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PACKAGING MACHINE

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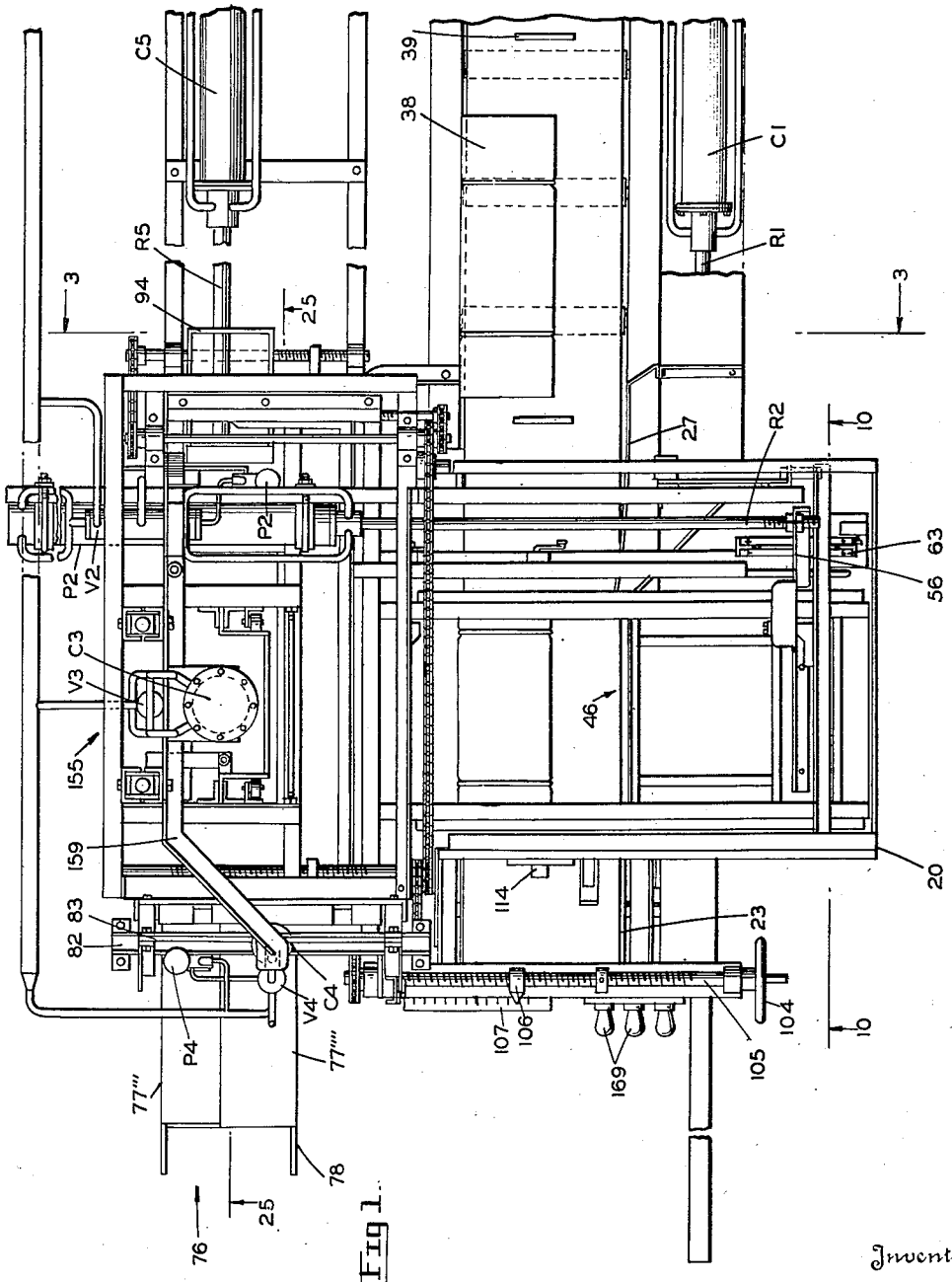

Fig 1.

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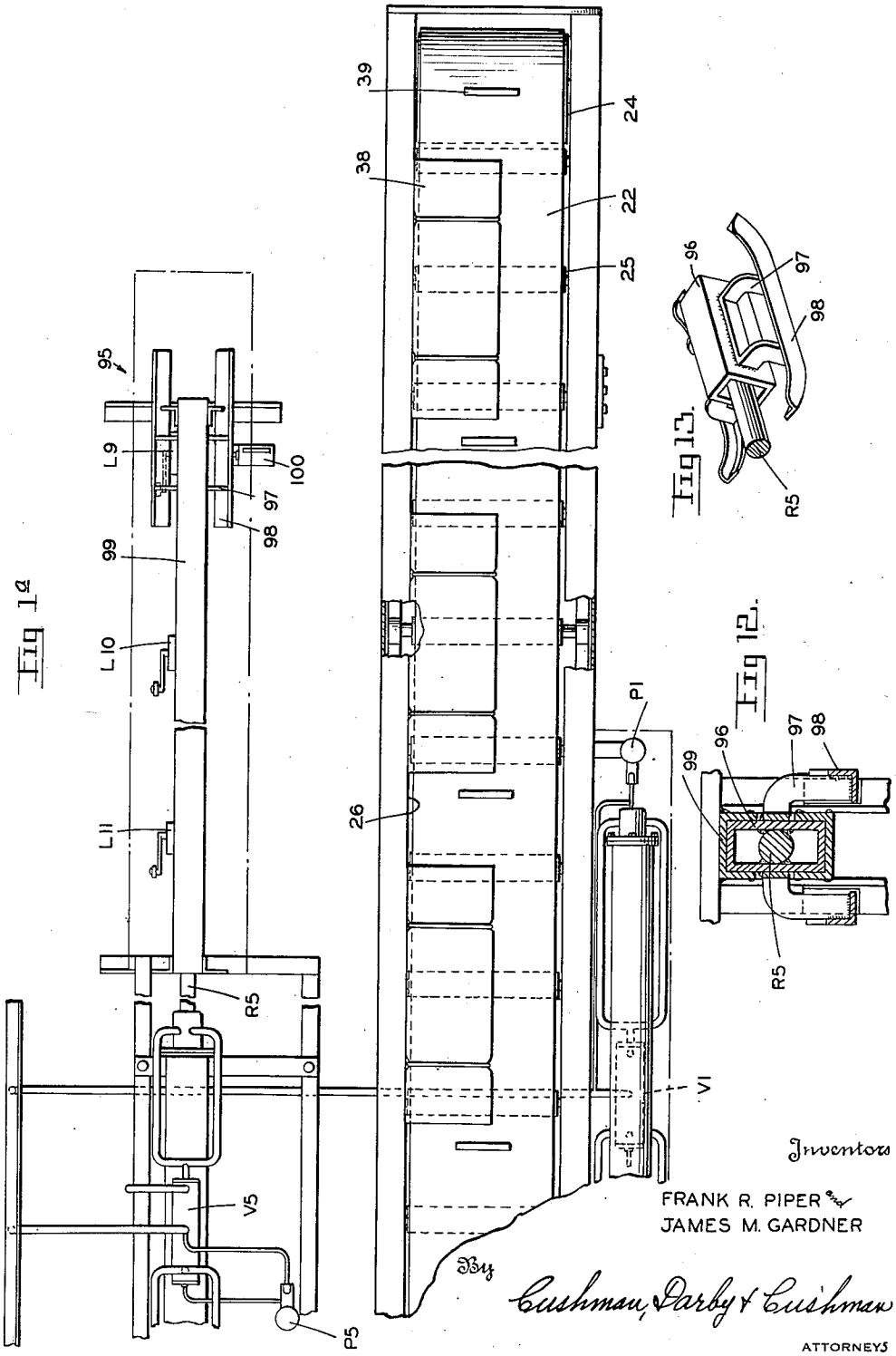

Fig 1a

Fig 13.

Fig 12.

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Fig 11.a

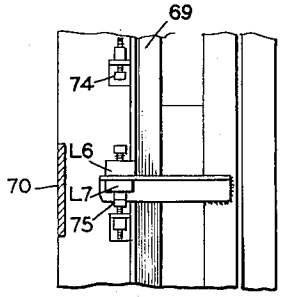

Fig 2.

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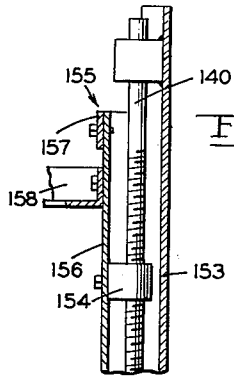

Fig 14.

Fig 3.

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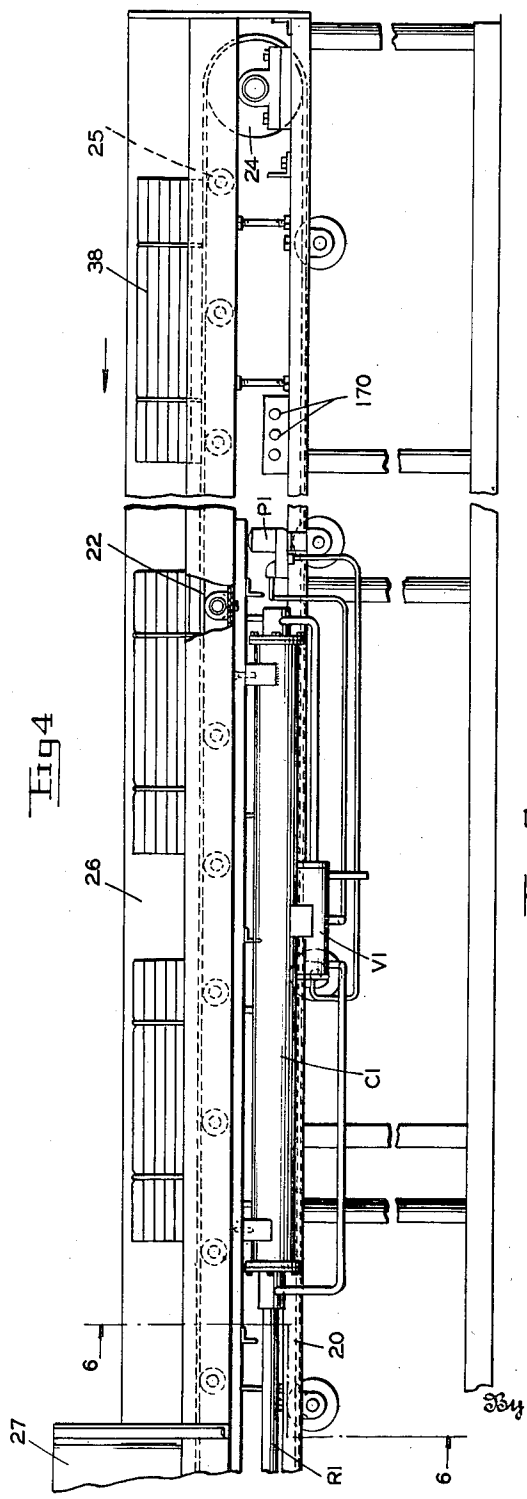

Fig 4

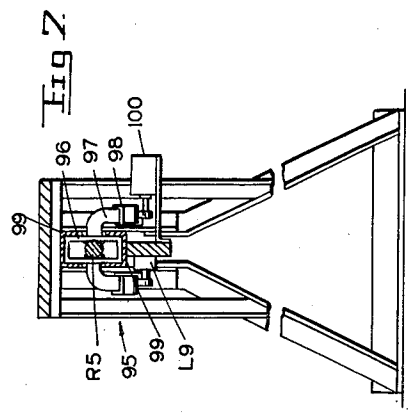

Fig 7

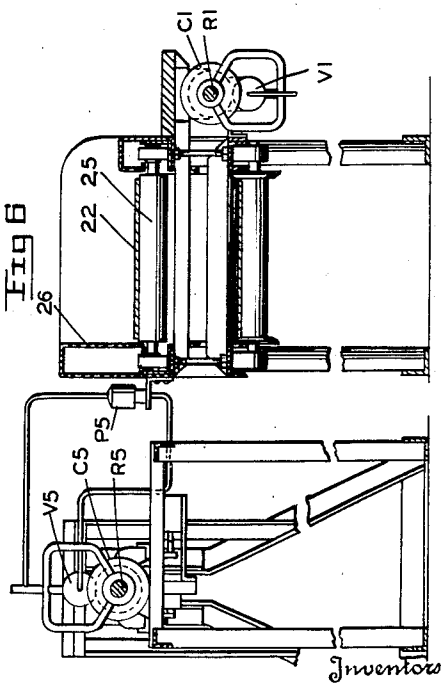

Fig 6

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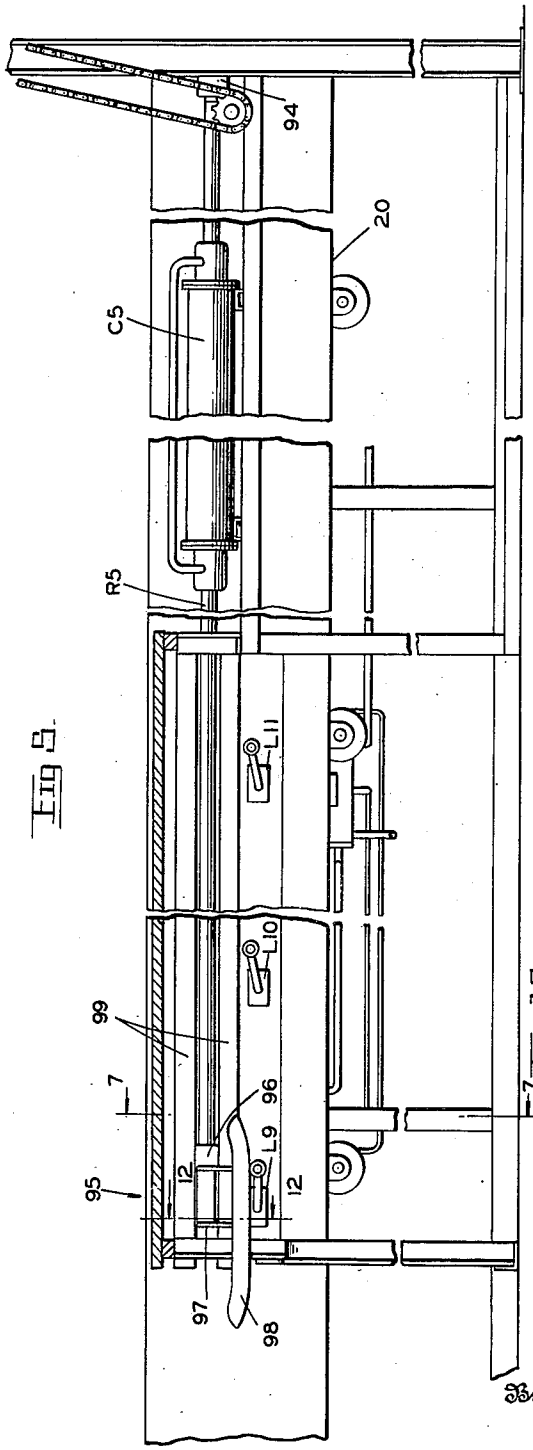

Fig 5.

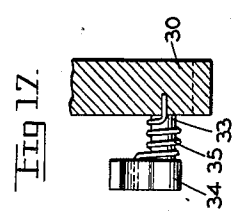

Fig 17.

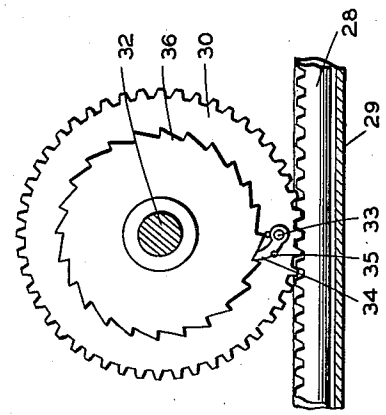

Fig 16.

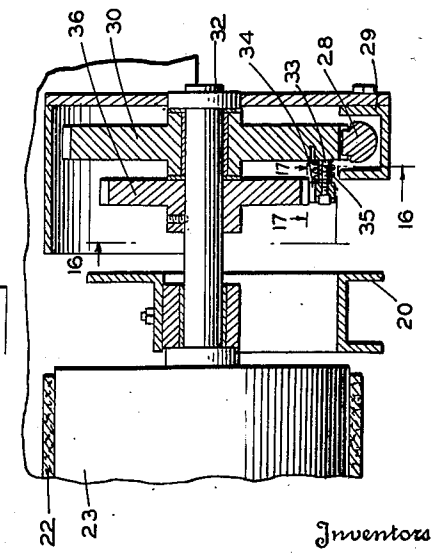

Fig 15.

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Fig 8.

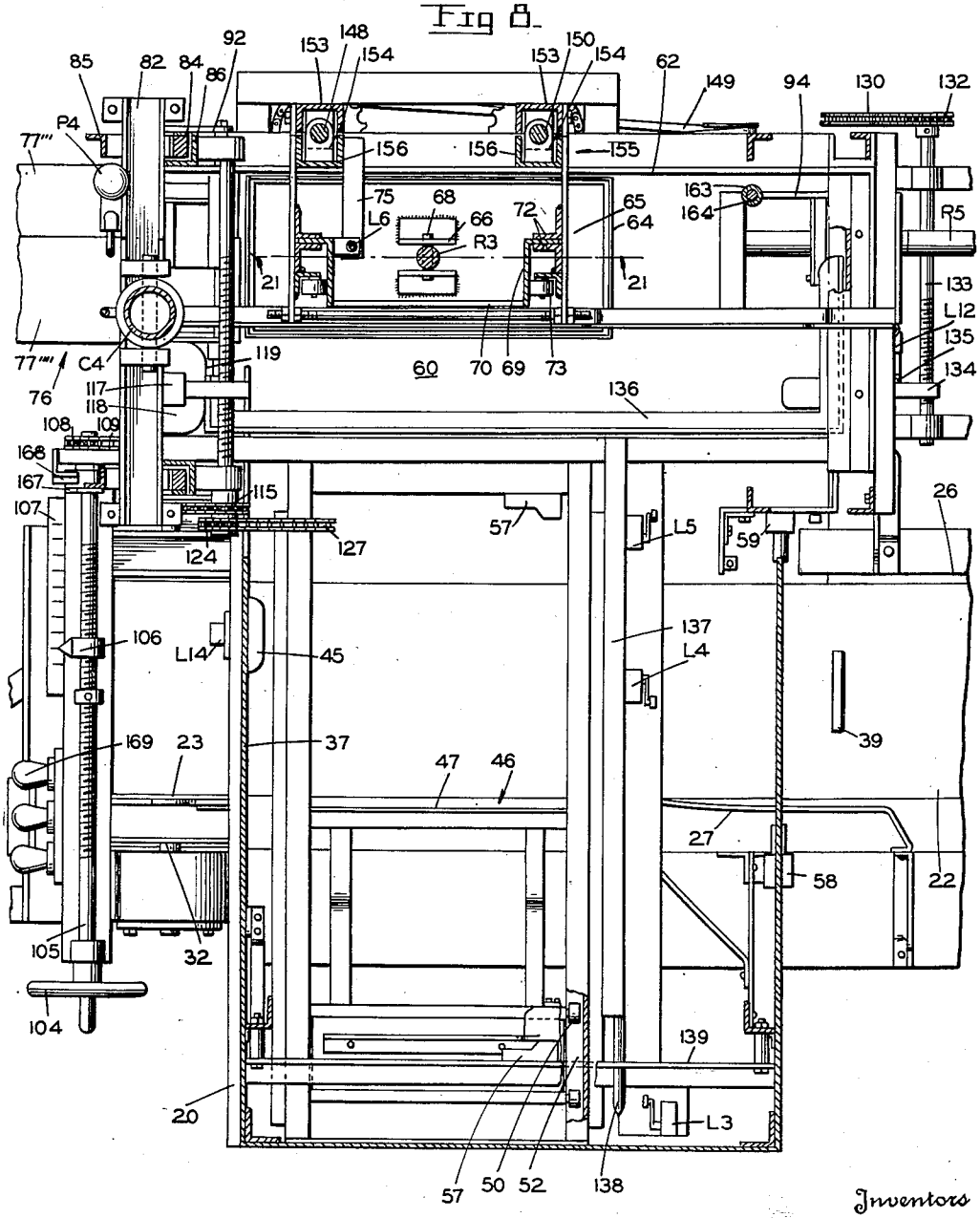

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Fig 9.

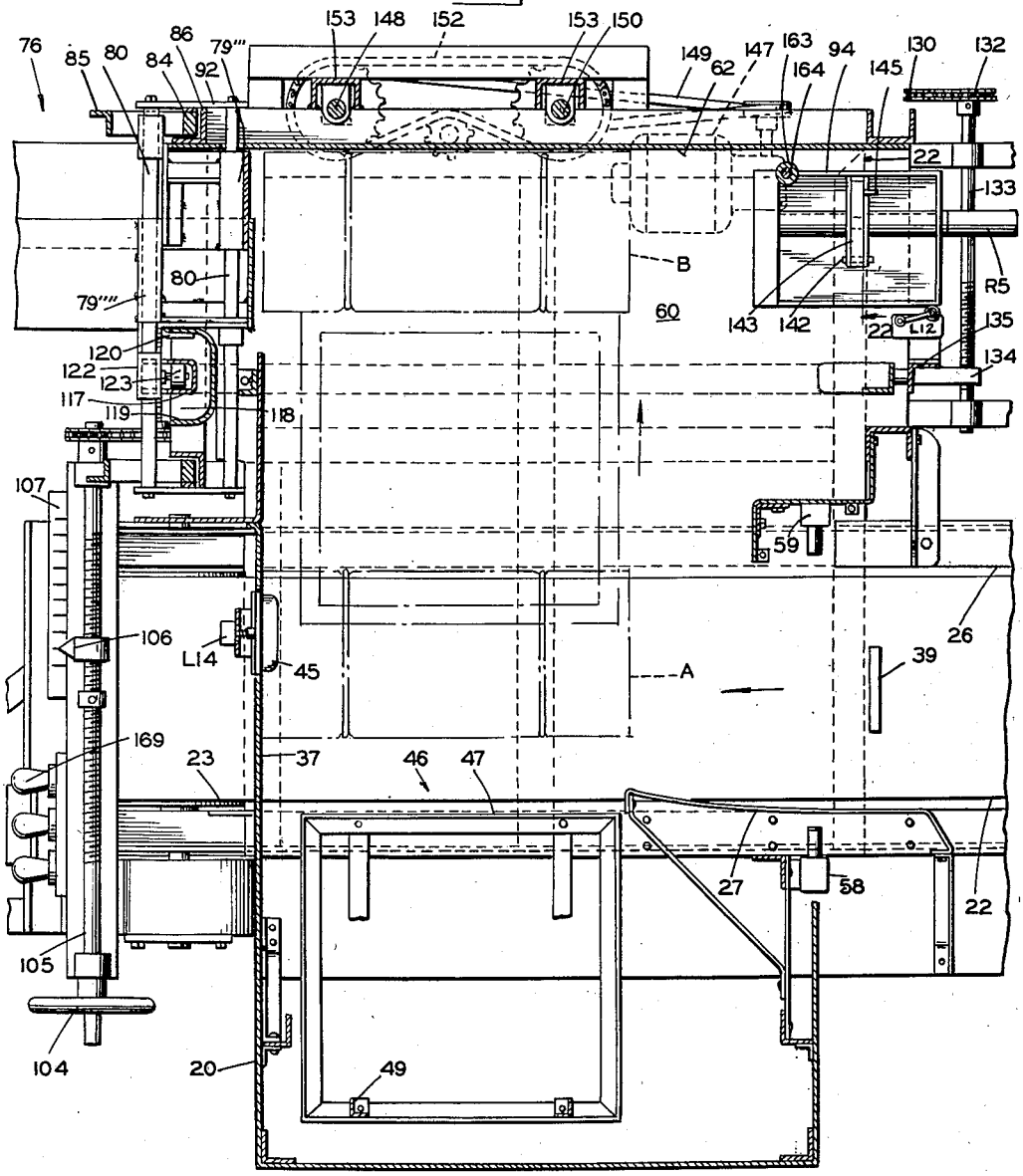
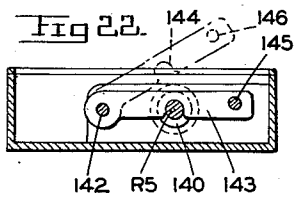


Fig 22.



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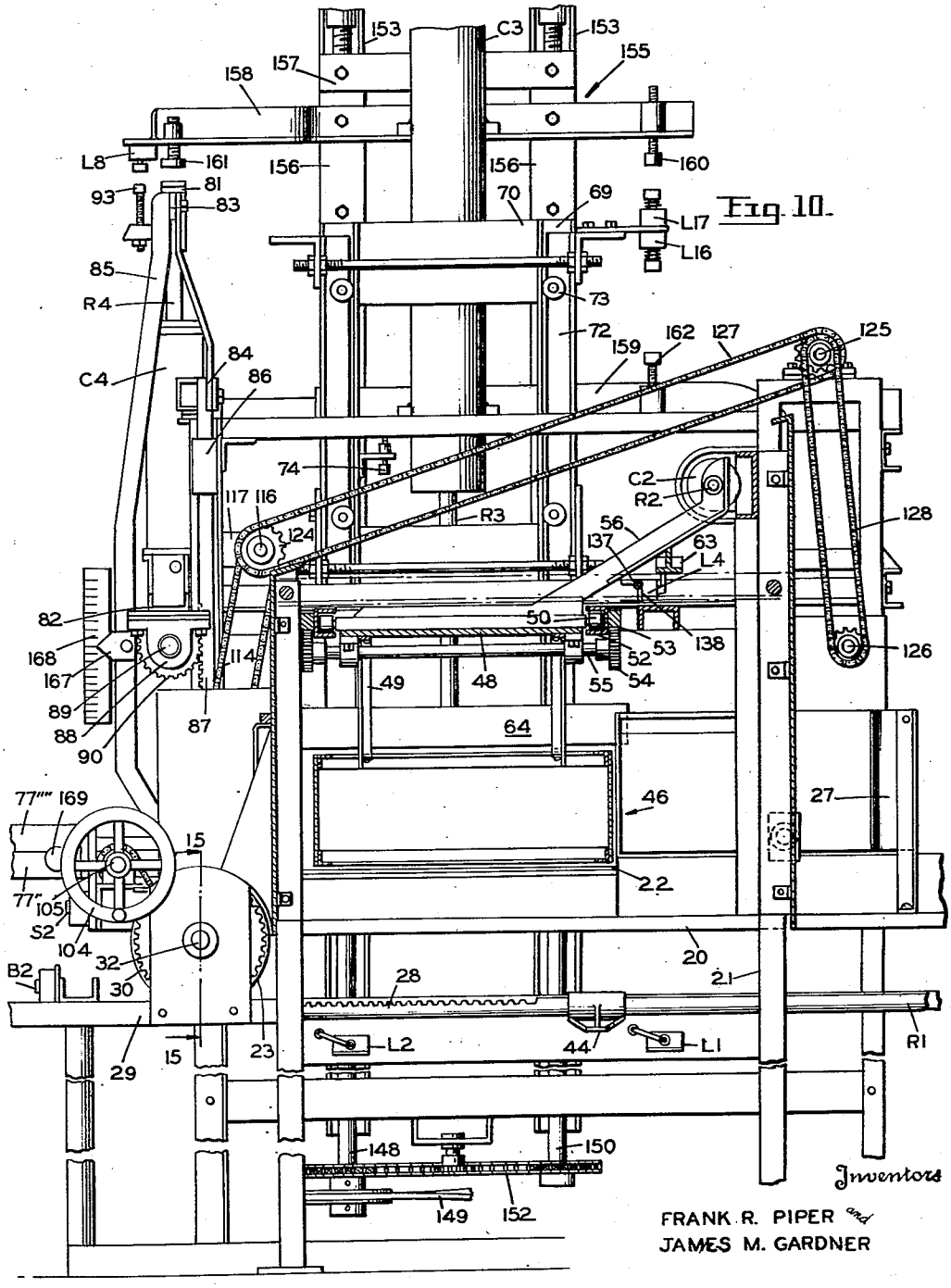

Fig. 10.

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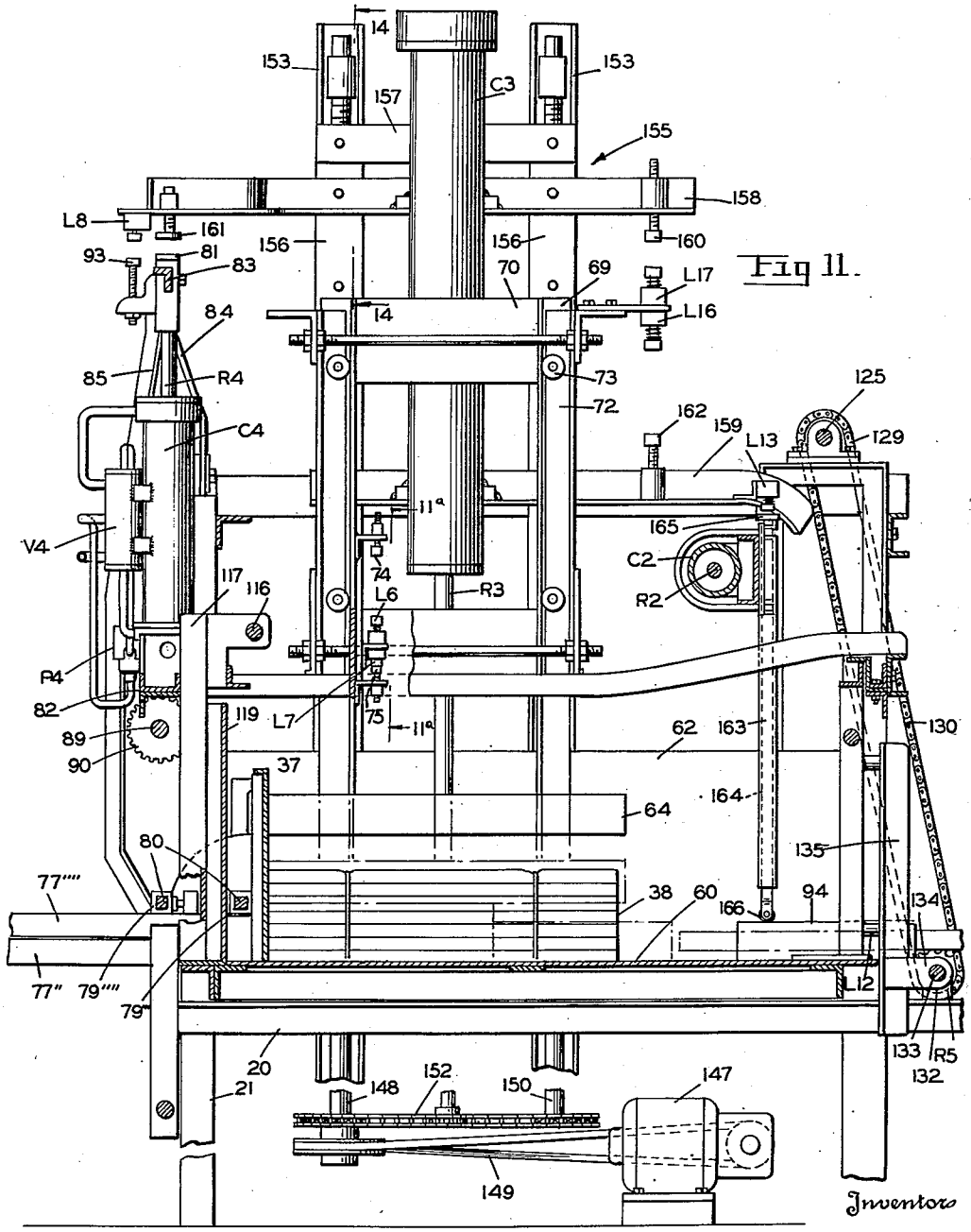

Fig 11.

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PACKAGING MACHINE

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Fig 18

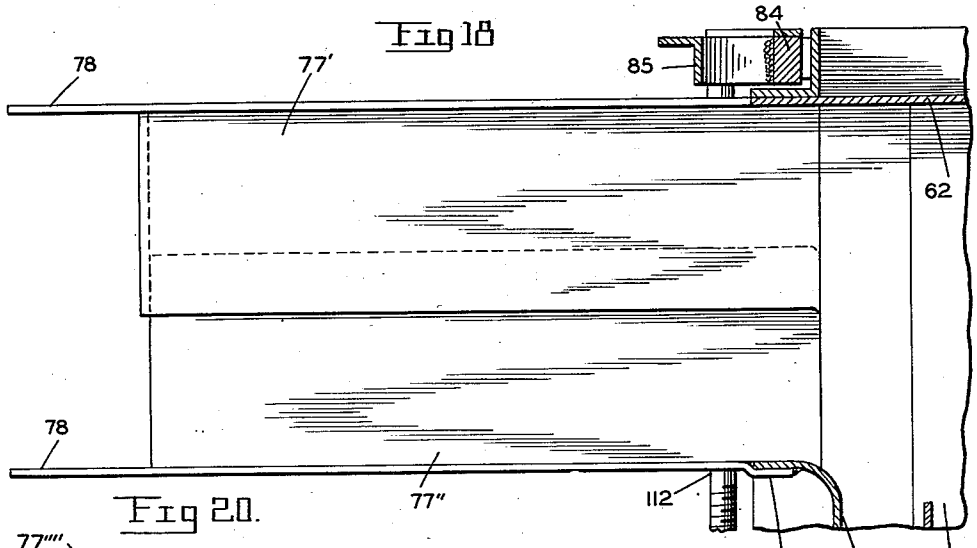

Fig 20.

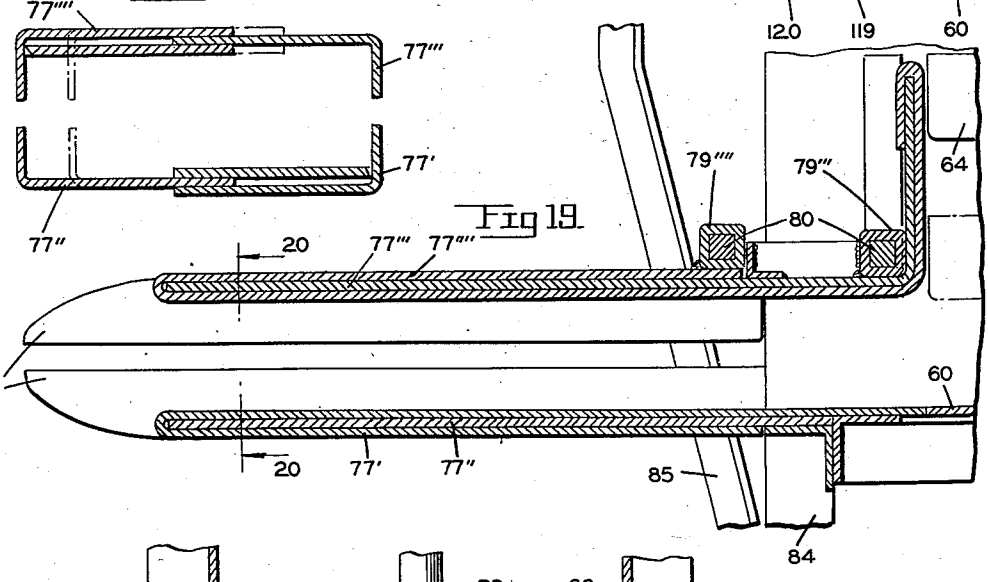

Fig 19.

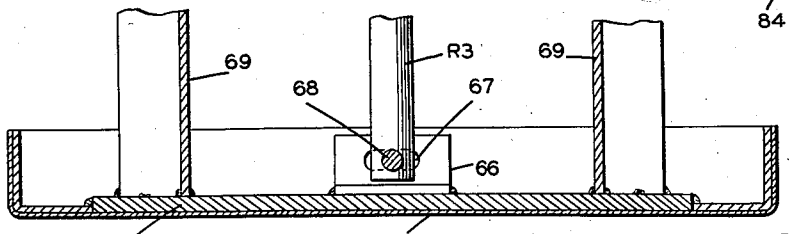

Fig 21.

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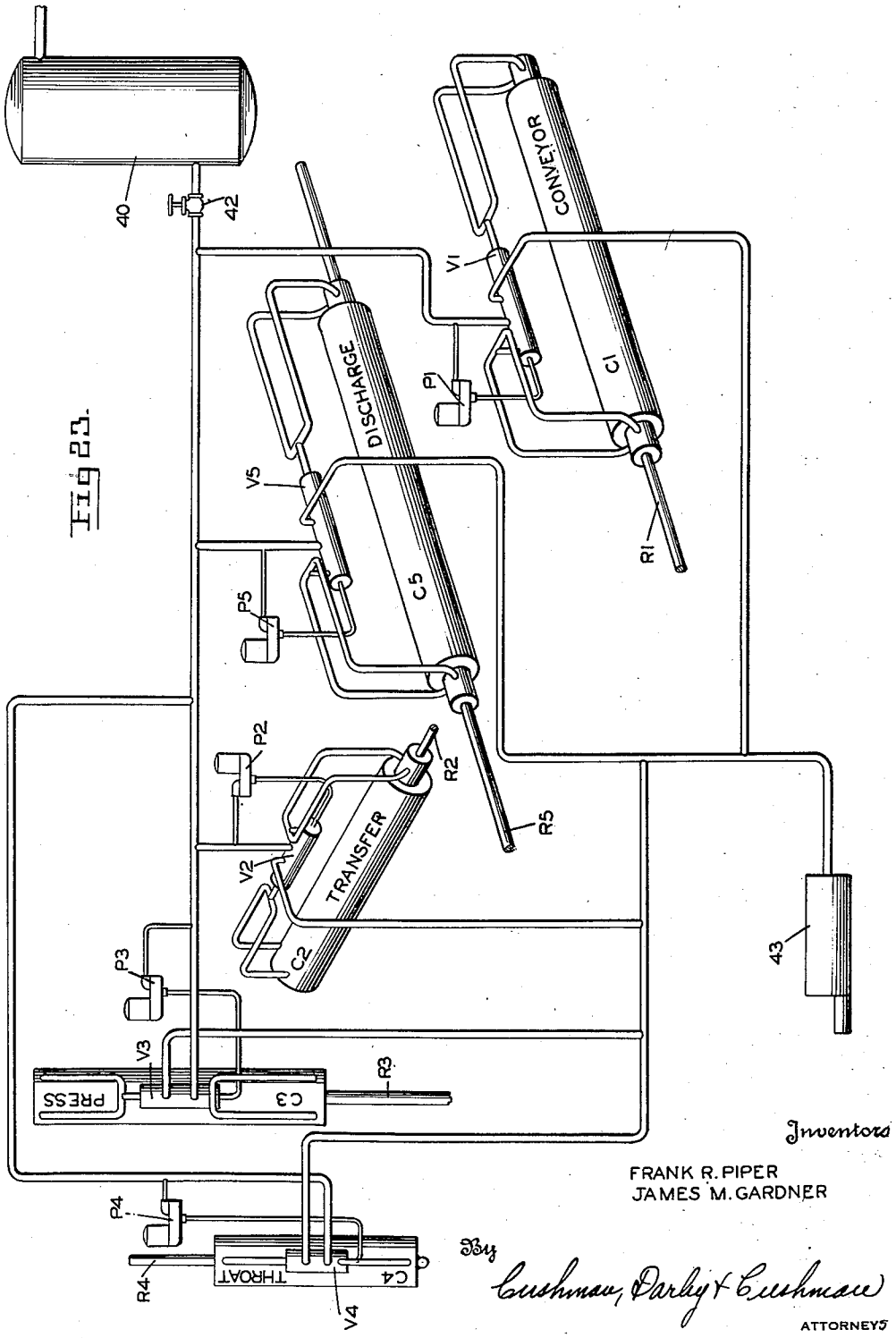

Fig 23.

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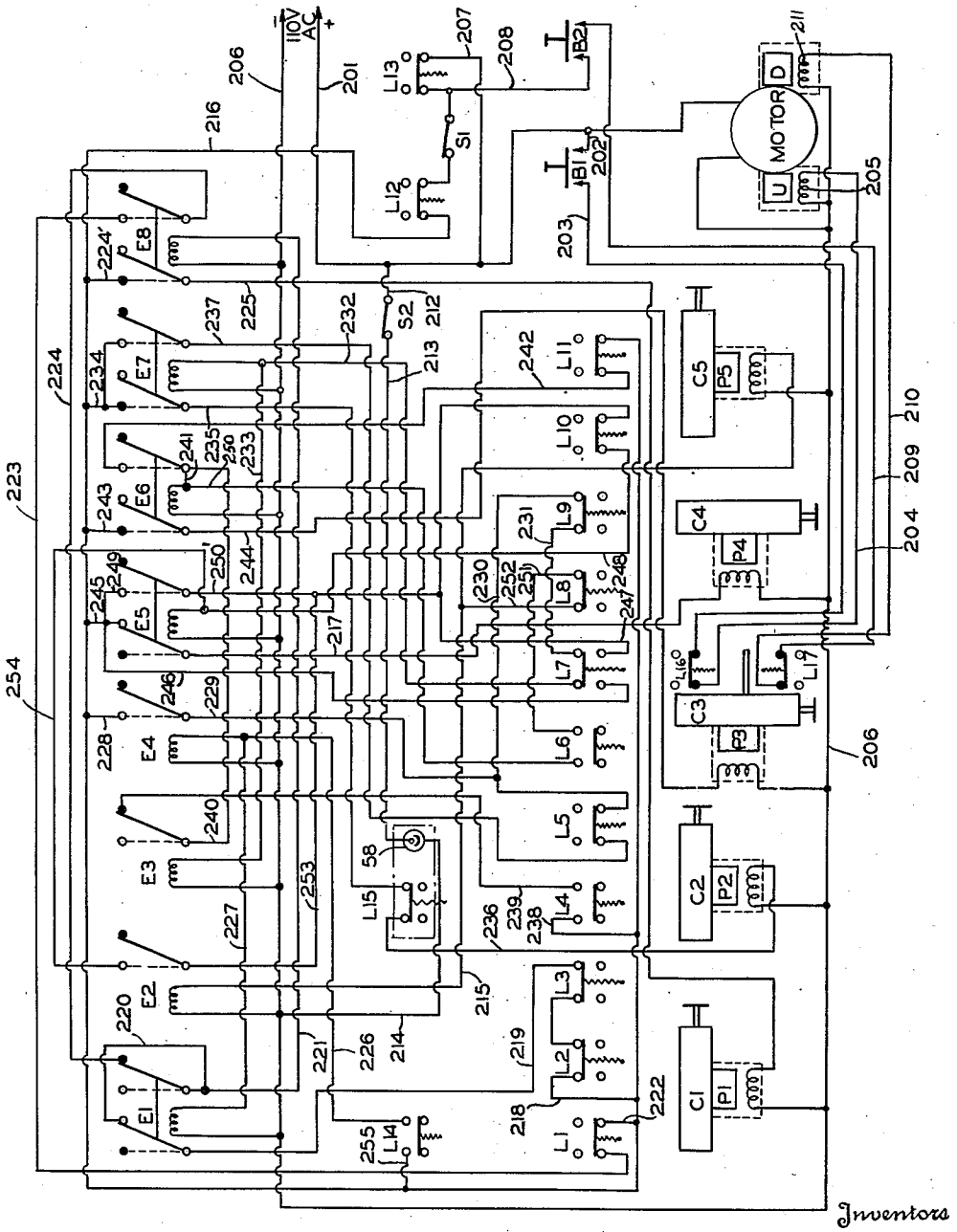

Fig 2.4.

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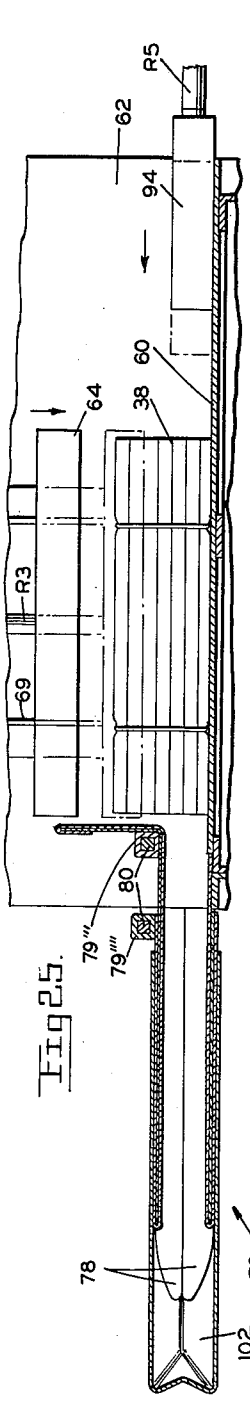

Fig 25.

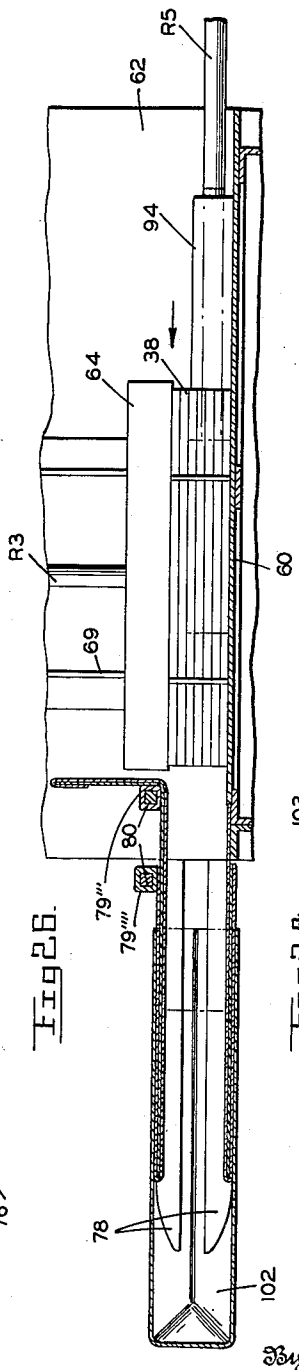

Fig 26.

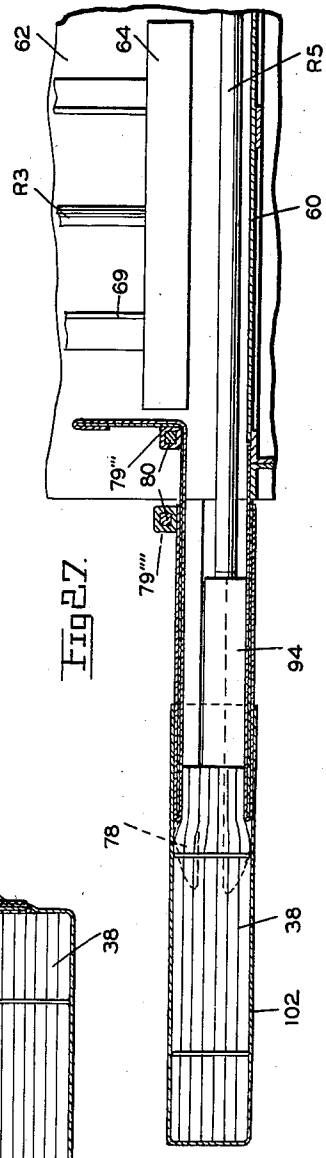

Fig 27.

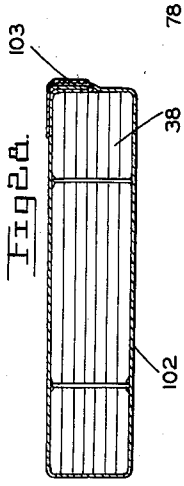

Fig 24.

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Patented Jan. 1, 1952 2,580,833

UNITED STATES PATENT OFFICE

2,580,833

PACKAGING MACHINE

Frank R. Piper and James M. Gardner, Fairfax, Ala., assignors to West Point Manufacturing Company, West Point, Ga., a corporation of Georgia

Application July 29, 1949, Serial No. 107,566

28 Claims. (Cl. 226—18)

1

This invention relates to packaging machines, particularly to machines adapted for the packaging of voluminous, compressible articles.

Many types of articles, such as towels, other textile products, foam rubber, fiber pads and the like, possess little weight or inherent rigidity, yet are of such disproportionate bulk as to make handling and wrapping or packaging thereof both difficult and expensive. Not only has the provision of packages of sufficient strength and rigidity to protect such articles been an item of considerable expense, but the bulk of the packaged articles has involved the wasteful utilization of space in shipping and storage.

It is an object of the present invention to provide a machine adapted to compress articles of the type referred to, and to insert the articles so reduced in volume into bags or packages of comparatively small size, whereby the rigidity of the packages is considerably increased by the resilience of the contained articles, and savings in container cost, handling cost and shipping and storage space are effected.

It is a further object of this invention to provide a machine adapted to automatically and efficiently compress and insert voluminous articles into paper bags of relatively small size, whereby such articles are packaged in an inexpensive and entirely satisfactory manner.

A further object is to provide a machine adapted to compress and package voluminous articles, wherein articles of widely varying sizes and shape may be handled and inserted into bags or packages of correspondingly varying shape and size.

Still another object is to provide a machine adapted to automatically package a succession of voluminous articles, in which successive operations of the machine are automatically coordinated and controlled to assure continuity of operation, and preclude malfunctioning.

Other objects will be in part obvious, and in part pointed out hereinafter.

The invention and the novel features thereof may best be made clear from the following description and the accompanying drawings, in which:

Figure 1 is a partial plan view of an exemplary machine embodying the principles of our invention, and Figure 1*a* is a continuation thereof;

Figure 2 is an end elevation of the delivery end of the machine of Figure 1;

Figure 3 is a sectional elevation taken on the line 3—3 of Figure 1, showing details of the ram section of the machine;

Figure 4 is a side elevation of the infeed conveyor portion of the machine;

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Figure 5 is an elevational view of the side opposite to that shown in Figure 4, showing the discharge ram drive cylinder and associated mechanism;

Figure 6 is a sectional elevation taken along the line 6—6 of Figure 4, showing details of the infeed conveyor, and the conveyor and discharge ram drive cylinders;

Figure 7 is a sectional elevation taken on the line 7—7 of Figure 5, showing details of the discharge ram cam carrier;

Figure 8 is a plan section showing the transverse adjustment mechanism of the machine, taken along the line 8—8 of Figure 2;

Figure 9 is a plan view of the machine press plate, taken on the line 9—9 of Figure 2;

Figure 10 is a sectional elevation of the ram section, taken on the line 10—10 of Figure 1, and showing details of the transfer ram;

Figure 11 is a sectional elevation taken on the line 11—11 of Figure 2, showing details of the pressing ram and associated structure;

Figure 11*a* is an elevational view showing details of the pressing ram control switches, taken on the line 11*a*—11*a* of Figure 11;

Figure 12 is a vertical section taken on the line 12—12 of Figure 5, showing further details of the discharge ram cam carrier;

Figure 13 is an isometric view of the discharge ram cam carrier;

Figure 14 is a sectional elevation taken on the line 14—14 of Figure 11, showing details of the vertical adjustment mechanism;

Figure 15 is a sectional elevation taken on the line 15—15 of Figure 10, showing details of the conveyor drive;

Figure 16 is a sectional elevation taken along the line 16—16 of Figure 15;

Figure 17 is an enlarged section taken on the line 17—17 of Figure 15;

Figure 18 is a plan section through the bagging throat of the machine, taken on the line 18—18 of Figure 2;

Figure 19 is a sectional elevation through the bagging throat, taken on the line 19—19 of Figure 2;

Figure 20 is a section taken on the line 20—20 of Figure 19;

Figure 21 is a sectional elevation through the pressing ram, taken on the line 21—21 of Figure 8;

Figure 22 is a view showing the manner of detachably securing the unloading ram, taken on the line 22—22 of Figure 9;

Figure 23 is a diagrammatic sketch showing the pneumatic drive system of the machine;

Figure 24 is a circuit diagram of the electrical control system of the machine;

Figures 25 to 27 are sectional views through the pressing ram and bagging throat of the machine, progressively showing successive steps of compressing a towel stack and inserting the stack into a bag, and

Figure 28 is a section through a compressed and bagged towel package.

Referring to the drawings, particularly Figures 1 and 1*a*, the exemplary embodiment of our invention comprises a frame **20**, suitably supported as by standards **21**. An extension of the frame supports an infeed conveyor section, comprising an endless conveyor belt **22** suitably tensioned between a drive roll **23** and the end roll **24**, and supported intermediate said rolls by a plurality of spaced idlers **25**. The vertically disposed side plate **26** adjoins one edge of the upper level of the belt from the outer end thereof to the point of its entrance into the ram section. A deflector plate **27** is positioned immediately above the belt where it enters the ram section, in opposed relationship to the side plate **26**.

The conveyor belt **22** is intermittently advanced in step-by-step fashion by the piston rod R*1* of pneumatic cylinder C*1*. As best shown in Figure 10, the rod R*1* is formed at its outer end into rack **28**, which is enclosed and guided by channel **29** and engaged by the gear **30**, freely rotatably mounted on the shaft **32** extending from conveyor drive roll **23**. As shown in Figures 15, 16 and 17, a pin **33** extends outwardly from the side of gear **30** and supports pawl **34**, constantly urged by spring **35** into engagement with the ratchet wheel **36**, suitably fixed to shaft **32** alongside gear **30**. Reciprocation of rack **28** by the pneumatic cylinder C*1*, it will be understood, effects intermittent rotation of drive roll **23** and consequent step-by-step advancement of the conveyor belt. On the outward stroke of the rack, gear **30** is rotated in the counterclockwise direction as shown in Figure 16, whereupon pawl **34** clicks over ratchet wheel **36** without displacing it. On the inward stroke of the rack, gear **30** is rotated in the clockwise direction as shown, whereupon the pawl **34** engages ratchet wheel **36** and effects corresponding rotation of the ratchet wheel and the drive roll **23**. The conveyor belt extends from its outer loading end into the ram section of the machine, and near the drive roll **23** at the end of its travel passes under the stop plate **37**, best shown in Figure 8.

In operation, articles to be packaged are placed on the conveyor belt near its outer end, this constituting the loading station of the machine. For purposes of illustration, a series of towel stacks **38** are shown in Figures 1*a* and 4, each stack comprising a plurality of turkish towels secured together by tying. The stacks **38** may be placed manually, positioned against side plate **26** and suitably spaced in accordance with registry marks **39**. Obviously, the stacks may be loaded and positioned automatically, by suitable conveyor or equivalent mechanism, if desired. From the loading station, the towel stacks are intermittently advanced by the conveyor belt into the ram section of the machine, and conveyed eventually into contact with the stop plate **37**.

As previously set forth, the conveyor belt is actuated by pneumatic cylinder C*1*. The functioning of the machine comprises five main operations, effected conveniently, in the exemplary embodiment, by five pneumatic cylinders, schematically shown in Figure 23. From their final position on the conveyor belt, abutting stop plate **37**, articles being packaged are displaced laterally by the transversely disposed transfer cylinder C**2**, from the belt to a position below the vertical press cylinder C**3**. At this point the articles are compressed by cylinder C**3** to the desired thickness. The vertical throat cylinder C**4** is mounted adjacent press cylinder C**3**, and functions to alternately collapse the bagging throat of the machine and open the throat for the passage of articles therethrough. The longitudinally disposed discharge cylinder C**5** is aligned with cylinders C**3** and C**4**, and is operative to discharge compressed articles from below press cylinder C**3** outwardly through the bagging throat.

Each of the pneumatic cylinders is actuated in identical manner by a conventional 4-way valve V of corresponding number, which in turn is actuated by a solenoid operated pilot valve P of common design, whereby the reciprocation of the cylinder piston rods R is electrically controlled. Compressed air may be furnished to all five cylinders from a common reservoir **40**, through valve **42** and suitable piping to the individual pilot valves and 4-way valves, and from the 4-way valves to the cylinders, as shown. Similarly, the exhaust from all the cylinders may be conducted to a common exhaust manifold **43**, suitably located for discharge of the exhaust air.

The solenoid operated pilot valve P*1* is partially controlled by a pair of limit switches L*1* and L**2**, mounted on the machine frame adjacent the path of rod R*1*, as best shown in Figure 10, and positioned and disposed for actuation by the cam **44** fixed to the rod. The switch L**2** is so positioned as to be actuated at one end of the stroke of rod R*1*, and the switch L*1* is operative when actuated to stop and reverse the movement of cylinder C*1*, so that in the absence of other control the cylinder will effect reciprocation of the cam between the two switches. This reciprocation of rod R*1* causes intermittent advance of the conveyor belt, in the manner previously described, which continues until an article thereon reaches stop plate **37**.

Mounted in stop plate **37** and projecting slightly therefrom is the bell housing **45** (see Figure 9), in actuating relationship with limit switch L*14*. The bell housing **45** is positioned over the conveyor belt so as to be engaged and displaced by articles conveyed thereby, and switch L*14* is operative when actuated to prevent further operation of the conveyor for the remainder of a machine cycle. The deflector plate **27** functions to direct articles not properly positioned on the belt in adjacency to side plate **26**, into contact with bell housing **45**.

Each article, as successively moved into contact with stop plate **37**, is next displaced laterally into the pressing section of the machine by the transfer ram indicated generally as **46**, including as its operative member the ram plate **47**, and driven by the transversely disposed transfer cylinder C**2**. As best seen in Figure 10, the transfer ram **46** is rigidly supported below ram carriage **48** by the members **49** extending downwardly therefrom. Ram carriage **48** comprises the rollers **50**, by means of which it reciprocates on the lower flanges of beams **52**, secured to the machine frame. The carriage **48** is retained and steadied during its reciprocation by the racks **53** adjoining beams **52**, which racks are engaged by gear wheels **54** mounted on shafts **55**, suitably fixed to the underside of the carriage. An arm **56** extends upwardly

and outwardly from the ram carriage, and at its outer end is engaged to the piston rod R2, whereby the transfer ram and ram carriage are operated by cylinder C2. Suitable bumpers 57 (see Figure 8) may be provided to limit the travel of the ram carriage.

As previously indicated, successive articles are suitably spaced on the conveyor belt, so that they engage stop plate 37 and the associated bell housing one at a time. The transfer ram 46 correspondingly functions to laterally displace the articles singly. It is obviously possible, should two successive articles be insufficiently spaced, for a second article as well as the one abutting the stop plate to be engaged by the transfer ram. Since the second article so engaged would be likely to foul the machine, means to preclude this eventuality are provided, comprising a photo-electric cell unit 58 and a light source 59, on opposite sides of the conveyor belt adjacent its point of entry into the ram section, as shown in Figure 9. These elements are arranged to project a beam of light from source 59 to cell 58 immediately above the belt, which beam is interrupted by the passage of each successive stack 38 therethrough. The photo-electric cell unit 58 incorporates a switch L15 (not shown), controlled thereby and operative to prevent functioning of the transfer ram when the beam is interrupted. In this manner, improper article spacing, likely to result in malfunctioning, effects a stoppage of the machine until the condition is corrected.

The stroke of transfer ram 46 may be adjusted to displace the ram from the solid line position shown in Figure 9 to that shown in dotted lines, thereby displacing a towel stack from the dotted line position A onto the press plate 60 to dotted line position B, in adjacency to side plate 62 of the press section. The stroke of the transfer ram is controlled and limited by the limit switches L3, L4 and L5 (Figure 8), aligned beneath the path of the arm 56 and adapted to be actuated by the cam 63 dependent therefrom, as shown in Figure 10. The switch L3 is mounted on the machine frame, and so positioned as to be actuated at one end of the stroke of the carriage 46, while the switches L4 and L5 are mounted on the transverse adjustment mechanism presently to be described. The switch L5 is operative when actuated to stop and reverse the cylinder C2 driving the ram carriage.

In position B, the towel stack is positioned immediately below the pressing ram 64, operable by the vertical press cylinder C3 and piston rod R3 extending downwardly therefrom, to the lower end of which the pressing ram is secured. As shown in Figures 8 and 21, the pressing ram is dished, and backed by the central backing plate 65, from which lugs 66 extend upwardly. The lugs 66 are provided with slots 67, which engage and retain the ends of the pin 68 which extends through and projects from the lower end of rod R3.

Two L-shaped guide members 69 extend upwardly from the pressing ram, and are stabilized by the cross plates 70 extending transversely between them (Figures 8 and 11). One leg of each of the guide members 69 is slidably retained between opposed pairs of guide angles 72, rigidly mounted on the machine frame. Also mounted on the machine frame adjacent the guide angles are the guide rollers 73, positioned and adapted to bear on the longer legs of the guide members 69. The guide members and cross plates, it will be understood, constitute a carriage by which the pressing ram is guided and supported during its reciprocation.

The stroke of press cylinder C3, the pressing ram and the pressing ram guide carriage is effective to actuate the switches L6 and L7, mounted on the vertical adjustment structure presently to be described. The switches L6 and L7, best shown in Figures 8, 11 and 11*a*, are positioned and disposed for actuation, respectively, by the adjustable switch stops 74 and 75, mounted on one of the guide members 69. The stop 75 is positioned so as to actuate switch L7 at the upper end of the pressing ram stroke, and the stop 74 so as to actuate the swtich L6 at the lower end of the pressing ram stroke.

The pressing ram 64 functions, upon the positioning of a towel stack therebeneath by the transfer ram and withdrawal of the transfer ram, to descend from the solid line position shown in Figure 11 into contact with the stack and to the dotted line position shown, whereby the stack is compressed between the pressing ram and the press plate 60 to a pre-determined fraction of its normal height, or thickness.

Adjoining press plate 60 is the throat section 76, constituting the bagging and outfeed portion of the machine. The throat section comprises four L-shaped throat members 77, together generally defining a rectangle, each of the throat members at its outer end being formed into an inwardly sloping bag guiding portion 78. The lower left throat member 77′ (as viewed in Figure 2) is fixed to the frame of the machine, with its upper horizontal surface substantially flush with that of press plate 60 and its inner vertical surface substantailly flush with that of side plate 62. The horizontal portion of throat member 77′ is bifurcate, and telescopically encloses the horizontal portion of the opposed lower throat member 77″, as best seen in Figures 19 and 20. The upper throat members 77‴ and 77⁗ are similarly telescopically joined, and comprise respectively the collars 79‴ and 79⁗, by means of which and the bars 80 passing therethrough, the upper throat members are supported.

The upper throat members 77‴ and 77⁗ are adapted to be reciprocated in unison relative to the lower throat members 77′ and 77″, this motion being effected by the vertically disposed throat cylinder C4. The cylinder C4 is supported by the beam 82, welded or otherwise suitably affixed to the frame, and piston rod R4 extending upwardly therefrom engages the cross piece 83 of a reciprocating throat carriage, including a pair of inner guide members 84 and a pair of outer guard members 85. The inner guide members 84 of the carriage are slidably retained within guide housings 86 extending from the machine frame, and constitute for a portion of their length racks 87. Bearings 88, mounted on the underside of beam 82, support shaft 89, upon which are mounted the gear wheels 90, maintained in meshing engagement with racks 87, the gear wheels in conjunction with housings 86 steadily maintaining and guiding the throat carriage during its vertical reciprocation. The guide members 84 near their lower ends support crossarms 92, between which the bars 80 are carried, whereby bars 80 and the upper throat members 77‴ and 77⁗ carried thereby are reciprocated with the throat carriage, under the impetus of throat cylinder C4. The cross piece 83 carries a stop 81, by means of which and the adjustable stop 161 supported thereabove the upward stroke of the throat carriage is limited. Cross piece 83 also

carries the adjustable switch stop 93, adapted to engage and actuate the limit switch L8 supported thereabove at the end of the upward stroke of the carriage.

Horizontally mounted alongside the infeed conveyor, in alignment with pressing ram 64 and throat section 76, is the discharge cylinder C5, from which extends piston rod R5, carrying at its outer end the discharge ram 94. As best seen in Figure 5, the rod R5 extends also from the other end of cylinder C5, and carries at the other end the cam carriage 95. The cam carriage comprises a box-like structure 96 affixed to the rod R5 (Figures 12 and 13), having opposed, downwardly curved arms 97 extending therefrom, each of which carries a cam 98. The box structure 96 is retained and guided within the opposed U beams 99, supported by the machine frame. One of the cams 98 is adapted to alternately actuate the switches L9, L10 and L11 (Figures 1a and 5), by which the reciprocation of the discharge ram is coordinated and controlled. The other cam 98 is adapted to actuate a mechanical counter 100 (Figure 7), suitably positioned on the frame at one end of the cam carrier stroke, in a readily accessible location. The switch L9 is so disposed on the machine frame as to be engaged and actuated by the cam carriage, when the rod R5 and the associated discharge ram are at one end of their stroke, corresponding to fully retracted position of the ram. Switches L10 and L11 are similarly disposed on the machine frame for successive actuation by the cam carrier in the course of the discharge stroke, the switch L11 being operative to stop and reverse the movement of the piston rod R5.

The coordinated action of the pressing ram 64, throat 76 and discharge ram 94, which represents an outstanding feature of our machine, is sequentially illustrated in Figures 25 to 28. When a towel stack 38 has been positioned under the pressing ram 64 by the transfer ram, the elements are positioned as shown in solid lines in Figure 25. The pressing ram is in its up position, the throat is collapsed, with the upper and lower throat members in immediate adjacency, and the discharge ram is in the retracted position shown. With the throat so collapsed, a bag 102 or other receptacle of suitable size may be readily placed over the throat, the emplacement of the bag thereover being facilitated by the rounded guiding portion 78. The bags may be positioned manually by an operator at the outfeed station, who may also receive and close the filled bags.

Upon the withdrawal of transfer ram 46 from under the pressing ram, the pressing ram is actuated by press cylinder C3 and displaced downwardly into compressing contact with the stack 38, as indicated by the arrow, and at the end of its stroke compresses the towel stack to a predetermined height or thickness, as illustrated in Figure 26. Substantially simultaneously, the throat cylinder C4 displaces the associated throat carriage upwardly, thereby raising the upper throat members 77''' and 77'''' to the position shown, whereby the throat is opened to an inner height corresponding to the compressed height of the towel stack. The opening of the throat, it will be understood, extends the bag 102 to its normal or full open size.

When the pressing ram and throat have reached their final position, the discharge ram 94 is actuated by discharge cylinder C5 into engagement with the end of the towel stack, to the intermediate position shown in Figure 26, and then proceeds in its stroke under the discharge ram and into the throat, to a final position such as that illustrated in Figure 27. The discharge ram displaces the towel stack from under the pressing ram into and through the throat, the leading end of the towel stack eventually contacting the bottom of the bag 102. Thereafter, as the stroke proceeds, the discharge ram displaces the compressed towel stack and the enclosing bag off the throat as a unit, to a final position which may be that illustrated in Figure 27. As so illustrated, the filled package is only slightly retained on the machine throat, and may be grasped on its outer end and pulled from the throat by the outfeed station operator. The open end of the filled bag may then be folded and closed, and secured by gluing or by a tape 103, in the manner of the final package shown in Figure 28. The end of the discharge ram stroke may be adjusted by employing discharge rams of different length, or by varying the position of switch L11. If so desired, the stroke of the discharge ram may be adjusted to end beyond the throat, so as to completely remove the towel packages therefrom, and suitable conveyor mechanism may be arranged under the outer end thereof to receive the packages and convey them to a closing station. On the other hand, especially in the case of relatively long articles, the discharge ram may effect adequate displacement of the articles for removal from the throat without itself entering the throat section.

When the discharge ram arrives at its final position, the discharge ram and pressing ram are retracted to the positions shown in Figure 25, whereupon the throat is collapsed by cylinder C4, in readiness for the emplacement of another bag thereover, the previously filled package having meanwhile been removed. The five operations effected by the five pneumatic cylinders described above constitute a complete cycle of operation upon an individual towel stack.

As previously indicated, our machine is readily adjustable to handle and package articles of widely varying width and height. To accommodate articles of varying width, it is obviously necessary to alter the width of the throat, as well as to vary accordingly the approach of transfer ram 46 to side plate 62 at the end of its stroke. This is accomplished, in the exemplary embodiment shown, by means of the hand wheel 104, engaged to the shaft 105 in driving relationship and positioned conveniently adjacent the main control station of the machine (see Figure 2). A portion of shaft 105 is screw threaded, and engages the internally threaded pointer member 106, disposed and maintained in association with the fixed scale 107, by means of which the state of adjustment of the machine for article width may be readily and accurately ascertained.

Shaft 105 at its inner end mounts the sprocket 108, engaged by chain 109 in driving relationship to the sprocket 110 of shaft 112, as shown in Figure 2. Shaft 112 also mounts the sprocket 113, engaged by chain 114 in driving relationship to the sprocket 115 of shaft 116. The central portions of shafts 112 and 116 are screw threaded, and engage thereby the guide channel 117 extending between them. Plates 118 extend outwardly from the guide channel, and support thereabout the U-shaped housing member 119. Each of the right hand throat members 77'' and 77'''' comprises an offset lip 120 (see Figures 2 and 9), which

extends over an edge of housing member 119, whereby the right hand throat members are laterally engaged to the housing member. Rotation of shaft 105 by the hand wheel 104, it will be understood, effects simultaneous rotation of shafts 112 and 116, and consequent lateral displacement of guide channel 117 and the structure associated therewith. This lateral displacement effects also corresponding displacement of the right hand throat members, whereby the effective width of the throat is altered. Each of the right hand throat members, as previously stated, is telescopically engaged to the corresponding left hand member, whereby the width of the throat is readily varied.

In the normal opening and closing action of the throat, the upper throat members 77''' and 77'''' are vertically reciprocable. It will be readily apparent that the throat member 77'''' is free to reciprocate vertically relative to the vertically stationary housing member 119, the lip 120 constituting only a slidable engagement therewith. To obviate binding of the reciprocating lip on the housing member, the bar 80 carrying the throat member collar 79'''' carries also the collar 122, from which extends roller 123, contained within and guided by the guide channel 117.

Also mounted on shaft 116 is the sprocket 124, by means of which the rotation of shaft 116 is transmitted to the shafts 125 and 126 in any appropriate manner, as by the chains 127 and 128 (see Figure 10). On the opposite side of the machine (see Figure 3) shaft 125 mounts the sprocket 129, whereby through chain 130 and sprocket 132 the rotary motion of shaft 125 is transmitted to the shaft 133, positioned transversely immediately below the piston rod R5. As seen in Figure 3, the shafts 126 and 133 are screw threaded for a portion of their length, whereby the internally threaded lugs 134 extending from angle member 135 are engaged. In this manner, rotation of the hand wheel 104 effects also simultaneous rotation of the shafts 126 and 133, whereby the angle member 135 is correspondingly laterally displaced.

Angle member 135 is fixedly secured to an end of the transverse slide member 136, which extends from the angle member to housing member 119 and is similarly fixed thereto (see Figure 8). From the transverse slide member 136 a switch carrier 137 extends laterally, the switch carrier member being formed at its outer end into a slide portion 138, which passes through and is guided and supported by the frame member 139. The switch carrier mounts the previously mentioned switches L4 and L5, which control and limit, as previously set forth in connection with the description of cam 63, the operative stroke of the transfer ram. Housing member 119 and angle member 135, then, are joined by the transverse slide member 136, and with switch carrier 137 constitute a transverse adjustment carriage effective not only to adjust the width of the throat, but also, by simultaneously displacing switches L4 and L5, to correspondingly adjust the final approach position of the transfer ram relative to side plates 62, so that the towel stacks are positioned by the ram in proper alignment with the machine throat, at any adjusted position thereof.

The angle member 135 also mounts the limit switch L12, positioned and disposed for contact with and actuation by the discharge ram 94. The switch L12, of course, moves with the transverse adjustment carriage, and, as best shown in Figures 3 and 9, its outstanding arm is adapted to engage the discharge ram in its retracted position, upon the approach of the switch relative thereto. The switch L12 is operative, when actuated, to prevent operation of the machine, the purpose of this precautionary feature being to preclude operation when the machine throat is adjusted to a width too small to permit passage of the discharge ram therethrough.

The discharge ram, as best shown in Figures 9 and 22, is readily detachable from the rod R5. Rod R5 extends through the rear wall of the ram, and is provided near its outer end with an annular groove 140. The discharge ram comprises pivot pin 142, upon which the locking arm 143 is pivotally mounted. Arm 143 is provided with a notch 144, adapted to engage the rod groove 140, and may be locked in engaging position therewith by pin 145, aligned for insertion into the locking hole 146 of the arm when the arm is in down and locking position. As will be apparent, a plurality of discharge rams of varying dimensions may be employed with the machine, and changed as required in conformity with the cross-sectional shape of the packages being produced. The frontal area of the discharge ram employed is desirably substantially identical with, or slightly smaller than, the cross-sectional shape of the throat opening. When necessary, a discharge ram may be removed from rod R5 by unlocking and lifting arm 143, and then sliding the ram off the end of the rod, and another ram may be substituted in reverse manner.

To vary the final compressed height of the articles being packaged, the approach of the pressing ram 64 to press plate 60 at the end of its stroke is controllably adjustable, whereby the articles may be reduced to any desired thickness within the range of the machine. The vertical stroke of the throat cylinder C4 is simultaneously adjusted, to effect an internal opening of the throat section 76 of corresponding height. The vertical adjustment mechanism is powered in the exemplary embodiment shown by means of a reversible gear motor 147, suitably mounted below or on the machine frame. Operation of motor 147 is controlled by the button switches B1 and B2, conveniently located adjacent hand wheel 104 at the main control station of the machine, as shown in Figure 2. The motor 147 is adapted to drive the vertical shaft 148 by means of belt 149, and the vertical shaft 150 is correspondingly driven in unison through chain 152 and suitable sprockets on the shafts engaged thereby (Figure 11). The shafts 148 and 150 are suitably mounted in the channel members 153 extending from the machine frame. Adjacent their upper ends, the shafts 148 and 150 are screw threaded, whereby they engage the internally threaded lugs 154 extending from the vertical adjustment carriage indicated generally as 155. The relationship of these parts is clearly shown in Figure 14.

The vertical adjustment carriage 155 includes channel members 156, from which the lugs 154 extend, the channel members 156 being disposed in opposed relationship to the similar members 153. The carriage is stabilized by the upper cross piece 157, and supports the upper beam 158 and lower beam 159, bolted or otherwise suitably secured to members 156. Beams 158 and 159 support the press cylinder C3, affixed thereto as by welding. Rod R3 extends downwardly from cyl-

inder C3, and supports at its lower end the pressing ram 64. As previously described, with the pressing ram is associated the pressing ram guide carriage, by which the ram is guided and supported during its reciprocation.

Extending downwardly from upper beam 158 adjacent the end thereof is the adjustable switch stop 160, and extending upwardly from lower beam 159 in vertical alignment therewith is the similar adjustable switch stop 162. The switch stops 160 and 162 are adapted to actuate alternately the limit switches L16 and L17 mounted therebetween, on the fixed frame of the machine. The function of these switches is to limit the movement of the vertical adjustment carriage 155. By operation of motor 147 in one direction under the influence of switch B1, the vertical adjustment carriage is elevated by the rotation of shafts 148 and 150 until the stop 162 actuates switch L16, whereupon the power circuit to the motor is interrupted. Conversely, when the motor is rotated in the opposite direction by means of switch B2, the vertical adjustment carriage descends until stop 160 actuates the switch L17, interrupting the power circuit and thereby limiting the travel of the carriage downwardly.

The vertical adjustment carriage, it will be understood, simultaneously displaces press cylinder C3, pressing ram 64 and the associated pressing ram guide carriage, relative to press plate 60, which is fixed to the frame of the machine. To accommodate the displacement of the press cylinder, it is obviously desirable that the air lines leading thereto comprise flexible hose portions. The stroke of the press cylinder being constant in length, vertical displacement of the cylinder varies the final approach position of the pressing ram relative to the press plate at the lower end of the pressing ram stroke. As previously indicated, the vertical adjustment carriage 155 carries also the switches L6 and L7, mounted for actuation by the stops 74 and 75 extending from the pressing ram guide carriage. Since the vertical adjustment carriage carries with it both the switches L6 and L7 and the pressing ram guide carriage, the relationship between the switches and the stops 74 and 75 is not altered by movement of the carriage.

To suitably coordinate the opening of the throat section 76 with the final approach position of pressing ram 64 relative to the press plate 60, the upper beam 158 of the vertical adjustment carriage extends to a position immediately above the throat carriage, and carries near the outer end thereof the adjustable stop 161, positioned to engage stop 81 mounted on cross piece 83 of the reciprocating throat carriage, and thereby limit the upward stroke of the throat carriage. The extension of upper beam 158 carries also limit switch L8, aligned for actuation at the end of the throat carriage stroke by the stop 93, also mounted on throat carriage cross piece 83. The stop 161 being mounted on the vertical adjustment carriage, it will be readily understood that the full open position of the throat is at all times adjusted to conform to the final approach position of the pressing ram relative to the press plate.

As a precautionary feature corresponding to the switch L12 carried by the transverse adjustment carriage, the vertical adjustment carriage may comprise means adapted to preclude operation of the machine when the vertical adjustment is too low to permit safe passage of the discharge ram under the pressing ram and through the throat. As shown in Figures 3 and 11, this feature may be in the form of a guide tube 163 depending from the outer end of lower beam 159, and a limit switch L13 mounted on the lower beam immediately above the upper end of the tube. An actuating rod 164 extends through the guide tube, depending from the collar 165 fastened to its upper end and resting on the upper edge of the guide tube. The lower end of rod 164 projects slightly beyond the lower end of the tube and is provided with a tip or roller 166. The guide tube being positioned directly above an edge of the discharge ram, in retracted position, it will be readily understood that lowering of the vertical adjustment carriage will bring the roller 166 into contact with discharge ram 94, and cause displacement of the rod 164 upwardly through the guide tube into actuating contact with switch L13. Obviously, the length of rod 164 is so adjusted as to effect opening of switch L13 when the vertical adjustment carriage is lowered to a point unsafe for the discharge ram in place on the machine. As previously stated, the discharge ram is detachably secured to rod R5, and may be replaced when necessary by similar rams of differing dimensions.

Since the position of the vertical adjustment carriage is accurately reflected by the full open position of the throat carriage, a convenient indication of the vertical adjustment carriage position may be provided by a pointer 167 mounted on guard member 85 of the throat carriage, in indicating relationship with a scale 168 projecting from the machine frame. The vertical adjustment scale and pointer are shown in Figures 2 and 10.

By the mechanisms described above the machine may be readily adjusted to handle articles of varying width by means of the hand wheel 104, may be adjusted to produce articles of varying height by means of button switches B1 and B2, and may be altered to handle articles of varying length, if desired, by changing discharge rams 94 or by displacing limit switch L11. A plurality of signal lights 169 may be provided at the main control station, and through individual circuits controlled by corresponding switches 170 provided at the loading station at the outer end of the infeed conveyor (see Figure 4). By means of the signal lights, the loading operator may indicate to the operator at the main control station the end of a run, and, if desired, the required adjustment for the next run. The signal lights may obviously be employed for other purposes, if desired, such as to indicate a change in color of articles being packaged, whereby this information may be conveyed to the operator at the outfeed throat station.

The electrical control system of the machine is designed to properly coordinate the various operations of the machine and maintain continuous operation, and includes numerous safety features adapted to preclude malfunctioning. The system, shown in Figure 24, will now be described in detail.

The control system is powered conveniently by a source of 110 v. alternating current, supplied through a main switch S1, located desirably at the main control station of the machine. From the source, power is conducted to the coils of eight electromagnetic switches E, which, in conjunction with the limit switches L, previously mentioned, control the operation of the five pneumatic cylinders by means of the solenoid operated pilot valves associated therewith. The

electromagnetic switches may conveniently be aranged in a bank, at any suitable location (not shown) on or near the machine . Of these switches, E1, E5, E6, E7 and E8 are double blade switches, and E2, E3 and E4 are single blade. Since the photoelectric cell unit 58 requires a short warm-up period, it is powered by a distinct circuit controlled by the switch S2, positioned adjacent switch S1 at the main control station. By this arrangement, the photoelectric cell unit 58 may be energized before the main switch S1 is closed, and when the machine is stopped for short periods of time by opening switch S1, the cell unit 58 may be permitted to remain energized, the switch S2 being opened desirably only when the machine is stopped for an extended period.

Before operation, the machine is first adjusted according to the final width and desired thickness of the articles to be packaged. As previously described, the adjustment for width is effected mechanically by means of hand wheel 104. Adjustment of the vertical adjustment carriage 155, to vary the thickness, is powered by gear motor 147, controlled by button switches B1 and B2. Closing of switch B1, it will be seen, completes a circuit through conductors 201 and 202, switch B1, conductor 203, normally closed switch L16, conductor 204, and thence through the coil 205 to the return line 206. The coil 205, it will be understood, is effective to energize the motor 147 and cause rotation thereof in the proper direction to elevate the pressing ram carriage, which elevation continues until the switch B1 is released and permitted to open. Should switch B1 be maintained closed until the vertical adjustment carriage reaches the upper end of its permissible travel, the switch L16 is engaged and opened by the switch stop 162, carried into actuating contact with the switch by lower beam 159 of the carriage, thereby opening the circuit and preventing further operation of the motor and carriage in the up direction.

Similarly, when button switch B2 is closed, a circuit is completed through conductors 201 and 207, normally closed switch L13, conductor 208, switch B2, conductor 209, normally closed switch L17, conductor 210, and thence through coil 211 to return line 206. In the manner described above, the coil 211 is effective to energize motor 147 and cause it to rotate in the direction resulting in lowering of the vertical adjustment carriage, until the switch B2 is released and closed. As in the case of switch L16, if the vertical adjustment carriage is lowered to the lower end of its permissible travel, the switch L17 is actuated and opened by the switch stop 160 carried by the upper beam 158 of the carriage, thereby opening the circuit and preventing further lowering of the carriage. The switch L13 being also in the circuit, lowering of the pressing ram carriage may also be stopped by the opening of this switch, occasioned by engagement of the actuating rod roller 166 with the discharge ram 94, and displacement of the rod 164 into actuating engagement with switch L13. Should the motor 147 be operated to lower the carriage to an adjusted vertical position too low to permit safe operation of the discharge ram in place on the machine, then, the switch L13 operates to terminate the adjustment, thereby warning the operator to replace the discharge ram with another of lesser height. The switch L13 is also effective when open, in a manner shortly to be described, to prevent operation of the machine until the switch is permitted to close, either by replacing the discharge ram or by elevating the vertical adjustment carriage.

When the machine has been adjusted as desired, the switch S2 may be closed, completing a circuit through conductors 201 and 212, switch S2, conductor 213, photo-electric cell unit 58, and conductors 214 and 206. The cell unit 58 controls the switch L15 in conventional manner, whereby it is operative to close the normally open switch when the light beam is uninterrupted. After a short warm-up period, then, the cell 58 is operative to close switch L15, which remains closed thereafter at all times, except when the light beam is interrupted, as by the passage therethrough of an article on the infeed conveyor.

Pressure air, of course, is made available to all the pneumatic cylinders by opening main valve 42, whereupon the machine is ready to operate, upon the energization thereof by closing main switch S1. The solenoid operated pilot valves P associated with the pneumatic cylinders C are effective, when the solenoids thereof are not energized, to cause the cylinders and the mechanism associated with each to assume the following at rest positions. The rod R1 of cylinder C1 is extended, poised to retract and advance the conveyor belt 22. The transfer ram, pressing ram and discharge ram are all retracted, and the throat 76 is open. Energization of the solenoid of pilot valve P1, then, effects retraction of rod R1 and consequent advance of the conveyor belt one step. Energization of solenoid P2 causes the transfer ram 46 to advance across the conveyor belt and press plate 60 to its final position below pressing ram 64, and energization of solenoid P3 effects the downward, compressing stroke of the pressing ram. Energization of solenoid P4 collapses the machine throat, and the solenoid P5 when energized causes the discharge ram 94 to advance below the pressing ram and through the throat.

When the coils thereof are not energized, the electromagnetic switches E are all open as shown. The switches L1 to L17, inclusive, are all spring loaded in the direction indicated in the diagram, and with the machine at rest occupy their normal position, with the following exceptions. Normally open switch L2 is closed by the cam 44 of piston rod R1, normally open switch L3 is closed by the cam 63 of the transfer ram carriage, switch L7 under the influence of switch stop 75 is in the position shown, in series with switch L9, normally open switch L8 is closed by the switch stop 93, which it contacts due to the elevated position of the throat carriage, normally open switch L9 is closed by the cam carrier 95 associated with the discharge ram, and, of course, switch L15 is closed by the photoelectric cell 58 (assuming the light beam thereof is uninterrupted). All of the switches L are single throw, with the exception of switch L7, the normal position of which is across the lower pair of contacts shown in Figure 24. The circuit diagram of Figure 24 illustrates the above-described condition of the control system at the instant the main switch S1 is closed, energizing the machine and starting a cycle of operation.

Immediately upon the application of voltage to the system by closing main switch S1, current is conducted from conductor 201 through conductor 207 and switches L13, S1 and L12 to conductor 216. In the absence of an over-size discharge ram, then, by which switches L12 and L13 would be opened, conductor 216 is in effect a line conductor. Solenoid P4 is immediately energized

from conductor 216 through conductor 245, the left hand blade of open switch E5, and conductor 217, the circuit being completed through solenoid P4 to the other line conductor 206. Energization of solenoid P4 effects retraction of cylinder C4, collapsing the throat and permitting switch L8 to assume its normally open position. The collapse of the throat constitutes the first operation in the machine cycle.

Simultaneously, the coil of switch E8 is energized by a circuit completed through conductors 216 and 218, switches L2 and L3, conductor 219, the left hand blade of open switch E1, E1 shunt 220, conductor 221, coil E8 and conductor 206. Switch E8 thereupon closes, and the coil of switch E8 is thereafter maintained energized through the normally closed switch L1, a circuit being completed through conductors 216 and 222, switch L1, conductor 223, the right hand blade of closed switch E8, conductor 224, the right hand blade of open switch E1, conductor 221, the coil of switch E8, and conductor 206. The closing of switch E3 energizes the solenoid P1 through conductors 216 and 224', the left hand blade of closed switch E8, conductor 225, solenoid P1 and conductor 206. The energization of solenoid P1 effects retraction of cylinder C1, whereby the conveyor belt 22 advances a distance corresponding to the stroke of the cylinder. If retraction of the cylinder C1 continues sufficiently, the cam 44 on piston rod R1 eventually opens switch L1, breaking the circuit through the coil of switch E8 and permitting switch E8 to open, whereupon the solenoid P1 is de-energized and the cylinder C1 extends.

If no article is brought into contact with the stop plate 37 by the first advance of the conveyor belt, the rod R1 extends until cam 44 again closes switch L2, whereupon the above-described sequence re-occurs, the resultant reciprocation of cylinder C1 and the accompanying intermittent advance of the conveyor belt 22 continue until an article on the conveyor belt reaches the stop plate. The switches L1 and L2 are so spaced, and the advance of the conveyor belt so coordinated, that an article properly placed on the conveyor belt engages bell housing 45 and closes the switch L14 actuated thereby an instant before the cam 44 opens switch L1. The closing of switch L14 by an article conveyed into transfer position by the infeed conveyor marks the end of the second operation in the cycle.

The closing of switch L14 by an article on the conveyor belt energizes the coils of switches E1 and E4, closing these switches. A circuit is completed through conductors 216 and 255, switch L14, and conductor 226, through coil E4 to conductor 206, and from conductor 226 through conductor 227, through coil E1 to conductor 206. The closing of switch E1 breaks the previously described circuit through the coil of switch E8, whereupon switch E8 opens and de-energizes solenoid P1, stopping the retraction of cylinder C1 at this point and causing extension thereof to its normal position, whereby switch L2 is again closed.

The closing of switch E4 energizes the coils of switches E3 and E7, circuits being completed through conductors 216 and 228, the blade of closed switch E4, conductors 229 and 230, switch L9, conductor 231, switch L7 and conductor 232, through coil E7 to conductor 206, and from conductor 232 through conductor 233 and coil E3 to conductor 206. The switch L7, as previously stated, is maintained in its upper position by the switch stop 75, and the switch L9 is closed by the cam carrier 95 associated with the discharge ram.

Their coils being energized, the switches E3 and E7 thereupon close. In closing, switch E7 energizes solenoid P2, a circuit being completed through conductors 216 and 234, the left hand blade of closed switch E7, conductor 235, switch L15, conductor 236, and through the solenoid P2 to conductor 206. It will be noted at this point that if the light beam of the photoelectric cell 58 is interrupted, as by a second article positioned too closely to the article against the stop plate 37, the switch L15 will not be closed, whereby the solenoid P2 will not be energized.

The energization of solenoid P2 causes cylinder C2 to advance the transfer ram 66 across the conveyor belt and press plate 60, whereby the article positioned against the stop late is displaced laterally to a position below the pressing ram 64. As the transfer ram carriage advances, the cam 63 associated therewith first moves away from switch L3, permitting that switch to assume its normally open position. The opening of switch L3 prevents operation of the conveyor cylinder C1 upon the next following opening of switch L14, which is occasioned as the article is moved away from bell housing 45. The opening of switch L14 de-energizes the switches E1 and E4, whereupon they open, but the solenoid P1 is not energized through the open switch E1 as formerly, because of the open switch L3. It will be recognized that the conveyor cannot again operate until the switch L3 is closed by the transfer ram returning to its fully retracted position.

The coil of switch E7, previously energized through switch E4, remains energized by a circuit including switches L5, L7 and L9, said circuit being completed through conductors 216 and 234, the right hand blade of closed switch E7, conductor 237, switch L5, conductor 230, switch L9, conductor 231, switch L7 and conductor 232, through coil E7 to conductor 206. As the transfer ram advances, the cam 63 associated therewith next closes switch L4. Since switch E3 is at this point open, the momentary closing of switch L4 at this stage of the cycle has no effect. The transfer ram carriage cam finally engages and opens switch L5, thereby breaking the holding circuit through the coil E7, whereupon switch E7 opens and de-energizes solenoid P2, ending the stroke of the transfer ram at this point and causing it to retract. The end of the transfer ram stroke, whereby an article is positioned immediately below the pressing ram 64, marks the end of the third operation of the machine cycle.

The coil of switch E3, previously energized through switch E4, also remains energized by a circuit including switches L5, L7 and L9, the circuit following that set forth in the preceding paragraph through conductor 232, and completed through conductor 233 and coil E3 to conductor 206. The opening of switch L5, then, at the end of the transfer ram stroke, also de-energizes coil E3, whereupon switch E3 opens.

As the transfer ram retracts, cam 63 again closes switch L4. Switch E3 now being open, the closing of switch L4 at this stage of the cycle energizes the coil of switch E6, a circuit being completed through conductors 216 and 238, switch L4, conductor 239, the blade of open switch E3, conductor 240, shunt 241, and thence through coil E6 to conductor 206. As switch E6 closes, it is locked in by a circuit through switch L11, that circuit being completed through conductor 216, switch L11, conductor 242, the right hand blade

of closed switch E6, shunt 241, and coil E6 to conductor 206. Simultaneously, the solenoid P3 is energized through the other blade of switch E6, a circuit being completed through conductors 216 and 243, the left hand blade of closed switch E6, conductor 244 and solenoid P3 to conductor 206. Thereby, as the transfer ram retracts to the point at which switch L4 is again closed, solenoid P3 is energized and the pressing ram begins its downward stroke, compressing the article positioned therebeneath to the predetermined height. Obviously, the switch L4 is so spaced from the switch L5 along the switch carrier 137 as to insure that the transfer ram is completely withdrawn from under the pressing ram before the downward stroke of the latter is initiated.

After closing the switch L4, the transfer ram continues to retract to the end of its stroke, at which point cam 63 closes switch L3. The closing of switch L3 energizes the coil of switch E8 as described in connection with the second operation of the machine cycle, and initiates operation of the infeed conveyor until another article reaches stop plate 37 and closes switch L14, as there described. Thus, the infeed conveyor commences the next cycle of its operation only after the transfer ram has completed its stroke and returned to fully retracted position.

As press cylinder C3 displaces the pressing ram 64 downwardly, switch stop 75 moves downwardly with the pressing ram guide carriage, out of contact with switch L7, permitting that switch to return to its normal position, opening the upper circuit and closing the lower circuit therethrough, as shown in the diagram. Breaking of the upper circuit through switch L7 prevents the energization of solenoid P2, in this manner preventing operation of transfer cylinder C2 and the transfer ram, while the pressing ram 64 is not in full up position. Closing of the lower circuit through switch L7 closes the switch E5, thereby de-energizing solenoid P4, whereby the machine throat is opened. The closing of the lower circuit through switch L7 energizes the coil of switch E5 by completing a circuit through conductors 216, 245 and 246, switch L7, conductor 247, switch L10 and conductor 248, through the coil E5 to conductor 206. The coil E5 thereupon closes switch E5, the coil remaining energized by a circuit through conductors 216, 245 and 249, the right hand blade of closed switch E5, conductors 250 and 247, switch L10 and conductor 248, and thence through coil E5 to conductor 206. The closing of switch E5 also breaks the circuit energizing solenoid P4, which passes through the left hand blade of switch E5 when open, as set forth in the description of the first operation of the machine cycle, whereupon the cylinder C4 extends until the throat carriage stop 81 engages the stop 161 carried by the vertical adjustment carriage, in this manner opening the machine throat to the proper delivery dimension. The opening of the throat also effects the closing of switch L8 by the throat carriage stop 93.

The pressing ram 64 and its guide carriage proceed downwardly to the end of the stroke of press cylinder C3, at which point the switch L6 is engaged and actuated by the switch stop 74 carried by the pressing ram guide carriage. The end of the compressing stroke of the pressing ram and the opening of the machine throat mark the end of the fourth operation of the machine cycle, at this point the article being compressed to its delivery height or thickness, and the throat being opened to a corresponding height.

The closing of switch L6 energizes solenoid P5, whereupon discharge cylinder C5 initiates the traverse of discharge ram 94 under the pressing ram and into the machine throat, and also energizes the coil of switch E2, which closes and completes a locking circuit through the coil of switch E5. The switch L6 directly energizes the coil of switch E2 and solenoid P5, circuits being completed through conductors 216, switch L11, conductor 242, the right hand blade of closed switch E6, shunt 241, conductor 250, switch L6, conductor 251, switch L8 (now closed by the elevated throat carriage), and conductors 252 and 215 to coil E2 and conductor 206, and from conductor 215 to solenoid P5 and conductor 206. As switch E2 closes, the locking circuit through coil E5 is completed through conductors 216, 245 and 249, the right hand blade of closed switch E5, conductors 250' and 253, the blade of closed switch E2, and conductor 254, to coil E5 and conductor 206. As the discharge ram 94 is advanced by discharge cylinder C5, the cam 98 associated therewith first passes out of actuating contact with the switch L9, permitting that switch to open and thereby further preventing energization of the coil of switch E7 and ensuing operation of the transfer ram while the discharge ram is out of fully retracted position. As the discharge ram advances, the cam 98 momentarily engages and opens switch L10, thereby opening one circuit through the coil of switch E5, but the coil E5 is not de-energized because of the locking circuit therethrough, including the closed switch E2. (If switch E5 were permitted to open, solenoid P4 would be energized and the machine throat would collapse.) The discharge ram continues to advance until the cam 98 engages and opens switch L11. Solenoids P3 and P5 both being energized through the switch L11, the opening of this switch de-energizes both solenoids, whereupon the discharge ram stops and both the discharge ram and the pressing ram retract simultaneously. The end of the discharge ram stroke marks the end of the fifth operation of the machine cycle.

The retraction of the pressing ram 64 effects the opening of switch L6, de-energizing the coil of switch E2. Switch E2 thereupon opens, breaking the locking circuit through the coil of switch E5. As the discharge ram 94 retracts, its cam 98 momentarily opens switch L10. The opening of switch L10 de-energizes the coil of switch E5, the locking circuit therethrough being already broken. Switch E5 thereupon opens and energizes solenoid P4, which effects the collapse of the throat. It will be evident that the switch L10 is so positioned as to delay collapse of the throat until the discharge ram is completely retracted therefrom. The discharge ram eventually reaches its fully retracted position, and thereby closes switch L9, making energization of solenoid P2 and actuation of the transfer cylinder C2 again possible in the event the switch L14 is closed by a towel stack properly positioned for transfer by the transfer ram. The foregoing description covers one complete cycle of operation, which, of course, is repeated in continuous fashion so long as switches S1 and S2 remain closed, and successive articles are fed to the infeed conveyor.

It will be understood from the above description that the operation of our machine is automatic and continuous, and is so coordinated as to maintain such operation without interruption. By the inclusion of the numerous safety features

described, substantially no possibility of malfunctioning exists. The machine, for example, can operate only when provided with a discharge ram of suitable size, as related to the machine adjustment. The conveyor can function only when the transfer ram is fully retracted, and then operates intermittently until an article is properly positioned thereon for transfer to the pressing section. Once an article is properly positioned, the conveyor cannot again operate until the discharge ram has completed a stroke and fully retracted. The transfer ram can operate only when no article interrupts the light beam of the photoelectric cell **58**, and when the pressing ram and discharge ram are fully retracted. The pressing ram is operative only after operation of the transfer ram, and sufficient retraction thereof to be entirely clear of the pressing ram. The discharge ram is operable only after the pressing ram has reached the end of its downward stroke, and the throat has opened accordingly. At the end of the discharge ram stroke, the discharge ram and pressing ram retract simultaneously, but the throat cannot collapse until the discharge ram is entirely clear thereof.

It will thus be seen that there has been provided by this invention a structure in which the various objects hereinbefore set forth, together with many practical advantages, are successfully achieved. As various possible embodiments may be made of the mechanical features of the above invention, all without departing from the scope thereof, it is to be understood that all matter hereinbefore set forth or shown in the accompanying drawings is to be interpreted as illustrative, and not in a limiting sense.

We claim:

1. Article packaging apparatus comprising a pair of spaced press members, means operative to advance one of said press members toward the other, a pair of opposed normally adjacent throat members, at least one of which is movable, disposed laterally of said press members, means operative in response to the advance of said one press member to separate said throat members into alignment with the final approach position of said press members, and a discharge member operative to traverse laterally between said press members in the direction of said throat members.

2. Apparatus according to claim 1, wherein the outer ends of said throat members are rounded to facilitate reception of paper bags thereover.

3. Apparatus according to claim 1, including adjusting means operative to vary the final approach position of said press members.

4. Apparatus according to claim 1, including adjusting means operative to vary the final approach position of said press members, and adjusting means operative to vary the effective width of said throat members.

5. Apparatus according to claim 1, including adjusting means operative to simultaneously vary the final approach position of said press members and vary the separated position of said throat members accordingly, and adjusting means operative to vary the effective width of said throat members.

6. Apparatus according to claim 1, including limit switch means responsive to the positioning of an article between said press members to actuate said press member operating means and said throat member operating means.

7. Apparatus according to claim 1, including means responsive to the arrival of said press members into final approach position and the arrival of said throat members into alignment therewith to actuate said discharge member.

8. Apparatus according to claim 1, including means responsive to the positioning of an article between said press members to actuate said press member operating means and said throat member operating means, means responsive to the arrival of said press members into final approach position and the arrival of said throat members into alignment therewith to actuate said discharge member, means responsive to the arrival of said discharge member at the end of its stroke to reverse said discharge member, and means responsive to the withdrawal of said discharge member to initiate reversal of said throat member operating means.

9. Article packaging apparatus comprising a pair of spaced press members, means operative to advance one of said press members toward the other, a pair of adjacent throat members disposed laterally of said press members, means operative to separate said throat members into alignment with the final approach position of said press members, a discharge member operative to traverse laterally between said press members in the direction of said throat members, and a transfer member operative to traverse to a final position substantially between said press members in a direction normal to the path of said discharge member.

10. Apparatus according to claim 9, including means responsive to the withdrawal of said transfer member from said press members to actuate said press member operating means and said throat member operating means.

11. Apparatus according to claim 9, including means responsive to the arrival of said transfer member in final position to reverse said transfer member, means responsive to the withdrawal of said transfer member from said press members to actuate said press member operating means and said throat member operating means, and means responsive to the arrival of said press members into final approach position and the arrival of said throat members into alignment therewith to actuate said discharge member.

12. Apparatus according to claim 9, including adjusting means operative to vary the final position of said transfer member relative to said press members and to simultaneously vary the effective width of said throat members in accordance therewith.

13. Apparatus according to claim 9, including adjusting means operative to simultaneously vary the final approach position of said press members and vary the separated position of said throat members accordingly.

14. Apparatus according to claim 9, including adjusting means operative to simultaneously vary the final approach position of said press members and vary the separated position of said throat members accordingly, and adjusting means operative to vary the final position of said transfer member relative to said press members and to simultaneously vary the effective width of said throat members in accordance therewith.

15. Apparatus according to claim 9, including adjusting means operative to vary the final position of said transfer member relative to said press members, and control means associated with said adjusting means disposed for actuating engagement by said discharge member and operative to prevent operation of said discharge member.

16. Apparatus according to claim 9, including

adjusting means operative to vary the final approach position of said press members, and control means associated with said adjusting means disposed for actuating engagement by said discharge member and operative to prevent operation of said discharge member.

17. Apparatus according to claim 9, including adjusting means operative to vary the final position of said transfer member relative to said press members, adjusting means operative to vary the final approach position of said press members, and control means associated with each of said adjusting means, each of said control means being disposed for actuating engagement by said discharge member and operative to prevent operation of said discharge member.

18. Apparatus according to claim 9, including electrically driven adjusting means operative to vary the final approach position of said press members, and switch means operative to limit the travel of said adjusting means.

19. Apparatus according to claim 9, including electrically driven adjusting means operative to vary the final approach position of said press members, switch means operative to limit the travel of said adjusting means, and means associated with said adjusting means operative to engage said discharge member in the course of movement of said adjusting means and thereby deactivate said adjusting means.

20. Article packaging apparatus comprising a press plate, a pressing member normally spaced from said press plate, means operative to displace said pressing member toward said press plate, a first throat member adjacent said press plate and in lateral alignment therewith, a second throat member opposed to said first throat member and normally adjacent thereto, means operative in response to said displacement of said pressing member to displace said second throat member into alignment with the advanced pressing position of said pressing member, a discharge member, and means operative to displace said discharge member between said press plate and said pressing member in the direction of said throat members.

21. Article packaging apparatus comprising a press plate, a pressing member normally spaced from said press plate, means operative to displace said pressing member toward said press plate, a first throat member adjacent said press plate and in lateral alignment therewith, a second throat member opposed to said first throat member and normally adjacent thereto, means operative to displace said second throat member into alignment with the advanced pressing position of said pressing member, a discharge member, means operative to displace said discharge member between said press plate and said pressing member in the direction of said throat members, a transfer member, and power means operative to displace said transfer member in a direction normal to the path of said discharge member to a final position between said press plate and said pressing member.

22. Apparatus according to claim 20, wherein said discharge member is detachably secured to said discharge member operating means, and including adjusting means operative to vary the final position of said transfer member relative to said press members, and adjusting means operative to vary the final approach position of said press members.

23. Article packaging apparatus comprising a press plate, a pressing member normally spaced from said press plate, means operative to displace said pressing member toward said press plate, a first throat member adjacent said press plate and in lateral alignment therewith, a second throat member opposed to said first throat member and normally adjacent thereto, means operative to displace said second throat member into alignment with the advanced pressing position of said pressing member, a discharge member, means operative to displace said discharge member between said press plate and said pressing member in the direction of said throat members, a transfer member, power means operative to displace said transfer member in a direction normal to the path of said discharge member to a final position between said press plate and said pressing member, and conveyor means disposed to convey articles into the path of said transfer member adjacent said press plate.

24. Apparatus according to claim 23, including means for intermittently driving said conveyor.

25. Apparatus according to claim 24, including means responsive to the positioning of an article by said conveyor in the path of said transfer ram to deactivate said conveyor drive means and actuate said transfer member operating means.

26. Apparatus according to claim 25, including photo-electric cell means positioned adjacent said conveyor and operative to prevent actuation of said transfer member operating means when the light beam of said photo-electric cell means is interrupted.

27. Apparatus according to claim 23, including means for intermittently driving said conveyor, and switch means positioned and disposed for actuation by said transfer ram in fully retracted position, said switch means being operative when not actuated by said transfer ram to deactivate said conveyor drive means.

28. Apparatus according to claim 23, including reciprocating drive means for intermittently driving said conveyor, switch means associated with said drive means operative to effect and limit reciprocation thereof, and means responsive to the positioning of an article by said conveyor in the path of said transfer ram to deactivate said switch means.

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