July 16, 1963 A. C. AVRIL 3,097,461

BAG CLOSING MACHINE

Filed Aug. 21, 1961 6 Sheets-Sheet 1

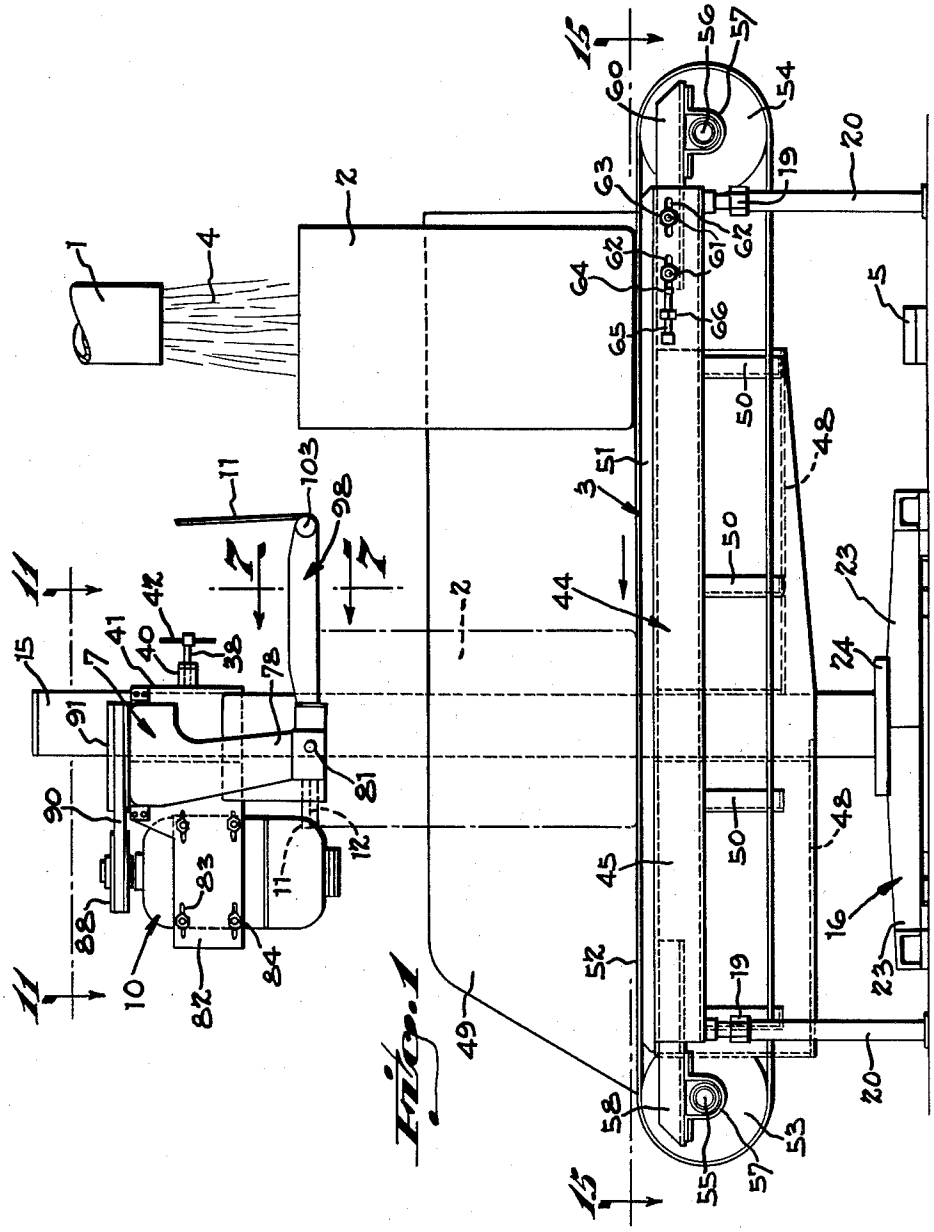


Fig. 1

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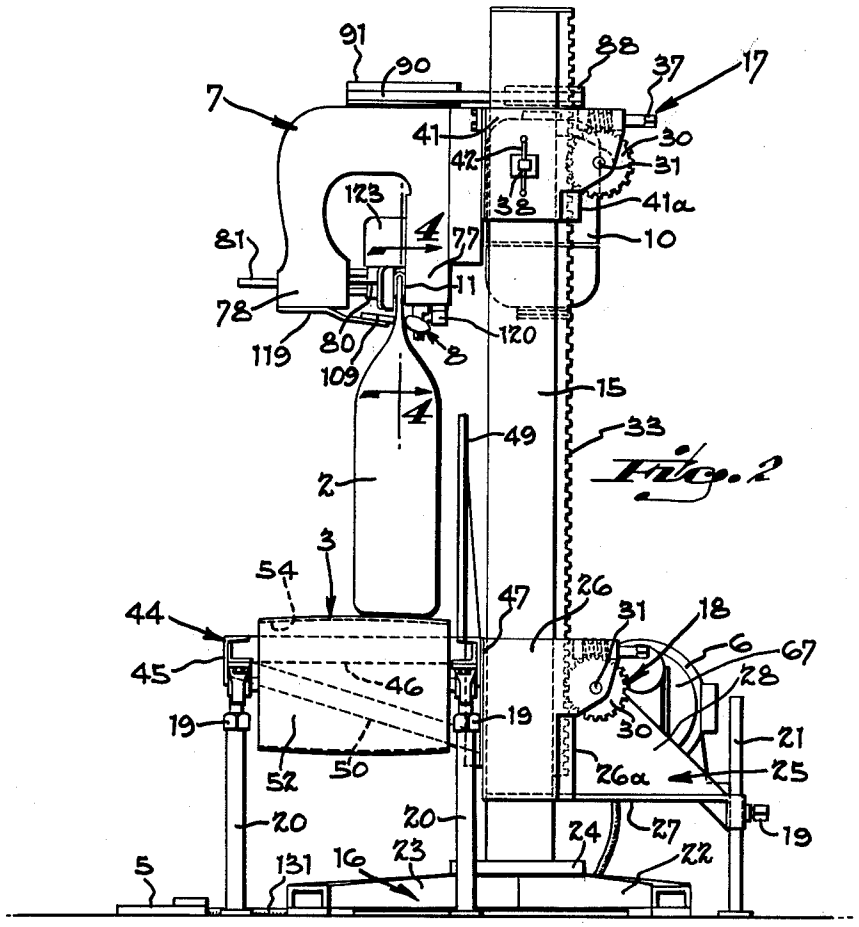


Fig. 2

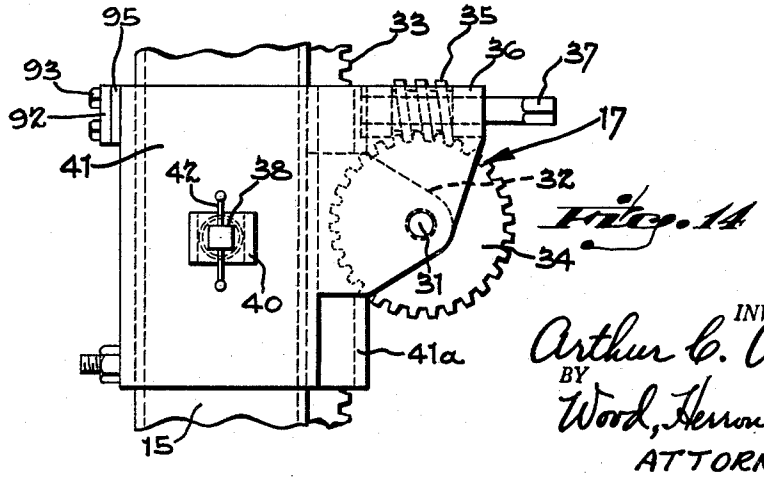


Fig. 14

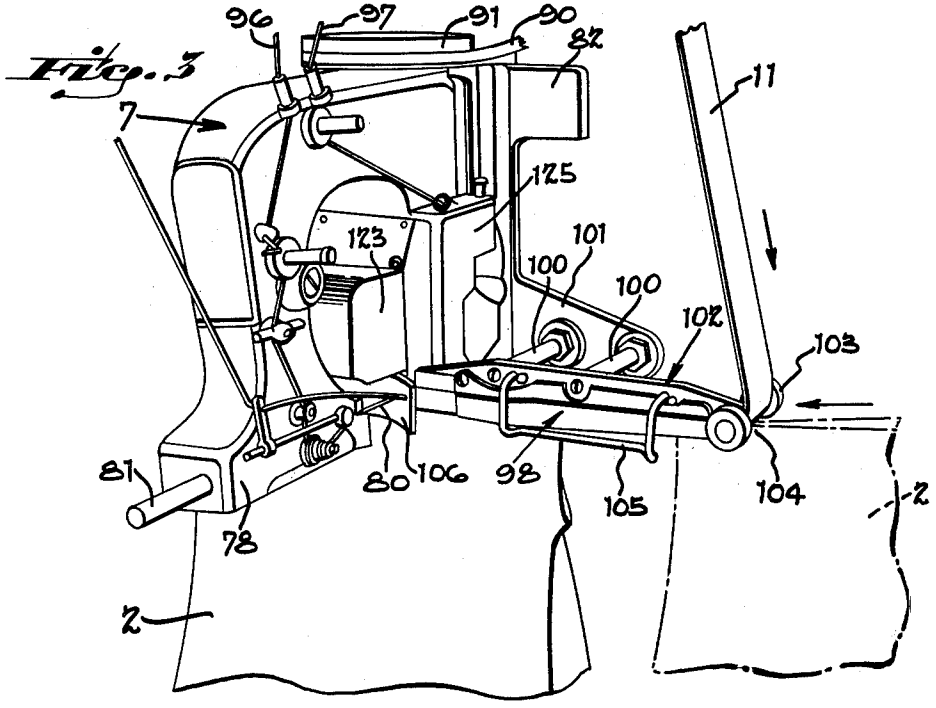
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Fig. 3



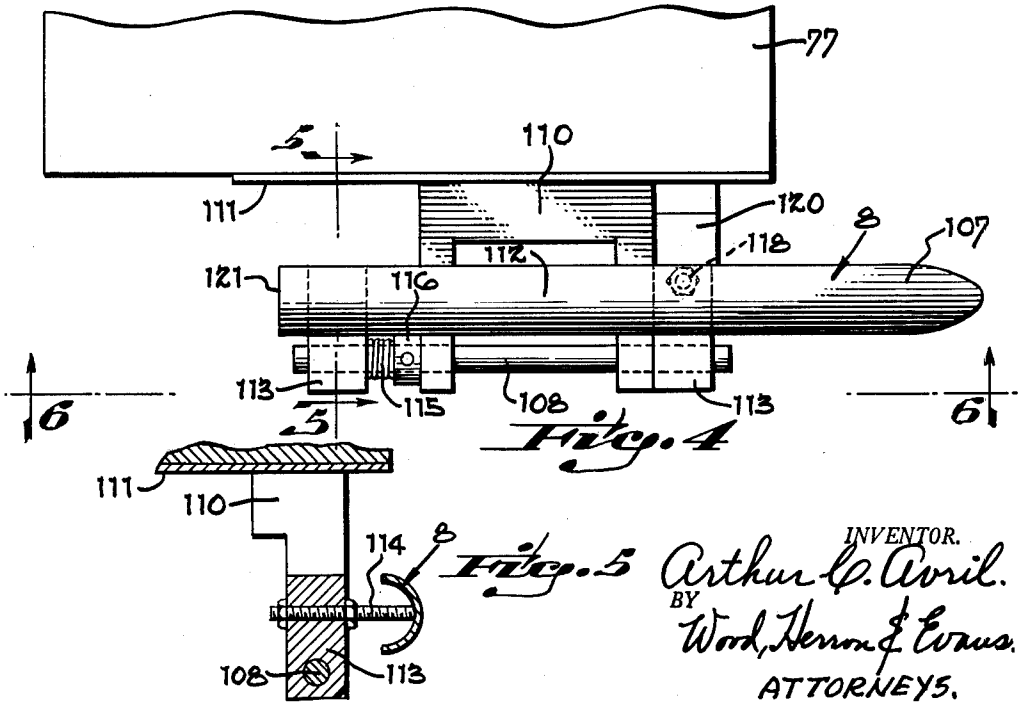


Fig. 4

Fig. 5

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BAG CLOSING MACHINE

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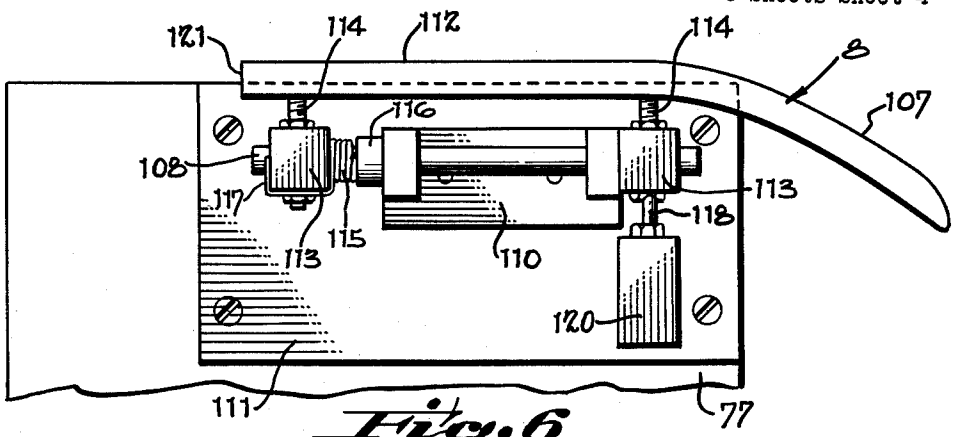


Fig. 6

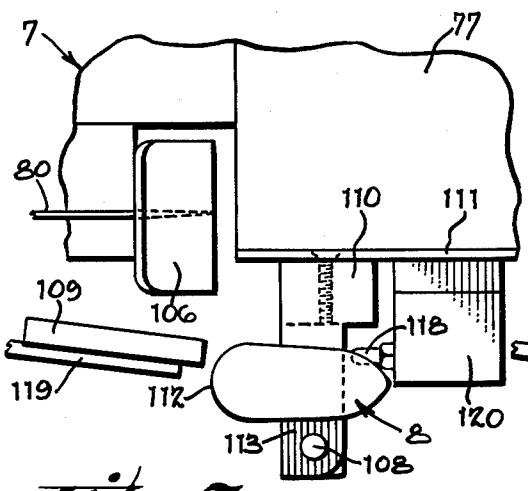


Fig. 7

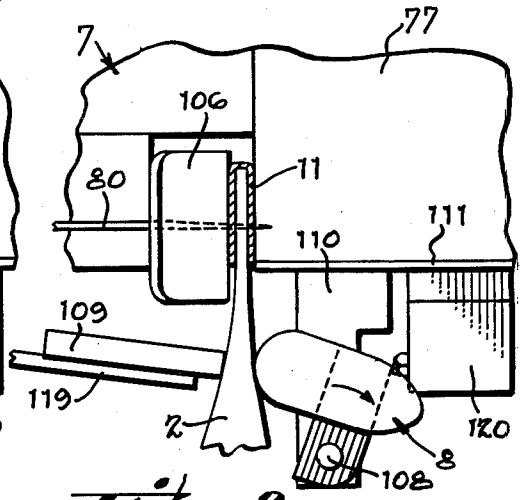


Fig. 8

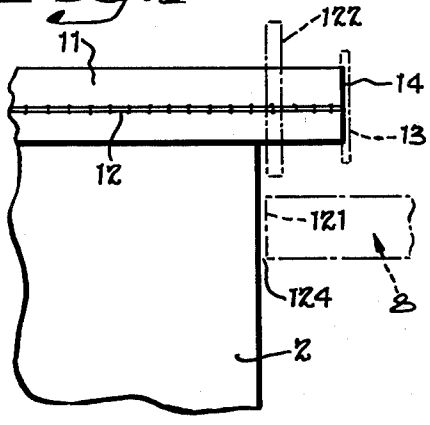


Fig. 9

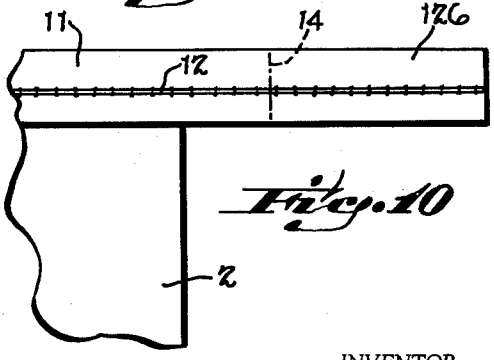


Fig. 10

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BAG CLOSING MACHINE

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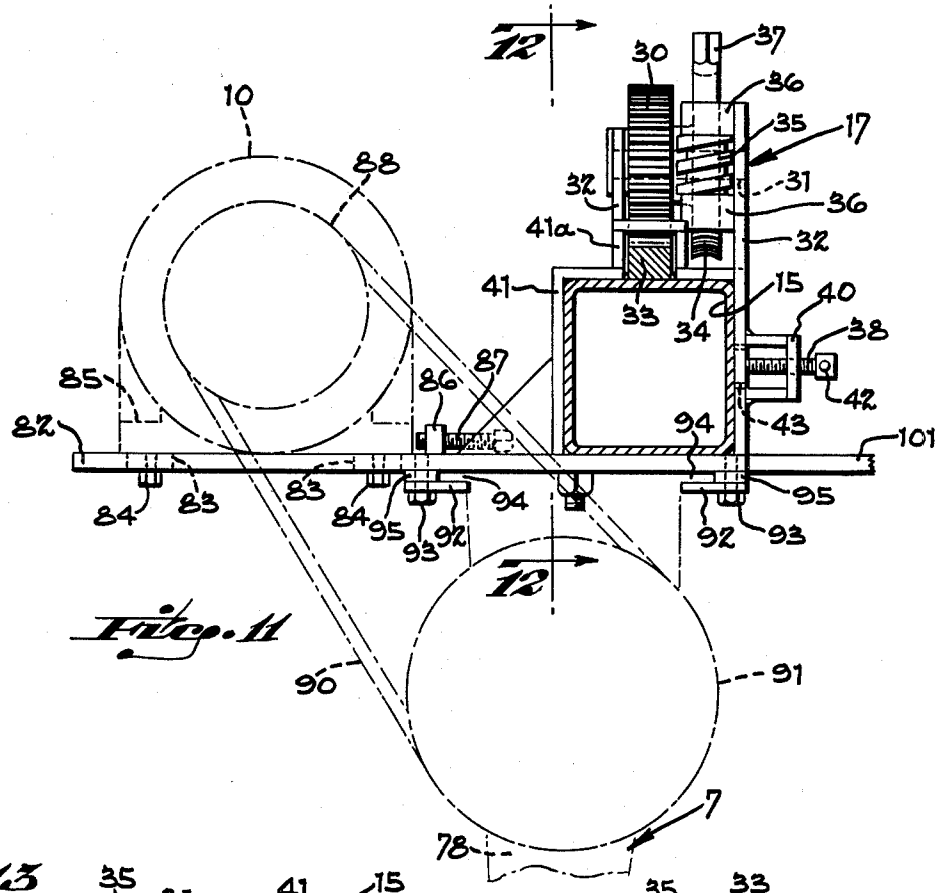


Fig. 11

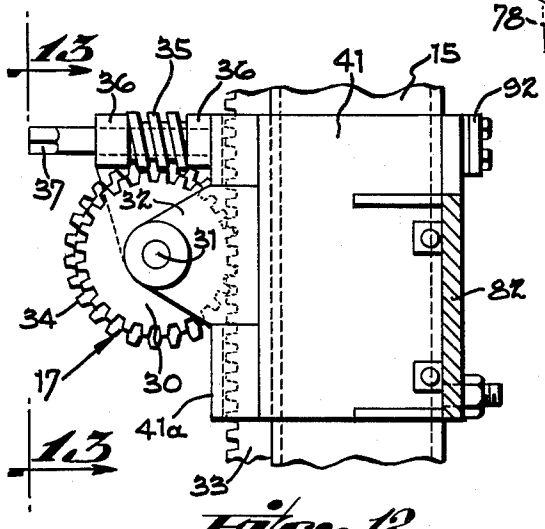


Fig. 12

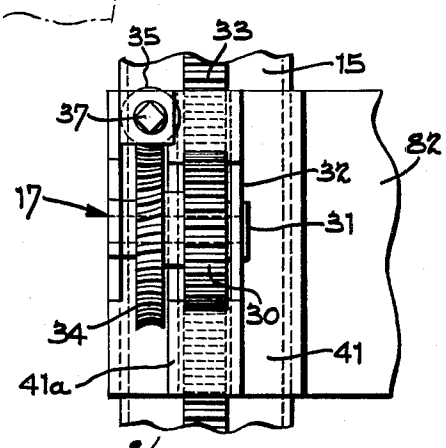


Fig. 13

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BAG CLOSING MACHINE

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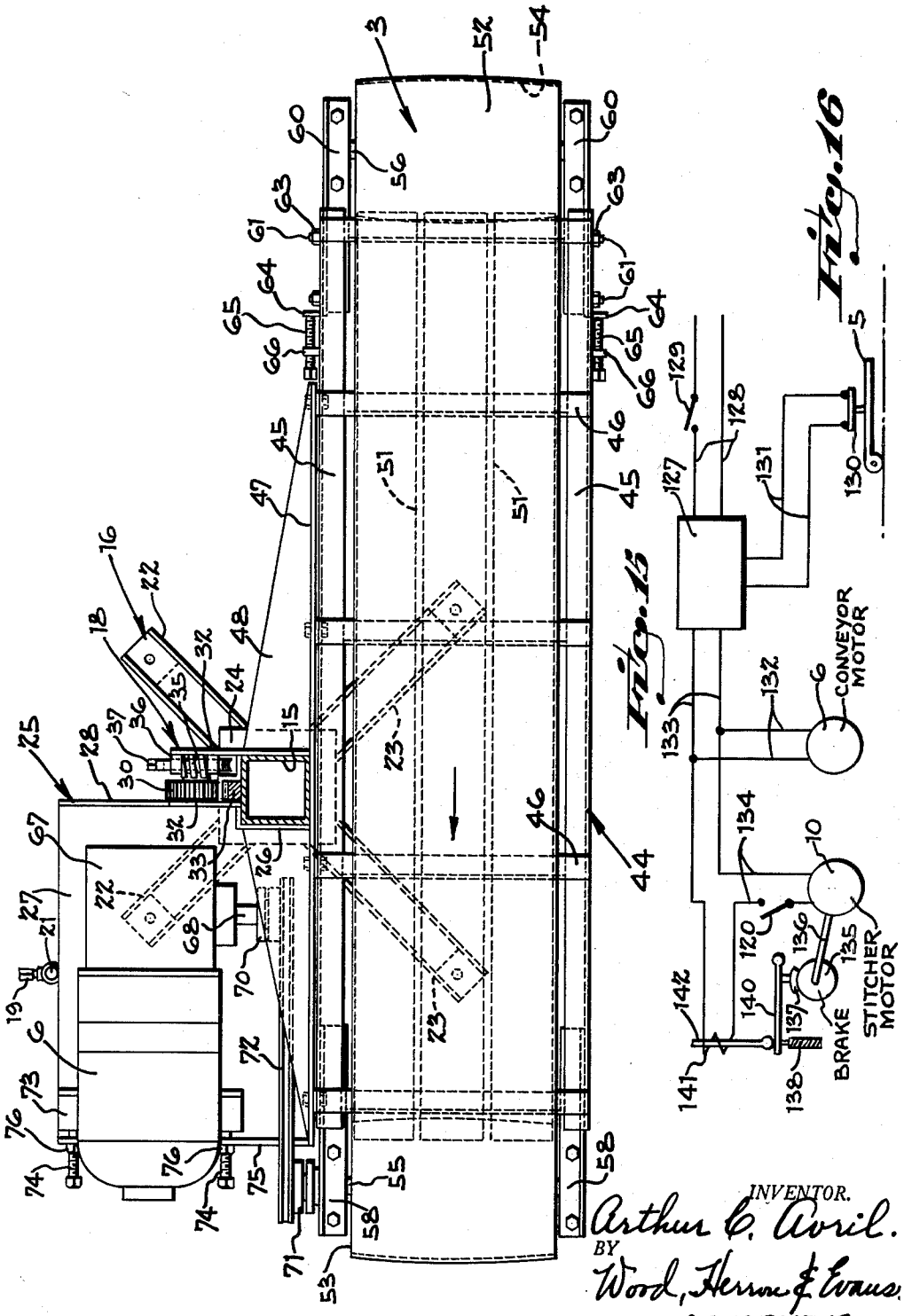


Fig. 16

Fig. 15

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United States Patent Office 3,097,461 Patented July 16, 1963

3,097,461
BAG CLOSING MACHINE

Arthur C. Avril, Wyoming, Ohio, assignor to A & T Development Corporation, Cincinnati, Ohio, a corporation of Ohio

Filed Aug. 21, 1961, Ser. No. 132,879
5 Claims. (Cl. 53—137)

This invention relates to bag closing machines of the type which fold a strip of tape across the open end of a filled bag and thereafter apply a line of stitching through the over-folded tape and bag to seal the contents therein.

The present invention is directed to improvements in bag closing machines of this general character, wherein the bag is formed of relatively heavy paper or fibrous material, the tape being formed of generally similar material. The bag filling and closing machine incorporating the present improvements, is intended particularly for packaging granulated materials and is disclosed in relation to the packaging of dry, pre-mixed building materials, for example, dry, pre-mixed concrete consisting of a mixture of dehydrated sand, aggregate and Portland cement. This material is prepared in a processing plant which dehydrates the sand and aggregate, mixes the materials with dry cement in predetermined proportions, then discharges the mixture in batch fashion into moisture repellent paper bags. A processing plant of this character is disclosed in the prior patent of Arthur C. Avril, No. 2,904,942. After being filled, the bag is sealed by the bag closing machine and is ready for storage and sale to the purchaser. It will be understood that the present bag closing apparatus is intended for packaging various other types of granulated material in conjunction with appropriate packaging plants wherein successive batches of material are loaded into bags which are subsequently sealed in a rapid manner by the bag closing machine.

A typical bag closing machine of the type to which the present improvements are directed, essentially comprises a bag conveyor and a stitching machine or head. The empty bags are placed upon the conveyor beneath the discharge spout of the processing plant by an operator who regulates the cycles of the processing plant and bag closing machine. After the material is discharged from the chute into the bag, the conveyor is operated to advance the filled bag toward the stitching machine, which is located above the conveyor in a position to act upon the upper portion of the bag.

As the upper portion of the bag advances into the stitching machine or head, it passes beneath and is embraced by a strip of tape which is partially doubled across the upper end of the bag which has been folded to a closed position. Upon further advancement by the conveyor, the upper portion of the bag trips a control device which energizes the motor of the stitching machine, causing it to apply a line of lock stitching through the doubled-over tape and upper portion of the bag, thus sealing the contents within the package.

As the trailing edge of the bag passes beyond the control device, the stitching machine is deenergized, then a trimming device, regulated by a sensing element which is tripped by the trailing edge of the bag, severs the tape which trails from the bag. However, due to inertia acting on the moving parts of the machine, the bag advances a substantial distance, for example, six to eight inches beyond the trimming device before the tape can be severed. Accordingly, in the operation of a conventional machine, each bag is discharged from the bag closing machine with this length of waste tape extending from its trailing side. Since the material is packaged at a high production rate, the amount of tape thus wasted during a day's run represents a very considerable expense item.

One of the primary objectives of the present invention has been to substantially eliminate the waste of tape, without essentially changing the conventional stitching machine, by providing a motor which includes braking apparatus arranged to bring the stitching machine abruptly to a stop as the trailing edge of the bag passes beyond the control device and sensing element of the trimming device.

According to this aspect of the invention, the brake stops the motor as soon as the motor circuit is deenergized, thereby to stop the stitching head and to prevent the trailing side of the bag from advancing very far beyond the sensing element of the trimming device. The sensing element thus is tripped to cause operation of the tape trimming device after the trailing edge of the bag advances a predetermined distance beyond the trimming device, thereby to control the amount of waste tape which trails from the bag. Briefly therefore, by applying the brake-type motor to the conventional machine, in accordance with the principles of this invention, the waste of tape at the cut-off operation is substantially eliminated without any change in the stitching and tape trimming mechanisms.

A further objective of the invention has been to improve the sensitivity of the control device which starts and stops the motor of the stitching machine in response to the advancement of the bag, thereby to further improve the accuracy of the tape trimming operation.

Briefly, the brake-type motor is energized by a normally open micro-switch, which is actuated by a trip bar mounted in a position to intercept an advancing bag, thereby to close the switch and energize the motor. The trip bar is pivotally mounted for motion in a path transverse to the line of advancement of the bag, the pivotal axis being disposed below the trip bar. The arrangement is such that the bar is tripped with very little resistance by the leading edge of the advancing bag to close the switch for energizing the motor; the bar also responds quickly to the passage of the trailing edge of the bag so as to deenergize and brake the motor with very little lag, thereby to increase the sensitivity of the control system and further reduce the wastage of tape.

Still another objective of the invention has been to improve the mounting structure of the stitching head and conveyor so as to adapt the machine to be adjusted conveniently to suit various bag sizes and also to allow the working parts to be adjusted relative to the floor level to compensate for the height of the operator.

In general, the mounting structure comprises a base having a vertical column, the stitching head and conveyor structure both being mounted upon the column, one above the other. In order to provide adjustment to accommodate for the bag sizes, the column includes a vertical rack, the conveyor and stitching head being slidably mounted upon the column and each including a duplicate self-locking adjustment mechanism, including a pinion meshing with the rack and adjusted by a worm and worm wheel drive. Accordingly the conveyor may be raised or lowered conveniently as a unit relative to the delivery chute to compensate for the height of the operator; while the stitching head, in a similar manner, may be adjusted along the column to locate the line of stitching accurately with respect to the upper portion of the bag which rests upon the conveyor. In order to stabilize the assembly, the conveyor structure, which extends outwardly from opposite sides of the column, includes extensible posts which are adjusted to engage the floor surface after the conveyor has been shifted to the desired elevation by the self-locking adjustment mechanism. The conveyor structure thus acts as an elongated base which firmly stabilizes the entire machine with reference to the floor surface.

The various features and advantages of the invention

will be more fully apparent to those skilled in the art from the following description, taken in conjunction with the drawings.

In the drawings:

FIGURE 1 is a front elevation of a bag filling and closing machine embodying the present improvements.

FIGURE 2 is an end view of the machine, as projected from FIGURE 1.

FIGURE 3 is a fragmentary perspective view, particularly illustrating the bag stitching head.

FIGURE 4 is an enlarged fragmentary view taken along line 4—4 of FIGURE 2, illustrating the switch-actuating trip bar for regulating the operation of the stitching head.

FIGURE 5 is a sectional view taken along line 5—5 of FIGURE 4, further illustrating the switch-actuating mechanism.

FIGURE 6 is a bottom plan, as viewed along line 6—6 of FIGURE 5, further detailing the switch-actuating mechanism.

FIGURE 7 is an enlarged fragmentary view taken along line 7—7 of FIGURE 1, showing the switch-actuating mechanism in its normal position with the stitching head deenergized.

FIGURE 8 is a view similar to FIGURE 7, showing the switch-actuating mechanism tripped by an advancing bag to energize the stitching head.

FIGURE 9 is a diagrammatic view showing the upper portion of a stitched bag and the relationship of the switch-actuating mechanism and tape severing device.

FIGURE 10 is a view similar to FIGURE 9, but showing a length of tape trailing from the bag as an example of the operation of a bag closing machine which is not equipped with the present improvements.

FIGURE 11 is a sectional view taken along line 11—11 of FIGURE 1, illustrating the adjustment mechanism for locating the stitching head at the proper elevation with respect to the top portion of the filled bag.

FIGURE 12 is a fragmentary side elevation, as viewed along line 12—12 of FIGURE 11, further illustrating the head adjustment mechanism.

FIGURE 13 is an end view of the adjustment mechanism taken along line 13—13 of FIGURE 12.

FIGURE 14 is a fragmentary view similar to FIGURE 12, showing the opposite side of the adjustment mechanism.

FIGURE 15 is a sectional view taken along line 15—15 of FIGURE 1, illustrating the conveyor system which advances the bags from the filling station through the stitching head.

FIGURE 16 is a diagram illustrating an electrical circuit for regulating the machine.

Structure and Operation Generally

As noted above, the bag filling and closing machine of the present invention is intended for the packaging of granulated materials generally, and is particularly adapted to the packaging of dry, premixed building materials, such as plaster mix, mortar mix, dry concrete mix, and the like. The machine is intended to be operated in conjunction with the processing plant which prepares and meters the material in batches for discharge into individual containers or bags.

The plant for dehydrating and discharging batches of dry concrete mixture, disclosed in the above noted patent to Arthur C. Avril, 2,904,942, presents a typical example of a processing apparatus with which the bag filling and closing machine of this invention may be used. As disclosed in this patent, the apparatus dehydrates the sand and aggregate or gravel by heat exchange principle, wherein the sand is first heated to a predetermined temperature (and dried), then is commingled with the raw, moist gravel. The heated sand thus drives off the moisture from the gravel by heat exchange, then metered quantities of dehydrated sand, dehydrated gravel and dry Portland cement are mixed and discharged in the form of individual batches into moisture-resistant paper bags while still warm. The exchange of heat between the hot sand and raw gravel not only dehydrates the gravel, but also reduces the mixture to a safe bagging temperature, adapting the mixture to be discharged immediately into the bags. In other words, the discharge temperature is sufficiently low to prevent damage to the fibers of the paper bags but is sufficiently high to prevent the mixture from reabsorbing moisture from the air after discharge and prior to packaging.

Referring to FIGURES 1 and 2, the chute indicated at 1 represents the delivery point of the processing machine with which the present bagging apparatus may be utilized. Described with reference to the Avril dehydration apparatus of the prior patent referred to above, the cycles of operation preferably are controlled by an operator who places an empty bag 2 on the belt conveyor, indicated generally at 3. The conveyor supports the bag in position beneath the chute to receive the dry concrete mixture, indicated at 4, as it issues from the chute. With the bag thus positioned, a prepared batch of dry concrete mix is discharged by gravity from the chute to the bag upon operation of a control switch by the operation. After the batch of dry concrete mix is delivered to the bag, the operator releases a treadle 5, which energizes the conveyor motor 6 (FIGURE 15), causing the bag to be advanced by the belt conveyor from the loading station to the stitching head, which is indicated generally at 7. As the bag approaches the stitching head, its upper portion engages a trip bar 8 (FIGURE 2) which energizes the motor 10 of the stitching head. This motor is a commercial product and includes a built-in brake which stops the motor immediately when the circuit is opened.

It will be understood at this point, that the stitching head 7 is also a commercial product and has not been disclosed in detail since its structural features, with certain exceptions as pointed out later, do not form a part of the present invention. The head includes the usual feed mechanism which advances the bag in time with the reciprocations of the needle and shuttle. However, the feed mechanism of the stitching head is not capable of advancing the heavily-loaded bag during the stitching operation; therefore, the conveyor motor 6, and the stitching head motor 10 are arranged to drive the conveyor belt and stitching mechanism in synchronism with one another. In other words, the bag is advanced by the conveyor 3 at the same rate as the feeding mechanism of the stitching head advances the upper portion of the bag; hence, there is no strain between the stitching mechanism and upper portion of the bag.

During the stitching operation, a strip of tape 11 (FIGURE 1) is fed along with the bag, the tape being doubled over the upper end of the bag, as explained later, then a line of lock stitching 12 (FIGURES 9 and 10) is applied through the over-folded tape and upper portion of the bag, thereby sealing the filled package. After the trailing end of the bag passes beyond the end of the trip bar 8, the stitcher motor 10 is deenergized and braked immediately to a stop; at about the same time, a trimming device, indicated diagrammatically at 13 (FIGURE 9), severs the tape as at 14, at a point slightly beyond the trailing edge of the bag. It will be understood that the conveyor 3 continues advancing the bag during the stitching and tape trimming operations.

The filling and closing mechanism is intended to operate at a rapid rate, whereby successive bags may be filled and guided through the stitching machine by an individual operator, then advanced preferably to a second operator downstream from the stitching head who unloads the finished package from the conveyor. For this purpose, the treadle 5 is arranged to energize the conveyor motor 6 continuously, except when the treadle is depressed by the operator. On the other hand, the motor 10, which

drives the stitching head, is energized only when the upper portion of the bag engages the trip bar 8, as noted above.

In operation therefore, the operator depresses the treadle 5 to deenergize conveyor motor 6, thereby to hold the bag in stationary position beneath the chute 1 during the filling operation. After the bag is filled, the operator releases the treadle to energize the conveyor motor; the operator therefore is free to follow the advancing bag while grasping its upper portion to bring it properly into the guiding mechanism of the stitching head, as explained later. The conveyor continues advancing during the stitching and tape trimming operation, at which point the stitching head is braked to a stop. Thereafter, the bag (with the tape severed) is free to advance until the operator returns to the loading station and depresses the treadle, thereby stopping the conveyor for the next bag loading and stitching cycle.

As viewed in FIGURES 1 and 2, the stitching head 7 is mounted upon a column 15 rising upwardly from a base 16 which rests upon the floor. In order to adapt the closing machine to the various bag sizes, the stitching head is connected to the column 15 through a self-locking adjustment mechanism, which is generally indicated at 17. The adjustment mechanism permits the stitching head to be raised or lowered with respect to the surface of conveyor 3 so as to locate the line of stitching 12 accurately with respect to the upper portion of the bag.

The conveyor 3 is also mounted for vertical adjustment with respect to the column 15 by means of a second adjustment mechanism, indicated generally at 18 in FIGURE 2. This mechanism is similar to the adjustment mechanism 17, thus bringing about a saving in fabrication costs. The second adjustment mechanism permits the conveyor to be adjusted vertically with respect to the floor level for the convenience of the operator, since it is extremely tiring to handle bags for prolonged periods with the conveyor too high or too low. The conveyor adjustment also accommodates for the height of the bag with reference to the lower end of the discharge chute 1 (FIGURE 1). It will be understood that the height of the stitching head is adjusted after the conveyor adjustment is made in order to properly locate the line of stitching 12 with reference to the upper portion of the bag. The two adjustment mechanisms 17 and 18 thus adapt the machine to the filling and closing of the various types and sizes of bags.

The conveyor includes pairs of extensible posts or jacks 20, which are arranged to be extended or retracted so as to engage the floor, thereby to stabilize both ends of the conveyor in its adjusted position. The mounting structure of the conveyor motor 6 also includes an extensible post 21 (FIGURE 2), which is similarly adjusted with reference to the floor level for stabilizing the structure. The posts 20 and 21 both include clamping elements 19 for locking the posts rigidly in adjustment.

Bag Conveyor

As explained above, the conveyor 3 and stitching head 7 are both supported upon the vertical column 15, which rises from the base 16. The base 16 consists of a channel iron structure suitably welded together (FIGURE 15), comprising channel irons 22—22 and 23—23 which extend diagonally with respect to the longitudinal axis of the conveyor. It will be noted that the channel irons 23 are substantially longer than the irons 22 in order to compensate for the overhanging weight load of the conveyor. The column is joined to the channel irons by a composite base plate structure 24 which may be welded to the channel irons upon which it rests.

The adjustment mechanism of the conveyor, previously indicated at 18, includes a vertically shiftable carriage structure, indicated generally at 25, having a sleeve portion 26 slidably embracing the column 15 and supporting the conveyor 3. The lower portion of the sleeve has a mounting plate 27 upon which is mounted the conveyor motor 6. The mounting plate 27 is braced with respect to the sleeve by a gusset plate 28 joined to the parts by welding.

The adjustment mechanism 18 of the conveyor is described in relation to the adjustment mechanism 17 of the stitching head (FIGURES 11–14) since both units 17 and 18 are in duplicate. Each adjustment mechanism comprises a pinion 30 keyed to a stub shaft 31, the stub shaft having its opposite end portions journalled in bearing brackets 32—32, which project outwardly from the sleeve 26 of the conveyor carriage (or from the sleeve 41 of the stitching head, as noted later). The pinion 30 meshes with a vertical rack 33, which is secured to and coextensive with the column 15. The sleeve 26 includes a bridging section 26*a* (FIGURE 2) passing across the rack 33 to reinforce the sleeve. The stitcher head sleeve 41 includes a similar bridging section 41*a*.

As best shown in FIGURES 11–14, shaft 31 includes a worm wheel 34 which is keyed to the shaft 31 adjacent the pinion 30. A worm 35 meshes with the worm wheel and is rotatably journalled between a pair of bearing lugs 36—36 (FIGURE 11) which are secured to one of the bearing brackets 32. The worm includes an outwardly projecting stub shaft, including a squared end 37 providing wrench engagement for rotating the worm when it is necessary to adjust the elevation of the conveyor. It will be seen that the worm and worm wheel provide a self-locking drive, such that the conveyor assembly will remain at any plane to which it is adjusted. However, as noted earlier, the structure includes extensible posts 20 and 21 which are shifted into engagement with the floor so as to stabilize the conveyor structure and also to rigidify the entire machine with respect to the floor upon which the machine is resting.

The adjustment mechanism 17 for the stitching head does not include the posts 20 and 21; instead, a clamp screw 38 (FIGURES 11 and 14) is provided for clamping the assembly rigidly to the column 15. The screw 38 is threaded through a bracket 40 which is welded to the sleeve 41 of the stitching head. The outer end of the clamp screw 38 includes a head 42 providing a hand grip for turning the screw, while its inner end engages a disk 43 seated in an opening formed in the sleeve 41, the disk being forced under pressure into engagement with the column 15 to clamp the stitcher head at its adjusted elevation.

The conveyor 6 consists of a longitudinal frame, indicated generally at 44 (FIGURES 1, 2 and 15), comprising a pair of spaced longitudinal angle irons 45—45, connected together by cross members 46. The cross members project transversely from a vertical plate 47 which forms a part of the sleeve 26, and which extends longitudinally from opposite sides of the sleeve. As shown in FIGURE 15, the vertical plate 47 is braced by a horizontal plate 48, also extending longitudinally from opposite sides of the sleeve. The conveyor frame structure includes a series of diagonal braces 50 (FIGURE 2) which extend in an upwardly inclined plane from the vertical plate 47 to the outer angle iron 45 of the conveyor frame, thereby providing a rigid structure.

The conveyor frame 44 includes a flat platform 51 (FIGURE 1) resting upon the cross members 46 and slidably supporting the upper run of an endless belt 52.

A vertical guide plate 49 rises upwardly from the frame 44 parallel with the inner edge of the endless belt 52. The guide plate 49 is adapted to slidably support the filled bags in upright position in the event that the bag should slip from the operator's grasp. The belt is tracked at opposite ends upon a drive roller 53 and an idler roller 54 (FIGURE 1) mounted on cross shafts 55 and 56 journalled at opposite ends of the conveyor frame 44. The cross shaft 55 comprises a power shaft and is journalled in bearings 57 at opposite sides of the frame, the bearings

being supported by fixed brackets 58 projecting from the end of the frame at opposite sides.

The shaft 56 of the idler roller 54 is similarly journalled in bearings 57 at opposite sides of the frame. However, in this case, the bearings are mounted upon adjustable brackets 60—60 (FIGURES 1 and 15) to provide adjustment of the belt 52. For this purpose, each bracket includes bolts 61—61 projecting outwardly through slots 62—62 formed in the angle irons 45, the bolts including clamping nuts 63. Each bracket 60 includes a lug 64 projecting outwardly through the rearward slot 62. An adjustment screw 65 for each adjustment bracket, is threaded through a lug 66, fixed to the conveyor frame, and has its end in engagement with the lug 64 of the adjustment bracket. The adjustment screws 65 may be rotated to tighten the endless belt, after which the nuts 63 are tightened to clamp the brackets 60 in adjusted position.

The drive roller 53 is powered by the conveyor motor 6 (FIGURE 15) which is supported by the mounting plate 27 carried by the sleeve 26, as explained earlier. The motor 6 includes a gear head 67 of conventional design, including a speed reduction drive shaft 68. A pulley 70 is mounted on shaft 68, and a companion pulley 71 is mounted on the shaft 55 of the drive roller 53. A V-belt 72 interconnects the pulleys 70 and 71 so as to drive the conveyor belt in the direction indicated by the arrow. The pulleys 70 and 71 may be of the adjustable type, whereby the rate of advancement of the conveyor belt is accurately regulated.

The motor 6 includes a base 73 (FIGURE 15), shiftably connected to the mounting plate 27 by clamping bolts (not shown) in order to adjust the V-belt 72. The belt is tensioned by means of adjustment screws 74—74 threaded through a plate 75 joined to mounting plate 27, the inner ends of the screws engaging the motor base 73 and including lock nuts 76. In order to tighten the belt 72, the mounting bolts are loosened, then the screws 74 are adjusted in a direction to shift the motor in belt-tightening direction.

It will be understood that the conveyor frame 44 and motor mounting plate 27 form a rigid structure which is raised or lowered as a unit relative to the column by operation of the adjustment mechanism 18. As noted earlier, operation of the conveyor motor is controlled by the treadle 5 which is depressed to stop the motor so that the operator may follow the filled bag as it advances toward the stitching head.

Stitching Head and Tape Trimming Mechanism

As is best shown in FIGURE 2, the stitching head 7 is generally in the form of an inverted U-shaped structure having a vertical foot portion 77, enclosing the feed mechanism, and an outwardly spaced stitching unit 78 enclosing the mechanism which reciprocates the needle 80. The needle is mounted in a needle bar 81 slidably mounted in the stitching unit 78. Since the feed and needle driving mechanisms are conventional, they have been omitted from the disclosure.

The stitching head is driven by the motor 10, previously noted, which is attached to a mounting plate 82 (FIGURE 1), which projects outwardly from the sleeve 41 of the stitching head. As best shown in FIGURE 11, the mounting plate 82 is slotted as at 83, the motor being secured to the plate by bolts 84 passing through the slots 83 and into the base 85 of the motor. In order to provide belt adjustment, mounting plate 82 includes a lug 86 through which is threaded an adjustment screw 87 engageable with the motor base 85.

The motor includes an adjustable V-belt pulley 88 (FIGURES 1, 2 and 11) connected by a belt 90 with the pulley 91 which drives the stitching head 7. The pulley 88 is of conventional design and provides variable pitch diameter in order to synchronize the speed of the stitching head with the rate of advancement of the bag conveyor 3, as noted earlier. In general, the adjustable pulley 88 is of split construction, having a section or sections which may be shifted axially along the shaft of the motor to regulate the speed of the stitching head. In making this adjustment, the screws 84 are loosened, the pulley pitch is regulated, then the adjustment screw 87 is rotated so as to shift the motor in a direction to maintain the belt 90 under proper tension, thereby to accommodate for the adjustment of pulley 88.

As viewed in FIGURE 11, the stitching head 7 is attached to the mounting plate 82 by means of clamp plates 92 which are secured to mounting plate 82 by screws 93. The plates 92 overlie the outwardly projecting base portions 94 of the stitching head, the screws 93 including spacers 95. The arrangement is such that the plates 92 firmly clamp the stitching head to the mounting plate 82.

As viewed in FIGURE 3, the stitching thread or cord 96 is supplied to the needle from a spool (not shown), and a similar cord 97 is supplied from a second spool to the shuttle in the conventional manner. The supply of tape 11, is also fed to the machine from an overhead reel (not shown). The tape consists of a heavy grade of paper or similar fibrous material which is preferably crinkled transversely to impart flexibility. As noted earlier, the tape is fed through the machine in time with the bag and is doubled over the open end of the bag as it advances toward the reciprocating needle, such that the line of stitching 12 secures the tape in overlapped relationship across the open end of the bag, as shown in FIGURES 8–10.

The tape passes into the stitching head in the direction of advancement of the bags, as indicated by the arrows in FIGURE 3. In order to fold the tape over the open end of the bag, the stitching head is provided with a tape folding device which is indicated generally at 98. The tape folding device 98 is mounted upon a pair of spacer bars 100—100 projecting outwardly from a bracket 101 which forms a part of the mounting plate 82.

The tape folding device 98 is also conventional and has not been disclosed in detail. In general, the folding device comprises an elongated forming rail structure, indicated generally at 102, projecting horizontally from the stitching head and including at its outer end a guide roller 103 arranged to direct the tape into the end of the rail 102. The forming rail structure, in cross section, delineates a passageway which converges progressively from its receiving end, indicated at 104, toward the stitching machine. As the bag is advanced by the conveyor, its upper portion passes into the passageway of rail structure 102 below the tape. The tape, which is stationary at this point, is folded generally to an inverted V-shape converging toward the stitching head, as delineated by the forming rail structure 102, such that the open end portion of the bag is enclosed progressively by the converging folded tape as the bag advances. The forming rail structure 102 includes a converging guide bar 105 which slidably engages the portion of the bag below the forming rail structure, so as to aid in closing the upper portion of the bag as it advances.

As the bag enters the stitching head, its leading edge engages the trip bar 8 (FIGURES 7 and 8), so as to shift the bar transversely and energize the motor 10, thus actuating the stitching head. At this point, the leading portion of the tape, which is engaged by the feed mechanism of the stitching head, is advanced by the feed mechanism, while the bag proper is being advanced by the conveyor 3, such that the bag advances with the over-folded tape toward the reciprocating needle 80. As the bag advances with the over-folded tape, it encounters an outwardly flared horizontal guide plate 106 (FIGURES 3, 7 and 8), which coacts with the feed mechanism to hold the tape and bag in assembled relationship, while the needle 80 applies the line of lock stitching 12.

As described in detail in (FIGURES 4–9), the trip bar

8 is partially cylindrical in cross section and includes a receiving end 107 disposed adjacent the receiving end of the guide plate 106. The receiving end 107 flares outwardly in a direction opposite to the receiving end of guide plate 106, so as to provide a converging throat for directing the upper portion of the advancing bag toward the needle of the stitching machine. The trip bar 8 is pivotally mounted upon a rock shaft 108 carried by a bracket 110 which depends downwardly from a mounting plate 111. The mounting plate 111 is secured to the lower surface of the stitching head foot 77 by screws.

The trip bar 8 includes a straight portion 112 which blends with the flared receiving end 107, and the straight portion includes a pair of downwardly projecting lugs 113 attached by screws 114 to the trip bar. The rock shaft 108 includes a torsion spring 115, having one end anchored in a collar 116 affixed to the rock shaft, the spring having an opposite end portion 117 engaging one of the lugs 113 (FIGURE 6). The arrangement is such that the spring 115 normally biases the trip bar to the position shown in FIGURE 7, adapting the trip bar to be swung in the direction indicated by the arrow in FIGURE 8 upon being slidably engaged by the advancing bag. In order to provide a backing, adapting the upper portion of the bag to actuate the trip bar 8, there is provided a fixed horizontal guide rail 109, which is supported by a bracket 119 attached to the stitching head by screws (FIGURE 2). The guide rail 109 is mounted in a plane below and coextensive with the guide plate 106, in a position to engage the upper flexible portion of the bag to prevent it from being deflected laterally by the spring-biased trip bar 8, thereby to insure positive operation of the bar.

As the trip bar is shifted to its tripped position (FIGURE 8), one of its lugs 113 engages and depresses the stem 118 of a micro-switch 120, which is also attached to the mounting plate 111. Upon being actuated, the micro-switch completes a circuit which releases the brake of the stitching head motor 10, at the same time energizing the motor, as explained later with reference to FIGURE 16. The stitching head continues to run until the trailing edge of the bag passes beyond the end 121 (FIGURE 6) of the trip bar. At this point, the motor 10 is deenergized and the motor brake is applied so as to stop the stitching head abruptly. At about the same time the tape trimming apparatus is actuated so as to trim off the tape at the trailing edge of the bag (FIGURE 9) from the length of tape which remains engaged by the feed mechanism of the stitching head, as explained in greater detail below.

The tape trimming or cut-off mechanism forms a part of the stitching head and has not been disclosed in detail. As shown diagrammatically in FIGURE 9, the trimming mechanism, in general, comprises a spring-biased sensing finger 122 which engages the upper portion of the bag beneath the tape, and the trimming device, previously indicated at 13, which is mounted in a position to sever the tape at a point downstream from the sensing finger 122 in the direction of the bag movement. The trailing end 121 of the trip bar 8 is located in relation to the sensing finger, as indicated in FIGURE 9. Thus, as the trailing edge of the bag passes beyond the end 121 of the trip bar, the spring-biased trip bar snaps to its normal position (FIGURE 7) so as to bring the stitching head to an abrupt stop. The braking action substantially eliminates momentum, such that the bag travels only slightly beyond the end of the trip bar, as indicated by the clearance 124 in FIGURE 9.

The sensing finger 122 is interconnected with a mechanism (not shown) which forms a part of the stitching head, and which actuates the cutter or trimming device 13 as soon as the edge of the bag passes beyond the sensing finger. The relationship of the sensing finger 122 and end 121 of the trip bar is such that the trimming device is actuated to trim the tape at about the same time the stitching head is braked to a stop. The sensing finger 122 and trimming device 13 are enclosed in a housing 123 (FIGURE 3) which is attached to the stitching head.

It will be understood at this point, that the trip bar 8 and the brake-type motor 10 coact with one another to provide precise control of the stitching head and also adapt the conventional stitching machine to bring about a significant reduction in the amount of tape which is wasted at the trailing edge of the bag, as shown in FIGURE 10. In other words, in a stitching machine which is not equipped with a sensitive trip bar 8 and brake-type motor, the inertia of the moving parts causes the trailing edge of the bag to advance at relatively high velocity beyond the trimming device 13 by reason of the inherent lag which occurs between the actuation of the sensing finger 122 and operation of the trimming device 13. Accordingly, the present structure eliminates the length of tape 126 (FIGURE 10) extending beyond the trim line 14, which represents a typical example of the waste which occurs due to overrunning of a conventional stitching machine which is not equipped with the present improvements.

It will be understood that in some instances it is not necessary to apply a tape to the end of the bag, that is, the line of stitching is applied directly to the bag itself. In this event, the machine is used in the same manner, with no changes in structure except that the supply of tape is omitted. At the end of each stitching operation the apparatus operates in the manner described above to trim the line of stitching at the trailing edge of the bag.

Electrical Control Circuit

The diagram shown in FIGURE 16 represents, in a simplified form, a typical electrical circuit suitable for controlling the apparatus of this invention. The block indicated at 127 represents the control system, including electrical relays and other components which regulate the operation of the conveyor motor 6 and the motor 10 of the stitching head. Power is supplied to the control system 127 by the power lines 128 under control of the treadle, indicated diagrammatically at 5. The treadle operates a normally-closed switch 130 interposed in one of the branch lines 131. The branch lines 131 and switch 130 complete the power circuit from the control system 127 to the motors 6 and 10. In other words, the conveyor motor 6 is normally energized and is deenergized only when the treadle 5 is depressed. On the other hand, the stitching head motor 10 also can be energized only when the treadle is released, the circuit being completed through the normally-open micro-switch 120. When the machine is shut down, the power circuit 128 is deenergized by opening the manually-operated switch 129.

The conveyor motor 6 is energized by the branch lines 132 which are interconnected with the power supply lines 133 leading from the control system. The supply lines 133 are also interconnected with the stitcher motor 10 by way of the branch lines 134. The micro-switch, previously indicated at 120, is of the normally open type and is interposed in one of the branch lines 134 leading to the stitcher motor 10, the arrangement being such that the motor is energized only when an advancing bag engages the trip bar 8 to close the switch 120.

As shown diagrammatically in FIGURE 16, the brake of the stitcher motor 10 may be of the friction type, comprising a brake drum 135 mounted on the motor shaft 136 and engaged by a brake shoe 137. The brake shoe 137, in the example illustrated, is normally forced into engagement with the drum 135 by a tension spring 138 connected to a lever 140 which actuates the shoe. The brake is released by means of a solenoid coil 141 connected in series with one of the branch lines 134 and having an armature 142 connected with the brake lever 140.

Under normal operation, the normally closed treadle switch 130 energizes the conveyor motor and thus causes the bag to be advanced toward the stitching head by the belt conveyor 3, the stitcher motor 10 normally being de-

energized by operation of the normally-open micro-switch **120**. When the bag engages the trip bar **8**, it closes the micro-switch **120** and thus simultaneously energizes the stitcher motor **10** and the solenoid coil **141** so as to release the brake and concurrently drive the motor. When the trailing edge of the bag advances beyond the end of the trip bar **8**, the solenoid **141** and motor **10** are de-energized, adapting the spring **138** to apply the brake and thus bring the motor **10** abruptly to a stop, as explained above.

Having described my invention, I claim:

1. A bag closing machine comprising, a base, a vertical column rising from said base, a vertical rack mounted on said column, a conveyor structure slidably connected to said column, self-locking conveyor adjustment means on said conveyor structure including a pinion meshing with said rack, a chute mounted above said conveyor and adapted to discharge material into the open end of a bag resting upon the conveyor, a bag stitching head mounted upon said column above the conveyor, said stitching head adapted to fold a strip of tape over the open upper portion of the filled bag and to apply a line of stitching through said tape and through the upper portion of the filled bag advancing on the conveyor, said conveyor adjustment means adapted to raise or lower the conveyor relative to said discharge chute, thereby to compensate for the size of a bag resting on the conveyor, said stitching head including trimming means for severing the strip of tape from the trailing edge of the bag in response to the advancement thereof relative to the stitching head and after application of said line of stitching.

2. A bag closing machine comprising, a base, a vertical column rising from said base, a vertical rack mounted on said column, a conveyor structure slidably connected to said column, self-locking conveyor adjustment means on said conveyor structure including a pinion meshing with said rack, a chute mounted above said conveyor and adapted to discharge material into the open end of a bag resting upon the conveyor, a bag stitching head slidably mounted upon said column, above the conveyor, self-locking head adjustment means connected to the stitching head and including a pinion meshing with said rack, said stitching head adapted to fold a strip of tape over the open upper portion of the filled bag and to apply a line of stitching through said tape and through the upper portion of the filled bag advancing on the conveyor, said conveyor adjustment means adapted to raise or lower the conveyor relative to said discharge chute, thereby to compensate for the size of a bag resting on the conveyor, said headt adjustment means adapted to raise or lower the stitching head relative to the conveyor, thereby to locate the strip of tape and line of stitching with reference to the upper portion of the bag, said stitching head including trimming means for severing the strip of tape from the trailing edge of the bag in response to the advancement thereof relative to the stitching head and after application of said line of stitching.

3. A bag closing machine comprising, a base, a vertical column rising from said base, a vertical rack mounted on said column, an elongated horizontal conveyor structure having means slidably embracing said column, a self-locking adjustment device mounted on said conveyor structure and including a pinion meshing with said rack, a stitcher head connected to the column above the conveyor, said stitcher head adapted to apply a strip of tape to the upper portion of a bag advancing on the conveyor and to apply a line of stitching through said tape and through the bag to seal the same, and extensible elements projecting downwardly from said conveyor structure, said extensible elements adapted to be adjusted downwardly into engagement with the surface upon which said base is resting, whereby the conveyor structure is adapted to stabilize the bag closing machine relative to said surface.

4. A bag closing machine comprising, a base, a vertical column rising from said base, a vertical rack mounted on said column, an elongated horizontal conveyor structure having means slidably embracing said column, a self-locking adjustment device mounted on said conveyor structure and including a pinion meshing with said rack, a stitcher head slidably connected to the column above the conveyor, a self-locking adjustment device mounted on the stitcher head and including a pinion meshing with said rack, said stitcher head adapted to apply a strip of tape to the upper portion of a bag advancing on the conveyor and to apply a line of stitching through said tape and through the bag to seal the same, and extensible elements projecting downwardly from said conveyor structure, said extensible elements adapted to be adjusted downwardly into engagement with the surface upon which said base is resting, whereby the conveyor structure is adapted to stabilize the bag closing machine relative to said surface.

5. A bag closing machine comprising, a base, a vertical column rising from said base, a conveyor, a conveyor adjustment means connecting the conveyor to the column, said conveyor adapted to support and advance a filled open bag, a bag stitching head adjustment means connecting said stitching head to said column in a position overhanging said conveyor, said stitching head adapted to apply a line of stitching through the upper portion of the filled bag advancing on the conveyor, said conveyor adjustment means adapted to shift the conveyor relative to the floor level to compensate for the height of an operator, said head adjustment means adapted to shift the stitching head relative to the conveyor, thereby to locate said line of stitching relative to the upper portion of the bag, and control means interconnected with said stitcher head and engageable with the bag advancing on the conveyor, said control means adapted to energize the stitching head in response to engagement by the leading edge of a bag advancing on the conveyor.

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