing motion of the folder plate 402 folds the other end section of the stockings 60 about the one end section which has already been folded about the cardboard insert 50 by the one folder plate 402. This condition is shown in Fig. 9F.

As the folding operation is complete, the stockings 60 has a bulky construction such as shown in Figs. 9F and 9G, in which the two end sections of the stockings 60 are folded about each other and the insert 50 on the center section 40d of the covering paper 40. Such a bulky construction of the folded stockings 60 may hamper subsequent folding of the end sections 40c and 40e, in particular the one end section 40e of the covering paper 40. Even when end folding itself can be carried out without any trouble, the bulky construction may hinder smooth packing of the stockings into the envelope. In order to avoid such troubles to be caused by the bulky construction of the folded stockings 60, the apparatus in accordance with the present invention is provided with the

stockings pressor assembly 501 which is arranged on the downstream side of the insert feeder assembly 401 along the path of travel of the forwarding members 6.

Stockings pressor assembly 501

After operation at the second prescribed the stockings 60 folded about the insert 50 and resting on the center section 40d of the covering paper 40 is brought to the downstream side third prescribed position by the forwarding member 6. During this transportation along the path of travel of the forwarding members 6, the one end section 40c of the covering paper 40 is automatically folded inwards due to presence of the horizontal section 41a of the guide plate 41 as shown in Fig. 9H.

The construction of the stockings pressor assembly 501 is shown in detail in Figs. 1 and 2A, in which the pressor assembly 501 includes a stopper 502 and a pressor plate 503. The stopper 502 registers the covering paper 40 carrying the folded stockings 60 at a correct position on the third prescribed position whereas the pressor plate 503 is adapted for uniformly pressing the entire top face of the folded

stockings 60 on the covering paper 40.

A bracket 504 is mounted to the rear section of the base plate 2 and its fixed shaft (not shown) rotatably holds a lever 505, which is secured to the proximal end of the stopper 502. As well seen in Fig. 2A, the stopper 502 is made up of a pair of upright sections and a horizontal section connecting the upright sections. The distal end of this stopper 502 is located just above the slot 8 in the base plate 2. A cam lever 507 is idly inserted at its proximal end over the horizontal shaft 4 and connected at its distal end to the body of the lever 505 by means of a connecting rod 506. The cam lever 507 is provided with a cam follower 509 which is kept in pressure contact with a cam 508 on the cam shaft 3 by means of a proper spring (not shown). Upon rotation of the cam 508, the lever 505 is driven for swing motion via the connecting rod 506 and the distal end of the stopper 502 moves vertically towards and away from the slot 8 in the base plate 2. The pressor plate 503 is given in the form of a rectangular plate normally located over the path of travel of the forwarding members 6. A holder arm 512 is fixed at its distal end to the top surface of this pressor plate 503, and pivoted at its proximal end to the fixed shaft on the bracket 504. A cam lever 514

is pivoted at its distal end to the horizontal shaft 4, and connected at its distal end to the body of the holder arm 512 by means of a connecting rod 513. The cam lever 514 is provided with a cam follower 516 which is kept in pressure contact with a cam 515 on the cam shaft 3 by means of a proper spring. As the cam 515 rotates, the pressor plate 503 is driven for vertical reciprocation over the path of travel of the forwarding members 6 via the connecting rod 513 and the holder arm 512.

With the construction described above, the stockings pressor assembly 501 totally operates as follows. As the covering paper 40 bearing the folded stockings 60 enters the third prescribed position whilst being carried by the forwarding member 6, the cam 508 starts to rotate in order to move the stopper 502 towards the path of travel of the forwarding member 6. The distal end of the stopper 502 in the lowered position abuts the leading edge of the advancing covering paper 40 in order to stop its further advance along the path of travel. Then, subsequent rotation of the cam 515 drives the pressor plate 503 for downward movement to press the folded stockings 60 on the covering paper 40. Further rotation of the cams 508 and 515 return the stopper 502 and the pressor plate 503 to their initial positions

above the path of travel of the forwarding members 6.

Covering paper folder assembly 601

After flattened by the stockings pressor assembly, the stockings 60 with the insert 50 and the covering paper 40 is passed to the fourth prescribed position by the forwarding member 6 for treatment of the covering paper 40 by the covering paper folder assembly 601 which is shown in detail in Figs. 1 and 2A. The folder assembly 601 includes, as the major elements, a first guide bar 602, a folder bar 603, a holder bar 604 and a second guide bar 605. On the course from the third to fourth prescribed position, the first guide bar 602 engages with the covering paper 40 bearing the stockings 60 in order to fold its one end section 40e inwards, i.e. towards the top face of the flattened stockings 60. Then, the end section 40e is completely folded about the stockings 60 through engagement with the folder bar 603 and this folded condition is kept undisturbed through engagement with the holder bar 604. The second guide bar 605 prevents automatic rising of the folded end section 40e during the travel of the covering paper 40 with the stockings 60 to the fifth prescribed position whereat the stockings transfer assembly 701 is arranged.

The first guide bar 602 is fixed to the front side guide plate 42 on the base plate 2 and has a horizontal section extending rearwards to a position just above the path of travel of the forwarding members 6. This guide bar 602 is at a level of the top edge of the guide plate 42. As the covering paper 40 with the stockings 60 travels towards the fourth prescribed position on the path of travel of the forwarding members 6, its end section 40e comes into sliding contact with the horizontal section of the first guide bar 602 and is gradually folded inwards as shown in Fig. 9J.

The above-described fixed shaft on the bracket 504 for the stocking pressor assembly 501 further rotatably carries a pair of levers 606 and 607 extending forwards, and the folder and holder bars 603 and 604 are secured to the distal ends of these levers 606 and 607, respectively.

The folder bar 603 has a bifurcated construction and is located between the guide plates 41 and 42 at a level just above the base plate 2. A cam lever 609 is pivoted at its proximal end to the horizontal shaft 4 and connected at its distal end to the body of the lever 606 for the folder bar 603 by means of a connecting rod 608. The cam lever 609

is provided with a cam follower 611 and a tension spring (not shown) to keep the cam follower 611 in pressure contact with a cam 610 secured to the cam shaft 3.

The holder bar 604 has a sigmoid construction and is located between the guide plates 41 and 42 at a level just above the base plate 2. The folder bar 603 is located closer to the front side guide plate 42 whereas the holder bar 604 is located closer to the rear side guide plate 41. A cam lever 616 is idly inserted at its proximal end over the horizontal shaft 4 and connected at its distal end to the body of the lever 607 for the holder bar 604 by means of a connecting rod 615. This cam lever 616 is provided with a cam follower 617 and a tension spring (not shown) to keep the cam follower 617 in prssure contact with a cam 618 secured on the cam shaft 3.

As the cams 610 and 618 rotate, the folder and holder bars 603 and 604 are driven for phased vertical movements above the base plate 2 via the connecting rods 608, 615 and the levers 606, 607. More specifically, as the end section 40e of the covering paper 40 stops at the fourth prescribed position after gradual folding through sliding contact with

the first guide bar 602, rotation of the cam 610 moves. the folder bar 603 downwards in order to press the end section 40e, whereby the end section 40e is folded about the end section 40c which has already folded about the stockings 60 due to sliding contact with the horizontal section 41a of the guide plate 41. Thus, the stockings 60 with the insert 50 is wholly wrapped by the covering paper 40.

As the folder bar 603 returns to its initial upper position, rotation of the cam 618 moves the holder bar 604 downwards in order to slightly press the top face of the end section 40e. While keeping this pressed condition, the forwarding member 6 passes the covering paper 40 with the stockings 60 to the fifth prescribed position to which the stockings transfer assembly 701 faces. The second guide bar 605 extends between the covering paper folder and stockings transfer assemblies 601 and 701 in order to prevent automatic rising of the end section 40e during the transportation, even after the holder bar 604 has returned to its initial upper position. As shown in Fig. 1, this second guide bar 605 is secured to the front side guide plate 42 and has a horizontal section extending to a position just above the path of travel of the forwarding members 6. The second guide bar 605 is further provided with a bifurcated

end extending along the above-described path of travel.

Stockings transfer assembly 701

The construction of the stockings transfer assembly 701 is shown in detail in Figs. 1, 2A and 8, in which the transfer assembly 701 is arranged at a position close to the end of the elongated slot 8 but deviated forwards from the extension of the path of travel of the forwarding members 6. The stockings transferer assembly 701 includes, as the major elements, a guide plate 702 and a transferer plate 703. The guide plate 702 guides the stockings 60 wrapped with the covering paper 40 to the correct position on the transferer plate 710 whereas the transfer plate 710 brings the stockings 60 to the sixth prescribed position on the path of the travel of encloser plates 802 and 803 of the stockings encloser assembly 801.

The guide plate 702 has a thin rectangular construction and fixed in a vertical arrangement to support arm 703 which is pivoted to a pin (not shown) on a bracket 704 mounted to the front end section of the base plate 2. A cam lever 705 is idly inserted at its center the horizontal shaft 4 and

connected at its one end to the body of the support arm 703 by means of a connecting rod 706. This cam lever 705 is provided with a cam follower 709 and a tension spring 708 to keep the cam follower 709 in pressure contact with a cam 707 on the cam shaft 3. Upon rotation of the cam 707, the guide plate 702 is driven for vertical motion via the connecting rod 706 and the support arm 703.

The transferer plate 710 is slidable on the base plate 2 in a direction normal to the extension of the path of travel of the forwarding members 6. A bearing 713 is fixed to the top face of the transferer plate 710 near its front end whereas an upright plate 714 is fixed to the transferer plate 710 near its rear end. The bearing 713 turnably holds a support arm 712 which carries at its distal end a slightly arcuated clamper plate 711. The upright plate 714 is located on the downstream side of and in line with the front side guide plate 42 whilst extending normal to the support arm 712.

Beneath the transferer plate 710, a guide shaft 715 is horizontally mounted to the pedestal 1 whilst extending in the longitudinal direction of the support arm 712 and a

slider 716 slidably inserted over this guide shaft 716 is secured to the bottom of the transferer plate 710. An air cylinder 717 is also secured to the bottom of the transferer plate 710 with its piston rod 717a extending upwards in engagement with a projection 712a formed on the support arm 712. A bell crank type cam lever 718 is pivoted at its apex to the horizontal shaft 4 and connected at its upper end to the bottom of the slider 716 by means of a connecting rod 719. The lower end of the cam lever 718 rotatably carries a cam follower 722 which is kept in pressure contact with a cam 720 on the cam shaft 3 by means of a tension spring 721 attached to the upper section of the cam lever 718.

As the cam 720 rotates, the slider 716 is driven for sliding reciprocation on the guide shaft 715 via the cam lever 718 and the connecting rod 719, whereby the transferer plate 710 is driven for reciprocation on the base plate 2 between the fifth prescribed position on the extension of the path of travel of the forwarding members 6 and the sixth prescribed position on the path of travel of the encloser plates 802 and 803 of the stockings encloser assembly 801.

The stockings transferer assembly 701 operates as followers. Before start of the operation, the guide plate 702 is kept at an upper stand-by position shown with solid lines in Fig. 8, the transferer plate 710 is located at a position to place its upright plate 714 in line with the front side guide plate 42, and the air cylinder 717 projects its piston rod 717a to hold the clamper plate 711 away front the top face of the transferer plate 710 as shown in Fig. 8.

As the stockings 60 wrapped with the covering paper 40 has been brought to the fifth prescribed position by the forwarding member 6, rotation of the cam 707 moves the support arm 703 downwards in order to shift the guide plate 702 to a lower position shown with chain lines in Fig. 8. Thus, both sides of the stockings 60 wrapped with the covering paper 40 are guided by the upright plate 714 on the transferer plate 710 and the guide plate 702 held by the support arm 703 during transportation by the forwarding member 6 to the fifth prescribed position, whereby the stockings 60 is correctly brought to the fifth prescribed position on the transferer plate 710.

Thereafter, the forwarding member 6, which has been involved in transportation of the covering paper 40 and the stockings 60, disappears downwards through an opening formed in the base plate 2 near the terminal of the elongated slot 8, and is carried intermittently towards the start of the slot 8 by means of the endless chain 12.

Upon arrival of the stockings 60 wrapped with the covering paper 40 at the fifth prescribed position, the piston rod 717a of the air cylinder 717 recedes in order to remove support to the support arm 712, which thereupon swings downwards in order to clamp the stockings 60 between its clamper plate 711 and the transferer plate 710 as shown in Fig. 9L. Further rotation of the cam 707 return the guide plate 702 to its initial upper position.

Subsequent rotation of the cam 720 causes the slider 716 to move rearwards along the guide shaft so that the transferer plate 710 transefers the stockings 60 from the fifth to the sixth prescribed position on the path of travel of the encloser plates 802 and 803 of the stockings transferer assembly 801 in cooperation with the clamper plate 711 in the lower position. As is clear in Fig. 1, the sixth

prescribed position is deviated rearwards from the fifth prescribed position in line with the path of travel of the forwarding members 6.

After one side of the stockings 60 has been provisionally pressed onto the base plate by a holder plate 804 of the stockings encloser assembly 801 in the sixth prescribed position, the air cylinder 717 is energized to lift the clamper plate 711 in order to remove the clamp on the stockings 60 wrapped with the covering paper 40, and further rotation of the cam 720 returns the transferer plate 710 to its initial stand-by position whilst leaving the stockings 60 at the sixth prescribed position between the pair of encloser plates 802 and 803 of the stockings encloser assembly 801. Next, the stockings 60 wrapped with the covering paper 40 is caught by the encloser plates 802 and 803 in order to be enclosed in an envelope 70 already located at the seventh prescribed position on the path of travel of the encloser plates 802 and 803.

Stockings encloser assembly 801

The construction of the stockings encloser assembly

801 is shown in detail in Figs. 1, 2B and 8, in which the encloser assembly 801 includes, as major elements, a holder plate 804, the pair of encloser plates 802 and 803, a driving mechanism 830, an envelope feeding mechanism 850 and an envelope discharging mechanism 880. The holder plate 804 provisionally presses onto the base plate 2 one side of the stockings 60 wrapped by the covering paper 40 transported from the fifth prescribed position by the stockings transferer assembly 701, the encloser plates 802 and 803 hold the transported stockings 60 with the covering paper 40 in order to enclose same in a syntheric resin film envelope 70, the driving mechanism 830 moves the encloser plates 802 and 803 reciprocally along the path of travel extending from the sixth to seventh prescribed position, the feeding mechanism 850 feeds the envelopes 70 one at one time to the seventh prescribed position on the above-described path of travel, and the discharging mechanism 880 discharges the envelope 70 containing the enclosed stockings 60 outside the system onto a conveyer 37.

As best seen in Figs. 2B and 8, the holder plate 804 has a thin rectangular construction and is supported, in a vertical arrangement, at a position somewhat deviated rearwards from the center line of the path of travel of the

encloser plates 802 and 803, by a support arm 805. This support arm 805 is pivoted at its proximal end to a fixed pin 807 on a bracket 806 mounted near the rear edge of the base plate 2. A cam lever 808 is idly inserted at its proximal end over the horizontal shaft 4 and connected at its distal end to the body of the support arm 805 by means of a connecting rod 809. The cam lever 808 is provided with a cam follower 812 and a tension spring 811 to keep the cam follower 812 in pressure contact with a cam 810 secured to the cam shaft 3. As the cam 810 rotates over 360°, the holder plate 804 is driven for one cycle vertical reciprocation via the connecting rod 809 and the support arm 805.

The encloser plates 802, 803 and their associated driving mechanism 830 are shown in combination in Figs. 1 and 2B. Below the base plate 2, upper and lower horizontal guides 815 and 816 are mounted in parallel to each other to the pedestal 1 of the apparatus whilst extending in the direction of an opening 2a in the base plate 2. An encloser head 817 is slidably mounted to the horizontal guides 815 and 816. This encloser head 817 securedly holds a horizontal plate bracket 818 which projects above the opening 2a and extends towards the position of the holder plate 804. A channel bracket 819 is fixed to the distal end of the

plate bracket 818. The lower encloser plate 802 is fixed to the bottom of this channel bracket 819 whereas the upper encloser plate 803 is secured to a horizontal rotary pin 820 mounted to the channel bracket 819. The rotary pin 820 further securedly carries at its end an L-shaped lever 821. This lever 821 rotatably holds a cam follower 824 which is brought into rolling contact with a pair of plate cams 822 and 823 arranged on the base plate 2. A tension spring 826 is interposed between the lever 821 and a spring seat 825 arranged on the plate bracket 818 so that the rotary pin 820 is urged to rotate in the counterclockwise direction and the upper clamper plate 803 should be always kept in pressure contact with the lower clamper plate 802 as shown with chain lines in Fig. 2B. When the cam follower 824 held by the lever 821 comes in engagement with the plate cams 822 and 823, however, the upper encloser plate 803 separates from the lower encloser plate 804 as shown with solid lines whilst overcoming the spring force.

In Fig. 2B, a smaller sprocket 823 is mounted to the pedestal 1 by means of a bearing 831 and a larger sprocket 845 is rotatably mounted to the pedestal 1 by means of a bearing (not shown), both at levels below the base plate 2. The larger sprocket 845 is coaxially formed in one body with

a gear 833. A sector gear 835 is idly inserted at its apex over a fixed pin 834 on the pedestal 1 and meshes with the gear 833. A cam lever 836 is pivoted to the lower side horizontal shaft 5 is connected at its distal end to an extension 835 a of the sector arm 835 by means of a connecting rod 837. The cam lever 836 is provided with a cam follower 840 and a tension spring 838 to keep the cam follower 840 in pressure contact with a cam 839 secured on the cam shaft 3. Both sprockets 832 and 845 are operationally coupled to each other by means of an endless chain 841 and a guide pin 842 is coupled to one link of the endless chain 841. A plate 843 having an open slot 843 is mounted to the enclosed head 817 so that the guide pin 842 on the endless chain 841 should be received in the open slot 843a.

Upon rotation of the cam 839, the sector gear 845 is driven for reciprocal swing motion about the fixed pin 834 via the connecting rod 837 and the gear 833 engaging the sector gear 845 causes reciprocal movement of the endless chain 841 as shown with arrows Z in Fig. 2B, whereby the encloser head 817 reciprocates along the horizontal guides 815 and 816. As a consequence, the pair of encloser plates 802 and 803 reciprocate along the above-described path of travel between the sixth and seventh prescribed positions.

As shown in Fig. 9M, the envelope 70 has a flap 70a projecting from its mouth 70b.

A continuous film band is delivered from a given supply source by means of a pair of delivery rollers 851 and 852 and cut into individual envelope 70 by a fusion cutter 853 arranged on the downstream side of the delivery rollers 851 and 852 of the envelope feeding mechanism 850. The rollers 851 and 852 are driven for intermittent rotation in order to deliver the film band over a length equal to the width of the envelope 70 per one rotation. During the dwell of the delivery rollers 851 and 852, the fusion cutter 853 descends to separate by cutting an envelope from the film band. The film band is fed in a folded condition along a longitudinal fold line so that one folded half extends beyond the edge of the other folded half. As a consequence, the one end of the envelope 70 is originally closed whereas the other end is initially left open as the mouth 70b, the larger folded half forming the flap 70a. Both sides of the envelope 70 are closed by fusion cutting. After this fusion cutting, the envelope 70 is carried to the above-described seventh prescribed position by a suction holder 857 which reciprocates between a position shown with chain lines and a position shown with solid lines in Fig. 1.

Below the base plate 2, a pair of horizontal and parallel guides 855 and 856 are fixed to the pedestal whilst extending normal to the path of travel of the encloser plates 802 and 803. A carrier head 858 is slidably mounted to the guides 855 and 856 and holds atop the suction holder 857. The suction holder 857 is given in the form of a hollow flat box having in its top face a lot of suction holes 857a. The chamfered end of the suction holder 857 facing the sixth prescribed position is provided with a U-shaped groove 857b which faces, in the seventh prescribed position, the lower inclined end of an projection 2b from the base plate 2.

An air cylinder 859 is horizontally secured to the pedestal 1 about the level of the carrier head 858, with its piston rod (not shown) being secured to the front side face of the above-described carrier head 858.

As the air cylinder 859 is energized to advance its piston rod, the carrier head 858 travels along the guides 855 and 856 in order to move the suction holder 857 from the seventh prescribed position to the position just in front of the delivery rollers 851 and 852, whereupon the

suction holder 857 receives an envelope 70 separated from the film band by the fusion cutter 853. Next, the air cylinder 859 causes its piston to recede so that the carrier head 858 returns forwards along the guides 855 and 856 and the suction holder 857 brings the envelope to the seventh prescribed position on the path of travel of the encloser plates 803 and 804. This situation is shown in Fig. 9N. As is clear from this illustration, the flap 70a of the envelope 70 is placed between the chamfered edge of the suction holder 857 and the inclined lower surface of the above-described projection 2a.

An additional mechanism is arranged at the seventh prescribed position in order to open the mouth 70b of the envelope 70 and keep such an open state for packing of the stockings 60. The mechanism includes, as shown in Fig. 2B, an L-shaped bracket 860 fixed to the pedestal 1 below the base plate 2, and an air cylinder 861 is vertically mounted to the bracket 860 with its piston 861a being directed to the inclined lower surface of the projection 2a. The piston 861a is provided at its end with a pressor piece 862. Reverting to Fig. 1, a bracket 863 is fixed to the front end section of the pedestal 1 and a swing arm 864 is pivoted at its proximal end to a horizontal pin (not shown)

secured to this bracket 863. The swing arm 864 is provided at its distal end with a suction mouth 865 which is connected to a given pneumatic suction source (not shown). A cam lever 866 is pivoted at its distal end to the horizontal shaft 4 and connected at its distal end to the body of the swing arm 864 by means of a connecting rod 867 as shown in Fig. 2B. The cam lever 866 is provided with a cam follower 869 and a tension spring (not shown) to keep the cam follower 869 in pressure contact with a cam 868 on the cam shaft 3. Rotation of the cam 868 causes vertical reciprotation of the suction mouth 865 via the connecting rod 867 and the swing arm 864.

A pair of rotary cylinders 870 and 871 are vertically fixed to the bottom of the base plate 2 on both sides of the path of travel of to encloser plates 802 and 803 at a position just upstream of the seventh prescribed position, with their rotary shafts projecting upwards from the base plate 2. Levers 872 and 873 are fixed a top these shafts and carry opener pawls 874 and 875 which converge towards the seventh prescribed position.

After the envelope 70 separated from the film band has

been brought to the seventh prescribed position by reciprocation of the suction holder 857, the lower side air cylinder 861 is energized to lift the pressor piece 862 which moves through the slot 857b in the suction holder 857 and presses the flap 70a of the envelope 70 against the inclined bottom surface of the projection 2a of the base plate 2. Subsequent rotation of the cam 868 causes vertical swing motion of the swing arm 864 so that the suction mouth 865 catches and opens the mouth 70b of the envelope 70 resting on the suction holder 857. Next, the rotary cylinders 870 and 871 operate to turn the opener pawls 874 and 875 into a mutually parallel state in order to laterally spread the mouth 70b of the envelope 70 as shown in Fig. 90.

Next, the stockings 60 wrapped with the covering paper 40 is packed in the envelope 70 through the mouth 70b kept in an open state by cooperation of the pressor piece 862, the suction mouth 865 and the opener pawls 874 and 875.

The construction of the envelope discharging mechanism 880 is also shown in Figs. 1 and 2B. A bearing 881 is mounted to the left front corner of the base plate 2 and a rod 883 is rotatably carried by this bearing 881. The rod 883 is provided with an L-shaped lever 882 extending

rearwards. An air cylinder 884 is horizontally fixed to the distal end of this lever 882 and its piston rod 884a is provided with a delivery plate 885 which delivers the envelope 70 caught by the suction holder 857 of the envelope feeding mechanism 850 onto the delivery conveyer 37. This delivery plate 885 has a center opening which is formed in its lower section over a width equal to that of the encloser plate 802 and 803 so that its reciprocation should not impede reciprocation of the encloser plates 802 and 803. A cam lever 886 is pivoted at its proximal end to the horizontal shaft 4 and connected at its distal end to the body of the L-shaped lever 882 by means of a connecting rod 887. The cam lever 886 is provided with a cam follower 889 and a spring (not shown) to keep the cam follower 889 in pressure contact with a cam 888 secured to the cam shaft 3. Rotation of the cam 888 causes vertical movement of the L-shaped lever 882 via the connecting rod 887. When the lever 882 is at its lowered position, the air cylinder 884 causes the piston rod 884a to recede so that the delivery plate 885 moves the envelope 70 on the suction holder 857 towards the delivery conveyer 37.

The stockings encloser assembly 801 totally operates in the following manner. Before the operation starts, the holder plate 804 is kept at the upper stand-by position and

the pair of encloser plates 802 and 803 are separate in each other at the sixth prescribed position shown in Fig. 1. An envelope 70 is caught by the suction holder 857 at the seventh prescribed position with its mouth being kept open by the pair of opener pawls 874 and 875. The delivery plate 885 is kept at a position above the suction holder 857 due to projection of the piston rod 884a.

Under this condition, stockings 60 wrapped by a covering paper 40 is brought to the space between the pair of encloser plates 802 and 803 standing by at the sixth prescribed position by operation of the stockings transferer assembly 701. Thereupon, the cam 810 rotates to move the holder plate 804 downwards in order to press one side of the stockings 60 with the covering paper 40 onto the base plate 2. Then, the stockings transferer assembly 701 returns to its initial position on the extension of the path of travel of the forwarding members 6 whilst leaving the stockings in the sixth prescribed position. Further rotation of the cam 810 returns the holder plate 804 to the initial upper position in order to cancel the pressure on the stockings 60.

Next, rotation of the cam 839 of the driving mechanism 830 causes the encloser plates 802 and 803 to move towards

the seventh prescribed position whereat the envelope 70 is standing by with its mouth kept open. Due to this movement, the cam follower 824 is released from engagement with the upstream side plate cam 822 and the upper encloser plate 803 is brought into pressure contact with the lower encloser plate 802 by the spring 826 in order to clamp the stockings 60 and the covering paper 40 therebetween. Further rotation of the cam 839 causes the encloser plates 802 and 803 to insert the stockings 60 into the envelope 70 throught its open mouth. After this insertion is complete, engagement of the cam follower 824 with the downstream side plate cam 823 separates the upper encloser plate 803 from the lower encloser plate 802, thereby releasing the stockings 60 from the clamp by the encloser plates 803 and 804.

Then, the cam 888 starts to rotate to move the delivery plate 885 downwards to a position in the proximity of the open mouth of the envelope 70 containing the stockings 60. The piston rod 884a of the air cylinder 884 recedes in order to move the envelope from the seventh prescribed position onto the delivery conveyer 37. Suction by the suction holder 857 has already stopped at this timing. Finally, further rotation of the cam 839 returns the encloser plates 802 and 803 to their initial positions.

Total operation of the apparatus.

The total operation of the appratus will now be explained in reference to Figs. 9A to 9 0.

The uppermost covering paper 40 of the stack in the reservoir 104 of the stacking mechanism 102 is caught by the feeder arm 132 of the feeding mechanism 103 and brought to the first prescribed position on the path of travel of the forwarding members 6. Here, the covering paper 40 is under the spread condition shown in Fig. 9A. The cam rotates 139 for horizontal reciprocation of the feed arm 131 and the cam 150 rotates for vertical reciprocation of the feeder arm 131 via the lifter arm 132.

The forwarding members 6 are driven for intermittent circulation with the endless chain 12 by the transmission gear mechanism 20 including the eccentric cam 30. During each dwell of the forwarding members 6, the above-described assemblies complete their one cycle operations.

As the covering paper 40 is brought to the position of the paper end raiser assembly 201, the cam 210 rotates in

order to move the pressor 202 downwards and the center section 40d of the covering paper 40 is pressed onto the base plate 2. Thereafter, the cam 223 starts to rotate in order to cause the raiser rods 203 and 204 to move towards each other and the end sections 40c and 40e of the covering paper 40 are folded upwards along the fold lines as shown in Figs. 9B and 9C. At this timing, the next uppermost covering paper 40 of the stack in the reservoir 104 has already been fed to the first prescribed position by operation of the covering paper feeder assembly 101.

Next intermittent movement of the forwarding member 6 brings the folded covering paper 40 to the second prescribed position between the pair of folder plates 402 and 403 of the stockings folder assembly 401.

Then, the uppermost stockings 60 of the stack on the operation table 62 is taken up and fed to the second prescribed position in a manner such that the center section is placed on the stockings tray 62 and both end sections are placed on the folder plates 402 and 403. After this placing is complete, the stockings tray 64 recedes into the operation table 62 so that the center section of the stockings 60 should fall on the center section 40d of the covering paper

40.

Combined rotations of the cams 326 and 332, and operation of the air cylinder 317 of the insert feeder assembly 301 make the suction mouth 318 take out the foremost insert 50 in the insert reservoir 302 and place it on the center section of the stockings on the second prescribed position as shown in Fig. 9D.

Next, the stockings folder assembly 401 starts its operation. Phased reciprocation of the pair of folder plates 402 and 403 are caused by rotation of the cams 415 and 428 so that the end sections of the stockings 60 resting on the folder plates 402 and 403 are folded about the insert 50 on the center section 40d of the covering paper 40 as shown in Figs. 9E to 9G.

Next intermittent movement of the forwarding member 6 brings the stockings 60 folded about the insert to the third prescribed position whereat the stockings pressor assembly 501 operates. During this transportation, one end section 40c of the covering paper is gradually folded inwards as shown in Fig. 9H due to sliding contact with the horizontal

section 41a of the guide plate 41 arranged along the path of travel of the forwarding members 6. Upon arrival of the stockings 60 at the third prescribed position, the cam 508 moves the stopper 502 in order to stop the stockings 60 at the correct position. Next, rotation of the cam 515 moves the pressor plate 503 downwards in order to flatten the bulky stockings 60 as shown in Fig. 9I.

Further, intermittent movement of the forwarding member 6 brings the flattened stockings to the fourth prescribed position whereat the covering paper folder assembly 601 operates. As the stockings 60 approaches the fourth prescribed position, the end section 40e of the covering paper 40 is gradually folded inwards due to sliding contact with the first guide bar 602. Upon arrival of the stockings 60 at the fourth prescribed position, rotation of the cam 610 moves the folder bar 603 downwards in order to press the end section 40e on the end section 40c which has already been folded about the stockings 60 due to the sliding contact with the horizontal section 41a of the guide plate 41 (see Fig. 9K). As a consequence, the stockings 60 is wholly wrapped with the covering paper 40. Further rotation of the cam 610 moves the folder bar 603 back to its initial upper position in order to remove the pressure on the stockings 60 wrapped with the covering paper 40. Alternately, rotation

of the other cam 515 moves the holder bar 604 downwards in order to slightly press the end section 40e of the covering paper 40 wrapping the stockings 60. Whilst keeping this slightly pressed condition, the stockings 60 is passed to the fifth prescribed position by the intermittent movement of the forwarding member 6, whereat the stockings transferer assembly 701 acts on the stockings 60. During this transportation, folded state of the end section 40e of the covering paper is stably maintained due to running contact with the second guide bar 605 arranged on the downstream side of the fourth prescribed position.

As the stockings 60 wrapped with the covering paper 40 approach the fifth prescribed position, the guide plate 702 and the upright plate 714 force the stockings 60 to stop at the correct position on the transferer plate 710. Next, the air cylinder 717 moves the clamper plate 711 downwards in order to fix the stockings 60 on the transfer plate 710 as shown in Fig. 9L. Following rotation of the cam 720 moves the transferer plate 710 with the stockings 60 rearwards towards the sixth prescribed position between the pair of encloser plates 802 and 803 of the stockings encloser assembly 801.

Finally, the stockings 60 is inserted, by operation of the stockings encloser assembly 801, into an envelope 70 with an open mouth 70b which has already been brought to the seventh prescribed position on the path of travel of the encloser plates 802 and 803.

After the stockings 60 is placed between the encloser plates 802 and 803 by operation of the stockings transferer assembly 701, rotation of the cam 839 moves the encloser plates 802 and 803 towards the seventh prescribed position. Due to this movement, the cam follower 824 is released from contact with the upstream plate cam 822 and the upper encloser plate 803 comes into pressure contact with the lower encloser plate 802 in order to clamp the stockings 60 with the covering paper 40 therebetween. Further movement of the encloser plates 802 and 803 in this state inserts the stockings 60 with the covering paper 40 into the envelope 70 standing by at the seventh prescribed position via its open mouth 70b. After this insertion is complete, the cam follower 824 comes into engagement with the downstream plate cam 823 and the encloser plates 802 and 803 separate from each other in order to remove the clamp on the stockings 60. Thereafter, cooperation of the air cylinder 884 with the cam 888 causes the delivery plate 885 to discharge the envelope 70 containing the stockings 60 onto the delivery

conveyer 37.

By repeating the above-described steps, stockings 60 are each folded about a cardboard insert 50, wrapped with a covering paper 40, and inserted into an envelope 70. In one practical example of the present invention, the forwarding members 6 are driven for an intermittent movement with 2 seconds of dwell. Thus, stockings are enclosed into envelope once in two seconds in accordance with the present invention.

The only manual operation required is to place stockings 60 in an extended state on covering papers 40 brought to the second prescribed position by movement of the forwarding members 6. Other operation are all carried out in a fully automatic fashion without any manual attendance. The collected arrangement of the cams on a single cam shaft assures well coordinated operation with reduced malfunction of the entire apparatus.

As stated above, enclosing of stockings in accordance with the present invention is carried out at a remarkably high rate such as one cycle in two seconds. This connects

to high rate consumption of the cardboard inserts 50 within the insert reservoir 302 which naturally requires frequent filling of inserts into the insert reservoir 302. Troublesome attention is required for the operation in order to always keep appreciable number of inserts in the insert reservoir 302. Moreover, depending on the situation, the operation of the insert feeder assembly 301 has to be stopped during filling of the inserts into the insert reservoir. As a consequence, entire operation of the apparatus has to be stopped and the operation efficiency of the apparatus is seriously reduced. The higher the operation rate of the apparatus, the greater the loss in the operation efficiency.

An embodiment of the insert feeder assembly 350 shown in Figs. 10 to 12 well solves this problem. The insert feeder assembly 350 of this embodiment feeds an insert to a prescribed position on the rear side of the above-described second prescribed position on the path of travel of the forwarding members 6.

As shown in Figs. 10 and 11, the insert feeder assembly 350 includes an insert reserving mechanism 360, a sunction tube 380, a rotary deliverer 390 and a feeding mechanism

395. The insert reserving mechanism 360 includes a plurality of insert reservoirs 365 each of which is adapted for storing a stack of cardboard inserts 50 and the suction tube 380 catches by suction the uppermost insert 50 of the stack. The rotary deliverer 390 delivers the insert 50 caught by the suction tube 380 in a prescribed direction off the insert reservoir 360 and the feeding mechanism 395 passes the delivered insert 50 to a tray 398 located at the above-described prescribed position.

A cylindrical stand 361 is arranged vertically on one side of the pedestal and rotatably and coaxially supports a main shaft 362 which extends upwards. Support plates 363 and 364 of a polygonal shape are secured horizontally to the upper and lower ends of the main shaft 362 in order to support the plurality of insert reservoirs 365 in a radical arrangement. The support plates 363 and 364 are provided in their top surfaces with grooves 363a and 364a which engage with hooks 365c arranged on the rear side of the insert reservoirs 365, whereby the reservoirs 365 are supported by the support plates 363 and 364. As a consequence, each insert reservoir 365 can be easily detached from the main shaft 362 simply by lifting.

In the case of the illustrated arrangement, the support plates 363 and 364 are hexagonal in shape and support six sets of insert reservoirs 365 in a radial arrangement at equal angular intervals. Any one of the six insert reservoirs 365 is normally registered at a position facing the above-described feeding mechanism 395 which extends towards the tray 398. For this registration, six through holes 364b are formed in the lower support plate 364 at equal angular intervals and an air cylinder 366 is vertically attached to the periphery of the cylindrical so that its piston rod is engageable with one of the six through holes 364a. By operation of this air cylinder 366, its piston rod is inserted into one of the through holes 364a in order to block rotation of the main shaft 362 when the inserts 50 are to be fed to the tray 398. When the inserts 50 in the reservoir 365 are fully consumed, the air cylinder 366 pull back its piston rod from the through hole 364a in order to remove the restriction on the main shaft 362 which thereupon can be rotated over 60 degrees for replacement of the insert reservoir 365 to be involved in feeding of the inserts 50. Though not shown in the illustration, a proper intermittent rotation control mechanism is attached to the main shaft 362.

The insert reservoir 365 is open on its top, bottom and front sides and adapted for reserving a stack of cardboard inserts 50. Thus, the inserts 50 within the reservoir 365 can be subsequently delivered from the uppermost one. The lower end of the reservoir 365 is slightly bent inwards in order to prevent fall of the inserts 50 when the reservoir 365 is located at a stand-by position off the position facing the feeding mechanism 395.

A pair of upper and lower bearings 367 are secured to the pedestal 1 on the side facing the reservoir 365 at the feed position. These bearings 367 supports a fixed guide shaft 368 and a rotary thread shaft 369 which extend vertically in parallel to each other as shown in Fig. 12. A slider 370 is arranged in engagement with these shafts 368 and 369. More specifically, the slider 370 is in screw engagement with the thread shaft 369 and idly inserted over the guide shaft 368 so that the slider 370 moves up and down along the guide shaft 368 upon rotation of the thread shaft 369. At a section close to the guide shaft 368, the slider 370 holds a supporting plate 371 which horizontally extends into the reservoir 365.

One example of the engagement of the slider 370 with the thread shaft 369 is shown in Fig. 12. A pin 373 is fixed to the section of the slider 370 close to the thread shaft 369 and a clamper 372 is pivoted to the pin 373 in an arrangement able to merge into a recess formed in one side of the slider 370. A semi-circular thread recess 372a is formed in the clamper 372 on the side facing the thread shaft 369. When the clamper 372 merges into the side recess as shown with solid lines, the slider 370 is brought into screw engagement with the thread shaft 369. Thus, rotation of the thread shaft 369 causes lift of the slider 370 with the supporting plate 371 along the guide shaft 368. After the supporting plate 371 has reached its uppermost position and the insert 50 within the reservoir 365 have all been delivered, the clamper 372 is pulled out as shown with chain lines in order to release the slider 370 from the screw engagement with the shaft 369, whereby the slider 370 with the supporting plate 371 can be lowered by one stroke to the lowermost position suited for next filling of new cardboard inserts 50.

Rotation of the thread shaft 369 is caused by a rotation-controlled motor 374 (i.e. an intermittent rotation motor) mounted to a bracket 367 fixed to the pedestal 1 below the insert reservoir 365. More specifically, a gear

374 secured to the output shaft of the motor 374 meshes with a gear 376 secured to the lower end of the thread shaft 369. As the motor 374 is energized, the thread shaft 369 is driven for rotation in a prescribed direction for prescribed numbers.

For rotation control of the motor 374, a photoelectric sensor 378 is held by a stand 381 arranged on the base plate 2. This sensor 378 is electrically connected to the control circuit of the drive motor 374 and its detecting end is directed towards the upper opening of the reservoir 365. The sensor 378 has a function to detect the change in distance between its detecting end and the upper surface of the uppermost insert 50 of the stack in the reservoir 365. When any change occurs in the distance dice to delivery of the inserts, the sensor 378 detects this change and generates a corresponding electric detection signal which is in turn passed to the above-described control circuit in order to energize the drive motor 374 over a period corresponding to the change in the distance.

As the inserts 50 are delivered from the reservoir 365, the above-described distance increases by a magnitude corresponding to the total thickness of the inserts 50 delivered

and the sensor 378 detects this change in the distance in order to start the drive motor 274. Then, the thread shaft 369 is driven for rotation in order to lift the supporting plate 371 via the slider 370, thereby lifting the stack of inserts 50 in the reservoir 365 over a distance equal to the above-described change in the distance. Thus, the distance between the detecting end of the sensor 378 and the uppermost insert 50 of the stack in the reservoir 365 resumes its initial value and the detection signal disappears in order to stop the drive motor 374 and further lift of the inserts 50. Such lifting of the inserts 50 by cooperation of the sensor 378 with the motor 374 takes place every time one insert 50 is delivered or once per delivery of two or more inserts 50 depending on sensitivity of the insert 50 so that the top level of the stack in the reservoir 365 should always be kept flush with the top end of the reservoir 365.

After the inserts 50 in the reservoir 365 have all been delivered, i.e. consumed, the supporting plate 371 is manually returned to the lowermost position by disengaging the slider 370 from the thread shaft 369 as described above, blocking by the air cylinder 366 is cancelled and the main shaft 362 is rotated over 60 degrees for replacement of the reservoir 365.

The suction tube 380 and the rotary deliverer 390 are used in combination for delivering the uppermost insert 50 of the stack off the reservoir 365. An upright stand 381 is fixed to one side of the upper bearing 367 and the above-described sensor 378 is mounted to the bent end of this stand 381 whilst facing the upper opening of the reservoir 365. A boss 382 and a bracket 383 are horizontally secured to the stand 381. The suction tube 380 is coupled at its upper end to the boss 382 in an arrangement swingable in a vertical plane. An air cylinder 385 is horizontally carried by the bracket 383 with its piston rod being pivoted to the distal end of an arm 384 which is securedly inserted at its proximal end over the upper end of the suction tube 380. The suction tube 380 is connected to a given suction source not shown in the drawings.

As the air cylinder 385 advances its piston rod, the suction tube 380 is registered at the position shown with solid lines in Fig. 11 in order to catch by suction the uppermost insert 50 of the stack in the reservoir 365. As the piston rod of the air cylinder 385 recedes, the suction tube 380 swings towards the rotary deliverer 390 with the insert 50 and, upon arrival at the position shown with chain lines in Fig. 11, stops its suction in order to release the insert 50.

A drive motor 381 is secured to the stand 381 at a position near the boss 382 and its horizontal output shaft securedly carries the rotary deliverer 390 which is in the form of a roller. The rotary deliverer 390 is constructed so that its lower end should be located quite close to the top surface of the upper horizontal section of an inclined chute 396 of the insert feeding mechanism 395. This rotary deliverer 390 positively delivers the insert 50, which has already been released by the suction tube 380, onto the inclined chute 396 by its rolling contact with the upper face of the insert 50. Preferably, the periphery of the rotary deliverer 390 should be covered with a high friction material such as hard rubber.

The inclined chute 396 extends downwards from the top end of the insert reservoir 365 to the tray 398 located on the rear side of the second prescribed position. Preferably, an air nozzle 397 should be arranged with its end opening in the inclined chute 396 for smooth travel, i.e. fall, of the insert 50 along the chute 396.

The insert feeder assembly 350 of this embodiment operates as follows. The insert reservoirs 365 are filled with a lot of inserts 50 and one insert reservoir 365 is

registered at the feed position facing the insert feeding mechanism 395. By operation of the suction tube 380, the uppermost insert 50 of the stack is caught and slightly moved towards the rotary deliverer 390 which thereupon passes the insert 50 over the inclined chute 396. The insert 50 falls along the chute 396 towards the tray 398. The change in the above-described distance due to insert delivery is detected by the sensor 378, the drive motor 374 is energized, the stack of the inserts 50 is pushed upwards by the ascending supporting plate 371 in order to offset the above-described change in the distance. When the inserts 50 in the reservoir 365 have all been consumed, the main shaft 362 is rotated over 60 degrees for replacement of the empty reservoir with a full reservoir.

In the case of the insert feeder assembly 301 of the first embodiment, the inserts 50 taken from the insert reservoir 302 are brought directly to the second prescribed position by operation of the suction mouth 318 of the insert feeding mechanism 303. In the case of the insert feeder assembly 350 of the second embodiment, however, the inserts 50 delivered from the insert reservoir 365 are fed one after another onto a tray 398 located on the rear side of the second prescribed position. Therefore, a stockings folder assembly to be used in combination with the insert feeder

assembly 350 of the second embodiment is required to have the function to shift the insert 50 on the tray 398 to the second prescribed position.

One embodiment of the stockings folder assembly of this type is shown in Figs. 13 through 15, in which the stockings folder assembly 550 includes an insert shifting mechanism 560 and a stockings folding mechanism 570. The insert shifting mechanism 560 catches the insert 50 on the tray 398 in order to deposite it on the center section of the stockings 60 located on the second prescribed position whereas the stockings folding mechanism 570 folds both end sections of the stockings 60 about the insert 50 so placed on the center section.

In the following description and in the accompanying drawings, reference to and illustration of the covering paper 70 are purposely omitted for simplification.

An upright bracket 561 is secured to the rear end of the base plate 2 and horizontally holds at its top end a guide 562 which extends forwards above the tray 398 of the insert feeder assembly 350. A slider 563 is coupled to

this guide 562 for free reciprocation. This slider 563 is connected to a proper cam (not shown) on the cam shaft 3 by means of a connecting rod 564 and moves to and fro along the guide 562 upon rotation of the cam. An air cylinder 565 is vertically mounted to the front extension of the slider 563 and its piston rod is provided at the lower end with a suction mouth 566 connected to a given pneumatic suction source (not shown). When the cam driven reciprocation of the slider 563 is combined with operation of the air cylinder 565, the suction mouth 566 travels as shown with arrows in Fig. 15 between positions shown with solid and chain lines in order to shift the insert 50 on the tray 398 to the center section of the stockings 60 located at the second prescribed position.

A stand 571 is fixed on the base plate whilst extending from the front end of the base plate 2 to a position close to the path of travel of the forwarding members 6. A horizontal guide 572 is carried by this stand 571 and a slider 573 is coupled to the guide 572 for movement towards and away from the path of travel of the forwarding members 6. For stabler movement of the slider 573 along the guide 572, a roller 573a is attached to the lower end of the slider 573 in rolling engagement with a groove (not shown) formed in the lower section of the stand 571. This slider 573

is connected to a proper cam (not shown) on the cam shaft 3 by means of a swing lever 575 pivoted to a horizontal pin 574 on the pedestal 1 and a connecting rod 576. As the cam rotates, the slider 573 is driven for reciprocation along the guide 572.

A feed tray 577 is secured atop the slider 573 whilst extending rearwards. This feed tray 577 has a flat rectangular construction whose top face is flush with that of the operation table 62. When the slider 573 is located at the foremost position on the guide 572, the feed tray 577 is accommodated in a rectangular recess 62a formed in the rear end center section of the operation table 62 as shown with solid lines in Fig. 13. When the slider 573 is located at the rearmost position on the guide 572, the feed tray 577 is registered at the second prescribed position on the path of travel of the forwarding members 6. At positions near both sides of the feed tray 577, a pair of slots 577a are formed in its rear end section while extending forwards. At positions corresponding these slots 577a in the feed tray 577, a pair of horizontal support plates 578 are fixed on the base plate 2. These support plates 578 are located beneath the feed tray 577 and extend rearwards across the path of travel of the forwarding members 6. As described later in more detail, the support plates 578 are adapted for

provisionally holding the both end sections of the stockings 60 brought to the second prescribed position. Therefore, the distance between the pair of support plates 578 should be smaller than the length of the stockings 60 in the extended state.

A guide plate 579 is secured to the bottom of the right side support plate 578 which inclines downwars and inwards and an opening 579a is formed about the center of this guide plate 579. An air ejector 580 is arranged below the guide plate 579 with its mouth being directed to the opening 579a and connected to a given supply source (not shown) of pressured air.

On the near side of the left side support plate 578, a horizontal guide 581 is secured on the base plate 2 and extends in parallel to the path of travel of the forwarding members 6. A slider 582 is coupled to the guide 581 for reciprocation and connected to a proper cam (not shown) on the cam shaft 3 by means of a connecting rod 583. This slider 582 monolithically carries a folder block 584 having a chamfer which inclines downwards and inwards. As the cam-driven slider 582 moves on the guide 581, the folder block 584 concurrently reciprocates inwards and outwards.

On the rear side of each support plate 578, an upright stand 585 is secured on the base plate 2 and holds atop a reversible drive motor 586. An L-shaped holder bar 587 is secured to the output shaft of this motor 586 and extends forwards over the associated support plate 578. The holder bar 587 is arranged so that, when it swings down onto the support plate 578 by rotation of the drive motor 586, its front end section is located at a position in line with the corresponding slot 577a in the feed tray 577 located on the front side.

In the case of the illustrated embodiment, a bearing 588 is fixed on the base plate 2 below the insert shifting mechanism 560 and swingably carries an L-shaped pressor bar 589 which extends upwards and forwards. This pressor bar 589 is connected to a proper cam (not shown) on the cam shaft 3 by means of a swing lever 590 and a connecting rod 591. As the cam rotates, the pressor bar 589 swings between the positions shown with solid and chain lines in Fig. 15.

The operation of the stockings folder assembly 550 with the above-described construction will now be explained in reference to Figs. 16A to 16D.

Before the operation starts, the suction mouth 566 of the insert shifting mechanism 560 is located above the tray 398 as shown in Fig. 15, the feed tray 577 of the stockings folding mechanism 570 still rests in the recess 62a of the operation table 62, the right side air ejector 580 is not yet in operation and the right side folder block 584 is located at the outermost position. As shown in Fig. 14, the holder bars 587 are kept at the upper position and the pressor bar 589 is also located at the upper position. Under this condition, the stockings 60 is manually taken from the stack on the operation table 62 and placed on the feed tray 577 in the extended state.

First, the feed tray 577 moves rearwards in order to bring the extended stockings 60 over the second prescribed position on the path of travel of the forwarding members 6. Then the holder bars 587 swing downwards and press the both end sections of the stockings 60 against the support plates 578 at the positions of the slots 577a in the feed tray 577. Thereafter, the feed tray 577 returns to its initial position in the recess 62a of the operation table 62. Concurrently with this process, the suction mouth 566 moves downwards in order to catch by suction the insert 50 on the tray 398 and further moves upwards, forwards and downwards to a position just above the center section of the stockings

60 whose end sections are held by the holder bars 587 on the support plates 578. Thereupon suction of the suction mouth 566 is cancelled so that the insert 50 should fall on the center section of the extended stockings 60. This condition is shown in Fig. 16A. After this release of the insert 50, the suction mouth 566 returns to its initial position above the tray 398 for the next cycle operation.

Soon after the insert 50 is released, the holder bars 587 move upwards in order to cancel the hold on the end sections of the stockings 60 which thereupon falls on the base plate 2. As a consequence, the center section of the stockings lies on the base plate, the right side end section on the guide plate 579 and the left side end section on the folder block 584. Next, the pressor bar 589 swings downwards in order to press the rear edge of the insert 50 against that of the center section of the stockings 60 on the base plate 2 so that their superimposed state should not be disturbed by the subsequent folding. This condition is shown in Fig. 16B.

Next the air ejector 580 operates to blow the right side end section of the stockings 60 via the opening 579a in the guide plate 579 so that the end section should be folded

about the insert 50 on the center section. This condition is shown in Fig. 16C. The air ejector 580 then stops its operation.

After this right side folding is complete, the cam-driven folder block 584 moves inwards, i.e. rightwards, in order to fold the left end section of the stockings about the right end section already folded about the insert 50 on the center section, thereby wholly covering the insert 50 with the stockings 60, This condition is shown in Fig. 16D. Thereafter, the folder block 584 returns to its initial position shown with chain lines in order to complete one cycle operation.

In the case of the illustrated example, the air ejector 580 is arranged on the right side and the folder block 584 on the left side. This arrangement, however, can be reversed. Further, two sets of air ejectors can be arranged on either sides or two sets of folder blocks can be arranged on either sides.

In the base of the apparatus, the first to fifth prescribed positions are taken in sequence on the path of

travel of the forwarding members 6 whereas the sixth and seventh prescribed positions are taken on the path of travel of the stockings encloser plates 802 and 803 which is deviated rearwards from the path of the forwarding members 6. For shift of the stockings from path to path, the stockings transfer assembly 701 has to be arranged at the fifth prescribed position.

A further embodiment of the stockings encloser assembly is shown in Figs. 18 to 20, in which the sixth and seventh prescribed positions are taken on the extension of the path of travel of the forwarding members 6 in order to omit the stockings transferer assembly 701 used for the foregoing embodiment of the apparatus.

The stockings encloser assembly 901 includes the stockings encloser plate 802, a stockings conveyer plate 903, the driving mechanism 830 for the encloser plate 802, a driving mechanism 910 for the conveyer plate 902, the envelope feeding mechanism 850 and the envelop discharging mechanism 880. The encloser plate 802 takes over in cooperation with the conveyer plate 903, the stockings 60 wrapped with the covering paper 70 from the forwarding member 6 and inserts same into a syntheric resin film envelope 70 located

at the seventh prescribed position. The discharging mechanism 880 delivers the envelope enclosing the stockings onto the delivery conveyer 37.

A pair of horizontal guides 815 and 816 are secured to the pedestal 1 below the base plate 2 as best seen in Fig.18 whilst extending between the fourth and seventh prescribed positions and a enxloser head 817 is coupled to these guides 815 and 816 for reciprocation. The encloser head 817 carries on its top face the encloser plate 802 which extends downstream and a spring 824 for loading the encloser plate 802. A plate cam 822 is arranged behind and in parallel to the encloser plate 802 whilst extending over a distance almost same as the guides 815 and 816 for the encloser head 817. This plate cam 822 is connected to a proper cam on the cam shaft 3 by means of a connecting rod 814, and a cam fallover 824 mounted to the back of the encloser head 817 engages with the plate cam 822. When the plate cam 822 is pushed up by operation of the cam on the cam shaft 3, the encloser plate 802 is located at the lower position shown with solid lines in Fig. 19.

A bearing 831 is fixed to the rear inner side of the pedestal 1 below the base plate 2 and rotatably carries a

small sprocket 832. Being spaced laterally from this arrangement, another bearing 813 is secured to the rear inner side of the pedestal 1 and rotatably carries a large sprocket 845 formed coaxially in one body with a gear 833. A pin 834 is horizontally secured to the pedestal 1 below the bearing 813 and a sector gear 835 is pivoted at its apex to the pin 834 in meshing engagement with the gear 833. This sector gear 835 is connected to a proper cam on the cam shaft 3 by means of a connecting rod 837. The sprockets 832 and 845 are connected one another by means of an endless chain 841 which securedly carries a lateral pin 845 received in a groove formed in the bottom of the encloser head 817. As the cam rotates, the sector gear 835 swings about the pin 834 and this swing motion is transmitted to the encloser head 817 via the endless chain 817. The encloser head 817 reciprocates on the guides 815 and 816 so that the encloser plate 802 reciprocates along the extension of the path of travel of the forwarding members 6.

The conveyer plate driving mechanism 910 includes a bearing 911 is secured on the base plate 2 at a position in front of the above-described extension and corresponding to the downstream end of the guide 815 of the encloser plate driving mechanism 830. A pin 912 pivoted to this bearing 911 is connected at its front to a proper cam on the cam

shaft 3 by means of an arm 913 and a connecting rod 914. This pin 921 securely carries at its rear end a guide 915 which extends upstream and a slider 916 is coupled to this guide 915 for reciprocation. This slider 916 carries the conveyer plate 903 in line with the encloser plate 803, and is connected to a proper cam on the cam shaft 3 by means of a connecting rod 917. As the cams rotate, the conveyer plate 902 is driven for vertical reciprocation and horizontal reciprocation in line with the movement of the encloser plate 802.

The construction of the envelope feeding mechanism 850 is shown in Figs. 17, 18 and 20. A material film band 70a is delivered from a roll (not shown) located behind the seventh prescribed position by means of a pair of delivery rollers 851 and 852 and heat cut in sequence into individual envelope 70 by a fusion cutter 853. As best seen in Fig.20, a pair of horizontal guides 855 and 856 are secured to the pedestal 1 below the base plate 2 and extend normal to the above-described extension of the path of travel of the forwarding members 6. A carrier head 858 slidably coupled to the guides 855 and 856 supports a mobile suction holder 857 at a position slightly above the base plate 2. The suction holder 857 takes the form of a flat rectangular box connected to a given pneumatic source (not shown). This flat

box is provided at its bottom with a lot of suction holes adapted for catching the envelope 70 by suction. A horizontal pin 921 is secured to the pedestal 1 below the carrier head 858 and swingably carries a contilever 922. This cantilever 922 is pivoted at its upper end to the carrier head 858, and connected at its lower end to a proper cam (not shown) on the cam shaft 3 by means of a connecting rod 923.

As the cam rotates, the carrier head 858 reciprocates on the guides 855 and 856 so that the suction holder 857 brings the envelope 70 cut by the fusion cutter 853 to the seventh prescribed position.

In the seventh prescribed position, a stationary suction holder 931 is secured to the pedestal 1 with its top face being flush with the base plate 2 so that, when the mobile suction holder 857 comes to the seventh prescribed position, a slight gap should be left between the mating faces of the suction holders 857 and 931. Like the mobile suction holder 857, this stationary suction holder 931 takes the form of a flat rectangular box almost coextensive with the mobile suction holder 857. The interior of the suction holder 931 is also connected to a given pneumatic suction

source (not shown), and is provided at its top with a lot of suction holes adapted for reliably holding the envelope 70 taken over from the mobile suction holder 857 during insertion of the stockings 60.

At the upstream end of the seventh prescribed position upper and lower guide plates 932 and 933 are secured sideways to the base plate 2 whilst leaving a slight gap therebetween. The guide plates 932 and 933 extend along the path of travel of the envelope 70 towards the seventh prescribed position. The guide plates 932 and 933 have properly curved constructions as best seen in Fig. 20 so that, as the envelope 70 is carried towards the seventh prescribed position by the mobile suction holder 857, the flap 70a of the envelope 70 (see Fig. 9M) enters the gap and is smoothly guided towards the bottom of the stationary suction holder 931 located at the seventh prescribed position. An air cylinder 924 is vertically mounted to the pedestal 1 below the suction holder 931 so that its piston rod presses the introduced flap 70d of the envelope 70 aginst the bottom of the stationary suction holder 931.

At a position above the upstream end of the stationary suction holder 931, an air cylinder 936 is vertically

mounted to a stand 935 arranged on the base plate 2 and its piston rod holds at the lower end a suction mouth 927 adapted for opening the mouth 70b of the envelope 70.

On the upstream side of the seventh prescribed position, a pair of opener pawls 874 are arranged on both sides of the above-described extension and connected to rotary cylinders 870 by means of levers 872. Normally, the opener pawls 874 converge towards each other on the downstream side. In order to open the mouth 70b of the envelope 70 passed to the seventh prescribed position, the cylinders 870 are driven for rotation in a known manner so that the opener pawls 874 are made parallel to each other as shown with chain lines in Fig. 17. Preferably, the operating end sections 874a of the opener pawls 874 are covered with an elastic material such as thin rubber so that they should not damage the envelope 70 when opening the mouth 70b.

The envelope discharging mechanism 880 includes a bearing 881 secured on the front end of the base plate 2 on the downstream side of the seventh prescribed position, and swingably carries an L-shaped lever 882 which extends rearwards. The rear end section of this lever 882 horizontally carries an air cylinder 884 whose piston rod extends in the

direction of the above-described extension and securedly carries a delivery plate 885. This delivery plate 885 has at its lower end an opening of a size same as that of the encloser plate 802. The lever 882 is connected to a proper cam on the cam shaft 3 by means of a connecting rod 887.

By cooperation of the air cylinder 884 with the cam on the cam shaft 3, the delivery plate 885 descends from the position shown with solid lines in Fig. 18 onto the stationary suction holder 931 and, by further operation of the air cylinder 884, moves leftwards in order to shift the envelope 70 containing the stockings 60 from the suction holder 931 to the delivery conveyer 37.

The total operation of the stockings encloser assembly 901 of this embodiment is summerized as follows. The envelope 70 cut by the fusion cutter 853 is first carried to the seventh prescribed position by the mobile suction holder 857. The moment suction on the mobile suction holder 857 is concelled, suction starts on the stationary suction holder 931 which thereupon firmly holds the envelope 70 passed over by the mobile suction holder 857. Next, the suction mouth 937 opens the mouth 70b of the envelope 70 up and down by its vertical reciprocation whereas the opener pawls 874

concurrently move into the envelope 70 and swing so that their end sections 874a open the mouth 70b sideways.

The stockings 60 carried to the sixth prescribed position by the forwarding member 6 is caught by the encloser and conveyer plates 802, 903, which thereupon move towards the seventh prescribed position in order to insert the stockings into the envelope 70 through its open mouth 70b. At this timing, suction on the suction holder 391 is cancelled, the delivery plate 885 descends and the envelope 70 containing the stockings 60 is passed over the delivery conveyer 37 by downstream movement of the delivery plate 885.

Claims

1. Improved method for automatic packing of stockings comprising

intermittently forwarding said stockings et al along a given path of travel from first to seventh prescribed positions taken in sequence on said path of travel,

the first step of feeding a flat covering paper to said first prescribed position on said path of travel,

the second step of raising almost upright both end sections of said covering paper

the fourth step of feeding stockings in an extended state onto the flat center section of said covering paper at said second prescribed position on said path of travel,

the fifth step of feeding a flat coardboard insert onto

the center section of said stockings placed on said covering paper,

the sixth step of folding both end sections of said stockings about said insert,

the seventh step of folding raised end sections of said covering paper about said stockings embracing paid insert at said fourth prescribed position on said path of travel,

the eighth step of holding said stockings embraced by said covering paper at said sixth prescribed position on said path of travel,

the ninth step of feeding an envelope to said seventh prescribed position on said path of travel with its mouth open to said sixth prescribed position,

the tenth step of forwarding said stockings embraced by said covering paper to said seventh prescribed position thereby enclosing same in said envelope via said open mouth,

the eleventh step of discharging said stockings enclosed in said envelope off said seventh prescribed position, and

periodically repeating said first to eleventh steps in the prescribed order.

2. Improved method as claimed in claim 1 further comprising, between said sixth and seventh steps,

the step of pressing said stockings against said insert for flattening purpose at the third prescribed position on said path of travel.

3. Improved method as claimed in claim 1 or 2 in which

said path of travel is made up of first and second separate sections located in parallel,

said first to fifth prescribed positions are taken on said first section whereas said sixth and seventh prescribed position are taken on said second section, and

said stockings embraced by said covering paper is transferred from said fifth to sixth prescribed position after said seventh step but before said eighth step.

4. Improved apparatus for automatic packing of stockings comprising

a flat base plate fixed atop the pedestal of said apparatus and provided with an elongated slot, means for intermittently circulating a plurality of equally spaced forwarding members for said stockings et al along a path of travel defined by said elongated slot in said base plate,

a cam shaft carrying a number of cams,

a covering paper feeding assembly arranged to feed one

flat covering paper at one time to a first prescribed position taken at the upstream end of said path of travel,

a covering paper end raiser assembly arranged on the downstream side of said first prescribed position along said path of travel, and for raising almost upright both end sections of said covering paper,

an insert feeder assembly arranged facing a second prescribed position on the downstream side of said covering paper end raiser assembly along said path of travel, and for feeding one cardboard insert at one time onto the center section of said stockings which is placed in said second prescribed position in an extended state,

a stockings folder assembly arranged at second prescribed position, and for folding both end sections of said stockings about said insert,

a covering paper folder assembly arranged at a fourth prescribed position on the downstream side of said stockings folder assembly along said path of travel, and for folding

said raised end sections of said covering paper about said stockings embracing said insert,

a stockings encloser assembly including an envelope feeding mechanism arranged to feed one envelope at one time to a seventh prescribed position on the downstream side of said covering paper folder assembly, a mouth opening mechanism arranged at said seventh prescribed position and for opening the mouth of said envelope, means for enclosing said stockings embraced by said covering paper in said envelope by its reciprocal movement between a sixth prescribed position and said seventh prescribed position, and an envelope discharging mechanism arranged to deliver said stockings embraced by said envelope off said seventh position.

5. Improved apparatus as claimed in claim 4 in which

a reciprocation path of said enclosing means is taken on the downstream extension of said path of travel of said forwarding members.

6. Improved apparatus as claimed in claim 4 in which

a reciprocation path of said enclosing means is deviated perpendicularly from and in parallel to the downstream extension of said path of travel of said forwarding mechanism, and

a stockings transferer assembly is arranged at a fifth prescribed position near the downstream end of said path of travel and aside said sixth prescribed position, and for transferring said stockings embraced by said covering paper from said covering paper folder to stockings encloser assembly.

7. Improved apparatus as claimed in claim 5 or 6

said covering paper feeder assembly includes a covering paper reservoir held by said pedestal and adapted for reserving a stack of covering papers, cam-driven means for intermittently lifting said stack of covering papers within said reservoir so that its top face is always kept flush with the top end of said reservoir, and means for sequentially delivering the uppermost covering paper of said stack of

covering papers from said reservoir to said first prescribed position.

8. Improved apparatus as claimed in claim 7 in which

said stack lifting means a vertical guide fixed to said pedestal, a slider coupled to said vertical guide for reciprocation and connected to a proper cam on said cam shaft via a clutch, a stack supporting plate held by said slider and extending horizontally into said reservoir, and a micro switch arranged above the top opening of said reservoir and electrically connected to said clutch so that said micro switch disenables said clutch when the uppermost covering paper of said stack is in contact with said micro switch.

9. Improved apparatus as claimed in claim 7 in which

said delivering means includes a suction mouth, a feeder arm holding said suction mouth and connected to a

proper cam on said cam shaft for reciprocation of said suction mouth between said covering paper reservoir and said first prescribed position, and a lifter arm coupled to said feeder arm and connected to a proper cam on said cam shaft for vertical reciprocation of said suction mouth via said feeder arm.

10. Improved apparatus as claimed in claim 5 or 6 in which

said covering paper raiser assembly includes a pair of raiser rods arranged on opposite sides of said path of travel, cam driven means for moving said raiser rods towards and away from end sections of said stockings, a pressor arranged above said path of travel, and cam-driven means for causing vertical reciprocation of said pressor.

11. Improved apparatus as claimed in claim 5 or 6 in which

said insert feeder assembly includes a plurality of insert reservoirs each adapted for reserving a stack of

inserts, means for registering one of said insert reservoirs at a given feed position of inserts, means arranged at said feed position and for intermittently lifting said stack of inserts within said insert reservoir so that its top face is always kept flush with the top end of said insert reservoir, and means for sequentially delivering the uppermost insert of said stack of inserts from said insert reservoir to a given position near said second prescribed position.

12. Improved apparatus as claimed in claim 11 in which

said insert reservoir registering means includes a rotary main shaft detachably holding said plurality of insert reservoirs in a radial horizontal arrangement at equal angular intervals, and means for intermittently rotating said main shaft over one prescribed center angle at one time.

13. Improved apparatus as claimed in claim 11 in which

said stack lifting means includes a rotary thread shaft vertically held by said pedestal at said feed position, a slider coupled to said thread shaft in detachable screw engagement therewith, a stack supporting plate carried by said slider and extending into said insert reservoir, a drive motor coupled to said thread shaft, and a sensor arranged above the top opening of said insert reservoir and electrically connected to said drive motor so that said drive motor is driven for controlled rotation when said sensor has detected change in distance between its detecting end and the uppermost insert of said stack in said insert reservoir.

14. Improved apparatus as claimed in claim 11 in w h i c h

said insert delivering means includes a swingable suction tube arranged over the top opening of said insert reservoir with its mouth facing said uppermost insert of said stack, an inclined chute extending downwards from said feed position to a tray on said given position, a rotary deliverer located next to said suction tube with its lower end placed close to the upper end section of said inclined chute.

15. Improved apparatus as claimed in claim 5 or 6 in which

said insert feeder assembly includes an insert reservoir arranged aside said path of travel and adapted for reserving a number of inserts in a vertical state and an insert feeding mechanism arranged aside said second prescribed position and adapted for shifting the foremost insert in said reservoir to said center section of said stockings in said second prescribed position.

16. Improved appratus as claimed in claim 15 in which

said insert feeding mechanism includes a suction mouth, an air cylinder holding said suction mouth for vertical reciprocation, cam driven means for causing movement of air cylinder towards and away from said second prescribed position, and cam driven means for causing swing motion of said air cylinder within a vertical plane parallel to said path of travel.

17. Improved apparatus as claimed in claim 5 or 6 in which

said stocking folder assembly includes an insert shifting mechanism arranged aside said second prescribed position and adapted for shifting an insert from a given position onto said center section of said stockings, and stockings folding mechanism arranged at said second prescribed position and adapted for folding said end sections of said stockings about said insert.

18. Improved appratus as claimed in claim 17 in which

said shifting mechanism includes a suction mouth, an air cylinder holding said suction mouth for vertical reciprocation, and cam-driven means for moving said air cylinder between said given and second prescribed positions.

19. Improved apparatus as claimed in claim 17 in which

said folding mechanism includes an operation table arranged on the front side of said path of travel and adapted for stacking a number of stockings, a feed tray reciprocal between a position in a rear center recess of said operation table and said second prescribed position and provided with a pair of rear side slots extending forwards near its both sides. A pair of fixed support plate arranged about the positions of said slot in said feed tray and extending rearwards over said second prescribed position, a motor-driven swingable holder bar attached to each said support plate for holding of one said end section of said stockings by pressure contact with said support plate at a position corresponding to associated said slot in said feed tray, and means for folding said end sections of said stockings about said insert when hold by said holder bar is cancelled.

20. Improved apparatus as claimed in claim 19 in which

said folding means includes a guide plate fixed to each said support plate and sloping downwards and inwards, and an air ejector arranged below said guide plate with its mouth directed to an opening formed in said guide plate.

21. Improved apparatus as claimed in claim 19 in which

said folding means include a folder block arranged below each said support plate and provided with a chamfer sloping inwards, and cam-driven means for reciprocating said folder block along said path of travel.

22. Improved apparatus as claimed in claim 19 in which

said folding means includes a guide plate fixed to one said support plate and sloping downwards and inwards, an air ejector arranged below said guide plate with its mouth directed to an opening formed in said guide plate, a folder block arranged below the other said support plate and provided with a chamfer sloping inwards, and cam-driven means for reciprocating said folder block along said path of travel.

23. Improved apparatus as claimed in claim 5 or 6 in which

said stockings folder assembly includes an operation table arranged on the front side of said path of travel and adapted for stacking a number of stockings, a pair of folder plates spaced from each other in said second prescribed position, and cam-driven means for causing phased swing motion of said folder plates in vertical direction in order to fold said end sections of said stockings carried by said folder plates about said insert.

24. Improved apparatus as claimed in claim 5 or 6 in which

said covering paper folder assembly includes a cam-driven folder bar and a cam driven holder bar.

25. Improved apparatus as claimed in claim 5 or 6 in which

said envelope feeding mechanism of said stockings encloser assembly includes a pair of delivery rollers for delivering a film band from a given supply source, a fusion cutter located besides said seventh prescribed

position and adapted for cutting an envelope from said film band, a mobile suction holder provided at its bottom with a number of suction holes for catching said envelope, cam-driven means for reciprocating said mobile suction holder between the position of said fusion cutter and said seventh prescribed position, and a stationary suction holder arranged at said seventh prescribed position and provided in its top face with a number of suction holes for taking over said envelope from said mobile suction holder whose bottom is slightly above said top face of said stationary suction holder at said seventh prescribed position.

26. Improved apparatus as claimed in claim 25 in which

said mouth opening mechanism of said stockings encloser assembly includes slightly spaced upper and lower guide plates arranged along a path of travel of said mobile suction holder in an arrangement to guide the flap of said envelope beneath said stationary suction holder, a suction mouth arranged above and vertically reciprocally towards and away from said stationary suction holder, a pair of opener pawls arranged on the upstream side of said seventh prescribed position on both sides of said extension of said

path of travel, and cam-driven means for causing horizontal swing motion of said opener pawls.

27. Improved apparatus as claimed in claim 25 in which

said enclosing means of said stockings encloser assembly includes an encloser plate, a conveyer plate cooperable with said encloser plate, means for causing said plates to hold said stockings embraced by said covering paper at said sixth prescribed position and to release same after insertion in said envelope held by said stationary suction holder in said seventh prescribed position, and cam-driven means for reciprocating said plates between said sixth and seventh positions.

28. Improved apparatus as claimed in claim 25 in which

said discharging mechanism of said stockings encloser assembly includes a delivery conveyer arranged on the downstream side of said seventh prescribed position, a

delivery plate, an air cylinder for moving said delivery plate between said seventh prescribed position and said delivery conveyer, and cam driven-means for causing vertical reciprocation of said delivery plate towards and away from said stationary suction holder.

29. Improved apparatus as claimed in claim 5 or 6 in which

said envelope feeding mechanism of said stockings encloser assembly includes a pair of delivery rollers for delivering a film band from a given supply source, a fusion cutter located besides said seventh prescribed position and adapted for cutting an envelope from said film band, a mobile suction holder provided in its top face with a number of suction holes for catching said envelope, and an air cylinder for reciprocating said mobile suction holder between the position of said fusion cutter and said seventh prescribed position.

30. Impoved apparatus as claimed in claim 29 in which

said mouth opening mechanism of said stockings encloser assembly includes a suction mouth arranged above and vertically reciprocally towards and away from said mobile suction holder in said seventh prescribed position, a pair of opener pawls arranged on the upstream side of said seventh prescribed position on both sides of said extension of said path of travel, and cam-driven means for causing horizontal swing motion of said opener pawls.

31. Improved apparatus as claimed in claim 29 in which

said enclosing means of said stockings enclosing assembly includes a pair of cooperable encloser plates, means for causing said plates to hold said stockings embraced by said covering paper at said sixth prescribed position and to release same after insertion in said envelope held by said mobile suction holder in said seventh prescribed position, and cam-driven means for reciprocating said plates between said sixth and seventh prescribed positions.

32. Improved apparatus as claimed in claim 29 in which

said discharging mechanism of said stockings encloser assembly includes a delivery conveyer arranged on the downstream side of said seventh prescribed position, a delivery plate, an air cylinder for moving said delivery plate between said seventh prescribed position and said delivery conveyer, and cam-driven means for causing vertical reciprocation of said delivery plate towards and away from said mobile suction holder in said seventh prescribed position.

33. Improved apparatus as claimed in claim 5 or 6 further comprising

a stockings pressor assembly arranged at a third prescribed position on the downstream side of said stockings folder assembly.

Fig. 1A

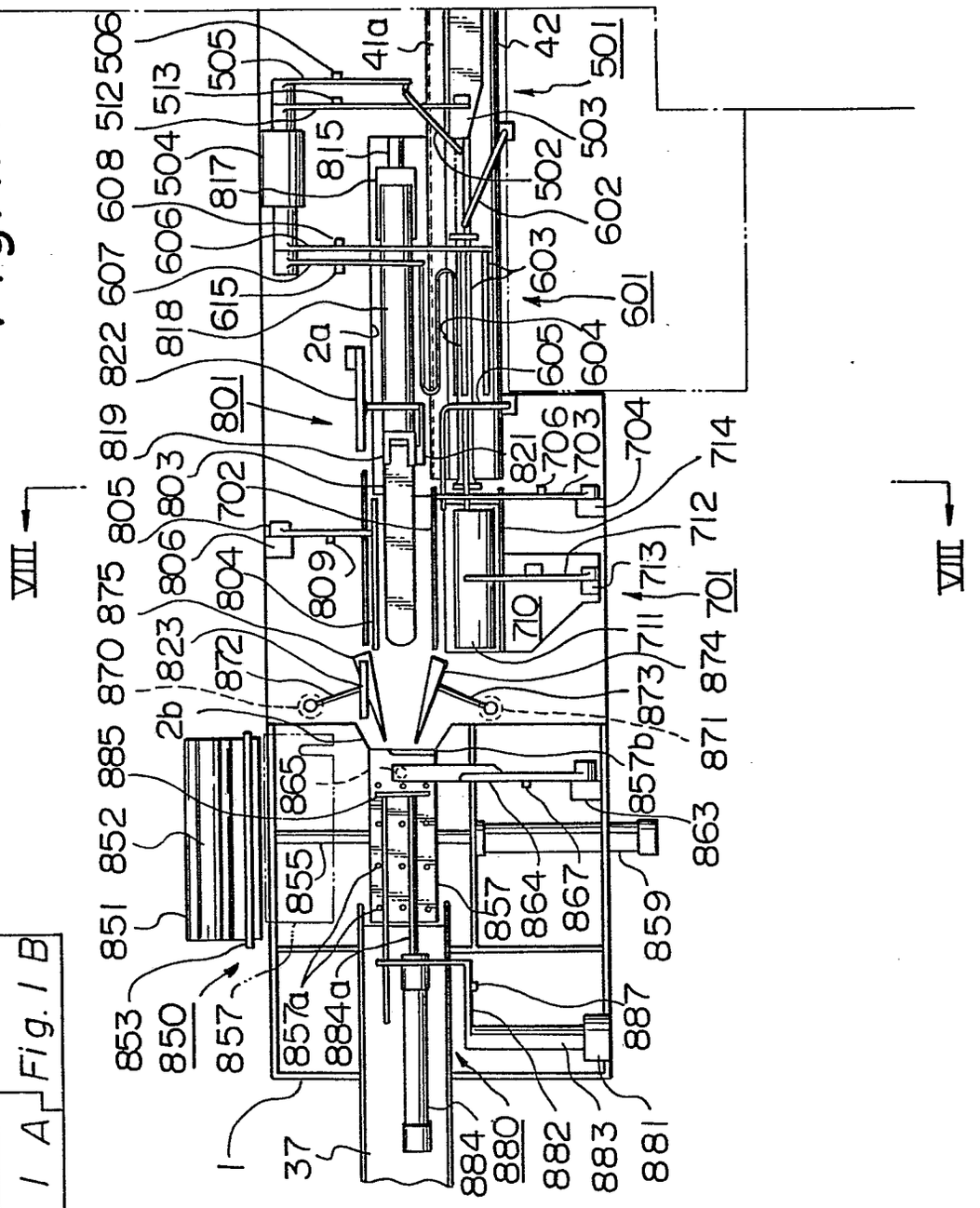

Fig. 1

Fig. 1 A | Fig. 1 B

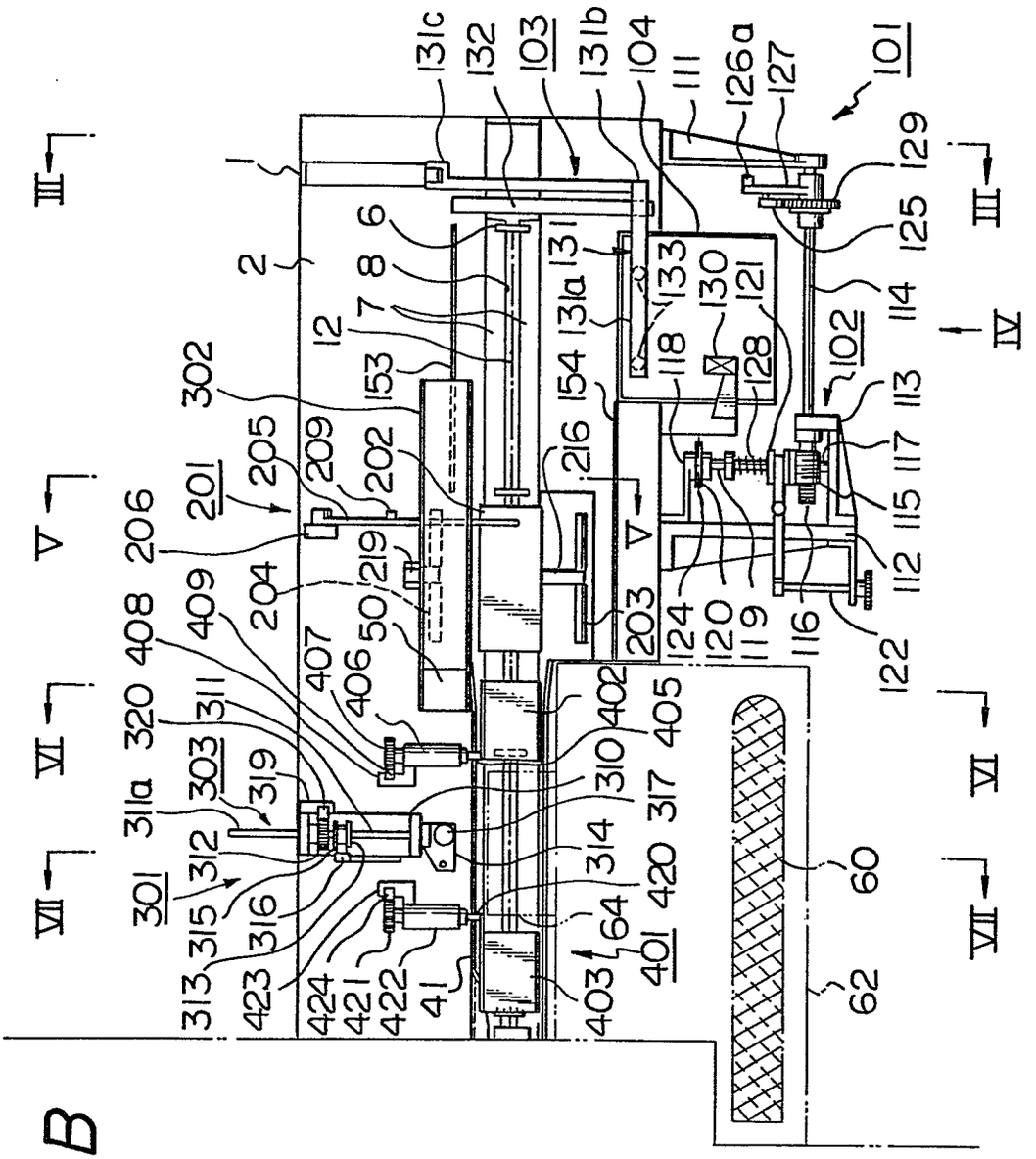
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Fig. 1B

Fig. 2A

Fig. 2A-1 | Fig. 2A-2

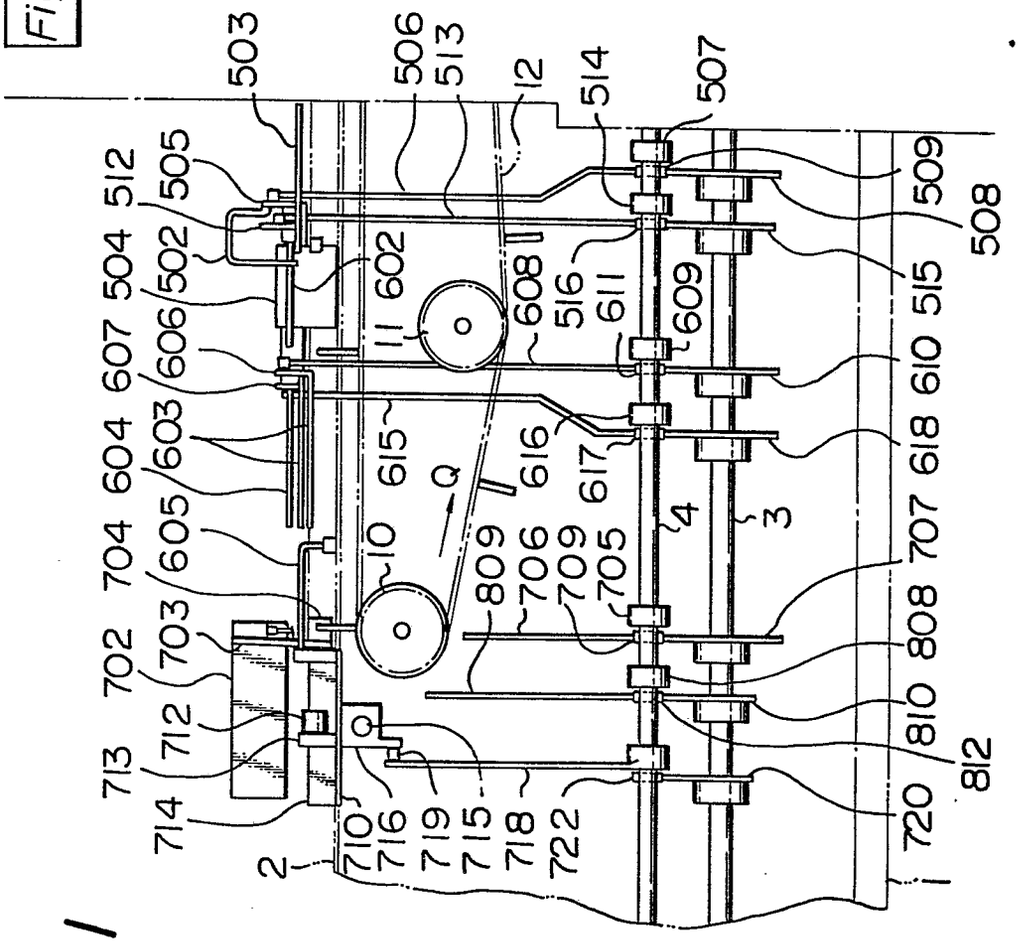

Fig. 2A-1

Fig. 2A-2

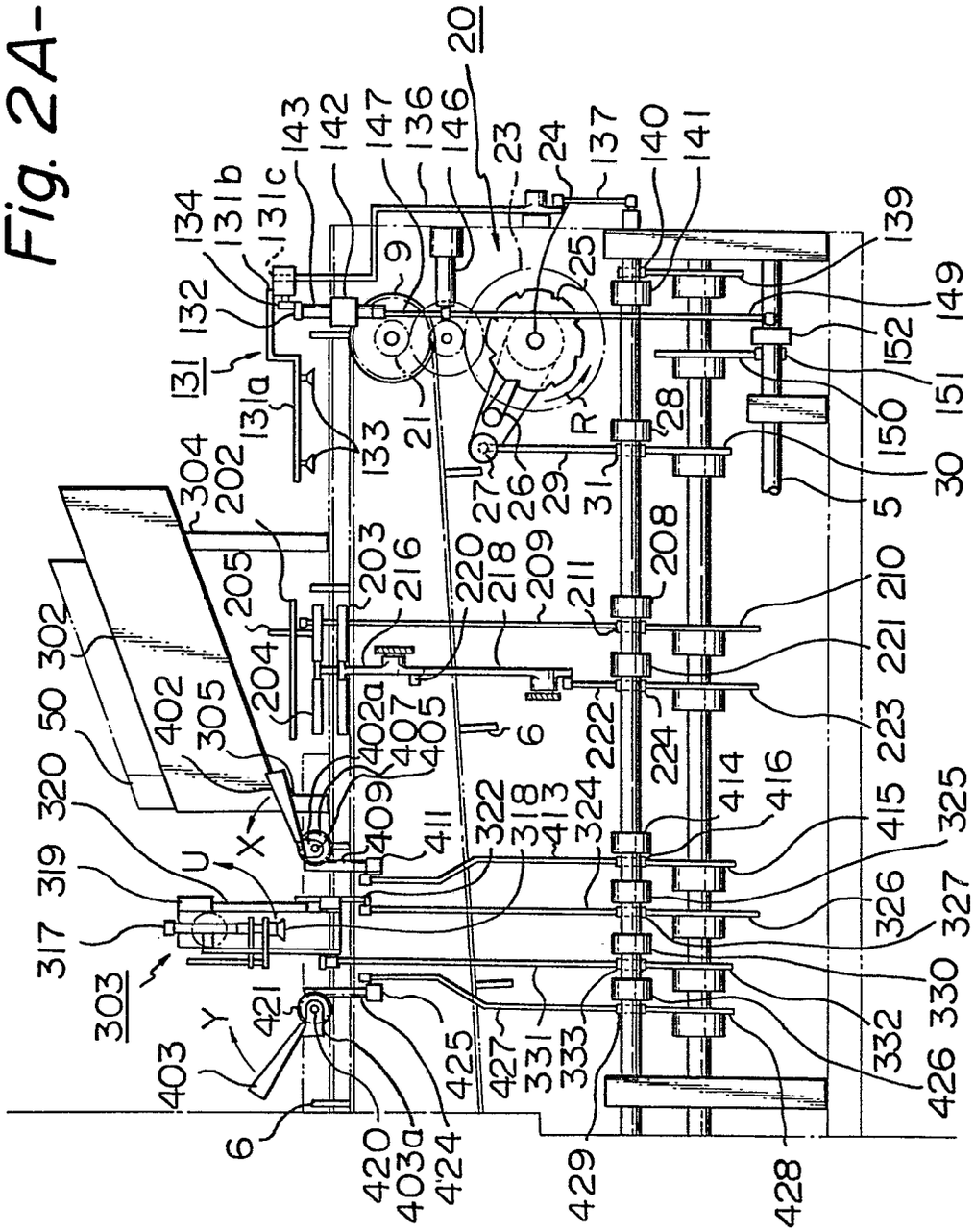
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Fig. 2B

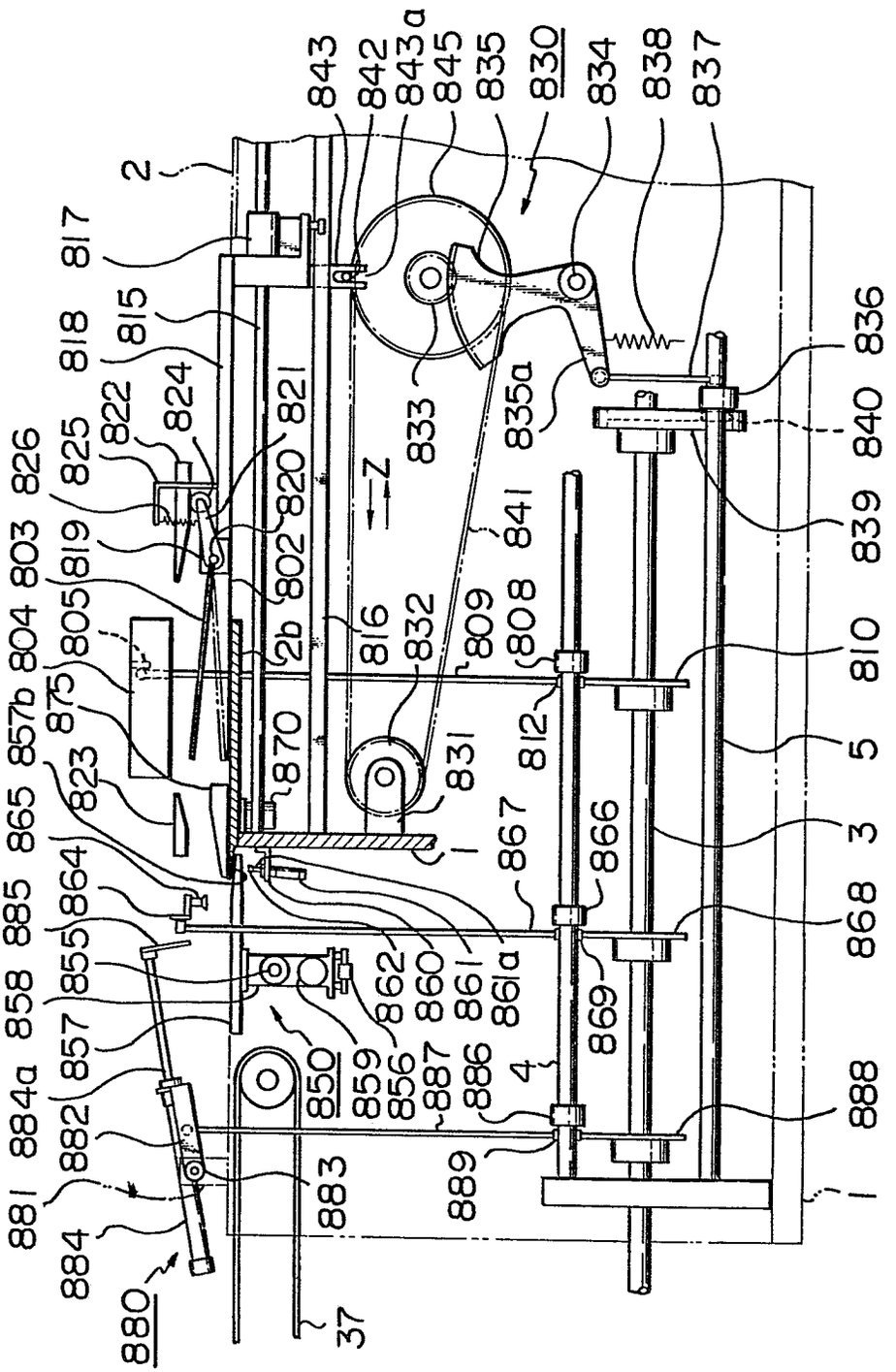
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Fig. 3

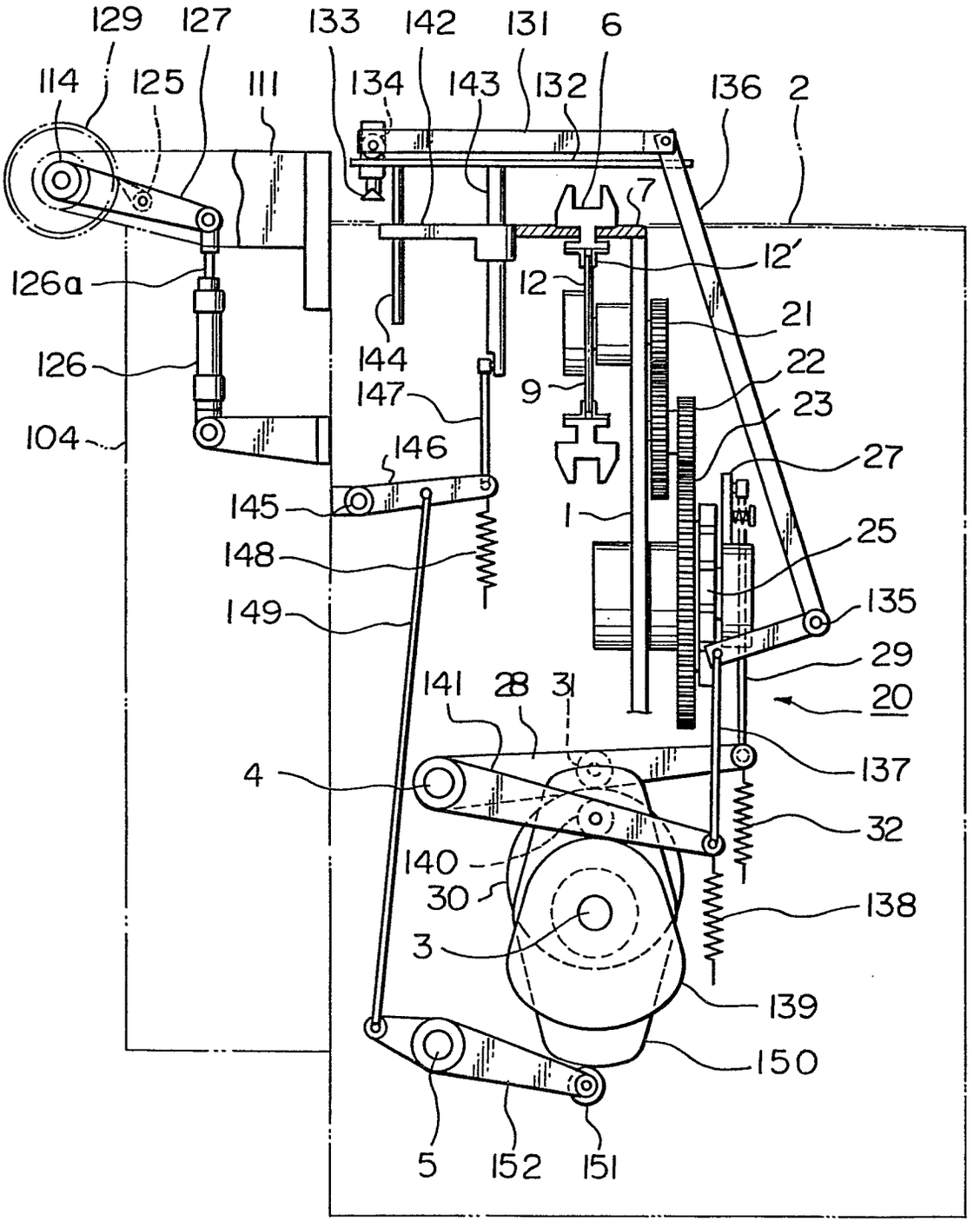
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Fig. 4

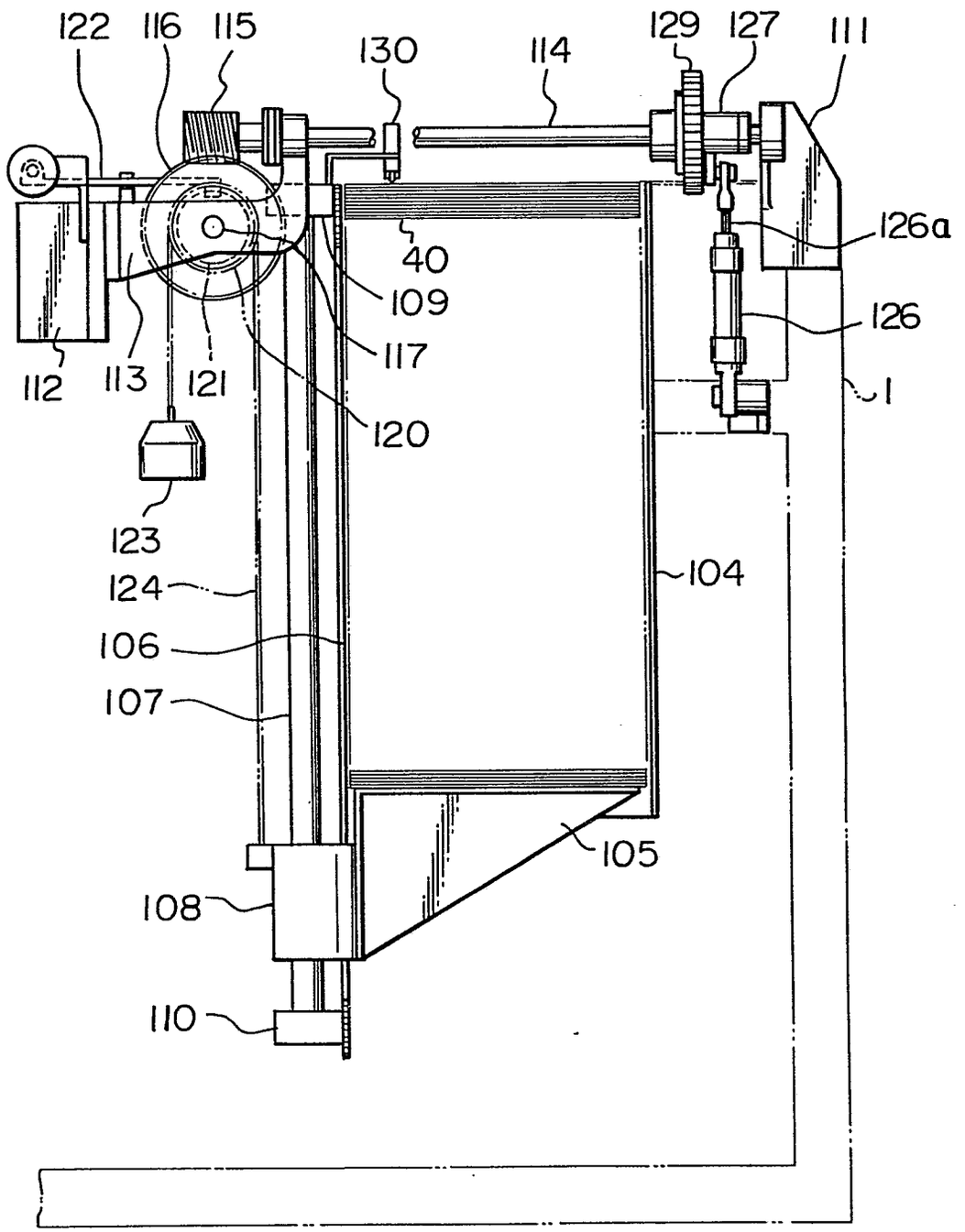
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Fig. 5

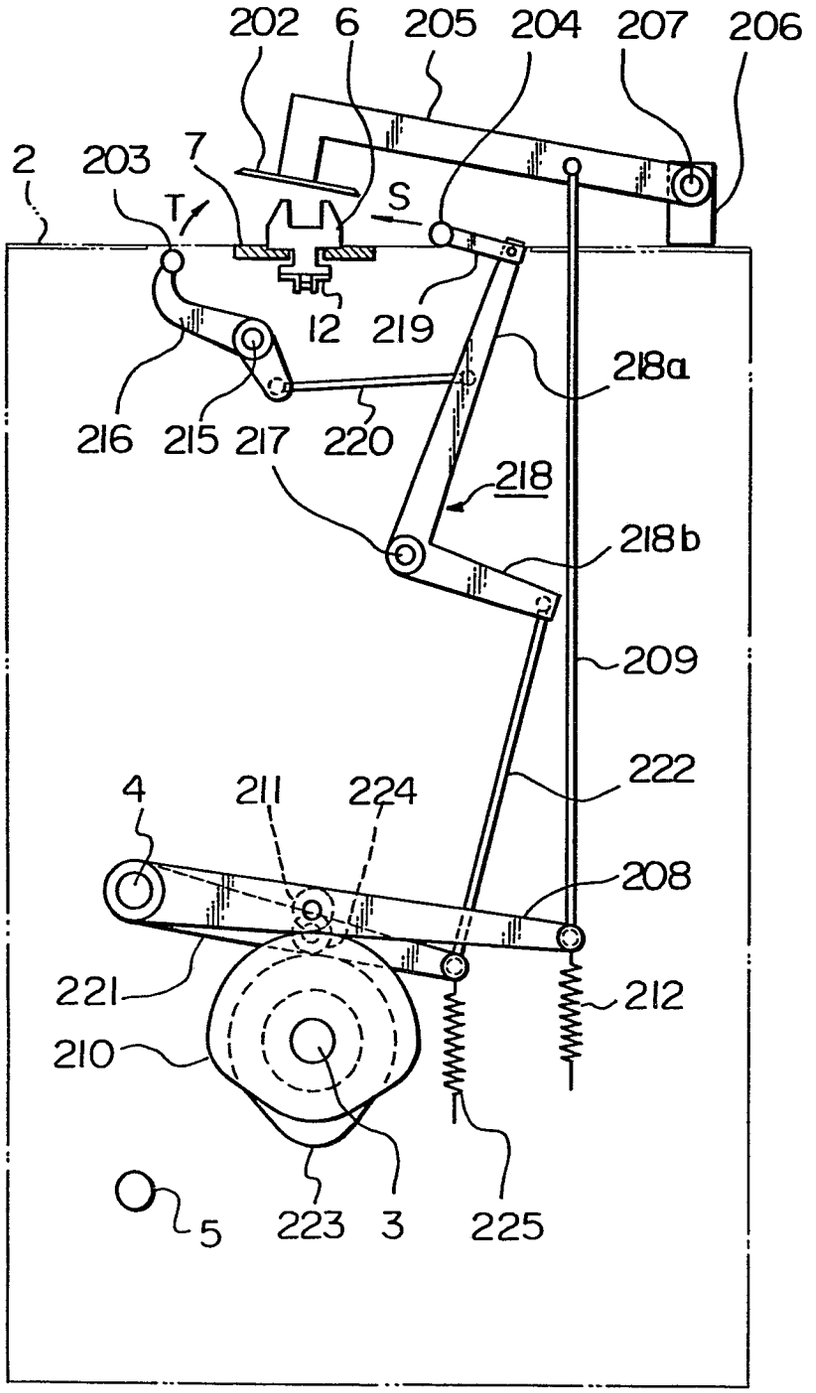
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Fig. 6

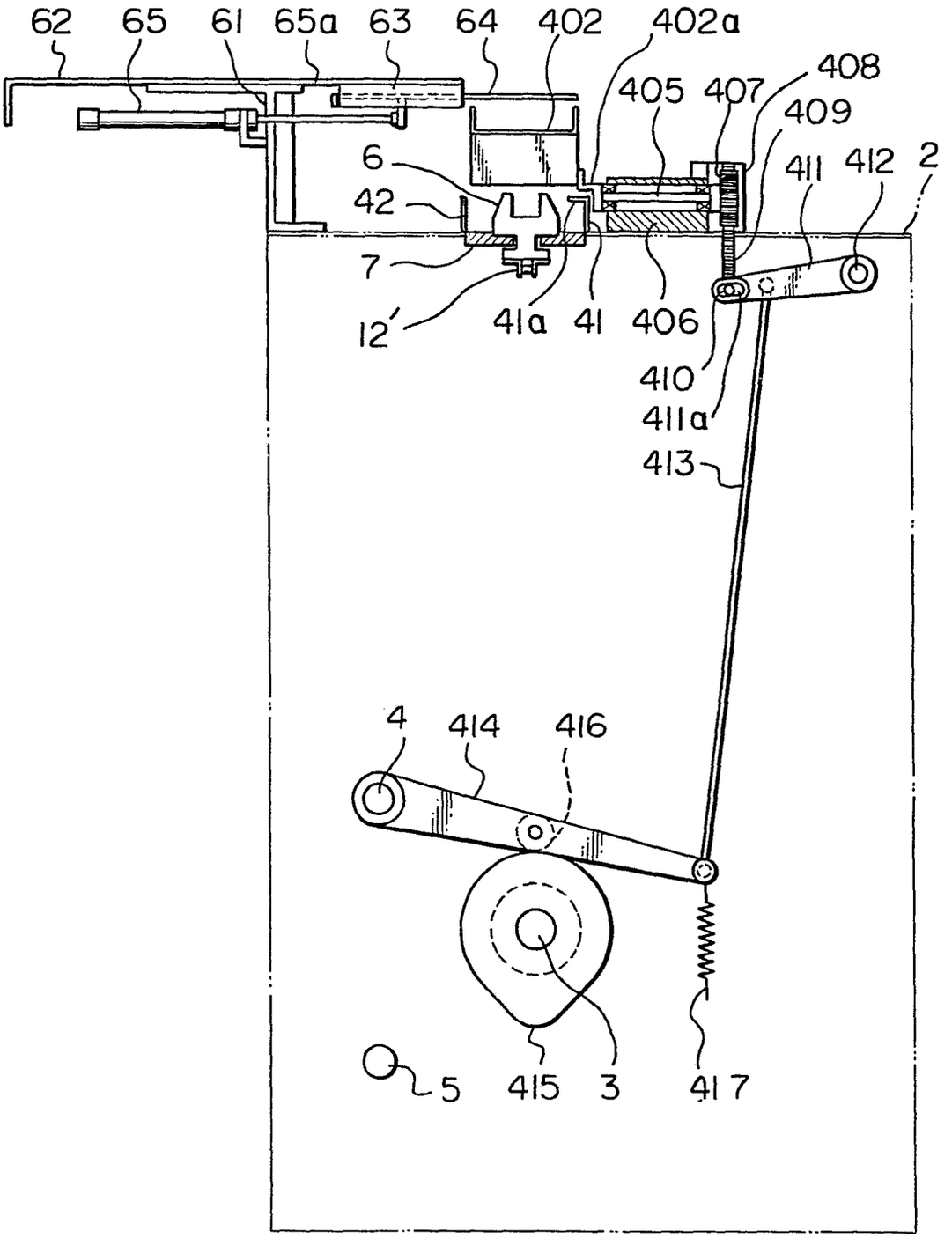
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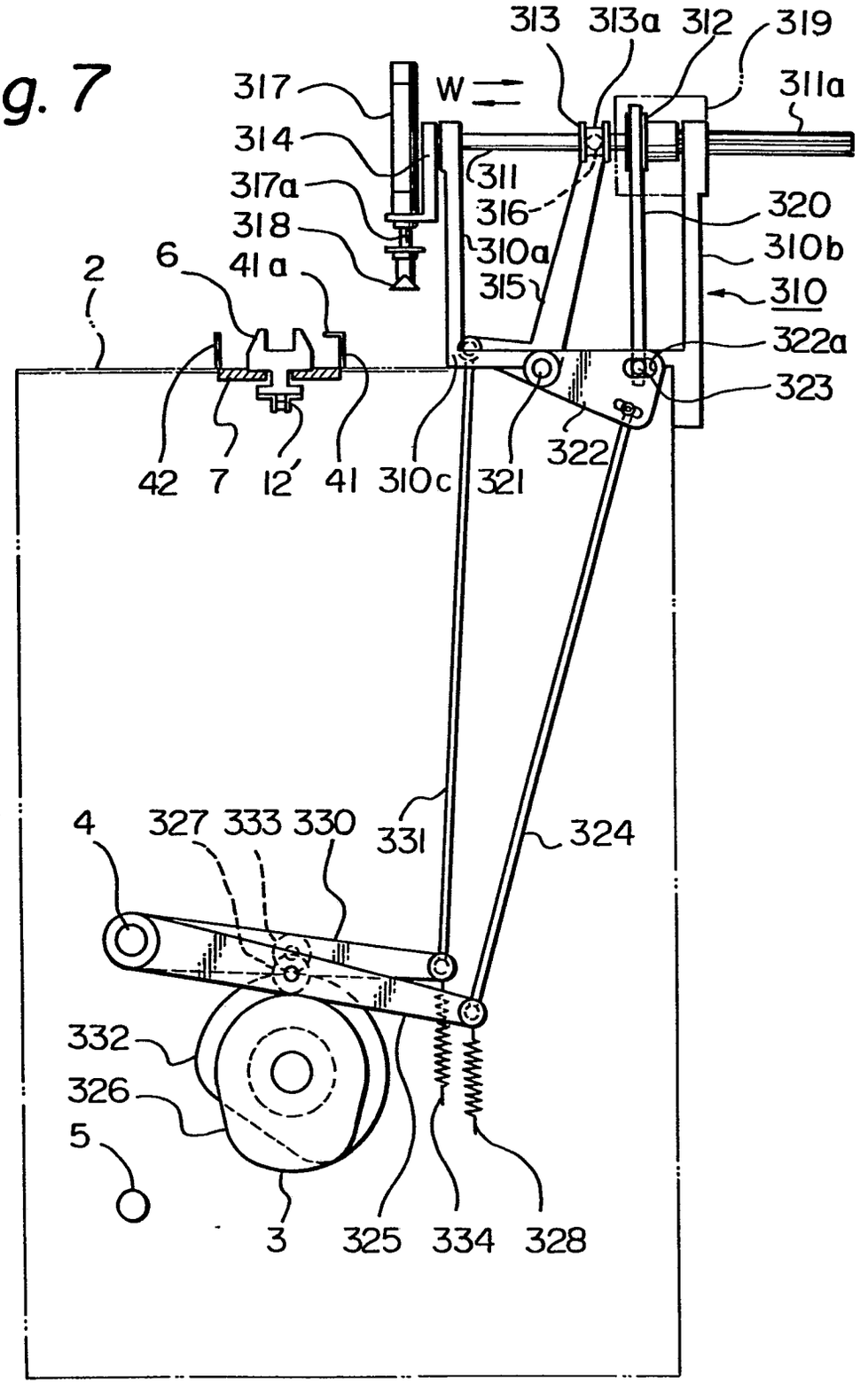
Fig. 7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322a
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42
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Fig. 8

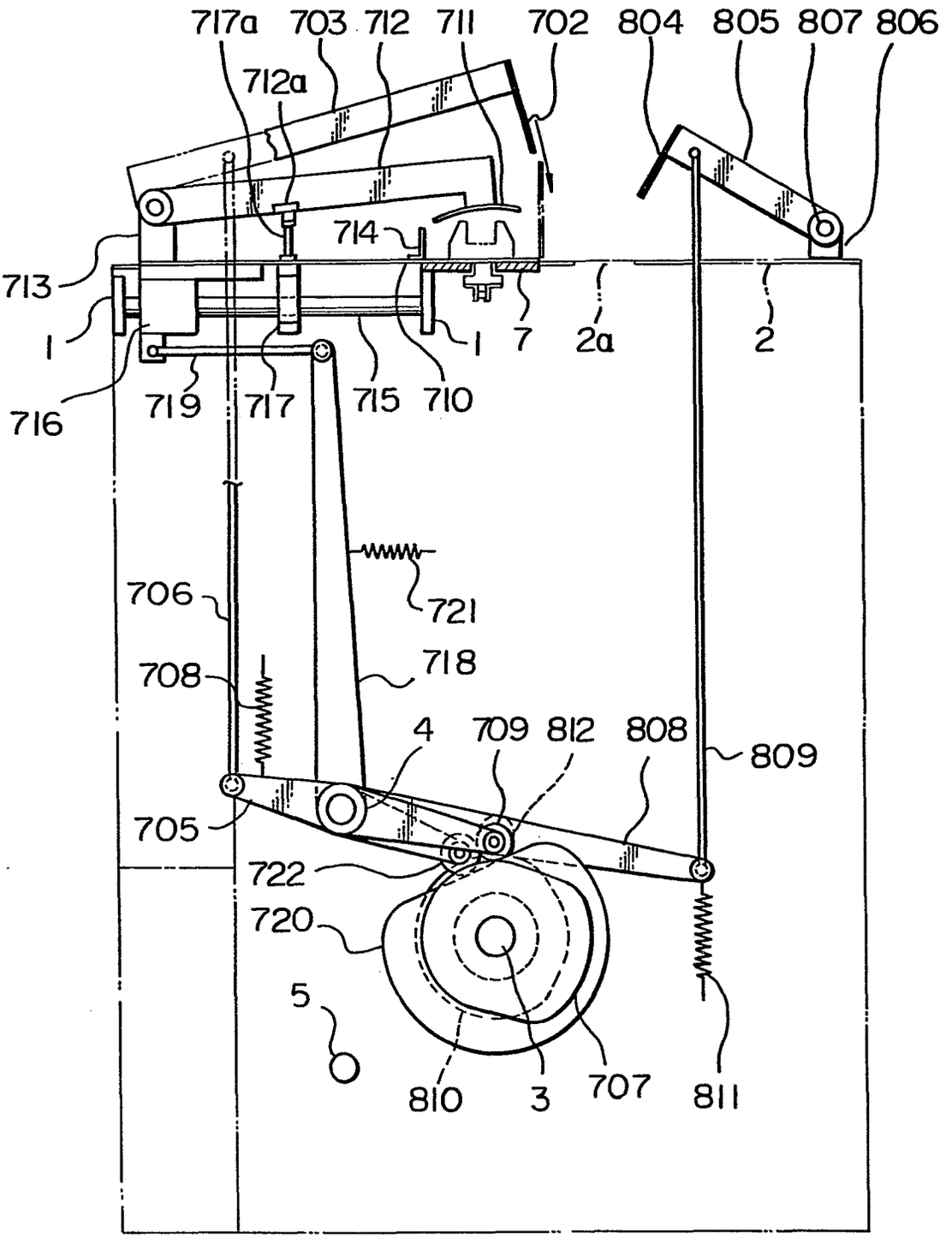
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Fig. 9A

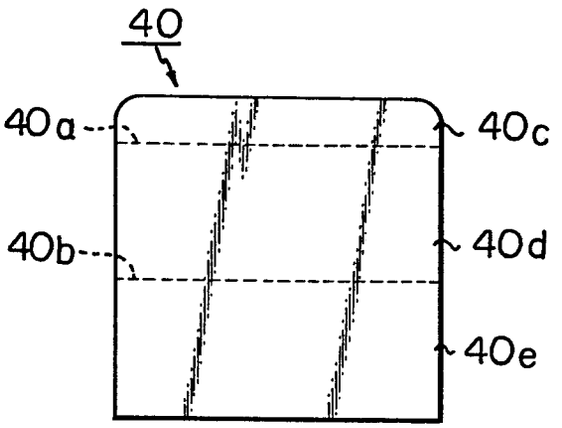


Fig. 9B

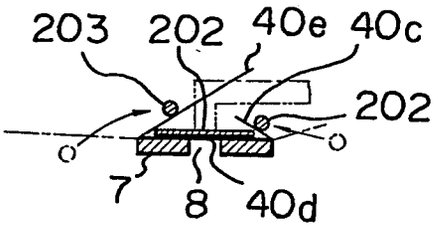


Fig. 9C

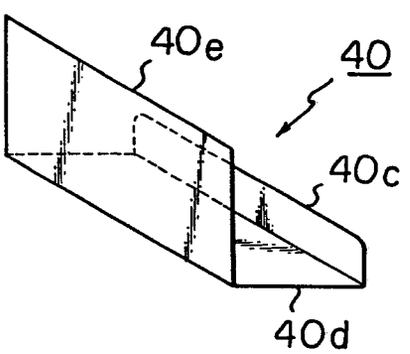


Fig. 9D

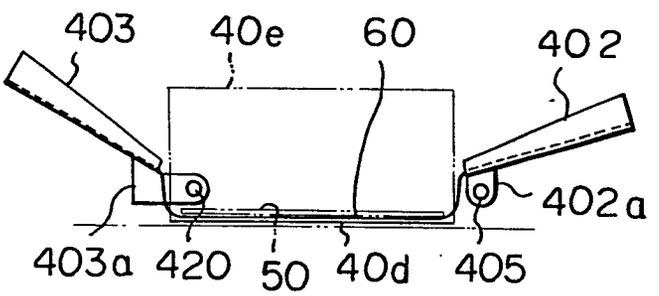


Fig. 9E

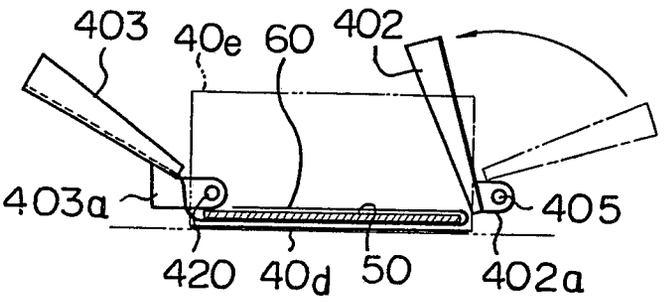


Fig. 9F

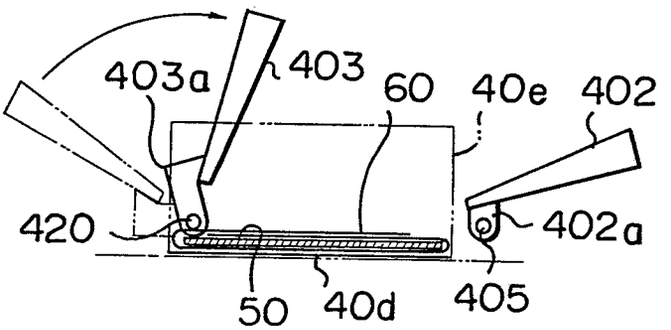


Fig. 9G

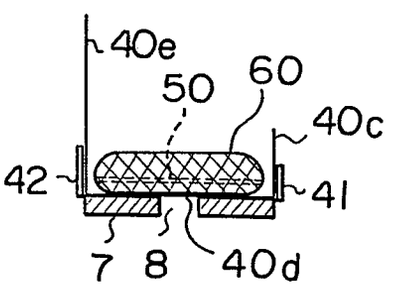


Fig. 9H

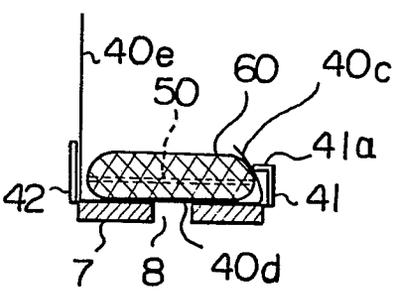


Fig. 9 I

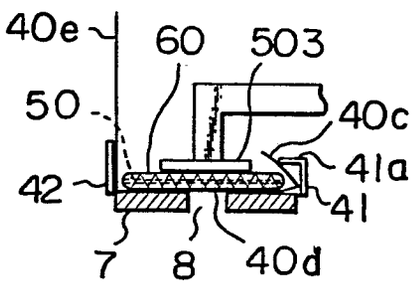


Fig. 9 J

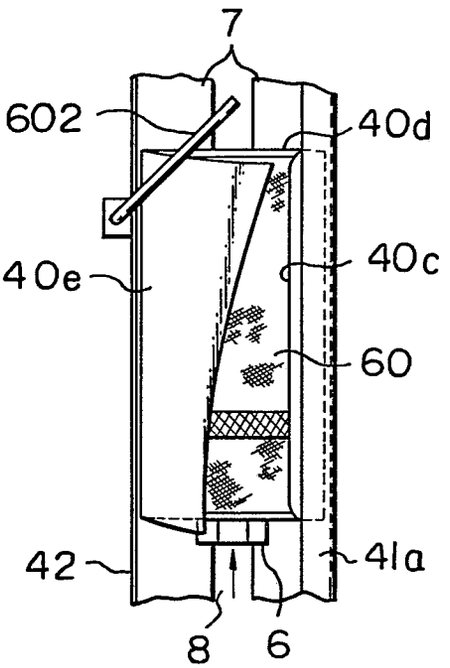


Fig. 9 K

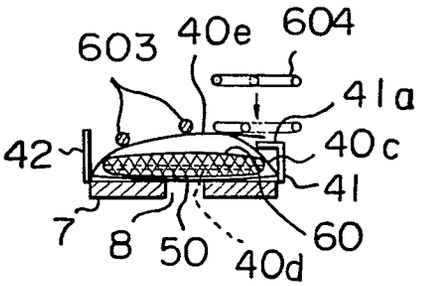


Fig. 9 L

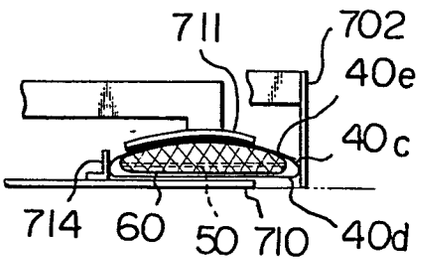


Fig. 9M

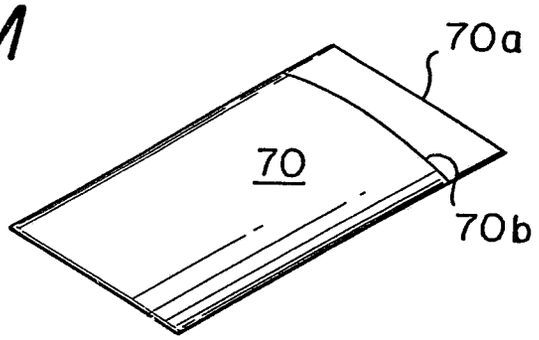


Fig. 9N

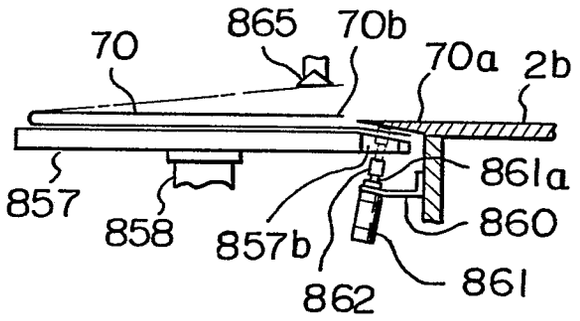
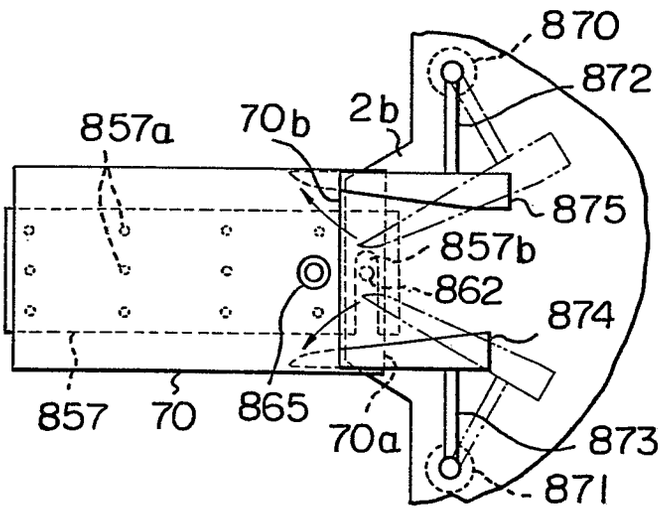


Fig. 9O



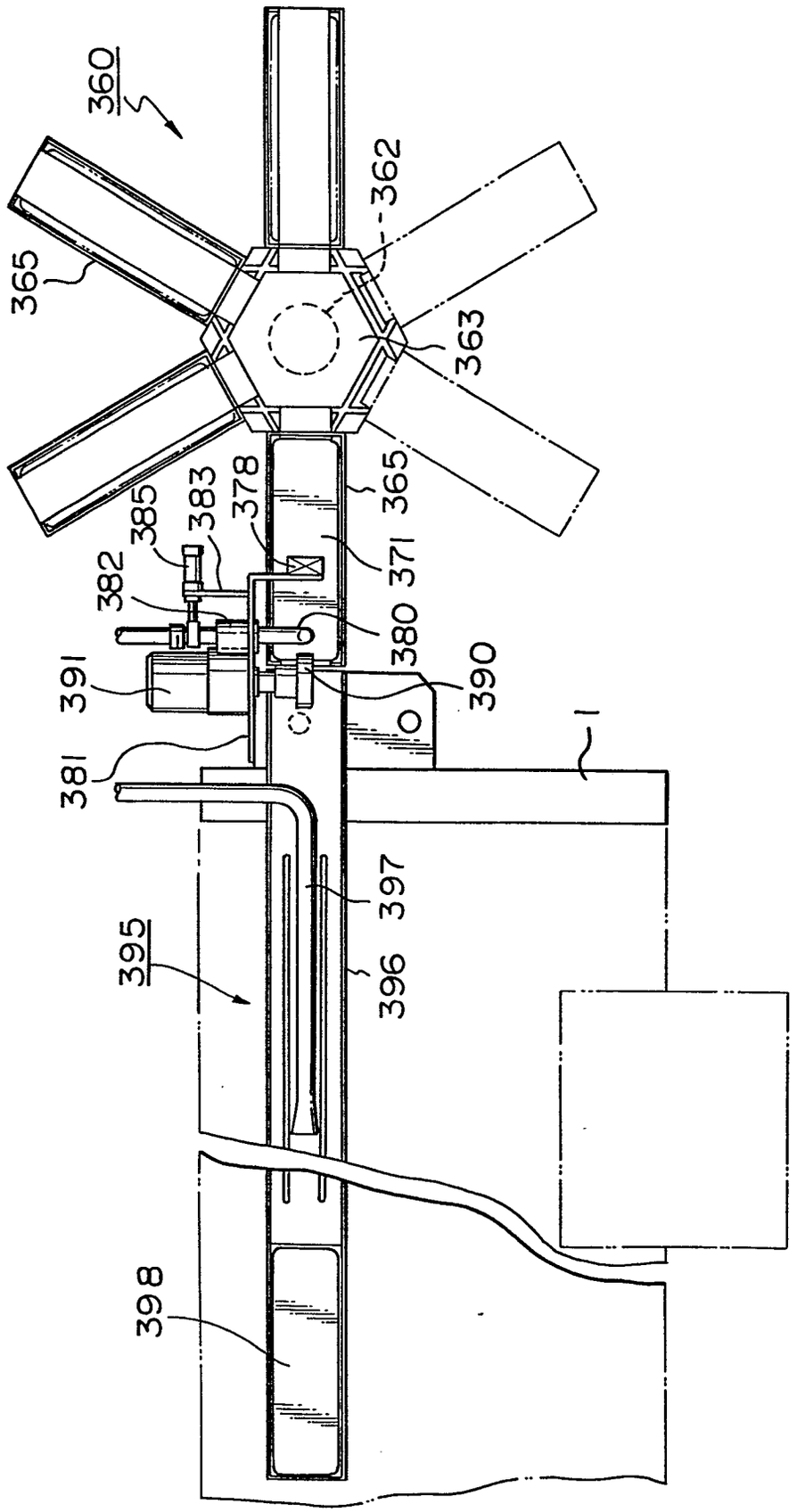

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Fig. 10

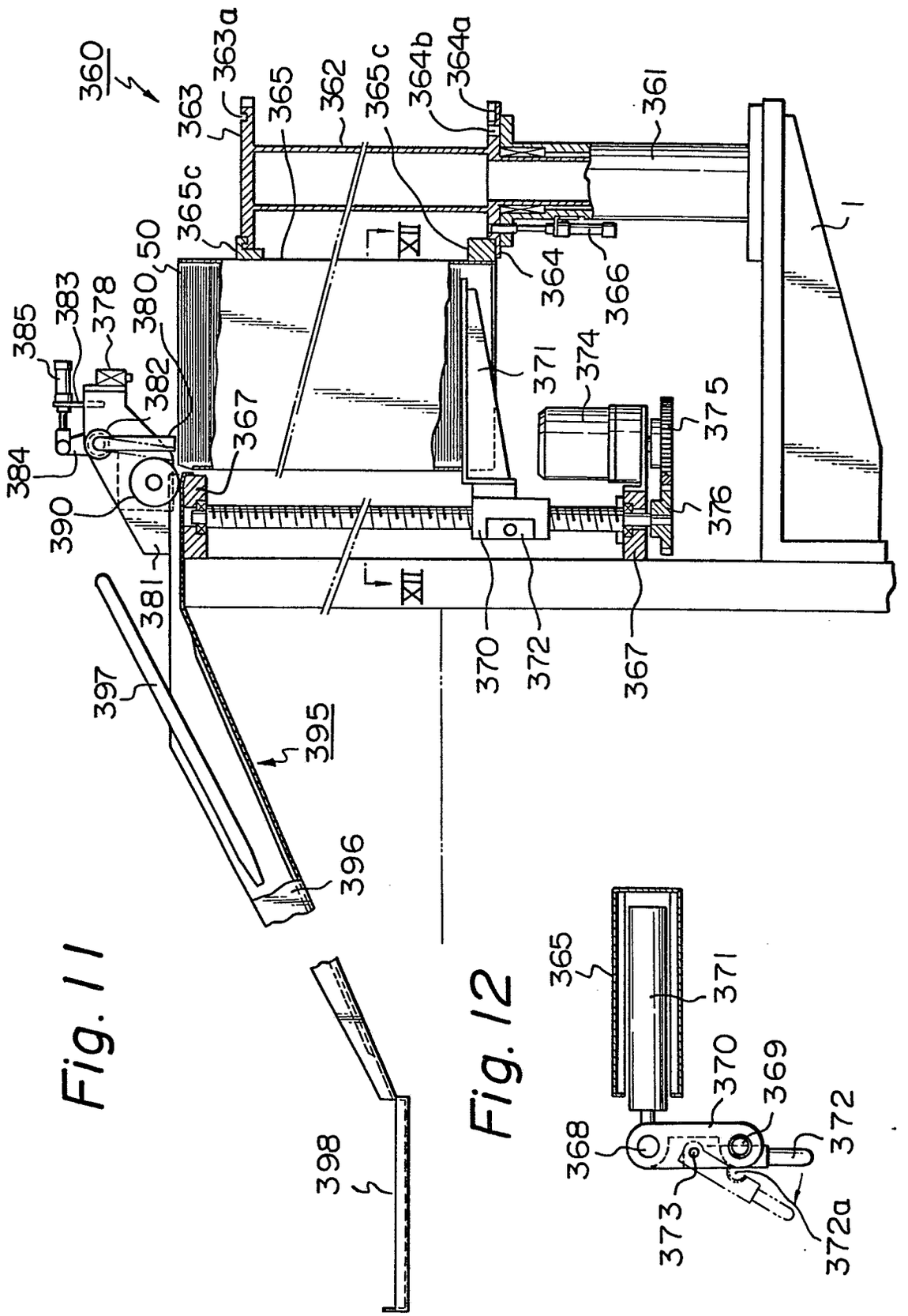
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Fig. 11

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Fig. 12

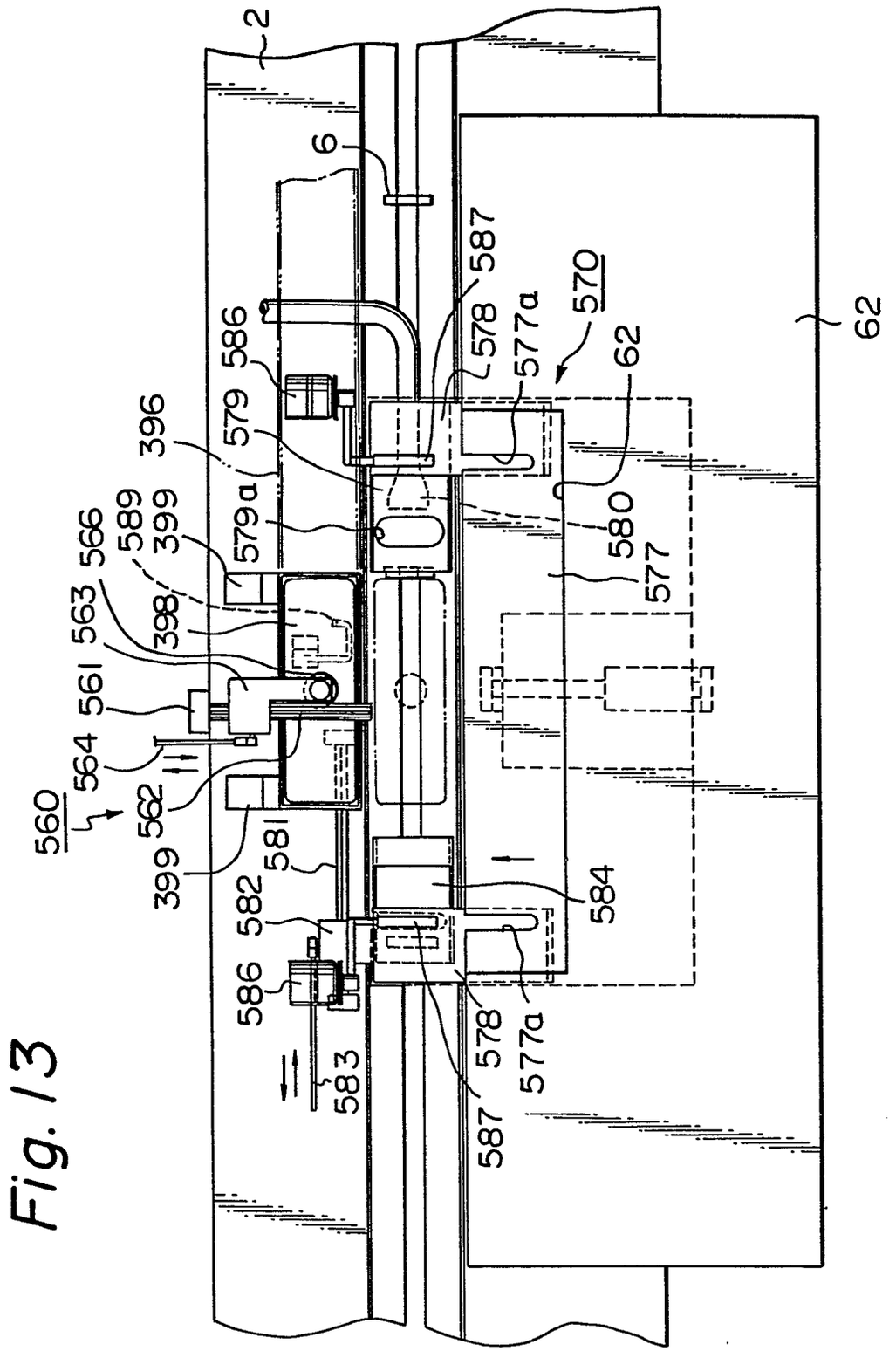
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Fig. 13

Fig. 14

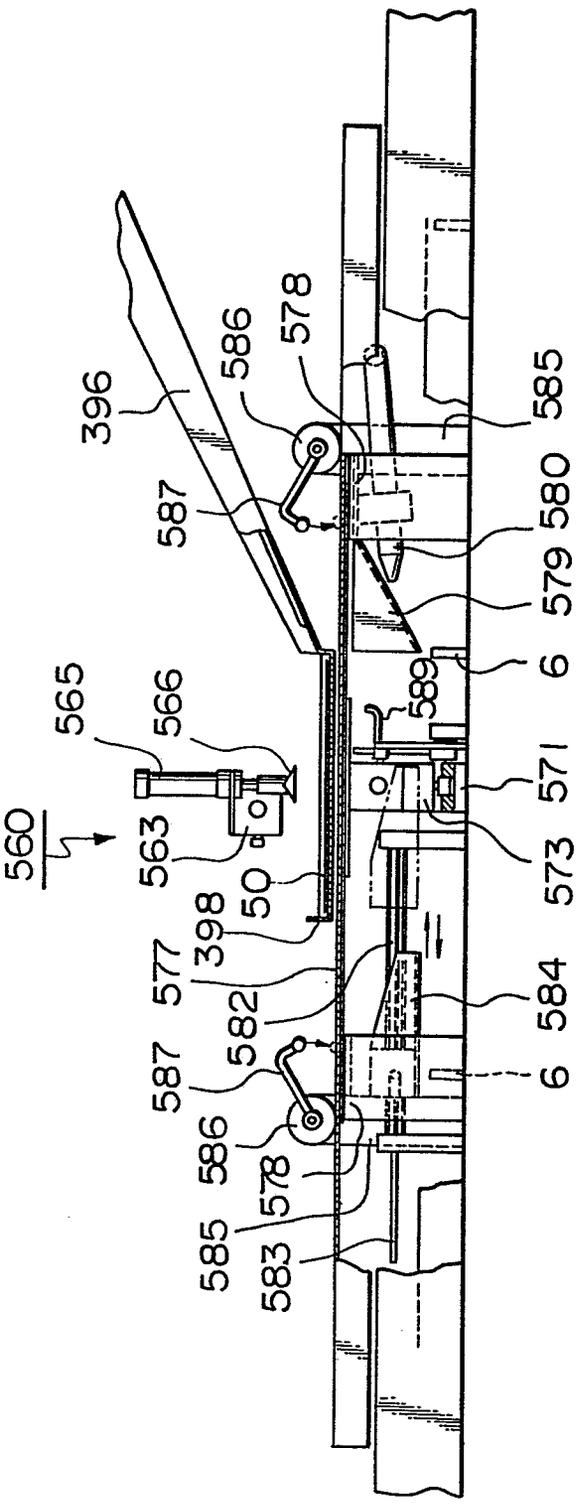
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Fig. 15

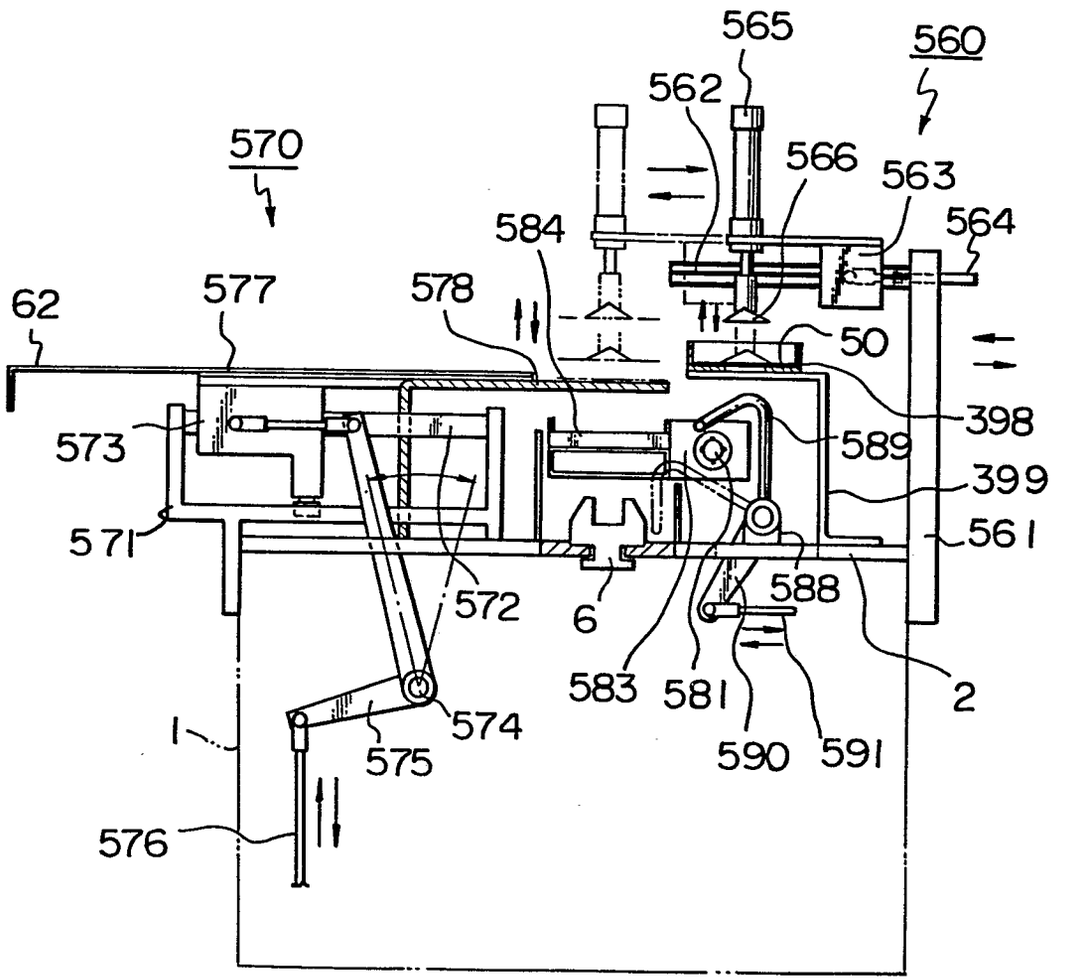
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Fig. 16A

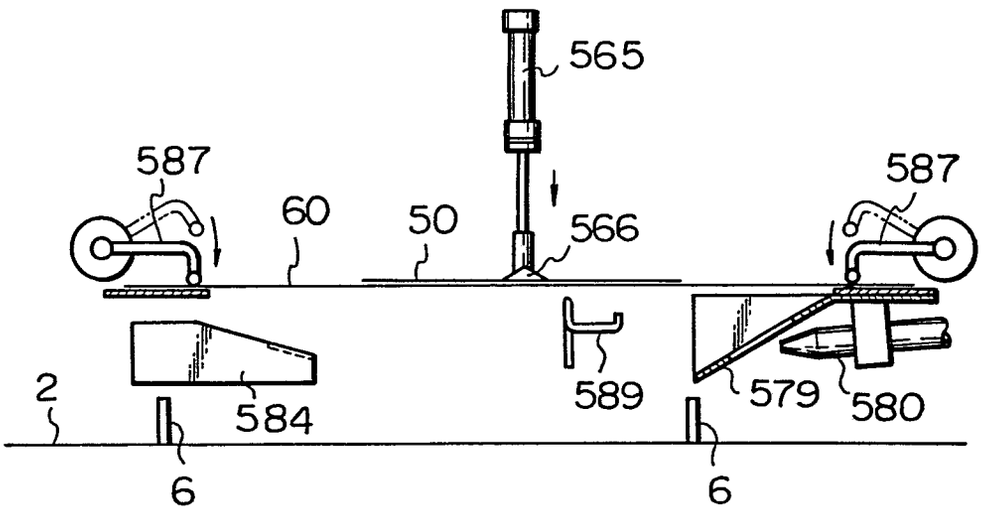

Fig. 16B

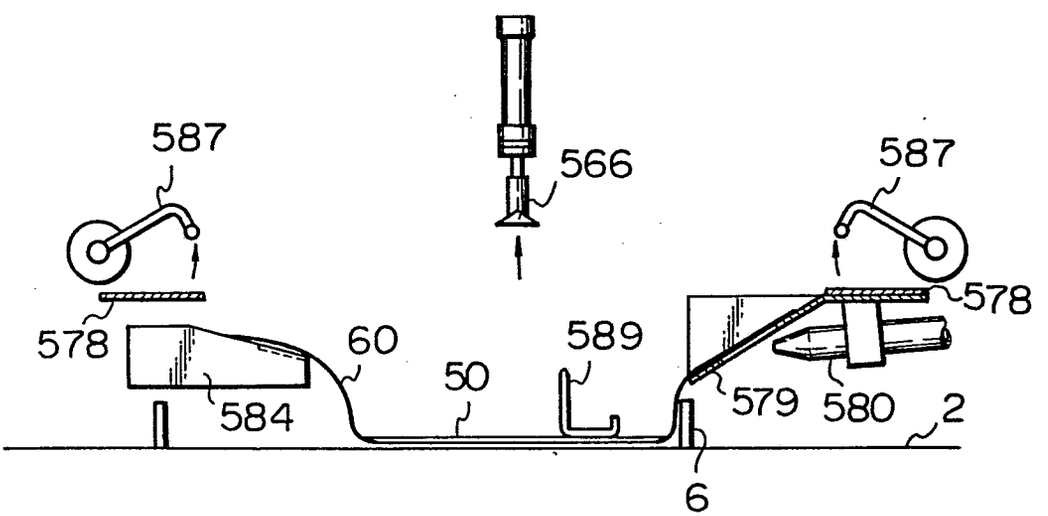

Fig. 16 C

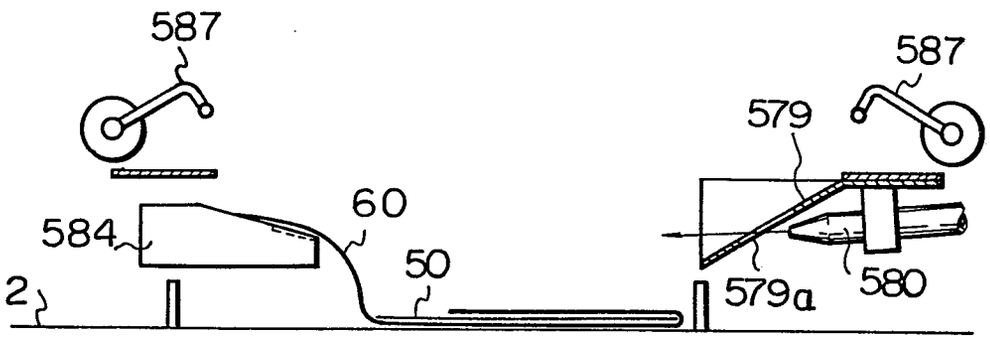

Fig. 16 D

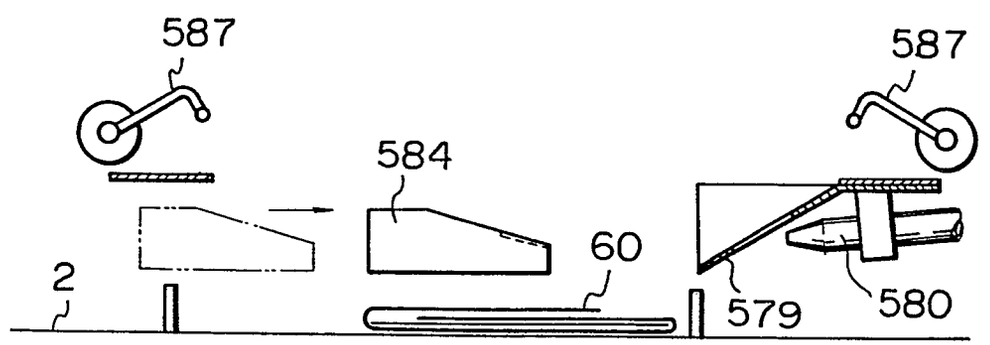

Fig. 17

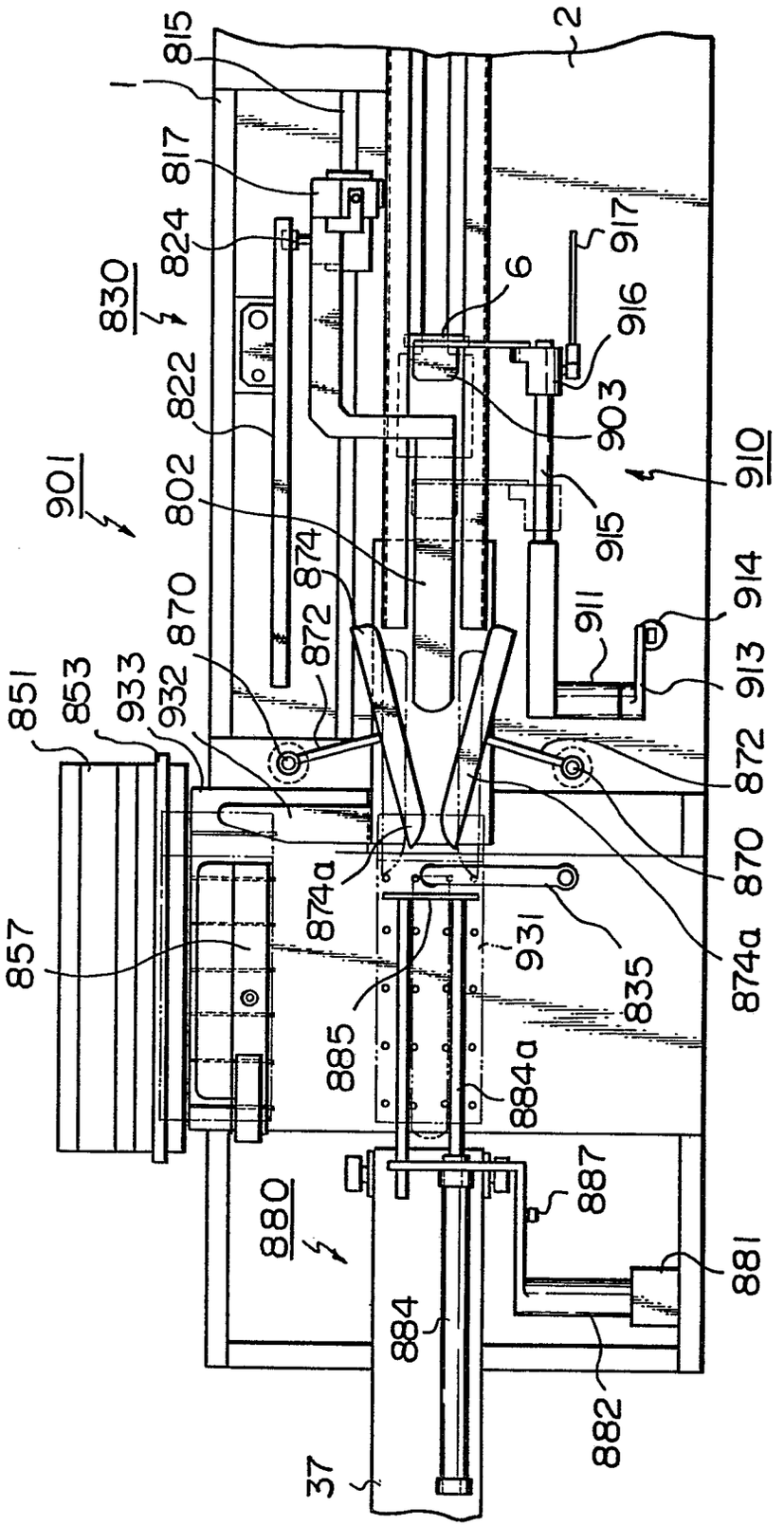
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Fig. 18

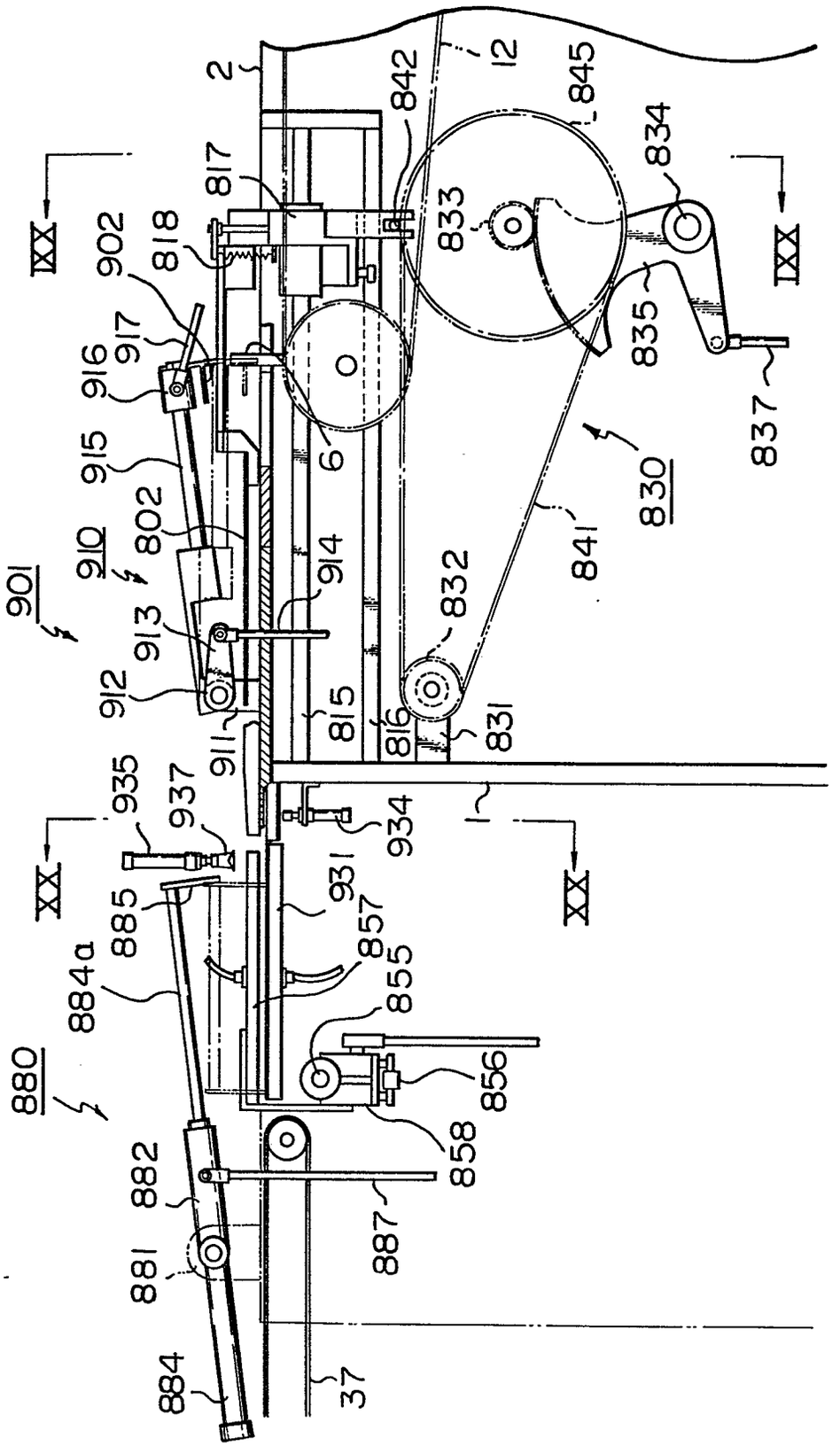
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Fig. 19

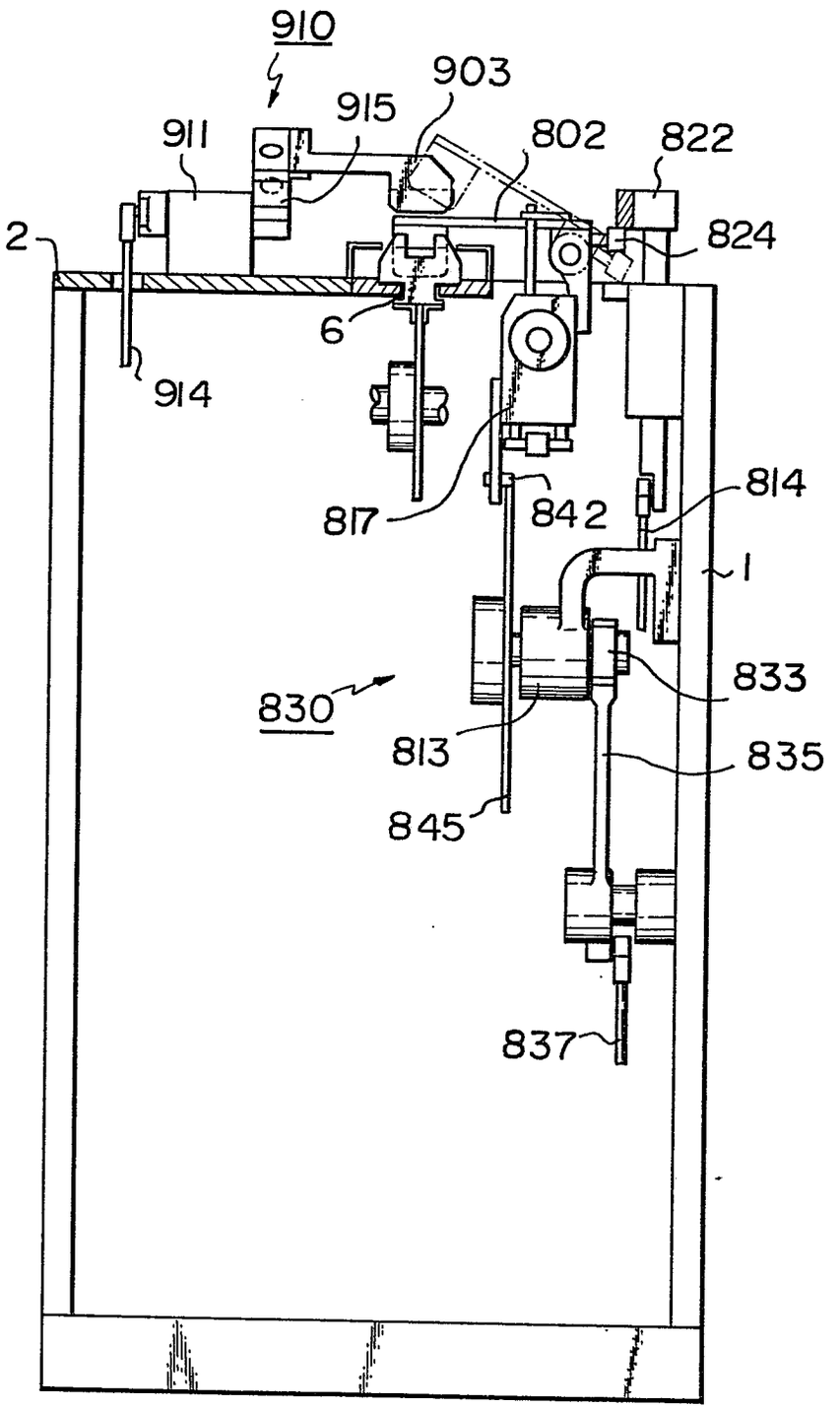
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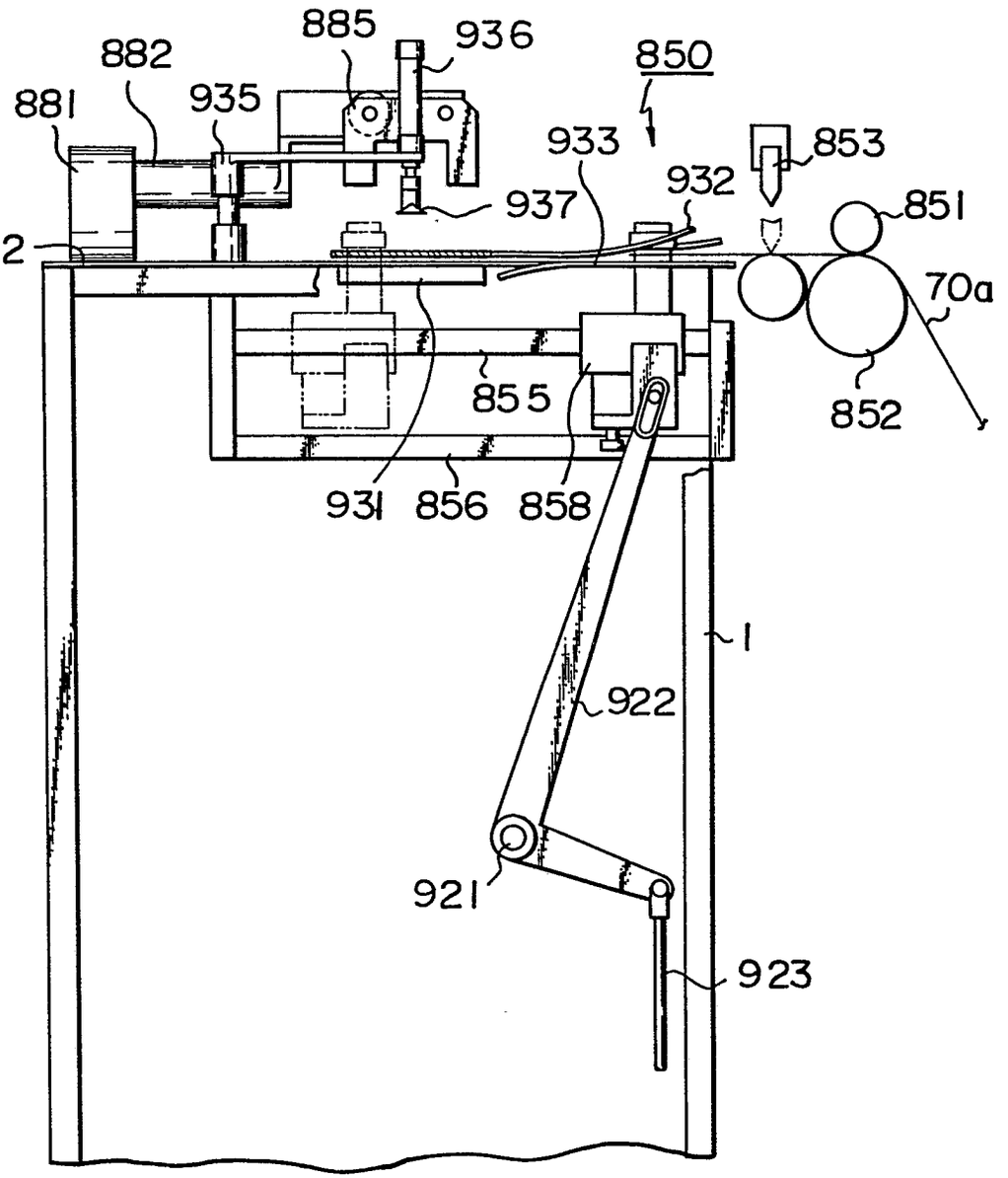
Fig. 20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European Patent Office

EUROPEAN SEARCH REPORT

Application number
EP 81850198.3

DOCUMENTS CONSIDERED TO BE RELEVANT

Category	Citation of document with indication, where appropriate, of relevant passages	Relevant to claim
D,P	EP - A1 - 0 026 164 (TAKATORI MACHINERY)	
	--	
A	GB - A - 692 034 (BACKHOUSE)	7-9
	--	
A	GB - A - 1 200 874 (CLOUD MACHINE) * Fig. 1 *	25,29
	--	
	US - A - 3 490 195 (ABRAMSON) * Fig. 15 *	26,30
	--	
A	US - A - 3 902 300 (GLAZE, JR)	

CLASSIFICATION OF THE APPLICATION (Int. Cl.³)

B 65 B 25/20

TECHNICAL FIELDS SEARCHED (Int. Cl.³)

B 65 B 25/00
B 65 B 41/00
B 65 B 43/00
B 65 B 49/00
B 65 B 61/00
B 65 B 63/00

CATEGORY OF CITED DOCUMENTS

X: particularly relevant
A: technological background
O: non-written disclosure
P: intermediate document
T: theory or principle underlying the invention
E: conflicting application
D: document cited in the application
L: citation for other reasons

&: member of the same patent family, corresponding document

X The present search report has been drawn up for all claims

Place of search	Date of completion of the search	Examiner
VIENNA	27-01-1982	MELZER

EPO Form 1503.1 06.78