March 6, 1951 J. C. BAIN ET AL 2,544,125

PACKAGING MACHINE HAVING ARTICLE RECEIVING AND TRANSFERRING SECTIONS FOR HANDLING ARTICLES IN GROUP FORMATION

Filed Dec. 26, 1944 7 Sheets-Sheet 1

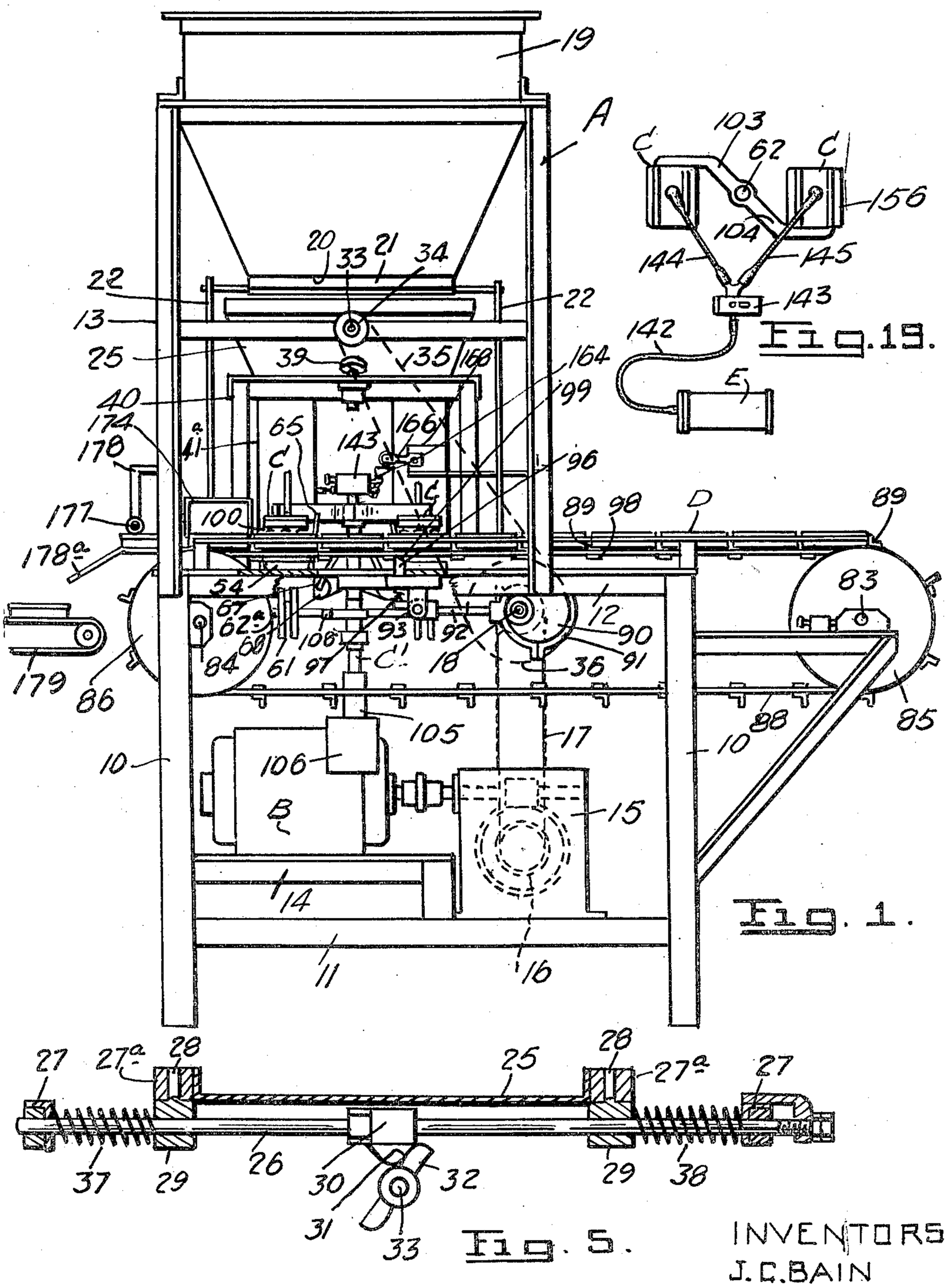

Fig. 1.

Fig. 19.

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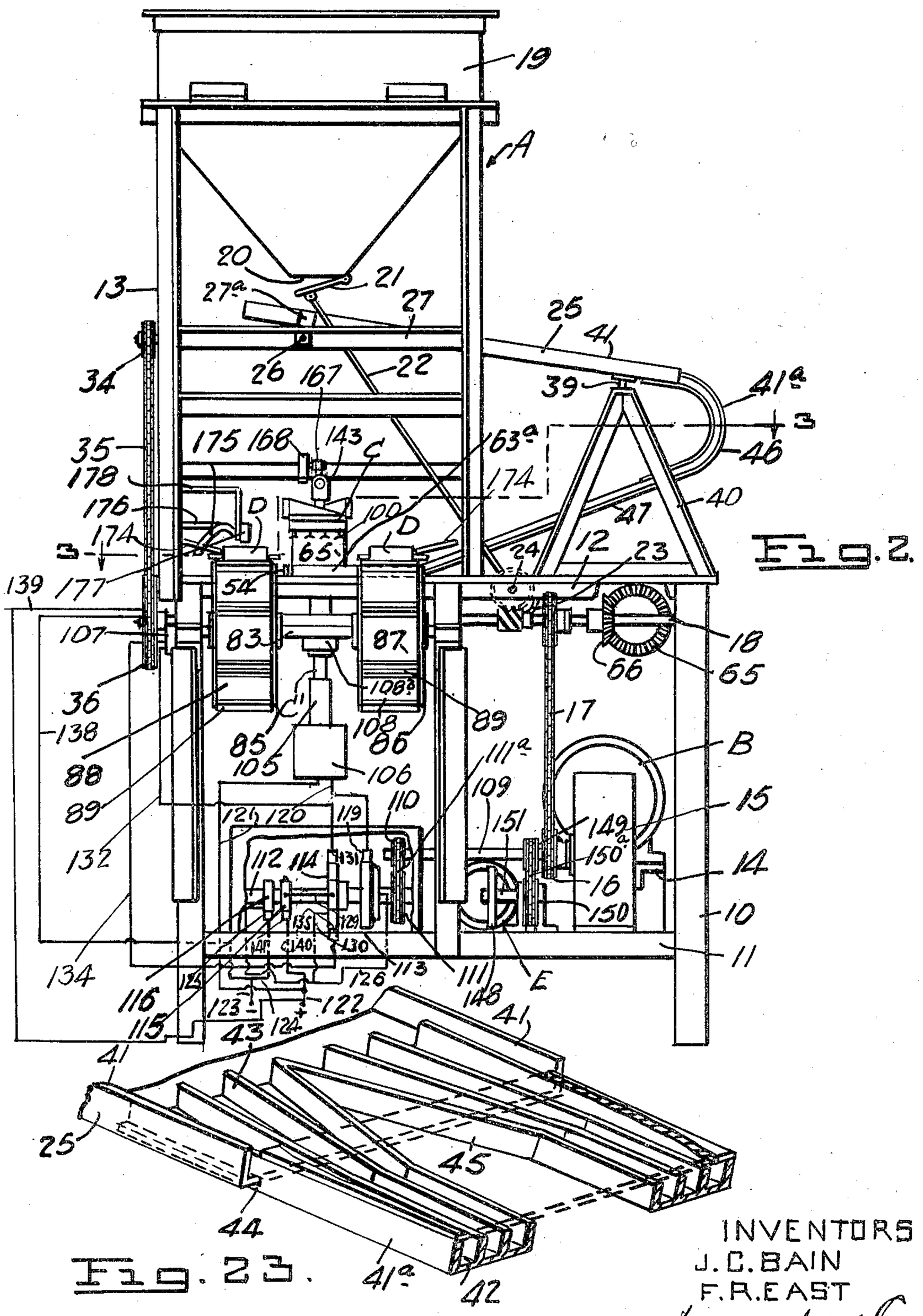

Fig. 2.

Fig. 23.

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Filed Dec. 26, 1944 7 Sheets-Sheet 3

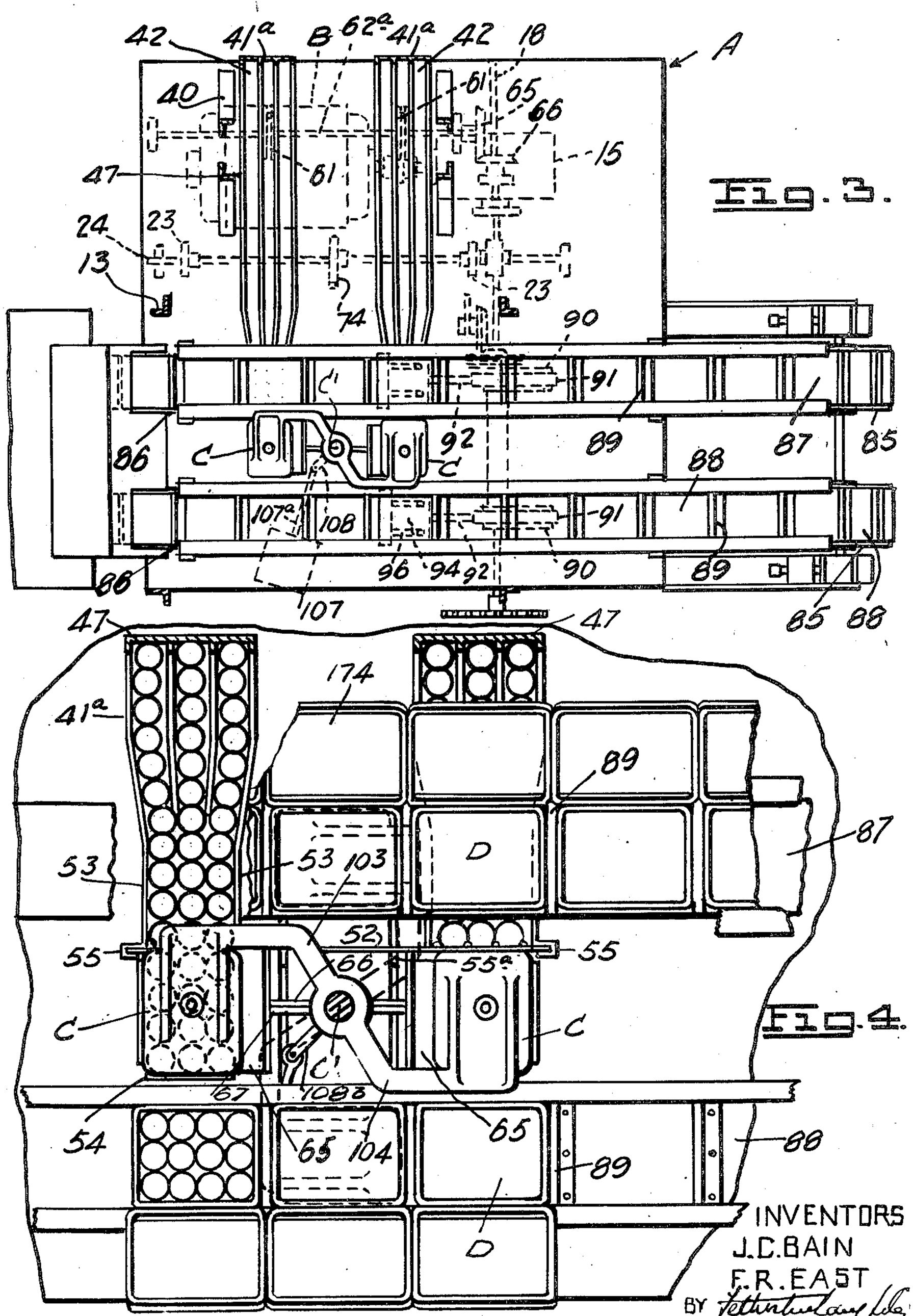

Fig. 3.

Fig. 4.

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PACKAGING MACHINE HAVING ARTICLE RECEIVING AND TRANSFERRING SECTIONS FOR HANDLING ARTICLES IN GROUP FORMATION

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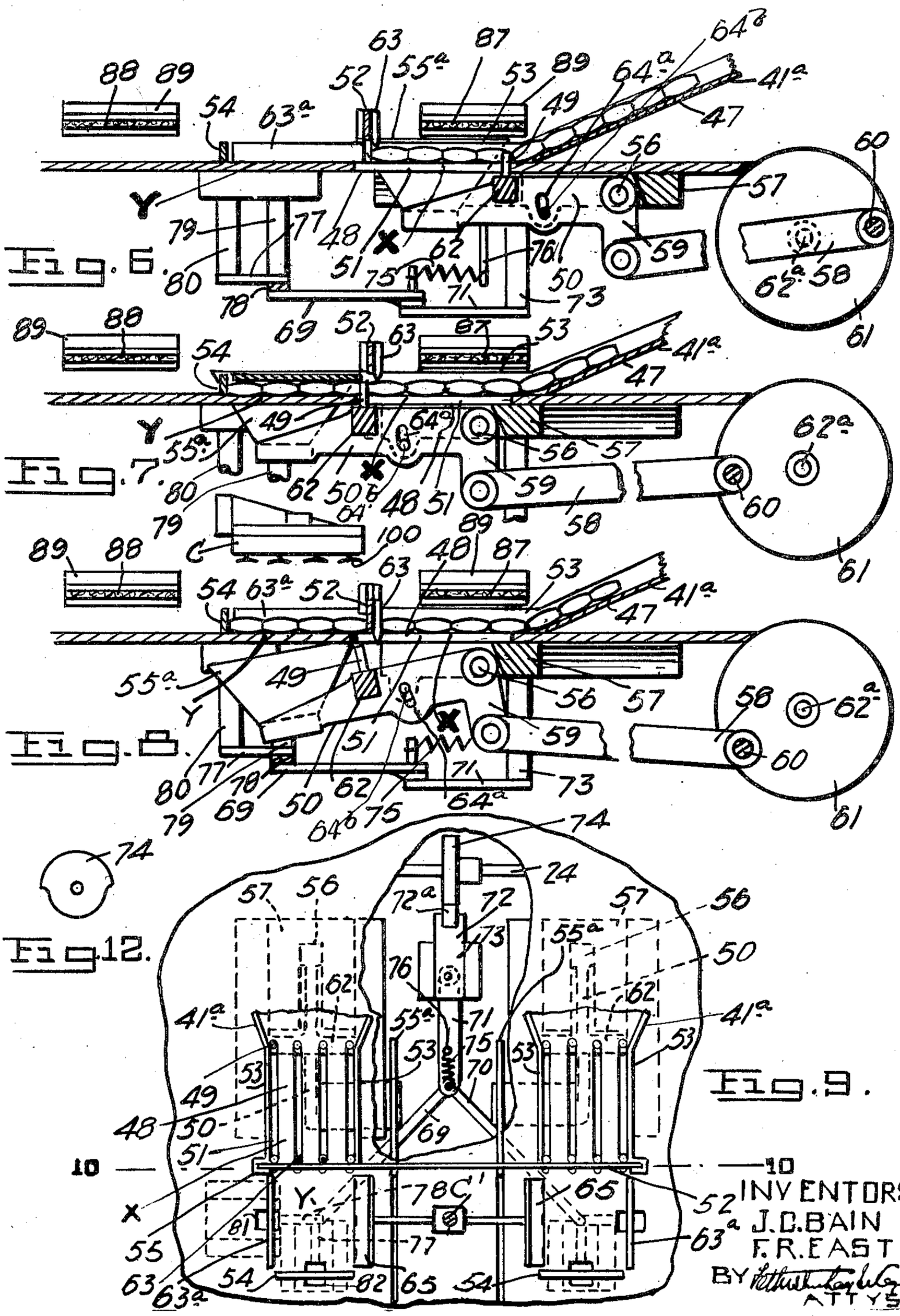

Fig. 6.

Fig. 7.

Fig. 8.

Fig. 12.

Fig. 9.

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PACKAGING MACHINE HAVING ARTICLE RECEIVING AND TRANSFERRING SECTIONS FOR HANDLING ARTICLES IN GROUP FORMATION

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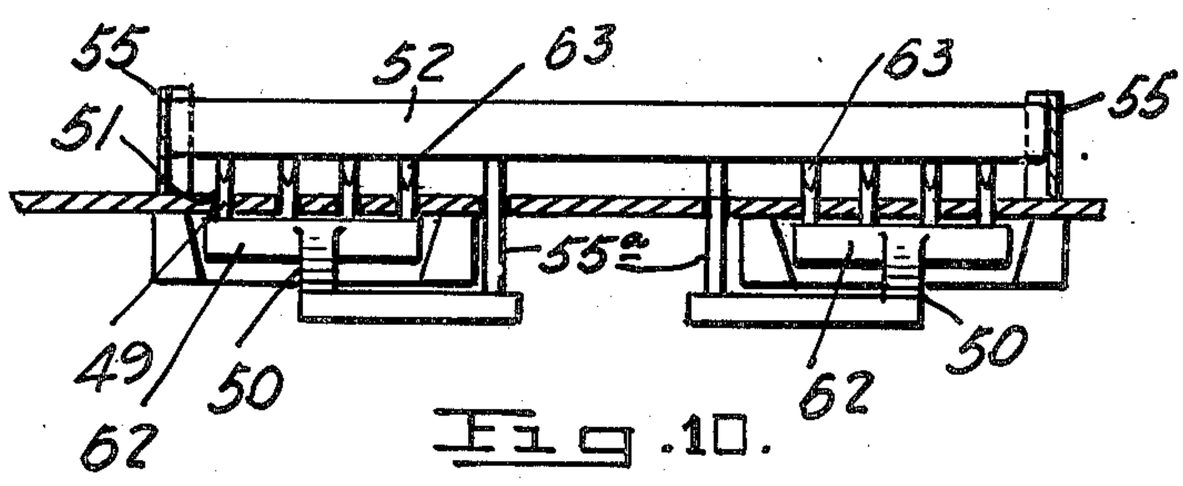

Fig. 10.

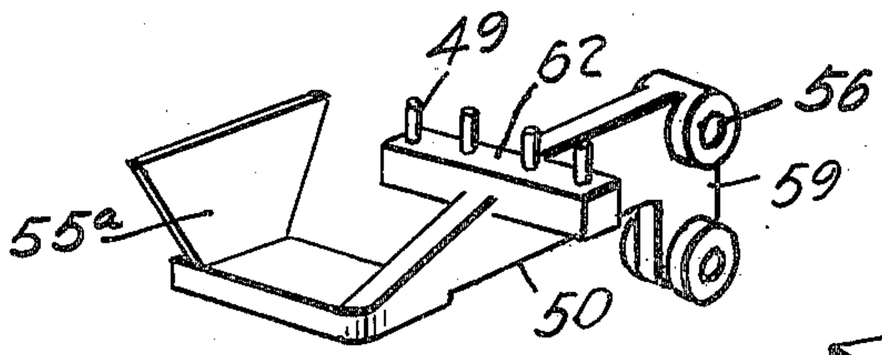

Fig. 11.

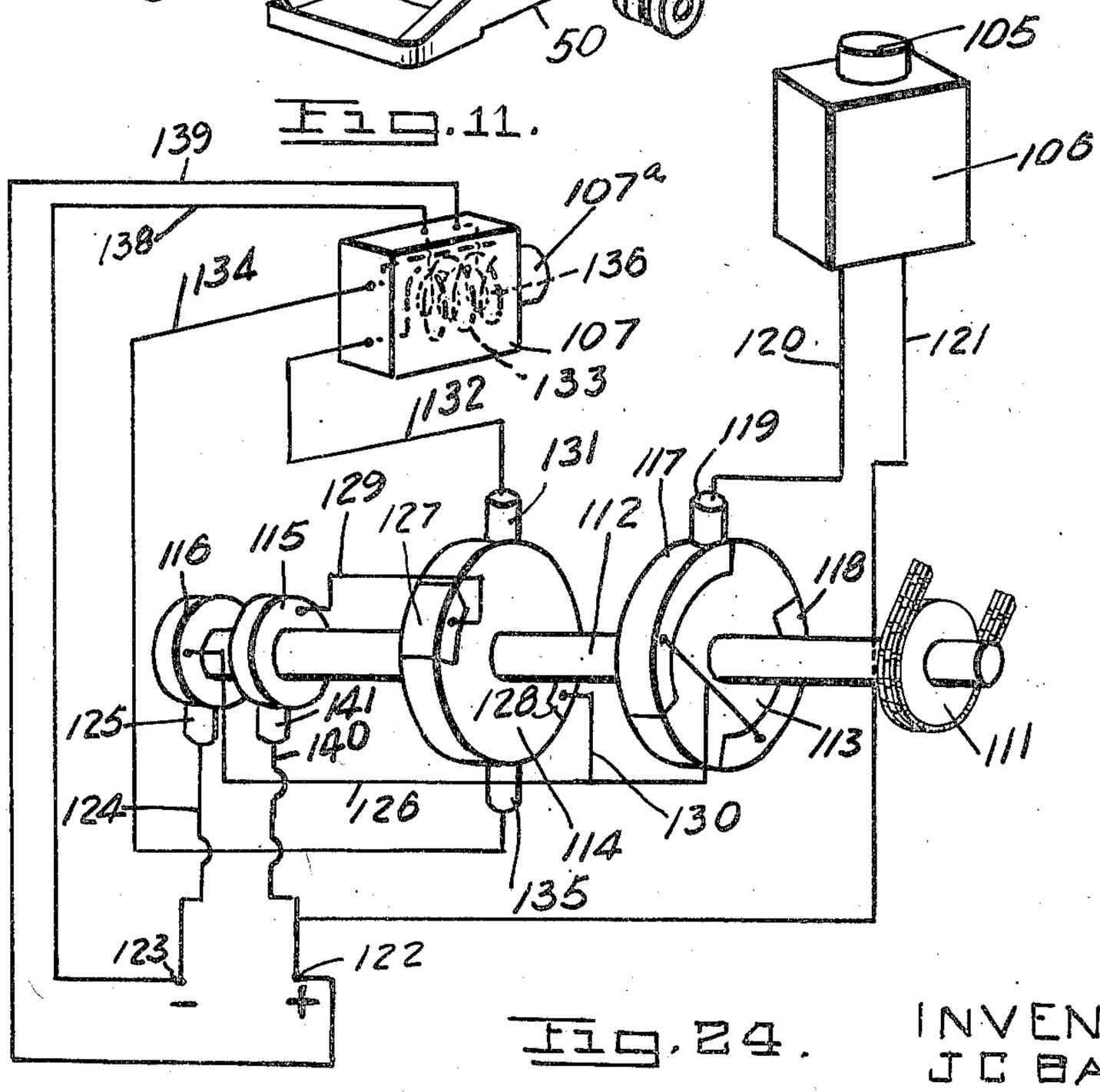

Fig. 24.

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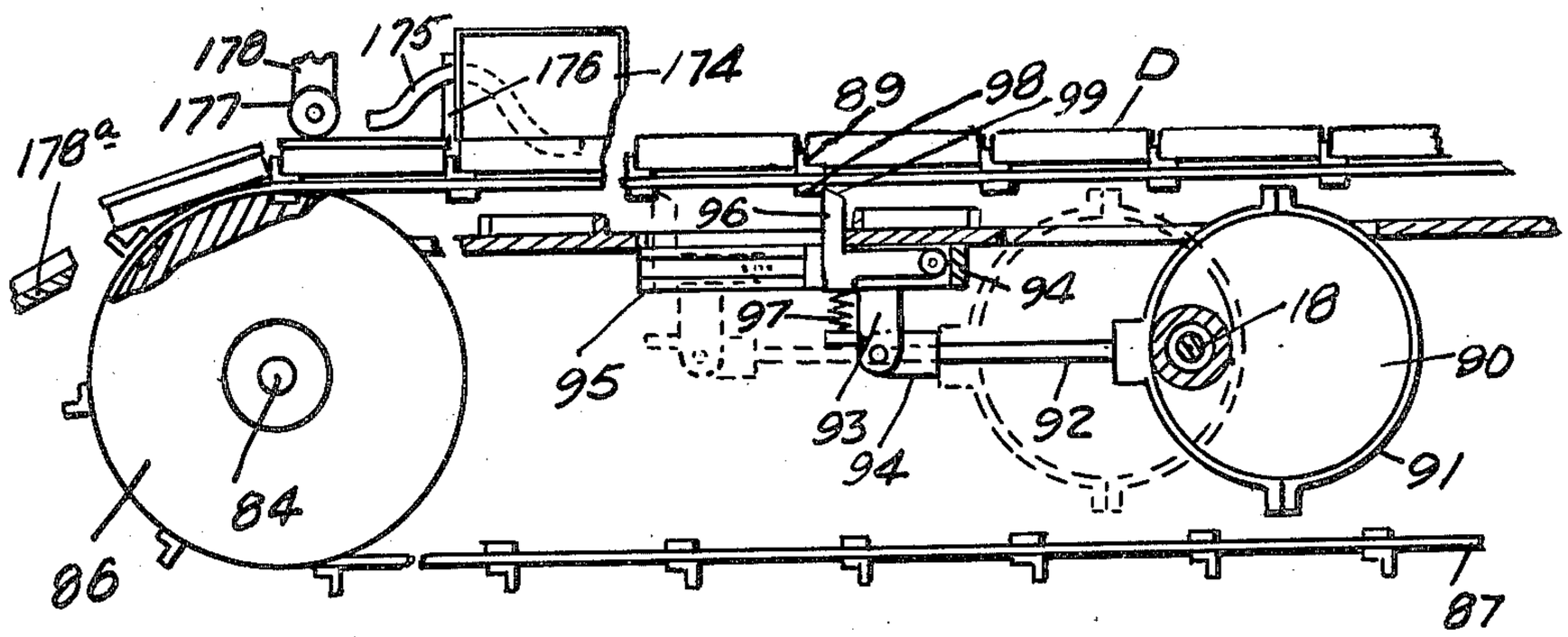

Fig. 14.

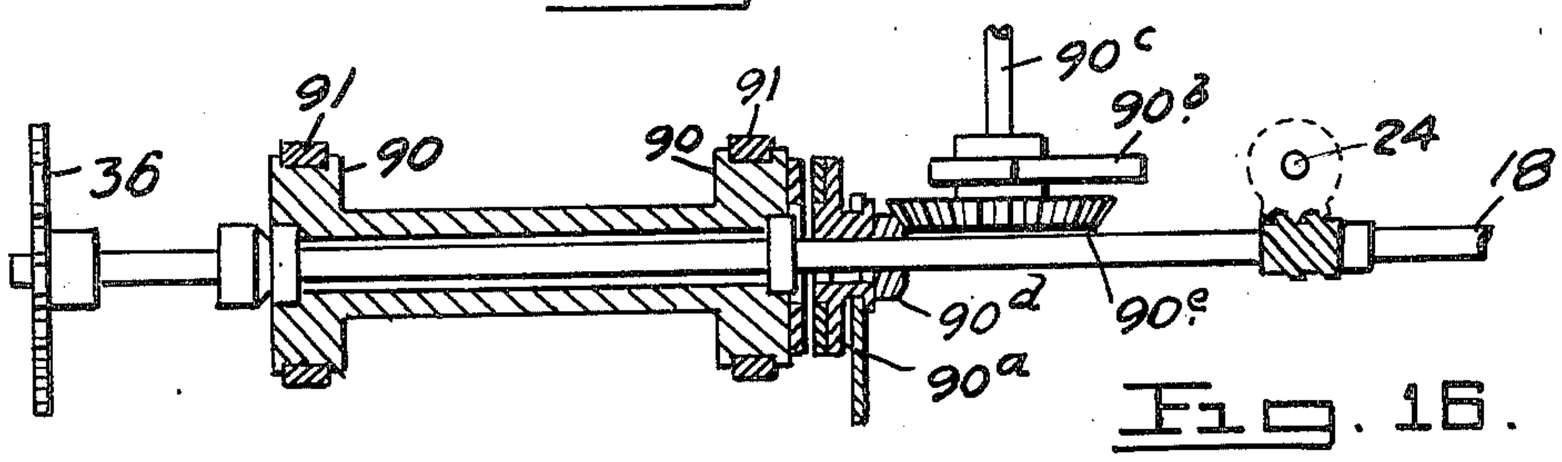

Fig. 16.

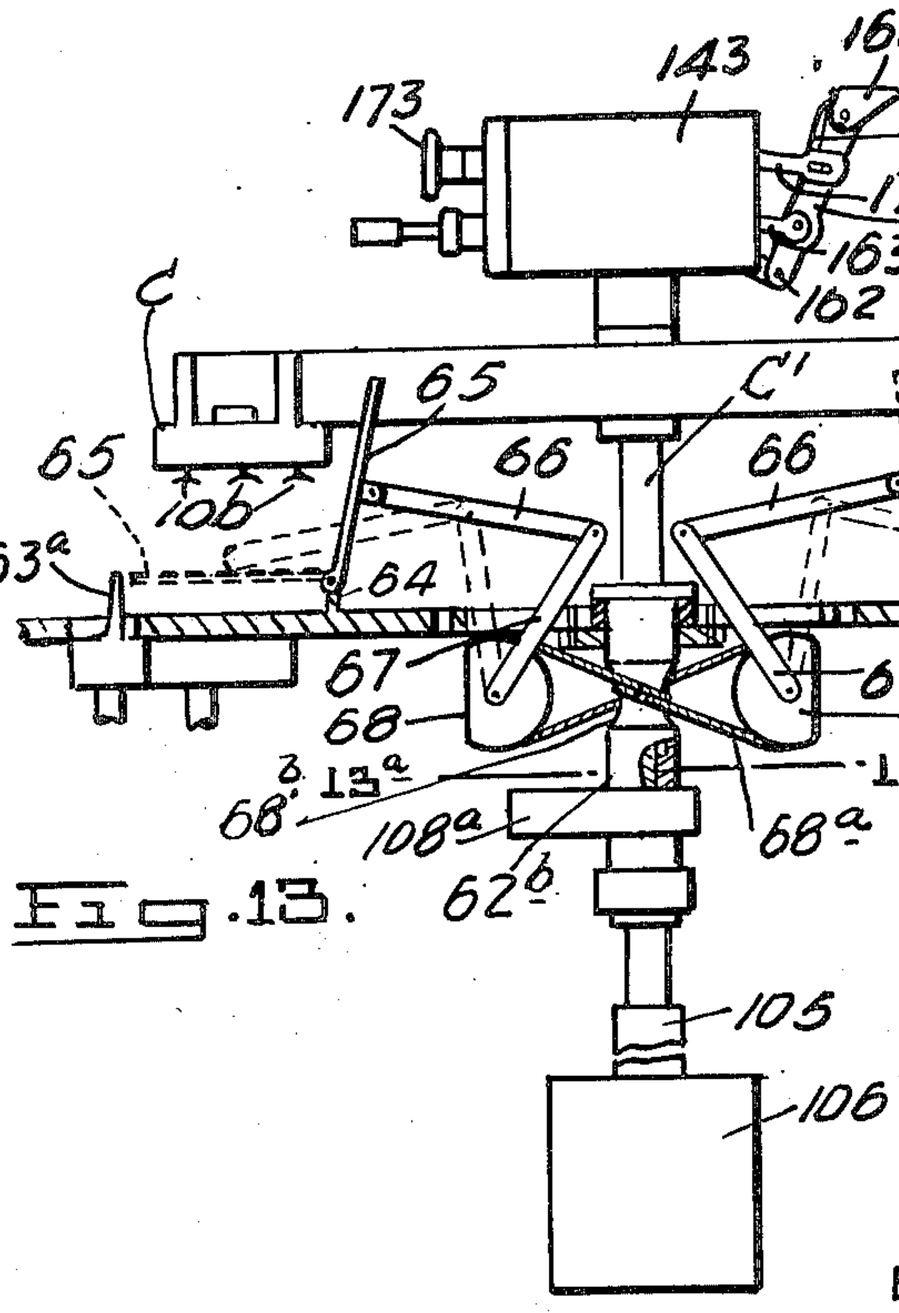

Fig. 13.

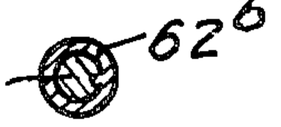

Fig. 13A.

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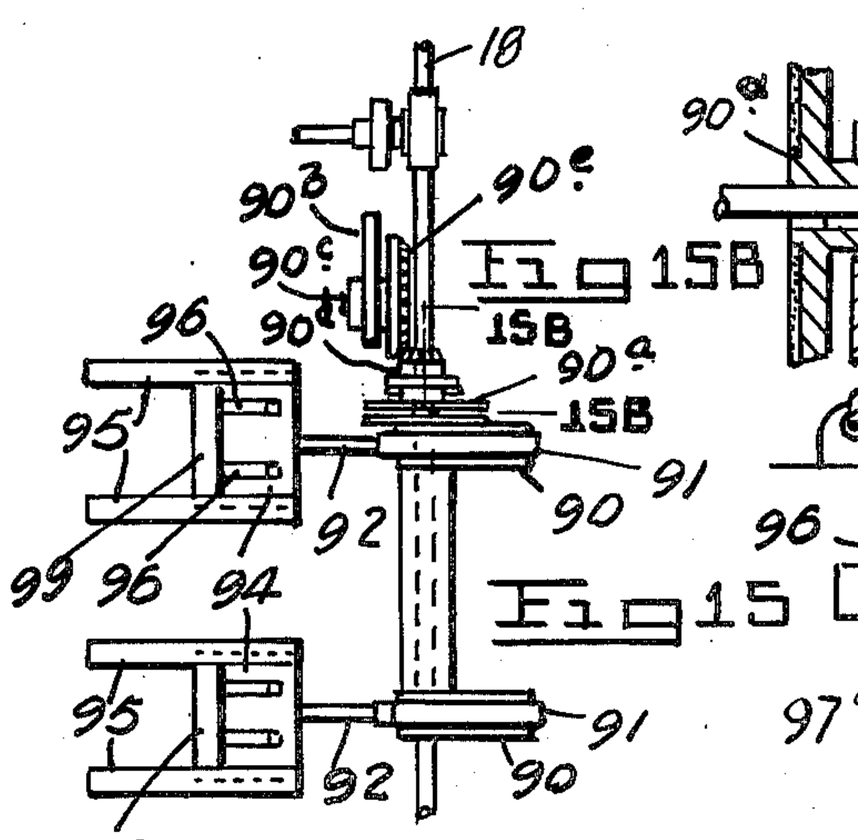

Fig. 15

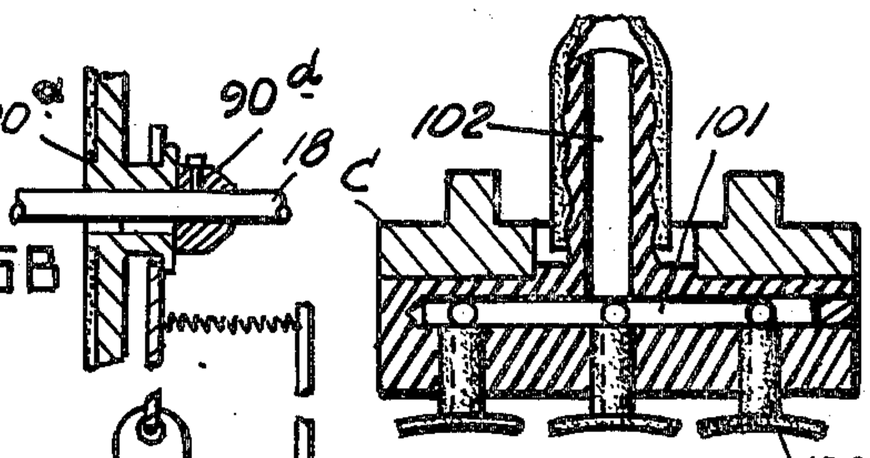

Fig. 21.

Fig. 17.

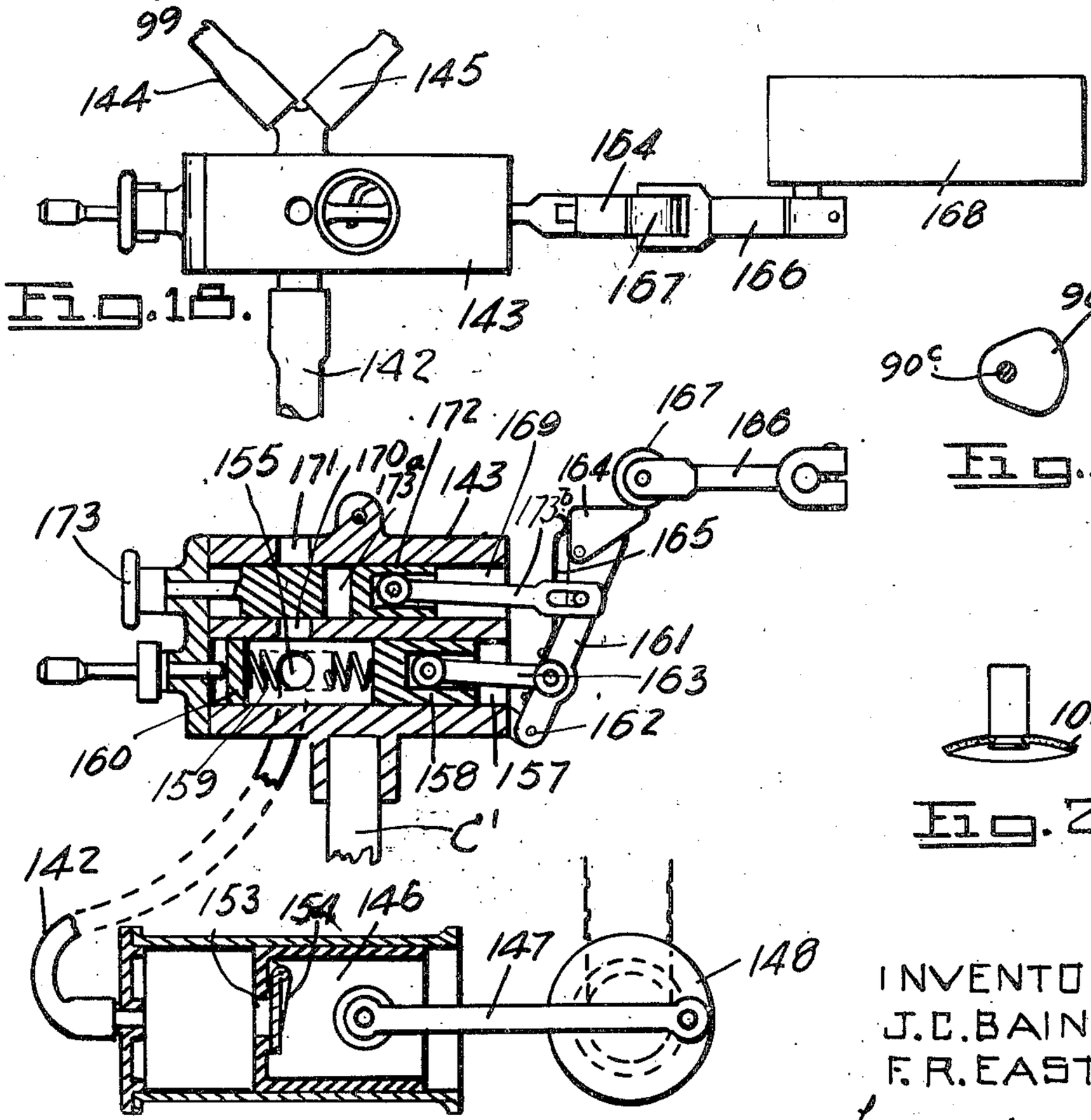

Fig. 18.

Fig. 15A.

Fig. 22.

Fig. 20.

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PACKAGING MACHINE HAVING ARTICLE RECEIVING AND TRANSFERRING SECTIONS FOR HANDLING ARTICLES IN GROUP FORMATION

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Application December 26, 1944, Serial No. 569,872

5 Claims. (Cl. 214—1)

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This invention relates to packaging machines and in particular to machines designed to pack tablets or wafer-like articles, such as lozenges, uniformly in containers designed to contain a group of the articles.

In the packaging of lozenges, as an example, it has been usual up to the present time to employ a number of packers to dispose the wrapped lozenges in packages and this necessarily requires quite a number of packagers at a substantial cost while the amount packed is less than might ordinarily be desirable and possible when using a machine such as produced under the present invention. It is therefore an object of the present invention to provide a packaging machine which is particularly designed for small articles such as lozenges and which will provide for the uniform packing of such small articles at a substantial rate of speed.

A further object of the invention is to provide a machine of this kind which will require a minimum number of persons to operate it and, will produce a quantity of packaged articles, in excess of that possible with four times as many persons packing manually.

A further object of the invention is to provide a machine of this kind which will package wrapped and unwrapped articles and in which both wrapped and unwrapped articles will be packed uniformly in all respects.

A still further object of this invention is to provide a machine of this character which is not complicated in general construction and which may be operated and controlled under all conditions in a practical manner.

With these and other objects in view the invention, in broader phases, comprises a packaging machine including a means of assembling articles in predetermined uniform groups and suction means for transferring one or more groups into a container.

The invention will be clearly understood by reference to the following detailed specification taken in conjunction with the accompanying drawings.

Referring to the drawings:

Fig. 1 is a side elevation of the packaging machine according to the present invention.

Fig. 2 is an end elevation of the machine.

Fig. 3 is a section taken substantially along the line 3—3 of Fig. 2 and showing lower portions of the machine in top plan view.

Fig. 4 is an enlarged top plan detail, partly in section of the article transferring mechanism and the feeding mechanism for the packages to receive the lozenges.

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Fig. 5 is a sectional detail of the means for agitating the agitating table.

Figs. 6 and 7 and 8 are enlarged sectional details showing in step by step relation the manner in which the lozenges are received from the agitating table and grouped for packaging.

Fig. 9 is a fragmentary detail plan of the grouping mechanism for grouping and transferring groups of lozenges in uniform arrangement for transfer to the packages.

Fig. 10 is an enlarged sectional detail taken on the line 10—10 of Fig. 9.

Fig. 11 is an enlarged perspective detail of the cam arm associated with the grouping mechanism in the grouping of the lozenges for packaging.

Fig. 12 is a side elevation of the cam for operating the grouping mechanism generally illustrated in Fig. 9.

Fig. 13 is an enlarged side elevation partly in section of the transferring mechanism for lifting groups of lozenges and elevating them and transferring them to the location of the boxes.

Fig. 13*a* is a sectional detail on line 13*a*—13*a* of Fig. 13.

Fig. 14 is an enlarged sectional detail of the box or package feeding mechanism.

Fig. 15 is a plan detail of the mechanism for clutching the main shaft in driving engagement with the box or feeding mechanism.

Fig. 15*a* is a side elevational detail of the cam for operating the clutch shown in Fig. 15.

Fig. 15*b* is a sectional view on line 15*b*—15*b* of Fig. 15.

Fig. 16 is an enlarged detail of the clutching mechanism shown in Fig. 15.

Fig. 17 is an end elevational detail of the dog mechanism and slide for moving the package feeding belts intermittently.

Fig. 18 is an enlarged plan view of the valve mechanism employed in conjunction with the suction head.

Fig. 19 is a schematic plan view of the suction valve and its connection with the suction heads and the vacuum pump.

Fig. 20 is a sectional detail of the valve mechanism shown in Fig. 19 and illustrating its general connection with the suction pump.

Fig. 21 is a transverse section taken through the suction head to illustrate the suction passages.

Fig. 22 is an enlarged detail of a suction cup as employed in the suction head.

Fig. 23 is an enlarged perspective detail of the channels in the vibrating table and in the feed

chute for transferring the articles from the one to the other.

Fig. 24 is a schematic perspective illustration showing the timing circuit for operating the suction head in both directions.

Referring to the drawings:

A indicates the machine as a whole which employs a suitable framework including the uprights 10, upper and lower cross members 11 and 12 and a super structure 13. A suitable operating motor B is mounted on a platform 14 carried by the lower cross members 11 and by means of the gear reduction unit 15 effects the operation of the necessary parts requiring predetermined movement. In this respect, by means of a suitable sprocket 16, operated from the gear reduction unit 15, and the connecting chain 17 the main drive shaft 18 is rotated. This latter then transmits the necessary motions to a number of other parts of the apparatus.

The super structure 13 carries suitable hopper 19 which is formed with a discharge opening 20 controlled by a swingable gate valve 21. This latter valve is operated intermittently by means of a pivotally connected link 22 operated by suitable eccentric 23 which is carried on a crank portion of the cross shaft 24 (see Fig. 3). Two links 22 are provided to operate the elongated gate valve 21, each link being disposed on opposite sides of the machine and operated by each of the eccentric connections 23 as shown in Fig. 3. Below the hopper 19 is disposed the agitating table 25 which is connected with a transverse shaft 26, mounted between parallel spaced apart transverse bars 27 carried by the super structure 13. In this respect reference is directed to Fig. 5 wherein it will be noted that the agitating table 25 is carried by the brackets 27*a* which are suitably connected such as by pins 28 with the collars 29 mounted on the shaft 26. Intermediate the ends of this shaft a fitting 30 is secured having the sloped face 31 which is designed to be engaged by the cam 32, the latter being carried on the shaft 33 which carries a pulley 34 (Fig. 1) and is operated by means of the belt 35 and by pulley 36 carried on the drive shaft 18.

Rotation of the cam 32 will cause the shaft 26 to slide sideways to the extent of the movement of the cam member which, will slide over the sloped surface 31 and then disengage from the fitting 30 whereupon the shaft 26 is caused to return to normal position by means of the coil spring 37 and the cushioning coil spring 38. This intermittent displacement of the agitating table 25 thus causes a sideways agitation of lozenges deposited thereon from the hopper 19.

The table 25 is sloped as shown in Fig. 2 and is mounted by means of a swivel or ball type connection 39 from a raised bracket structure 40 mounted on the lower frame work. The table is flanged at its sides as indicated at 41 and is open at its lower end for the discharge of the lozenges. The lozenges are transferred from the agitating table 25 to the discharge chute 41*a* which has the discharge channels 42 in a number corresponding to the number of rows of lozenges it is desired to dispose in uniform arrangement for packaging in suitable containers. In the present illustration two separate series of three channels is disclosed.

The discharge chute 41*a* is connected with the table 25 by the freely projecting ends 43 of the side walls of the channels 42, the frame of the chute being slotted as at 44 to permit an interengagement between table 25 and chute 41*a* while

the channels 42 are flared or widened at this point as indicated at 45 in order to guide the lozenges into the channels 42. These lozenges finally pass through the channels 42 one ahead of the other by reason of the width of the channels.

At the points where the chute 41*a* curves or otherwise changes direction as at 46 (Fig. 2) the channels are covered by a suitable cover plate thus to permit their transition to the inclined base portion 47 of the chute, down which they slide by gravity to be received on the bed 48. In the present instance it will be clear that each series of three channels will therefore dispose three rows of lozenges at two spaced apart points on the bed 48, (Fig. 9). As they slide on to the bed 48 the stop pins 49 projecting from the upper surface of a control lever 50 move up to traverse a plurality of slots 51 formed in the bed 48 to stop the downward movement of the lozenges on the chute 41*a*. The upward movement of the pins 49 is timed to permit the passage of three lines of four lozenges to be deposited on the bed, the outermost of each line being disposed directly adjacent to a vertically slidable gate valve 52 which is carried on the frame work of the bed.

The bed 48 is defined into a receiving area X and a transferring area Y, the former being defined by the side walls 53 projecting upwardly from the bed and the gate 52, the latter area being disposed between the gate 52, the end wall 54 and side walls, to be referred to later. The gate 52 is caused to drop by gravity and operates in the vertically disposed slide 55.

Normally when the lozenges have been received in the receiving area X of the bed, the gate 52 is held in its uppermost position by means of a holding plate 55*a* which is connected to and moves with the outermost end of the lever 50. The lever 50 is swingably mounted as at 56 on the sliding frame 57 disposed below the bed 48 and is designed to be slid from the point shown in Fig. 6 to the point shown in Fig. 7 by means of the link 58 pivotally connected to the angularly projecting arm 59 of this lever and eccentrically connected as at 60 to the disc 61. It is obvious therefore that upon rotation of the disc 61, sliding movement of the lever will take place. Moreover the transverse bar 62 mounted on lever 50 and in turn carrying the necessary number of projecting pins 49, in this case four as shown in Fig. 9, will be caused to move with lever 50. It will be clear also that upon movement of the lever 50 from the position shown in Fig. 6 to the position shown in Fig. 7 the series of lozenges disposed in advance of the pins 49 will be shifted from receiving section X of bed 48 to the transferring section Y.

The disc 61 is rotated by shaft 62*a* (Fig. 3) which is driven by the meshing bevel gears 65 and 66, the latter being carried by the drive shaft 18 and the former carried on the shaft 62*a*. Thus disc 61 is rotated in timed relation with other mechanisms of the machine and for every rotation of disc 61 the lever 50 is reciprocated once. Moreover when this lever has been reciprocated to the position shown in Fig. 7 and the disc 61 continues to rotate lever 50 will swing about its pivotal mounting 56 as shown in Fig. 8 thus to withdraw the pins 49 from engagement with the last of the series of lozenges which they pushed from the receiving section X to the transferring section Y. Furthermore the holding plate 55*a* of lever 50 is likewise lowered thus dropping the gate 52

together with its attached series of pins 63 which will be disposed between the spaces of the adjacent rows of lozenges and in a substantially corresponding position to the normal vertical position of the pins 49 at the end of the transferring movement of lever 50. The gate carrying these pins 63 forms a stop to prevent the gravity-fed lozenges from going beyond the receiving station X.

As the disc 61 continues to rotate and the upper end of slot 64*a* engages pin 64*b* which extends between the sides of the carriage 57, the downward swinging movement of lever 50 will stop and the continued movement of the link 58 with the rotating disc 61 will return the carriage 57 and lever 50 to its original position. As the pivot point 60 on the disc 61 moves past dead center, as shown in Fig. 6, the inclined lever will be returned to its normal horizontal position wherein the pins 49 are again projected between the lozenges disposed in the receiving section X and those which are disposed on the inclined chute 47. This is clear merely from consideration of Fig. 6.

It will be clear of course that, as the machine employs two chutes discharging onto the receiving bed 48, the parts described in conjunction with Figs. 6 to 8 above are duplicated. This will be apparent from a consideration of Fig. 9 illustrating the receiving bed in top plan view, and also from a consideration of Figs. 3 and 4.

Each time that lozenges are delivered to the transferring section Y of the bed 48, they are subjected to a compacting operation to assure that the grouped lozenges are arranged in an area of exact dimensions, such as to correspond with the area of boxes into which they are packed, and when they are so arranged they are transferred by a transferring mechanism from receiving section Y to a point of discharge and disposed in the boxes. The transferring is effected by means of opposed suction heads C, reference to which will be had hereinafter, and these suction heads are swung back and forth between two opposed points during the transferring operations by means of a vertical shaft C^1.

In order to compact the lozenges within the defined area, as for instance, to take up any spacing that might be caused by loose wrapping and also to assure that the group of lozenges in each transferring section Y are disposed in a flat plane, suitable compacting means is provided. In this instance each transferring section is provided with the movable side and end walls 63*a* and 54 in addition to the stationary side wall 64 (Fig. 13) and the gate 52 which, in its lowered position, forms a stationary end wall. The side wall 63*a* and end wall 54 are movable inwardly to effect the slight compacting operation desired, while the stationary side wall 64 is provided with a hinged flap 65 which is of an area and shape to correspond with the area of the transferring section Y when the side wall 63*a* and end wall 54 are moved inwardly.

In sequence of operation, after a group of lozenges has been projected into the transferring section Y, the hinged cover flaps 65 are caused to swing down to engage and compress the top portion of the lozenges. This is effected in any suitable manner, the present illustration, as shown in Fig. 13, incorporating the pivotally connected link members 66 and 67, the former being pivoted to the cover flaps 65 and the latter being fixedly secured to the pulleys 68 which are oscillated, during the rotary transferring operation of the

suction heads C such as by the cables 68*a* operated by the spool portion 68*b* of sleeve 62*b* keyed to shaft C^1, upon the partial rotation of shaft C^1. Consequently, as the suction heads C swing with a group of lozenges previously received in the transferring section Y, and the next group is projected into the transferring section Y, the cover flaps 65 are initially caused to swing to the lowered dotted line position shown in Fig. 13, thus to effect a slight compressing of the lozenges with vertically downwardly directed pressure. Substantially simultaneous with this operation, the side wall 63*a* and the end wall 54 of each transferring section Y are caused to move inwardly to compress the group of lozenges into the required accurate area so that they will be firmly grouped, in slight bearing contact with one another. This movement of the walls 63*a* and 54 is effected by means of a toggle mechanism which includes the links 69 and 70 pivotally connected to the operating slide 71 which, is pivotally connected to fitting 72 carrying the vertical arm 73. The vertical arm 73 is designed to be engaged by the cam 74 carried on the shaft 24, the cam 74 being designed to exert pressure on the arm 73 during part of its rotation so as to press the operating slide 71 against the compression of the coil spring 75 which is anchored at one end of the slide 71 and at the other end is anchored to the downwardly projecting pin 76 (Fig. 6). The links 69 and 70 pivoted at their inner end to the slide 71 are pivoted at their outer ends to the links 77 and 78, the links being commonly pivoted together and such common pivot point being also the common point of pivotal connection with the links 69 and 70 (see Fig. 9). The opposite ends of the links 77 and 78 are pivotally connected with the downwardly projecting fingers 79 and 80 connected respectively with the movable side walls 63*a* and movable end walls 54. The fingers 79 and 80 project upwardly through the guide slots 81 and 82 in the bed 48 to connect with the walls 63*a* and 54. Normally, when the cam presses the arm 73 inwardly to press the slide 71 against the pressure of the coil spring 75, it will be obvious that through the link connections described, effected between the slide 71 and the walls 63*a* and 54 of transferring section Y, that these walls will be held in their outermost position shown in Fig. 9. However when the cam 74 releases its pressure on arm 73, the slide 71, in following the cam surface, will be moved towards the lower part of the cam by the coil spring 75. Therefore, links 69 and 70 will be pulled with consequent pull on the links 77 and 78 causing the walls 63*a* and 54 to be pulled to their innermost position to compress the group of lozenges in transferring section Y held below the downwardly compressing flaps 65. The groups of lozenges therefore are ready for transfer to the point of discharge when lifted by the suction heads which are then rotated.

When the shaft C^1 rotates in a reverse direction to return the suction heads C from point of discharge to a point disposed over the transferring sections Y, to engage and remove the group of lozenges contained therein, it will be apparent that such return rotation of shaft C^1 will, through the instrumentality referred to in connection with the flaps 65, raise them just immediately before downward movement of the suction heads, while the cam 74, at the appropriate moment, will release the side walls 63*a* and 54 so that the group of lozenges can be removed from the transferring section Y for their transfer to the boxes.

Before dealing specifically with the construction and operation of the suction heads and the transferring operation which they entail, reference to the feeding and disposition of the boxes would appear to be desirable. The boxes and their positioning can best be appreciated by reference to Figs. 1, 3, 4 and 5. Referring first of all to Fig. 1, the opposed transverse shafts **83** and **84** are mounted on the framework **10** in any suitable manner and are designed to carry pairs of spaced apart pulleys **85** and **86** respectively. These pulleys, as will be noted from Figs. 3 and 4 are spaced apart on their shafts a distance sufficient freely to accommodate therebetween the area of the receiving sections X and transferring sections Y of the bed **48**. The pairs of pulleys **85** and **86** carry the conveyor belts **87** and **88** which are designed in their travel to pass by on each side of the transferring sections Y (see Fig. 3).

A suitable form of conveyor is more particularly illustrated in Fig. 14 carrying the spaced transverse ribs **89**. These are spaced apart a suitable distance to accommodate therebetween the boxes D which are designed to receive groups of lozenges from the transferring section Y and are of an area which substantially corresponds to the area of transferring section Y when the movable side and end walls **63***a* and **54** are moved to their compressing positions.

The conveyor belts **87** and **88** are designed to be moved intermittently to stop at stations on outside of each transferring sections Y of bed **48** for sufficient length of time to permit the transfer of two groups of lozenges from each of the transferring sections Y to and into these boxes. This is accomplished by means of mechanism previously described and concerning links **69**, **70**, **77** and **78** and the walls **63***a* and **54**, the latter being pulled to their innermost position to compress the group of lozenges in transferring section Y held below the downwardly depressing flap **65** whereby the groups of lozenges are ready for transfer to the point of discharge when lifted by the suction heads which are then rotated; thus to provide a completely filled box carrying two groups of lozenges, one on top of the other.

Movement of the conveyors is effected from the drive shaft **18** by means of the eccentrics **90** and their strap connections **91** with the arms **92** (see Fig. 14). The arms **92** are designed to pivotally connect with lugs **93** downwardly projecting from the slide blocks **94** (see Fig. 17), which slide in the parallel spaced apart guideways **95**. The blocks **94** carry the pivotal angle fingers or dogs **96** which are spring pressed upwardly by a relatively weak spring **97**, the upper ends of the fingers **96** terminating just below the under surface of the conveyors **87** and **88**, which latter are provided with the transverse strap members or other suitable projections **98** disposed directly below the ribs **89** and are designed to be engaged by the fingers **96**. It will be apparent therefore that with each complete revolution of the eccentrics **90** the blocks **94** will be moved to the dotted line position (Fig. 14) and therefore the conveyor belts will be moved a corresponding distance which in fact corresponds substantially with the length of each box.

The eccentrics **90** are caused to operate intermittently by employing the clutch **90***a* (Fig. 15) which when engaged places these eccentrics in driving relation with the drive shaft **18**. The clutch **90***a* is engaged by means of the swingable arm **90***b* on its stop shaft **90***c* which is operated by

the bevel driving gear **90***d* carried on the drive shaft **18** and designed to mesh with the bevel gear **90***e*. Therefore, intermittent movement of the conveyors is provided to advance them a distance of the length of one box for each revolution of eccentrics **90**. Moreover, when this advance has been made and the slide blocks **94** returned to starting position again, the bevelled top **99** of the fingers **96** will brush past the straps or projections **98** while the conveyor remains stationary.

The conveyor belt arrangement is such that a box will be stopped on the outside of each of the transferring sections Y and at a point located between these sections as shown in Fig. 4, so that the containers stopped in this position are located to coincide with the terminal point of the suction heads in their transferring movement from the transferring section Y during a 90 degree rotation of shaft C^1.

The suction heads C are formed with a plurality of suction cups **100**, which project from their lower faces and are provided in number corresponding to the number of lozenges it is desired to pack in one layer in a box and arranged in suitable arrangement to coincide with the disposition of each lozenge one to the other in any one layer in a box. In the present case, therefore, having regard to the grouped lozenges shown in Fig. 4, there will be twelve suction cups **100**. These are designed to communicate in suitable manner with the suction chamber **101** of the suction heads C which in turn are connected by the conduit **102** with a suitable source of suction intermittently applied, as will be referred to in more detail hereinafter. It is sufficient to point out at this stage that when suction is intermittently applied in timed relation to the movement and disposition of the suction heads, said suction cups may be engaged with a group of lozenges in transferring section Y, caused to adhere to the cups when suction is applied, and may therefore be lifted from transferring section Y and transferred to their ultimate location where they are released upon release of the suction.

The suction heads are carried on the opposed arms **103** which are angularly offset as at **104** (see Fig. 4) the arms being so arranged that the suction heads may be disposed accurately over the transferring sections Y, whereas upon rotation in a clockwise direction through 90 degrees to their extremity of movement in this direction, they will be accurately disposed over the waiting containers D stopped at the outer sides of the transferring sections Y on the conveyor belts **87** and **88**. Obviously, therefore, a transfer of lozenges from transferring sections Y to boxes D can be readily made and, moreover, by timing the oscillation of the vertical shaft C^1, the suction heads may be moved from transferring sections Y to the waiting boxes D twice while these boxes are held in the said stationary position. Consequently, a box may be filled with two superimposed layers of lozenges.

The vertical shaft C^1 is slidably supported on the framework, being slidably carried in sleeve **62***b* which is keyed thereto, carried by suitable bearing and is designed not only for an oscillating rotational motion, but also for a vertical motion. This is effected in a suitable manner and in the present illustration, accomplished by way of opposed cooperating solenoids, although other instrumentalities might be used. Assuming that the suction heads C are disposed, as shown in

Fig. 4, directly over the transferring sections Y of the bed 48, the end of shaft C^1 engaged by the vertically moving core 105 of the solenoid 106 will permit the shaft C^1 to move downwardly upon shutting off the current fed to the solenoid. Accordingly, solenoid core 105 is caused to slide downwardly and shaft C^1 accordingly will move downwardly to engage its suction cups 100 with the lozenges disposed in the receiving sections Y. Suction being applied to the suction cups through the suction system, (to be described later), current is again supplied to the solenoid 106 and the consequent upward movement of the core 105 will therefore raise shaft C^1. Consequently, upon energizing solenoid 107, which is designed to function in a push-pull manner, and the core 107*a* of which is connected pivotally to arm 108 of sleeve 62*a* (Fig. 3), the movement of the core of this solenoid to the full length of its stroke will cause the shaft C^1 to be swung in a clockwise direction and to terminate its movement when the suction heads C are disposed directly over the waiting boxes D on the conveyors 87 and 88. By shutting off the current to solenoid 107 at this point and also shutting off the current to solenoid 106 at this point, the shaft C^1 will be caused to slide downwardly to dispose the suction heads C partially within the waiting boxes D and the release of suction will therefore release the groups of lozenges in the boxes. Thus, upon energization of the solenoid 106, the shaft C^1 is raised and then, upon immediate energization of solenoid 107, it is caused to pull the core back to original position and return the suction heads to their position over the transferring sections Y for a repeat of this operation.

The solenoids 106 and 107 are operated in timed relation with the other mechanism and effected by means of the shaft 109 (Fig. 2), operated from the reduction unit 15 and carrying the sprocket 110 designed, by chain connection, to drive the sprocket 111 carried on the solenoid timing shaft 112. This latter shaft is shown schematically in Fig. 24, from which it will be noted that it carries the discs 113 and 114, of suitable insulating material as well as the collector rings 115 and 116.

The disc 113 is designed for the control of solenoid 106, and includes the opposed segments 117 and 118 extending over a substantial arc of the periphery of the disc 113 which, is engaged by the brush 119. The latter is connected by the lead 120 with one terminal of the coil of solenoid 106 and designed to move the core 105 which, in the present illustration, is of the permanent magnet type. The other terminal of the coil is connected by the lead 121 which connects with the input terminal 122 of the solenoid circuits. The other input terminal 123 of the circuits is connected by the lead 124 with brush 125 making contact with the collector ring 116 which, is connected by the lead 126 with the segments 117 and 118 of the disc 113. As a result, therefore, during the period of contact of the brush 119 and either segments 117 or 118, the coil in solenoid 106 will be energized thus to cause the core 105 to move upwardly from the solenoid casing. This will effect the raising of the shaft C^1 for alternate periods of corresponding duration and the segments are of such length, having regard to the speed of rotation of the shaft 112 that the shaft C^1 will be held in the raised position by solenoid 106 during each rotational movement of shaft 62 to and from the transferring section Y, of bed 48, and the position of the waiting containers D.

Disc 114 is provided with the opposed segments 127 and 128 which occupy but a small arc of the periphery of disc 114 and therefore function momentarily to effect the rotational movements of shaft C^1, during the time it is raised by the solenoid 106. In this connection the segments 127 and 128 are connected by the leads 129 and 130 respectively with the collector ring 115 and lead 126. Furthermore, the segments 127 and 128 are engaged by a suitable brush 131 connected by the lead 132 with the stationary coil 133 of solenoid 107. The other terminal of the stationary coil being connected by the lead 134 with the brush 135 which also engages the periphery of disc 114. Moreover the movable coil 136 of solenoid 107 is connected by the leads 138 and 139 with the input terminals 122 and 123 of the solenoid circuits. As a result of this, the movable coil is always maintained energized during operation of the machine and the direction of the current in the stationary coil 133 is reversed in timed relation so as to produce a push pull effect. In this connection it will be understood that when the brush 131 contacts with the segment 127, current will flow from the input terminal 122 through the lead 140 to brush 141 of the collector ring 115 and it will pass to the segment 127 by the lead 129 through the brush 131 and via lead 132 through the stationary coil 133 and return by way of lead 134 to the brush 135 which at that instant will be engaged with the segment 128 so that through the leads 130 and 126, collector ring 116 and lead 124, the current flows to the input terminal 123. This will cause the repulsion of the core of solenoid 107 and therefore will cause rotary movement of the shaft C^1 to move the suction heads C from their position over the receiving sections Y to their position over the waiting boxes D. However, when the disc 114 rotates to position the segment 128 in contact with brush 131, and segment 127 in contact with brush 135, current will flow from the input terminal 122 via lead 140, brush 141, collector ring 115 and the lead 129 to segment 127 and through the brush 135, lead 134, coil 133 and then by way of lead 132 to the brush 131 and from segment 128 via leads 130 and 126, collector ring 116 and lead 124 to the input terminal 123. This therefore reverses the flow of current through the coil 123 and consequently will cause a retraction of the core of solenoid 107. As a result therefore the shaft C^1 is rotated so that the suction heads C are returned from their position over the waiting boxes D to their position over the receiving sections Y of the bed 48.

When suction heads C are disposed in either of these extreme positions due to the operation of solenoid 107, the brush 119 momentarily disengages from either of the segments 117 or 118 as the case may be, thus stopping the flow of current to solenoid 106 as the brush passes over the insulated part of the periphery of disc 113. Therefore, the solenoid core 105 naturally drops, to lower shaft C^1 and the suction heads C, either into transferring sections Y of bed 48 or the two opposed waiting boxes D, as the case may be. Consequently, the shaft C^1 is controlled in timed relation both in its vertical movement and rotary movement.

It is obvious of course that the coil 136 may be replaced by a permanent magnet thus dispensing with leads 138 and 139. Likewise as an alternative connection to the solenoid 107, the leads 134,

132 and the leads 138, 139 may connect to coils 136 and 133 respectively.

Suction is applied to the suction heads C by means of the suction pump E. This is shown diagrammatically in Fig. 19 connected by flexible air line 142 with the valve 143 which is mounted on the upper end of shaft C^1 and connected through the conduits 144 and 145, with the suction heads C. As shown in Fig. 20, the pump E includes a piston 146 which is reciprocated by the piston rod 147 eccentrically connected to the disc 148 which, is rotated from the shaft 109 by means of the chain connected sprockets 149 and 150, the latter being keyed on the stub shaft 151 which carries the disc 148 (see Fig. 2).

The piston 146 is provided with a port 153 controlled by a flap valve 154 so that, on the inward motion, any air therewithin passes out through port 153, while on the return or outward motion, partial vacuum is created and applied through the air line 142. This connects with the passage 155, in the valve 143, which in turn communicates directly with the fitting 156 to which the conduits 144 and 145 are connected so that, during the suction stroke of pump E, a partial vacuum is imposed within the chamber 101 of the suction head C. The operation of the pump is timed by the gear ratio employed so as to provide a suction stroke during the period that the suction heads enter the transferring section Y, of bed 48, and then rise, swing and drop in their movement from transferring section Y to the waiting boxes D.

The valve E employs a passage 157 which houses the piston 158 which is normally outwardly pressed by a coil spring 159. One end of this spring engages the piston and the other engages the base member 160 which is subject to adjustment within the passage 157. Consequently, since the passage 155 intersects passage 157 the partial vacuum created within the passage 157 will draw the piston 158 inwardly to an extent determined by the pressure of the coil spring 159. This will have the effect of swinging inwardly the lever arm 161 pivotally mounted as at 162 on the valve casing E and connected with the piston 158 by means of piston rod 163.

The lever arm 161 is provided with a spring pressed dog or latch member 164 normally pressed by the leaf spring 165, which when the valve is not subject to partial vacuum conditions, extends in the position shown in Fig. 20 and is disposed in the path of the switch arm 166 carrying the roller 167. This switch arm is most clearly illustrated in Fig. 1 as pivotally mounted on the emergency switch 168 carried on the framework above the lower level of the valve E. The switch arm is here shown in its lower position or "on" position. If however when the suction heads C engage their suction cups 100 with a group of lozenges in transferring section Y, and if one of these lozenges is broken or no lozenge is positioned in the area of one of these suction cups, the vacuum applied will be broken and consequently the piston 158 will not be drawn inwardly in passage 157 of valve E. Therefore the lever arm 161 will remain in the position shown in Fig. 20. Consequently upon the upward movement of shaft C^1, the dog 164 will engage roller 167, of switch arm 166, causing it to swing and shut off switch 168, thus stopping the operation of the machine. This therefore provides a means of stopping operation if abnormal conditions develop.

In normal operation with the lever arm 161 drawn inwardly by piston 158 the dog 164 will pass the switch arm 166 in the lifting operation of shaft C^1.

Moreover, upon return rotational movement of the shaft 62, to position the suction heads over the transferring section Y, and upon downward motion of the shaft C^1, the dog 164 will permit the lever arm 161 to brush past switch arm 166.

In order to provide for operation of the machine and not apply partial vacuum conditions to the suction heads C thus to permit the various sequences of operation without lozenges being transferred, such as in the case where it is necessary to start the machine and initially advance the lozenges to the transferring section Y, manual means is provided for shutting off suction. This is accomplished by the inclusion of an additional passage 169 in valve E including the ports 170 and 171, the former communicating between the passage 157 and passage 169 and the latter venting passage 169 to atmosphere. The plunger valve 172 is mounted in passageway 169 and operable by the handle 173. Therefore by pulling this handle outwardly to retract the valve 172 from the position shown in Fig. 20, the passage 157 is vented to atmosphere via the ports 170 and 171, through the medium of port 173*a* in valve 172. The establishment of partial vacuum conditions therefore is thus prevented. Moreover, it will be noted that valve 172 is connected by the connecting rod 173*b* with the lever 161 which will be pulled inwardly on its pivot 162 so that it will not cause operation of switch 168 during this phase of operation. On the other hand, due to the lost motion connection between link 173*b* and link 161, valve 172 will not be operated in the normal course when piston 158 swings lever arm 161 inwardly.

The containers D are preferably of the character employing a hinged lid such as illustrated in Fig. 14 by the numeral 174. As the boxes D are moved along on the conveyors 87 and 88 these lids hang open, for instance as illustrated in Fig. 4. After the boxes are filled these lids are closed in any simple manner. One practical means of accomplishing this is by employing a substantially spiral cam member 175 positioned in the path of the open lids in any suitable way such as by suspension by an auxiliary frame 176 (see Fig. 2). Consequently as the conveyors carry the filled boxes to the location of the spiral cam 175, the lowest portion of the cam, engaging under the lid, will start to raise it and the following contour of the cam member 175 will complete its upward and then downward swinging movement to the closed position. When in this latter position, the covers are firmly closed by means of a roller 177 disposed on a suitable arm 178 carried from the frame-work of the machine. The location of the roller 177 being such that it will engage the closed lids of the boxes in a pressure engagement prior to their discharge from the conveyors thus to assure that the boxes are firmly closed as they are discharged. They are then discharged from the conveyors on to a suitably inclined chute 178*a* (Figs. 1 and 14) where they may be received on a conveyor 179, if desired, to convey them to any predetermined location.

The advantages of the invention will be apparent from the foregoing and while the invention is designed preferably to handle wafer like articles it will be apparent that it is capable of handling articles of regular shape and having one substantially smooth surface such that it may be

picked up by the suction apparatus of the machine.

What we claim as our invention is:

1. A packaging machine comprising a receiving bed having a receiving section and a transferring section, means for feeding a series of small articles into the receiving section of said bed in predetermined grouped arrangement, means for moving said articles to the transferring section of said bed in corresponding grouped arrangement, means in connection with said transferring section for urging said group of articles within a predetermined area and including movable side and end walls for said transferring section movable inwardly to reduce the area of said transferring section and a movable cover movable into engagement with the outer portions of said articles to maintain said articles in a common plane, suction means for engaging said grouped articles in the transferring section of the bed, said suction means being movable to transfer said group of articles therefrom, and means for moving said suction means away from said transferring section or bed to release said grouped articles at a predetermined point in said grouped formation.

2. A packaging machine comprising a receiving bed having a receiving section and a transferring section, means for feeding a series of small articles into the receiving section of said bed in predetermined grouped arrangement, means for moving said articles to the transferring section of said bed in corresponding grouped arrangement, means in connection with said transferring section for urging said group of articles within a predetermined area and including movable side and end walls for said transferring section movable inwardly to reduce the area of said transferring section and a movable cover movable into engagement with the outer portions of said articles to maintain said article in a common plane, suction means for engaging said grouped articles in the transferring section of the bed, said suction means being movable to transfer said group of articles therefrom, and means for moving said suction means away from said transferring section or bed to release said grouped articles at a predetermined point in said grouped formation, said suction means comprising a suction head having a plurality of suction cups in predetermined arrangement and corresponding with the grouping of said articles in the transferring section of said bed, each of said cups being designed to engage a corresponding article in said transferring section, means for moving said suction head into engagement with said articles, means for applying suction to said head whereby said cups group said articles, means for moving said suction head away from said transferring section to a point of discharge, and means for releasing said articles from said cups on point of discharge.

3. A packaging machine comprising a receiving bed having a receiving section and a transferring section, means for feeding a series of small articles into the receiving section of said bed in predetermined grouped arrangement, means for moving said articles to the transferring section of said bed in corresponding grouped arrangement, means in connection with said transferring section for urging said group of articles within a predetermined area and including movable side and end walls for said transferring section movable inwardly to reduce the area of said transferring section and a movable cover movable into

engagement with the outer portions of said articles to maintain said articles in a common plane, suction means for engaging said grouped articles in the transferring section of the bed, said suction means being movable to transfer said group of articles therefrom, and means for moving said suction means away from said transferring section or bed to release said grouped articles at a predetermined point in said grouped formation, the means for feeding said articles comprising a hopper, an agitating table designed to receive the articles from the hopper, means for agitating said table, a feeding chute, said feeding chute communicating with the table and having discharge channels for feeding rows of said articles into the machine.

4. A packaging machine comprising a receiving bed having a receiving section and a transferring section, means for feeding a series of small articles into the receiving section of said bed in predetermined grouped arrangement, means for moving said articles to the transferring section of said bed in corresponding grouped arrangement, means in connection with said transferring section for urging said group of articles within a predetermined area and including movable side and end walls for said transferring section movable inwardly to reduce the area of said transferring section and a movable cover movable into engagement with the outer portions of said articles to maintain said articles in a common plane, suction means for engaging said grouped articles in the transferring section of the bed, said suction means being movable to transfer said group of articles therefrom, and means for moving said suction means away from said transferring section or bed to release said grouped articles at a predetermined point in said grouped formation, said receiving bed being slotted, said means for moving said articles to the transfer section of said bed including a swingable member having a series of projecting pins projectable through said slots and adapted to extend between a preceding and succeeding article fed into the machine to separate a group of preceding articles from a group of succeeding articles.

5. A packaging machine comprising a receiving bed having a receiving section and a transferring section, means for feeding a series of small articles into the receiving section of said bed in predetermined grouped arrangement, means for moving said articles to the transferring section of said bed in corresponding grouped arrangement, means in connection with said transferring section for urging said group of articles within a predetermined area and including movable side and end walls for said transferring section movable inwardly to reduce the area of said transferring section and a movable cover movable into engagement with the outer portions of said articles to maintain said articles in a common plane, suction means for engaging said grouped articles in the transferring section of the bed, said suction means being movable to transfer said group of articles therefrom, and means for moving said suction means away from said transferring section or bed to release said grouped articles at a predetermined point in said grouped formation, the means for feeding said articles comprising a hopper, an agitator table designed to receive the articles from the hopper, means for agitating said table, a feeding chute, said feeding chute communicating with the table and having discharge channels for feeding rows of said articles into the machine, said receiving bed being

slotted, said means for moving said articles to the transferring section of said bed including a swingable member having a series of projecting pins projectable through said slots and adapted to extend between a preceding and succeeding article fed into the machine to separate a group of preceding articles from a group of succeeding articles.

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