

Oct. 2, 1962

W. E. LOVETT ET AL
BOX SET-UP APPARATUS

3,056,338

Filed May 19, 1960

5 Sheets-Sheet 1

Fig. 1.

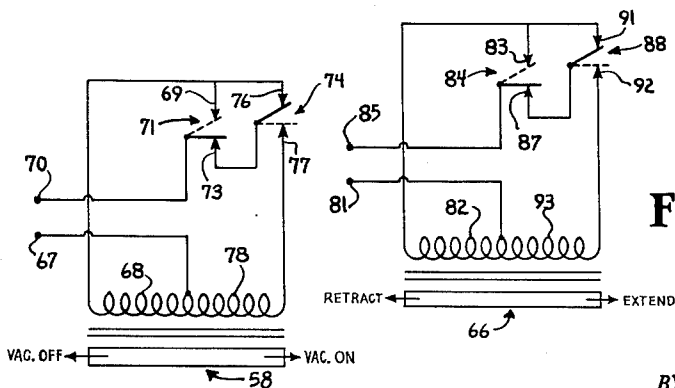
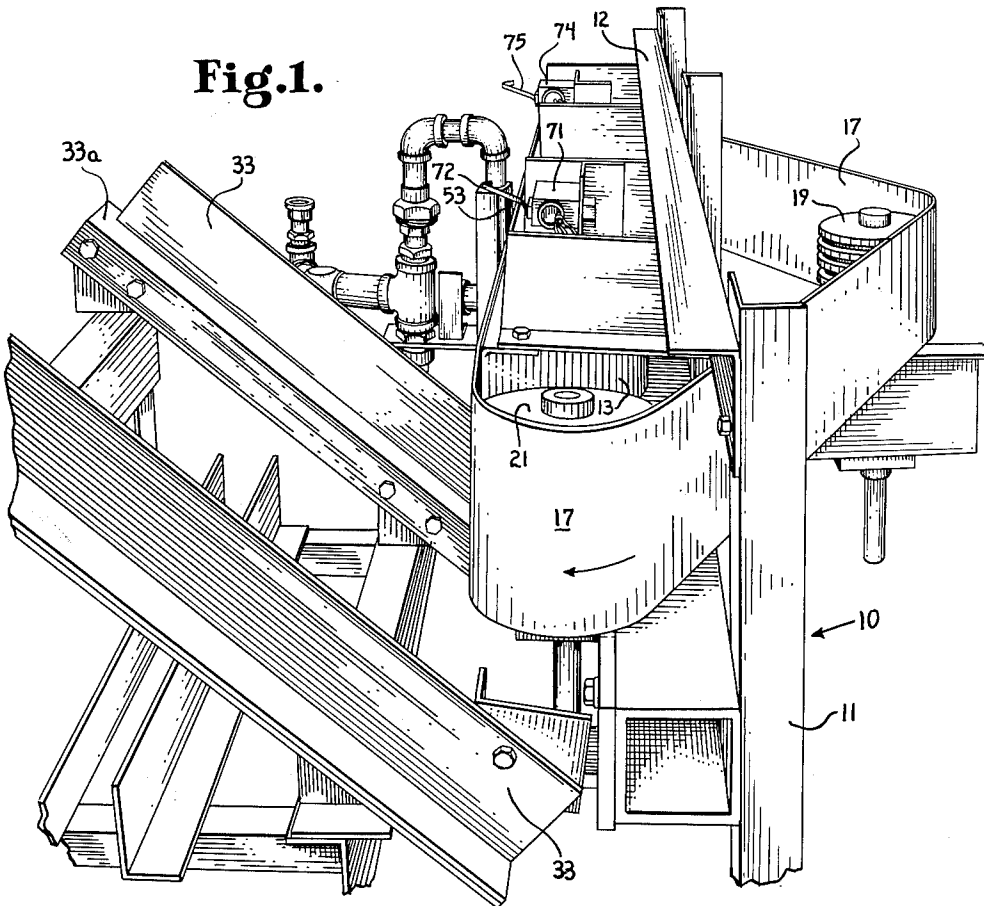


Fig. 7.

Fig. 8.

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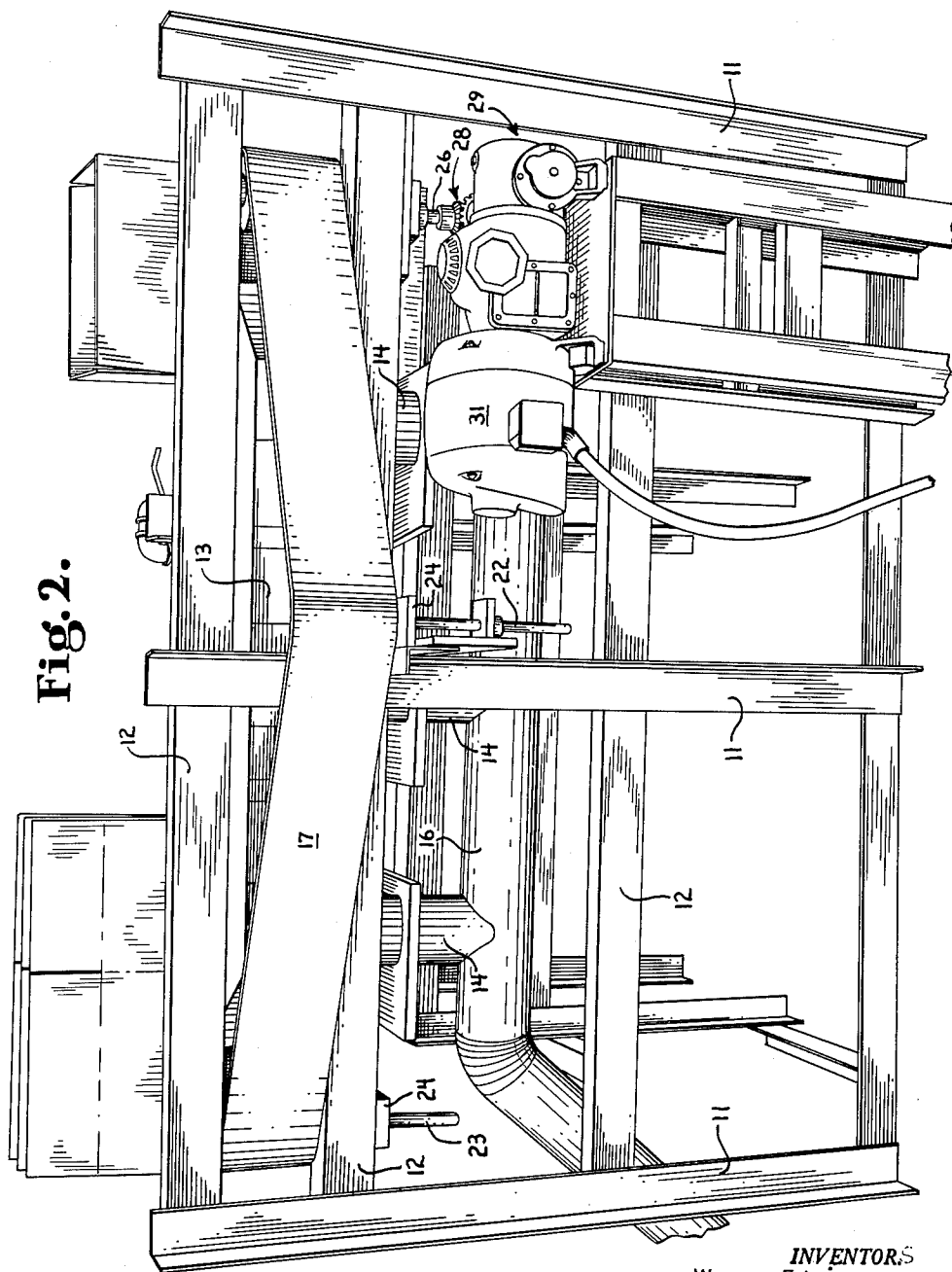
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5 Sheets-Sheet 2



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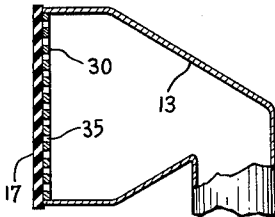


Fig. 5.

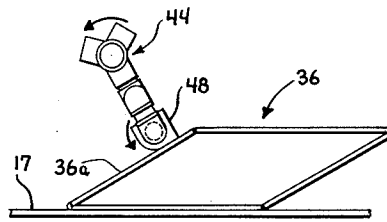


Fig. 6.

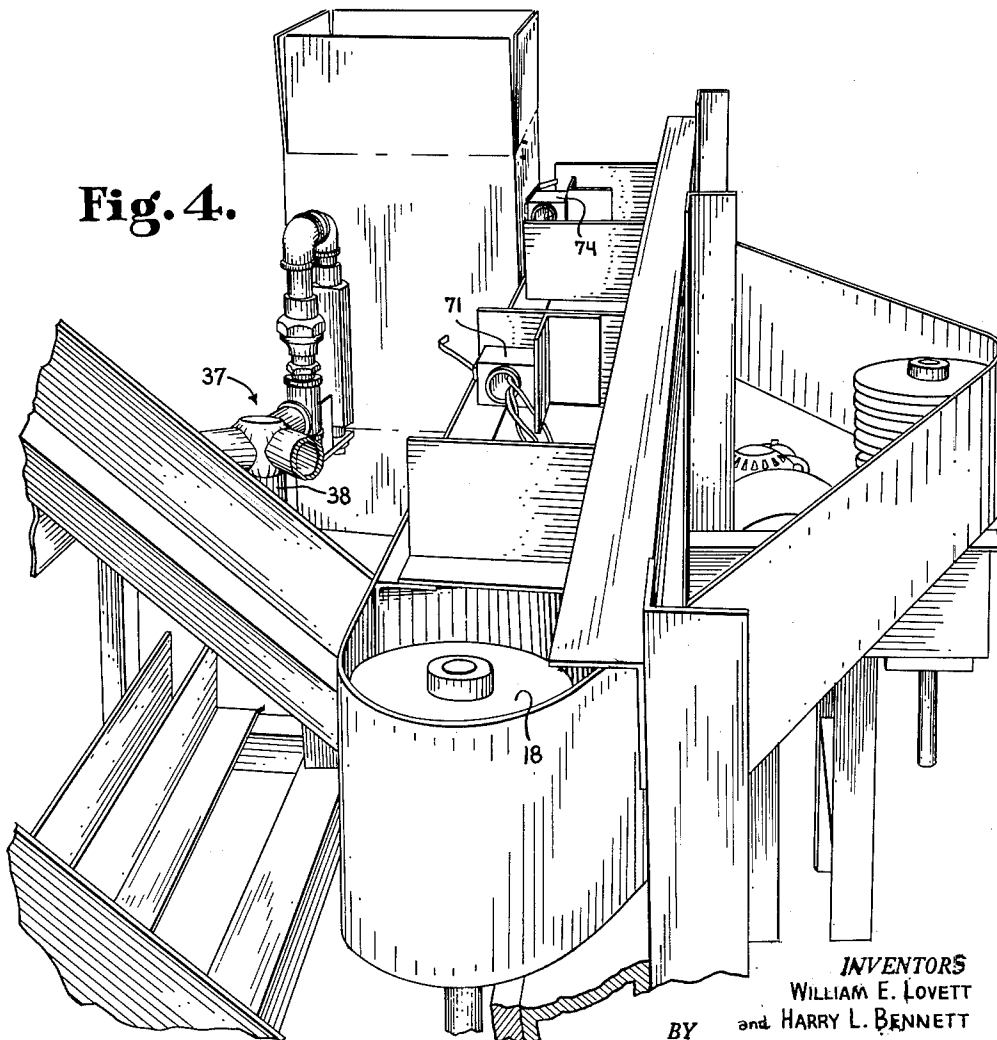


Fig. 4.

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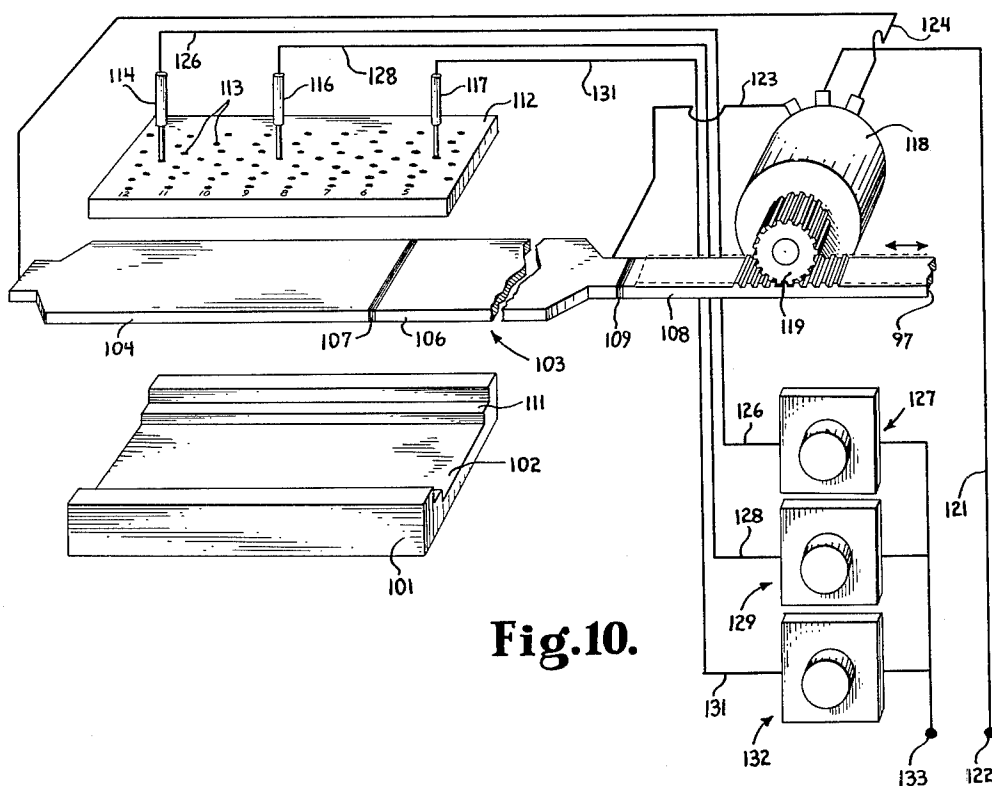


Fig.10.

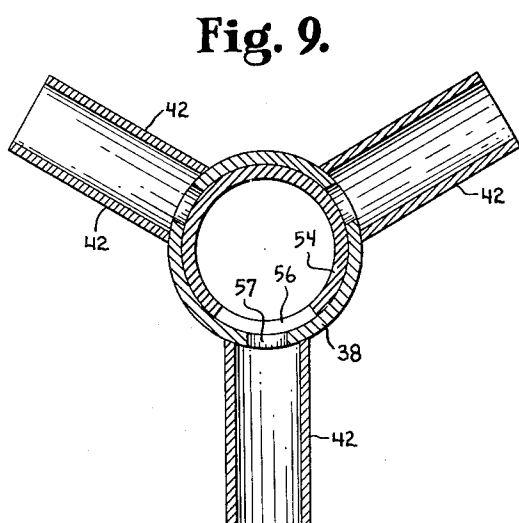


Fig. 9.

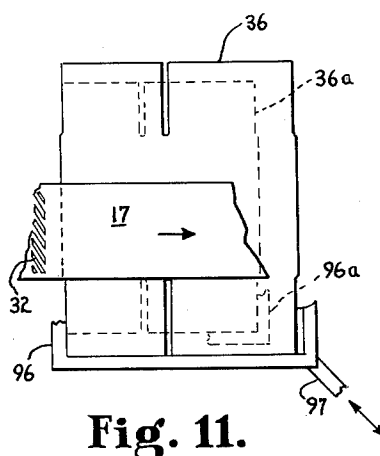


Fig. 11.

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3,056,338

BOX SET-UP APPARATUS

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Filed May 19, 1960, Ser. No. 30,236

13 Claims. (Cl. 93—53)

This invention relates generally to apparatus for setting up or squaring corrugated board cartons or boxes prior to their entry into conventional box sealing machinery.

Apparatus for receiving flattened boxes and performing the setting up or squaring function have not been unknown in the prior art. Conventional apparatus of this type, however, has been characterized by relatively slow operating speed and a lack of convenient adjustability for accommodating boxes of various sizes. Ideally, box set-up apparatus should be capable of withdrawing a single folded box from a magazine or other box supply source, maintaining control of the box as it moves through the area in which the squaring operation is performed and releasing the squared box at the proper time for subsequent transfer either automatically or manually to the box sealing machinery.

The apparatus of the present invention provides the features described above by means of an endless belt moving across the face of a plenum chamber which is maintained at subatmospheric pressure. The belt is provided with a series of apertures so that as its face remote from the plenum chamber passes the flattened boxes in the magazine, the top-most box will be picked up by the belt and transported away from the magazine. As the flattened box is displaced by the belt, a head assembly attaches itself to the adjacent side of the box restraining the movement of the box side panel so that as the belt continues its movement, the box is unfolded into a rectangular cross-sectional configuration. As the squaring of the box is completed, two opposed lower end flaps are moved or kicked up to a position wherein they are transverse to the side panels. Appropriate switching apparatus is utilized to sequence the application of a vacuum to the side panel grasping head so that the side panel will be grasped and released at the proper time and so that the end flap kick-up element will be actuated in proper sequence. The apparatus of the present invention is further characterized by an adjusting arrangement for accommodating boxes of various sizes wherein a single actuating movement, applying generally diagonally with relation to the box side walls, serves to rapidly complete the adjustment.

The primary object of the present invention is to provide a box set-up or squaring apparatus which can be operated at relatively high speed and which is arranged so that it can be rapidly adjusted by unskilled personnel to accommodate runs of boxes of various sizes.

A further object of the present invention is to provide an apparatus of the type referred to in which only a single, rectilinear motion need be applied to the magazine or source of flattened boxes to provide the adjustment necessary to vary the box size accommodated by the apparatus.

A further object of the present invention is to provide an apparatus of the type referred to which maintains accurate control of the box during the squaring operation.

A further object of the present invention is to provide an apparatus of the type referred to which has only one continuously moving part and which functions by means of a series of simple mechanical operations and, therefore, provides relatively trouble-free service and can be easily repaired.

These and other objects will become apparent as the

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description proceeds with reference to the accompanying drawings in which:

FIG. 1 is a perspective view of a portion of the apparatus of the present invention with the magazine unloaded.

FIG. 2 is a perspective view of the apparatus of the present invention taken from one side thereof.

FIG. 3 is a perspective view of the apparatus of the present invention showing flattened boxes in the magazine, the view being taken from the opposite end of the apparatus from that of FIG. 1.

FIG. 4 is a perspective view of the apparatus similar to FIG. 3 but showing a box positioned at the termination of the squaring operation.

FIG. 5 is a side sectional view of a portion of the plenum chamber illustrating the position of the belt with relation thereto.

FIG. 6 is a schematic illustration, in top plan view, of an intermediate step in the box squaring operation.

FIG. 7 is a schematic wiring diagram of the means for controlling the application of vacuum to the head assembly.

FIG. 8 is a schematic wiring diagram for a means controlling actuation of the end flap kick-up element.

FIG. 9 is a sectional view of a portion of the head assembly.

FIG. 10 is a schematic illustration of one form of adjustment actuating and control apparatus.

FIG. 11 is a schematic view illustrating the adjusting motion of the various elements as the apparatus is adjusted to accommodate boxes of various sizes.

Referring initially to FIGURES 1-4, the apparatus includes a framework 10 formed of suitable structural steel members and including uprights 11 and spaced, horizontal members 12. Supported between the upper two of the horizontal members 12 is an elongated plenum chamber 13 which may be fabricated from sheet metal or other suitable material. The cross-sectional configuration of the plenum chamber will be evident from FIG. 5 and, as will be apparent from FIG. 2, the plenum chamber is provided with ducts 14 which communicate with a header 16 which is attached to a vacuum pump of any suitable type or to any other source of sub-atmospheric pressure.

Disposed so as to pass across the open face of the plenum chamber is an endless belt 17 which is driven by a sheave 18 (FIG. 4). The belt further passes over idler sheaves 19 and 21, which are mounted on shafts 22 and 23 (FIG. 2) respectively, the shafts being journaled in suitable bearing structures 24 supported on the framework. The driving sheave 18 is supported on a shaft 26, journaled in elements 27 carried by the frame work. As will be apparent from FIGS. 2 and 3, the shaft 26 is driven by means of the gearing 28 which receives its motive power from the adjustable speed gear box 29. The power input to the gear box is provided by an electric motor 31.

As will be evident from FIG. 3, at one or more spaced areas on the belt 17 there is provided a series of inclined apertures or slots 32 and, as may be seen in FIG. 5, the front face of the plenum has disposed thereover a plate 30 having a series of apertures 35 closely spaced both transversely and longitudinally therein. Adjacent one end of the framework there are provided inclined members 33 having box retaining ledges 33a which function as a magazine or source of supply of boxes to be squared. A group of flattened boxes are shown at 34 in FIG. 3 in position in the magazine. The magazine itself may be properly supported so as to be movable or reciprocable in a direction diagonal with respect to the faces of the flattened boxes contained therein, this diagonal reciprocation of the magazine being necessary for adjustment of the apparatus as will subsequently be described.

Referring to FIG. 3, it will be evident that with the plenum chamber 13 at sub-atmospheric pressure and with the belt traveling in the direction indicated, as the apertured area 32 of the belt moves across the face of the outermost box 36, the box will adhere to the belt and will be moved horizontally out of the magazine.

Spaced from the inner margin of the magazine in the direction of travel of the belt 17, is a vacuum head assembly indicated generally at 37. This assembly includes a pipe 38 which is supported on a bearing assembly 39, the bearing assembly being, in turn, supported on a pipe 41. The pipe 41 is mounted on the framework structural members as shown in FIG. 3 and its interior communicates with a vacuum pump or other suitable source of sub-atmospheric pressure. The upper end of the pipe 38 carries three, equally spaced, radially extending tubes 42. Mounted on the ends of the pipe 42 are identical head sub-assemblies indicated generally at 43, 44, and 46. In the drawings, only the sub-assembly 43 is shown in detail to prevent obscuring other portions of the apparatus.

The sub-assembly 43 includes piping 47 which communicates with the interior of the pipe 42 and, at its opposite end, communicates with the interior of a head 48. The junction of the piping 47 and upper end of the vertically disposed head is such as to permit the head to rotate axially while maintaining a vacuum-tight seal. The base of the head 48 is supported for rotation on a bracket 49 carried by the base end of the piping 47. An abutment, such as plug 51, extends from one face of the head and engages a stop member 52 extending upwardly from the bracket 49. The function of the stop members 51 and 52 is to prevent rotation of the head in a direction other than that indicated by an arrow in FIG. 6. As may best be seen in FIG. 1, the face of the head 48 which is normally adjacent the belt 17, is provided with a slot 53 which extends substantially the entire length of the head.

The pipe 38 encloses a valving sleeve 54 (FIG. 9). The sleeve 54 extends upwardly from the bearing structure 39 and is maintained stationary as the pipe 38 is rotated counterclockwise (as viewed in FIG. 9) during the operation of the apparatus. The sleeve 54 is provided with a single, elongated aperture 56 which registers with the aperture 57 in the pipe 42 which extends toward the belt. It will be understood that the pipe 38 is shown in FIG. 9 at a midpoint in its rotative travel and that communication between the interior of the sleeve 54 and the appropriate pipe 42 is maintained as the head sub-assembly 43, for example, moves from its position of FIG. 3, to its position of FIG. 4 in the operation of the apparatus. It will be evident that the valving structure just described with reference to FIG. 9 permits the application of sub-atmospheric pressure to each of the three heads in turn as they swing into position adjacent the belt and closes off each of the heads as they swing beyond the box releasing position illustrated in FIG. 4. The application of sub-atmospheric pressure to the head assembly 44 is controlled by a conventional, two-position solenoid valve 58 (FIG. 7) which is installed in the line to the vacuum pump.

The function of the head 48 is to grasp the adjacent side panel of a flattened box as the box passes in front of the slotted face of the head, the grasping or the adhering force being provided by the application of sub-atmospheric pressure to the box side panel through the head slot 58. As may be seen in FIG. 6 with one of the heads 48 grasping the box side panel, further movement of the belt 17 causes the head assembly 44 to rotate counterclockwise forcing the box into squared or set-up configuration. It should be noted that during rotation of the assembly 44, the head 48 must also rotate axially as indicated in FIG. 6 to accommodate the arcuate path of the side panel 36a engaged by the head 48 as the box is swung into squared configuration. As the box moves into its squared configuration its lower, leading end flap will engage the inclined surface 59 of the bracket 61 (FIG. 3) which is rigidly mounted on the framework

elements. The bracket 61 serves to kick up the leading flap, bracing the box in squared condition. The trailing, lower end flap of the box is kicked up by a member 62, pivoted at its lower end 62a on the adjacent framework structural element. Intermediate its ends the element 62 is pivotally attached at 63 to the free end of a solenoid plunger 64. The plunger 64 is moved between extended and retracted positions by a two-position solenoid conventional structure indicated at 66 in FIG. 3 and FIG. 8. Thus, by means of a control circuit to be subsequently described, the solenoid plunger 64 is extended at the proper time to swing element 62 about its pivotal mounting so as to engage the trailing end flap of the box and move it into a substantially horizontal plane. It will be understood that a further plenum chamber (not shown) at sub-atmospheric pressure might be mounted adjacent the head assembly and that a perforated belt, similar to belt 17 and passing across this chamber, might be utilized to grasp the carton panel opposite that adhering to belt 17 as the carton moves into squared condition. With such an arrangement the end flap kick-up operation need not be coordinated with the vacuum release.

The control system for sequencing the application of vacuum to the head sub-assembly 43, 44 and 46 and for operating the solenoid 66 will now be described with reference to FIGURES 3, 4, 7 and 8. With particular reference to FIG. 7, the power input terminal 67 is connected to one end of a coil 68 which is part of the solenoid valve assembly 58 and serves, when energized, to move the valve to a position shutting off the application of subatmospheric pressure to the head assembly 44. The opposite end of the coil 68 is connected to the normally open terminal 69 of a conventional double-throw, enclosed snap switch 71. The switch 71 is physically located, as indicated in FIGS. 1 and 4, adjacent the belt 17 and is provided with a resilient actuating blade 72 which extends into the path of the boxes transported by the belt. Engagement and displacement of the blade 72 by a box carried by the belt will move switch 71 so as to open its normally closed contacts and close its normally open contacts. The common side of the switch 71 is connected to the power input terminal 70. The normally closed contact 73 of the switch 71 is connected to the common side of a double-throw, totally enclosed switch 74. The switch 74 is physically located, as indicated in FIGS. 1 and 4, adjacent the upper margin of the belt 17 and is provided with an actuating blade 75. The switch 74 is normally closed against its contact 76, the normally closed side of the switch being connected to one side of the coil 68. Engagement and displacement of the blade 75 by a box carried by the belt will open the normally closed side of switch 74 and close the common side of the switch against the normally open contact 77. The normally open contact 77 is connected to one side of a solenoid coil 78, wound upon the same core as the coil 68 but in reverse direction so that upon energization of coil 78, the solenoid valve 57 will be moved to open position thereby applying vacuum to the head assembly 44. The opposite end of the coil 78 is connected to the power input terminal 67.

The control circuit for the two-position solenoid 66 is identical to that just described, as may be seen in FIG. 8. The power input terminal 81 is connected to one end of a coil 82 which is part of the two-position solenoid operator 66 and serves, when energized, to move the plunger 64 (FIG. 3) to retracted position. When the plunger is in this retracted position, as will be evident from FIG. 3, the member 62 is in a position such that the box end flaps may pass over it. The opposite end of the coil 82 is connected to the normally open terminal 83 of a conventional double-throw, enclosed snap switch 84. The switch 84 is physically located as indicated in FIG. 3, adjacent the lower margin of the belt 17 and provided with a resilient actuating blade 86 which extends into the path of the boxes transported by the belt. Engagement and displacement of the blade 86 by a box carried by the

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belt will move switch 84 so as to open its normally closed contacts and close its normally open contacts. The common side of the switch 84 is connected to the power input terminal 85. The normally closed contact 87 of the switch 84 is connected to the common side of a double-throw, totally enclosed switch 88. The switch 88 is physically located, as indicated in FIG. 3, adjacent the upper margin of the belt 17 and is provided with an actuating blade 89. The switch 88 is normally closed against its contact 91, the normally closed side of the switch being connected to one side of the coil 82. Engagement and displacement of the blade 89 by a box carried by the belt will open the normally closed side of the switch 88 and will close the common side of the switch against the normally open contact 92. The normally open contact 92 is connected to one side of a solenoid coil 93, wound upon the same core as the coil 82 but in reverse direction so that upon energization of coil 93, the plunger 64, forming a part of the actuator assembly 66, will be extended thereby pivoting the member 62 so as to engage the trailing end flap of the box and to move its position into a substantially horizontal position.

In operation, with the interior of the plenum chamber at sub-atmospheric pressure, upon placing the drive motor 31 in operation, the belt will be moved in the direction indicated in FIG. 3 about the sheaves 18, 19 and 21. As the slots 32 in the belt 17 pass the foremost flattened box in the magazine, the box will be picked up by the belt and moved sidewardly from the magazine and its leading edge will engage the actuating blade for switch 71. The switch will be moved so as to close against its normally open contact 69, however, the coil 68 remains energized preventing the application of vacuum to the head assembly 43. Continued movement of the belt causes the flattened box or carton to engage the actuating blade for switch 74 closing it against its normally open contact 77. This switching action does not energize the coil 78 and the coil 68 remains energized through contact 69 of switch 71. Further movement of the flattened carton carries it past the actuating blade of switch 71 so that it returns to its normal position wherein it is closed against contact 73. This switching action energizes the coil 78 to apply vacuum to the head assembly. With the interior of the head 48 at sub-atmospheric pressure, because of the slot 53 in the head, the side panel 36a of the carton will be held by the head as previously described with reference to FIG. 6. Continued movement of the belt causes the head assembly 44 to rotate as indicated in FIG. 6 continuing the squaring movement of the carton. As the carton moves into squared condition the leading edge thereof engages the actuating blade of the switch 84 moving it so as to close against its contact 83. This switching action leaves the retracting coil 82 of the actuator assembly 66 energized so that the member 63 is not moved from its position of FIG. 3. Further movement of the belt causes the leading edge of the carton to engage the actuating blade of the switch 88 causing it to close against its contact 92. This switching action has no effect upon the energizing and deenergizing conditions respectively of the coils 82 and 93 so that the plunger 64 and the member 62 are retained in their positions of FIG. 3. As the trailing edge of the carton sidewall disengages switch 84, the switch returns to its normal position wherein it is closed against its contact 87. This switching action de-energizes the coil 82 and energizes the coil 93 causing the actuator to extend the plunger 64 and move the member 62 so as to kick up the trailing end flap of the carton.

As the squaring operation moves to completion the trailing edge of the carton disengages the actuating blade for the switch 74 causing it to close against its normally closed contact 76 thereby deenergizing coil 78 and energizing coil 68 to shut off the vacuum to the head assembly. The squared carton is thus released from the head and as the belt moves its apertured portion 32 beyond

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the open face of the plenum chamber the squared box will be released from the belt for conveyance to a sealing apparatus for closing of the lower box end. The release of the squared carton occurs almost simultaneously with the final end flap kick up action of the member 62. The sealing apparatus is not shown herein but is conventional in the box fabricating art. It will be noted that the belt 17 may have more than one set of apertures 32 therein so that a box may be removed from the magazine and grasped by the adjacent one of the heads 48 immediately after the preceding box has been squared.

In the foregoing, the structure has been described without reference to adjustability of the machine for accommodating cartons of various sizes. Such adjustment will now be described with reference to FIGS. 10 and 11. Referring initially to FIG. 11 the magazine formed by members 33 of FIG. 1 is indicated schematically at 96. An actuator 97 is rigidly attached to and extends diagonally from the magazine 96. The magazine 96 is mounted in the framework by any suitable means so as to be movable or slidable along the axis of the member 97. It will be understood that for the machine to operate properly the lower fold line of the carton, defining the base of the end flaps, should coincide with the lower margin of the belt 17. The magazine 96 is positioned in FIG. 11 so that the box 36 is properly positioned with relation to the belt 17. Should it be desired to feed into the apparatus boxes of smaller dimension than that of the box 36, it will be evident that the magazine 96 must be moved diagonally upwardly to a position such as indicated in broken lines at 96a. When so displaced the magazine will properly position a smaller carton (such as indicated at 36a) in proper position with relation to the lower edge of the belt 17. Thus, by moving the magazine diagonally the lower fold line of the carton may be properly placed with relation to the belt 17 no matter what the height dimension of the carton.

One means for providing a push-button positioning of the magazine, permitting unskilled personnel to make the required adjustment rapidly, will now be described with reference to FIG. 10. The apparatus includes a generally channel shaped element 101 fabricated of electrical insulating material. The central portion 102 of the member 101 slidably accommodates a reciprocating element 103. The element 103 comprises a first conductor element 104 and a second conductor element 106, electrically insulated from each other by a strip or lamination 107 of insulating material. The element 106 is rigidly secured to a rack 108 but is electrically insulated therefrom by the strip of insulating material 109. An extension of the tooth rack 108 may form a portion of the actuator 97. The abutments 111 in the member 101 receive a perforated plate 112 formed of insulating material. The plate 112 overlies the bar formed by the elements 104 and 106. The plate is provided with a series of apertures 113 therethrough, the apertures having graduated spacing along the length of the plate 112. Adapted to extend through the selected apertures and to make contact with the adjacent elements 104, 107 and 103 are removable conducting plugs 114, 116 and 117. The rack is driven in either direction axially by means of a reversible motor 118, the motor driving a pinion gear 119 which meshes with the rack. The center terminal of the motor is connected by means of a wire 121 to one D.C. power terminal 122. The motor terminal for controlling clockwise rotation (as viewed in FIG. 10) of the pinion 119 is connected by means of a wire 123 to the conductive element or section 106. The motor terminal controlling counterclockwise rotation of the pinion 119 is connected by means of a wire 124 to the conductive element 104. The plug 114 is connected by means of a wire 126 to one side of a bush button switch 127 which is normally open. The plug 116 is connected by means of a wire 128 to one side of a normally open push button switch 129. The plug 117 is connected by means

of a wire 131 to one side of a normally open push button switch 132. The opposite sides of the switches 127, 129 and 132 are connected in common to the power input terminal 133.

In operation, the plugs 114, 116 and 117 are positioned in selected ones of the apertures 113 so as to provide the proper positioning of the member 97, and consequently the magazine 96 for three different sizes of cartons to be run through the apparatus. With the plugs positioned, for example, in the apertures as shown in FIG. 10, it will be evident that upon actuation of the switch 132 the motor 118 will be energized so as to rotate the pinion 119 counterclockwise and move the member 97 rightwardly as viewed in FIG. 10. This rightward movement of the member 97, and consequently the positioning movement of the magazine 96 will continue until the insulating strip 107 is moved beneath the plug 117 whereupon the motor 118 will be de-energized and movement of the magazine halted.

In properly positioning a flattened carton for passage through the apparatus of the present invention, it should be noted that two positional factors are important. The lower fold line of the carton at the junction of its side panels and lower end flaps must be substantially aligned with the lower margin of the belt 17, and the front or leading margin of the flattened carton (whose position is determined by the position of the leading side member of the magazine) must be properly located in the direction of travel of belt 17 so that the belt will initially grasp only the proper carton panel and will grasp it at a point displaced somewhat from the intermediate vertical fold line of the flattened carton. Thus the proper vertical orientation of the carton depends on the length of the carton end flaps and the proper horizontal orientation of the carton depends on the width of the carton side panels. Since these two dimensions, for conventional cartons, have a fixed relationship to each other, that is, the end flap length is always one half the carton side panel width, a single diagonal positioning movement of the magazine may be utilized to properly orient cartons of various sizes.

If it is assumed that rightward movement of the element 97 as viewed in FIG. 10 produces diagonally upward movement of the magazine 96 as viewed in FIG. 11, it will be evident that proper positioning of the smaller carton 36a of FIG. 11 with relation to the belt 17 can be accomplished, that is, by a push button operation the lower fold line of the smaller carton 36a may be positioned adjacent the lower margin of the belt 17 and the carton will be properly positioned in the direction of the travel of belt 17 so that the proper side panel of the carton will be grasped by the belt. If larger cartons such as that shown at 36 in FIG. 11 are to be included in a run through the apparatus, the plug 116 may be properly positioned to provide the proper positioning of the magazine 96 to accommodate these larger cartons. With the plug 116 positioned as shown in FIG. 10, for example, by closing the push button switch 129 the motor 118 will be operated so as to move the element 97 leftwardly as viewed in FIG. 10 until the insulating strip 107 is moved into engagement with the tip of the plug 116. This leftward movement of the element 97 causes the magazine to move diagonally downwardly as viewed in FIG. 11 thereby properly positioning the carton 36 adjacent the belt 17 both vertically and horizontally. If a larger carton than either of those indicated at 36 and 36a in FIG. 11 is to be accommodated in the apparatus, it will be evident that actuation of switch 127 will provide the proper positioning of the magazine. Thus, after the plugs 114, 116 and 117 are positioned in the proper apertures 113, it will be evident that adjustment of the rack to accommodate boxes of selected sizes can be properly accomplished merely by a push button operation performed by unskilled personnel. While only three plugs and switches have been illustrated in FIG. 10, it will be understood that more or fewer indexing stations might be provided

depending upon operational requirements. The concept of diagonally positioning the magazine so that reciprocating movement along a single, linear axis is all that is required to adjust the apparatus for boxes of various sizes is considered to be an important feature of the present invention. It will be understood that drive means for indexing the magazine other than that disclosed might also be utilized without departing from the scope of the present invention.

The apparatus of the present invention, as will be evident from the foregoing, functions to set up flat boxes or cartons for entry into conventional carton sealing machinery. The speed of operation of the apparatus of the present invention is such as to square cartons at a rate of the order of 50 per minute, this rate being two to three times faster than conventional set-up apparatus. The apparatus is characterized by ruggedness and relative simplicity. It has only one continuous moving part, the belt 17, and operation and adjustment of the apparatus can be accomplished, as previously mentioned, by relatively inexperienced personnel.

While the invention has been disclosed and described in some detail in the drawings and foregoing description, they are to be considered as illustrative and not restrictive in character, as other modifications may readily suggest themselves to persons skilled in this art and within the broad scope of the invention, reference being had to the appended claims.

What is claimed is:

1. A box set-up apparatus including a receptacle or magazine adapted to accommodate a stack of flattened boxes, an endless belt mounted so as to move across the outer face of the outermost box in said magazine, means for moving said belt with relation to the magazine, a hood providing a plenum chamber mounted adjacent the face of said belt remote from said magazine, said hood extending laterally beyond said magazine in the direction of travel of said belt, means for applying sub-atmospheric pressure to said plenum chamber, said belt having at least one apertured area therein whereby as said apertured area is moved across said magazine the outermost box therein adheres to said belt and is removed from the magazine, a panel-grasping head mounted adjacent said belt and spaced in the direction of travel of the belt from said magazine, said head having a generally tubular configuration and disposed so that its longitudinal axis parallels the outer face of said belt, the mounting means for said head permitting it to rotate about its own longitudinal axis and to swing in an arc substantially tangent to the path of travel of said belt as it moves across said hood, means for applying sub-atmospheric pressure to the interior of said head, said head having an elongated aperture in its sidewall adjacent said belt whereby as a flattened box is conveyed by said belt across said hood, said head adheres to the box, further movement of the box by said belt causing said head to rotate axially and move arcuately to square the box, and means for kicking up two opposed end flaps of the box into a position substantially normal to the plane of the belt as the box squaring operation is completed.

2. A box set-up apparatus as claimed in claim 1 wherein the means for applying sub-atmospheric pressure to said head includes a two-position solenoid valve, circuit means controlling opening and closing of said valve, said circuit means including two switches actuated in sequence as a flattened box is carried away from said magazine by said belt, said switches energizing said valve to open position, only when the last to be actuated switch is in actuated position and the first to be actuated switch is in deactuated position.

3. A box set-up apparatus as claimed in claim 1 in which the mounting means for said head includes a stationary tube adapted to have sub-atmospheric pressure applied to the interior thereof, a sleeve encircling said tube and rotatable relative thereto, an aperture in said

tube, a plurality of tubular elements extending radially from the outer surface of said sleeve, apertures in said sleeve communicating with the interior of said tubular elements, panel-grasping heads mounted on each of said tubular elements, said stationary tube being disposed with relation to said belt so that said tube aperture registers only with the sleeve aperture which communicates with the head closest to said belt.

4. A box set-up apparatus as claimed in claim 1 wherein said magazine is rectilinearly movable along a diagonal of the flattened boxes in the magazine, and means for selectively positioning said magazine to adjust its position and consequently the position of the boxes loaded therein with relation to said belt.

5. A box set-up apparatus including a receptacle or magazine adapted to accommodate a stack of flattened boxes, an endless belt mounted so as to move across the outer face of the outermost box in said magazine, means for moving said belt with relation to the magazine, a hood providing a plenum chamber mounted adjacent the face of said belt remote from said magazine, said hood extending laterally beyond said magazine in the direction of travel of said belt, means for applying sub-atmospheric pressure to said plenum chamber, said belt having at least one apertured area therein whereby as said apertured area is moved across said magazine the outermost box therein adheres to said belt and is removed from the magazine, a panel-grasping head mounted adjacent said belt and spaced in the direction of travel of the belt from said magazine, said head having an interior pressure chamber, the mounting means for said head permitting it to swing in an arc substantially tangent to the path of travel of said belt as it moves across said hood, means for applying sub-atmospheric pressure to the interior chamber of said head, said head having an aperture in its sidewall adjacent said belt whereby as a flattened box is conveyed by said belt across said head, said head adheres to the box, further movement of the box by said belt causing said head to move arcuately to square the box, and means for kicking up two opposed end flaps of the box into a position substantially normal to the plane of the belt as the box squaring operation is completed.

6. A box set-up apparatus as claimed in claim 5 wherein the means for applying sub-atmospheric pressure to said head includes a two-position solenoid valve, circuit means controlling opening and closing of said valve, said circuit means including two switches actuated in sequence as a flattened box is carried away from said magazine by said belt, said switch energizing said valve to open position, only when the last to be actuated switch is in actuated position and the first to be actuated switch is in deactuated position.

7. A box set-up apparatus as claimed in claim 5 wherein said magazine is rectilinearly movable along a diagonal of the flattened boxes in the magazine, and means for selectively positioning said magazine to adjust its position and consequently the position of the boxes loaded therein with relation to said belt.

8. A box set-up apparatus including a receptacle or magazine adapted to accommodate a stack of flattened boxes, an endless belt mounted so as to move across the outer face of the outermost box in said magazine, means for moving said belt with relation to the magazine, a hood providing a plenum chamber mounted adjacent the face of said belt remote from said magazine, said hood extending laterally beyond said magazine in the direction of travel of said belt, means for applying sub-atmospheric pressure to said plenum chamber, said belt having at least one apertured area therein whereby as said apertured area is moved across said magazine the outermost box therein adheres to said belt and is removed from the magazine, a panel-grasping head mounted adjacent said belt and spaced

in the direction of travel of the belt from said magazine, the mounting means for said head permitting it to rotate about its own longitudinal axis and to swing in an arc substantially tangent to the path of travel of said belt as it moves across said hood, means for causing said head to selectively grasp and release a flattened box conveyed by said belt across said head, whereby said head rotates axially and moves arcuately to square the box, and means for kicking up two opposed end flaps of the box into a position substantially normal to the plane of the belt as the box squaring operation is completed.

9. A box set-up apparatus as claimed in claim 8 wherein said magazine is rectilinearly movable along a diagonal of the flattened boxes in the magazine, and means for selectively positioning said magazine to adjust its position and consequently the position of the boxes loaded therein with relation to said belt.

10. A box set-up apparatus including a receptacle or magazine adapted to accommodate a stack of flattened boxes, an endless belt mounted so as to move across the outer face of the outermost box in said magazine, means for moving said belt with relation to the magazine, a hood providing a plenum chamber mounted adjacent the face of said belt remote from said magazine, said hood extending laterally beyond said magazine in the direction of travel of said belt, means for applying sub-atmospheric pressure to said plenum chamber, said belt having at least one apertured area therein whereby as said apertured area is moved across said magazine the outermost box therein adheres to said belt and is removed from the magazine, a panel-grasping head mounted adjacent said belt and spaced in the direction of travel of the belt from said magazine, the mounting means for said head permitting it to swing in an arc substantially tangent to the path of travel of said belt as it moves across said hood, means for causing said head to selectively grasp and release a flattened box conveyed by said belt across said head whereby said head moves arcuately to square the box.

11. A box set-up apparatus as claimed in claim 10 wherein said magazine is rectilinearly movable along a diagonal of the flattened boxes in the magazine, and means for selectively positioning said magazine to adjust its position and consequently the position of the boxes loaded therein with relation to said belt.

12. A box set up apparatus including a receptacle or magazine adapted to accommodate a stack of flattened boxes, an endless belt mounted so as to move across the outer face of the outermost box in said magazine, means for causing said belt to grasp the outermost box in said magazine and remove it therefrom, a panel-grasping head mounted adjacent said belt and spaced in the direction of travel of the belt from said magazine, the mounting means for said head permitting it to swing in an arc substantially tangent to the path of travel of said belt, means for causing said head to selectively grasp and release a flattened box conveyed by said belt whereby said head moves arcuately to square the box, and means for kicking up the trailing lower end flap of the box into a position substantially normal to the plane of the box side walls as the box squaring operation is completed.

13. A box set up apparatus as claimed in claim 12 wherein said magazine is rectilinearly movable along a diagonal of the flattened boxes in the magazine, and means for selectively positioning said magazine to adjust its position and consequently the position of the boxes loaded therein with relation to said belt.

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